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REMOVAL SUPPORT TEAM 3
EPA CONTRACT EP-S2-14-01

March 26, 2019

Mr. Eric Daly, On-Scene Coordinator
U.S. Environmental Protection Agency, Region II
Removal Action Branch
186 Exchange Street
Buffalo, New York 14204

EPA CONTRACT No: EP-S2-14-01
TDD No: TO-0370-0008
DC No: RST3-05-F-0075
SUBJECT: FINAL REMOVAL ASSESSMENT SAMPLING REPORT, 2016 and 2017 EVENTS 738 UPPER MOUNTAIN ROAD SITE LEWISTON, NIAGARA COUNTY, NEW YORK

Dear Mr. Daly,

Enclosed please find the Removal Assessment Sampling Report, 2016 and 2017 Events, which summarizes the ground radiological survey, soil and radon sampling activities conducted by the U.S. Environmental Protection Agency (EPA) with the support of Weston Solutions, Inc., Removal Support Team 3 (RST 3) at the 738 Upper Mountain Road Site (the Site) located in Lewiston, Niagara County, New York. The radiological survey and sampling activities were performed as part of Removal Assessment events conducted at the Site on October 25, 2016, November 18, 2016, and August 11 through 14, 2017. The EPA comments regarding the prior version of this report (DCN: RST3-05-D-0034) have been incorporated.

If you have any questions or comments, please contact me at (732) 585-4413.

Sincerely,

WESTON SOLUTIONS, INC.

Bernard Nwosu
RST 3 Site Project Manager

Enclosure
cc: TDD File: TO-0370-0008

FINAL REMOVAL ASSESSMENT SAMPLING REPORT, 2016 and 2017 EVENTS

738 UPPER MOUNTAIN ROAD SITE

Lewiston, Niagara County, New York

SSID No: A23M
EPA ID No.: NYN000206697

DC No: RST3-05-F-0075
TDD No: TO-0370-0008
EPA Contract No: EP-S2-14-01

Prepared for:

U.S. Environmental Protection Agency, Region II
2890 Woodbridge Avenue
Edison, New Jersey 08837

Prepared by:

Removal Support Team 3
Weston Solutions, Inc.
Federal East Division
Edison, New Jersey 08837

March 2019

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1.0 Introduction:

On October 25, 2016, November 18, 2016, and August 11 through 14, 2017, the U.S. Environmental Protection Agency (EPA) Region II Removal Action Branch with the support of Weston Solutions Inc., Removal Support Team 3 (RST 3) performed Removal Assessment events at the 738 Upper Mountain Road Site (the Site). Respectively on the aforementioned dates, radiological survey was conducted inside the one residence located in proximity to a small area of concern (AOC) at the Site and exterior areas, soil samples were collected from select locations at the Site, and radon sampling was performed in living spaces within the residence. The soil and radon samples were submitted to the assigned laboratories for analyses.

1.1 Site Location and Description:

The Site is situated at 738 Upper Mountain Road in Lewiston, New York and the geographic coordinates are 43.15553, -79.02245. The Site consists of a small AOC with radionuclide contamination approximately 1,493 square feet (ft^2), and is located on the vacant, approximately 10.2 acre parcel 115.08-1-27 owned by Talarico Bros. Building Corp (TBBC). The AOC is located at the entrance of the driveway currently utilized by the 738 Upper Mountain Road residence although the driveway was historically used as an access road to the vacant TBBC property. The residence is on a separate property from the AOC. The Site is bordered to the north by Upper Mountain Road, residential properties, and a further wooded area; to the east and west by residential properties; and to the south by a wooded area.

Refer to Attachment A, Figure 1: Site Location Map.

1.2 Site History and Background:

In July 1985, members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) performed a radiological survey of 738 Upper Mountain Road and documented a maximum gamma exposure rate of 710 microroentgens per hour (μR/hr). The area where this reading was collected is approximately 10 feet wide by 59 feet in length along a ditch and gravel residential driveway. The survey showed that the 738 Upper Mountain Road anomaly is associated with the asphalt driveway that contained a phosphate slag material. This rocky-slag waste material was used for bedding under asphalt surfaces and in general gravel applications at the Site and 61 other locations in the Niagara Falls area identified by ORNL.

Biased surface soil samples collected in conjunction with the study indicated the presence of radium-226 (Ra-226), uranium-238 (U-238), and thorium-232 (Th-232) at the Site. The subsequent November 1986 report stated that all the contaminated soil and rock samples collected had approximately equal concentrations of Ra-226 and U-238, which suggests that the rocks probably originated from a singular source. The origin of the thorium-bearing material was unknown; the report postulated that its source was from some type of mineral extraction activity in the Niagara Falls area. The report stated that the 738 Upper Mountain Road anomaly was not related to materials connected with Niagara Falls Storage Site (NFSS), including materials that were transported to NFSS.

During a reconnaissance performed by the New York State Department of Health (NYSDOH) and New York State Department of Environmental Conservation (NYSDEC) on July 9, 2013, screening activities showed radiation levels at 300 µR/hr with a hand-held pressurized ion chamber (PIC) and 105,000 to 110,000 counts per minute (cpm) with a sodium iodide (NaI) 2x2 scintillation detector; the singular reading was taken at the end of the driveway adjacent to Upper Mountain Road.

On December 12, 2013, Weston Solutions, Inc., Site Assessment Team (SAT) collected a total of nine soil samples and two slag samples from the Site. At each sample location, soil samples were collected directly beneath slag material; at locations where a radioactive layer was not present the soil sample was collected at the equivalent depth interval. The slag samples consisted of pulverized silty sand with rocks, cobbles, and gravel (*i.e.*, radioactive waste material mixture) rather than singular pieces of slag. The soil and slag samples, and aqueous rinsate blank, were analyzed for target analyte list (TAL) metals, including mercury; isotopic thorium, isotopic uranium, Ra-226, and radium-228 (Ra-228) by alpha spectroscopy; and other radioisotopes by gamma spectroscopy. Analytical results indicated concentrations of radionuclides found in the slag and soil to be significantly higher than at background conditions.

On May 1 and 2, 2014, SAT collected radon and thoron concentration measurements from locations on and in the vicinity of the Site. The radon and thoron measurements were collected at heights of one meter above the ground surface. During the May 2014 air monitoring event, background radon concentrations were measured at 0.16 +/- 0.13 picocuries per liter (pCi/L) (to account for maximum background concentrations, the uncertainty value is added to the background measurement for an adjusted concentration of 0.29 pCi/L) during the morning hours on May 2, 2014 and an adjusted value of 0.12 pCi/L during the afternoon hours on May 1, 2014. Background thoron concentrations were calculated to be 0.060 pCi/L (adjusted concentration) during the morning hours on May 2, 2014 and an adjusted value of 0.15 pCi/L during the afternoon hours on May 1, 2014. There were no radon or thoron concentrations that exceeded the site-specific background, nor were there any adjusted concentrations that equaled or exceeded a value two standard deviations above the mean site-specific background concentrations for these radionuclides in ambient air.

2.0 Scope of Work:

RST-3 was tasked by EPA to provide support for a Removal Assessment of the Site. The scope of work (SOW) included, a gamma survey of interior areas within the one residence located in proximity to the AOC and exterior areas of the Site. The gamma survey was conducted to determine if radiation-containing material was present in the residence and to verify the reported presence of radiation-containing material at the AOC. The SOW also included soil sampling for laboratory analysis from select locations at the Site in order to determine the nature and extent of soil contamination. Furthermore, radon canister samples were collected for laboratory analysis to determine the presence/absence of radon in living spaces within the residence. RST 3 was also tasked with photographic documentation and notation in the Site logbook of all site activities, entering sample information into the EPA SCRIBE database (an environmental data management system), and collecting sample location data using Global Positioning System (GPS) technology.

3.0 On-site Personnel:

Table 1-1: On-Site Personnel

Name	Affiliation	Duties On-site
Eric Daly	EPA, Region II	On-Scene Coordinator
Lyndsey Nguyen	EPA/ERT	Health Physicist
Peter Lisichenko	Weston Solutions Inc., RST 3, Region II	Team Lead, Site Health & Safety, Radiation Survey, Quality Assurance/Quality Control, Written and Photographic Documentation
Chad Conway	Weston Solutions Inc., RST 3, Region II	HPGe Soil Screening, Sample Management, and Quality Assurance/Quality Control
Richard Pezzino	Accu-View Property Inspections, Inc.	Radon Sampling

U.S. EPA: United States Environmental Protection Agency
ERT: Environmental Response Team
HPGe: High-purity Germanium
RST 3: Removal Support Team 3

4.0 Summary of Site Activities and Observations:

On October 25, 2016, EPA and RST 3 conducted radiological survey inside the one residence located in proximity to the AOC and exterior areas of the Site. A hand-held radiation meter was utilized to conduct radiological survey in the residence, and an all-terrain vehicle (ATV) with a radiation meter and internet-based setup was utilized to conduct mobile ground radiological survey throughout the Site and areas surrounding the residence. Gamma readings collected within the residence were at background levels (10 to 12 µR/hr). The highest exterior gamma reading of 462.2 µR/hr was recorded at the AOC (the entrance of the driveway currently utilized by the 738 Upper Mountain Road residence).

On November 18, 2016, EPA and RST 3 mobilized to the Site to continue Removal Assessment activities. Dig Safely New York was contacted prior to mobilizing for field work in order to mark out the existing underground public utilities at the Site. Based on radiological survey measurements collected during the October 2016 Removal Assessment event, four test pit locations were selected on-site by the EPA On-Scene Coordinator (OSC) and marked out with spray paint. Utilizing a mini excavator, test pits were advanced to a depth of 2 feet below ground surface (bgs) at the four selected locations. Upon completing each test pit, RST 3 documented the soil characteristics, description, and depths of visible slag/rock material within each test pit in order to provide reference information for estimating volumes of waste that may be potentially removed from the Site. A total of 17 heterogeneous samples of soil/slag/rock, including quality assurance/quality control (QA/QC) samples, were collected from all four test pits. The test pit locations were backfilled after sampling and restored as close as possible to pre-existing conditions.

On December 2 through 7, 2016, RST 3 utilized a High-purity Germanium (HPGe) detector to perform on-site quantitative gamma spectrometry analysis of the soil samples collected from the Site. On December 7, 2016 after HPGe screening was completed, all the soil samples were shipped via FedEx to the assigned laboratory for analysis.

On August 11, 2017, personnel from RST 3-procured National Radon Safety Board (NRSB)-certified Company, Accu-View Property Inspections (Accu-View), deployed a total of eight activated charcoal canisters (radon canisters), including one field duplicate, for radon sampling at

the residence. On August 14, 2017, all the radon canisters were picked up by personnel from Accu-View and shipped to the assigned laboratory for analysis.

Throughout Removal Assessment activities during each of the three events, RST 3 performed photographic documentation and notation in the Site logbook of all site activities, entered sample information into the EPA SCRIBE database, and documented sample locations with GPS technology.

Refer to Attachment A, Figure 3: Test Pit Location Map, Attachment B, Table 1: Soil Sample Collection and Test Pit Geological Summary Table, and Attachment D: Photographic Documentation log.

5.0 Survey, Sampling, and Screening Methodology:

All field activities, including ground radiological survey, soil and radon sampling, were performed in accordance with the RST 3 *Site-specific Health and Safety Plan*. All sampling activities were performed in compliance with EPA's Environmental Response Team (ERT)/Scientific, Engineering, Response and Analytical Services (SERAS) contractor's Standard Operating Procedure (SOP) Number (No.) 2001: *General Field Sampling Guidelines*. The following summary describes the methodologies utilized for ground radiological survey, field data collection, and soil and radon sampling during the Removal Assessment events.

5.1 Radiological Survey:

A NaI 3x3 scintillator attached to a Ludlum-2241-2 gamma meter was utilized to conduct radiological survey in the residence. Gamma readings were collected at each selected location within the residence by holding the NaI scintillator in place approximately 6 inches above the ground for approximately 60 seconds. The instantaneous highest and lowest readings measured in cpm by the instrumentation setup were recorded as a range and compared with the background gamma readings measured by the instrument.

The instrumentation setup for the exterior survey consisted of a Ludlum-2241-2 gamma meter, a NaI 3x3 scintillator, a Life-line Interoperable Network Communicator (LINC), a Trimble® GPS unit, and a laptop computer, all synchronized to communicate with EPA's VIPER system (a wireless network-based communications system) via a Gateway (internet source) to provide instantaneous real-time gamma readings through a computer server (Viper Deployment Manager [VDM]). The entire instrumentation setup was placed in an ATV, and the NaI scintillator which was fixed at the rear of the ATV was set to approximately 6 inches above ground surface.

As the RST 3 personnel conducting the exterior gamma survey drove the ATV along predetermined paths, the radiological survey instrumentation setup generated gamma readings in μR/hr which were transmitted to EPA's VIPER system. The GPS unit provided geographical reference of the gamma readings by transmitting the locational data of the survey instrumentation setup. The instantaneous gamma readings along with the geographical locations were viewed online through a field laptop computer via VIPER, on the VDM website and were compared with the background gamma readings measured by the instrument. All the gamma survey data were stored on the ERT servers.

5.2 Soil Sampling:

Soil sampling was conducted in accordance with EPA's ERT/SERAS contractor's SOP No. 2012: *Soil Sampling*. At the request of RST 3, Dig Safely New York conducted a subsurface utility mark out of the existing underground public utilities at the Site. Test pit locations were selected by the EPA OSC based on results of the exterior mobile ground radiological survey conducted throughout the Site during the October 2016 Removal Assessment event. Utilizing a mini excavator, four test pits were advanced to a depth of 2 feet bgs at the selected locations. Upon completing each test pit, RST 3 documented the soil characteristics, description, and depths of visible slag/rock material within each test pit.

Heterogeneous soil/slag/rock samples were collected from the side walls of each test pit at 6 inch intervals from 0 to 6, 6 to 12, 12 to 18, 18 to 24 inches bgs. The samples were collected in reverse order using dedicated disposable plastic scoops starting from the deepest interval upwards to the surface. This sampling method was adopted in order to reduce chances of cross contamination between sampling intervals. Fresh nitrile gloves were donned between each sampling interval and location. Prior to sample collection at each interval, the bottom of the plastic scoop was used to scrape each area of the sidewall to be sampled in order to expose fresh soil/slag/rocks which was collected, placed directly into dedicated re-sealable plastic bags, homogenized, and then transferred into 16 ounce polyethylene sample containers. Field duplicate and additional volumes of field sample designated as matrix spike/matrix spike duplicate (MS/MSD) were collected at a frequency of one per 20 field samples.

All sample information was transcribed into EPA's SCRIBE data management system, from which sample labels and chain of custody (COC) record were generated. The sample labels were affixed to the sample jars which were stored in coolers. All the soil/slag/rock samples were shipped to the assigned laboratory for analysis after screening with HPGe analyzer.

5.3 Soil Screening:

All the soil/slag/rock samples collected from the Site were screened using HPGe analyzer which provided quantitative gamma spectrometry analysis. Gamma ray spectrometry is an analytical method that allows the identification and quantification of gamma emitting isotopes in a variety of matrices. In one single measurement with minimal sample preparation, gamma ray spectrometry allows for the detection of several gamma emitting radionuclides in a sample. The measurement gives a spectrum of lines, the amplitude of which is proportional to the activity of the radionuclide, and its position on the horizontal axis gives an idea on its energy. After screening each soil sample, a printout of the analytical report presented in pCi/g was generated by the HPGe analyzer.

5.4 Radon Sampling:

Radon sampling was conducted in accordance with guidelines presented in the American National Standards Institute (ANSI)/American Association of Radon Scientists and Technologists (AARST) *Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings* (MAMF 2012), and as directed by the EPA OSC. Personnel from RST 3-procured NRPP-certified company, Accu-View, located in East Amherst, New York, provided field support for identifying radon canister placement locations in living spaces of the residence, placing the canisters, picking up the canisters, and delivering to the assigned laboratory for radon

analysis. Radon canisters were used to conduct short-term radon sampling tests that lasted a minimum of approximately 72 hours. Weather information including temperature, humidity, wind speed and direction, and barometric pressure, were documented during deployment and pickup of the radon canisters.

Radon testing locations were focused on frequently occupied spaces in the residence. The canisters were raised no less than approximately 20 inches above the ground and, where possible, away from draft and vents. When the protective covering of the canister inlet surface was peeled off, ambient air was allowed to collect in the canisters for a minimum of approximately 72 hours at each location. The radon samples were collected for definitive data and QA/QC objectives. One field duplicate (co-located sample) was collected.

6.0 Laboratories Receiving Samples:

The following laboratories were utilized for sample analysis during the November 2016 and August 2017 sampling events:

Table 2-1: Laboratories Receiving Samples

Laboratory	Sample Matrix	Analysis
Pace Analytical Services, Inc. 1638 Roseytown Road, Suite 2, 3 & 4 Greensburg, PA 15601	Soil/Slag/Rocks	Bi-212, Cs-137, K-40, Pb-212, Pa-234, Ra-226, Ra-228, Th-228, Th-230, Th-232, Th-234, Tl-208, U-233/234, U235/236, U235, and U238.
Radon Testing Corporation of America 2 Hayes Street Elmsford, New York 10523	Indoor Air	Radon

7.0 Sample Collection and Dispatch:

On November 18, 2016, RST 3 collected a total of 17 heterogeneous soil/slag/rock samples, including one field duplicate, from the Site. On December 7, 2016, all the soil/slag/rock samples were shipped under COC Record No. 2-120716-091830-0001 via FedEx Airbill No. 7778-8428-1129 to Pace Analytical Services, Inc. (Pace) located in Greensburg, Pennsylvania for laboratory analyses including: bismuth-212 (Bi-212), cesium-137 (Cs-137), potassium-40 (K-40), lead-212 (Pb-212), protactinium-234 (Pa-234), Ra-226, Ra-228, thorium-228 (Th-228), thorium-230 (Th-230), Th-232, thorium-234 (Th-234), thallium-208 (Tl-208), uranium-233/234 (U-233/234), uranium-235/236 (U235/236), uranium-235 (U235), and U238.

Refer to Attachment B, Table 1: Soil Sample Collection and Test Pit Geological Summary Table and Attachment D: Chain of Custody Record and FedEx Airbills.

On August 11, 2017, Accu-View deployed a total of eight radon canisters, including one field duplicate, at the residence. On August 14, 2017, all the radon canister samples were picked up by Accu-View and submitted to Radon Testing Corporation of America (RTCA), located in Elmsford, New York, for radon analysis.

Refer to Attachment E: Radon Testing Summary Sheets.

8.0 Radiological Survey Results Summary:

Background gamma readings collected at the Site were approximately 10 to 12 µR/hr. Based on results of the radiological survey completed in the residence, gamma readings were at background levels.

Based on results of the exterior ground radiological survey conducted throughout the Site and areas surrounding the residence, gamma reading generally ranged from background to less than three time (3x) background except at a small area of the driveway entrance currently utilized by the 738 Upper Mountain Road residence where gamma readings were as high as 462.2 µR/hr.

Refer to Attachment A, Figure 2: Gamma Survey Map.

9.0 Radon Analytical Results Summary:

The validated analytical results of the eight radon canister samples, including one field duplicate, collected inside the residence were compared with the EPA Action Level of 4.0 pCi/L for radon. Based on validated analytical results, radon concentrations were below the EPA Action Level.

Refer to Attachment B, Table 3: Radon Sample Collection and Validated Analytical Results Summary Table and Attachment H: Validated Radon Analytical Data Package.

10.0 Soil Screening Results Summary:

The HPGe screening results of the 17 soil/slag/rock samples, including one field duplicate, collected from the Site were compared with the Site-Specific Action Levels (SSALs) established by EPA (in March 2019) for the target radioisotopes.

Based on HPGe screening results, the concentrations of four radionuclides, including actinium-228 [Ac-228], Bi-212, Ra-226, and Th-234, exceeded the respective EPA SSALs in sample UMR001-S003-0006-01 collected at depths 0 to 6 inches bgs from sample location UMR001-S003.

Based on HPGe screening results, the concentrations of at least six of seven specific radionuclides, including Ac-228, Bi-212, Pb-212, Ra-226, Tl-208, Th-228, and Th-234, exceeded the respective EPA SSALs in all four samples collected at depths 0 to 24 inches bgs from UMR001-S004.

Refer to Attachment B, Table 2: Soil Analytical and Screening Results – Radioisotopes Summary Table and Attachment F: HPGe Soil Screening Reports.

11.0 Soil Analytical Results Summary:

The analytical results of the 17 soil/slag/rock samples, including one field duplicate, collected from the Site were compared with the SSALs established by EPA (in March 2019) for the target radioisotopes.

Based on analytical results, the concentrations of Pa-234M and Th-228 exceeded the respective EPA SSALs in nine samples with exceedance concentrations identified in at least one depth interval from 0 to 24 inches bgs at all four sample locations, UMR001-S001 through UMR001-S004.

There were no exceedance concentrations of the EPA SSALs for any radionuclide in surface samples (0 to 6 inches bgs) collected from UMR001-S001 and UMR001-S002.

The greatest number of target radionuclides with concentrations exceeding the respective EPA SSALs ranged from six to 13 radionuclides, and were identified in samples collected from UMR001-S003 and UMR001-S004. All the samples collected from UMR001-S004 had exceedance concentrations of at least nine to 13 radionuclides (Bi-212, Pb-212, Pa-234M, Ra-226, Ra-228, Tl-208, Th-228, Th-230, Th-232, Th-234, U-233/234, and U-238) in all the sampled depth intervals from 0 to 24 inches bgs.

At the request of EPA, the validated analytical results of nine soil samples, including one field duplicate, and two slag samples collected by SAT during the December 2013 site investigation were compared against the EPA SSALs. It is noteworthy that the laboratory analysis of SAT's soil and slag samples, specifically for Ra-226, was not performed by 21-days ingrowth method.

Based on validated analytical results, concentrations of the eight target radionuclides, including Ra-226, Ra-228, Th-228, Th-230, Th-232, U-233/234, U-235/236, and U-238, exceeded the respective EPA SSALs in both slag samples SG01(0-1) and SG02(0-1) collected at 0 to 1 feet bgs.

Based on validated analytical results, soil samples S01(1-2), S03(1-2), and S10(1-2) (field duplicate of S03(1-2)) collected at 1 to 2 feet bgs, immediately below the 0 to 1 foot sampling interval of both slag samples, indicated concentrations of at least three radionuclides (Ra-228, Th-228, and Th-230) exceeding the respective EPA SSALs. It is noteworthy that, the concentrations of all eight target radionuclides exceeded the respective EPA SSALs in S01(1-2) collected below the slag sampling interval of SG02(0-1).

In addition, the concentrations of at three radionuclides (Ra-228, Th-228, and Th-230) exceeded the respective EPA SSALs in S05(1-2) and S06(2-3) collected at 1 to 2 inches bgs and 2 to 3 inches bgs respectively. The concentrations of five radionuclides exceeded the respective EPA SSALs in S04(1.5-2.5) collected at 1.5 to 2.5 feet bgs.

Refer to Attachment A, Figure 4: Soil Analytical Results Map, Attachment B, Table 2A: Soil Analytical and Screening Results – Radioisotopes Summary Table, Table 2B: Validated SAT Soil Analytical Results – Radioisotopes Summary Table, and Attachment G: PACE Laboratory Analytical Data Package.

12.0 Area and Volume Estimations:

Based on results of exterior radiological survey conducted at the Site in October 2016, the surface area of contaminated portions of the Site was determined by utilizing Geographical Information

System (GIS) to select areas on the Gamma Survey Map (presented in Figure 2) where gamma readings equaled or exceeded at least 3x background.

In addition, based on analytical results of the soil/slag/rock samples, the vertical extent of radionuclide contamination at the Site was determined to be 24 inches bgs at locations where the concentrations of target radionuclides exceeded the EPA SSALs. A depth of 2 feet bgs was therefore utilized to estimate the volume of contaminated soil at the Site.

Table 3-1: Area and Volume Estimates

Area (m^2)	Area (ft^2)	Depth (ft)	Volume (yd^3)
128.11	1,378.98	2	102.15

m^2: Square meters ft^2: Square feet ft: Feet yd^3: Cubic yards

Based on the estimated surface area of 128.11 square meters (1,378.98 square feet) and a depth of 2 feet bgs as vertical extent of the soil contamination, there is approximately 102.15 cubic yards of contaminated soil present at the AOC on-site.

Attachment A, Figure 2: Gamma Survey Map, Figure 5: Area and Volume Map, and Table 3-1: Area and Volume Estimates.

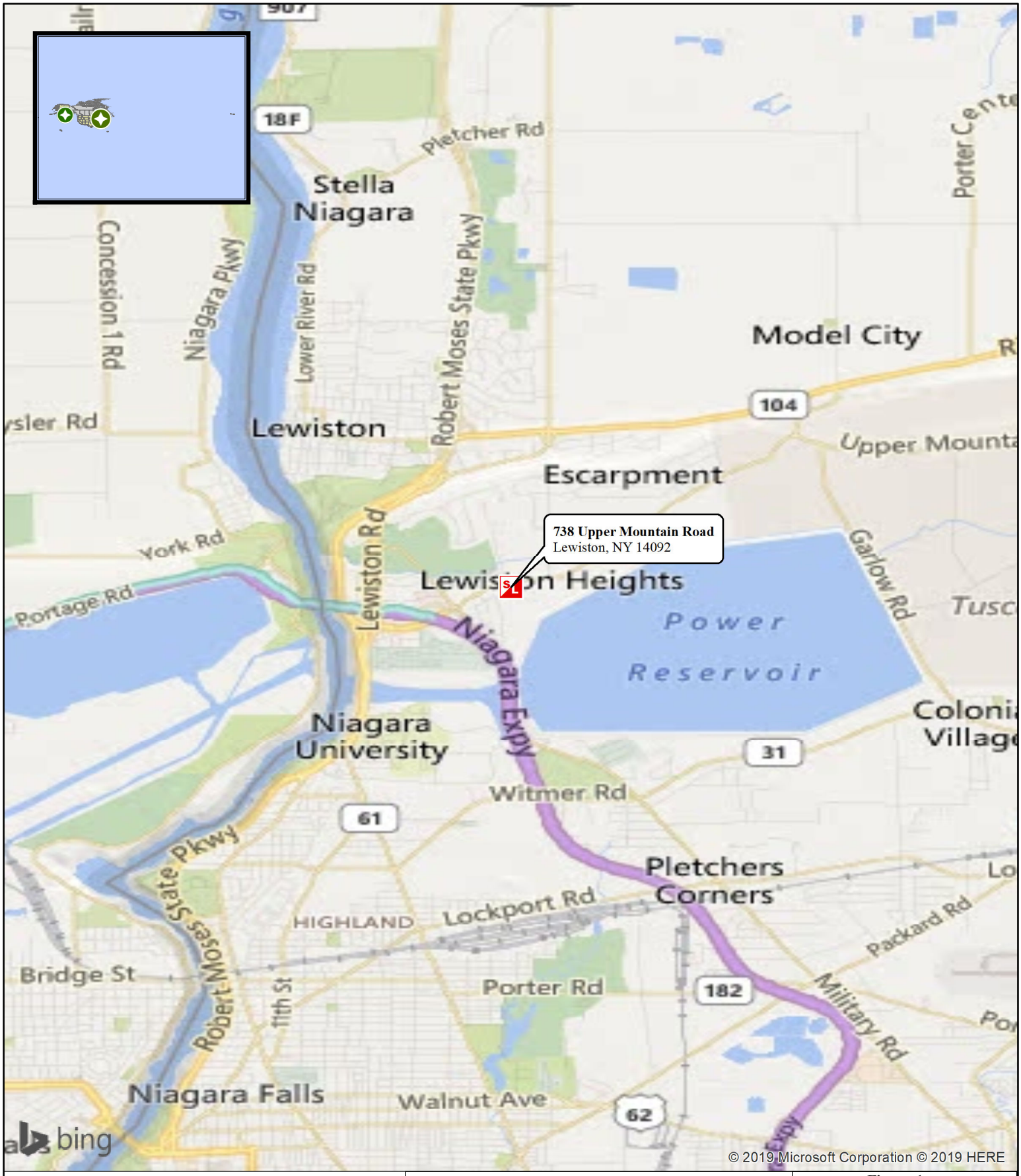
Report prepared by: _____ 3/26/2019
Bernard Nwosu Date
RST 3 Site Project Manager

Report reviewed by: _____ 3/26/2019
Bernard Nwosu Date
RST 3 Group Leader

ATTACHMENT A

Figures

Figure 1: Site Location Map
Figure 2: Gamma Survey Map
Figure 3: Test Pit Location Map
Figure 4: Soil Analytical Results Map
Figure 5: Area and Volume Map



Legend

Site Location

N

0 0.35 0.7 1.4 2.1 2.8 Miles

Weston Solutions, Inc.
Federal East Division

In Association With
Scientific and Environmental Associates, Inc.,
Environmental Compliance Consultants, Inc.,
Avatar Environmental, LLC, On-Site Environmental,
Inc.and Sovereign Consulting, Inc

Figure 1:
Site Location Map

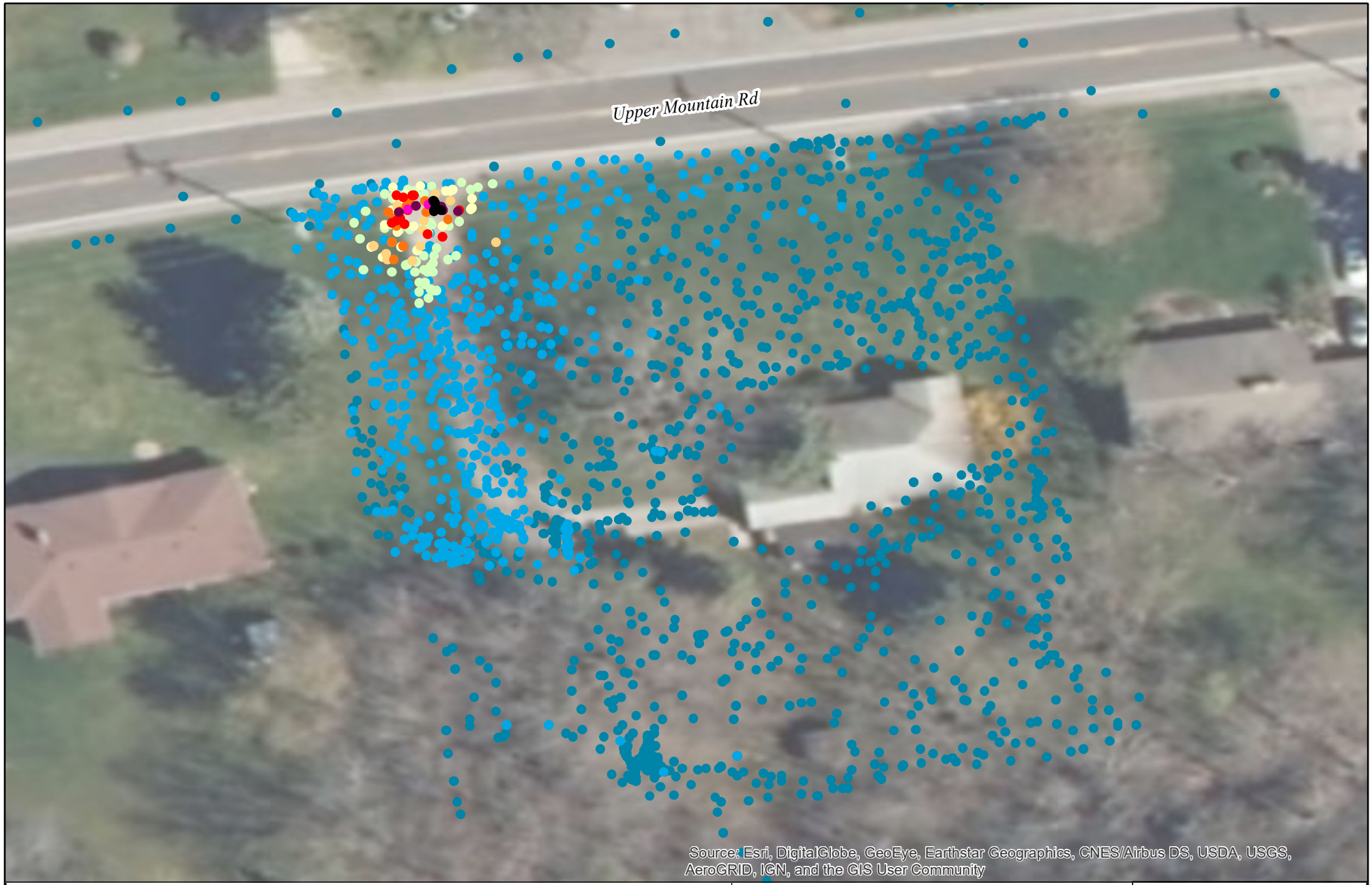
738 Upper Mountain Road Site
Lewiston, New York

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

DATE MODIFIED: 3/20/2019

GIS ANALYST:	M. MANNINO
EPA OSC:	E. DALY
RST SPM:	B. NWOSU
FILENAME:	170329_SiteLocationMap.mxd

\\FSED2DATA1\GISDATA\RST_3\03700008\MXD\170329_UMR_SITELOCATIONMAP.MXD



Legend

Gamma Scan (µR/hr)

- < 12 (1x)
- 12 - 36 (1x-3x)
- 36 - 60 (3x-5x)
- 60 - 84 (60 - 84 (5x-7x)
- 84 - 120 (7x-10x)
- 120 - 180 (10x-15x)
- 180 - 240 (15x - 20x)
- 240 - 300 (20x-25x)
- 300 - 420 (25x-35x)
- 420 - 463 (35x-39x)

Notes:
Gamma readings recorded in microroentgens per hour (µR/hr).
Gamma Survey conducted on October 25, 2016.
Background gamma reading: 10.5 µR/hr.
Maximum gamma reading: 462.2 µR/hr.

0 10 20 40 60 80 Feet

N

Weston Solutions, Inc.

In association with
Scientific and Environmental Associates, Inc.,
Avatar Environmental, LLC, Environmental Compliance Consultants,
On-Site Environmental, Inc., and Sovereign Consulting, Inc.

DATE MODIFIED: 3/22/2019

Figure 2:
Gamma Survey Map

738 UPPER MOUNTAIN ROAD
LEWISTON, NEW YORK

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

GIS ANALYST:	M. MANNINO
EPA OSC:	E. DALY
RST SPM:	B. NWOSU
FILENAME:	180709_Figure_2_Gamma_Map.mxd

Legend

- Sample Locations

N

0 10 20 40 60 80 Feet

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Avatar Environmental, LLC, Environmental Compliance Consultants,
On-Site Environmental, Inc., and Sovereign Consulting, Inc.

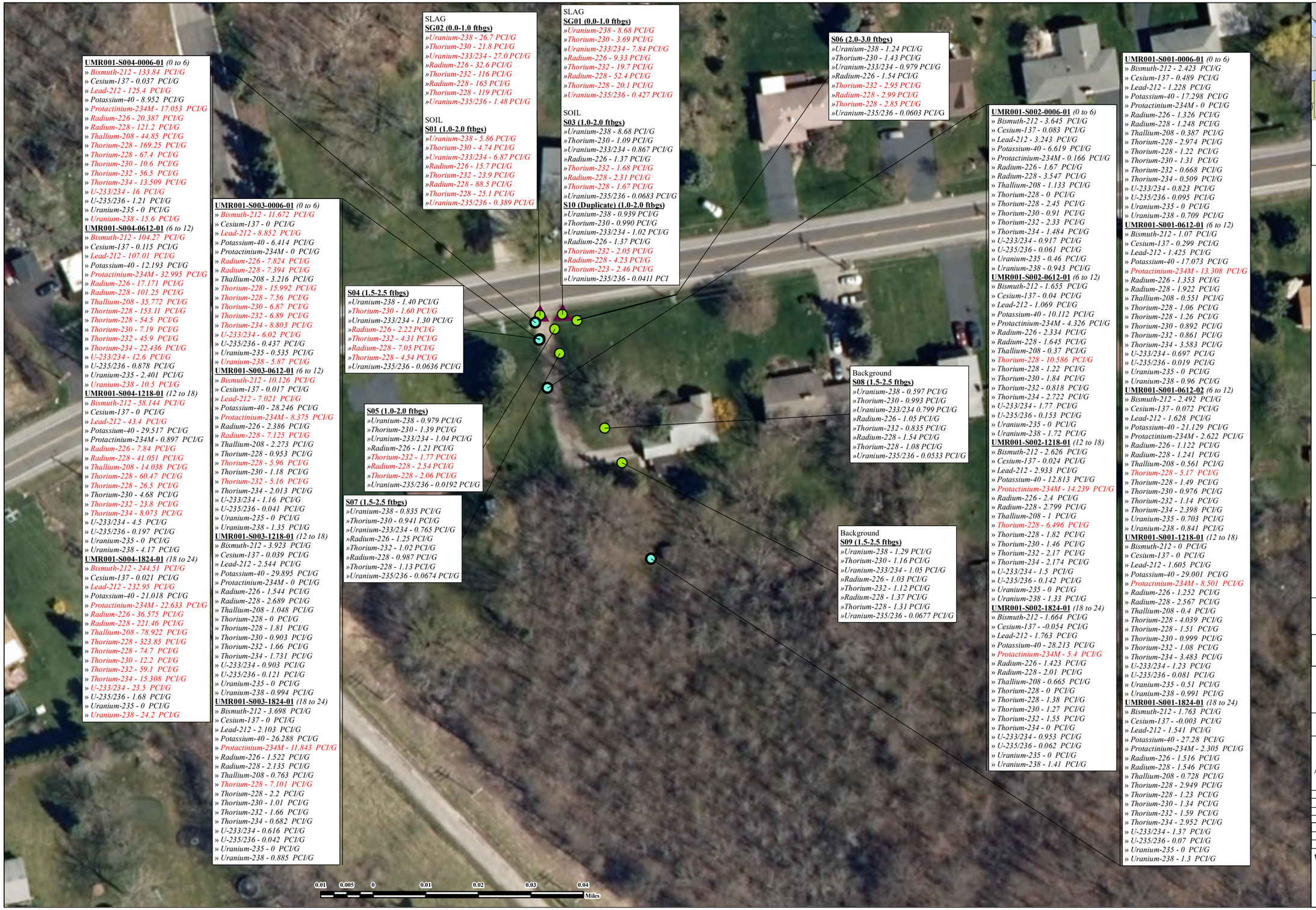
DATE MODIFIED: 3/22/2019

Figure 3:
Test Pit Location Map

738 UPPER MOUNTAIN ROAD
LEWISTON, NEW YORK

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

GIS ANALYST:	M. MANNINO
EPA OSC:	E. DALY
RST SPM:	B. NWOSU
FILENAME:	170428_Figure_3_TP_Map.mxd



UMR001-S004-0006-01 *(0 to 6)*
» Bismuth-212 - 133.84 PCI/G
» Cesium-137 - 0.037 PCI/G
» Lead-212 - 125.4 PCI/G
» Potassium-40 - 8.952 PCI/G
» Protactinium-234M - 17.053 PCI/G
» Radium-226 - 20.387 PCI/G
» Radium-228 - 121.2 PCI/G
» Thallium-208 - 44.85 PCI/G
» Thorium-228 - 169.25 PCI/G
» Thorium-228 - 67.4 PCI/G
» Thorium-230 - 10.6 PCI/G
» Thorium-232 - 56.5 PCI/G
» Thorium-234 - 13.509 PCI/G
» U-233/234 - 16 PCI/G
» U-235/236 - 1.21 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 15.6 PCI/G

UMR001-S004-0612-01 *(6 to 12)*
» Bismuth-212 - 104.27 PCI/G
» Cesium-137 - 0.115 PCI/G
» Lead-212 - 107.01 PCI/G
» Potassium-40 - 12.193 PCI/G
» Protactinium-234M - 32.995 PCI/G
» Radium-226 - 17.171 PCI/G
» Radium-228 - 101.25 PCI/G
» Thallium-208 - 35.772 PCI/G
» Thorium-228 - 153.11 PCI/G
» Thorium-228 - 54.5 PCI/G
» Thorium-230 - 7.19 PCI/G
» Thorium-232 - 45.9 PCI/G
» Thorium-234 - 22.436 PCI/G
» U-233/234 - 12.6 PCI/G
» U-235/236 - 0.878 PCI/G
» Uranium-235 - 2.401 PCI/G
» Uranium-238 - 10.5 PCI/G

UMR001-S004-1218-01 *(12 to 18)*
» Bismuth-212 - 58.144 PCI/G
» Cesium-137 - 0 PCI/G
» Lead-212 - 43.4 PCI/G
» Potassium-40 - 29.517 PCI/G
» Protactinium-234M - 0.897 PCI/G
» Radium-226 - 7.84 PCI/G
» Radium-228 - 41.051 PCI/G
» Thallium-208 - 14.038 PCI/G
» Thorium-228 - 60.47 PCI/G
» Thorium-228 - 26.5 PCI/G
» Thorium-230 - 4.68 PCI/G
» Thorium-232 - 23.8 PCI/G
» Thorium-234 - 8.073 PCI/G
» U-233/234 - 4.5 PCI/G
» U-235/236 - 0.197 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 4.17 PCI/G

UMR001-S004-1824-01 *(18 to 24)*
» Bismuth-212 - 244.51 PCI/G
» Cesium-137 - 0.021 PCI/G
» Lead-212 - 232.95 PCI/G
» Potassium-40 - 21.018 PCI/G
» Protactinium-234M - 22.633 PCI/G
» Radium-226 - 36.575 PCI/G
» Radium-228 - 221.46 PCI/G
» Thallium-208 - 78.922 PCI/G
» Thorium-228 - 323.85 PCI/G
» Thorium-228 - 74.7 PCI/G
» Thorium-230 - 12.2 PCI/G
» Thorium-232 - 59.1 PCI/G
» Thorium-234 - 15.308 PCI/G
» U-233/234 - 23.5 PCI/G
» U-235/236 - 1.68 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 24.2 PCI/G

UMR001-S003-0006-01 *(0 to 6)*
» Bismuth-212 - 11.672 PCI/G
» Cesium-137 - 0 PCI/G
» Lead-212 - 8.852 PCI/G
» Potassium-40 - 6.414 PCI/G
» Protactinium-234M - 0 PCI/G
» Radium-226 - 7.824 PCI/G
» Radium-228 - 7.394 PCI/G
» Thallium-208 - 3.216 PCI/G
» Thorium-228 - 15.992 PCI/G
» Thorium-228 - 7.56 PCI/G
» Thorium-230 - 6.87 PCI/G
» Thorium-232 - 6.89 PCI/G
» Thorium-234 - 8.803 PCI/G
» U-233/234 - 6.02 PCI/G
» U-235/236 - 0.437 PCI/G
» Uranium-235 - 0.535 PCI/G
» Uranium-238 - 5.87 PCI/G

UMR001-S003-0612-01 *(6 to 12)*
» Bismuth-212 - 10.126 PCI/G
» Cesium-137 - 0.017 PCI/G
» Lead-212 - 7.021 PCI/G
» Potassium-40 - 28.246 PCI/G
» Protactinium-234M - 8.375 PCI/G
» Radium-226 - 2.386 PCI/G
» Radium-228 - 7.125 PCI/G
» Thallium-208 - 2.273 PCI/G
» Thorium-228 - 0.953 PCI/G
» Thorium-228 - 5.96 PCI/G
» Thorium-230 - 1.18 PCI/G
» Thorium-232 - 5.16 PCI/G
» Thorium-234 - 2.013 PCI/G
» U-233/234 - 1.16 PCI/G
» U-235/236 - 0.041 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 1.35 PCI/G

UMR001-S003-1218-01 *(12 to 18)*
» Bismuth-212 - 3.923 PCI/G
» Cesium-137 - 0.039 PCI/G
» Lead-212 - 2.544 PCI/G
» Potassium-40 - 29.895 PCI/G
» Protactinium-234M - 0 PCI/G
» Radium-226 - 1.544 PCI/G
» Radium-228 - 2.689 PCI/G
» Thallium-208 - 1.048 PCI/G
» Thorium-228 - 0 PCI/G
» Thorium-228 - 1.81 PCI/G
» Thorium-230 - 0.903 PCI/G
» Thorium-232 - 1.66 PCI/G
» Thorium-234 - 1.731 PCI/G
» U-233/234 - 0.903 PCI/G
» U-235/236 - 0.121 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 0.994 PCI/G

UMR001-S003-1824-01 *(18 to 24)*
» Bismuth-212 - 3.698 PCI/G
» Cesium-137 - 0 PCI/G
» Lead-212 - 2.103 PCI/G
» Potassium-40 - 26.288 PCI/G
» Protactinium-234M - 11.843 PCI/G
» Radium-226 - 1.522 PCI/G
» Radium-228 - 2.135 PCI/G
» Thallium-208 - 0.763 PCI/G
» Thorium-228 - 7.101 PCI/G
» Thorium-228 - 2.2 PCI/G
» Thorium-230 - 1.01 PCI/G
» Thorium-232 - 1.66 PCI/G
» Thorium-234 - 0.682 PCI/G
» U-233/234 - 0.616 PCI/G
» U-235/236 - 0.042 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 0.885 PCI/G

SLAG
SG02 (0.0-1.0 ftbgs)
»Uranium-238 - 26.7 PCI/G
»Thorium-230 - 21.8 PCI/G
»Uranium-233/234 - 27.0 PCI/G
»Radium-226 - 32.6 PCI/G
»Thorium-232 - 116 PCI/G
»Radium-228 - 165 PCI/G
»Thorium-228 - 119 PCI/G
»Uranium-235/236 - 1.48 PCI/G

SOIL
S01 (1.0-2.0 ftbgs)
»Uranium-238 - 5.86 PCI/G
»Thorium-230 - 4.74 PCI/G
»Uranium-233/234 - 6.87 PCI/G
»Radium-226 - 15.7 PCI/G
»Thorium-232 - 23.9 PCI/G
»Radium-228 - 88.5 PCI/G
»Thorium-228 - 25.1 PCI/G
»Uranium-235/236 - 0.389 PCI/G

S04 (1.5-2.5 ftbgs)
»Uranium-238 - 1.40 PCI/G
»Thorium-230 - 1.60 PCI/G
»Uranium-233/234 - 1.30 PCI/G
»Radium-226 - 2.22 PCI/G
»Thorium-232 - 4.31 PCI/G
»Radium-228 - 7.05 PCI/G
»Thorium-228 - 4.54 PCI/G
»Uranium-235/236 - 0.0636 PCI/G

S05 (1.0-2.0 ftbgs)
»Uranium-238 - 0.979 PCI/G
»Thorium-230 - 1.39 PCI/G
»Uranium-233/234 - 1.04 PCI/G
»Radium-226 - 1.21 PCI/G
»Thorium-232 - 1.77 PCI/G
»Radium-228 - 2.54 PCI/G
»Thorium-228 - 2.06 PCI/G
»Uranium-235/236 - 0.0192 PCI/G

S07 (1.5-2.5 ftbgs)
»Uranium-238 - 0.835 PCI/G
»Thorium-230 - 0.941 PCI/G
»Uranium-233/234 - 0.765 PCI/G
»Radium-226 - 1.25 PCI/G
»Thorium-232 - 1.02 PCI/G
»Radium-228 - 0.987 PCI/G
»Thorium-228 - 1.13 PCI/G
»Uranium-235/236 - 0.0674 PCI/G

SLAG
SG01 (0.0-1.0 ftbgs)
»Uranium-238 - 8.68 PCI/G
»Thorium-230 - 3.69 PCI/G
»Uranium-233/234 - 7.84 PCI/G
»Radium-226 - 9.33 PCI/G
»Thorium-232 - 19.7 PCI/G
»Radium-228 - 52.4 PCI/G
»Thorium-228 - 20.1 PCI/G
»Uranium-235/236 - 0.427 PCI/G

SOIL
S03 (1.0-2.0 ftbgs)
»Uranium-238 - 8.68 PCI/G
»Thorium-230 - 1.09 PCI/G
»Uranium-233/234 - 0.867 PCI/G
»Radium-226 - 1.37 PCI/G
»Thorium-232 - 1.68 PCI/G
»Radium-228 - 2.31 PCI/G
»Thorium-228 - 1.67 PCI/G
»Uranium-235/236 - 0.0683 PCI/G

S10 (Duplicate) (1.0-2.0 ftbgs)
»Uranium-238 - 0.939 PCI/G
»Thorium-230 - 0.990 PCI/G
»Uranium-233/234 - 1.02 PCI/G
»Radium-226 - 1.37 PCI/G
»Thorium-232 - 2.05 PCI/G
»Radium-228 - 4.23 PCI/G
»Thorium-223 - 2.46 PCI/G
»Uranium-235/236 - 0.0411 PCI

S06 (2.0-3.0 ftbgs)
»Uranium-238 - 1.24 PCI/G
»Thorium-230 - 1.43 PCI/G
»Uranium-233/234 - 0.979 PCI/G
»Radium-226 - 1.54 PCI/G
»Thorium-232 - 2.95 PCI/G
»Radium-228 - 2.99 PCI/G
»Thorium-228 - 2.85 PCI/G
»Uranium-235/236 - 0.0603 PCI/G

Background
S08 (1.5-2.5 ftbgs)
»Uranium-238 - 0.597 PCI/G
»Thorium-230 - 0.993 PCI/G
»Uranium-233/234 0.799 PCI/G
»Radium-226 - 1.05 PCI/G
»Thorium-232 - 0.835 PCI/G
»Radium-228 - 1.54 PCI/G
»Thorium-228 - 1.08 PCI/G
»Uranium-235/236 - 0.0533 PCI/G

Background
S09 (1.5-2.5 ftbgs)
»Uranium-238 - 1.29 PCI/G
»Thorium-230 - 1.16 PCI/G
»Uranium-233/234 - 1.05 PCI/G
»Radium-226 - 1.03 PCI/G
»Thorium-232 - 1.12 PCI/G
»Radium-228 - 1.37 PCI/G
»Thorium-228 - 1.31 PCI/G
»Uranium-235/236 - 0.0677 PCI/G

UMR001-S002-0006-01 *(0 to 6)*
» Bismuth-212 - 3.645 PCI/G
» Cesium-137 - 0.083 PCI/G
» Lead-212 - 3.243 PCI/G
» Potassium-40 - 6.619 PCI/G
» Protactinium-234M - 0.166 PCI/G
» Radium-226 - 1.67 PCI/G
» Radium-228 - 3.547 PCI/G
» Thallium-208 - 1.133 PCI/G
» Thorium-228 - 0 PCI/G
» Thorium-228 - 2.45 PCI/G
» Thorium-230 - 0.91 PCI/G
» Thorium-232 - 2.33 PCI/G
» Thorium-234 - 1.484 PCI/G
» U-233/234 - 0.917 PCI/G
» U-235/236 - 0.061 PCI/G
» Uranium-235 - 0.46 PCI/G
» Uranium-238 - 0.943 PCI/G

UMR001-S002-0612-01 *(6 to 12)*
» Bismuth-212 - 1.655 PCI/G
» Cesium-137 - 0.04 PCI/G
» Lead-212 - 1.069 PCI/G
» Potassium-40 - 10.112 PCI/G
» Protactinium-234M - 4.326 PCI/G
» Radium-226 - 2.334 PCI/G
» Radium-228 - 1.645 PCI/G
» Thallium-208 - 0.37 PCI/G
» Thorium-228 - 10.586 PCI/G
» Thorium-228 - 1.22 PCI/G
» Thorium-230 - 1.84 PCI/G
» Thorium-232 - 0.818 PCI/G
» Thorium-234 - 2.722 PCI/G
» U-233/234 - 1.77 PCI/G
» U-235/236 - 0.153 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 1.72 PCI/G

UMR001-S002-1218-01 *(12 to 18)*
» Bismuth-212 - 2.626 PCI/G
» Cesium-137 - 0.024 PCI/G
» Lead-212 - 2.933 PCI/G
» Potassium-40 - 12.813 PCI/G
» Protactinium-234M - 14.239 PCI/G
» Radium-226 - 2.4 PCI/G
» Radium-228 - 2.799 PCI/G
» Thallium-208 - 1 PCI/G
» Thorium-228 - 6.496 PCI/G
» Thorium-228 - 1.82 PCI/G
» Thorium-230 - 1.46 PCI/G
» Thorium-232 - 2.17 PCI/G
» Thorium-234 - 2.174 PCI/G
» U-233/234 - 1.5 PCI/G
» U-235/236 - 0.142 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 1.33 PCI/G

UMR001-S002-1824-01 *(18 to 24)*
» Bismuth-212 - 1.664 PCI/G
» Cesium-137 - -0.054 PCI/G
» Lead-212 - 1.763 PCI/G
» Potassium-40 - 28.213 PCI/G
» Protactinium-234M - 5.4 PCI/G
» Radium-226 - 1.423 PCI/G
» Radium-228 - 2.01 PCI/G
» Thallium-208 - 0.665 PCI/G
» Thorium-228 - 0 PCI/G
» Thorium-228 - 1.38 PCI/G
» Thorium-230 - 1.27 PCI/G
» Thorium-232 - 1.55 PCI/G
» Thorium-234 - 0 PCI/G
» U-233/234 - 0.953 PCI/G
» U-235/236 - 0.062 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 1.41 PCI/G

UMR001-S001-0006-01 *(0 to 6)*
» Bismuth-212 - 2.423 PCI/G
» Cesium-137 - 0.489 PCI/G
» Lead-212 - 1.228 PCI/G
» Potassium-40 - 17.298 PCI/G
» Protactinium-234M - 0 PCI/G
» Radium-226 - 1.326 PCI/G
» Radium-228 - 1.248 PCI/G
» Thallium-208 - 0.387 PCI/G
» Thorium-228 - 2.974 PCI/G
» Thorium-228 - 1.22 PCI/G
» Thorium-230 - 1.31 PCI/G
» Thorium-232 - 0.668 PCI/G
» Thorium-234 - 0.509 PCI/G
» U-233/234 - 0.823 PCI/G
» U-235/236 - 0.095 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 0.709 PCI/G

UMR001-S001-0612-01 *(6 to 12)*
» Bismuth-212 - 1.07 PCI/G
» Cesium-137 - 0.299 PCI/G
» Lead-212 - 1.425 PCI/G
» Potassium-40 - 17.073 PCI/G
» Protactinium-234M - 13.308 PCI/G
» Radium-226 - 1.353 PCI/G
» Radium-228 - 1.922 PCI/G
» Thallium-208 - 0.551 PCI/G
» Thorium-228 - 1.06 PCI/G
» Thorium-228 - 1.26 PCI/G
» Thorium-230 - 0.892 PCI/G
» Thorium-232 - 0.861 PCI/G
» Thorium-234 - 3.583 PCI/G
» U-233/234 - 0.697 PCI/G
» U-235/236 - 0.019 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 0.96 PCI/G

UMR001-S001-0612-02 *(6 to 12)*
» Bismuth-212 - 2.492 PCI/G
» Cesium-137 - 0.072 PCI/G
» Lead-212 - 1.628 PCI/G
» Potassium-40 - 21.129 PCI/G
» Protactinium-234M - 2.622 PCI/G
» Radium-226 - 1.122 PCI/G
» Radium-228 - 1.241 PCI/G
» Thallium-208 - 0.561 PCI/G
» Thorium-228 - 5.17 PCI/G
» Thorium-228 - 1.49 PCI/G
» Thorium-230 - 0.976 PCI/G
» Thorium-232 - 1.14 PCI/G
» Thorium-234 - 2.398 PCI/G
» Uranium-235 - 0.703 PCI/G
» Uranium-238 - 0.841 PCI/G

UMR001-S001-1218-01 *(12 to 18)*
» Bismuth-212 - 0 PCI/G
» Cesium-137 - 0 PCI/G
» Lead-212 - 1.605 PCI/G
» Potassium-40 - 29.001 PCI/G
» Protactinium-234M - 8.501 PCI/G
» Radium-226 - 1.252 PCI/G
» Radium-228 - 2.567 PCI/G
» Thallium-208 - 0.4 PCI/G
» Thorium-228 - 4.039 PCI/G
» Thorium-228 - 1.51 PCI/G
» Thorium-230 - 0.999 PCI/G
» Thorium-232 - 1.08 PCI/G
» Thorium-234 - 3.483 PCI/G
» U-233/234 - 1.23 PCI/G
» U-235/236 - 0.081 PCI/G
» Uranium-235 - 0.51 PCI/G
» Uranium-238 - 0.991 PCI/G

UMR001-S001-1824-01 *(18 to 24)*
» Bismuth-212 - 1.763 PCI/G
» Cesium-137 - -0.003 PCI/G
» Lead-212 - 1.541 PCI/G
» Potassium-40 - 27.28 PCI/G
» Protactinium-234M - 2.305 PCI/G
» Radium-226 - 1.516 PCI/G
» Radium-228 - 1.546 PCI/G
» Thallium-208 - 0.728 PCI/G
» Thorium-228 - 2.949 PCI/G
» Thorium-228 - 1.23 PCI/G
» Thorium-230 - 1.34 PCI/G
» Thorium-232 - 1.59 PCI/G
» Thorium-234 - 2.952 PCI/G
» U-233/234 - 1.37 PCI/G
» U-235/236 - 0.07 PCI/G
» Uranium-235 - 0 PCI/G
» Uranium-238 - 1.3 PCI/G

SCALE
1:1,100

LEGEND

RST Sample Location
Soil

SAT Sample Location
Soil
Soil/Slag

Notes:
» Analytical results were compared with the U.S. Environmental Protection Agency's (EPA's) Site-Specific Action Levels (SSAL) for target radionuclide.
» SAT - Site Assessment Team
» PCI/G - Picocuries per gram

Figure 4:
Soil Analytical Results Map

783 UPPER MOUNTAIN ROAD
LEWISTON, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

Weston Solutions, Inc.

In Association With
Scientific and Environmental Associates, Inc., Environmental Compliance Consultants, Inc., Avatar Environmental, LLC, On-Site Environmental, Inc., and Sovereign Consulting, Inc.

GIS ANALYST:	M. MANNINO
EPA OSC:	E. DALY
RST 2 SPM:	B. NWOSU
FILENAME:	181002 Figure 4 Results
FIGURE:	4
REVISION	0.0
DATE MODIFIED	3/28/2019

WESTON SOLUTIONS

Area and Volume Estimates			
Area (m^2)	Area (ft^2)	Depth (ft)	Volume (yd^3)
128.11	1,378.98	2	102.15

Legend

Area of Concern

0 10 20 40 60 80 Feet

m^2 = square meters
ft = feet
ft^2 = square feet
yd^3 = cubic yards

N

Weston Solutions, Inc.

In association with
Scientific and Environmental Associates, Inc.,
Avatar Environmental, LLC, Environmental Compliance Consultants,
On-Site Environmental, Inc., and Sovereign Consulting, Inc.

DATE MODIFIED: 3/22/2019

Figure 5:
Area and Volume Map

738 UPPER MOUNTAIN ROAD
LEWISTON, NEW YORK

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

GIS ANALYST:	M. MANNINO
EPA OSC:	E. DALY
RST SPM:	B. NWOSU
FILENAME:	170427_Figure_5_AOC_Map.mxd

ATTACHMENT B

Tables

Table 1: Soil Sample Collection and Test Pit Geological Summary Table
Table 2A: Soil Analytical and Screening Results – Radioisotopes Summary Table
Table 2B: Validated SAT Soil Analytical Results – Radioisotopes Summary Table
Table 3: Radon Sample Collection and Validated Analytical Results Summary Table

Table 1: Soil Sample Collection and Test Pit Geological Summary Table
738 Upper Mountain Road Site
Lewiston, Niagara County, New York
November 18, 2016

Sampling Date	Sampling Location	RST 3 Sample Number	Sampling Depth Intervals (inches)	Sample Type	Analyses	Test Pit Depth Intervals (inches)	Test Pit Geological Log
11/18/2016	UMR001-S001	UMR001-S001-0006-01	0-6	Field Sample	Gamma Spectroscopy Isotopic Uranium Isotopic Thorium	0 - 1	Moist dark brown silty fine SAND, little fine to medium gravel, trace organic (roots).
		UMR001-S001-0612-01*	6 - 12	Field Sample		1 - 8	Moist dark brown silty fine SAND, little fine to medium gravel, little clay, trace roots.
		UMR001-S001-0612-02	6 - 12	Field Duplicate			
		UMR001-S001-1218-01	12 - 18	Field Sample		8 - 18	Moist brown silty CLAY.
		UMR001-S001-1824-01	18 - 24	Field Sample		18 - 24	Brown silty stiff CLAY.
	UMR001-S002	UMR001-S002-0006-01	0 - 6	Field Sample	Gamma Spectroscopy Isotopic Uranium Isotopic Thorium	0 - 4	Moist dark grey fine to coarse GRAVEL, some fine to coarse sand.
		UMR001-S002-0612-01	6 - 12	Field Sample		4 - 10	Moist dark grey to light grey fine to coarse GRAVEL (cinder and ash/slag like material), some fine to coarse sand.
		UMR001-S002-1218-01	12 - 18	Field Sample		10 - 24	Moist light brown silty medium stiff CLAY.
		UMR001-S002-1824-01	18-24	Field Sample			
	UMR001-S003	UMR001-S003-0006-01	0 - 6	Field Sample	Gamma Spectroscopy Isotopic Uranium Isotopic Thorium	0 - 4	Moist dark grey to light grey medium to coarse GRAVEL, little fine to coarse sand.
		UMR001-S003-0612-01	6 - 12	Field Sample		4 - 24	Moist brown silty CLAY.
		UMR001-S003-1218-01	12 - 18	Field Sample			
		UMR001-S003-1824-01	18-24	Field Sample			
	UMR001-S004	UMR001-S004-0006-01	0 - 6	Field Sample	Gamma Spectroscopy Isotopic Uranium Isotopic Thorium	0 - 6	Moist dark grey to light grey fine to coarse GRAVEL, some fine to coarse sand.
		UMR001-S004-0612-01	6 - 12	Field Sample		6 - 12	Moist dark brown to dark grey fine to coarse SAND some fine to medium gravel, transitioning to clay.
		UMR001-S004-1218-01	12 - 18	Field Sample		12 - 24	Moist dark brown silty CLAY.
		UMR001-S004-1824-01	18 - 24	Field Sample			

Notes:
RST 3 - Removal Support Team 3
*Matrix Spike/Matrix Spike Duplicate Sample

Table 2A: Soil Analytical and Screening Results - Radioisotopes Summary Table
738 Upper Mountain Road Site
Upper Mountain Road, Lewiston, New York
November 18, 2016

		RST 3 Sample No.	UMR001-S001-0006-01					UMR001-S001-0612-01					UMR001-S001-0612-02					UMR001-S001-1218-01					UMR001-S001-1824-01				
		Sample Depth (inches)	0-6					6-12					6-12					12-18					18-24				
		Sample Matrix	Soil					Soil					Soil					Soil					Soil				
		Sample Date	11/18/2016					11/18/2016					11/18/2016					11/18/2016					11/18/2016				
		Data Type	Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening	
		Sample Result	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty
Radioisotope	**Analytical Method**	**[1]EPA SSAL (pCi/g)**																									
Actinium-228 (Ac-228)	NA	5.01	NA		NA	0.657	0.047	NA		NA	0.960	0.048	NA		NA	0.877	0.054	NA		NA	0.896	0.045	NA		NA	1.057	0.054
Bismuth-212 (Bi-212)	EPA 901.1	5.01	2.423		1.802	0.939	0.183	1.070		1.083	1.183	0.202	2.492		1.305	1.096	0.192	0.000		1.761	0.937	0.211	1.763		2.337	1.333	0.246
Cesium-137 (Cs-137)	EPA 901.1	28.40	0.489		0.159	0.157	0.012	0.299		0.095	0.059	0.014	0.072		0.112	0.077	0.017	0.000		0.027	NA	NA	-0.0030		0.148	NA	NA
Lead-212 (Pb-212)	EPA 901.1	5.01	1.228		0.326	0.707	0.037	1.425		0.323	0.943	0.046	1.628		0.307	0.958	0.047	1.605		0.358	0.914	0.044	1.541		0.333	1.062	0.048
Potassium-40 (K-40)	EPA 901.1	83.30	17.298		3.990	10.992	0.483	17.073		4.240	15.906	0.637	21.129		3.507	14.751	0.606	29.001		5.508	18.677	0.686	27.280		4.720	21.703	0.767
Protactinium-234M (Pa-234M)	EPA 901.1	5.18	0.000		4.030	NA	NA	**13.308**		7.356	NA	NA	2.622		12.084	NA	NA	**8.501**		14.801	NA	NA	2.305		15.326	NA	NA
Radium-226* (Ra-226)	EPA 901.1	5.18	1.326		0.371	1.536	0.305	1.353		0.322	1.561	0.353	1.122		0.280	1.994	0.407	1.252		0.361	2.248	0.351	1.516		0.334	1.619	0.323
Radium-228 (Ra-228)	EPA 901.1	5.01	1.248		0.564	NA	NA	1.922		0.484	NA	NA	1.241		0.339	NA	NA	2.567		0.629	NA	NA	1.546		0.394	NA	NA
Thallium-208 (Tl-208)	EPA 901.1	5.01	0.387		0.214	0.224	0.020	0.551		0.177	0.329	0.024	0.561		0.145	0.307	0.0253	0.400		0.268	0.342	0.022	0.728		0.182	0.338	0.024
Thorium-228 (Th-228)	EPA 901.1	5.01	2.974		5.663	NA	NA	1.060		11.237	NA	NA	**5.170**		8.934	NA	NA	4.039		7.337	NA	NA	2.949		11.117	NA	NA
Thorium-234 (Th-234)	EPA 901.1	5.18	0.509		2.833	0.692	0.193	3.583		3.207	NA	NA	2.398		2.263	1.853	0.260	3.483		2.714	NA	NA	2.952		1.438	1.716	0.236
Uranium-235 (U-235)	EPA 901.1	21.10	0.000		0.665	NA	NA	0.000		0.574	NA	NA	0.703		1.141	NA	NA	0.51		0.605	NA	NA	0.000		0.732	NA	NA
Thorium-228 (Th-228)	HSL-300	5.01	1.22		0.367	NA	NA	1.260		0.380	NA	NA	1.49		0.514	NA	NA	1.510		0.411	NA	NA	1.23		0.385	NA	NA
Thorium-230 (Th-230)	HSL-300	5.18	1.31		0.364	NA	NA	0.892		0.289	NA	NA	0.976		0.363	NA	NA	0.999		0.305	NA	NA	1.34		0.379	NA	NA
Thorium-232 (Th-232)	HSL-300	5.01	0.668		0.237	NA	NA	0.861		0.281	NA	NA	1.14		0.394	NA	NA	1.08		0.316	NA	NA	1.59		0.422	NA	NA
U-233/234	HSL-300	5.18	0.823		0.239	NA	NA	0.697		0.236	NA	NA	0.935		0.313	NA	NA	1.23		0.319	NA	NA	1.37		0.347	NA	NA
U-235/236	HSL-300	21.10	0.095		0.081	NA	NA	0.019		0.073	NA	NA	-0.006		0.091	NA	NA	0.081		0.08	NA	NA	0.070		0.083	NA	NA
Uranium-238 (U-238)	HSL-300	5.18	0.709		0.216	NA	NA	0.960		0.287	NA	NA	0.841		0.285	NA	NA	0.991		0.275	NA	NA	1.3		0.333	NA	NA

		RST 3 Sample No.	UMR001-S002-0006-01					UMR001-S002-0612-01					UMR001-S002-1218-01					UMR001-S002-1824-01					UMR001-S003-0006-01				
		Sample Depth (inches)	0-6					6-12					12-18					18-24					0-6				
		Sample Matrix	Soil					Soil					Soil					Soil					Soil				
		Sample Date	11/18/2016					11/18/2016					11/18/2016					11/18/2016					11/18/2016				
		Data Type	Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening	
		Sample Result	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty
Radioisotope	**Analytical Method**	**[1]EPA SSAL (pCi/g)**																									
Actinium-228 (Ac-228)	EPA 901.1	5.01	NA		NA	1.923	0.053	NA		NA	0.677	0.041	NA		NA	2.01	0.063	NA		NA	1.476	0.065	NA		NA	**5.242**	0.101
Bismuth-212 (Bi-212)	EPA 901.1	5.01	3.645		1.611	2.366	0.229	1.655		1.402	0.555	0.134	2.626		2.788	2.095	0.241	1.664		2.179	1.03	0.283	**11.672**		3.213	**5.451**	0.325
Cesium-137 (Cs-137)	EPA 901.1	28.40	0.083		0.164	0.037	0.012	0.040		0.105	0.017	0.008	0.024		0.124	NA	NA	-0.054		0.192	NA	NA	0.000		0.094	NA	NA
Lead-212 (Pb-212)	EPA 901.1	5.01	3.243		0.572	1.63	0.064	1.069		0.270	0.618	0.033	2.933		0.529	1.866	0.076	1.763		0.372	1.302	0.062	**8.852**		1.305	3.319	0.155
Potassium-40 (K-40)	EPA 901.1	83.30	6.619		2.015	4.121	0.248	10.112		2.253	8.801	0.368	12.813		2.983	10.853	0.471	28.213		4.922	22.276	0.855	6.414		2.096	4.122	0.275
Protactinium-234M (Pa-234M)	EPA 901.1	5.18	0.166		15.598	NA	NA	4.326		11.663	NA	NA	**14.239**		8.620	NA	NA	**5.400**		14.560	NA	NA	0.000		2.409	NA	NA
Radium-226* (Ra-226)	EPA 901.1	5.18	1.670		0.404	1.419	0.294	2.334		0.432	2.272	0.342	2.400		0.501	2.838	0.484	1.423		0.350	1.612	0.394	**7.824**		1.160	**11.179**	0.717
Radium-228 (Ra-228)	EPA 901.1	5.01	3.547		0.673	NA	NA	1.645		0.410	NA	NA	2.799		0.572	NA	NA	2.010		0.622	NA	NA	**7.394**		1.411	NA	NA
Thallium-208 (Tl-208)	EPA 901.1	5.01	1.133		0.265	0.677	0.030	0.370		0.122	0.218	0.017	1.000		0.245	0.651	0.032	0.665		0.198	0.404	0.029	3.216		0.535	1.731	0.058
Thorium-228 (Th-228)	EPA 901.1	5.01	0.000		3.938	NA	NA	**10.586**		8.458	NA	NA	**6.496**		9.029	NA	NA	0.000		7.404	NA	NA	**15.992**		12.500	0.628	16.972
Thorium-234 (Th-234)	EPA 901.1	5.18	1.484		2.819	NA	NA	2.722		2.422	1.095	0.360	2.174		2.682	3.257	0.314	0.000		1.269	NA	NA	**8.803**		4.205	**9.635**	0.609
Uranium-235 (U-235)	EPA 901.1	21.10	0.460		1.491	NA	NA	0.000		0.848	NA	NA	0.000		0.480	NA	NA	0.000		0.335	NA	NA	0.535		0.782	NA	NA
Thorium-228 (Th-228)	HSL-300	5.01	2.45		0.586	NA	NA	1.22		0.396	NA	NA	1.82		0.481	NA	NA	1.38		0.405	NA	NA	**7.56**		1.43	NA	NA
Thorium-230 (Th-230)	HSL-300	5.18	0.910		0.303	NA	NA	1.84		0.484	NA	NA	1.46		0.398	NA	NA	1.27		0.366	NA	NA	**6.87**		1.30	NA	NA
Thorium-232 (Th-232)	HSL-300	5.01	2.33		0.549	NA	NA	0.818		0.287	NA	NA	2.17		0.520	NA	NA	1.55		0.413	NA	NA	**6.89**		1.30	NA	NA
U-233/234	HSL-300	5.18	0.917		0.275	NA	NA	1.77		0.437	NA	NA	1.50		0.380	NA	NA	0.953		0.263	NA	NA	**6.02**		1.24	NA	NA
U-235/236	HSL-300	21.10	0.061		0.075	NA	NA	0.153		0.125	NA	NA	0.142		0.107	NA	NA	0.062		0.065	NA	NA	0.437		0.24	NA	NA
Uranium-238 (U-238)	HSL-300	5.18	0.943		0.271	NA	NA	1.72		0.429	NA	NA	1.33		0.348	NA	NA	1.41		0.337	NA	NA	**5.87**		1.21	NA	NA

Notes:

RST 3 - Removal Support Team 3.

No. - Number, NA - Not Analyzed.

Radium-226* analyzed via 21 days ingrowth.

Screening data collected using High Purity Germanium (HPGe) detector.

pCi/g - picocuries per gram.

[1]U.S. Environmental Protection Agency (EPA) Site-Specific Action Level (SSAL), March 2019.

Values in red equal or exceed the EPA SSAL.

Table 2A: Soil Analytical and Screening Results - Radioisotopes Summary Table
738 Upper Mountain Road Site
Upper Mountain Road, Lewiston, New York
November 18, 2016

	RST 3 Sample No.		UMR001-S003-0612-01					UMR001-S003-1218-01					UMR001-S003-1824-01					UMR001-S004-0006-01					UMR001-S004-0612-01				
	Sample Depth (inches)		6-12					12-18					18-24					0-6					6-12				
	Sample Matrix		Soil					Soil					Soil					Soil					Soil				
	Sample Date		11/18/2016					11/18/2016					11/18/2016					11/18/2016					11/18/2016				
	Data Type		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening	
	Sample Result		Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty
Radioisotope	**Analytical Method**	**[1]EPA SSAL (pCi/g)**																									
Actinium-228 (Ac-228)	EPA 901.1	5.01	NA		NA	3.412	0.085	NA		NA	1.45	0.056	NA		NA	1.331	0.054	NA		NA	**93.395**	0.956	NA		NA	**94.206**	0.983
Bismuth-212 (Bi-212)	EPA 901.1	5.01	**10.126**		2.446	3.57	0.318	3.923		1.740	1.428	0.190	3.698		1.598	1.575	0.237	**133.840**		20.082	**97.971**	2.048	**104.270**		15.317	**98.684**	2.117
Cesium-137 (Cs-137)	EPA 901.1	28.40	0.017		0.138	NA	NA	0.039		0.135	NA	NA	0.000		0.029	NA	NA	0.037		0.669	NA	NA	0.115		0.481	NA	NA
Lead-212 (Pb-212)	EPA 901.1	5.01	**7.021**		1.073	2.881	0.101	2.544		0.497	1.391	0.059	2.103		0.408	1.27	0.059	**125.400**		16.994	**57.641**	1.327	**107.010**		14.455	**63.265**	1.451
Potassium-40 (K-40)	EPA 901.1	83.30	28.246		4.688	18.564	0.698	29.895		5.779	18.615	0.695	26.288		4.629	22.527	0.809	8.952		6.183	NA	NA	12.193		3.949	NA	NA
Protactinium-234M (Pa-234M)	EPA 901.1	5.18	**8.375**		18.021	NA	NA	0.000		12.577	NA	NA	**11.843**		6.775	NA	NA	**17.053**		58.277	NA	NA	**32.995**		40.188	NA	NA
Radium-226* (Ra-226)	EPA 901.1	5.18	2.386		0.551	1.867	0.532	1.544		0.416	2.225	0.409	1.522		0.310	2.226	0.372	**20.387**		2.950	**25.619**	2.506	**17.171**		2.560	**30.621**	2.56
Radium-228 (Ra-228)	EPA 901.1	5.01	**7.125**		1.291	NA	NA	2.689		0.676	NA	NA	2.135		0.486	NA	NA	**121.200**		16.267	NA	NA	**101.250**		13.553	NA	NA
Thallium-208 (Tl-208)	EPA 901.1	5.01	2.273		0.405	1.137	0.047	1.048		0.257	0.500	0.028	0.763		0.210	0.489	0.031	**44.850**		6.096	**31.616**	0.629	**35.772**		4.826	**32.875**	0.631
Thorium-228 (Th-228)	EPA 901.1	5.01	0.953		12.964	NA	NA	0.000		5.649	NA	NA	**7.101**		8.728	NA	NA	**169.250**		37.684	**67.960**	5.612	**153.110**		39.461	**71.350**	5.813
Thorium-234 (Th-234)	EPA 901.1	5.18	2.013		6.952	2.368	0.302	1.731		3.010	NA	NA	0.682		4.624	NA	NA	**13.509**		8.427	NA	NA	**22.436**		13.181	NA	NA
Uranium-235 (U-235)	EPA 901.1	21.10	0.000		1.473	NA	NA	0.000		0.974	NA	NA	0.000		0.608	NA	NA	0.000		6.356	NA	NA	2.401		3.048	NA	NA
Thorium-228 (Th-228)	HSL-300	5.01	**5.96**		1.17	NA	NA	1.81		0.472	NA	NA	2.20		0.537	NA	NA	**67.4**		11.3	NA	NA	**54.5**		9.26	NA	NA
Thorium-230 (Th-230)	HSL-300	5.18	1.18		0.347	NA	NA	0.903		0.289	NA	NA	1.01		0.317	NA	NA	**10.6**		2.18	NA	NA	**7.19**		1.63	NA	NA
Thorium-232 (Th-232)	HSL-300	5.01	**5.16**		1.02	NA	NA	1.66		0.426	NA	NA	1.66		0.423	NA	NA	**56.5**		9.53	NA	NA	**45.9**		7.85	NA	NA
U-233/234	HSL-300	5.18	1.16		0.322	NA	NA	0.903		0.264	NA	NA	0.616		0.233	NA	NA	**16.0**		2.70	NA	NA	**12.6**		2.65	NA	NA
U-235/236	HSL-300	21.10	0.041		0.073	NA	NA	0.121		0.095	NA	NA	0.042		0.076	NA	NA	1.21		0.370	NA	NA	0.878		0.441	NA	NA
Uranium-238 (U-238)	HSL-300	5.18	1.35		0.354	NA	NA	0.994		0.275	NA	NA	0.885		0.274	NA	NA	**15.6**		2.63	NA	NA	**10.5**		2.27	NA	NA

	RST 3 Sample No.		UMR001-S004-1218-01					UMR001-S004-1824-01				
	Sample Depth (inches)		12-18					18-24				
	Sample Matrix		Soil					Soil				
	Sample Date		11/18/2016					11/18/2016				
	Data Type		Laboratory Analysis			HPGe Screening		Laboratory Analysis			HPGe Screening	
	Sample Result		Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Total Uncertainty
Radioisotope	**Analytical Method**	**[1]EPA SSAL (pCi/g)**										
Actinium-228 (Ac-228)	EPA 901.1	5.01	NA		NA	**184.732**	1.825	NA		NA	**30.030**	0.385
Bismuth-212 (Bi-212)	EPA 901.1	5.01	**58.144**		10.790	**193.849**	3.774	**244.510**		34.048	**31.833**	1.083
Cesium-137 (Cs-137)	EPA 901.1	28.40	0.000		0.091	NA	NA	0.021		0.772	NA	NA
Lead-212 (Pb-212)	EPA 901.1	5.01	**43.400**		6.013	**106.704**	2.479	**232.950**		31.355	**26.470**	0.581
Potassium-40 (K-40)	EPA 901.1	83.30	29.517		6.155	24.248	1.316	21.018		7.619	21.572	0.868
Protactinium-234M (Pa-234M)	EPA 901.1	5.18	0.897		41.284	NA	NA	**22.633**		65.987	NA	NA
Radium-226* (Ra-226)	EPA 901.1	5.18	**7.840**		1.448	**50.317**	4.016	**36.575**		5.021	**11.097**	1.632
Radium-228 (Ra-228)	EPA 901.1	5.01	**41.051**		5.833	NA	NA	**221.460**		29.416	NA	NA
Thallium-208 (Tl-208)	EPA 901.1	5.01	**14.038**		2.065	**63.226**	1.225	**78.922**		10.525	**10.417**	0.261
Thorium-228 (Th-228)	EPA 901.1	5.01	**60.470**		22.484	**120.836**	9.677	**323.850**		66.646	**26.200**	15.223
Thorium-234 (Th-234)	EPA 901.1	5.18	**8.073**		8.388	**96.244**	6.327	**15.308**		23.142	NA	NA
Uranium-235 (U-235)	EPA 901.1	21.10	0.000		2.656	NA	NA	0.000		4.514	NA	NA
Thorium-228 (Th-228)	HSL-300	5.01	**26.5**		5.01	NA	NA	**74.7**		12.5	NA	NA
Thorium-230 (Th-230)	HSL-300	5.18	4.68		1.33	NA	NA	**12.2**		2.46	NA	NA
Thorium-232 (Th-232)	HSL-300	5.01	**23.8**		4.51	NA	NA	**59.1**		9.97	NA	NA
U-233/234	HSL-300	5.18	4.50		0.846	NA	NA	**23.5**		3.88	NA	NA
U-235/236	HSL-300	21.10	0.197		0.127	NA	NA	1.68		0.459	NA	NA
Uranium-238 (U-238)	HSL-300	5.18	4.17		0.794	NA	NA	**24.2**		3.98	NA	NA

Notes:
RST 3 - Removal Support Team 3.
No. - Number, NA - Not Analyzed.
Radium-226* analyzed via 21 days ingrowth.
Screening data collected using High Purity Germanium (HPGe) detector.
pCi/g - picocuries per gram.
[1]U.S. Environmental Protection Agency (EPA) Site-Specific Action Level (SSAL), March 2019.
Values in red equal or exceed the EPA SSAL.

Table 2B: Validated SAT Soil Analytical Results - Radioisotopes Summary Table
738 Upper Mountain Road Site
Upper Mountain Road, Lewiston, New York
December 12, 2013

	RST 3 Sample No.	S01 (0-2)			S03 (1-2)			S10 (1-2)			S04 (1.5-2.5)			S05 (1-2)			S06 (2-3)			S07 (1.5-2.5)			SG01 (0-1)		
	Sample Depth (feet)	0 - 2			1 - 2			1 - 2			1.5 - 2.5			1 - 2			2 - 3			1.5 - 2.5			0 - 1		
	Sample Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	Data Type	Laboratory Analysis			Laboratory Analysis			Laboratory Analysis			Laboratory Analysis			Laboratory Analysis			Laboratory Analysis			Laboratory Analysis			Laboratory Analysis		
	Sample Result	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty
Radioisotope	**[1]EPA SSAL (pCi/g)**																								
Actinium-228 (Ac-228)	5.01	NA			NA			NA			NA			NA			NA			NA			NA		
Bismuth-212 (Bi-212)	5.01	NA			NA			NA			NA			NA			NA			NA			NA		
Cesium-137 (Cs-137)	28.40	NA			NA			NA			NA			NA			NA			NA			NA		
Lead-212 (Pb-212)	5.01	NA			NA			NA			NA			NA			NA			NA			NA		
Potassium-40 (K-40)	83.30	NA			NA			NA			NA			NA			NA			NA			NA		
Protactinium-234M (Pa-234M)	5.18	NA			NA			NA			NA			NA			NA			NA			NA		
Radium-226* (Ra-226)	5.18	**15.7**	V	2.1	1.37	V	0.277	1.37	V	0.266	2.22	V	0.448	1.21	V	0.274	1.54	V	0.3	1.25	V	0.363	**9.33**	V	1.16
Radium-228 (Ra-228)	5.01	**88.5**	V	9.26	2.31	V	0.448	4.23	V	0.645	**7.05**	V	0.92	2.54	V	0.484	2.99	V	0.49	0.987	V	0.387	**52.4**	V	5.48
Thallium-208 (Tl-208)	5.01	NA			NA			NA			NA			NA			NA			NA			NA		
Thorium-228 (Th-228)	5.01	**25.1**	V	2.47	1.67	V	0.323	2.46	V	0.399	4.54	V	0.599	2.06	V	0.345	2.85	V	0.421	1.13	V	0.237	**20.1**	V	1.97
Thorium-234 (Th-234)	5.18	NA			NA			NA			NA			NA			NA			NA			NA		
Uranium-235 (U-235)	21.10	NA			NA			NA			NA			NA			NA			NA			NA		
Thorium-228 (Th-228)	5.01	NA			NA			NA			NA			NA			NA			NA			NA		
Thorium-230 (Th-230)	5.18	4.74	V	0.69	1.09	V	0.252	0.99	V	0.231	1.6	V	0.306	1.39	V	0.272	1.43	V	0.274	0.941	V	0.21	3.69	V	0.531
Thorium-232 (Th-232)	5.01	**23.9**	V	2.37	1.68	V	0.323	2.05	V	0.354	4.31	V	0.577	1.77	V	0.314	2.95	V	0.431	1.02	V	0.219	**19.7**	V	1.93
U-233/234	5.18	**6.87**	V	0.777	0.867	V	0.21	1.02	V	0.229	1.3	V	0.268	1.04	V	0.23	0.979	V	0.224	0.765	V	0.194	**7.84**	V	0.867
U-235/236	21.10	0.389	V	0.142	0.0683	V	0.0613	0.0411	V	0.0476	0.0636	U	0.065	0.0192	U	0.0388	0.0603	U	0.0616	0.0674	V	0.0605	0.427	V	0.152
Uranium-238 (U-238)	5.18	**5.86**	V	0.687	1.01	V	0.226	0.939	V	0.219	1.4	V	0.28	0.963	V	0.221	1.24	V	0.256	0.835	V	0.203	**8.68**	V	0.94

	RST 3 Sample No.	SG02 (0-1)			S08 (1.5-2.5)			S09 (1.5-2.5)		
	Sample Depth (feet)	0 - 1			1.5 - 2.5			1.5 - 2.5		
	Sample Matrix	Soil			Soil			Soil		
	Data Type	Laboratory Analysis			Laboratory Analysis			Laboratory Analysis		
	Sample Result	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty	Value (pCi/g)	Qualifier	Total Uncertainty
Radioisotope	**[1]EPA SSAL (pCi/g)**									
Actinium-228 (Ac-228)	5.01	NA			NA			NA		
Bismuth-212 (Bi-212)	5.01	NA			NA			NA		
Cesium-137 (Cs-137)	28.40	NA			NA			NA		
Lead-212 (Pb-212)	5.01	NA			NA			NA		
Potassium-40 (K-40)	83.30	NA			NA			NA		
Protactinium-234M (Pa-234M)	5.18	NA			NA			NA		
Radium-226* (Ra-226)	5.18	**32.6**	V	3.97	1.05	V	0.25	1.03	V	0.265
Radium-228 (Ra-228)	5.01	**165**	V	17.1	1.54	V	0.309	1.37	V	0.299
Thallium-208 (Tl-208)	5.01	NA			NA			NA		
Thorium-228 (Th-228)	5.01	**119**	V	12	1.08	V	0.237	1.31	V	0.268
Thorium-234 (Th-234)	5.18	NA			NA			NA		
Uranium-235 (U-235)	21.10	NA			NA			NA		
Thorium-228 (Th-228)	5.01	NA			NA			NA		
Thorium-230 (Th-230)	5.18	**21.8**	V	3.43	0.993	V	0.224	1.16	V	0.249
Thorium-232 (Th-232)	5.01	**116**	V	11.7	0.835	V	0.203	1.12	V	0.242
U-233/234	5.18	**27**	V	2.58	0.799	V	0.197	1.05	V	0.235
U-235/236	21.10	1.48	V	0.345	0.0533	V	0.0535	0.0677	V	0.0634
Uranium-238 (U-238)	5.18	**26.7**	V	2.55	0.597	V	0.168	1.29	V	0.265

Notes:
SAT - Site Assessment Team.
No. - Number, NA - Not Analyzed.
U - Not detected.
V - Verified by Certified Health Physicist.
Radium-226* analyzed via 21 days ingrowth.
S10 Duplicate of S03
pCi/g - picocuries per gram.
[1]U.S. Environmental Protection Agency (EPA) Site-Specific Action Level (SSAL), March 2019.
*Radium-226 (Non-ingrowth) analysis.
Background Sample
Value equals or exceeds the EPA SSAL.

Table 3: Radon Sample Collection and Validated Analytical Results Summary Table
738 Upper Mountain Road Site
Upper Mountain Road, Lewiston, New York
August 11 through 14, 2017

Canisters Number	Result (pCi/L)	Sample Type	Sample Location	Sample Media	Analysis
2471303	1.5	Field Sample	First floor, southeast bedroom	Charcoal Canister	Radon
2523071	1.2	Field Sample	First floor, northeast bedroom		
2559490	1.3	Field Sample	First floor, living room		
2559505	3.0	Field Sample	Basement, southeast		
2559571	3.8	Field Sample	Basement, sump room		
2559514*	3.1	Field Duplicate	Basement, sump room		
2559549	1.1	Field Sample	Second floor, northwest		
2559565	2.5	Field Sample	Basement, southewest		

Notes:
*Field duplicate 2559571
pCi/L - Picocuries

ATTACHMENT C

Photographic Documentation Log

Photographic Documentation Log
738 Upper Mountain Road Site
Lewiston, Niagara County, New York
November 18, 2016

Photograph 1: A view of the driveway entrance to the 738 Upper Mountain Road Site (the Site). Weston Solutions, Inc., Removal Support Team 3 (RST 3) was tasked by the U.S. Environmental Protection Agency (EPA) with conducting exterior radiological survey of the Site in order to verify the presence of radiation-containing material and to define the extent of the contaminated areas.

Photograph 2: A view of the driveway into the Site while facing Upper Mountain Road. The area of concern (AOC) is located at the entrance of the driveway currently utilized by the 738 Upper Mountain Road residence, although the driveway was historically used as an access road to the vacant Talarico Bros. Building Corp (TBBC) property.

Photograph 3: A view of the Site driveway facing south.

Photograph 4: A view of the radiological survey equipment setup. A sodium iodide (NaI) 3x3 scintillator attached to a Ludlum-2241 scaler ratemeter which was connected to a Life-line Interoperable Network Communicators (LINC) and a Global Positioning System (GPS) unit, all of which communicated with the VIPER system (a wireless network-based communication system) via a Gateway (internet source) in order to provide instantaneous real-time gamma readings. The gamma readings stored on VIPER were viewed on-site through a computer on the Viper Deployment Manager (VDM) website. RST 3 utilized an all-terrain vehicle (ATV) to provide mobility for the radiological survey equipment setup.

Photograph 5: View of a proposed test pit location which were selected by the EPA On-Scene Coordinator (OSC) based on results of the radiological survey performed at the Site in October 2016.

Photograph 6: View of a proposed test pit location further south of the driveway entrance.

Photograph 7: Using a mini excavator, test pits were advanced by RST 3 to depths below ground surface (bgs) at four locations.

Photograph 8: A view of test pit location UMR001-S002.

Photograph 9: A view of slag material excavated from test pit UMR001-S002.

Photograph 10: A close up view of test pit UMR001-S002.

Photograph 11: A view of test pit location UMR001-S003.

Photograph 12: A close up view of test pit UMR001-S003.

Photograph 13: A view of test pit location UMR001-S004.

Photograph 14: A close up view of test pit location UMR001-S004.

ATTACHMENT D

Chain of Custody Record and FedEx Airbills

Weston Solutions, Inc.
DateShipped: 12/7/2016
CarrierName: FedEx
AirbillNo: 7778 8428 0670

CHAIN OF CUSTODY RECORD
Case #: 416
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-120716-091830-0001
Cooler #:
Lab: PACE Analytical Services
Lab Phone: 724-850-5600

Lab #	Sample #	Location	Analyses	Matrix	Collected	Sample Time	Numb Cont	Container	Preservative	Lab QC
	UMR001-S001-0006-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:58	1	8 oz glass	4 C	N
	UMR001-S001-0006-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:58	1	8 oz glass	4 C	N
	UMR001-S001-0006-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:58	1	16 oz	4 C	N
	UMR001-S001-0612-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:55	2	8 oz glass	4 C	Y
	UMR001-S001-0612-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:55	2	8 oz glass	4 C	Y
	UMR001-S001-0612-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:55	2	16 oz	4 C	Y
	UMR001-S001-0612-02	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:55	1	8 oz glass	4 C	N
	UMR001-S001-0612-02	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:55	1	8 oz glass	4 C	N
	UMR001-S001-0612-02	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:55	1	16 oz	4 C	N
	UMR001-S001-1218-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:50	1	8 oz glass	4 C	N
	UMR001-S001-1218-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:50	1	8 oz glass	4 C	N
	UMR001-S001-1218-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:50	1	16 oz	4 C	N
	UMR001-S001-1824-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:45	1	8 oz glass	4 C	N
	UMR001-S001-1824-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:45	1	8 oz glass	4 C	N
	UMR001-S001-1824-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:45	1	16 oz	4 C	N
	UMR001-S002-0006-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:40	1	8 oz glass	4 C	N
	UMR001-S002-0006-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:40	1	8 oz glass	4 C	N
	UMR001-S002-0006-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:40	1	16 oz	4 C	N
	UMR001-S002-0612-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:38	1	8 oz glass	4 C	N

Special Instructions: Gamma Spec: K-40, Tl-208, Bi-212, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-234, U-235, & Cs-137.
Standard TAT, RFP# 416, PO# 0093240
All materials in the sample, including rock fragments and soil, must be analyzed.

SAMPLES TRANSFERRED FROM

CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES ALL ANALYSIS	Peter Lisichenko (WESTON)	12/7/16 1700 HRS			

Weston Solutions, Inc.
DateShipped: 12/7/2016
CarrierName: FedEx
AirbillNo: 7778 8428 0670

CHAIN OF CUSTODY RECORD
Case #: 416
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-120716-091830-0001
Cooler #:
Lab: PACE Analytical Services
Lab Phone: 724-850-5600

Lab #	Sample #	Location	Analyses	Matrix	Collected	Sample Time	Numb Cont	Container	Preservative	Lab QC
	UMR001-S002-0612-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:38	1	8 oz glass	4 C	N
	UMR001-S002-0612-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:38	1	16 oz	4 C	N
	UMR001-S002-1218-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:35	1	8 oz glass	4 C	N
	UMR001-S002-1218-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:35	1	8 oz glass	4 C	N
	UMR001-S002-1218-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:35	1	16 oz	4 C	N
	UMR001-S002-1824-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:30	1	8 oz glass	4 C	N
	UMR001-S002-1824-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:30	1	8 oz glass	4 C	N
	UMR001-S002-1824-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:30	1	16 oz	4 C	N
	UMR001-S003-0006-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:25	1	8 oz glass	4 C	N
	UMR001-S003-0006-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:25	1	8 oz glass	4 C	N
	UMR001-S003-0006-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:25	1	16 oz	4 C	N
	UMR001-S003-0612-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:22	1	8 oz glass	4 C	N
	UMR001-S003-0612-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:22	1	8 oz glass	4 C	N
	UMR001-S003-0612-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:22	1	16 oz	4 C	N
	UMR001-S003-1218-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:18	1	8 oz glass	4 C	N
	UMR001-S003-1218-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:18	1	8 oz glass	4 C	N
	UMR001-S003-1218-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:18	1	16 oz	4 C	N
	UMR001-S003-1824-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:15	1	8 oz glass	4 C	N
	UMR001-S003-1824-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:15	1	8 oz glass	4 C	N

Special Instructions: Gamma Spec: K-40, Tl-208, Bi-212, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-234, U-235, & Cs-137.
Standard TAT, RFP# 416, PO# 0093240
All materials in the sample, including rock fragments and soil, must be analyzed.

SAMPLES TRANSFERRED FROM

CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES ALL ANALYSES	[illegible] (WESTON)	12/2/16 1200 HRS			

Weston Solutions, Inc.
DateShipped: 12/7/2016
CarrierName: FedEx
AirbillNo: 7778 8428 0670

CHAIN OF CUSTODY RECORD
Case #: 416
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-120716-091830-0001
Cooler #:
Lab: PACE Analytical Services
Lab Phone: 724-850-5600

Lab #	Sample #	Location	Analyses	Matrix	Collected	Sample Time	Numb Cont	Container	Preservative	Lab QC
	UMR001-S003-1824-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:15	1	16 oz	4 C	N
	UMR001-S004-0006-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:30	1	8 oz glass	4 C	N
	UMR001-S004-0006-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:30	1	8 oz glass	4 C	N
	UMR001-S004-0006-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:30	1	16 oz	4 C	N
	UMR001-S004-0612-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:25	1	8 oz glass	4 C	N
	UMR001-S004-0612-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:25	1	8 oz glass	4 C	N
	UMR001-S004-0612-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:25	1	16 oz	4 C	N
	UMR001-S004-1218-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:22	1	8 oz glass	4 C	N
	UMR001-S004-1218-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:22	1	8 oz glass	4 C	N
	UMR001-S004-1218-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:22	1	16 oz	4 C	N
	UMR001-S004-1824-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:20	1	8 oz glass	4 C	N
	UMR001-S004-1824-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:20	1	8 oz glass	4 C	N
	UMR001-S004-1824-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:20	1	16 oz	4 C	N

Special Instructions: Gamma Spec: K-40, Tl-208, Bi-212, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-234, U-235, & Cs-137.
Standard TAT, RFP# 416, PO# 0093240
All materials in the sample, including rock fragments and soil, must be analyzed.

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES ALL ANALYSE	(WESTON)	12/7/16 1700 hrs			

ORIGIN ID:DKKA (732) 585-4411
PETER LISICHENKO
WESTON SOLUTIONS, INC.
9626 NIAGARA FALLS BLVD
NIAGARA FALLS, NY 14304
UNITED STATES US

SHIP DATE: 07DEC16
ACTWGT: 40.00 LB
CAD: 105422927/INET3790
DIMS: 24x14x16 IN
BILL THIRD PARTY

TO **SAMANTHA SAULTZ**
PACE ANALYTICAL SERVICES
1638 ROSEYTOWN ROAD
SUITE 2,3,4
GREENSBURG PA 15601
(724) 850-5600
INV
PO
REF: 30400.031.007.3117
DEPT

544J1/D42F/14E8

J162016101201uv

FedEx Express

1 of 2

TRK# 0201 **7778 8428 0670**

MASTER

THU - 08 DEC 10:30A
PRIORITY OVERNIGHT

NA CVAA

15601
PIT
PA-US

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ORIGIN ID:DKKA (732) 585-4411
PETER LISICHENKO
WESTON SOLUTIONS, INC.
9626 NIAGARA FALLS BLVD
NIAGARA FALLS, NY 14304
UNITED STATES US

SHIP DATE: 07DEC16
ACTWGT: 40.00 LB
CAD: 105422927/INET3790
DIMS: 24x14x16 IN
BILL THIRD PARTY

TO **SAMANTHA SAULTZ**
PACE ANALYTICAL SERVICES
1638 ROSEYTOWN ROAD
SUITE 2,3,4
GREENSBURG PA 15601
(724) 850-5600
INV:
PO:
REF: 30400.031.007.3117
DEPT

544J1/D42F/14E8

J162016101201uv

FedEx Express

2 of 2
MPS# 0263 **7778 8428 1129**
Mstr# **7778 8428 0670**

0201

THU - 08 DEC 10:30A
PRIORITY OVERNIGHT

NA CVAA

15601
PIT
PA-US

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Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.
Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com.FedEx will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery,misdelivery,or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim.Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental,consequential, or special is limited to the greater of $100 or the authorized declared value. Recovery cannot exceed actual documented loss.Maximum for items of extraordinary value is $1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our ServiceGuide. Written claims must be filed within strict time limits, see current FedEx Service Guide.

ATTACHMENT E

Radon Testing Summary Sheets

Radon Testing Corp. of America
2 Hayes Street, Elmsford, NY 10523, Phone: (914)345-3380

Radon Testing Summary Sheet
Please fill out all pertinent information legibly

Send Results Report to:
Contact: Richard F. Rezzino

Company/Agen: Accu-View Property Inspections, Inc.
P.O. Box 641
Buffalo, NY 14051
716-882-2200

Address: _____

City: _____ Zip: _____

Phone: _____ Fax: _____

Email: info@AccuviewInspections.com

Test Location Information:
School District: _____ School Code #: _____

County: Niagara Municipality: Lewiston

Building/School Name: _____

Address: 738 Upper Mountain Rd.

City: Lewiston State: NY Zip: 14092

NRSB# Placed by ID#: 1SS0032 Retrieved by ID#: 1SS0032

Start Date: 8-11-2017 Stop Date: 8-14-2017

Time zone: EST Total # of detectors for this building: 8

PLEASE CIRCLE APPROPRIATE CONDITIONS

Building Type: Day Care-(D) Residential-(R) Non-Residential-(N) School-(S) Public School-(P) Unknown-(U)

Structural Type of Building: Basement-(B) Crawlspace-(C) Slab-on-grade-(S) Other-(O) Unknown-(U)

Purpose of Test: Screening-(S) Real Estate-(R) Post Mitigation-(POM)

Test Conditions: Open House-(OH) Closed House-(CH) Rainy-(RA) Windy-(WY) Unknown-(NO)

Instructions: Tear off center bar coded label from detector and affix to sheet in spaces provided. Please make sure top bar code label is left on detector. Record start & stop time, identify test location and indicate if QA measurement for each detector. Use additional sheets as necessary. Please mark clearly if any detector is missing or damaged at retrieval.

Bar Code Label

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559505

Start Time: 8:15 Am Stop Time: 8:31 Am

Room # or other identifier: SE Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559565

Start Time: 8:23 Am Stop Time: 8:33 Am

Room # or other identifier: SW Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559514

Start Time: 8:32 Am Stop Time: 8:36 Am

Room # or other identifier: Sump Rm Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559571

Start Time: 8:32 Am Stop Time: 8:36 Am

Room # or other identifier: Sump Rm Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559490

Start Time: 8:38 Am Stop Time: 8:39 Am

Room # or other identifier: Liv Rm Floor: 1

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2523071

Start Time: 8:42 Am Stop Time: 8:41 Am

Room # or other identifier: NE Bedroo. Floor: 1

Please circle if QA Measurement: Blank Duplicate

Instructions: Tear off center bar coded label from detector and affix to sheet in spaces provided. Please make sure top bar code label is left on detector. Record start & stop time, identify test location and indicate if QA measurement for each detector. Use additional sheets as necessary. Please mark clearly if any detector is missing or damaged at retrieval.

Bar Code Label

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2471303

Start Time: 8:45 Am Stop Time: 8:43 Am

Room # or other identifier: SE Bed Floor: 1

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559549

Start Time: 8:47 Stop Time: 8:45 AM

Room # or other identifier: NW Floor: 2

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

ATTACHMENT F

HPGe Soil Screening Reports

Date: _____

9626 Niagara Falls Blvd Onsite Gamma Spec Screening Lab

Gamma Spectroscopy Detector work sheet.

Counted by (Initial,date)	Geometry Description	Analysis Number/Sample ID/Remarks	Sample Collection mmddyy hh:mm	Sample Quantity	Sample Units (GWET,GDR Y,L, ft^3, etc)	Count Time (s)	Report Matches Sample Parameters (Initial, date)
cc/120216	450 cc SOIL	UMR001-S003-0006-01	11-18-16 1125	846.0	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S004-0006-01	11-18-16 12:30	808.9	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S002-0612-01	11-18-16 10:38	753.2	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-0006-01	11-18-16 1040	721.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1218-01	11-18-16 1035	555.9	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1824-01	11-18-16 1030	382.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S001-0006-01	11-18-16 0958	490.1	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S003-0612-01	11-18-16 1122	530.4	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1218-01	11-18-16 1118	534.5	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1824-01	11-18-16 1115	493.5	GWET	7200	

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************
```

Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S001-0006-01.CNF

Report Generated On	: 12/3/2016 6:39:31 PM
Sample Title	: UMR001-S001-0006-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 4.901E+002 GWET
Sample Taken On	: 11/18/2016 9:58:00 AM
Acquisition Started	: 12/3/2016 4:39:27 PM
Live Time	: 7200.0 seconds
Real Time	: 7201.7 seconds
Dead Time	: 0.02 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S001-0006-01
Peak Analysis Performed on: 12/3/2016 6:39:32 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	294-	319	300.04	74.97	0.97	2.13E+002	20.43	2.94E+002
m	2	294-	319	309.03	77.22	0.98	3.12E+002	23.40	2.89E+002
M	3	345-	381	349.95	87.45	0.88	8.21E+001	16.85	3.10E+002
m	4	345-	381	360.98	90.20	0.89	5.64E+001	15.32	3.27E+002
m	5	345-	381	371.50	92.83	0.89	1.50E+002	19.48	2.88E+002
	6	739-	753	744.12	186.00	1.10	2.07E+002	29.90	2.34E+002
M	7	947-	974	954.69	238.64	1.12	8.83E+002	32.86	2.08E+002
m	8	947-	974	966.77	241.66	1.13	1.66E+002	16.78	1.82E+002
M	9	1173-	1205	1180.63	295.13	1.07	2.71E+002	19.65	1.34E+002
m	10	1173-	1205	1199.47	299.84	1.07	5.29E+001	11.38	1.16E+002
	11	1308-	1315	1311.80	327.93	0.75	1.15E+001	13.08	7.95E+001
	12	1343-	1358	1353.21	338.28	1.27	1.42E+002	24.27	1.48E+002
	13	1396-	1415	1407.30	351.80	1.10	4.75E+002	30.39	1.26E+002
	14	1846-	1856	1851.91	462.97	0.42	4.79E+001	13.38	5.51E+001
	15	2032-	2053	2042.52	510.62	1.06	2.31E+002	26.60	1.27E+002
	16	2323-	2339	2331.97	582.99	0.99	2.72E+002	22.73	7.85E+001
	17	2425-	2446	2436.31	609.08	1.33	3.73E+002	25.52	7.43E+001
M	18	2620-	2653	2625.16	656.30	1.27	1.38E+001	5.74	4.19E+001
m	19	2620-	2653	2645.98	661.50	1.28	1.74E+002	12.93	4.95E+001
	20	2900-	2915	2907.50	726.89	0.75	7.62E+001	14.63	4.58E+001
	21	3634-	3652	3643.48	910.90	1.32	1.90E+002	18.50	4.51E+001
	22	3867-	3884	3874.62	968.69	1.14	1.11E+002	16.40	4.86E+001
	23	4473-	4488	4480.99	1120.29	1.05	6.05E+001	12.71	3.35E+001
	24	4948-	4959	4953.09	1238.33	0.30	2.60E+001	10.11	3.00E+001
	25	5831-	5857	5844.01	1461.08	1.74	8.96E+002	30.65	9.97E+000
	26	6350-	6361	6355.40	1588.94	1.35	2.60E+001	5.79	3.00E+000
	27	7052-	7069	7060.94	1765.34	0.34	6.06E+001	10.52	1.54E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S001-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	5.0751E-001	5.08E-001	1.0992E+001
	Co-60	1173.23	99.85	8.7956E-002	6.95E-002	-2.1412E-003
		1332.49	99.98	6.9469E-002		3.4540E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
+	Cs-137	32.06	5.54	1.0317E+003	4.42E-002	-3.5216E+002
		661.66*	84.99	4.4157E-002		1.5669E-001
+	Tl-208	72.80	2.02	7.5215E+000	6.50E-002	-1.3900E+000
		74.97*	3.41	2.3903E+000		4.4177E+000
		84.90	1.51	5.9521E+000		9.8117E-002
		277.36	6.31	8.3179E-001		3.0162E-001
		510.77*	22.60	3.5474E-001		1.7511E-001
		583.19*	84.50	6.5016E-002		2.2221E-001
		763.13	1.81	3.7985E+000		-4.2681E+000
		860.56	12.42	6.4454E-001		2.6441E-001
+	Bi-212	39.86	1.06	5.2987E+002	7.06E-001	-9.4677E+000
		727.33*	6.74	7.0647E-001		9.3903E-001
		785.37	1.11	6.0944E+000		-1.2251E+000
		1620.74	1.51	4.0270E+000		2.7709E+000
		1806.00	0.09	5.6950E+001		1.2509E+001
+	Pb-212	74.81*	10.40	7.8374E-001	9.16E-002	1.4485E+000
		77.11*	17.50	4.1784E-001		1.1374E+000
		87.30*	7.81	6.9334E-001		4.8058E-001
		115.18	0.59	9.3618E+000		-1.7312E+000
		238.63*	43.30	9.1590E-002		7.7889E-001
		300.09*	3.28	9.9692E-001		7.1718E-001
+	Bi-214	76.86*	0.43	1.6907E+001	1.27E-001	4.6023E+001
		89.81*	0.24	2.1093E+001		9.7870E+000
		386.77	0.30	1.7756E+001		-3.8770E+000
		454.77	0.29	1.7188E+001		-6.7526E+000
		609.31*	45.49	1.2736E-001		5.9093E-001
		665.45	1.53	6.0269E+000		-2.4464E-001
		703.11	0.48	1.3436E+001		-6.5297E+000
		719.86	0.39	1.7161E+001		-4.1386E+000
		768.36	4.89	1.4667E+000		8.9600E-002
		786.10	0.31	2.2613E+001		8.1399E+000
		806.17	1.26	5.5563E+000		3.6760E+000
		934.06	3.10	2.0780E+000		-4.6984E-001
		964.08	0.36	2.9482E+001		9.1733E+000
		1051.96	0.31	2.1826E+001		-1.3915E+000
		1120.29*	14.91	3.6539E-001		4.4723E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.1077E+001	1.27E-001	6.1235E+000
		1155.19	1.63	4.9759E+000		-3.0292E-001
		1207.68	0.45	2.0485E+001		8.3516E+000
		1238.11*	5.79	8.8176E-001		5.2957E-001
		1280.96	1.43	5.9956E+000		-5.9382E-001
		1377.67	4.00	1.7407E+000		4.1855E-001
		1385.31	0.76	7.6220E+000		-4.2939E+000
		1401.50	1.27	5.7121E+000		-5.3973E+000
		1407.98	2.15	3.5029E+000		2.8438E-001
		1509.23	2.11	3.0900E+000		2.2245E+000
		1538.50	0.38	1.2958E+001		-4.3180E+000
		1543.32	0.20	2.5730E+001		-3.7240E+000
		1583.22	0.69	1.1364E+001		-1.1454E+000
		1594.73	0.25	3.1528E+001		-6.0599E+000
		1599.31	0.23	2.7728E+001		-7.9524E+000
		1661.28	1.15	5.0174E+000		2.2944E+000
		1683.99	0.22	2.6976E+001		1.1829E+001
		1729.59	2.92	2.3366E+000		1.2043E+000
		1764.49*	15.40	3.7225E-001		5.4283E-001
		1847.42	2.11	2.7791E+000		-1.0929E+000
		1873.16	0.22	2.5675E+001		7.7551E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	4.8225E+001	1.33E-001	2.0674E+001
		74.81*	6.44	1.2466E+000		2.3040E+000
		77.11*	10.80	6.6687E-001		1.8154E+000
		87.30*	4.84	1.1020E+000		7.6382E-001
		242.00*	7.43	4.7687E-001		8.6618E-001
		258.87	0.52	9.7192E+000		4.3333E+000
		274.80	0.47	1.0911E+001		-1.3004E+001
		295.22*	19.30	1.7721E-001		6.1060E-001
		351.93*	37.60	1.3333E-001		6.0545E-001
		462.00*	0.22	1.4970E+001		1.2809E+001
		533.66	0.19	3.0985E+001		-9.7812E+000
		785.96	1.07	6.5508E+000		1.3534E+000
		839.04	0.59	1.1750E+001		-2.4625E+000
+	Ra-224	81.07	0.13	7.0531E+001	8.77E-001	-2.5801E+001
		83.78	0.22	4.0536E+001		4.1003E+000
		240.99*	4.10	8.7737E-001		1.5937E+000
+	Ra-226	81.07	0.20	4.6196E+001	1.28E+000	-1.6899E+001
		83.78	0.33	2.6415E+001		2.6719E+000
		94.90	0.15	4.8436E+001		-3.3946E+000
		186.21*	3.59	1.2811E+000		1.5362E+000
+	Ac-228	99.50	1.26	4.4266E+000	2.29E-001	-2.0822E+000
		129.07	2.50	2.3399E+000		-5.6262E-001
		209.25	3.97	1.4537E+000		-1.0596E-001
		270.24	3.55	1.5641E+000		7.1286E-001
		328.00*	3.04	9.5308E-001		1.7799E-001
		338.32*	11.40	4.2653E-001		5.9943E-001
		409.46	2.02	2.9013E+000		2.5136E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	7.5478E-001	2.29E-001	6.4583E-001
		755.31	1.03	6.4145E+000		-3.7573E+000
		772.29	1.52	4.7793E+000		2.8236E+000
		794.94	4.31	1.7363E+000		7.5345E-001
		835.70	1.70	4.1709E+000		2.6714E+000
		911.20*	26.20	2.2934E-001		6.8507E-001
		964.79	4.99	2.2118E+000		6.2550E-001
		968.96*	15.90	3.8951E-001		7.1063E-001
		1588.20*	3.06	7.1935E-001		1.2081E+000
		1630.62	1.52	4.1209E+000		-1.6537E+000
	Th-228	84.37	1.26	7.0564E+000	7.06E+000	7.6631E-001
		131.61	0.13	4.4085E+001		-1.9219E+001
		166.41	0.10	4.9601E+001		1.2864E-001
		215.98	0.25	2.1479E+001		7.6026E+000
	Pa-234m	258.23	0.07	6.8150E+001	8.90E+000	1.5513E+000
		742.81	0.09	6.2247E+001		-2.6764E+001
		766.36	0.32	2.1822E+001		-1.6231E+001
		786.27	0.05	1.3213E+002		9.7709E+001
		1001.03	0.85	8.9026E+000		2.6934E+000
		1737.77	0.02	2.4380E+002		-5.7066E+002
+	Th-234	63.30	3.75	6.1892E+000	1.16E+000	-1.3897E+000
		92.59*	4.33	1.1607E+000		6.9174E-001
		112.81	0.22	2.5020E+001		-3.0434E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S001-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.990	1460.82*		10.55	1.09917E+001	4.82938E-001
Cs-137	0.992	32.06	@	5.54		
		661.66*		84.99	1.56694E-001	1.24741E-002
Eu-152m	0.980	89.85*		69.90	3.42363E-002	9.36761E-003
Tl-208	0.709	72.80	@	2.02		
		74.97*	@	3.41	4.41770E+000	4.49627E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	1.75105E-001	7.81276E-002
		583.19*		84.50	2.22206E-001	2.05071E-002
		763.13	@	1.81		
		860.56		12.42		
Bi-211	0.908	351.03*		13.00	1.75344E+000	1.34969E-001
Bi-212	0.554	39.86	@	1.06		
		727.33*		6.74	9.39031E-001	1.82767E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.985	74.81*		10.40	1.44850E+000	1.53233E-001
		77.11*		17.50	1.13744E+000	9.95720E-002
		87.30*		7.81	4.80577E-001	1.01023E-001
		115.18	@	0.59		
		238.63*		43.30	7.78888E-001	4.60578E-002
		300.09*		3.28	7.17181E-001	1.57255E-001
Bi-214	0.550	76.86*	@	0.43	4.60233E+001	4.05899E+000
		89.81*	@	0.24	9.78704E+000	2.70081E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	5.90926E-001	4.43233E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36		4.89		
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08	@	0.36		
		1051.96	@	0.31		
		1120.29*		14.91	4.47234E-001	9.45663E-002
		1133.66	@	0.25		
		1155.19	@	1.63		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.550	1207.68	@	0.45		
		1238.11*		5.79	5.29572E-001	2.06425E-001
		1280.96	@	1.43		
		1377.67		4.00		
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	5.42828E-001	1.05886E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.944	53.28	@	1.20		
		74.81*		6.44	2.30401E+000	2.46241E-001
		77.11*		10.80	1.81536E+000	1.64576E-001
		87.30*		4.84	7.63817E-001	1.61214E-001
		242.00*		7.43	8.66183E-001	9.63547E-002
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	6.10596E-001	5.10003E-002
		351.93*		37.60	6.05447E-001	4.62069E-002
		462.00*	@	0.22	1.28088E+001	3.64527E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.825	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	1.59365E+000	1.76774E-001
Ra-226	0.773	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	1.53619E+000	3.04986E-001
Ac-228	0.452	99.50	@	1.26		
		129.07	@	2.50		
		209.25		3.97		
		270.24		3.55		
		328.00*		3.04	1.77986E-001	2.03067E-001
		338.32*		11.40	5.99431E-001	1.07111E-001
		409.46	@	2.02		
		463.00*		4.45	6.45826E-001	1.85210E-001
		755.31	@	1.03		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.452	772.29	@	1.52		
		794.94		4.31		
		835.70	@	1.70		
		911.20*		26.20	6.85067E-001	7.38744E-002
		964.79		4.99		
		968.96*		15.90	7.10633E-001	1.08237E-001
		1588.20*		3.06	1.20813E+000	2.74962E-001
		1630.62	@	1.52		
Th-234	0.453	63.30		3.75		
		92.59*		4.33	6.91738E-001	1.93258E-001
		112.81	@	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.990	1.099172E+001	4.829383E-001
X	Cd-109		0.946		
	Cs-137	@	0.992	1.566938E-001	1.247408E-002
	Eu-152m		0.980	3.227197E-002	9.363884E-003
	Tl-208	@	0.709	2.242179E-001	2.040488E-002
	Bi-211		0.908	1.495877E-001	1.893073E-001
	Bi-212	@	0.554	9.390308E-001	1.827673E-001
	Pb-212	@	0.985	7.070679E-001	3.703501E-002
	Bi-214	@	0.550	5.615237E-001	3.687104E-002
	Pb-214	@	0.944	5.537954E-001	4.668122E-002
	Ra-224	@	0.825	5.747490E-001	1.955704E-001
	Ra-226	@	0.773	1.536188E+000	3.049859E-001
	Ac-228	@	0.452	6.566801E-001	4.729046E-002
	Th-234	@	0.453	6.917375E-001	1.932583E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/3/2016 6:39:32 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
M 18	656.30	1.9152E-003	41.60	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

Date: _____

9626 Niagara Falls Blvd Onsite Gamma Spec Screening Lab

Gamma Spectroscopy Detector work sheet.

Counted by (Initial,date)	Geometry Description	Analysis Number/Sample ID/Remarks	Sample Collection mmddyy hh:mm	Sample Quantity	Sample Units (GWET,GDRY,L, ft^3, etc)	Count Time (s)	Report Matches Sample Parameters (Initial, date)
cc/120516	450 cc SOIL	[redacted] UMR001-S001-0612-[redacted] 01	11-18-16 0955	490.3	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S001-1824-01	11-18-16 0945	541.6 [redacted]	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S001-1218-01	11-18-16 0950	576.1	GWET	7200	
cc/120616	450 cc SOIL	Duplicate UMR001-S001-0612-D2	11-18-16 0955	452.0	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S004-0612-01	11-18-16 1225	712.4	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S004-1218-01	11-18-16 1222	593.5	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S004-1824-01	11-18-16 1220	490.4	GWET	7200	
cc/120716	450 cc SOIL	161207 STANDARD-2HR	12-07-16 09[redacted]33	771.0	STD	7200	
cc/120816	450 cc SOIL	STANDARD-2HR-161208	12-08-16 1553	1	STD	7200	
	450 cc SOIL					7200	

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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```

Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S001-0612-01.CNF

Report Generated On	: 12/5/2016 5:41:34 PM
Sample Title	: UMR001-S001-0612-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 4.903E+002 GWET
Sample Taken On	: 11/18/2016 9:55:00 AM
Acquisition Started	: 12/5/2016 3:41:30 PM
Live Time	: 7200.0 seconds
Real Time	: 7201.6 seconds
Dead Time	: 0.02 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S001-0612-01
Peak Analysis Performed on: 12/5/2016 5:41:34 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	294-	314	299.96	74.95	0.95	2.29E+002	21.74	3.73E+002
m	2	294-	314	308.98	77.20	0.95	3.84E+002	26.28	3.65E+002
M	3	343-	365	349.30	87.28	0.66	6.89E+001	35.23	2.92E+002
m	4	343-	365	360.82	90.16	0.66	4.04E+001	20.87	3.09E+002
	5	608-	619	615.02	153.72	0.30	1.19E+001	26.61	2.78E+002
	6	738-	754	744.10	185.99	1.24	2.10E+002	34.96	3.20E+002
	7	834-	845	837.37	209.31	1.23	8.26E+001	24.01	1.95E+002
M	8	945-	974	954.68	238.64	1.12	1.12E+003	36.50	2.19E+002
m	9	945-	974	966.71	241.65	1.12	2.00E+002	17.77	1.97E+002
	10	1174-	1187	1180.72	295.16	0.97	3.06E+002	26.08	1.36E+002
	11	1193-	1204	1200.73	300.16	0.76	5.48E+001	19.60	1.31E+002
	12	1307-	1317	1311.96	327.97	0.44	2.00E+001	16.76	1.09E+002
	13	1346-	1362	1352.96	338.22	1.28	2.38E+002	26.45	1.47E+002
	14	1395-	1416	1407.38	351.83	0.87	6.40E+002	35.53	1.66E+002
	15	1844-	1858	1850.85	462.70	0.76	6.56E+001	18.14	9.14E+001
	16	1979-	1988	1983.29	495.82	0.31	1.14E+001	9.94	3.86E+001
	17	2030-	2053	2042.36	510.58	1.85	2.60E+002	28.49	1.38E+002
	18	2322-	2342	2331.94	582.98	1.54	4.08E+002	26.68	8.37E+001
	19	2427-	2446	2436.47	609.12	1.22	4.48E+002	27.18	8.26E+001
	20	2640-	2653	2645.45	661.37	0.98	6.58E+001	15.73	6.52E+001
	21	2899-	2917	2908.43	727.12	1.20	9.58E+001	16.10	4.82E+001
	22	3170-	3188	3178.64	794.68	1.25	5.33E+001	14.88	4.97E+001
	23	3209-	3219	3214.15	803.56	0.33	1.50E+001	9.55	3.10E+001
	24	3434-	3447	3441.53	860.41	0.30	2.70E+001	11.94	4.20E+001
	25	3632-	3655	3643.72	910.96	1.59	3.16E+002	21.28	3.35E+001
M	26	3850-	3884	3857.47	964.40	1.47	4.47E+001	8.64	4.05E+001
m	27	3850-	3884	3875.14	968.82	1.47	1.33E+002	13.30	4.94E+001
	28	4473-	4489	4480.64	1120.21	0.50	8.46E+001	15.96	5.44E+001
	29	5830-	5857	5843.97	1461.07	1.85	1.29E+003	38.02	3.49E+001
	30	7052-	7071	7059.37	1764.94	0.47	7.65E+001	11.37	1.55E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S001-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	8.1387E-001	8.14E-001	1.5906E+001
	Co-60	1173.23	99.85	9.2220E-002	8.62E-002	5.4605E-002
		1332.49	99.98	8.6195E-002		7.9492E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
+	Cs-137	32.06	5.54	1.0822E+003	5.89E-002	-3.2718E+002
		661.66*	84.99	5.8901E-002		5.9285E-002
+	Tl-208	72.80	2.02	8.2653E+000	7.18E-002	-1.1481E+000
		74.97*	3.41	2.6918E+000		4.7557E+000
		84.90	1.51	6.4510E+000		1.8057E+000
		277.36	6.31	9.1018E-001		3.6131E-002
		510.77*	22.60	3.7393E-001		2.5778E-001
		583.19*	84.50	7.1839E-002		3.3756E-001
		763.13	1.81	4.1234E+000		-3.9844E+000
		860.56*	12.42	3.9711E-001		2.0351E-001
+	Bi-212	39.86	1.06	5.7526E+002	7.67E-001	7.9126E+001
		727.33*	6.74	7.6738E-001		1.1834E+000
		785.37	1.11	6.1038E+000		3.9455E-001
		1620.74	1.51	4.9240E+000		2.0073E+000
		1806.00	0.09	7.1294E+001		3.1539E+001
+	Pb-212	74.81*	10.40	8.8261E-001	9.39E-002	1.5593E+000
		77.11*	17.50	4.6911E-001		1.4019E+000
		87.30*	7.81	6.7742E-001		4.0521E-001
		115.18	0.59	1.0001E+001		1.8831E+000
		238.63*	43.30	9.3893E-002		9.9706E-001
		300.09*	3.28	1.1848E+000		7.4592E-001
+	Bi-214	76.86*	0.43	1.8944E+001	1.30E-001	5.6614E+001
		89.81*	0.24	2.0550E+001		7.0140E+000
		386.77	0.30	1.8503E+001		-2.1326E-001
		454.77	0.29	2.1562E+001		-4.1060E+000
		609.31*	45.49	1.2987E-001		7.1060E-001
		665.45	1.53	5.5819E+000		3.5958E+000
		703.11	0.48	1.5492E+001		8.2736E+000
		719.86	0.39	1.7485E+001		-4.3181E+000
		768.36	4.89	1.4798E+000		-8.6663E-003
		786.10	0.31	2.2527E+001		9.5320E+000
		806.17	1.26	5.5736E+000		-1.6193E+000
		934.06	3.10	2.5466E+000		-4.5740E-001
		964.08*	0.36	1.2218E+001		1.2265E+001
		1051.96	0.31	2.4951E+001		-2.3341E+000
		1120.29*	14.91	4.6804E-001		6.2507E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.4218E+001	1.30E-001	-1.0006E+001
		1155.19	1.63	5.5960E+000		-4.6962E-001
		1207.68	0.45	2.2073E+001		3.3408E+000
		1238.11	5.79	1.7748E+000		1.4140E+000
		1280.96	1.43	6.0727E+000		1.3188E+000
		1377.67	4.00	2.0956E+000		1.3310E+000
		1385.31	0.76	9.2982E+000		-1.2291E+001
		1401.50	1.27	5.5030E+000		-4.0396E+000
		1407.98	2.15	3.1593E+000		1.6486E+000
		1509.23	2.11	3.1488E+000		1.0807E+000
		1538.50	0.38	1.7394E+001		2.9037E-001
		1543.32	0.20	3.1428E+001		-9.8073E-001
		1583.22	0.69	1.0507E+001		-8.5916E-001
		1594.73	0.25	3.1515E+001		4.9571E+000
		1599.31	0.23	2.9805E+001		-1.2077E+001
		1661.28	1.15	5.5672E+000		-1.5080E-001
		1683.99	0.22	2.8858E+001		3.6705E+000
		1729.59	2.92	2.4840E+000		7.4648E-001
		1764.49*	15.40	3.7969E-001		6.9888E-001
		1847.42	2.11	2.4327E+000		-1.4152E+000
		1873.16	0.22	2.6595E+001		-7.9323E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	4.9900E+001	1.56E-001	1.1894E+001
		74.81*	6.44	1.4012E+000		2.4755E+000
		77.11*	10.80	7.4725E-001		2.2331E+000
		87.30*	4.84	1.0746E+000		6.4278E-001
		242.00*	7.43	4.9580E-001		1.0428E+000
		258.87	0.52	1.0623E+001		-6.1386E-001
		274.80	0.47	1.2130E+001		-6.1968E+000
		295.22*	19.30	2.0844E-001		6.8771E-001
		351.93*	37.60	1.5565E-001		8.1876E-001
		462.00*	0.22	2.0889E+001		1.7524E+001
		533.66	0.19	3.1504E+001		-1.5969E+001
		785.96	1.07	6.4809E+000		-1.2696E-001
		839.04	0.59	1.4124E+001		1.3899E+001
+	Ra-224	81.07	0.13	7.6412E+001	9.14E-001	-9.5420E+001
		83.78	0.22	4.3102E+001		7.2268E+000
		240.99*	4.10	9.1397E-001		1.9224E+000
+	Ra-226	81.07	0.20	4.9951E+001	1.52E+000	-6.2376E+001
		83.78	0.33	2.8033E+001		4.7001E+000
		94.90	0.15	5.1806E+001		6.6365E+001
		186.21*	3.59	1.5244E+000		1.5611E+000
+	Ac-228	99.50	1.26	4.8059E+000	2.19E-001	-3.9631E-001
		129.07	2.50	2.6864E+000		2.5739E+000
		209.25*	3.97	9.8909E-001		7.7094E-001
		270.24	3.55	1.7515E+000		1.1956E+000
		328.00*	3.04	1.2086E+000		3.1054E-001
		338.32*	11.40	4.3395E-001		1.0052E+000
		409.46	2.02	2.8944E+000		3.3298E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.0553E+000	2.19E-001	8.8530E-001
		755.31	1.03	7.0859E+000		-5.2166E-001
		772.29	1.52	4.6943E+000		-2.0395E+000
		794.94*	4.31	1.2952E+000		1.0948E+000
		835.70	1.70	5.0255E+000		1.9179E+000
		911.20*	26.20	2.1881E-001		1.1564E+000
		964.79*	4.99	9.0414E-001		9.0762E-001
		968.96*	15.90	3.1237E-001		8.5064E-001
		1588.20	3.06	2.5926E+000		4.2567E-001
		1630.62	1.52	3.9714E+000		1.4042E+000
	Th-228	84.37	1.26	7.6108E+000	7.61E+000	1.8422E+000
		131.61	0.13	4.9887E+001		7.0036E+000
		166.41	0.10	5.5568E+001		1.4098E+000
		215.98	0.25	2.1624E+001		4.6833E-001
	Pa-234m	258.23	0.07	7.5493E+001	9.47E+000	8.4184E+000
		742.81	0.09	6.9911E+001		5.1452E+001
		766.36	0.32	2.3449E+001		7.9075E+000
		786.27	0.05	1.3031E+002		4.6458E+001
		1001.03	0.85	9.4663E+000		3.2840E+000
		1737.77	0.02	2.7439E+002		-1.1823E+002
	Th-234	63.30	3.75	6.6491E+000	2.00E+000	1.3953E+000
		92.59	4.33	2.0030E+000		2.6002E+000
		112.81	0.22	2.7359E+001		3.2760E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S001-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.991	1460.82*		10.55	1.59056E+001	6.36956E-001
Cs-137	0.983	32.06	@	5.54		
		661.66*		84.99	5.92850E-002	1.42712E-002
Eu-152m	0.984	89.85*		69.90	2.45424E-002	1.27017E-002
Tl-208	0.835	72.80	@	2.02		
		74.97*	@	3.41	4.75573E+000	4.80176E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	2.57776E-001	8.37529E-002
		583.19*		84.50	3.37558E-001	2.50493E-002
		763.13	@	1.81		
		860.56*		12.42	2.03513E-001	9.01198E-002
Bi-211	0.904	351.03*		13.00	2.37161E+000	1.64955E-001
Bi-212	0.570	39.86	@	1.06		
		727.33*		6.74	1.18339E+000	2.02279E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.986	74.81*		10.40	1.55933E+000	1.63742E-001
		77.11*		17.50	1.40192E+000	1.14980E-001
		87.30*		7.81	4.05209E-001	2.08111E-001
		115.18	@	0.59		
		238.63*		43.30	9.97061E-001	5.58204E-002
		300.09*		3.28	7.45917E-001	2.68382E-001
Bi-214	0.498	76.86*	@	0.43	5.66143E+001	4.68278E+000
		89.81*	@	0.24	7.01396E+000	3.63872E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	7.10601E-001	4.82567E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36		4.89		
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08*	@	0.36	1.22653E+001	2.42117E+000
		1051.96	@	0.31		
		1120.29*		14.91	6.25066E-001	1.18899E-001
		1133.66	@	0.25		
		1155.19	@	1.63		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.498	1207.68	@	0.45		
		1238.11		5.79		
		1280.96	@	1.43		
		1377.67		4.00		
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	6.98884E-001	1.14958E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.945	53.28	@	1.20		
		74.81*		6.44	2.47549E+000	2.62657E-001
		77.11*		10.80	2.23312E+000	1.90563E-001
		87.30*		4.84	6.42776E-001	3.30347E-001
		242.00*		7.43	1.04285E+000	1.04553E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	6.87709E-001	6.52771E-002
		351.93*		37.60	8.18755E-001	5.63536E-002
		462.00*	@	0.22	1.75242E+001	4.93789E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.827	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	1.92243E+000	1.92060E-001
Ra-226	0.773	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	1.56105E+000	3.52698E-001
Ac-228	0.656	99.50	@	1.26		
		129.07	@	2.50		
		209.25*		3.97	7.70936E-001	2.28042E-001
		270.24		3.55		
		328.00*		3.04	3.10543E-001	2.60816E-001
		338.32*		11.40	1.00519E+000	1.23464E-001
		409.46	@	2.02		
		463.00*		4.45	8.85298E-001	2.51413E-001
		755.31	@	1.03		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.656	772.29	@	1.52		
		794.94*		4.31	1.09476E+000	3.09075E-001
		835.70	@	1.70		
		911.20*		26.20	1.15641E+000	9.10126E-002
		964.79*		4.99	9.07620E-001	1.79320E-001
		968.96*		15.90	8.50642E-001	9.12665E-002
		1588.20		3.06		
		1630.62	@	1.52		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.991	1.590561E+001	6.369563E-001
X	Cd-109		0.914		
	Cs-137	@	0.983	5.928496E-002	1.427124E-002
	Eu-152m		0.984	2.209901E-002	1.270076E-002
	Tl-208	@	0.835	3.288145E-001	2.396732E-002
	Bi-211		0.904	4.955770E-001	2.368732E-001
	Bi-212	@	0.570	1.183392E+000	2.022787E-001
	Pb-212	@	0.986	9.434867E-001	4.644768E-002
	Bi-214	@	0.498	6.982891E-001	4.158931E-002
	Pb-214	@	0.945	6.476660E-001	5.989585E-002
	Ra-224	@	0.827	7.284930E-001	2.202924E-001
	Ra-226	@	0.773	1.561054E+000	3.526984E-001
	Ac-228	@	0.656	9.596918E-001	4.777410E-002

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/5/2016 5:41:34 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
5	153.72	1.6557E-003	223.25	Sum	
16	495.82	1.5833E-003	87.19		
23	803.56	1.4980E-003	90.17	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************
```

Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S001-1824-01.CNF

Report Generated On	: 12/5/2016 7:47:17 PM
Sample Title	: UMR001-S001-1824-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 5.416E+002 GWET
Sample Taken On	: 11/18/2016 9:45:00 AM
Acquisition Started	: 12/5/2016 5:47:14 PM
Live Time	: 7200.0 seconds
Real Time	: 7201.7 seconds
Dead Time	: 0.02 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

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*************************************************************************
*****              P E A K   A N A L Y S I S   R E P O R T          *****
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Detector Name: ERT01
Sample Title: UMR001-S001-1824-01
Peak Analysis Performed on: 12/5/2016 7:47:17 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	124-	131	128.05	31.97	0.42	2.50E+001	23.07	2.52E+002
	2	250-	262	253.91	63.43	0.80	7.86E+001	33.38	3.91E+002
M	3	290-	316	299.76	74.90	0.91	2.73E+002	24.09	4.48E+002
m	4	290-	316	308.84	77.17	0.91	4.23E+002	27.73	4.33E+002
M	5	343-	383	349.69	87.38	1.26	2.02E+002	24.40	5.63E+002
m	6	343-	383	360.20	90.01	1.26	1.14E+002	21.15	5.62E+002
m	7	343-	383	371.98	92.95	1.27	2.81E+002	25.82	5.16E+002
	8	511-	522	516.40	129.06	0.30	3.86E+001	31.37	3.76E+002
	9	736-	749	743.65	185.88	0.79	2.33E+002	35.14	3.64E+002
	10	831-	843	837.63	209.37	0.66	1.21E+002	28.77	2.68E+002
M	11	947-	978	954.66	238.64	1.08	1.39E+003	40.46	2.67E+002
m	12	947-	978	967.08	241.74	1.09	2.43E+002	19.58	2.35E+002
	13	1076-	1089	1080.69	270.15	0.71	9.75E+001	25.51	2.00E+002
	14	1173-	1187	1180.90	295.20	1.22	2.84E+002	30.94	2.34E+002
	15	1195-	1206	1200.81	300.18	1.25	6.44E+001	21.31	1.56E+002
	16	1347-	1359	1353.19	338.28	0.69	2.81E+002	26.83	1.67E+002
	17	1399-	1419	1407.40	351.83	1.07	6.44E+002	37.57	2.09E+002
	18	1844-	1860	1850.86	462.71	0.34	6.63E+001	20.02	1.07E+002
	19	2029-	2056	2042.47	510.61	1.31	3.52E+002	33.98	1.78E+002
	20	2324-	2341	2331.75	582.94	1.54	4.59E+002	28.74	1.13E+002
	21	2428-	2445	2436.45	609.11	1.62	5.30E+002	29.18	9.87E+001
	22	2896-	2916	2908.47	727.13	1.11	1.19E+002	21.68	9.67E+001
	23	3173-	3186	3178.96	794.76	1.52	5.09E+001	14.14	5.31E+001
	24	3337-	3347	3341.28	835.34	0.55	1.58E+001	11.42	4.72E+001
	25	3433-	3447	3440.62	860.18	0.69	2.82E+001	15.25	7.08E+001
	26	3634-	3652	3643.96	911.02	1.35	3.36E+002	23.50	6.41E+001
	27	3866-	3886	3875.33	968.87	1.21	1.74E+002	23.67	1.05E+002
	28	4473-	4490	4480.86	1120.26	2.29	1.23E+002	18.60	6.66E+001
	29	5831-	5856	5844.34	1461.16	1.84	1.93E+003	44.61	1.31E+001
	30	7051-	7071	7060.03	1765.11	1.83	9.48E+001	11.25	9.17E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
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Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S001-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	4.9938E-001	4.99E-001	2.1703E+001
	Co-60	1173.23	99.85	9.8998E-002	7.69E-002	-3.0416E-002
		1332.49	99.98	7.6923E-002		4.7096E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.1373E+003	8.20E-002	5.0982E+002
		661.66	84.99	8.1967E-002		-8.8791E-003
+	Tl-208	72.80	2.02	8.1449E+000	7.11E-002	-5.6785E-001
		74.97*	3.41	2.6702E+000		5.1427E+000
		84.90	1.51	6.4828E+000		4.4899E-001
		277.36	6.31	8.9838E-001		1.3312E-001
		510.77*	22.60	3.8942E-001		4.6979E-001
		583.19*	84.50	7.1060E-002		3.4431E-001
		763.13	1.81	4.0519E+000		-2.2681E+000
		860.56*	12.42	4.7217E-001		1.9208E-001
+	Bi-212	39.86	1.06	5.8119E+002	1.00E+000	1.3890E+002
		727.33*	6.74	1.0039E+000		1.3333E+000
		785.37	1.11	6.9090E+000		3.6188E+000
		1620.74	1.51	3.8811E+000		1.1691E+000
		1806.00	0.09	5.6980E+001		-1.5752E+001
+	Pb-212	74.81*	10.40	8.7550E-001	9.31E-002	1.6862E+000
		77.11*	17.50	4.6265E-001		1.4035E+000
		87.30*	7.81	8.4331E-001		1.0726E+000
		115.18	0.59	9.8810E+000		-6.7063E+000
		238.63*	43.30	9.3087E-002		1.1226E+000
		300.09*	3.28	1.1636E+000		7.9309E-001
+	Bi-214	76.86*	0.43	1.8682E+001	1.23E-001	5.6673E+001
		89.81*	0.24	2.5008E+001		1.8019E+001
		386.77	0.30	1.9439E+001		-1.6365E+000
		454.77	0.29	1.9366E+001		-5.4677E+000
		609.31*	45.49	1.2346E-001		7.6091E-001
		665.45	1.53	4.5871E+000		2.4596E+000
		703.11	0.48	1.5003E+001		-1.7271E+000
		719.86	0.39	1.8042E+001		-9.0317E-001
		768.36	4.89	1.6159E+000		2.5502E-001
		786.10	0.31	2.5247E+001		1.4068E+001
		806.17	1.26	5.6604E+000		-2.6999E+000
		934.06	3.10	2.5719E+000		9.5891E-002
		964.08	0.36	3.3593E+001		2.4373E+001
		1051.96	0.31	2.5583E+001		-8.9142E+000
		1120.29*	14.91	4.8219E-001		8.2531E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.5208E+001	1.23E-001	1.9100E+001
		1155.19	1.63	5.8874E+000		2.9819E+000
		1207.68	0.45	2.0342E+001		-4.3277E+000
		1238.11	5.79	1.9623E+000		-3.6014E-001
		1280.96	1.43	6.5189E+000		2.3290E+000
		1377.67	4.00	1.9549E+000		1.3813E+000
		1385.31	0.76	9.2498E+000		-3.9089E+000
		1401.50	1.27	5.1690E+000		-4.5211E+000
		1407.98	2.15	3.4314E+000		1.3480E-001
		1509.23	2.11	3.2044E+000		2.8873E-001
		1538.50	0.38	1.6961E+001		1.0100E+001
		1543.32	0.20	3.1401E+001		4.9485E-001
		1583.22	0.69	1.0504E+001		6.0276E+000
		1594.73	0.25	3.1458E+001		9.1939E+000
		1599.31	0.23	2.9697E+001		1.9098E+000
		1661.28	1.15	5.1567E+000		8.8235E-001
		1683.99	0.22	2.2558E+001		3.9418E+000
		1729.59	2.92	2.1827E+000		-1.2361E-001
		1764.49*	15.40	2.8170E-001		7.9511E-001
		1847.42	2.11	2.6759E+000		-1.3101E+000
		1873.16	0.22	2.3659E+001		7.6705E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	5.0727E+001	1.56E-001	2.9567E+001
		74.81*	6.44	1.3898E+000		2.6767E+000
		77.11*	10.80	7.3688E-001		2.2355E+000
		87.30*	4.84	1.3376E+000		1.7013E+000
		242.00*	7.43	4.8924E-001		1.1470E+000
		258.87	0.52	1.0217E+001		3.3013E+000
		274.80	0.47	1.1869E+001		4.6285E+000
		295.22*	19.30	2.5124E-001		5.7741E-001
		351.93*	37.60	1.5576E-001		7.4579E-001
		462.00*	0.22	2.1232E+001		1.6031E+001
		533.66	0.19	3.1820E+001		-3.3729E+000
		785.96	1.07	7.3462E+000		5.4847E+000
		839.04	0.59	1.3121E+001		2.2646E+000
+	Ra-224	81.07	0.13	7.7111E+001	9.02E-001	-4.3976E+001
		83.78	0.22	4.3668E+001		-1.7265E+000
		240.99*	4.10	9.0198E-001		2.1146E+000
+	Ra-226	81.07	0.20	5.0403E+001	1.37E+000	-2.8744E+001
		83.78	0.33	2.8398E+001		-1.1227E+000
		94.90	0.15	5.1619E+001		1.1311E+000
		186.21*	3.59	1.3731E+000		1.6191E+000
+	Ac-228	99.50	1.26	5.0044E+000	2.44E-001	3.8698E+000
		129.07*	2.50	1.8768E+000		4.9772E-001
		209.25*	3.97	1.0672E+000		1.0184E+000
		270.24*	3.55	1.1974E+000		1.0415E+000
		328.00	3.04	2.0537E+000		1.6840E+000
		338.32*	11.40	3.8308E-001		1.0764E+000
		409.46	2.02	2.9631E+000		3.4754E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.0727E+000	2.44E-001	8.0994E-001
		755.31	1.03	6.6659E+000		-4.1837E-001
		772.29	1.52	5.2536E+000		8.3399E-001
		794.94*	4.31	1.1068E+000		9.4638E-001
		835.70*	1.70	2.5641E+000		7.7187E-001
		911.20*	26.20	2.4411E-001		1.1125E+000
		964.79	4.99	2.5582E+000		2.1739E+000
		968.96*	15.90	5.4405E-001		1.0072E+000
		1588.20	3.06	2.6678E+000		1.7157E-001
		1630.62	1.52	4.1294E+000		2.9238E+000
	Th-228	84.37	1.26	7.6361E+000	7.64E+000	7.2690E-001
		131.61	0.13	4.9547E+001		-5.7052E-002
		166.41	0.10	5.3311E+001		-3.6619E+000
		215.98	0.25	2.3162E+001		1.1874E+001
	Pa-234m	258.23	0.07	7.3105E+001	9.51E+000	2.6308E+001
		742.81	0.09	7.5815E+001		-1.2349E+001
		766.36	0.32	2.3159E+001		-5.1929E+000
		786.27	0.05	1.4669E+002		1.0910E+002
		1001.03	0.85	9.5115E+000		2.6698E+000
		1737.77	0.02	2.7984E+002		-1.8753E+002
+	Th-234	63.30*	3.75	5.4765E+000	1.34E+000	1.5413E+000
		92.59*	4.33	1.3440E+000		1.7236E+000
		112.81	0.22	2.7029E+001		1.0450E+001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S001-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.982	1460.82*		10.55	2.17031E+001	7.67114E-001
Eu-152m	0.996	89.85*		69.90	6.30521E-002	1.18543E-002
Tl-208	0.831	72.80	@	2.02		
		74.97*	@	3.41	5.14268E+000	4.87282E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	4.69786E-001	9.07355E-002
		583.19*		84.50	3.44308E-001	2.46370E-002
		763.13	@	1.81		
		860.56*		12.42	1.92083E-001	1.04174E-001
Bi-211	0.903	351.03*		13.00	2.16026E+000	1.55287E-001
Bi-212	0.570	39.86	@	1.06		
		727.33*		6.74	1.33331E+000	2.45997E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.987	74.81*		10.40	1.68620E+000	1.67012E-001
		77.11*		17.50	1.40351E+000	1.11560E-001
		87.30*		7.81	1.07261E+000	1.38781E-001
		115.18	@	0.59		
		238.63*		43.30	1.12257E+000	6.04996E-002
		300.09*		3.28	7.93090E-001	2.64404E-001
Bi-214	0.490	76.86*	@	0.43	5.66734E+001	4.54556E+000
		89.81*	@	0.24	1.80194E+001	3.44892E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	7.60907E-001	4.79112E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36		4.89		
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08	@	0.36		
		1051.96	@	0.31		
		1120.29*		14.91	8.25306E-001	1.26062E-001
		1133.66	@	0.25		
		1155.19	@	1.63		
		1207.68	@	0.45		
		1238.11		5.79		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.490	1280.96	@	1.43		
		1377.67		4.00		
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	7.95115E-001	1.04401E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.946	53.28	@	1.20		
		74.81*		6.44	2.67666E+000	2.68219E-001
		77.11*		10.80	2.23545E+000	1.85334E-001
		87.30*		4.84	1.70131E+000	2.22469E-001
		242.00*		7.43	1.14696E+000	1.06678E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	5.77410E-001	6.74302E-002
		351.93*		37.60	7.45787E-001	5.30860E-002
		462.00*	@	0.22	1.60309E+001	4.92006E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.810	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	2.11455E+000	1.95871E-001
Ra-226	0.764	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	1.61911E+000	3.22922E-001
Ac-228	0.689	99.50	@	1.26		
		129.07*	@	2.50	4.97717E-001	4.04632E-001
		209.25*		3.97	1.01842E+000	2.49536E-001
		270.24*		3.55	1.04148E+000	2.77542E-001
		328.00		3.04		
		338.32*		11.40	1.07645E+000	1.16984E-001
		409.46	@	2.02		
		463.00*		4.45	8.09936E-001	2.50223E-001
		755.31	@	1.03		
		772.29	@	1.52		
		794.94*		4.31	9.46380E-001	2.65891E-001

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.689	835.70* @	1.70	7.71871E-001	5.59034E-001
		911.20*	26.20	1.11248E+000	9.01156E-002
		964.79	4.99		
		968.96*	15.90	1.00723E+000	1.42462E-001
		1588.20	3.06		
		1630.62 @	1.52		
Th-234	0.931	63.30*	3.75	1.54127E+000	1.18175E+000
		92.59*	4.33	1.72358E+000	2.41245E-001
		112.81 @	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.982	2.170307E+001	7.671139E-001
X	Mn-54		0.960		
X	Cd-109		0.934		
	Eu-152m		0.996	6.034725E-002	1.184284E-002
	Tl-208	@	0.831	3.376080E-001	2.379722E-002
	Bi-211		0.903	5.979886E-001	2.335409E-001
	Bi-212	@	0.570	1.333314E+000	2.459971E-001
	Pb-212	@	0.987	1.062594E+000	4.790217E-002
	Bi-214	@	0.490	7.730185E-001	4.105825E-002
	Pb-214	@	0.946	5.393431E-001	6.119849E-002
	Ra-224	@	0.810	1.120210E+000	2.245670E-001
	Ra-226	@	0.764	1.619110E+000	3.229216E-001
	Ac-228	@	0.689	1.057091E+000	5.445473E-002
	Th-234	@	0.931	1.716287E+000	2.363698E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/5/2016 7:47:17 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
1	31.97	3.4722E-003	92.28	Tol.	Cs-137

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S001-1218-01.CNF

Report Generated On	: 12/6/2016 11:23:11 AM
Sample Title	: UMR001-S001-1218-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 5.761E+002 GWET
Sample Taken On	: 11/18/2016 9:50:00 AM
Acquisition Started	: 12/6/2016 9:23:07 AM
Live Time	: 7200.0 seconds
Real Time	: 7201.8 seconds
Dead Time	: 0.03 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S001-1218-01
Peak Analysis Performed on: 12/6/2016 11:23:11 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	289-	321	299.50	74.83	0.97	2.60E+002	24.16	5.10E+002
m	2	289-	321	308.85	77.17	0.97	4.18E+002	28.19	4.60E+002
M	3	345-	387	349.58	87.35	1.07	1.83E+002	22.18	3.88E+002
m	4	345-	387	360.32	90.04	1.07	1.34E+002	20.12	4.59E+002
m	5	345-	387	372.13	92.99	1.08	2.75E+002	23.83	4.14E+002
	6	734-	751	743.42	185.82	1.20	3.20E+002	40.01	3.94E+002
	7	830-	841	837.12	209.25	0.94	7.90E+001	28.19	2.85E+002
M	8	947-	976	954.75	238.66	1.12	1.30E+003	39.45	2.74E+002
m	9	947-	976	966.99	241.72	1.13	2.24E+002	19.09	2.24E+002
	10	1172-	1187	1180.76	295.17	1.16	3.46E+002	32.30	2.32E+002
	11	1192-	1208	1200.84	300.19	0.77	6.03E+001	26.95	2.13E+002
	12	1307-	1322	1311.94	327.96	1.39	8.63E+001	23.56	1.54E+002
	13	1348-	1359	1353.11	338.26	1.14	2.69E+002	25.76	1.51E+002
	14	1397-	1417	1407.27	351.80	0.98	6.24E+002	36.57	1.97E+002
	15	1633-	1643	1637.44	409.35	0.43	3.69E+001	15.69	8.71E+001
	16	1844-	1860	1852.49	463.11	1.06	7.39E+001	21.47	1.22E+002
	17	2028-	2058	2042.27	510.56	1.50	3.69E+002	38.17	2.22E+002
	18	2322-	2340	2332.20	583.05	1.24	4.78E+002	27.36	8.04E+001
	19	2428-	2445	2436.38	609.10	1.22	5.10E+002	29.85	1.16E+002
	20	2897-	2915	2908.49	727.13	0.82	8.91E+001	19.82	8.99E+001
	21	3171-	3185	3178.18	794.56	0.83	5.47E+001	15.36	6.23E+001
	22	3434-	3450	3441.36	860.36	0.69	6.46E+001	15.62	5.74E+001
	23	3630-	3653	3644.12	911.06	1.75	3.22E+002	24.65	7.23E+001
M	24	3852-	3885	3858.21	964.59	1.28	2.98E+001	9.01	7.00E+001
m	25	3852-	3885	3875.37	968.87	1.28	1.61E+002	14.88	7.03E+001
	26	4472-	4489	4480.72	1120.23	1.21	1.07E+002	18.91	7.66E+001
	27	5832-	5857	5844.15	1461.11	1.80	1.77E+003	44.44	4.81E+001
	28	7052-	7070	7060.96	1765.34	0.81	1.00E+002	10.78	4.75E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S001-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	7.7362E-001	7.74E-001	1.8677E+001
	Co-60	1173.23	99.85	9.0086E-002	7.06E-002	5.6135E-002
		1332.49	99.98	7.0556E-002		-8.7970E-003
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.0407E+003	7.69E-002	-3.5668E+002
		661.66	84.99	7.6892E-002		8.3038E-003
+	Tl-208	72.80	2.02	7.8176E+000	5.81E-002	-9.3569E-001
		74.97*	3.41	2.6870E+000		4.6197E+000
		84.90	1.51	5.9798E+000		-2.9446E+000
		277.36	6.31	8.8126E-001		8.3732E-002
		510.77*	22.60	4.1379E-001		4.8453E-001
		583.19*	84.50	5.8066E-002		3.3716E-001
		763.13	1.81	4.1510E+000		-4.1252E-001
		860.56*	12.42	4.1727E-001		4.1472E-001
+	Bi-212	39.86	1.06	5.5971E+002	8.81E-001	-6.2214E+001
		727.33*	6.74	8.8107E-001		9.3741E-001
		785.37	1.11	5.9462E+000		1.7500E+000
		1620.74	1.51	3.8934E+000		-1.1990E+000
		1806.00	0.09	5.7280E+001		2.3294E+001
+	Pb-212	74.81*	10.40	8.8103E-001	8.86E-002	1.5147E+000
		77.11*	17.50	4.4824E-001		1.3039E+000
		87.30*	7.81	6.6176E-001		9.1316E-001
		115.18	0.59	9.7306E+000		9.0174E+000
		238.63*	43.30	8.8575E-002		9.8665E-001
		300.09*	3.28	1.4216E+000		6.9899E-001
+	Bi-214	76.86*	0.43	1.8088E+001	1.26E-001	5.2616E+001
		89.81*	0.24	2.1267E+001		1.9893E+001
		386.77	0.30	1.8193E+001		7.2959E+000
		454.77	0.29	1.8741E+001		1.1487E+000
		609.31*	45.49	1.2610E-001		6.8819E-001
		665.45	1.53	4.3405E+000		2.0098E+000
		703.11	0.48	1.3751E+001		-2.1467E-002
		719.86	0.39	1.5338E+001		1.0495E-001
		768.36	4.89	1.5540E+000		-2.9089E-001
		786.10	0.31	2.1810E+001		5.0566E+000
		806.17	1.26	5.5380E+000		1.0756E+000
		934.06	3.10	2.4700E+000		7.8862E-001
		964.08*	0.36	1.3475E+001		6.9478E+000
		1051.96	0.31	2.4126E+001		8.9341E+000
		1120.29*	14.91	4.7953E-001		6.7544E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.1863E+001	1.26E-001	-1.2634E+001
		1155.19	1.63	5.3668E+000		3.0969E+000
		1207.68	0.45	2.1135E+001		4.5072E+000
		1238.11	5.79	1.8735E+000		4.9341E-001
		1280.96	1.43	5.6389E+000		-3.1830E+000
		1377.67	4.00	1.8199E+000		-9.3395E-001
		1385.31	0.76	8.1450E+000		-5.6589E+000
		1401.50	1.27	5.5049E+000		-2.3802E+000
		1407.98	2.15	3.2978E+000		1.4766E+000
		1509.23	2.11	2.9674E+000		-5.5534E-001
		1538.50	0.38	1.5385E+001		3.2401E+000
		1543.32	0.20	2.7892E+001		-2.4058E+000
		1583.22	0.69	1.0210E+001		3.7541E+000
		1594.73	0.25	2.9045E+001		1.1293E+001
		1599.31	0.23	2.6325E+001		1.8361E+000
		1661.28	1.15	4.1421E+000		4.7772E-001
		1683.99	0.22	2.4247E+001		1.2794E+001
		1729.59	2.92	2.1743E+000		1.3595E+000
		1764.49*	15.40	2.1013E-001		7.9284E-001
		1847.42	2.11	2.4412E+000		4.7275E-001
		1873.16	0.22	2.4134E+001		-3.4250E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	4.7037E+001	1.41E-001	8.8449E+000
		74.81*	6.44	1.3976E+000		2.4029E+000
		77.11*	10.80	7.1348E-001		2.0754E+000
		87.30*	4.84	1.0490E+000		1.4475E+000
		242.00*	7.43	4.4960E-001		9.9665E-001
		258.87	0.52	9.1646E+000		1.4820E-001
		274.80	0.47	1.1366E+001		-1.4134E+001
		295.22*	19.30	2.4016E-001		6.6182E-001
		351.93*	37.60	1.4128E-001		6.7988E-001
		462.00	0.22	2.7671E+001		2.3837E+001
		533.66	0.19	2.9171E+001		6.0858E+000
		785.96	1.07	6.2846E+000		1.3188E+000
		839.04	0.59	1.2822E+001		5.4478E+000
+	Ra-224	81.07	0.13	7.1758E+001	8.29E-001	-3.3911E+001
		83.78	0.22	4.0424E+001		-1.0415E+001
		240.99*	4.10	8.2942E-001		1.8386E+000
+	Ra-226	81.07	0.20	4.6874E+001	1.45E+000	-2.2151E+001
		83.78	0.33	2.6271E+001		-6.7685E+000
		94.90	0.15	4.7004E+001		-9.2299E-001
		186.21*	3.59	1.4455E+000		2.2476E+000
+	Ac-228	99.50	1.26	4.6228E+000	2.61E-001	1.7960E+000
		129.07	2.50	2.4180E+000		1.6211E+000
		209.25*	3.97	1.0099E+000		6.2796E-001
		270.24	3.55	1.5969E+000		1.1607E+000
		328.00*	3.04	1.3676E+000		1.1420E+000
		338.32*	11.40	3.4222E-001		9.6930E-001
		409.46*	2.02	1.6231E+000		8.5624E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.0839E+000	2.61E-001	8.5060E-001
		755.31	1.03	6.0719E+000		-2.4566E+000
		772.29	1.52	4.9951E+000		2.4526E+000
		794.94*	4.31	1.1435E+000		9.5682E-001
		835.70	1.70	4.3565E+000		6.6422E-001
		911.20*	26.20	2.6144E-001		1.0015E+000
		964.79*	4.99	9.9789E-001		5.1451E-001
		968.96*	15.90	3.1459E-001		8.7575E-001
		1588.20	3.06	2.5096E+000		2.9891E-001
		1630.62	1.52	3.9617E+000		-3.9391E+000
	Th-228	84.37	1.26	7.0551E+000	7.06E+000	-2.9840E+000
		131.61	0.13	4.5852E+001		2.5867E+001
		166.41	0.10	5.1186E+001		1.3785E+001
		215.98	0.25	2.0660E+001		-8.8110E+000
	Pa-234m	258.23	0.07	6.5272E+001	8.43E+000	2.8405E+000
		742.81	0.09	6.5371E+001		-3.9104E+000
		766.36	0.32	2.3774E+001		1.0596E+001
		786.27	0.05	1.2616E+002		7.5497E+001
		1001.03	0.85	8.4278E+000		1.7724E+000
		1737.77	0.02	2.7514E+002		-2.2647E+002
	Th-234	63.30	3.75	6.5027E+000	1.82E+000	3.3878E+000
		92.59	4.33	1.8179E+000		3.5942E+000
		112.81	0.22	2.6058E+001		6.7709E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S001-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.987	1460.82*		10.55	1.86773E+001	6.86122E-001
Eu-152m	0.994	89.85*		69.90	6.96152E-002	1.06806E-002
Tl-208	0.837	72.80	@	2.02		
		74.97*	@	3.41	4.61972E+000	4.58133E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	4.84533E-001	9.54894E-002
		583.19*		84.50	3.37157E-001	2.25102E-002
		763.13	@	1.81		
		860.56*		12.42	4.14722E-001	1.00813E-001
Bi-211	0.910	351.03*		13.00	1.96948E+000	1.41936E-001
Bi-212	0.570	39.86	@	1.06		
		727.33*		6.74	9.37410E-001	2.10593E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.987	74.81*		10.40	1.51473E+000	1.56441E-001
		77.11*		17.50	1.30387E+000	1.05712E-001
		87.30*		7.81	9.13159E-001	1.18666E-001
		115.18	@	0.59		
		238.63*		43.30	9.86652E-001	5.38904E-002
		300.09*		3.28	6.98993E-001	3.13547E-001
Bi-214	0.487	76.86*	@	0.43	5.26161E+001	4.30302E+000
		89.81*	@	0.24	1.98933E+001	3.13440E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	6.88188E-001	4.54470E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36		4.89		
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08*	@	0.36	6.94782E+000	2.12223E+000
		1051.96	@	0.31		
		1120.29*		14.91	6.75445E-001	1.20063E-001
		1133.66	@	0.25		
		1155.19	@	1.63		
		1207.68	@	0.45		
		1238.11		5.79		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.487	1280.96	@	1.43		
		1377.67		4.00		
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	7.92836E-001	9.49246E-002
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.942	53.28	@	1.20		
		74.81*		6.44	2.40293E+000	2.50848E-001
		77.11*		10.80	2.07541E+000	1.75230E-001
		87.30*		4.84	1.44747E+000	1.90085E-001
		242.00*		7.43	9.96651E-001	9.65613E-002
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	6.61820E-001	6.76788E-002
		351.93*		37.60	6.79885E-001	4.85216E-002
		462.00	@	0.22		
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.814	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	1.83862E+000	1.77466E-001
Ra-226	0.759	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	2.24762E+000	3.51388E-001
Ac-228	0.699	99.50	@	1.26		
		129.07	@	2.50		
		209.25*		3.97	6.27962E-001	2.26698E-001
		270.24		3.55		
		328.00*		3.04	1.14198E+000	3.17488E-001
		338.32*		11.40	9.69301E-001	1.05586E-001
		409.46*	@	2.02	8.56242E-001	3.66167E-001
		463.00*		4.45	8.50599E-001	2.53081E-001
		755.31	@	1.03		
		772.29	@	1.52		
		794.94*		4.31	9.56818E-001	2.71691E-001

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.699	835.70	@	1.70		
		911.20*		26.20	1.00154E+000	8.72105E-002
		964.79*		4.99	5.14510E-001	1.57216E-001
		968.96*		15.90	8.75754E-001	8.79109E-002
		1588.20		3.06		
		1630.62	@	1.52		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
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	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.987	1.867728E+001	6.861216E-001
X	Cd-109		0.929		
	Eu-152m		0.994	6.715687E-002	1.066469E-002
	Tl-208	@	0.837	3.415761E-001	2.178468E-002
	Bi-211		0.910	2.471562E-001	2.231605E-001
	Bi-212	@	0.570	9.374097E-001	2.105931E-001
	Pb-212	@	0.987	9.141436E-001	4.371287E-002
	Bi-214	@	0.487	7.024904E-001	3.868999E-002
	Pb-214	@	0.942	5.945639E-001	6.027207E-002
	Ra-224	@	0.814	7.417691E-001	2.082178E-001
	Ra-226	@	0.759	2.247620E+000	3.513877E-001
	Ac-228	@	0.699	8.956347E-001	4.499180E-002

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/6/2016 11:23:11 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m	5	92.99	2.7630E-002	12.35	Tol.	Yb-169 Th-227 Th-234

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S001-0612-02.CNF

Report Generated On	: 12/6/2016 1:30:30 PM
Sample Title	: UMR001-S001-0612-02
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 4.520E+002 GWET
Sample Taken On	: 11/18/2016 9:55:00 AM
Acquisition Started	: 12/6/2016 11:30:27 AM
Live Time	: 7200.0 seconds
Real Time	: 7201.6 seconds
Dead Time	: 0.02 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S001-0612-02
Peak Analysis Performed on: 12/6/2016 1:30:31 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	249-	258	255.87	63.92	0.50	5.41E+001	25.43	2.63E+002
M	2	293-	321	299.73	74.89	0.99	2.30E+002	21.74	3.86E+002
m	3	293-	321	308.78	77.15	0.99	3.89E+002	25.88	3.67E+002
M	4	345-	382	349.59	87.36	1.32	1.52E+002	20.79	3.57E+002
m	5	345-	382	360.06	89.97	1.33	1.29E+002	19.86	4.41E+002
m	6	345-	382	372.30	93.03	1.33	2.67E+002	23.89	4.03E+002
	7	734-	752	744.06	185.98	0.73	2.38E+002	37.02	3.35E+002
	8	833-	843	837.43	209.33	0.75	6.97E+001	24.41	2.20E+002
M	9	948-	973	954.63	238.63	1.10	1.02E+003	34.99	2.10E+002
m	10	948-	973	966.18	241.52	1.10	1.72E+002	16.91	1.85E+002
	11	1074-	1088	1080.18	270.02	1.08	9.46E+001	24.10	1.68E+002
	12	1173-	1189	1180.87	295.19	0.84	3.11E+002	28.86	1.66E+002
	13	1192-	1209	1200.58	300.12	0.82	8.65E+001	24.49	1.58E+002
	14	1217-	1224	1220.88	305.20	0.64	2.26E+001	13.06	7.34E+001
	15	1347-	1358	1352.87	338.20	1.09	1.57E+002	22.38	1.37E+002
	16	1401-	1416	1407.48	351.85	1.31	5.45E+002	29.59	1.10E+002
	17	1844-	1859	1851.58	462.88	1.08	6.77E+001	18.91	9.63E+001
	18	2034-	2055	2042.35	510.58	0.88	2.71E+002	28.30	1.41E+002
	19	2228-	2238	2232.80	558.20	0.29	7.77E-001	10.43	4.52E+001
	20	2323-	2342	2331.71	582.93	1.30	3.41E+002	25.53	8.66E+001
	21	2429-	2444	2436.10	609.03	1.12	4.61E+002	26.63	8.29E+001
	22	2639-	2653	2646.16	661.55	1.15	7.90E+001	17.19	7.50E+001
	23	2901-	2916	2908.91	727.24	1.37	8.17E+001	14.06	3.83E+001
	24	3031-	3040	3035.88	758.99	0.60	1.35E+001	7.29	1.75E+001
	25	3068-	3080	3072.82	768.22	0.70	2.85E+001	13.02	5.25E+001
	26	3634-	3653	3643.93	911.01	1.37	2.38E+002	20.20	4.80E+001
	27	3866-	3884	3875.16	968.82	1.29	1.30E+002	18.16	5.93E+001
	28	4473-	4493	4480.00	1120.05	0.70	8.83E+001	17.35	5.87E+001
	29	4946-	4958	4951.98	1238.05	0.33	1.78E+001	12.48	5.22E+001
	30	5832-	5856	5844.34	1461.16	1.78	1.10E+003	33.98	1.23E+001
	31	6349-	6360	6354.40	1588.68	0.85	1.98E+001	4.77	1.25E+000
	32	7051-	7070	7061.19	1765.40	0.60	9.56E+001	10.19	2.41E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S001-0612-02
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	5.7667E-001	5.77E-001	1.4751E+001
	Co-60	1173.23	99.85	9.7616E-002	8.37E-002	5.2840E-003
		1332.49	99.98	8.3744E-002		1.5476E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
+	Cs-137	32.06	5.54	1.1720E+003	6.95E-002	-3.2097E+002
		661.66*	84.99	6.9505E-002		7.7224E-002
+	Tl-208	72.80	2.02	8.8056E+000	7.88E-002	4.8549E-001
		74.97*	3.41	2.9776E+000		5.1860E+000
		84.90	1.51	6.9215E+000		-2.3768E-001
		277.36	6.31	9.9169E-001		3.5994E-001
		510.77*	22.60	4.0019E-001		3.1418E-001
		583.19*	84.50	7.8821E-002		3.0535E-001
		763.13	1.81	4.4229E+000		-4.9295E-001
		860.56	12.42	6.8788E-001		6.5542E-001
+	Bi-212	39.86	1.06	6.6143E+002	7.07E-001	4.7593E+002
		727.33*	6.74	7.0743E-001		1.0958E+000
		785.37	1.11	7.3811E+000		3.4952E+000
		1620.74	1.51	4.5458E+000		2.6479E+000
		1806.00	0.09	6.0553E+001		-2.9858E+001
+	Pb-212	74.81*	10.40	9.7632E-001	1.00E-001	1.7004E+000
		77.11*	17.50	5.1164E-001		1.5466E+000
		87.30*	7.81	8.1005E-001		9.6680E-001
		115.18	0.59	1.0441E+001		9.9147E-002
		238.63*	43.30	1.0003E-001		9.7944E-001
		300.09*	3.28	1.5953E+000		1.2770E+000
+	Bi-214	76.86*	0.43	2.0645E+001	1.31E-001	6.2408E+001
		89.81*	0.24	2.6616E+001		2.4323E+001
		386.77	0.30	2.1010E+001		1.0944E+001
		454.77	0.29	2.0818E+001		-6.7816E+000
		609.31*	45.49	1.3059E-001		7.9267E-001
		665.45	1.53	6.1412E+000		-1.8343E-001
		703.11	0.48	1.5541E+001		6.5867E+000
		719.86	0.39	1.8668E+001		-2.5773E+000
		768.36*	4.89	1.0924E+000		5.3718E-001
		786.10	0.31	2.6751E+001		5.9153E+000
		806.17	1.26	6.1715E+000		1.0087E+000
		934.06	3.10	2.5874E+000		1.9251E+000
		964.08	0.36	3.2815E+001		9.4753E+000
		1051.96	0.31	2.6287E+001		4.5859E+000
		1120.29*	14.91	5.6534E-001		7.0756E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.6432E+001	1.31E-001	9.1911E+000
		1155.19	1.63	5.7539E+000		2.6917E+000
		1207.68	0.45	2.1657E+001		-8.3210E+000
		1238.11*	5.79	1.2654E+000		3.9305E-001
		1280.96	1.43	6.1434E+000		-1.6727E+000
		1377.67	4.00	2.0768E+000		6.6261E-001
		1385.31	0.76	9.9350E+000		-9.9552E+000
		1401.50	1.27	5.9234E+000		1.2221E+000
		1407.98	2.15	3.6176E+000		-2.3282E+000
		1509.23	2.11	3.3504E+000		-8.3183E-001
		1538.50	0.38	1.9056E+001		8.4877E+000
		1543.32	0.20	3.3716E+001		6.1984E-002
		1583.22	0.69	1.0596E+001		-2.0468E+000
		1594.73	0.25	3.4186E+001		1.5792E+001
		1599.31	0.23	3.3850E+001		2.6577E+001
		1661.28	1.15	5.3605E+000		-1.3280E+000
		1683.99	0.22	2.7030E+001		-1.4108E+001
		1729.59	2.92	2.4489E+000		1.0745E+000
		1764.49*	15.40	2.2404E-001		9.6096E-001
		1847.42	2.11	4.0275E+000		2.0587E-001
		1873.16	0.22	2.9821E+001		2.5085E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	5.4693E+001	1.25E-001	8.3776E+000
		74.81*	6.44	1.5487E+000		2.6973E+000
		77.11*	10.80	8.1432E-001		2.4616E+000
		87.30*	4.84	1.2839E+000		1.5324E+000
		242.00*	7.43	5.2198E-001		9.7605E-001
		258.87	0.52	1.0740E+001		3.9565E+000
		274.80	0.47	1.2695E+001		3.3279E+000
		295.22*	19.30	2.6580E-001		7.5838E-001
		351.93*	37.60	1.2548E-001		7.5502E-001
		462.00*	0.22	2.3740E+001		1.9629E+001
		533.66	0.19	3.3983E+001		9.7749E+000
		785.96	1.07	7.8154E+000		4.7605E+000
		839.04	0.59	1.3869E+001		-4.4896E+000
+	Ra-224	81.07	0.13	8.1335E+001	9.63E-001	-3.9939E+001
		83.78	0.22	4.6341E+001		-1.0268E+001
		240.99*	4.10	9.6303E-001		1.8008E+000
+	Ra-226	81.07	0.20	5.3126E+001	1.74E+000	-2.6087E+001
		83.78	0.33	3.0114E+001		-6.6724E+000
		94.90	0.15	5.6728E+001		-8.1995E+000
		186.21*	3.59	1.7407E+000		1.9936E+000
+	Ac-228	99.50	1.26	5.2963E+000	2.62E-001	1.9623E+000
		129.07	2.50	2.6962E+000		-4.5724E-001
		209.25*	3.97	1.1076E+000		7.0619E-001
		270.24*	3.55	1.3479E+000		1.2114E+000
		328.00	3.04	2.1614E+000		1.0502E+000
		338.32*	11.40	4.0797E-001		7.2117E-001
		409.46	2.02	3.2633E+000		1.0628E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.2003E+000	2.62E-001	9.9245E-001
		755.31	1.03	6.9745E+000		3.7851E+000
		772.29	1.52	5.6249E+000		-1.4274E+000
		794.94	4.31	1.9686E+000		2.1501E-001
		835.70	1.70	5.0477E+000		1.8819E+000
		911.20*	26.20	2.6235E-001		9.3877E-001
		964.79	4.99	2.5142E+000		9.6355E-001
		968.96*	15.90	4.7489E-001		8.9963E-001
		1588.20*	3.06	5.4235E-001		9.9770E-001
		1630.62	1.52	4.5355E+000		-1.5999E+000
	Th-228	84.37	1.26	8.1549E+000	8.15E+000	6.5087E-002
		131.61	0.13	5.2301E+001		2.2738E+001
		166.41	0.10	5.7986E+001		-6.5616E+000
		215.98	0.25	2.4187E+001		-1.4156E+001
	Pa-234m	258.23	0.07	7.5847E+001	9.49E+000	8.5606E+000
		742.81	0.09	8.0565E+001		2.0364E+001
		766.36	0.32	2.6755E+001		1.7433E+001
		786.27	0.05	1.5296E+002		-7.4771E+000
		1001.03	0.85	9.4927E+000		-5.8827E-001
		1737.77	0.02	3.0208E+002		-1.4440E+002
+	Th-234	63.30*	3.75	4.9585E+000	1.44E+000	8.0951E-001
		92.59*	4.33	1.4448E+000		1.9195E+000
		112.81	0.22	2.8505E+001		-2.6656E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S001-0612-02
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.982	1460.82*		10.55	1.47512E+001	6.06037E-001
Cs-137	0.993	32.06	@	5.54		
		661.66*		84.99	7.72236E-002	1.69412E-002
Eu-152m	0.997	89.85*		69.90	8.51186E-002	1.34383E-002
Tl-208	0.705	72.80	@	2.02		
		74.97*	@	3.41	5.18605E+000	5.22792E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	3.14176E-001	9.04818E-002
		583.19*		84.50	3.05350E-001	2.54242E-002
		763.13	@	1.81		
		860.56		12.42		
Bi-211	0.898	351.03*		13.00	2.18713E+000	1.50270E-001
Bi-212	0.573	39.86	@	1.06		
		727.33*		6.74	1.09584E+000	1.91613E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.987	74.81*		10.40	1.70043E+000	1.78295E-001
		77.11*		17.50	1.54664E+000	1.24313E-001
		87.30*		7.81	9.66805E-001	1.39844E-001
		115.18	@	0.59		
		238.63*		43.30	9.79439E-001	5.60173E-002
		300.09*		3.28	1.27702E+000	3.65344E-001
Bi-214	0.614	76.86*	@	0.43	6.24076E+001	5.06049E+000
		89.81*	@	0.24	2.43232E+001	3.93798E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	7.92674E-001	5.18171E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	5.37176E-001	2.45893E-001
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08	@	0.36		
		1051.96	@	0.31		
		1120.29*		14.91	7.07555E-001	1.40142E-001
		1133.66	@	0.25		
		1155.19	@	1.63		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.614	1207.68	@	0.45		
		1238.11*		5.79	3.93048E-001	2.75727E-001
		1280.96	@	1.43		
		1377.67		4.00		
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	9.60964E-001	1.14513E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.944	53.28	@	1.20		
		74.81*		6.44	2.69727E+000	2.85777E-001
		77.11*		10.80	2.46163E+000	2.06186E-001
		87.30*		4.84	1.53237E+000	2.23542E-001
		242.00*		7.43	9.76047E-001	1.05863E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	7.58380E-001	7.71711E-002
		351.93*		37.60	7.55015E-001	5.13196E-002
		462.00*	@	0.22	1.96292E+001	5.58411E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.849	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	1.80076E+000	1.94727E-001
Ra-226	0.772	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	1.99362E+000	4.06743E-001
Ac-228	0.570	99.50	@	1.26		
		129.07	@	2.50		
		209.25*		3.97	7.06186E-001	2.50328E-001
		270.24*		3.55	1.21142E+000	3.14652E-001
		328.00		3.04		
		338.32*		11.40	7.21170E-001	1.09337E-001
		409.46	@	2.02		
		463.00*		4.45	9.92454E-001	2.84506E-001
		755.31	@	1.03		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.570	772.29	@	1.52		
		794.94		4.31		
		835.70	@	1.70		
		911.20*		26.20	9.38769E-001	8.94967E-002
		964.79		4.99		
		968.96*		15.90	8.99629E-001	1.30777E-001
		1588.20*		3.06	9.97701E-001	2.45299E-001
		1630.62	@	1.52		
Th-234	0.900	63.30*		3.75	8.09507E-001	1.05895E+000
		92.59*		4.33	1.91954E+000	2.68280E-001
		112.81	@	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.982	1.475122E+001	6.060371E-001
X	Cd-109		0.929		
	Cs-137	@	0.993	7.722362E-002	1.694120E-002
	Eu-152m		0.997	8.234880E-002	1.341933E-002
	Tl-208	@	0.705	3.066741E-001	2.527137E-002
	Bi-211		0.898	9.038337E-002	2.469139E-001
	Bi-212	@	0.573	1.095841E+000	1.916128E-001
	Pb-212	@	0.987	9.582119E-001	4.702931E-002
	Bi-214	@	0.614	7.915050E-001	4.336376E-002
	Pb-214	@	0.944	7.238143E-001	6.852810E-002
	Ra-224	@	0.849	4.653569E-001	2.311298E-001
	Ra-226	@	0.772	1.993617E+000	4.067435E-001
	Ac-228	@	0.570	8.768420E-001	5.383657E-002
	Th-234	@	0.900	1.852594E+000	2.600640E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/6/2016 1:30:31 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
14	305.20	3.1322E-003	57.91	Sum	
19	558.20	1.0794E-004	1342.11		
24	758.99	1.8728E-003	54.07	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

Date: _____

9626 Niagara Falls Blvd Onsite Gamma Spec Screening Lab

Gamma Spectroscopy Detector work sheet.

Counted by (Initial,date)	Geometry Description	Analysis Number/Sample ID/Remarks	Sample Collection mmddyy hh:mm	Sample Quantity	Sample Units (GWET,GDRY,L, ft^3, etc)	Count Time (s)	Report Matches Sample Parameters (Initial, date)
cc/120316	450 cc SOIL	UMR001-S003-0006-01	11-18-16 1125	846.0	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S004-0006-01	11-18-16 12:30	808.9	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S002-0612-01	11-18-16 10:38	753.2	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-0006-01	11-18-16 1040	721.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1218-01	11-18-16 1035	555.9	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1824-01	11-18-16 1030	382.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S001-0006-01	11-18-16 0958	490.1	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-0612-01	11-18-16 1122	530.4	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1218-01	11-18-16 1118	534.5	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1824-01	11-18-16 1115	493.5	GWET	7200	

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************
```

Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S002-0006-01.CNF

Report Generated On	: 12/3/2016 11:32:01 AM
Sample Title	: UMR001-S002-0006-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 7.218E+002 GWET
Sample Taken On	: 11/18/2016 10:40:00 AM
Acquisition Started	: 12/3/2016 9:31:56 AM
Live Time	: 7200.0 seconds
Real Time	: 7202.8 seconds
Dead Time	: 0.04 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S002-0006-01
Peak Analysis Performed on: 12/3/2016 11:32:01 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	289-	314	300.05	74.97	0.99	5.54E+002	32.41	6.98E+002
m	2	289-	314	309.06	77.22	0.99	8.71E+002	37.99	6.69E+002
M	3	345-	381	349.41	87.31	1.10	3.14E+002	29.90	7.45E+002
m	4	345-	381	360.28	90.03	1.11	2.31E+002	27.62	8.36E+002
m	5	345-	381	372.97	93.20	1.11	3.45E+002	30.25	7.89E+002
	6	510-	523	517.26	129.28	0.59	1.60E+002	45.70	7.00E+002
	7	737-	750	744.41	186.07	0.85	2.64E+002	42.81	5.68E+002
	8	832-	846	837.03	209.23	1.21	2.24E+002	44.34	5.99E+002
M	9	941-	975	954.59	238.62	1.12	3.23E+003	60.13	4.40E+002
m	10	941-	975	965.00	241.22	1.12	3.99E+002	25.24	3.67E+002
	11	1073-	1092	1080.70	270.15	1.03	2.38E+002	42.48	4.42E+002
	12	1104-	1118	1109.16	277.26	1.11	1.33E+002	33.49	3.40E+002
	13	1172-	1189	1180.67	295.14	1.23	5.20E+002	40.42	3.43E+002
	14	1190-	1206	1200.32	300.06	1.18	1.58E+002	34.77	3.36E+002
	15	1302-	1316	1311.32	327.81	1.35	1.25E+002	30.92	2.89E+002
	16	1345-	1360	1353.06	338.24	1.21	6.44E+002	39.23	2.97E+002
	17	1398-	1420	1407.20	351.78	1.22	1.00E+003	47.23	3.16E+002
	18	1629-	1643	1637.69	409.41	1.39	9.33E+001	24.97	1.84E+002
	19	1843-	1857	1851.18	462.79	1.14	2.22E+002	24.92	1.39E+002
	20	2029-	2053	2042.14	510.53	1.10	4.71E+002	40.58	2.85E+002
	21	2324-	2342	2331.75	582.94	1.49	1.18E+003	41.47	1.60E+002
	22	2389-	2398	2393.13	598.28	0.53	1.03E+001	13.98	8.07E+001
	23	2424-	2448	2436.34	609.09	1.28	7.83E+002	37.54	1.52E+002
	24	2640-	2653	2645.81	661.46	0.77	5.99E+001	19.18	1.11E+002
	25	2898-	2918	2908.01	727.02	1.66	2.83E+002	25.83	1.06E+002
M	26	3048-	3077	3052.06	763.03	0.98	2.53E+001	8.32	5.63E+001
m	27	3048-	3077	3072.04	768.03	0.98	5.37E+001	10.82	7.29E+001
	28	3170-	3185	3178.08	794.54	1.19	1.14E+002	19.12	8.38E+001
	29	3333-	3350	3343.24	835.83	1.00	3.82E+001	17.35	8.08E+001
	30	3432-	3451	3440.96	860.26	1.63	1.49E+002	19.23	6.27E+001
	31	3633-	3656	3643.47	910.89	1.64	8.38E+002	33.67	7.41E+001
	32	3729-	3742	3735.77	933.97	0.77	3.67E+001	12.20	4.03E+001
M	33	3849-	3887	3857.85	964.50	1.60	1.57E+002	14.05	5.22E+001
m	34	3849-	3887	3874.59	968.68	1.60	4.46E+002	22.01	4.28E+001
	35	3999-	4011	4004.83	1001.24	0.26	2.73E+001	10.57	3.08E+001
	36	4470-	4490	4480.13	1120.08	1.72	1.56E+002	19.60	6.11E+001
	37	4613-	4624	4618.41	1154.65	0.79	2.74E+001	10.33	3.16E+001
	38	4943-	4960	4951.77	1238.00	0.64	4.63E+001	14.64	5.17E+001
	39	5505-	5518	5511.87	1378.04	0.37	3.34E+001	10.39	2.66E+001
	40	5626-	5638	5631.69	1407.99	0.34	3.23E+001	8.44	1.47E+001
	41	5831-	5856	5844.00	1461.07	1.96	5.03E+002	26.13	4.23E+001
M	42	6347-	6377	6355.32	1588.92	1.20	5.20E+001	8.43	1.84E+001

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
m	43	6347-	6377	6372.20	1593.14	1.20	1.48E+001	5.98	2.34E+001
	44	6519-	6531	6524.60	1631.24	0.56	3.17E+001	9.42	2.13E+001
	45	7051-	7070	7061.00	1765.35	1.76	1.23E+002	12.82	1.20E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S002-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	5.8599E-001	5.86E-001	4.1208E+000
	Co-60	1173.23	99.85	6.3022E-002	5.77E-002	2.1155E-002
		1332.49	99.98	5.7669E-002		-3.1438E-003
>		2505.71	0.10	0.0000E+000		0.0000E+000
+	Cs-137	32.06	5.54	1.0737E+003	5.16E-002	-1.9446E+002
		661.66*	84.99	5.1583E-002		3.6662E-002
+	Tl-208	72.80	2.02	7.9900E+000	6.38E-002	3.6281E-003
		74.97*	3.41	2.4787E+000		7.7830E+000
		84.90	1.51	6.1737E+000		-3.4868E+000
		277.36*	6.31	6.8006E-001		6.0817E-001
		510.77*	22.60	3.3998E-001		5.8342E-001
		583.19*	84.50	6.3841E-002		6.6876E-001
		763.13*	1.81	1.6779E+000		8.1486E-001
		860.56*	12.42	3.6647E-001		7.6279E-001
+	Bi-212	39.86	1.06	5.5954E+002	7.86E-001	1.8652E+002
		727.33*	6.74	7.8564E-001		2.3658E+000
		785.37	1.11	5.7790E+000		5.8134E+000
		1620.74	1.51	4.3087E+000		2.9697E+000
		1806.00	0.09	5.5682E+001		1.1929E+001
+	Pb-212	74.81*	10.40	8.1272E-001	8.79E-002	2.5519E+000
		77.11*	17.50	4.2764E-001		2.1552E+000
		87.30*	7.81	7.2620E-001		1.2493E+000
		115.18	0.59	9.7822E+000		4.9702E+000
		238.63*	43.30	8.7919E-002		1.9713E+000
		300.09*	3.28	1.4142E+000		1.4561E+000
+	Bi-214	76.86*	0.43	1.7309E+001	1.28E-001	8.7232E+001
		89.81*	0.24	2.2793E+001		2.7336E+001
		386.77	0.30	1.7355E+001		-3.5504E+000
		454.77	0.29	1.8464E+001		-3.9611E+000
		609.31*	45.49	1.2824E-001		8.4264E-001
		665.45	1.53	4.4706E+000		2.7112E+000
		703.11	0.48	1.3636E+001		7.6836E+000
		719.86	0.39	1.4893E+001		5.9055E-001
		768.36*	4.89	6.9516E-001		6.3374E-001
		786.10	0.31	2.0902E+001		7.6766E+000
		806.17	1.26	4.4985E+000		8.2876E-001
		934.06*	3.10	1.1088E+000		7.8234E-001
		964.08*	0.36	9.3549E+000		2.9314E+001
		1051.96	0.31	1.6811E+001		5.1789E+000
		1120.29*	14.91	3.6609E-001		7.8214E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	2.1657E+001	1.28E-001	-7.3738E+000
		1155.19*	1.63	2.0596E+000		1.2812E+000
		1207.68	0.45	1.2837E+001		-2.9736E+000
		1238.11*	5.79	8.7069E-001		6.4082E-001
		1280.96	1.43	4.4015E+000		-4.2127E-001
		1377.67*	4.00	9.2238E-001		7.1936E-001
		1385.31	0.76	8.2908E+000		-1.2308E+000
		1401.50	1.27	4.5829E+000		1.2306E+000
		1407.98*	2.15	1.2887E+000		1.3127E+000
		1509.23	2.11	2.8444E+000		-1.7662E+000
		1538.50	0.38	1.5301E+001		6.6518E+000
		1543.32	0.20	2.7253E+001		9.1379E+000
		1583.22	0.69	1.1517E+001		-1.4550E+000
		1594.73	0.25	3.1128E+001		-2.1928E-001
		1599.31	0.23	2.6308E+001		-9.2609E+000
		1661.28	1.15	4.2007E+000		1.3470E+000
		1683.99	0.22	2.0332E+001		6.4368E+000
		1729.59	2.92	2.1926E+000		1.2233E+000
		1764.49*	15.40	2.3409E-001		7.8447E-001
		1847.42	2.11	2.7203E+000		-9.3424E-001
		1873.16	0.22	2.4778E+001		5.0994E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	4.6715E+001	1.47E-001	-1.1477E+001
		74.81*	6.44	1.2931E+000		4.0604E+000
		77.11*	10.80	6.8273E-001		3.4408E+000
		87.30*	4.84	1.1546E+000		1.9863E+000
		242.00*	7.43	4.5618E-001		1.4140E+000
		258.87	0.52	9.4716E+000		-1.3825E+000
		274.80	0.47	1.1806E+001		-6.4395E-001
		295.22*	19.30	2.4113E-001		7.9479E-001
		351.93*	37.60	1.4665E-001		8.7404E-001
		462.00*	0.22	1.7348E+001		4.0357E+001
		533.66	0.19	2.9442E+001		-1.1531E+001
		785.96	1.07	6.0329E+000		2.1312E+000
		839.04	0.59	1.1188E+001		2.4072E+000
+	Ra-224	81.07	0.13	6.9723E+001	8.39E-001	-1.8922E+002
		83.78	0.22	4.0816E+001		-1.9782E+001
		240.99*	4.10	8.3904E-001		2.6006E+000
+	Ra-226	81.07	0.20	4.5682E+001	1.27E+000	-1.2397E+002
		83.78	0.33	2.6606E+001		-1.2895E+001
		94.90	0.15	4.9203E+001		-1.9911E+000
		186.21*	3.59	1.2690E+000		1.4190E+000
+	Ac-228	99.50	1.26	4.8615E+000	1.98E-001	-9.5460E-001
		129.07*	2.50	1.9939E+000		1.5463E+000
		209.25*	3.97	1.2441E+000		1.4130E+000
		270.24*	3.55	1.4934E+000		1.9017E+000
		328.00*	3.04	1.4390E+000		1.3183E+000
		338.32*	11.40	4.0639E-001		1.8450E+000
		409.46*	2.02	2.0261E+000		1.7221E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	8.7442E-001	1.98E-001	2.0342E+000
		755.31	1.03	5.9546E+000		2.9386E+000
		772.29	1.52	4.5003E+000		-3.6838E-001
		794.94*	4.31	1.0649E+000		1.5913E+000
		835.70*	1.70	2.8565E+000		1.3990E+000
		911.20*	26.20	2.1148E-001		2.0970E+000
		964.79*	4.99	6.9068E-001		2.1643E+000
		968.96*	15.90	1.9802E-001		1.9311E+000
		1588.20*	3.06	9.7631E-001		1.6414E+000
		1630.62*	1.52	2.4463E+000		2.0485E+000
	Th-228	84.37	1.26	7.2238E+000	7.22E+000	-3.0251E+000
		131.61	0.13	4.9059E+001		7.4873E-001
		166.41	0.10	5.2722E+001		-4.8430E+001
		215.98	0.25	2.2900E+001		-1.1783E-001
	Pa-234m	258.23	0.07	6.7069E+001	6.92E+000	1.6566E-001
		742.81	0.09	6.1228E+001		1.1886E+001
		766.36	0.32	2.1749E+001		1.0482E+001
		786.27	0.05	1.2156E+002		5.8567E+001
		1001.03	0.85	6.9241E+000		1.2609E+000
		1737.77	0.02	2.3761E+002		-1.1653E+002
	Th-234	63.30	3.75	6.1498E+000	1.88E+000	-5.8618E-001
		92.59	4.33	1.8800E+000		3.3951E+000
		112.81	0.22	2.6364E+001		4.6725E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

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*************************************************************************
*****  N U C L I D E   I D E N T I F I C A T I O N   R E P O R T  *****
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Sample Title: UMR001-S002-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.990	1460.82*	10.55	4.12078E+000	2.48323E-001
Cs-137	0.989	32.06 @	5.54		
		661.66*	84.99	3.66619E-002	1.17808E-002
Eu-152m	0.995	89.85*	69.90	9.56220E-002	1.18571E-002
Tl-208	0.947	72.80 @	2.02		
		74.97* @	3.41	7.78295E+000	5.29223E-001
		84.90 @	1.51		
		277.36*	6.31	6.08165E-001	1.55258E-001
		510.77* @	22.60	5.83419E-001	8.18805E-002
		583.19*	84.50	6.68756E-001	3.21105E-002
		763.13* @	1.81	8.14865E-001	2.68913E-001
		860.56*	12.42	7.62793E-001	1.00027E-001
TL-208e	0.944	1592.53*	99.16	1.44238E-002	5.89810E-003
Bi-211	0.914	351.03*	13.00	2.53124E+000	1.58606E-001
Bi-212	0.564	39.86 @	1.06		
		727.33*	6.74	2.36579E+000	2.28661E-001
		785.37	1.11		
		1620.74	1.51		
		1806.00 @	0.09		
Pb-212	0.986	74.81*	10.40	2.55191E+000	1.88493E-001
		77.11*	17.50	2.15520E+000	1.35178E-001
		87.30*	7.81	1.24934E+000	1.32313E-001
		115.18 @	0.59		
		238.63*	43.30	1.97129E+000	9.61044E-002
		300.09*	3.28	1.45613E+000	3.25980E-001
Bi-214	0.750	76.86* @	0.43	8.72322E+001	5.55071E+000
		89.81* @	0.24	2.73365E+001	3.52871E+000
		386.77 @	0.30		
		454.77 @	0.29		
		609.31*	45.49	8.42636E-001	4.79469E-002
		665.45 @	1.53		
		703.11 @	0.48		
		719.86 @	0.39		
		768.36*	4.89	6.33745E-001	1.28705E-001
		786.10 @	0.31		
		806.17 @	1.26		
		934.06*	3.10	7.82341E-001	2.60978E-001
		964.08* @	0.36	2.93139E+001	2.87370E+000
		1051.96 @	0.31		
		1120.29*	14.91	7.82137E-001	1.00204E-001
		1133.66 @	0.25		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.750	1155.19*	@	1.63	1.28122E+000	4.83414E-001
		1207.68	@	0.45		
		1238.11*		5.79	6.40816E-001	2.03231E-001
		1280.96	@	1.43		
		1377.67*		4.00	7.19365E-001	2.24602E-001
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98*	@	2.15	1.31274E+000	3.45798E-001
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	7.84468E-001	9.01965E-002
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.938	53.28	@	1.20		
		74.81*		6.44	4.06044E+000	3.06208E-001
		77.11*		10.80	3.44083E+000	2.30547E-001
		87.30*		4.84	1.98630E+000	2.13698E-001
		242.00*		7.43	1.41395E+000	1.10823E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	7.94789E-001	7.00584E-002
		351.93*		37.60	8.74038E-001	5.40616E-002
		462.00*	@	0.22	4.03567E+001	5.02107E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.882	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	2.60063E+000	2.02660E-001
Ra-226	0.776	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	1.41896E+000	2.93670E-001
Ac-228	0.916	99.50	@	1.26		
		129.07*	@	2.50	1.54633E+000	4.44979E-001
		209.25*		3.97	1.41297E+000	2.91147E-001
		270.24*		3.55	1.90173E+000	3.52996E-001
		328.00*		3.04	1.31832E+000	3.32839E-001
		338.32*		11.40	1.84500E+000	1.47856E-001
		409.46*	@	2.02	1.72206E+000	4.67963E-001
		463.00*		4.45	2.03415E+000	2.63106E-001

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.916	755.31	@	1.03		
		772.29	@	1.52		
		794.94*		4.31	1.59129E+000	2.74103E-001
		835.70*	@	1.70	1.39902E+000	6.38143E-001
		911.20*		26.20	2.09697E+000	1.17039E-001
		964.79*		4.99	2.16429E+000	2.12917E-001
		968.96*		15.90	1.93107E+000	1.21696E-001
		1588.20*		3.06	1.64140E+000	2.76794E-001
		1630.62*	@	1.52	2.04855E+000	6.16838E-001

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.990	4.120776E+000	2.483227E-001
X	Mn-54		0.854		
X	Cd-109		0.920		
	Cs-137	@	0.989	3.666191E-002	1.178083E-002
	Eu-152m		0.995	9.282524E-002	1.182931E-002
	Tl-208	@	0.947	6.773884E-001	2.955698E-002
	TL-208e		0.944	1.442382E-002	5.898103E-003
	Bi-211		0.914	5.520798E-001	2.441127E-001
	Bi-212	@	0.564	2.365789E+000	2.286612E-001
	Pb-212	@	0.986	1.630204E+000	6.359672E-002
	Bi-214	@	0.750	7.995397E-001	3.578686E-002
	Pb-214	@	0.938	6.834047E-001	6.533742E-002
	Ra-224	@	0.882	1.343672E+000	2.334667E-001
	Ra-226	@	0.776	1.418964E+000	2.936698E-001
	Ac-228	@	0.916	1.922891E+000	5.342480E-002

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/3/2016 11:32:01 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m 5	93.20	3.7372E-002	11.46	Tol.	Yb-169 Th-227 Th-234
22	598.28	1.4255E-003	136.21	Sum	
35	1001.24	3.2225E-003	46.21	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S002-1218-01.CNF

Report Generated On	: 12/3/2016 1:57:50 PM
Sample Title	: UMR001-S002-1218-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 5.559E+002 GWET
Sample Taken On	: 11/18/2016 10:35:00 AM
Acquisition Started	: 12/3/2016 11:57:45 AM
Live Time	: 7200.0 seconds
Real Time	: 7202.7 seconds
Dead Time	: 0.04 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: ERT01
Sample Title: UMR001-S002-1218-01
Peak Analysis Performed on: 12/3/2016 1:57:50 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	249-	260	253.19	63.25	0.91	6.54E+001	40.35	6.23E+002
M	2	293-	316	300.23	75.02	0.91	5.22E+002	32.17	7.85E+002
m	3	293-	316	309.01	77.21	0.91	8.62E+002	37.67	7.21E+002
M	4	334-	383	338.44	84.57	1.27	1.40E+002	25.30	7.03E+002
m	5	334-	383	349.57	87.35	1.27	4.55E+002	32.14	8.80E+002
m	6	334-	383	360.38	90.05	1.28	2.84E+002	27.86	8.32E+002
m	7	334-	383	371.98	92.95	1.28	4.88E+002	32.01	7.37E+002
	8	508-	526	516.32	129.04	0.52	1.12E+002	57.08	9.30E+002
	9	612-	621	616.75	154.15	0.68	7.49E+001	32.39	4.31E+002
	10	735-	752	744.03	185.97	1.10	3.79E+002	54.05	7.82E+002
	11	832-	842	836.69	209.14	0.78	1.72E+002	35.65	4.54E+002
M	12	948-	976	954.59	238.62	1.12	2.53E+003	54.32	4.72E+002
m	13	948-	976	966.84	241.68	1.12	5.33E+002	28.04	3.81E+002
	14	1071-	1088	1080.86	270.19	0.97	2.35E+002	37.67	3.64E+002
	15	1105-	1115	1109.91	277.45	0.78	7.18E+001	26.60	2.67E+002
	16	1174-	1189	1180.70	295.15	1.19	8.51E+002	42.94	3.30E+002
	17	1192-	1206	1200.37	300.07	1.23	1.89E+002	31.92	2.89E+002
	18	1307-	1318	1312.29	328.05	0.86	1.42E+002	26.66	2.26E+002
	19	1344-	1359	1353.09	338.25	1.05	5.07E+002	37.95	3.10E+002
	20	1399-	1417	1407.29	351.80	1.16	1.51E+003	49.99	2.90E+002
	21	1630-	1643	1636.86	409.20	1.06	7.43E+001	24.65	1.94E+002
	22	1846-	1855	1850.90	462.71	1.04	1.21E+002	19.67	1.18E+002
	23	2030-	2052	2042.25	510.56	1.49	4.51E+002	35.35	2.06E+002
	24	2322-	2340	2331.60	582.90	1.37	8.80E+002	36.77	1.40E+002
	25	2428-	2443	2436.27	609.07	1.46	1.12E+003	39.17	1.38E+002
	26	2654-	2665	2659.82	664.96	0.54	2.16E+001	14.23	7.14E+001
	27	2900-	2919	2908.10	727.04	1.46	2.14E+002	24.21	1.06E+002
	28	3064-	3077	3072.70	768.19	1.71	1.19E+002	17.01	6.05E+001
	29	3135-	3147	3141.97	785.51	0.80	3.34E+001	14.26	6.46E+001
	30	3172-	3187	3178.56	794.66	1.39	1.10E+002	17.78	6.80E+001
	31	3218-	3229	3223.63	805.93	0.35	2.80E+001	12.73	5.20E+001
	32	3336-	3347	3341.51	835.40	1.54	2.82E+001	11.97	4.58E+001
	33	3433-	3450	3440.82	860.23	0.95	1.27E+002	18.20	6.25E+001
	34	3634-	3653	3643.53	910.91	1.73	6.50E+002	30.47	7.96E+001
	35	3725-	3741	3734.51	933.66	0.89	5.33E+001	16.09	6.57E+001
M	36	3849-	3886	3857.38	964.38	1.63	1.14E+002	13.01	6.75E+001
m	37	3849-	3886	3874.85	968.74	1.64	4.11E+002	21.70	5.90E+001
	38	3997-	4008	4002.67	1000.70	0.86	2.38E+001	11.42	4.22E+001
	39	4471-	4491	4480.30	1120.12	1.42	2.77E+002	23.24	7.25E+001
	40	4943-	4961	4952.27	1238.12	0.83	1.10E+002	17.86	6.12E+001
	41	5117-	5130	5124.10	1281.08	0.76	2.64E+001	11.28	3.66E+001
	42	5502-	5523	5510.40	1377.67	0.30	7.45E+001	13.79	3.05E+001

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	43	5626-	5639	5632.51	1408.20	0.55	1.90E+001	10.77	3.50E+001
	44	5831-	5857	5843.69	1461.00	1.69	1.00E+003	33.71	3.06E+001
	45	6032-	6043	6037.12	1509.36	0.44	2.67E+001	7.64	1.23E+001
M	46	6346-	6378	6353.26	1588.40	1.40	4.27E+001	8.07	2.30E+001
m	47	6346-	6378	6372.19	1593.13	1.40	2.87E+001	6.50	1.54E+001
	48	6478-	6489	6483.72	1621.02	0.84	1.80E+001	7.54	1.50E+001
	49	6913-	6927	6920.67	1730.26	0.36	4.02E+001	10.02	2.08E+001
	50	7048-	7071	7060.46	1765.21	1.39	2.14E+002	16.56	1.50E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S002-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	6.7515E-001	6.75E-001	1.0853E+001
	Co-60	1173.23	99.85	9.3505E-002	7.88E-002	4.0943E-002
		1332.49	99.98	7.8772E-002		1.0765E-003
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.4172E+003	9.40E-002	-1.6524E+002
		661.66	84.99	9.4023E-002		8.2652E-002
+	Tl-208	72.80	2.02	1.0358E+001	7.78E-002	6.2543E-002
		74.97*	3.41	3.4016E+000		9.4970E+000
		84.90*	1.51	5.0959E+000		4.0236E+000
		277.36*	6.31	7.1178E-001		4.2596E-001
		510.77*	22.60	3.7769E-001		7.0601E-001
		583.19*	84.50	7.7803E-002		6.4614E-001
		763.13	1.81	4.7782E+000		8.4485E-001
		860.56*	12.42	4.5834E-001		8.4550E-001
+	Bi-212	39.86	1.06	7.2184E+002	1.00E+000	-9.2160E+001
		727.33*	6.74	1.0037E+000		2.3288E+000
		785.37*	1.11	4.4128E+000		2.3241E+000
		1620.74*	1.51	2.6692E+000		1.5128E+000
		1806.00	0.09	7.1561E+001		2.6075E+001
+	Pb-212	74.81*	10.40	1.1153E+000	1.18E-001	3.1139E+000
		77.11*	17.50	5.7661E-001		2.7720E+000
		87.30*	7.81	1.0226E+000		2.3547E+000
		115.18	0.59	1.2145E+001		1.4012E+000
		238.63*	43.30	1.1812E-001		2.0023E+000
		300.09*	3.28	1.6353E+000		2.2671E+000
+	Bi-214	76.86*	0.43	2.3336E+001	1.36E-001	1.1218E+002
		89.81*	0.24	2.9521E+001		4.3600E+001
		386.77	0.30	2.3158E+001		-2.0257E+000
		454.77	0.29	2.5064E+001		1.3750E+001
		609.31*	45.49	1.3616E-001		1.5653E+000
		665.45*	1.53	2.8895E+000		9.5417E-001
		703.11	0.48	1.7156E+001		1.0151E-001
		719.86	0.39	2.0948E+001		1.4495E+001
		768.36*	4.89	9.7337E-001		1.8174E+000
		786.10*	0.31	1.5566E+001		8.1986E+000
		806.17*	1.26	3.4753E+000		1.7234E+000
		934.06*	3.10	1.9215E+000		1.4753E+000
		964.08*	0.36	1.3718E+001		2.7640E+001
		1051.96	0.31	2.5620E+001		1.1697E+001
		1120.29*	14.91	5.0855E-001		1.8079E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.2103E+001	1.36E-001	1.5309E+000
		1155.19	1.63	5.9600E+000		5.3755E+000
		1207.68	0.45	2.1535E+001		1.0116E+000
		1238.11*	5.79	1.2557E+000		1.9720E+000
		1280.96*	1.43	3.6768E+000		1.9631E+000
		1377.67*	4.00	1.4743E+000		2.0824E+000
		1385.31	0.76	1.0902E+001		8.0301E-001
		1401.50	1.27	6.0989E+000		-1.2533E+000
		1407.98*	2.15	2.5616E+000		1.0030E+000
		1509.23*	2.11	1.6300E+000		1.5072E+000
		1538.50	0.38	1.9868E+001		2.9067E+000
		1543.32	0.20	3.6989E+001		4.1685E+000
		1583.22	0.69	1.5097E+001		6.5131E+000
		1594.73	0.25	3.9176E+001		-1.3528E+001
		1599.31	0.23	3.4542E+001		-2.0422E+001
		1661.28	1.15	6.1314E+000		3.3641E+000
		1683.99	0.22	2.7313E+001		-1.1163E+001
		1729.59*	2.92	1.7444E+000		1.8092E+000
		1764.49*	15.40	3.5420E-001		1.8053E+000
		1847.42	2.11	3.8973E+000		7.2575E-001
		1873.16	0.22	2.7506E+001		-7.1259E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	5.8623E+001	1.71E-001	-3.1476E+001
		74.81*	6.44	1.7745E+000		4.9541E+000
		77.11*	10.80	9.2048E-001		4.4251E+000
		87.30*	4.84	1.6256E+000		3.7432E+000
		242.00*	7.43	6.0335E-001		2.4534E+000
		258.87	0.52	1.2420E+001		5.6452E+000
		274.80	0.47	1.4664E+001		2.5759E+000
		295.22*	19.30	2.9592E-001		1.6874E+000
		351.93*	37.60	1.7098E-001		1.7208E+000
		462.00*	0.22	1.8507E+001		2.8545E+001
		533.66	0.19	3.6807E+001		-2.9496E+001
		785.96*	1.07	4.5099E+000		2.3753E+000
		839.04	0.59	1.4778E+001		5.4919E+000
+	Ra-224	81.07	0.13	9.2638E+001	1.11E+000	-3.3566E+001
		83.78*	0.22	3.5460E+001		2.7999E+001
		240.99*	4.10	1.1098E+000		4.5129E+000
+	Ra-226	81.07	0.20	6.0689E+001	2.07E+000	-2.1990E+001
		83.78*	0.33	2.3112E+001		1.8249E+001
		94.90	0.15	6.1586E+001		-2.9305E+000
		186.21*	3.59	2.0726E+000		2.8380E+000
+	Ac-228	99.50	1.26	5.9673E+000	2.67E-001	3.5103E+000
		129.07*	2.50	3.2998E+000		1.4063E+000
		209.25*	3.97	1.2870E+000		1.4144E+000
		270.24*	3.55	1.6897E+000		2.4379E+000
		328.00*	3.04	1.5530E+000		1.9425E+000
		338.32*	11.40	5.3860E-001		1.8852E+000
		409.46*	2.02	2.6381E+000		1.7810E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	9.3292E-001	2.67E-001	1.4389E+000
		755.31	1.03	7.8690E+000		5.1500E+000
		772.29	1.52	6.1244E+000		-4.6325E+000
		794.94*	4.31	1.2570E+000		1.9899E+000
		835.70*	1.70	2.4979E+000		1.3388E+000
		911.20*	26.20	2.6667E-001		2.1099E+000
		964.79*	4.99	1.0129E+000		2.0410E+000
		968.96*	15.90	2.9921E-001		2.3129E+000
		1588.20*	3.06	1.4032E+000		1.7501E+000
		1630.62	1.52	5.4673E+000		2.9396E+000
	Th-228	84.37*	1.26	6.1070E+000	6.11E+000	4.8220E+000
		131.61	0.13	6.1237E+001		1.8493E+000
		166.41	0.10	7.0731E+001		3.4245E+001
		215.98	0.25	2.7731E+001		-1.4183E+001
	Pa-234m	258.23	0.07	8.8123E+001	9.53E+000	2.9577E+001
		742.81	0.09	7.9839E+001		-2.9216E+001
		766.36	0.32	2.8533E+001		1.8386E+001
		786.27	0.05	1.5784E+002		1.3593E+002
		1001.03	0.85	9.5349E+000		4.4848E+000
		1737.77	0.02	3.3017E+002		-1.8107E+002
+	Th-234	63.30*	3.75	6.5276E+000	1.54E+000	1.0769E+000
		92.59*	4.33	1.5389E+000		3.3728E+000
		112.81	0.22	3.2951E+001		-7.7121E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S002-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.995	1460.82*		10.55	1.08531E+001	4.71336E-001
Eu-152m	0.993	89.85*		69.90	1.52515E-001	1.57900E-002
Tm-170	0.984	84.25*		2.48	2.61950E+000	4.91720E-001
Tl-208	0.947	72.80	@	2.02		
		74.97*	@	3.41	9.49695E+000	6.71751E-001
		84.90*	@	1.51	4.02364E+000	7.41048E-001
		277.36*		6.31	4.25964E-001	1.58933E-001
		510.77*	@	22.60	7.06014E-001	9.33374E-002
		583.19*		84.50	6.46142E-001	3.43961E-002
		763.13	@	1.81		
		860.56*		12.42	8.45500E-001	1.22543E-001
TL-208e	0.944	1592.53*		99.16	3.62834E-002	8.52107E-003
Bi-211	0.909	351.03*		13.00	4.98357E+000	2.62000E-001
Bi-212	0.951	39.86	@	1.06		
		727.33*		6.74	2.32876E+000	2.73123E-001
		785.37*		1.11	2.32415E+000	9.95379E-001
		1620.74*		1.51	1.51284E+000	6.36710E-001
		1806.00	@	0.09		
Pb-212	0.986	74.81*		10.40	3.11390E+000	2.37868E-001
		77.11*		17.50	2.77197E+000	1.74011E-001
		87.30*		7.81	2.35466E+000	1.98456E-001
		115.18	@	0.59		
		238.63*		43.30	2.00230E+000	1.00006E-001
		300.09*		3.28	2.26714E+000	3.93246E-001
Bi-214	0.847	76.86*	@	0.43	1.12184E+002	7.14434E+000
		89.81*	@	0.24	4.36003E+001	4.77728E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	1.56533E+000	7.27658E-002
		665.45*	@	1.53	9.54173E-001	6.30657E-001
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	1.81742E+000	2.64781E-001
		786.10*	@	0.31	8.19861E+000	3.75130E+000
		806.17*	@	1.26	1.72336E+000	7.83603E-001
		934.06*		3.10	1.47531E+000	4.46924E-001
		964.08*	@	0.36	2.76405E+001	3.34003E+000
		1051.96	@	0.31		
		1120.29*		14.91	1.80791E+000	1.57795E-001
		1133.66	@	0.25		
		1155.19	@	1.63		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.847	1207.68	@	0.45		
		1238.11*		5.79	1.97198E+000	3.25497E-001
		1280.96*	@	1.43	1.96307E+000	8.41279E-001
		1377.67*		4.00	2.08243E+000	3.90223E-001
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98*	@	2.15	1.00298E+000	5.69753E-001
		1509.23*	@	2.11	1.50721E+000	4.33749E-001
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59*	@	2.92	1.80915E+000	4.54669E-001
		1764.49*		15.40	1.80534E+000	1.56995E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.959	53.28	@	1.20		
		74.81*		6.44	4.95414E+000	3.85868E-001
		77.11*		10.80	4.42505E+000	2.96714E-001
		87.30*		4.84	3.74325E+000	3.23351E-001
		242.00*		7.43	2.45340E+000	1.71924E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	1.68745E+000	1.10430E-001
		351.93*		37.60	1.72081E+000	8.88089E-002
		462.00*	@	0.22	2.85450E+001	4.88540E+000
		533.66	@	0.19		
		785.96*	@	1.07	2.37530E+000	1.03245E+000
		839.04	@	0.59		
Ra-224	0.887	81.07	@	0.13		
		83.78*	@	0.22	2.79986E+001	5.25889E+000
		240.99*		4.10	4.51292E+000	3.13970E-001
Ra-226	0.870	81.07	@	0.20		
		83.78*	@	0.33	1.82489E+001	3.42664E+000
		94.90	@	0.15		
		186.21*		3.59	2.83801E+000	4.86256E-001
Ac-228	0.901	99.50	@	1.26		
		129.07*	@	2.50	1.40633E+000	7.17089E-001
		209.25*		3.97	1.41441E+000	3.03011E-001
		270.24*		3.55	2.43793E+000	4.10065E-001
		328.00*		3.04	1.94255E+000	3.78774E-001
		338.32*		11.40	1.88521E+000	1.71946E-001
		409.46*	@	2.02	1.78096E+000	5.96621E-001
		463.00*		4.45	1.43894E+000	2.51472E-001
		755.31	@	1.03		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.901	772.29	@	1.52		
		794.94*		4.31	1.98986E+000	3.31680E-001
		835.70*	@	1.70	1.33878E+000	5.72029E-001
		911.20*		26.20	2.10991E+000	1.28587E-001
		964.79*		4.99	2.04095E+000	2.47197E-001
		968.96*		15.90	2.31292E+000	1.51994E-001
		1588.20*		3.06	1.75007E+000	3.40394E-001
		1630.62	@	1.52		
Th-234	0.933	63.30*		3.75	1.07691E+000	1.39772E+000
		92.59*		4.33	3.37276E+000	3.22514E-001
		112.81	@	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.995	1.085312E+001	4.713361E-001
X	Mn-54		0.951		
X	Cd-109		0.928		
	Eu-152m		0.993	1.467043E-001	1.573692E-002
	Tm-170		0.984	1.630051E+000	4.890143E-001
	Tl-208	@	0.947	6.513418E-001	3.203211E-002
	TL-208e		0.944	3.628340E-002	8.521067E-003
	Bi-211		0.909	5.377307E-001	3.786479E-001
	Bi-212	@	0.951	2.095441E+000	2.411628E-001
	Pb-212	@	0.986	1.865809E+000	7.570844E-002
	Bi-214	@	0.847	1.661006E+000	5.701215E-002
	Pb-214	@	0.959	1.535137E+000	9.768650E-002
	Ra-224	@	0.887	1.689101E+000	3.575424E-001
	Ra-226	@	0.870	2.838013E+000	4.839370E-001
	Ac-228	@	0.901	2.010463E+000	6.265202E-002
X	Th-228		0.497		
X	Th-231		0.823		
	Th-234	@	0.933	3.256707E+000	3.142563E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/3/2016 1:57:50 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
9	154.15	1.0397E-002	43.26	Sum	
38	1000.70	2.7395E-003	58.62	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************
```

Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S002-1824-01.CNF

Report Generated On	: 12/3/2016 4:04:04 PM
Sample Title	: UMR001-S002-1824-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 3.828E+002 GWET
Sample Taken On	: 11/18/2016 10:30:00 AM
Acquisition Started	: 12/3/2016 2:04:00 PM
Live Time	: 7200.0 seconds
Real Time	: 7201.7 seconds
Dead Time	: 0.02 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S002-1824-01
Peak Analysis Performed on: 12/3/2016 4:04:04 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	292-	315	299.90	74.93	0.98	2.11E+002	21.57	3.84E+002
m	2	292-	315	309.00	77.21	0.98	3.96E+002	26.85	3.78E+002
M	3	344-	378	349.42	87.31	1.08	1.50E+002	20.68	3.63E+002
m	4	344-	378	360.87	90.18	1.09	6.88E+001	17.57	4.19E+002
m	5	344-	378	371.98	92.95	1.09	2.06E+002	22.77	4.13E+002
	6	512-	524	516.74	129.15	0.99	6.00E+001	29.88	3.15E+002
	7	738-	751	743.88	185.94	1.35	1.79E+002	30.50	2.71E+002
	8	828-	847	837.63	209.38	0.83	1.14E+002	35.47	3.27E+002
M	9	947-	974	954.72	238.65	1.16	1.24E+003	38.52	2.45E+002
m	10	947-	974	967.01	241.72	1.16	2.74E+002	19.24	1.43E+002
	11	1074-	1088	1079.77	269.92	1.16	1.31E+002	24.14	1.56E+002
	12	1175-	1189	1180.74	295.16	1.16	2.73E+002	26.38	1.45E+002
	13	1195-	1210	1200.36	300.07	0.78	8.04E+001	22.96	1.47E+002
	14	1305-	1316	1311.85	327.94	0.47	3.56E+001	19.22	1.33E+002
	15	1347-	1359	1352.81	338.18	1.32	2.49E+002	24.09	1.26E+002
	16	1398-	1413	1407.23	351.79	1.24	4.84E+002	29.23	1.23E+002
	17	1633-	1642	1637.17	409.28	0.26	2.12E+001	14.67	8.58E+001
	18	1843-	1860	1851.50	462.87	0.99	7.02E+001	20.51	1.08E+002
	19	2032-	2051	2041.82	510.45	1.19	2.25E+002	27.53	1.51E+002
	20	2325-	2339	2331.83	582.96	0.75	3.74E+002	25.13	8.86E+001
	21	2427-	2446	2436.23	609.06	1.42	3.72E+002	27.32	1.06E+002
	22	2733-	2742	2737.33	684.34	0.44	1.06E+001	8.32	2.54E+001
	23	2900-	2916	2908.25	727.07	0.57	6.53E+001	17.83	8.08E+001
	24	3173-	3186	3179.02	794.77	0.40	3.25E+001	12.89	4.85E+001
	25	3333-	3345	3339.68	834.94	0.61	3.36E+001	11.53	3.74E+001
	26	3436-	3449	3441.86	860.49	0.85	5.69E+001	12.41	3.51E+001
	27	3634-	3655	3643.49	910.90	1.76	3.11E+002	22.52	5.19E+001
M	28	3850-	3885	3858.59	964.68	1.79	7.94E+001	11.20	5.58E+001
m	29	3850-	3885	3874.88	968.75	1.79	2.11E+002	15.70	3.82E+001
	30	4472-	4488	4481.06	1120.31	1.39	8.25E+001	16.23	5.75E+001
	31	4945-	4956	4950.09	1237.58	0.71	2.89E+001	10.22	3.01E+001
	32	5832-	5856	5843.69	1461.00	1.77	1.41E+003	38.47	1.80E+001
	33	6346-	6359	6353.05	1588.35	0.35	1.78E+001	7.68	1.42E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*****************************************************************************
*****                N U C L I D E   M D A   R E P O R T                *****
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Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S002-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	7.7107E-001	7.71E-001	2.2276E+001
	Co-60	1173.23	99.85	1.2360E-001	9.88E-002	-2.4915E-002
		1332.49	99.98	9.8779E-002		1.4467E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.4458E+003	1.08E-001	-7.9589E+001
		661.66	84.99	1.0802E-001		9.5968E-002
+	Tl-208	72.80	2.02	1.0621E+001	8.50E-002	1.3277E+000
		74.97*	3.41	3.4895E+000		5.6054E+000
		84.90	1.51	8.2727E+000		-1.0870E+000
		277.36	6.31	1.1898E+000		7.0522E-001
		510.77*	22.60	4.7201E-001		2.0234E-001
		583.19*	84.50	8.5034E-002		3.9500E-001
		763.13	1.81	5.4851E+000		5.4997E-001
		860.56*	12.42	4.6797E-001		5.4792E-001
+	Bi-212	39.86	1.06	7.6317E+002	1.21E+000	6.1617E+001
		727.33*	6.74	1.2090E+000		1.0299E+000
		785.37	1.11	8.4230E+000		2.5739E+000
		1620.74	1.51	5.9014E+000		4.1873E+000
		1806.00	0.09	7.4478E+001		-1.2864E+001
+	Pb-212	74.81*	10.40	1.1442E+000	1.26E-001	1.8379E+000
		77.11*	17.50	6.1028E-001		1.8476E+000
		87.30*	7.81	9.6211E-001		1.1284E+000
		115.18	0.59	1.2379E+001		6.0423E+000
		238.63*	43.30	1.2643E-001		1.4151E+000
		300.09*	3.28	1.7553E+000		1.3979E+000
	Bi-214	76.86	0.43	4.7549E+001	3.26E-001	2.9041E-001
		89.81	0.24	4.7982E+001		-2.6043E+001
		386.77	0.30	2.5432E+001		-1.2279E+001
		454.77	0.29	2.4824E+001		-1.1879E+001
		609.31	45.49	3.2568E-001		7.7396E-001
		665.45	1.53	5.6234E+000		9.7497E-001
		703.11	0.48	1.9481E+001		-5.8838E+000
		719.86	0.39	2.4208E+001		-8.9850E+000
		768.36	4.89	2.0415E+000		-1.3454E-001
		786.10	0.31	3.0950E+001		1.7549E+000
		806.17	1.26	7.4324E+000		2.9625E+000
		934.06	3.10	3.3922E+000		7.5716E-001
		964.08	0.36	4.6075E+001		-4.1231E-001
		1051.96	0.31	2.9952E+001		-1.0278E+001
		1120.29	14.91	9.4664E-001		7.3844E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
	Bi-214	1133.66	0.25	4.5400E+001	3.26E-001	6.0909E+000
		1155.19	1.63	7.5677E+000		1.6809E+000
		1207.68	0.45	2.7225E+001		2.2674E+000
		1238.11	5.79	2.3965E+000		1.6844E+000
		1280.96	1.43	7.5032E+000		-1.9995E+000
		1377.67	4.00	2.5853E+000		7.7237E-001
		1385.31	0.76	1.0987E+001		-1.7801E+001
		1401.50	1.27	7.6183E+000		1.3290E+000
		1407.98	2.15	4.5730E+000		-1.1498E-001
		1509.23	2.11	3.5879E+000		-1.2068E+000
		1538.50	0.38	1.8604E+001		-9.9637E+000
		1543.32	0.20	3.3483E+001		-1.5461E+001
		1583.22	0.69	1.3571E+001		-1.2804E+000
		1594.73	0.25	4.3443E+001		2.3888E+001
		1599.31	0.23	3.7054E+001		-2.9199E+000
		1661.28	1.15	7.3771E+000		2.4948E+000
		1683.99	0.22	3.7885E+001		9.9521E+000
		1729.59	2.92	2.8916E+000		2.8883E-001
		1764.49	15.40	8.7225E-001		9.3567E-001
		1847.42	2.11	4.1026E+000		2.4465E-001
		1873.16	0.22	2.9666E+001		-2.7986E+001
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	6.3116E+001	1.56E-001	-5.5170E+000
		74.81*	6.44	1.8202E+000		2.9238E+000
		77.11*	10.80	9.7414E-001		2.9492E+000
		87.30*	4.84	1.5294E+000		1.7936E+000
		242.00*	7.43	5.4387E-001		1.8311E+000
		258.87	0.52	1.2915E+001		-3.6457E+000
		274.80	0.47	1.5357E+001		3.7426E+000
		295.22*	19.30	2.8323E-001		7.8647E-001
		351.93*	37.60	1.5609E-001		7.9010E-001
		462.00*	0.22	3.0731E+001		2.4033E+001
		533.66	0.19	4.3173E+001		2.6169E+001
		785.96	1.07	9.0189E+000		2.3488E+000
		839.04	0.59	1.8610E+001		-4.7633E+000
+	Ra-224	81.07	0.13	9.9409E+001	1.00E+000	-4.4816E+001
		83.78	0.22	5.5514E+001		-1.2180E+001
		240.99*	4.10	1.0005E+000		3.3685E+000
+	Ra-226	81.07	0.20	6.5119E+001	1.71E+000	-2.9357E+001
		83.78	0.33	3.6180E+001		-7.9379E+000
		94.90	0.15	6.6724E+001		-9.3499E+000
		186.21*	3.59	1.7064E+000		1.6115E+000
+	Ac-228	99.50	1.26	6.3321E+000	3.29E-001	1.6535E+000
		129.07*	2.50	2.4891E+000		1.0901E+000
		209.25*	3.97	1.9079E+000		1.3620E+000
		270.24*	3.55	1.5302E+000		1.9773E+000
		328.00*	3.04	1.7402E+000		7.0693E-001
		338.32*	11.40	4.7171E-001		1.3462E+000
		409.46*	2.02	2.3489E+000		7.3629E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.5493E+000	3.29E-001	1.2116E+000
		755.31	1.03	8.6304E+000		2.5473E+000
		772.29	1.52	6.4956E+000		-3.6214E-001
		794.94*	4.31	1.4835E+000		8.5505E-001
		835.70*	1.70	3.3839E+000		2.3139E+000
		911.20*	26.20	3.2941E-001		1.4525E+000
		964.79*	4.99	1.3446E+000		2.0595E+000
		968.96*	15.90	3.5378E-001		1.7257E+000
		1588.20*	3.06	1.9360E+000		1.0592E+000
		1630.62	1.52	6.0590E+000		2.2482E-001
	Th-228	84.37	1.26	9.8134E+000	9.81E+000	8.6118E-001
		131.61	0.13	6.3391E+001		-7.1614E-001
		166.41	0.10	7.1938E+001		3.6036E+001
		215.98	0.25	2.8367E+001		6.0821E+000
	Pa-234m	258.23	0.07	9.1101E+001	1.20E+001	-2.7294E+001
		742.81	0.09	9.6621E+001		7.9039E+001
		766.36	0.32	3.0863E+001		4.4316E+000
		786.27	0.05	1.7796E+002		-5.5587E+000
		1001.03	0.85	1.1992E+001		5.5569E+000
		1737.77	0.02	3.5668E+002		-1.8852E+002
	Th-234	63.30	3.75	8.5658E+000	2.53E+000	1.4934E+000
		92.59	4.33	2.5311E+000		1.6179E-001
		112.81	0.22	3.4173E+001		1.5373E+001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S002-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.995	1460.82*		10.55	2.22762E+001	8.55403E-001
Mn-54	0.998	834.84*		99.97	4.00887E-002	1.38088E-002
Eu-152m	0.983	89.85*		69.90	5.35023E-002	1.37760E-002
Tl-208	0.832	72.80	@	2.02		
		74.97*	@	3.41	5.60541E+000	6.04477E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	2.02337E-001	1.03258E-001
		583.19*		84.50	3.94999E-001	3.00090E-002
		763.13	@	1.81		
		860.56*		12.42	5.47923E-001	1.20389E-001
Bi-211	0.912	351.03*		13.00	2.28820E+000	1.69090E-001
Bi-212	0.567	39.86	@	1.06		
		727.33*		6.74	1.02986E+000	2.83208E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.986	74.81*		10.40	1.83793E+000	2.05167E-001
		77.11*		17.50	1.84761E+000	1.50558E-001
		87.30*		7.81	1.12835E+000	1.63883E-001
		115.18	@	0.59		
		238.63*		43.30	1.41514E+000	7.78433E-002
		300.09*		3.28	1.39794E+000	4.03178E-001
Pb-214	0.945	53.28	@	1.20		
		74.81*		6.44	2.92383E+000	3.29400E-001
		77.11*		10.80	2.94917E+000	2.50171E-001
		87.30*		4.84	1.79361E+000	2.62709E-001
		242.00*		7.43	1.83109E+000	1.54074E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	7.86465E-001	8.27476E-002
		351.93*		37.60	7.90103E-001	5.78465E-002
		462.00*	@	0.22	2.40332E+001	7.14071E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.813	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	3.36851E+000	2.82024E-001
Ra-226	0.769	81.07	@	0.20		
		83.78	@	0.33		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ra-226	0.769	94.90	@	0.15		
		186.21*		3.59	1.61151E+000	3.94034E-001
Ac-228	0.901	99.50	@	1.26		
		129.07*	@	2.50	1.09008E+000	5.45097E-001
		209.25*		3.97	1.36200E+000	4.29785E-001
		270.24*		3.55	1.97726E+000	3.77312E-001
		328.00*		3.04	7.06931E-001	3.83362E-001
		338.32*		11.40	1.34623E+000	1.47809E-001
		409.46*	@	2.02	7.36294E-001	5.11783E-001
		463.00*		4.45	1.21161E+000	3.62533E-001
		755.31	@	1.03		
		772.29	@	1.52		
		794.94*		4.31	8.55047E-001	3.40457E-001
		835.70*	@	1.70	2.31387E+000	8.02705E-001
		911.20*		26.20	1.45249E+000	1.21005E-001
		964.79*		4.99	2.05952E+000	3.02789E-001
		968.96*		15.90	1.72571E+000	1.44945E-001
		1588.20*		3.06	1.05924E+000	4.59483E-001
		1630.62	@	1.52		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.995	2.227616E+001	8.554030E-001
	Mn-54		0.998	1.451225E-002	1.385449E-002
X	Cd-109		0.920		
	Eu-152m		0.983	5.350227E-002	1.377598E-002
	Tl-208	@	0.832	4.035920E-001	2.892380E-002
	Bi-211		0.912	2.568180E-001	2.746474E-001
	Bi-212	@	0.567	1.029858E+000	2.832081E-001
	Pb-212	@	0.986	1.302449E+000	6.156422E-002
	Pb-214	@	0.945	7.014249E-001	7.561729E-002
	Ra-224	@	0.813	2.078158E+000	3.117702E-001
	Ra-226	@	0.769	1.611511E+000	3.940340E-001
	Ac-228	@	0.901	1.476243E+000	6.487920E-002

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/3/2016 4:04:04 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m	5	92.95	1.8123E-002	18.04	Tol.	Yb-169 Th-227 Th-234
	21	609.06	5.1684E-002	7.34	Sum	
	22	684.34	1.4776E-003	78.23	Tol.	Sb-127
	30	1120.31	1.1461E-002	19.66	Sum	
	31	1237.58	4.0137E-003	35.38	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S001-0006-01.CNF

Report Generated On              : 12/3/2016   6:39:31 PM

Sample Title                     : UMR001-S001-0006-01
Sample Description               : 450 cc Soil
Sample Identification            :
Sample Type                      :
Sample Geometry                  :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :   100 -  8192
Peak Area Range (in channels)    :   100 -  8192
Identification Energy Tolerance  :    1.000 keV

Sample Size                      :  4.901E+002 GWET

Sample Taken On                  : 11/18/2016  9:58:00 AM
Acquisition Started              : 12/3/2016   4:39:27 PM

Live Time                        :     7200.0 seconds
Real Time                        :     7201.7 seconds

Dead Time                        :   0.02 %

          Energy Calibration Used Done On       : 10/24/2016
          Efficiency Calibration Used Done On   : 9/27/2016
          Efficiency ID                         : ERT0101
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S001-0006-01
Peak Analysis Performed on: 12/3/2016 6:39:32 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	294-	319	300.04	74.97	0.97	2.13E+002	20.43	2.94E+002
m	2	294-	319	309.03	77.22	0.98	3.12E+002	23.40	2.89E+002
M	3	345-	381	349.95	87.45	0.88	8.21E+001	16.85	3.10E+002
m	4	345-	381	360.98	90.20	0.89	5.64E+001	15.32	3.27E+002
m	5	345-	381	371.50	92.83	0.89	1.50E+002	19.48	2.88E+002
	6	739-	753	744.12	186.00	1.10	2.07E+002	29.90	2.34E+002
M	7	947-	974	954.69	238.64	1.12	8.83E+002	32.86	2.08E+002
m	8	947-	974	966.77	241.66	1.13	1.66E+002	16.78	1.82E+002
M	9	1173-	1205	1180.63	295.13	1.07	2.71E+002	19.65	1.34E+002
m	10	1173-	1205	1199.47	299.84	1.07	5.29E+001	11.38	1.16E+002
	11	1308-	1315	1311.80	327.93	0.75	1.15E+001	13.08	7.95E+001
	12	1343-	1358	1353.21	338.28	1.27	1.42E+002	24.27	1.48E+002
	13	1396-	1415	1407.30	351.80	1.10	4.75E+002	30.39	1.26E+002
	14	1846-	1856	1851.91	462.97	0.42	4.79E+001	13.38	5.51E+001
	15	2032-	2053	2042.52	510.62	1.06	2.31E+002	26.60	1.27E+002
	16	2323-	2339	2331.97	582.99	0.99	2.72E+002	22.73	7.85E+001
	17	2425-	2446	2436.31	609.08	1.33	3.73E+002	25.52	7.43E+001
M	18	2620-	2653	2625.16	656.30	1.27	1.38E+001	5.74	4.19E+001
m	19	2620-	2653	2645.98	661.50	1.28	1.74E+002	12.93	4.95E+001
	20	2900-	2915	2907.50	726.89	0.75	7.62E+001	14.63	4.58E+001
	21	3634-	3652	3643.48	910.90	1.32	1.90E+002	18.50	4.51E+001
	22	3867-	3884	3874.62	968.69	1.14	1.11E+002	16.40	4.86E+001
	23	4473-	4488	4480.99	1120.29	1.05	6.05E+001	12.71	3.35E+001
	24	4948-	4959	4953.09	1238.33	0.30	2.60E+001	10.11	3.00E+001
	25	5831-	5857	5844.01	1461.08	1.74	8.96E+002	30.65	9.97E+000
	26	6350-	6361	6355.40	1588.94	1.35	2.60E+001	5.79	3.00E+000
	27	7052-	7069	7060.94	1765.34	0.34	6.06E+001	10.52	1.54E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S001-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	5.0751E-001	5.08E-001	1.0992E+001
	Co-60	1173.23	99.85	8.7956E-002	6.95E-002	-2.1412E-003
		1332.49	99.98	6.9469E-002		3.4540E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
+	Cs-137	32.06	5.54	1.0317E+003	4.42E-002	-3.5216E+002
		661.66*	84.99	4.4157E-002		1.5669E-001
+	Tl-208	72.80	2.02	7.5215E+000	6.50E-002	-1.3900E+000
		74.97*	3.41	2.3903E+000		4.4177E+000
		84.90	1.51	5.9521E+000		9.8117E-002
		277.36	6.31	8.3179E-001		3.0162E-001
		510.77*	22.60	3.5474E-001		1.7511E-001
		583.19*	84.50	6.5016E-002		2.2221E-001
		763.13	1.81	3.7985E+000		-4.2681E+000
		860.56	12.42	6.4454E-001		2.6441E-001
+	Bi-212	39.86	1.06	5.2987E+002	7.06E-001	-9.4677E+000
		727.33*	6.74	7.0647E-001		9.3903E-001
		785.37	1.11	6.0944E+000		-1.2251E+000
		1620.74	1.51	4.0270E+000		2.7709E+000
		1806.00	0.09	5.6950E+001		1.2509E+001
+	Pb-212	74.81*	10.40	7.8374E-001	9.16E-002	1.4485E+000
		77.11*	17.50	4.1784E-001		1.1374E+000
		87.30*	7.81	6.9334E-001		4.8058E-001
		115.18	0.59	9.3618E+000		-1.7312E+000
		238.63*	43.30	9.1590E-002		7.7889E-001
		300.09*	3.28	9.9692E-001		7.1718E-001
+	Bi-214	76.86*	0.43	1.6907E+001	1.27E-001	4.6023E+001
		89.81*	0.24	2.1093E+001		9.7870E+000
		386.77	0.30	1.7756E+001		-3.8770E+000
		454.77	0.29	1.7188E+001		-6.7526E+000
		609.31*	45.49	1.2736E-001		5.9093E-001
		665.45	1.53	6.0269E+000		-2.4464E-001
		703.11	0.48	1.3436E+001		-6.5297E+000
		719.86	0.39	1.7161E+001		-4.1386E+000
		768.36	4.89	1.4667E+000		8.9600E-002
		786.10	0.31	2.2613E+001		8.1399E+000
		806.17	1.26	5.5563E+000		3.6760E+000
		934.06	3.10	2.0780E+000		-4.6984E-001
		964.08	0.36	2.9482E+001		9.1733E+000
		1051.96	0.31	2.1826E+001		-1.3915E+000
		1120.29*	14.91	3.6539E-001		4.4723E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.1077E+001	1.27E-001	6.1235E+000
		1155.19	1.63	4.9759E+000		-3.0292E-001
		1207.68	0.45	2.0485E+001		8.3516E+000
		1238.11*	5.79	8.8176E-001		5.2957E-001
		1280.96	1.43	5.9956E+000		-5.9382E-001
		1377.67	4.00	1.7407E+000		4.1855E-001
		1385.31	0.76	7.6220E+000		-4.2939E+000
		1401.50	1.27	5.7121E+000		-5.3973E+000
		1407.98	2.15	3.5029E+000		2.8438E-001
		1509.23	2.11	3.0900E+000		2.2245E+000
		1538.50	0.38	1.2958E+001		-4.3180E+000
		1543.32	0.20	2.5730E+001		-3.7240E+000
		1583.22	0.69	1.1364E+001		-1.1454E+000
		1594.73	0.25	3.1528E+001		-6.0599E+000
		1599.31	0.23	2.7728E+001		-7.9524E+000
		1661.28	1.15	5.0174E+000		2.2944E+000
		1683.99	0.22	2.6976E+001		1.1829E+001
		1729.59	2.92	2.3366E+000		1.2043E+000
		1764.49*	15.40	3.7225E-001		5.4283E-001
		1847.42	2.11	2.7791E+000		-1.0929E+000
		1873.16	0.22	2.5675E+001		7.7551E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	4.8225E+001	1.33E-001	2.0674E+001
		74.81*	6.44	1.2466E+000		2.3040E+000
		77.11*	10.80	6.6687E-001		1.8154E+000
		87.30*	4.84	1.1020E+000		7.6382E-001
		242.00*	7.43	4.7687E-001		8.6618E-001
		258.87	0.52	9.7192E+000		4.3333E+000
		274.80	0.47	1.0911E+001		-1.3004E+001
		295.22*	19.30	1.7721E-001		6.1060E-001
		351.93*	37.60	1.3333E-001		6.0545E-001
		462.00*	0.22	1.4970E+001		1.2809E+001
		533.66	0.19	3.0985E+001		-9.7812E+000
		785.96	1.07	6.5508E+000		1.3534E+000
		839.04	0.59	1.1750E+001		-2.4625E+000
+	Ra-224	81.07	0.13	7.0531E+001	8.77E-001	-2.5801E+001
		83.78	0.22	4.0536E+001		4.1003E+000
		240.99*	4.10	8.7737E-001		1.5937E+000
+	Ra-226	81.07	0.20	4.6196E+001	1.28E+000	-1.6899E+001
		83.78	0.33	2.6415E+001		2.6719E+000
		94.90	0.15	4.8436E+001		-3.3946E+000
		186.21*	3.59	1.2811E+000		1.5362E+000
+	Ac-228	99.50	1.26	4.4266E+000	2.29E-001	-2.0822E+000
		129.07	2.50	2.3399E+000		-5.6262E-001
		209.25	3.97	1.4537E+000		-1.0596E-001
		270.24	3.55	1.5641E+000		7.1286E-001
		328.00*	3.04	9.5308E-001		1.7799E-001
		338.32*	11.40	4.2653E-001		5.9943E-001
		409.46	2.02	2.9013E+000		2.5136E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	7.5478E-001	2.29E-001	6.4583E-001
		755.31	1.03	6.4145E+000		-3.7573E+000
		772.29	1.52	4.7793E+000		2.8236E+000
		794.94	4.31	1.7363E+000		7.5345E-001
		835.70	1.70	4.1709E+000		2.6714E+000
		911.20*	26.20	2.2934E-001		6.8507E-001
		964.79	4.99	2.2118E+000		6.2550E-001
		968.96*	15.90	3.8951E-001		7.1063E-001
		1588.20*	3.06	7.1935E-001		1.2081E+000
		1630.62	1.52	4.1209E+000		-1.6537E+000
	Th-228	84.37	1.26	7.0564E+000	7.06E+000	7.6631E-001
		131.61	0.13	4.4085E+001		-1.9219E+001
		166.41	0.10	4.9601E+001		1.2864E-001
		215.98	0.25	2.1479E+001		7.6026E+000
	Pa-234m	258.23	0.07	6.8150E+001	8.90E+000	1.5513E+000
		742.81	0.09	6.2247E+001		-2.6764E+001
		766.36	0.32	2.1822E+001		-1.6231E+001
		786.27	0.05	1.3213E+002		9.7709E+001
		1001.03	0.85	8.9026E+000		2.6934E+000
		1737.77	0.02	2.4380E+002		-5.7066E+002
+	Th-234	63.30	3.75	6.1892E+000	1.16E+000	-1.3897E+000
		92.59*	4.33	1.1607E+000		6.9174E-001
		112.81	0.22	2.5020E+001		-3.0434E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

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*************************************************************************
*****  N U C L I D E   I D E N T I F I C A T I O N   R E P O R T  *****
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Sample Title: UMR001-S001-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.990	1460.82*		10.55	1.09917E+001	4.82938E-001
Cs-137	0.992	32.06	@	5.54		
		661.66*		84.99	1.56694E-001	1.24741E-002
Eu-152m	0.980	89.85*		69.90	3.42363E-002	9.36761E-003
Tl-208	0.709	72.80	@	2.02		
		74.97*	@	3.41	4.41770E+000	4.49627E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	1.75105E-001	7.81276E-002
		583.19*		84.50	2.22206E-001	2.05071E-002
		763.13	@	1.81		
		860.56		12.42		
Bi-211	0.908	351.03*		13.00	1.75344E+000	1.34969E-001
Bi-212	0.554	39.86	@	1.06		
		727.33*		6.74	9.39031E-001	1.82767E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.985	74.81*		10.40	1.44850E+000	1.53233E-001
		77.11*		17.50	1.13744E+000	9.95720E-002
		87.30*		7.81	4.80577E-001	1.01023E-001
		115.18	@	0.59		
		238.63*		43.30	7.78888E-001	4.60578E-002
		300.09*		3.28	7.17181E-001	1.57255E-001
Bi-214	0.550	76.86*	@	0.43	4.60233E+001	4.05899E+000
		89.81*	@	0.24	9.78704E+000	2.70081E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	5.90926E-001	4.43233E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36		4.89		
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08	@	0.36		
		1051.96	@	0.31		
		1120.29*		14.91	4.47234E-001	9.45663E-002
		1133.66	@	0.25		
		1155.19	@	1.63		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.550	1207.68	@	0.45		
		1238.11*		5.79	5.29572E-001	2.06425E-001
		1280.96	@	1.43		
		1377.67		4.00		
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	5.42828E-001	1.05886E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.944	53.28	@	1.20		
		74.81*		6.44	2.30401E+000	2.46241E-001
		77.11*		10.80	1.81536E+000	1.64576E-001
		87.30*		4.84	7.63817E-001	1.61214E-001
		242.00*		7.43	8.66183E-001	9.63547E-002
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	6.10596E-001	5.10003E-002
		351.93*		37.60	6.05447E-001	4.62069E-002
		462.00*	@	0.22	1.28088E+001	3.64527E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.825	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	1.59365E+000	1.76774E-001
Ra-226	0.773	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	1.53619E+000	3.04986E-001
Ac-228	0.452	99.50	@	1.26		
		129.07	@	2.50		
		209.25		3.97		
		270.24		3.55		
		328.00*		3.04	1.77986E-001	2.03067E-001
		338.32*		11.40	5.99431E-001	1.07111E-001
		409.46	@	2.02		
		463.00*		4.45	6.45826E-001	1.85210E-001
		755.31	@	1.03		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.452	772.29	@	1.52		
		794.94		4.31		
		835.70	@	1.70		
		911.20*		26.20	6.85067E-001	7.38744E-002
		964.79		4.99		
		968.96*		15.90	7.10633E-001	1.08237E-001
		1588.20*		3.06	1.20813E+000	2.74962E-001
		1630.62	@	1.52		
Th-234	0.453	63.30		3.75		
		92.59*		4.33	6.91738E-001	1.93258E-001
		112.81	@	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.990	1.099172E+001	4.829383E-001
X	Cd-109		0.946		
	Cs-137	@	0.992	1.566938E-001	1.247408E-002
	Eu-152m		0.980	3.227197E-002	9.363884E-003
	Tl-208	@	0.709	2.242179E-001	2.040488E-002
	Bi-211		0.908	1.495877E-001	1.893073E-001
	Bi-212	@	0.554	9.390308E-001	1.827673E-001
	Pb-212	@	0.985	7.070679E-001	3.703501E-002
	Bi-214	@	0.550	5.615237E-001	3.687104E-002
	Pb-214	@	0.944	5.537954E-001	4.668122E-002
	Ra-224	@	0.825	5.747490E-001	1.955704E-001
	Ra-226	@	0.773	1.536188E+000	3.049859E-001
	Ac-228	@	0.452	6.566801E-001	4.729046E-002
	Th-234	@	0.453	6.917375E-001	1.932583E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/3/2016 6:39:32 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
M 18	656.30	1.9152E-003	41.60	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

Date: _____

9626 Niagara Falls Blvd Onsite Gamma Spec Screening Lab

Gamma Spectroscopy Detector work sheet.

Counted by (Initial,date)	Geometry Description	Analysis Number/Sample ID/Remarks	Sample Collection mmddyy hh:mm	Sample Quantity	Sample Units (GWET,GDR Y,L, ft^3, etc)	Count Time (s)	Report Matches Sample Parameters (Initial, date)
cc/120216	450 cc SOIL	UMR001-S003-0006-01	11-18-16 1125	846.0	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S004-0006-01	11-18-16 12:30	808.9	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S002-0612-01	11-18-16 10:38	753.2	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-0006-01	11-18-16 1040	721.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1218-01	11-18-16 1035	555.9	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1824-01	11-18-16 1030	382.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S001-0006-01	11-18-16 0958	490.1	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-0612-01	11-18-16 1122	530.4	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1218-01	11-18-16 1118	534.5	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1824-01	11-18-16 1115	493.5	GWET	7200	

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S003-0006-1.CNF

Report Generated On	: 12/2/2016 1:18:29 PM
Sample Title	: UMR001-S003-0006-1
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 8.460E+002 GWET
Sample Taken On	: 11/18/2016 11:25:00 AM
Acquisition Started	: 12/2/2016 11:18:20 AM
Live Time	: 7200.0 seconds
Real Time	: 7206.6 seconds
Dead Time	: 0.09 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S003-0006-1
Peak Analysis Performed on: 12/2/2016 1:18:29 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	244-	258	254.44	63.57	1.00	3.34E+002	95.91	3.08E+003
M	2	288-	382	300.05	74.97	1.13	2.43E+003	74.10	3.57E+003
m	3	288-	382	309.15	77.25	1.14	3.08E+003	79.69	3.44E+003
m	4	288-	382	324.14	80.99	1.14	2.66E+002	63.97	3.30E+003
m	5	288-	382	337.47	84.33	1.15	6.97E+002	52.75	3.44E+003
m	6	288-	382	349.48	87.33	1.15	1.03E+003	51.61	3.33E+003
m	7	288-	382	360.60	90.11	1.16	1.31E+003	65.52	3.23E+003
m	8	288-	382	372.03	92.97	1.16	1.92E+003	63.98	2.91E+003
	9	511-	526	516.82	129.17	1.06	5.07E+002	105.30	3.52E+003
	10	611-	629	616.66	154.13	1.00	2.16E+002	119.72	4.17E+003
	11	738-	750	744.71	186.14	1.25	2.02E+003	92.19	2.47E+003
	12	830-	848	837.55	209.35	0.95	8.08E+002	105.35	3.03E+003
M	13	946-	981	954.91	238.70	1.12	9.66E+003	106.96	2.03E+003
m	14	946-	981	967.63	241.88	1.12	2.40E+003	59.22	1.77E+003
	15	1068-	1091	1081.11	270.25	1.30	9.31E+002	100.79	2.31E+003
	16	1103-	1119	1109.76	277.41	1.11	3.55E+002	74.18	1.64E+003
	17	1174-	1190	1181.13	295.26	1.03	4.41E+003	94.51	1.44E+003
	18	1190-	1208	1200.66	300.14	1.25	4.72E+002	77.94	1.66E+003
	19	1258-	1269	1261.06	315.24	0.74	9.33E+001	47.25	8.50E+002
	20	1301-	1324	1312.06	327.99	1.08	3.93E+002	88.59	1.86E+003
M	21	1346-	1369	1353.47	338.35	1.19	2.10E+003	54.06	9.42E+002
m	22	1346-	1369	1363.44	340.84	1.19	1.81E+002	26.63	8.05E+002
	23	1398-	1419	1407.89	351.95	1.23	7.98E+003	114.10	1.34E+003
	24	1551-	1560	1555.90	388.96	0.37	6.48E+000	36.79	5.96E+002
M	25	1616-	1646	1621.42	405.34	1.15	8.50E+001	22.51	6.34E+002
m	26	1616-	1646	1637.78	409.43	1.15	2.98E+002	29.03	6.78E+002
	27	1703-	1712	1707.29	426.81	0.34	9.87E+001	31.21	3.87E+002
	28	1842-	1859	1852.24	463.05	1.27	6.77E+002	54.07	6.91E+002
	29	2030-	2053	2043.05	510.76	1.40	1.29E+003	70.15	9.09E+002
	30	2240-	2256	2249.87	562.47	1.29	1.50E+002	39.46	4.50E+002
M	31	2314-	2341	2319.61	579.90	1.31	7.71E+001	18.74	3.87E+002
m	32	2314-	2341	2332.61	583.15	1.31	3.58E+003	63.59	4.90E+002
	33	2424-	2447	2437.13	609.29	1.37	6.36E+003	94.81	6.57E+002
	34	2652-	2673	2661.41	665.36	0.86	2.22E+002	44.75	4.74E+002
	35	2898-	2917	2909.17	727.31	1.32	8.13E+002	46.01	3.72E+002
	36	3016-	3029	3020.41	755.12	0.72	1.14E+002	28.67	2.55E+002
M	37	3061-	3101	3073.40	768.37	1.53	6.32E+002	30.13	3.12E+002
m	38	3061-	3101	3089.21	772.32	1.53	1.75E+002	18.83	2.73E+002
M	39	3124-	3150	3128.67	782.19	1.43	3.16E+001	12.76	2.86E+002
m	40	3124-	3150	3143.08	785.79	1.43	1.99E+002	19.46	3.29E+002
	41	3171-	3191	3179.68	794.94	1.20	3.98E+002	41.09	3.54E+002
	42	3216-	3236	3225.71	806.45	1.46	1.60E+002	34.73	2.88E+002

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	43	3337-	3367	3342.89	835.74	1.25	1.48E+002	17.70	1.93E+002
m	44	3337-	3367	3358.95	839.76	1.26	8.55E+001	15.50	2.36E+002
	45	3432-	3454	3441.93	860.50	1.65	3.78E+002	40.90	3.34E+002
	46	3609-	3623	3616.14	904.06	0.92	8.27E+001	24.82	1.83E+002
	47	3633-	3658	3645.01	911.28	1.59	2.62E+003	61.81	2.84E+002
	48	3728-	3747	3736.73	934.21	1.29	3.49E+002	32.32	1.99E+002
M	49	3849-	3890	3859.13	964.82	1.56	4.18E+002	23.80	2.19E+002
m	50	3849-	3890	3876.20	969.08	1.56	1.53E+003	41.45	1.97E+002
	51	3997-	4014	4004.85	1001.25	0.87	7.66E+001	25.70	1.79E+002
	52	4469-	4496	4482.17	1120.59	1.75	1.49E+003	49.13	2.07E+002
	53	4608-	4630	4622.09	1155.57	1.76	1.96E+002	29.10	1.68E+002
	54	4658-	4671	4664.86	1166.26	0.73	3.59E+001	15.36	7.21E+001
	55	4942-	4966	4954.22	1238.61	1.74	5.41E+002	34.96	1.65E+002
	56	5114-	5134	5126.24	1281.62	1.26	1.67E+002	23.38	1.04E+002
	57	5502-	5522	5512.80	1378.27	1.15	3.37E+002	28.17	1.26E+002
M	58	5600-	5645	5608.25	1402.13	1.64	1.03E+002	13.85	1.19E+002
m	59	5600-	5645	5634.70	1408.74	1.65	2.18E+002	17.25	9.30E+001
	60	5830-	5857	5845.82	1461.53	1.61	5.86E+002	34.77	1.39E+002
M	61	5980-	6015	5988.34	1497.16	0.46	3.03E+001	4.74	3.78E+001
m	62	5980-	6015	6010.13	1502.61	0.46	1.82E+001	4.34	3.40E+001
	63	6030-	6046	6038.83	1509.79	1.65	1.40E+002	21.37	1.01E+002
	64	6152-	6166	6158.09	1539.60	0.45	4.29E+001	15.78	7.11E+001
M	65	6347-	6409	6356.36	1589.18	1.72	1.90E+002	16.36	8.62E+001
m	66	6347-	6409	6373.82	1593.54	1.72	1.08E+002	13.05	8.89E+001
m	67	6347-	6409	6401.88	1600.56	1.72	3.51E+001	9.43	7.25E+001
	68	6476-	6496	6484.92	1621.32	1.63	9.42E+001	21.49	9.88E+001
	69	6516-	6535	6526.28	1631.66	2.10	1.15E+002	19.03	7.01E+001
	70	6639-	6659	6649.43	1662.45	1.77	1.08E+002	17.55	5.49E+001
	71	6911-	6932	6922.84	1730.81	1.78	2.19E+002	23.82	9.28E+001
	72	7049-	7077	7063.23	1765.91	1.75	1.19E+003	39.25	7.62E+001
	73	7384-	7406	7395.64	1849.02	1.53	1.62E+002	19.87	5.86E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S003-0006-1
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	8.7683E-001	8.77E-001	4.1215E+000
	Co-60	1173.23	99.85	8.3480E-002	8.35E-002	2.3099E-002
		1332.49	99.98	8.7793E-002		1.9085E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.8009E+003	1.19E-001	-1.4844E+002
		661.66	84.99	1.1857E-001		2.0732E-002
+	Tl-208	72.80	2.02	1.3873E+001	7.25E-002	-1.0282E+000
		74.97*	3.41	4.7351E+000		2.9120E+001
		84.90*	1.51	7.3915E+000		1.3263E+001
		277.36*	6.31	1.3095E+000		1.3838E+000
		510.77*	22.60	4.8011E-001		1.8402E+000
		583.19*	84.50	7.2526E-002		1.7368E+000
		763.13	1.81	5.8356E+000		3.5064E-002
		860.56*	12.42	7.4065E-001		1.6439E+000
+	Bi-212	39.86	1.06	9.6731E+002	1.22E+000	-2.8461E+002
		727.33*	6.74	1.2173E+000		5.7998E+000
		785.37*	1.11	5.5788E+000		9.0895E+000
		1620.74*	1.51	5.0761E+000		5.2065E+000
		1806.00	0.09	8.3784E+001		5.3182E+001
+	Pb-212	74.81*	10.40	1.5526E+000	1.57E-001	9.5479E+000
		77.11*	17.50	8.1899E-001		6.4911E+000
		87.30*	7.81	1.2983E+000		3.4905E+000
		115.18	0.59	1.7562E+001		3.1567E-001
		238.63*	43.30	1.5699E-001		5.0451E+000
		300.09*	3.28	2.7556E+000		3.7113E+000
+	Bi-214	76.86*	0.43	3.3180E+001	2.22E-001	2.6298E+002
		89.81*	0.24	3.7902E+001		1.3174E+002
		386.77	0.30	3.0247E+001		1.4305E+001
		454.77	0.29	3.0554E+001		8.1834E+000
		609.31*	45.49	2.2167E-001		5.8389E+000
		665.45*	1.53	5.7883E+000		6.4590E+000
		703.11	0.48	2.0793E+001		4.7200E+000
		719.86	0.39	2.3921E+001		3.1108E+000
		768.36*	4.89	1.1977E+000		6.3686E+000
		786.10*	0.31	1.9701E+001		3.2098E+001
		806.17*	1.26	6.1863E+000		6.4656E+000
		934.06*	3.10	2.2814E+000		6.3621E+000
		964.08*	0.36	1.5897E+001		6.6403E+001
		1051.96	0.31	2.6073E+001		4.1067E+000
		1120.29*	14.91	6.1809E-001		6.3674E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.4012E+001	2.22E-001	2.5086E+001
		1155.19*	1.63	4.8380E+000		7.8130E+000
		1207.68	0.45	1.9992E+001		5.6791E+000
		1238.11*	5.79	1.4644E+000		6.3820E+000
		1280.96*	1.43	4.5671E+000		8.1436E+000
		1377.67*	4.00	1.8745E+000		6.1944E+000
		1385.31	0.76	1.4255E+001		1.2703E+001
		1401.50*	1.27	4.3592E+000		6.0320E+000
		1407.98*	2.15	2.2942E+000		7.5797E+000
		1509.23*	2.11	3.1725E+000		5.1773E+000
		1538.50	0.38	2.5730E+001		6.3441E+000
		1543.32	0.20	4.9407E+001		3.9941E+001
		1583.22	0.69	1.7477E+001		5.4808E+000
		1594.73	0.25	5.1696E+001		9.6611E+001
		1599.31	0.23	4.4992E+001		-5.3850E+000
		1661.28	1.15	8.0379E+000		8.1925E+000
		1683.99	0.22	3.6649E+001		-5.8736E-001
		1729.59	2.92	4.0080E+000		7.5655E+000
		1764.49	15.40	1.3742E+000		6.7173E+000
		1847.42	2.11	5.0621E+000		2.8111E+000
		1873.16	0.22	3.3183E+001		-1.2811E+001
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	8.1620E+001	2.50E-001	-2.2668E+001
		74.81*	6.44	2.4727E+000		1.5206E+001
		77.11*	10.80	1.3088E+000		1.0373E+001
		87.30*	4.84	2.0661E+000		5.5548E+000
		242.00*	7.43	8.4573E-001		7.2538E+000
		258.87	0.52	1.6859E+001		1.1911E+001
		274.80	0.47	2.0018E+001		7.5772E-001
		295.22*	19.30	4.1113E-001		5.7483E+000
		351.93*	37.60	2.4997E-001		5.9830E+000
		462.00	0.22	4.7324E+001		1.1629E+002
		533.66	0.19	4.7836E+001		8.4231E+000
		785.96*	1.07	5.7076E+000		9.2993E+000
		839.04*	0.59	9.2631E+000		7.6364E+000
+	Ra-224	81.07*	0.13	9.2839E+001	1.55E+000	6.4845E+001
		83.78*	0.22	5.1434E+001		9.2290E+001
		240.99*	4.10	1.5540E+000		1.3329E+001
+	Ra-226	81.07*	0.20	6.0884E+001	2.15E+000	4.2526E+001
		83.78*	0.33	3.3559E+001		6.0216E+001
		94.90	0.15	8.6518E+001		-4.0647E+001
		186.21*	3.59	2.1456E+000		1.1179E+001
+	Ac-228	99.50	1.26	8.5060E+000	3.51E-001	6.1722E+000
		129.07*	2.50	3.9524E+000		4.1647E+000
		209.25*	3.97	2.5569E+000		4.3553E+000
		270.24*	3.55	3.0637E+000		6.3472E+000
		328.00*	3.04	3.6268E+000		3.5291E+000
		338.32*	11.40	4.9963E-001		5.1346E+000
		409.46*	2.02	2.7362E+000		4.6857E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.7406E+000	3.51E-001	5.2833E+000
		755.31*	1.03	6.0623E+000		5.4431E+000
		772.29*	1.52	3.6726E+000		5.7779E+000
		794.94*	4.31	2.0158E+000		4.7326E+000
		835.70*	1.70	2.9314E+000		4.6040E+000
		911.20*	26.20	3.5363E-001		5.6087E+000
		964.79*	4.99	1.1726E+000		4.8980E+000
		968.96*	15.90	3.5094E-001		5.6309E+000
		1588.20*	3.06	1.7148E+000		5.1033E+000
		1630.62	1.52	6.6448E+000		4.5936E+000
+	Th-228	84.37*	1.26	8.8580E+000	8.86E+000	1.5894E+001
		131.61	0.13	8.5765E+001		3.6626E+000
		166.41	0.10	9.8011E+001		4.6985E+001
		215.98	0.25	3.9678E+001		3.5910E+001
	Pa-234m	258.23	0.07	1.1966E+002	1.08E+001	5.1992E+001
		742.81	0.09	1.0309E+002		4.9885E+001
		766.36	0.32	3.7977E+001		-9.8454E-001
		786.27	0.05	2.0284E+002		2.6474E+002
		1001.03	0.85	1.0823E+001		6.6322E+000
		1737.77	0.02	4.8369E+002		1.9487E+002
+	Th-234	63.30*	3.75	9.6310E+000	1.94E+000	6.5363E+000
		92.59*	4.33	1.9418E+000		9.9172E+000
		112.81	0.22	4.7414E+001		-3.9209E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S003-0006-1
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.923	1460.82*	10.55	4.12151E+000	2.75430E-001
Eu-152m	0.989	89.85*	69.90	4.60763E-001	2.77140E-002
Tl-208	0.957	72.80 @	2.02		
		74.97* @	3.41	2.91196E+001	1.34415E+000
		84.90* @	1.51	1.32628E+001	1.10034E+000
		277.36*	6.31	1.38376E+000	2.95130E-001
		510.77* @	22.60	1.84018E+000	1.31956E-001
		583.19*	84.50	1.73678E+000	6.42481E-002
		763.13 @	1.81		
		860.56*	12.42	1.64392E+000	1.82729E-001
Bi-211	0.873	351.03*	13.00	1.73254E+001	7.48208E-001
Pb-211	0.498	74.81* @	0.23	4.26292E+002	2.70320E+001
		77.11* @	0.39	2.89828E+002	1.78983E+001
		87.30* @	0.17	1.55594E+002	1.18061E+001
		404.85*	3.78	7.00265E-001	1.87666E-001
		427.09*	1.76	1.81225E+000	5.79360E-001
		832.01	3.52		
Bi-212	0.951	39.86 @	1.06		
		727.33*	6.74	5.79985E+000	3.75760E-001
		785.37*	1.11	9.08950E+000	9.21328E-001
		1620.74*	1.51	5.20647E+000	1.19965E+000
		1806.00 @	0.09		
Pb-212	0.985	74.81*	10.40	9.54786E+000	5.19706E-001
		77.11*	17.50	6.49109E+000	3.37308E-001
		87.30*	7.81	3.49054E+000	2.37861E-001
		115.18 @	0.59		
		238.63*	43.30	5.04506E+000	2.33813E-001
		300.09*	3.28	3.71131E+000	6.31053E-001
Bi-214	0.698	76.86* @	0.43	2.62978E+002	1.39534E+001
		89.81* @	0.24	1.31741E+002	9.22620E+000
		386.77 @	0.30		
		454.77 @	0.29		
		609.31*	45.49	5.83890E+000	1.98800E-001
		665.45* @	1.53	6.45901E+000	1.31509E+000
		703.11 @	0.48		
		719.86 @	0.39		
		768.36*	4.89	6.36856E+000	3.43245E-001
		786.10* @	0.31	3.20977E+001	6.10765E+000
		806.17* @	1.26	6.46560E+000	1.41222E+000
		934.06*	3.10	6.36209E+000	6.07133E-001
		964.08* @	0.36	6.64032E+001	4.64099E+000

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.698	1051.96	@	0.31		
		1120.29*		14.91	6.36738E+000	2.62259E-001
		1133.66	@	0.25		
		1155.19*	@	1.63	7.81299E+000	1.17669E+000
		1207.68	@	0.45		
		1238.11*		5.79	6.38201E+000	4.50959E-001
		1280.96*	@	1.43	8.14364E+000	1.16704E+000
		1377.67*		4.00	6.19437E+000	5.47513E-001
		1385.31	@	0.76		
		1401.50*	@	1.27	6.03196E+000	8.29829E-001
		1407.98*	@	2.15	7.57968E+000	6.50949E-001
		1509.23*	@	2.11	5.17726E+000	8.08841E-001
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49		15.40		
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.965	53.28	@	1.20		
		74.81*		6.44	1.52064E+001	8.59402E-001
		77.11*		10.80	1.03730E+001	5.91877E-001
		87.30*		4.84	5.55484E+000	3.92869E-001
		242.00*		7.43	7.25385E+000	3.80499E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	5.74825E+000	2.69315E-001
		351.93*		37.60	5.98298E+000	2.51324E-001
		462.00	@	0.22		
		533.66	@	0.19		
		785.96*	@	1.07	9.29934E+000	1.16828E+000
		839.04*	@	0.59	7.63643E+000	1.40311E+000
Ra-223	0.520	81.07*		15.30	5.48217E-001	1.33261E-001
		83.78*		25.40	7.78530E-001	6.63833E-002
		94.90		11.50		
		122.32	@	1.21		
		144.24		3.27		
		154.21*		5.70	7.49359E-001	4.17681E-001
		158.63	@	0.69		
		179.54	@	0.15		
		269.46*		13.90	1.60066E+000	1.91432E-001
		288.18	@	0.16		
		323.87		3.99		
		328.38*	@	0.21	5.06869E+001	1.17464E+001

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ra-223	0.520	338.32*	2.84	2.03512E+001	1.06681E+000
		342.87 @	0.22		
		371.68 @	0.49		
		445.03 @	1.29		
Ra-224	0.887	81.07* @	0.13	6.48451E+001	1.59558E+001
		83.78* @	0.22	9.22898E+001	8.37866E+000
		240.99*	4.10	1.33291E+001	6.90163E-001
Ra-226	0.941	81.07* @	0.20	4.25261E+001	1.04472E+001
		83.78* @	0.33	6.02161E+001	5.45996E+000
		94.90 @	0.15		
		186.21*	3.59	1.11789E+001	7.41144E-001
Ac-228	0.945	99.50 @	1.26		
		129.07* @	2.50	4.16470E+000	8.81927E-001
		209.25*	3.97	4.35531E+000	6.17588E-001
		270.24*	3.55	6.34725E+000	7.58185E-001
		328.00*	3.04	3.52914E+000	8.16671E-001
		338.32*	11.40	5.13458E+000	2.98136E-001
		409.46* @	2.02	4.68574E+000	5.07419E-001
		463.00*	4.45	5.28333E+000	5.42370E-001
		755.31* @	1.03	5.44312E+000	1.39719E+000
		772.29* @	1.52	5.77791E+000	6.77409E-001
		794.94*	4.31	4.73256E+000	5.24483E-001
		835.70* @	1.70	4.60398E+000	5.93743E-001
		911.20*	26.20	5.60870E+000	2.52969E-001
		964.79*	4.99	4.89800E+000	3.44694E-001
		968.96*	15.90	5.63088E+000	2.68568E-001
		1588.20*	3.06	5.10330E+000	5.00171E-001
		1630.62 @	1.52		
Th-228	0.501	84.37*	1.26	1.58944E+001	1.34258E+000
		131.61 @	0.13		
		166.41 @	0.10		
		215.98	0.25		
Th-231	0.997	81.23* @	0.90	9.30833E+000	2.34624E+000
		84.21*	6.60	2.99251E+000	3.07460E-001
		89.95* @	1.00	3.21442E+001	2.71692E+000
Th-234	0.927	63.30*	3.75	6.53633E+000	2.10682E+000
		92.59*	4.33	9.91723E+000	6.35676E-001
		112.81 @	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

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***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.923	4.121506E+000	2.754301E-001
X	Mn-54		0.877		
X	Cd-109		0.923		
	Eu-152m		0.989	4.324309E-001	5.942329E-002
X	Tm-170		0.999		
	Tl-208	@	0.957	1.731067E+000	5.800733E-002
	Bi-211		0.873	5.424220E+000	9.458093E-001
	Pb-211	@	0.498	7.821349E-001	1.781679E-001
	Bi-212	@	0.951	5.450627E+000	3.247310E-001
	Pb-212	@	0.985	3.319036E+000	1.552380E-001
	Bi-214	@	0.698	6.112242E+000	1.289037E-001
	Pb-214	@	0.965	4.109835E+000	2.180938E-001
	Ra-223	@	0.520	3.266918E-001	1.703501E-001
	Ra-224	@	0.887	5.777184E+000	7.813479E-001
	Ra-226	@	0.941	1.117894E+001	7.172075E-001
	Ac-228	@	0.945	5.242479E+000	1.011607E-001
	Th-228	@	0.501	6.276435E-001	1.697215E+001
	Th-231	@	0.997	4.851457E-001	3.677368E+000
	Th-234	@	0.927	9.635126E+000	6.085781E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/2/2016 1:18:29 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
19	315.24	1.2965E-002	50.61	Sum	
m 22	340.84	2.5183E-002	14.68	Sum	
24	388.96	8.9943E-004	568.10	Sum	
30	562.47	2.0775E-002	26.38		
M 31	579.90	1.0704E-002	24.32	Sum	
M 39	782.19	4.3891E-003	40.38		
46	904.06	1.1490E-002	30.00	Sum	
51	1001.25	1.0076E-002	35.51	Sum	
54	1166.26	4.9817E-003	42.83	Sum	
M 61	1497.16	4.2074E-003	15.64		
m 62	1502.61	2.5309E-003	23.79	Sum	
64	1539.60	5.9606E-003	36.77	Sum	
m 66	1593.54	1.4981E-002	12.10	Sum	
m 67	1600.56	4.8745E-003	26.86	Sum	
69	1631.66	1.5955E-002	16.56	Sum	
70	1662.45	1.5008E-002	16.24	Sum	
71	1730.81	3.0443E-002	10.86	Sum	
72	1765.91	1.6497E-001	3.30		
73	1849.02	2.2559E-002	12.23	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S004-0006-01.CNF

Report Generated On	: 12/2/2016 3:23:17 PM
Sample Title	: UMR001-S004-0006-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 8.089E+002 GWET
Sample Taken On	: 11/18/2016 12:30:00 PM
Acquisition Started	: 12/2/2016 1:22:22 PM
Live Time	: 7200.0 seconds
Real Time	: 7253.2 seconds
Dead Time	: 0.73 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S004-0006-01
Peak Analysis Performed on: 12/2/2016 3:23:17 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	276-	315	292.14	72.99	1.04	2.81E+003	131.70	2.79E+004
m	2	276-	315	299.99	74.96	1.04	2.03E+004	194.53	2.80E+004
m	3	276-	315	309.05	77.22	1.04	3.13E+004	227.87	2.81E+004
M	4	331-	384	338.24	84.52	1.24	5.25E+003	154.63	2.97E+004
m	5	331-	384	349.45	87.32	1.24	1.64E+004	194.94	3.13E+004
m	6	331-	384	360.35	90.05	1.25	1.25E+004	177.78	3.08E+004
m	7	331-	384	373.76	93.40	1.25	1.43E+004	186.76	3.02E+004
	8	387-	407	398.69	99.63	0.97	3.40E+003	385.29	4.00E+004
M	9	407-	441	422.34	105.55	1.37	4.63E+003	176.49	3.32E+004
m	10	407-	441	435.86	108.93	1.38	1.67E+003	148.35	2.93E+004
	11	453-	473	461.69	115.38	1.11	1.81E+003	387.77	4.09E+004
	12	509-	523	516.98	129.21	1.03	7.22E+003	315.62	3.21E+004
M	13	561-	588	564.35	141.05	0.57	4.22E+002	100.97	1.38E+004
m	14	561-	588	576.35	144.05	0.57	3.23E+002	93.10	1.55E+004
m	15	561-	588	583.97	145.96	0.57	3.10E+002	95.43	1.54E+004
	16	612-	627	616.38	154.06	0.98	2.89E+003	301.31	2.91E+004
	17	737-	758	744.48	186.09	1.27	4.39E+003	378.09	3.68E+004
	18	792-	809	797.86	199.43	1.14	1.04E+003	305.73	2.84E+004
	19	828-	848	837.34	209.30	1.05	1.48E+004	358.65	3.13E+004
	20	855-	872	864.50	216.09	0.87	1.16E+003	293.19	2.61E+004
M	21	947-	980	954.71	238.65	1.10	1.67E+005	427.50	1.70E+004
m	22	947-	980	964.64	241.13	1.11	1.75E+004	162.49	1.37E+004
	23	1006-	1021	1010.45	252.58	1.13	4.48E+002	208.38	1.43E+004
	24	1072-	1093	1081.02	270.23	1.13	1.19E+004	280.93	1.77E+004
	25	1104-	1122	1109.48	277.35	1.11	7.20E+003	240.89	1.48E+004
	26	1147-	1159	1152.73	288.16	1.07	1.12E+003	162.20	9.56E+003
	27	1172-	1190	1180.92	295.21	1.19	1.03E+004	240.26	1.40E+004
	28	1191-	1208	1200.49	300.10	1.11	1.05E+004	226.00	1.25E+004
	29	1280-	1292	1287.12	321.76	0.51	2.77E+002	151.36	8.57E+003
M	30	1301-	1335	1311.86	327.94	1.18	8.96E+003	130.84	9.65E+003
m	31	1301-	1335	1329.81	332.43	1.19	1.03E+003	81.44	8.81E+003
M	32	1344-	1370	1353.16	338.27	1.17	3.46E+004	205.99	8.88E+003
m	33	1344-	1370	1363.55	340.87	1.17	1.04E+003	77.84	8.54E+003
	34	1399-	1416	1407.54	351.87	1.19	1.88E+004	225.36	9.81E+003
	35	1630-	1649	1637.45	409.35	1.26	4.99E+003	190.08	8.82E+003
	36	1757-	1766	1761.38	440.33	1.00	3.42E+002	94.13	3.77E+003
	37	1804-	1823	1811.02	452.74	1.32	1.09E+003	165.12	7.45E+003
	38	1842-	1860	1851.62	462.89	1.29	1.04E+004	183.47	6.88E+003
	39	1871-	1882	1877.88	469.46	0.57	4.47E+001	103.04	4.21E+003
	40	1906-	1918	1913.19	478.29	0.76	9.94E+001	110.74	4.61E+003
	41	2007-	2020	2014.64	503.65	1.00	3.89E+002	113.10	4.49E+003
	42	2020-	2057	2042.46	510.61	1.40	2.01E+004	306.46	1.27E+004

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	43	2178-	2205	2185.92	546.48	1.09	2.52E+002	57.78	4.30E+003
m	44	2178-	2205	2198.69	549.67	1.10	1.87E+002	54.59	4.28E+003
	45	2237-	2257	2249.56	562.39	1.33	1.94E+003	154.53	6.05E+003
	46	2279-	2294	2285.73	571.43	1.30	3.93E+002	121.63	4.79E+003
	47	2322-	2345	2332.18	583.05	1.34	6.05E+004	297.88	7.00E+003
	48	2427-	2448	2436.57	609.14	1.44	1.54E+004	189.39	5.42E+003
	49	2496-	2506	2501.06	625.27	0.47	7.09E+001	79.34	2.61E+003
	50	2600-	2611	2604.88	651.23	1.46	1.50E+002	86.86	2.95E+003
	51	2653-	2674	2662.18	665.55	0.80	4.09E+002	143.09	5.34E+003
M	52	2800-	2833	2806.86	701.73	1.34	3.64E+002	59.61	3.66E+003
m	53	2800-	2833	2828.75	707.20	1.35	1.84E+002	52.06	3.40E+003
	54	2898-	2921	2908.41	727.11	1.47	1.38E+004	182.16	4.82E+003
	55	3009-	3028	3020.63	755.17	1.48	1.71E+003	121.95	3.76E+003
M	56	3042-	3101	3052.94	763.25	1.48	1.26E+003	57.83	3.08E+003
m	57	3042-	3101	3072.60	768.17	1.48	1.33E+003	57.41	3.14E+003
m	58	3042-	3101	3088.65	772.18	1.48	2.59E+003	70.03	3.03E+003
M	59	3120-	3152	3127.80	781.97	1.46	8.05E+002	49.94	2.48E+003
m	60	3120-	3152	3141.50	785.39	1.47	2.16E+003	65.84	2.75E+003
	61	3166-	3190	3179.05	794.78	1.51	7.23E+003	145.83	3.40E+003
	62	3215-	3237	3224.18	806.06	1.64	3.76E+002	106.49	2.82E+003
M	63	3312-	3372	3321.35	830.36	1.58	8.83E+002	48.09	2.15E+003
m	64	3312-	3372	3342.08	835.54	1.59	2.92E+003	68.30	2.19E+003
m	65	3312-	3372	3360.45	840.14	1.59	1.64E+003	55.83	2.11E+003
	66	3430-	3452	3441.59	860.42	1.45	7.29E+003	128.31	2.37E+003
M	67	3475-	3507	3480.70	870.20	1.93	1.38E+002	36.95	1.64E+003
m	68	3475-	3507	3495.19	873.82	1.93	3.01E+002	43.55	2.10E+003
	69	3564-	3581	3573.04	893.29	1.13	5.26E+002	75.52	1.59E+003
	70	3606-	3627	3616.40	904.13	1.45	9.62E+002	93.00	2.05E+003
	71	3627-	3660	3644.20	911.08	1.60	4.38E+004	241.64	2.78E+003
	72	3726-	3746	3735.96	934.02	1.63	7.58E+002	78.20	1.48E+003
	73	3800-	3819	3808.39	952.13	1.59	2.07E+002	69.98	1.33E+003
M	74	3827-	3898	3833.76	958.47	1.61	3.90E+002	35.87	1.20E+003
m	75	3827-	3898	3858.59	964.68	1.62	7.84E+003	94.48	1.44E+003
m	76	3827-	3898	3875.42	968.89	1.62	2.59E+004	164.29	1.31E+003
	77	3946-	3959	3953.48	988.41	2.25	2.46E+002	48.61	7.65E+002
	78	3993-	4011	4004.03	1001.04	1.35	2.10E+002	64.25	1.16E+003
	79	4124-	4142	4133.06	1033.30	1.07	2.75E+002	59.66	9.72E+002
	80	4252-	4270	4260.54	1065.18	1.22	3.37E+002	62.95	1.07E+003
	81	4301-	4325	4314.72	1078.72	1.51	7.83E+002	79.47	1.34E+003
	82	4365-	4391	4375.59	1093.94	2.06	8.02E+002	81.57	1.33E+003
	83	4432-	4456	4441.89	1110.52	1.67	6.22E+002	74.34	1.18E+003
	84	4467-	4502	4481.09	1120.32	1.71	3.74E+003	114.22	1.67E+003
	85	4604-	4635	4620.37	1155.14	1.42	6.52E+002	89.89	1.48E+003
	86	4940-	4963	4952.81	1238.26	1.85	1.37E+003	74.54	1.05E+003
	87	4966-	5004	4988.74	1247.24	1.54	7.52E+002	107.47	1.83E+003
M	88	5115-	5162	5125.56	1281.45	2.29	3.22E+002	36.29	1.18E+003
m	89	5115-	5162	5148.66	1287.22	2.29	2.28E+002	32.59	1.26E+003
	90	5504-	5524	5511.64	1377.98	1.76	7.86E+002	65.34	9.57E+002
	91	5535-	5548	5541.95	1385.56	1.02	1.10E+002	41.98	5.97E+002
M	92	5594-	5647	5607.95	1402.06	1.98	3.22E+002	31.56	9.66E+002

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
m 93	5594-	5647	5633.52	1408.45	1.98	5.00E+002	35.86	9.94E+002
94	5826-	5858	5838.43	1459.68	2.93	1.42E+003	82.90	1.06E+003
M 95	5974-	6018	5985.09	1496.35	1.84	1.12E+003	41.74	7.17E+002
m 96	5974-	6018	6007.93	1502.06	1.85	5.43E+002	32.92	7.50E+002
M 97	6024-	6063	6038.65	1509.74	1.89	4.21E+002	30.52	7.17E+002
m 98	6024-	6063	6052.96	1513.32	1.89	4.23E+002	30.66	7.15E+002
99	6220-	6239	6230.25	1557.64	1.51	1.73E+002	47.28	5.83E+002
100	6311-	6340	6324.01	1581.09	2.27	7.63E+002	71.16	8.97E+002
M101	6342-	6390	6354.64	1588.75	1.96	3.79E+003	67.20	8.63E+002
m102	6342-	6390	6372.39	1593.18	1.96	1.99E+003	51.37	8.63E+002
M103	6476-	6540	6485.25	1621.40	1.94	1.73E+003	48.58	6.81E+002
m104	6476-	6540	6501.58	1625.48	1.95	2.32E+002	26.10	7.78E+002
m105	6476-	6540	6524.84	1631.30	1.95	1.85E+003	49.50	7.04E+002
106	6545-	6573	6555.60	1638.99	1.81	5.36E+002	64.19	7.66E+002
M107	6634-	6678	6647.93	1662.07	1.99	2.13E+002	26.44	6.26E+002
m108	6634-	6678	6667.71	1667.02	1.99	1.61E+002	25.27	6.70E+002
109	6911-	6931	6921.96	1730.59	1.68	5.09E+002	51.58	5.93E+002
110	7047-	7074	7061.50	1765.47	2.09	2.85E+003	78.29	7.28E+002
111	7218-	7245	7229.22	1807.41	0.71	2.22E+002	55.66	6.38E+002
112	7383-	7403	7394.11	1848.63	2.07	3.38E+002	49.73	5.89E+002
113	7806-	7837	7815.15	1953.90	0.51	6.70E+001	66.65	8.73E+002

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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***** N U C L I D E M D A R E P O R T *****
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Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S004-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
	K-40	1460.82	10.55	2.7933E+000	2.79E+000	9.9998E+000
	Co-60	1173.23	99.85	2.2504E-001	2.25E-001	1.2579E-001
		1332.49	99.98	2.4692E-001		1.4982E-001
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	5.5389E+003	3.72E-001	-1.8816E+003
		661.66	84.99	3.7207E-001		1.5403E-001
+	Tl-208	72.80*	2.02	2.5675E+001	3.98E-001	6.5469E+001
		74.97*	3.41	1.3825E+001		2.5398E+002
		84.90*	1.51	2.2488E+001		1.0386E+002
		277.36*	6.31	4.2801E+000		2.9303E+001
		510.77*	22.60	2.1870E+000		3.4423E+001
		583.19*	84.50	3.9828E-001		3.0747E+001
		763.13*	1.81	1.0570E+001		3.6330E+001
		860.56*	12.42	2.0412E+000		3.3185E+001
+	Bi-212	39.86	1.06	2.9949E+003	4.85E+000	1.2033E+003
		727.33*	6.74	4.8477E+000		1.0312E+002
		785.37*	1.11	1.6631E+001		1.0320E+002
		1620.74*	1.51	1.0078E+001		1.0003E+002
		1806.00	0.09	2.7806E+002		1.2129E+002
+	Pb-212	74.81*	10.40	4.5330E+000	4.71E-001	8.3277E+001
		77.11*	17.50	2.4401E+000		6.9098E+001
		87.30*	7.81	4.1407E+000		5.8154E+001
		115.18*	0.59	6.6155E+001		6.6893E+001
		238.63*	43.30	4.7066E-001		9.1422E+001
		300.09*	3.28	7.7134E+000		8.6664E+001
+	Bi-214	76.86*	0.43	9.8853E+001	6.42E-001	2.7993E+003
		89.81*	0.24	1.2199E+002		1.3158E+003
		386.77	0.30	9.3949E+001		6.2342E+001
		454.77	0.29	9.8662E+001		1.4191E+002
		609.31*	45.49	6.4159E-001		1.4803E+001
		665.45*	1.53	2.0133E+001		1.2442E+001
		703.11	0.48	6.8739E+001		2.4315E+000
		719.86	0.39	7.7774E+001		-1.5655E+001
		768.36*	4.89	3.9104E+000		1.4008E+001
		786.10*	0.31	5.8725E+001		3.6441E+002
		806.17*	1.26	2.0684E+001		1.5875E+001
		934.06*	3.10	6.5311E+000		1.4438E+001
		964.08*	0.36	4.1978E+001		1.3029E+003
		1051.96	0.31	6.7892E+001		2.2864E+001
		1120.29*	14.91	2.0215E+000		1.6732E+001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	8.4676E+001	6.42E-001	1.5999E+001
		1155.19*	1.63	1.6823E+001		2.7200E+001
		1207.68	0.45	5.0384E+001		-2.5878E+000
		1238.11*	5.79	3.7457E+000		1.6914E+001
		1280.96*	1.43	1.1702E+001		1.6474E+001
		1377.67*	4.00	5.3239E+000		1.5109E+001
		1385.31*	0.76	1.9536E+001		1.1185E+001
		1401.50*	1.27	1.2680E+001		1.9719E+001
		1407.98*	2.15	7.6221E+000		1.8158E+001
		1509.23*	2.11	6.9353E+000		1.6316E+001
		1538.50	0.38	6.2348E+001		3.8432E+001
		1543.32	0.20	1.1718E+002		7.8997E-002
		1583.22	0.69	6.2803E+001		8.5998E+001
		1594.73	0.25	1.9212E+002		3.6635E+001
		1599.31	0.23	1.4620E+002		3.3968E+001
		1661.28*	1.15	1.2740E+001		1.6207E+001
		1683.99	0.22	1.1097E+002		7.3901E+001
		1729.59*	2.92	6.7498E+000		1.5728E+001
		1764.49*	15.40	1.6009E+000		1.6925E+001
		1847.42	2.11	1.3084E+001		1.5306E+001
		1873.16	0.22	1.1529E+002		-3.0484E+001
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	2.4777E+002	6.54E-001	-6.4866E+001
		74.81*	6.44	7.2192E+000		1.3263E+002
		77.11*	10.80	3.8992E+000		1.1042E+002
		87.30*	4.84	6.5892E+000		9.2542E+001
		242.00*	7.43	2.4457E+000		5.5199E+001
		258.87	0.52	5.0272E+001		1.1760E+000
		274.80	0.47	6.3730E+001		-5.4668E+001
		295.22*	19.30	1.3836E+000		1.4078E+001
		351.93*	37.60	6.5419E-001		1.4771E+001
		462.00*	0.22	1.1526E+002		1.6899E+003
		533.66	0.19	1.5461E+002		2.0428E+001
		785.96*	1.07	1.7014E+001		1.0558E+002
		839.04	0.59	5.9758E+001		3.5982E+000
+	Ra-224	81.07	0.13	3.8623E+002	4.49E+000	-9.3154E+002
		83.78*	0.22	1.5649E+002		7.2272E+002
		240.99*	4.10	4.4941E+000		1.0143E+002
+	Ra-226	81.07	0.20	2.5329E+002	1.03E+001	-6.1089E+002
		83.78*	0.33	1.0210E+002		4.7153E+002
		94.90	0.15	2.6044E+002		1.4611E+000
		186.21*	3.59	1.0266E+001		2.5701E+001
+	Ac-228	99.50*	1.26	3.1908E+001	9.29E-001	6.1202E+001
		129.07*	2.50	1.2169E+001		6.2071E+001
		209.25*	3.97	8.8562E+000		8.3672E+001
		270.24*	3.55	8.6001E+000		8.5086E+001
		328.00*	3.04	6.0869E+000		8.4069E+001
		338.32*	11.40	1.5897E+000		8.8450E+001
		409.46*	2.02	1.3545E+001		8.2159E+001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	5.8045E+000	9.29E-001	8.5099E+001
		755.31*	1.03	2.6892E+001		8.5502E+001
		772.29*	1.52	1.2582E+001		8.9412E+001
		794.94*	4.31	6.8761E+000		8.9793E+001
		835.70*	1.70	1.0112E+001		9.5098E+001
		911.20*	26.20	1.2690E+000		9.8275E+001
		964.79*	4.99	3.0965E+000		9.6111E+001
		968.96*	15.90	9.2942E-001		9.9871E+001
		1588.20*	3.06	5.5060E+000		1.0655E+002
		1630.62*	1.52	1.0222E+001		1.0654E+002
+	Th-228	84.37*	1.26	2.6950E+001	2.70E+001	1.2447E+002
		131.61	0.13	2.8177E+002		-1.4557E+002
		166.41	0.10	2.9961E+002		-3.9959E+001
		215.98*	0.25	1.2104E+002		1.0317E+002
	Pa-234m	258.23	0.07	3.5695E+002	2.65E+001	5.9879E+001
		742.81	0.09	3.1688E+002		-1.6449E+002
		766.36	0.32	1.0416E+002		-7.1184E+002
		786.27	0.05	6.2634E+002		-2.6464E+000
		1001.03	0.85	2.6461E+001		2.5648E+001
		1737.77	0.02	1.1582E+003		-1.3632E+002
	Th-234	63.30	3.75	3.2584E+001	1.01E+001	1.6101E+001
		92.59	4.33	1.0116E+001		1.2360E+002
		112.81	0.22	1.4757E+002		-3.8241E+001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

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***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
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Sample Title: UMR001-S004-0006-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Be-7	0.928	477.60*	10.44	4.19130E-001	4.67413E-001
Mn-54	0.924	834.84*	99.97	1.64536E+000	5.48330E-002
Mo-99	0.645	40.58 @	1.02		
		140.51*	89.60	3.41921E+000	8.26282E-001
		181.07	6.01		
		366.42	1.19		
		739.50	12.12		
Ce-141	0.951	40.82 @	2.67		
		145.44*	48.29	1.79627E-001	5.56260E-002
Eu-152m	0.994	89.85*	69.90	4.60197E+000	1.66824E-001
Eu-155	0.920	45.30	1.31		
		60.01	1.22		
		86.55*	30.70	1.46715E+001	5.36254E-001
		105.31*	21.10	4.74352E+000	2.61051E-001
Tl-208	0.997	72.80* @	2.02	6.54690E+001	3.80386E+000
		74.97* @	3.41	2.53983E+002	9.13929E+000
		84.90* @	1.51	1.03861E+002	4.66865E+000
		277.36*	6.31	2.93030E+001	1.61586E+000
		510.77* @	22.60	3.44226E+001	1.28435E+000
		583.19*	84.50	3.07472E+001	1.00860E+000
		763.13* @	1.81	3.63302E+001	1.89505E+000
		860.56*	12.42	3.31853E+001	1.00963E+000
TL-208e	0.935	1592.53*	99.16	1.73380E+000	1.15104E-001
Bi-211	0.894	351.03*	13.00	4.27746E+001	1.81659E+000
Bi-212	0.947	39.86 @	1.06		
		727.33*	6.74	1.03121E+002	3.52433E+000
		785.37*	1.11	1.03197E+002	4.14604E+000
		1620.74*	1.51	1.00028E+002	4.31352E+000
		1806.00 @	0.09		
Pb-212	0.999	74.81*	10.40	8.32772E+001	3.84064E+000
		77.11*	17.50	6.90979E+001	3.15410E+000
		87.30*	7.81	5.81539E+001	2.76774E+000
		115.18* @	0.59	6.68935E+001	1.44649E+001
		238.63*	43.30	9.14220E+001	4.12057E+000
		300.09*	3.28	8.66642E+001	4.01844E+000
Bi-214	0.891	76.86* @	0.43	2.79929E+003	1.31256E+002
		89.81* @	0.24	1.31578E+003	6.71041E+001
		386.77 @	0.30		
		454.77 @	0.29		
		609.31*	45.49	1.48032E+001	4.88312E-001
		665.45* @	1.53	1.24424E+001	4.36998E+000

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.891	703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	1.40084E+001	6.99933E-001
		786.10*	@	0.31	3.64406E+002	6.04820E+001
		806.17*	@	1.26	1.58753E+001	4.51570E+000
		934.06*		3.10	1.44380E+001	1.52700E+000
		964.08*	@	0.36	1.30295E+003	5.50506E+001
		1051.96	@	0.31		
		1120.29*		14.91	1.67322E+001	6.56355E-001
		1133.66	@	0.25		
		1155.19*	@	1.63	2.71995E+001	3.80948E+000
		1207.68	@	0.45		
		1238.11*		5.79	1.69137E+001	1.03869E+000
		1280.96*	@	1.43	1.64744E+001	1.91472E+000
		1377.67*		4.00	1.51087E+001	1.32886E+000
		1385.31*	@	0.76	1.11846E+001	4.29436E+000
		1401.50*	@	1.27	1.97194E+001	2.01660E+000
		1407.98*	@	2.15	1.81582E+001	1.43877E+000
		1509.23*	@	2.11	1.63157E+001	1.28724E+000
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28*	@	1.15	1.62073E+001	2.10514E+000
		1683.99	@	0.22		
		1729.59*	@	2.92	1.57283E+001	1.67785E+000
		1764.49*		15.40	1.69253E+001	7.52336E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.951	53.28	@	1.20		
		74.81*		6.44	1.32626E+002	6.44044E+000
		77.11*		10.80	1.10417E+002	5.67228E+000
		87.30*		4.84	9.25423E+001	4.74009E+000
		242.00*		7.43	5.51994E+001	2.60762E+000
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	1.40784E+001	6.71816E-001
		351.93*		37.60	1.47713E+001	6.09603E-001
		462.00*	@	0.22	1.68987E+003	9.59247E+001
		533.66	@	0.19		
		785.96*	@	1.07	1.05576E+002	8.91031E+000
		839.04	@	0.59		
Rn-220	0.999	549.73*		0.11	6.75797E+001	2.22374E+001
Ra-224	0.952	81.07	@	0.13		
		83.78*	@	0.22	7.22723E+002	4.20156E+001
		240.99*		4.10	1.01434E+002	4.71550E+000
Ra-226	0.876	81.07	@	0.20		

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ra-226	0.876	83.78* @	0.33	4.71534E+002	2.73289E+001
		94.90 @	0.15		
		186.21*	3.59	2.57014E+001	2.54364E+000
Ac-228	0.996	99.50* @	1.26	6.12022E+001	7.41011E+000
		129.07* @	2.50	6.20710E+001	3.72058E+000
		209.25*	3.97	8.36724E+001	5.08689E+000
		270.24*	3.55	8.50856E+001	4.74012E+000
		328.00*	3.04	8.40693E+001	4.62788E+000
		338.32*	11.40	8.84497E+001	4.63471E+000
		409.46* @	2.02	8.21587E+001	4.98164E+000
		463.00*	4.45	8.50992E+001	5.69117E+000
		755.31* @	1.03	8.55022E+001	7.28536E+000
		772.29* @	1.52	8.94116E+001	4.81900E+000
		794.94*	4.31	8.97932E+001	4.07006E+000
		835.70* @	1.70	9.50984E+001	5.03762E+000
		911.20*	26.20	9.82750E+001	3.81132E+000
		964.79*	4.99	9.61113E+001	4.13719E+000
		968.96*	15.90	9.98714E+001	3.96628E+000
		1588.20*	3.06	1.06554E+002	5.32051E+000
		1630.62* @	1.52	1.06541E+002	5.80306E+000
Th-228	0.754	84.37*	1.26	1.24469E+002	5.93356E+000
		131.61 @	0.13		
		166.41 @	0.10		
		215.98*	0.25	1.03166E+002	2.65937E+001

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	Be-7		0.928	4.191300E-001	4.674133E-001
	Mn-54		0.924	2.946764E-002	5.727529E-002
	Mo-99	@	0.645	3.419214E+000	8.262818E-001
X	Cd-109		0.922		
	Ce-141	@	0.951	1.796270E-001	5.562600E-002
	Eu-152m		0.994	4.547729E+000	1.620827E-001
	Eu-155		0.920	3.698965E+000	2.114581E-001
X	Tm-170		0.989		
	Tl-208	@	0.997	3.161613E+001	6.290624E-001
	TL-208e		0.935	1.733798E+000	1.151042E-001
	Bi-211		0.894	5.990706E+000	2.528038E+000
	Bi-212	@	0.947	9.797062E+001	2.047755E+000
	Pb-212	@	0.999	5.764123E+001	1.327088E+000
	Bi-214	@	0.891	1.550952E+001	2.821176E-001
	Pb-214	@	0.951	1.270251E+001	6.443676E-001
	Rn-220		0.999	6.757966E+001	2.223741E+001
	Ra-224	@	0.952	7.791423E+001	4.699813E+000
	Ra-226	@	0.876	2.561860E+001	2.506368E+000
	Ac-228	@	0.996	9.339525E+001	9.563772E-001
	Th-228	@	0.754	6.796032E+001	5.612091E+000
X	Th-231		0.827		

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/2/2016 3:23:17 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m 7	93.40	1.9705E+000	1.32		
m 10	108.93	2.3201E-001	8.88		
m 14	144.05	4.3678E-002	29.61	Tol.	Ra-223
16	154.06	4.0178E-001	10.42	Sum	
18	199.43	1.4405E-001	29.48	Sum	
23	252.58	6.2263E-002	46.48		
26	288.16	1.5613E-001	14.43	Sum	
29	321.76	3.8474E-002	54.64	Sum	
m 31	332.43	1.4328E-001	7.89	Sum	
m 33	340.87	1.4379E-001	7.52	Sum	
36	440.33	4.7522E-002	27.51	Sum	
37	452.74	1.5185E-001	15.10	Sum	
39	469.46	6.2104E-003	230.45	Sum	
41	503.65	5.4060E-002	29.06	Sum	
M 43	546.48	3.5025E-002	22.91	Sum	
45	562.39	2.6890E-001	7.98	Sum	
46	571.43	5.4648E-002	30.91	D-Esc.	
49	625.27	9.8445E-003	111.94	Sum	
50	651.23	2.0820E-002	57.94	Sum	
M 52	701.73	5.0608E-002	16.36	Sum	
m 53	707.20	2.5506E-002	28.35	Tol.	Ag-110m
M 59	781.97	1.1177E-001	6.21		
M 63	830.36	1.2262E-001	5.45	Sum	
m 65	840.14	2.2774E-001	3.40	Sum	
M 67	870.20	1.9181E-002	26.76	Sum	
m 68	873.82	4.1867E-002	14.45	S-Esc.	
69	893.29	7.3052E-002	14.36	Sum	
70	904.13	1.3361E-001	9.67	Sum	
73	952.13	2.8815E-002	33.73	Sum	
M 74	958.47	5.4228E-002	9.19	Sum	
77	988.41	3.4120E-002	19.79	Sum	
78	1001.04	2.8563E-002	31.25	Sum	
79	1033.30	3.8238E-002	21.67	Sum	
80	1065.18	4.6857E-002	18.66	Sum	
81	1078.72	1.0877E-001	10.15	S-Esc.	
82	1093.94	1.1138E-001	10.17	Sum	
83	1110.52	8.6382E-002	11.95	S-Esc.	
87	1247.24	1.0445E-001	14.29	Sum	
m 89	1287.22	3.1609E-002	14.32		
94	1459.68	1.9430E-001	5.93	Sum	
M 95	1496.35	1.5513E-001	3.74	Sum	
m 96	1502.06	7.5423E-002	6.06	Sum	
m 98	1513.32	5.8717E-002	7.25	Sum	
99	1557.64	2.4029E-002	27.33	Sum	

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
100	1581.09	1.0592E-001	9.33	Sum	
m104	1625.48	3.2213E-002	11.26	Sum	
106	1638.99	7.4408E-002	11.98	Sum	
m108	1667.02	2.2371E-002	15.69	Sum	
111	1807.41	3.0771E-002	25.12	Sum	
112	1848.63	4.6987E-002	14.70	Sum	
113	1953.90	9.3081E-003	99.45		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S002-0612-01.CNF

Report Generated On              : 12/2/2016   6:28:52 PM

Sample Title                     : UMR001-S002-0612-01
Sample Description               : 450 cc Soil
Sample Identification            :
Sample Type                      :
Sample Geometry                  :

Peak Locate Threshold            :  3.00
Peak Locate Range (in channels)  :   100 -  8192
Peak Area Range (in channels)    :   100 -  8192
Identification Energy Tolerance  :    1.000 keV

Sample Size                      :  7.532E+002 GWET

Sample Taken On                  : 11/18/2016 10:38:00 AM
Acquisition Started              : 12/2/2016   4:28:47 PM

Live Time                        :     7200.0 seconds
Real Time                        :     7202.2 seconds

Dead Time                        :   0.03 %

            Energy Calibration Used Done On       : 10/24/2016
            Efficiency Calibration Used Done On   : 9/27/2016
            Efficiency ID                         : ERT0101
```

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S002-0612-01
Peak Analysis Performed on: 12/2/2016 6:28:52 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	294-	315	300.20	75.01	0.92	2.51E+002	25.31	5.96E+002
m	2	294-	315	309.11	77.24	0.93	4.65E+002	30.33	5.73E+002
	3	345-	354	350.07	87.48	1.03	1.32E+002	34.42	4.65E+002
	4	366-	385	371.32	92.79	1.11	2.57E+002	58.36	8.90E+002
	5	736-	755	744.17	186.01	1.26	4.07E+002	50.91	6.18E+002
	6	833-	847	837.61	209.37	1.02	6.01E+001	37.18	4.56E+002
M	7	947-	975	954.61	238.62	1.13	1.19E+003	38.43	3.38E+002
m	8	947-	975	967.76	241.91	1.13	3.61E+002	23.79	3.24E+002
	9	1172-	1194	1180.87	295.19	1.23	6.91E+002	45.64	3.51E+002
	10	1196-	1206	1200.22	300.03	1.24	8.92E+001	21.38	1.52E+002
	11	1345-	1360	1353.01	338.23	1.07	1.90E+002	30.74	2.51E+002
	12	1397-	1417	1407.50	351.86	1.14	1.31E+003	46.16	2.28E+002
	13	1844-	1859	1852.47	463.11	1.19	6.70E+001	22.49	1.46E+002
	14	2032-	2053	2042.65	510.66	1.43	2.63E+002	31.64	1.96E+002
	15	2325-	2343	2331.92	582.98	1.11	4.04E+002	28.71	1.24E+002
	16	2427-	2447	2436.51	609.13	1.40	9.64E+002	38.35	1.38E+002
	17	2640-	2650	2645.10	661.28	0.63	2.82E+001	13.49	6.38E+001
	18	2903-	2916	2908.47	727.13	1.35	6.92E+001	16.54	7.38E+001
	19	3065-	3081	3072.41	768.12	0.42	8.28E+001	19.05	8.93E+001
	20	3434-	3451	3442.08	860.54	1.37	5.54E+001	15.90	6.06E+001
	21	3633-	3655	3643.86	910.99	1.52	3.21E+002	22.69	4.94E+001
	22	3868-	3886	3875.17	968.83	1.67	1.76E+002	19.22	5.74E+001
	23	4471-	4491	4481.21	1120.35	1.67	2.49E+002	20.01	4.18E+001
	24	4943-	4962	4953.45	1238.42	1.21	1.01E+002	17.34	5.67E+001
	25	5504-	5518	5511.25	1377.88	1.06	5.08E+001	11.50	2.82E+001
	26	5830-	5856	5844.40	1461.17	1.86	1.10E+003	34.84	2.66E+001
	27	6348-	6360	6354.18	1588.63	0.50	2.15E+001	8.67	1.85E+001
	28	7050-	7072	7061.30	1765.43	1.72	2.14E+002	15.38	5.75E+000
	29	7388-	7401	7394.01	1848.61	1.33	3.42E+001	8.99	1.68E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S002-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	4.6811E-001	4.68E-001	8.8006E+000
	Co-60	1173.23	99.85	6.4354E-002	5.55E-002	-3.9768E-002
		1332.49	99.98	5.5518E-002		-3.8389E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
+	Cs-137	32.06	5.54	8.8048E+002	3.54E-002	-2.4438E+002
		661.66*	84.99	3.5395E-002		1.6522E-002
+	Tl-208	72.80	2.02	6.3895E+000	5.43E-002	-3.3725E-002
		74.97*	3.41	2.1924E+000		3.3648E+000
		84.90	1.51	5.1432E+000		5.5916E-001
		277.36	6.31	7.5362E-001		1.5813E-001
		510.77*	22.60	2.7020E-001		1.7281E-001
		583.19*	84.50	5.4322E-002		2.1651E-001
		763.13	1.81	3.2032E+000		-1.9361E+000
		860.56*	12.42	3.3285E-001		2.7114E-001
+	Bi-212	39.86	1.06	4.7083E+002	5.54E-001	1.0983E+002
		727.33*	6.74	5.5439E-001		5.5481E-001
		785.37	1.11	4.5442E+000		1.1136E+000
		1620.74	1.51	3.0836E+000		9.1475E-001
		1806.00	0.09	4.9930E+001		1.2877E+001
+	Pb-212	74.81*	10.40	7.1885E-001	7.45E-002	1.1033E+000
		77.11*	17.50	3.7944E-001		1.1010E+000
		87.30*	7.81	5.8370E-001		5.0310E-001
		115.18	0.59	7.9641E+000		-2.3263E+000
		238.63*	43.30	7.4469E-002		6.8387E-001
		300.09*	3.28	8.1102E-001		7.8703E-001
+	Bi-214	76.86*	0.43	1.5369E+001	1.11E-001	4.4593E+001
		89.81	0.24	2.9487E+001		-4.1092E+000
		386.77	0.30	1.5484E+001		3.1649E+000
		454.77	0.29	1.5545E+001		2.0884E+000
		609.31*	45.49	1.1074E-001		9.9470E-001
		665.45	1.53	3.6205E+000		-8.9070E-001
		703.11	0.48	1.1123E+001		4.7798E+000
		719.86	0.39	1.2595E+001		-1.8595E+000
		768.36*	4.89	9.1152E-001		9.3641E-001
		786.10	0.31	1.6549E+001		4.6532E+000
		806.17	1.26	4.0476E+000		3.6574E-001
		934.06	3.10	1.8843E+000		9.1730E-001
		964.08	0.36	2.2901E+001		3.1807E+000
		1051.96	0.31	1.7075E+001		-8.2844E+000
		1120.29*	14.91	2.8817E-001		1.1985E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	2.2193E+001	1.11E-001	-3.7580E+000
		1155.19	1.63	4.1910E+000		3.0678E+000
		1207.68	0.45	1.5171E+001		5.2501E+000
		1238.11*	5.79	9.0600E-001		1.3420E+000
		1280.96	1.43	4.5415E+000		-2.7454E-001
		1377.67*	4.00	9.2229E-001		1.0475E+000
		1385.31	0.76	7.1225E+000		-5.1801E-001
		1401.50	1.27	4.4578E+000		-2.3383E+000
		1407.98	2.15	2.7924E+000		-1.3679E+000
		1509.23	2.11	2.5008E+000		-1.3318E-001
		1538.50	0.38	1.4224E+001		1.2550E+001
		1543.32	0.20	2.6631E+001		1.8840E+001
		1583.22	0.69	7.8592E+000		1.5196E+000
		1594.73	0.25	2.5023E+001		-2.6967E+000
		1599.31	0.23	2.2979E+001		2.9299E+000
		1661.28	1.15	3.7900E+000		1.2326E+000
		1683.99	0.22	1.8785E+001		-1.1076E+001
		1729.59	2.92	2.0166E+000		2.1314E+000
		1764.49*	15.40	1.7874E-001		1.3344E+000
		1847.42	2.11	3.0879E+000		2.0801E+000
		1873.16	0.22	2.0049E+001		-4.8686E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	3.9564E+001	1.16E-001	4.4173E+000
		74.81*	6.44	1.1446E+000		1.7567E+000
		77.11*	10.80	6.0621E-001		1.7590E+000
		87.30*	4.84	9.2867E-001		8.0044E-001
		242.00*	7.43	4.1144E-001		1.2291E+000
		258.87	0.52	8.4450E+000		4.7785E+000
		274.80	0.47	9.5653E+000		-7.5270E+000
		295.22*	19.30	2.5787E-001		1.0119E+000
		351.93*	37.60	1.1593E-001		1.0936E+000
		462.00	0.22	2.2744E+001		8.6407E+000
		533.66	0.19	2.4743E+001		1.4604E+000
		785.96	1.07	4.8197E+000		2.3021E+000
		839.04	0.59	9.6922E+000		7.0242E+000
+	Ra-224	81.07	0.13	6.2105E+001	7.56E-001	-4.4437E+001
		83.78	0.22	3.4843E+001		-1.8534E+000
		240.99*	4.10	7.5621E-001		2.2591E+000
+	Ra-226	81.07	0.20	4.0719E+001	1.42E+000	-2.9135E+001
		83.78	0.33	2.2728E+001		-1.2090E+000
		94.90	0.15	4.1391E+001		-2.4036E+000
		186.21*	3.59	1.4226E+000		2.2723E+000
+	Ac-228	99.50	1.26	4.0677E+000	1.67E-001	1.4834E+000
		129.07	2.50	2.1064E+000		6.3317E-001
		209.25*	3.97	1.0402E+000		3.6367E-001
		270.24	3.55	1.3009E+000		1.7210E-001
		328.00	3.04	1.5835E+000		8.3484E-001
		338.32*	11.40	3.5796E-001		5.2224E-001
		409.46	2.02	2.2869E+000		7.7345E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	8.7768E-001	1.67E-001	5.8697E-001
		755.31	1.03	4.9904E+000		9.5959E-001
		772.29	1.52	4.3026E+000		9.8598E-001
		794.94	4.31	1.3078E+000		3.2438E-001
		835.70	1.70	3.3280E+000		2.0820E+000
		911.20*	26.20	1.6652E-001		7.6039E-001
		964.79	4.99	1.7308E+000		1.6770E-001
		968.96*	15.90	2.7956E-001		7.2813E-001
		1588.20*	3.06	1.1112E+000		6.4967E-001
		1630.62	1.52	3.0766E+000		6.0389E-001
	Th-228	84.37	1.26	6.0484E+000	6.05E+000	-4.0373E-001
		131.61	0.13	4.0529E+001		2.7862E+001
		166.41	0.10	4.5719E+001		1.3612E+001
		215.98	0.25	1.7968E+001		-5.2051E+000
	Pa-234m	258.23	0.07	5.9971E+001	6.61E+000	3.1438E+001
		742.81	0.09	5.5586E+001		2.1903E+001
		766.36	0.32	1.9725E+001		1.8213E+001
		786.27	0.05	9.5469E+001		1.9251E+001
		1001.03	0.85	6.6147E+000		-3.5891E+000
		1737.77	0.02	2.1709E+002		-2.0256E+002
+	Th-234	63.30	3.75	5.2145E+000	1.63E+000	2.2961E+000
		92.59*	4.33	1.6261E+000		1.0953E+000
		112.81	0.22	2.1695E+001		-1.1961E+001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S002-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.980	1460.82*		10.55	8.80061E+000	3.68171E-001
Cs-137	0.974	32.06	@	5.54		
		661.66*		84.99	1.65216E-002	7.92230E-003
Tl-208	0.836	72.80	@	2.02		
		74.97*	@	3.41	3.36485E+000	3.59253E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	1.72812E-001	6.00567E-002
		583.19*		84.50	2.16508E-001	1.72223E-002
		763.13	@	1.81		
		860.56*		12.42	2.71139E-001	7.80734E-002
Bi-211	0.897	351.03*		13.00	3.16699E+000	1.71429E-001
Bi-212	0.570	39.86	@	1.06		
		727.33*		6.74	5.54813E-001	1.33698E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.985	74.81*		10.40	1.10328E+000	1.22017E-001
		77.11*		17.50	1.10097E+000	8.73239E-002
		87.30*		7.81	5.03100E-001	1.32871E-001
		115.18	@	0.59		
		238.63*		43.30	6.83865E-001	3.82271E-002
		300.09*		3.28	7.87027E-001	1.91428E-001
Bi-214	0.656	76.86*	@	0.43	4.45934E+001	3.56910E+000
		89.81	@	0.24		
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	9.94702E-001	4.99227E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	9.36407E-001	2.16874E-001
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08	@	0.36		
		1051.96	@	0.31		
		1120.29*		14.91	1.19854E+000	1.00666E-001
		1133.66	@	0.25		
		1155.19	@	1.63		
		1207.68	@	0.45		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.656	1238.11*		5.79	1.34201E+000	2.32948E-001
		1280.96	@	1.43		
		1377.67*		4.00	1.04745E+000	2.39245E-001
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	1.33443E+000	1.09074E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.943	53.28	@	1.20		
		74.81*		6.44	1.75671E+000	1.96111E-001
		77.11*		10.80	1.75896E+000	1.45541E-001
		87.30*		4.84	8.00435E-001	2.11940E-001
		242.00*		7.43	1.22914E+000	9.88772E-002
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	1.01187E+000	7.89951E-002
		351.93*		37.60	1.09363E+000	5.81745E-002
		462.00	@	0.22		
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.771	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	2.25912E+000	1.80741E-001
Ra-226	0.774	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	2.27227E+000	3.42322E-001
Ac-228	0.489	99.50	@	1.26		
		129.07	@	2.50		
		209.25*		3.97	3.63666E-001	2.26029E-001
		270.24		3.55		
		328.00		3.04		
		338.32*		11.40	5.22238E-001	8.86250E-002
		409.46	@	2.02		
		463.00*		4.45	5.86971E-001	2.00758E-001
		755.31	@	1.03		
		772.29	@	1.52		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.489	794.94		4.31		
		835.70	@	1.70		
		911.20*		26.20	7.60391E-001	6.22073E-002
		964.79		4.99		
		968.96*		15.90	7.28126E-001	8.46340E-002
		1588.20*		3.06	6.49672E-001	2.63703E-001
		1630.62	@	1.52		
Th-234	0.454	63.30		3.75		
		92.59*		4.33	1.09534E+000	3.60475E-001
		112.81	@	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.980	8.800613E+000	3.681705E-001
X	Cd-109		0.951		
	Cs-137	@	0.974	1.652156E-002	7.922297E-003
	Tl-208	@	0.836	2.183711E-001	1.671469E-002
	Bi-211		0.897	8.070945E-001	2.485846E-001
	Bi-212	@	0.570	5.548134E-001	1.336981E-001
	Pb-212	@	0.985	6.177341E-001	3.336917E-002
	Bi-214	@	0.656	1.080335E+000	3.933135E-002
	Pb-214	@	0.943	8.149234E-001	6.418617E-002
	Ra-224	@	0.771	7.613172E-001	2.140699E-001
	Ra-226	@	0.774	2.272274E+000	3.423222E-001
	Ac-228	@	0.489	6.773824E-001	4.137656E-002
	Th-234	@	0.454	1.095343E+000	3.604746E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 12/2/2016 6:28:52 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
29	1848.61	4.7535E-003	26.25		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

Date: _____

9626 Niagara Falls Blvd Onsite Gamma Spec Screening Lab

Gamma Spectroscopy Detector work sheet.

Counted by (Initial,date)	Geometry Description	Analysis Number/Sample ID/Remarks	Sample Collection mmddyy hh:mm	Sample Quantity	Sample Units (GWET,GDRY,L, ft^3, etc)	Count Time (s)	Report Matches Sample Parameters (Initial, date)
cc/120316	450 cc SOIL	UMR001-S003-0006-01	11-18-16 1125	846.0	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S004-0006-01	11-18-16 12:30	808.9	GWET	7200	
cc/120216	450 cc SOIL	UMR001-S002-0612-01	11-18-16 10:38	753.2	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-0006-01	11-18-16 1040	721.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1218-01	11-18-16 1035	555.9	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S002-1824-01	11-18-16 1030	382.8	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S001-0006-01	11-18-16 0958	490.1	GWET	7200	
cc/120316	450 cc SOIL	UMR001-S003-0612-01	11-18-16 1122	530.4	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1218-01	11-18-16 1118	534.5	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S003-1824-01	11-18-16 1115	493.5	GWET	7200	

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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```

Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S003-0612-01.CNF

Report Generated On	: 12/5/2016 10:21:32 AM
Sample Title	: UMR001-S003-0612-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 5.304E+002 GWET
Sample Taken On	: 11/18/2016 11:22:00 AM
Acquisition Started	: 12/5/2016 8:21:28 AM
Live Time	: 7200.0 seconds
Real Time	: 7202.5 seconds
Dead Time	: 0.03 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S003-0612-01
Peak Analysis Performed on: 12/5/2016 10:21:32 AM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	250-	258	254.33	63.54	0.58	4.81E+001	35.31	5.62E+002
M	2	295-	316	300.04	74.97	0.93	6.42E+002	36.26	9.13E+002
m	3	295-	316	309.12	77.24	0.94	1.03E+003	41.82	9.26E+002
M	4	344-	389	349.72	87.39	1.01	4.21E+002	33.15	9.03E+002
m	5	344-	389	360.46	90.07	1.01	3.24E+002	30.29	9.03E+002
m	6	344-	389	373.56	93.35	1.02	4.01E+002	31.50	8.22E+002
	7	513-	523	516.57	129.10	1.14	1.81E+002	42.15	6.66E+002
	8	737-	755	744.12	186.00	0.89	2.57E+002	57.90	9.12E+002
	9	828-	843	837.03	209.23	1.12	3.65E+002	52.23	7.88E+002
M	10	948-	974	954.70	238.65	1.11	4.17E+003	68.42	5.40E+002
m	11	948-	974	965.23	241.28	1.11	5.16E+002	27.97	4.12E+002
	12	1075-	1088	1080.55	270.11	1.11	3.03E+002	37.40	3.93E+002
	13	1099-	1118	1109.43	277.33	0.75	1.41E+002	45.24	5.43E+002
	14	1172-	1187	1180.86	295.19	0.96	4.90E+002	39.01	3.44E+002
	15	1193-	1211	1200.18	300.02	0.89	3.40E+002	40.46	3.82E+002
	16	1305-	1318	1311.81	327.93	1.28	2.96E+002	31.79	2.60E+002
	17	1344-	1359	1353.04	338.24	1.15	8.27E+002	43.41	3.53E+002
	18	1401-	1419	1407.50	351.86	1.15	8.59E+002	44.94	3.39E+002
	19	1632-	1645	1637.46	409.35	1.32	1.25E+002	25.82	1.96E+002
	20	1844-	1857	1851.50	462.86	1.14	2.74E+002	26.84	1.62E+002
	21	2027-	2054	2042.64	510.65	1.20	6.56E+002	47.87	3.62E+002
	22	2243-	2257	2248.23	562.06	1.06	6.88E+001	22.00	1.43E+002
	23	2322-	2339	2331.84	582.96	1.26	1.44E+003	44.57	1.68E+002
	24	2425-	2447	2436.67	609.17	1.18	7.70E+002	37.80	1.70E+002
	25	2898-	2917	2908.47	727.13	1.38	3.20E+002	29.67	1.60E+002
	26	3016-	3026	3020.66	755.18	0.60	2.90E+001	15.66	9.00E+001
M	27	3048-	3095	3052.27	763.08	1.27	3.13E+001	8.83	5.61E+001
m	28	3048-	3095	3071.69	767.94	1.28	7.04E+001	11.75	8.41E+001
m	29	3048-	3095	3088.90	772.24	1.28	4.71E+001	10.57	8.66E+001
	30	3134-	3148	3141.11	785.30	0.98	4.42E+001	18.84	1.08E+002
	31	3171-	3190	3178.77	794.71	1.58	1.95E+002	23.45	1.00E+002
	32	3334-	3349	3341.31	835.35	0.37	5.17E+001	17.72	8.53E+001
	33	3432-	3451	3440.75	860.21	1.73	2.10E+002	24.13	1.05E+002
	34	3634-	3654	3643.95	911.01	1.51	1.04E+003	37.65	1.03E+002
	35	3728-	3743	3735.08	933.80	0.63	5.84E+001	14.80	5.26E+001
M	36	3849-	3885	3857.80	964.48	1.49	1.75E+002	15.37	8.17E+001
m	37	3849-	3885	3874.90	968.76	1.49	5.65E+002	25.68	1.04E+002
	38	4473-	4489	4480.57	1120.19	0.77	1.37E+002	18.71	6.84E+001
	39	4945-	4959	4953.02	1238.31	0.34	5.71E+001	16.27	7.09E+001
	40	5505-	5518	5511.17	1377.86	0.40	4.10E+001	11.74	3.40E+001
	41	5833-	5857	5844.26	1461.14	1.68	1.62E+003	42.63	4.81E+001
	42	6344-	6362	6354.21	1588.64	1.02	7.78E+001	14.30	3.72E+001

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
43	6478-	6494	6485.37	1621.43	0.36	4.15E+001	9.90	1.75E+001
44	6643-	6654	6648.32	1662.17	0.68	8.30E+000	6.59	1.37E+001
45	7050-	7072	7060.13	1765.13	1.17	1.25E+002	13.96	1.76E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S003-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	8.2442E-001	8.24E-001	1.8564E+001
	Co-60	1173.23	99.85	1.0303E-001	8.99E-002	1.9046E-002
		1332.49	99.98	8.9870E-002		4.6870E-003
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.5506E+003	1.09E-001	3.1452E+002
		661.66	84.99	1.0919E-001		5.1827E-002
+	Tl-208	72.80	2.02	1.2114E+001	8.74E-002	-6.6472E+000
		74.97*	3.41	3.8568E+000		1.2294E+001
		84.90	1.51	9.5229E+000		7.9712E-001
		277.36*	6.31	1.2811E+000		8.7621E-001
		510.77*	22.60	5.3410E-001		1.2838E+000
		583.19*	84.50	8.7428E-002		1.1153E+000
		763.13*	1.81	2.2839E+000		1.3768E+000
		860.56*	12.42	6.4397E-001		1.4592E+000
+	Bi-212	39.86	1.06	8.4078E+002	1.29E+000	3.2403E+002
		727.33*	6.74	1.2871E+000		3.6512E+000
		785.37*	1.11	6.1932E+000		3.2335E+000
		1620.74*	1.51	3.3268E+000		3.6724E+000
		1806.00	0.09	7.6693E+001		6.8626E+000
+	Pb-212	74.81*	10.40	1.2646E+000	1.32E-001	4.0310E+000
		77.11*	17.50	6.8416E-001		3.4580E+000
		87.30*	7.81	1.0861E+000		2.2856E+000
		115.18	0.59	1.4384E+001		4.4516E+000
		238.63*	43.30	1.3214E-001		3.4671E+000
		300.09*	3.28	2.1377E+000		4.2739E+000
+	Bi-214	76.86*	0.43	2.7639E+001	1.79E-001	1.3970E+002
		89.81*	0.24	3.2204E+001		5.2133E+001
		386.77	0.30	2.6044E+001		-4.6622E+000
		454.77	0.29	2.7922E+001		2.0698E+000
		609.31*	45.49	1.7876E-001		1.1285E+000
		665.45	1.53	5.9494E+000		2.3336E-001
		703.11	0.48	2.0158E+001		4.7944E+000
		719.86	0.39	2.3277E+001		-7.4254E+000
		768.36*	4.89	1.0125E+000		1.1307E+000
		786.10*	0.31	2.1808E+001		1.1386E+001
		806.17	1.26	7.0723E+000		4.4787E-001
		934.06*	3.10	1.7898E+000		1.6940E+000
		964.08*	0.36	1.5750E+001		4.4359E+001
		1051.96	0.31	2.7715E+001		4.7733E+000
		1120.29*	14.91	4.8265E-001		9.3282E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.7147E+001	1.79E-001	8.7684E+000
		1155.19	1.63	5.9364E+000		1.9662E-002
		1207.68	0.45	2.3972E+001		-3.8211E+000
		1238.11*	5.79	1.3122E+000		1.0743E+000
		1280.96	1.43	7.4447E+000		1.6938E+000
		1377.67*	4.00	1.4204E+000		1.1997E+000
		1385.31	0.76	1.0740E+001		-1.9321E+000
		1401.50	1.27	6.5437E+000		-6.9036E+000
		1407.98	2.15	4.1681E+000		2.5552E-001
		1509.23	2.11	3.8504E+000		4.8306E-001
		1538.50	0.38	2.0699E+001		-2.7828E+000
		1543.32	0.20	3.7576E+001		-1.3063E+000
		1583.22	0.69	1.6594E+001		5.0990E+000
		1594.73	0.25	4.9429E+001		3.6456E+001
		1599.31	0.23	3.9802E+001		6.9789E+000
		1661.28*	1.15	3.5163E+000		9.6405E-001
		1683.99	0.22	3.0149E+001		1.2804E+001
		1729.59	2.92	3.3471E+000		3.1698E+000
		1764.49*	15.40	3.9356E-001		1.0895E+000
		1847.42	2.11	3.8154E+000		8.4528E-002
		1873.16	0.22	3.7419E+001		1.6433E+001
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	6.7514E+001	1.94E-001	-3.1434E+001
		74.81*	6.44	2.0083E+000		6.4017E+000
		77.11*	10.80	1.0902E+000		5.5103E+000
		87.30*	4.84	1.7234E+000		3.6269E+000
		242.00*	7.43	6.5699E-001		2.4895E+000
		258.87	0.52	1.4440E+001		4.8438E+000
		274.80	0.47	1.7234E+001		1.4972E+000
		295.22*	19.30	3.1616E-001		1.0188E+000
		351.93*	37.60	1.9402E-001		1.0196E+000
		462.00*	0.22	2.4949E+001		6.7670E+001
		533.66	0.19	4.4966E+001		-1.2735E+001
		785.96*	1.07	6.3181E+000		3.2987E+000
		839.04	0.59	1.7271E+001		7.3233E+000
+	Ra-224	81.07	0.13	1.1102E+002	1.21E+000	-9.5783E+001
		83.78	0.22	6.3351E+001		1.0992E+001
		240.99*	4.10	1.2107E+000		4.5876E+000
+	Ra-226	81.07	0.20	7.2598E+001	2.39E+000	-6.2637E+001
		83.78	0.33	4.1216E+001		7.1515E+000
		94.90	0.15	7.0981E+001		2.6891E+000
		186.21*	3.59	2.3884E+000		1.8671E+000
+	Ac-228	99.50	1.26	6.9103E+000	3.22E-001	2.0925E+000
		129.07*	2.50	2.4773E+000		2.3794E+000
		209.25*	3.97	1.9716E+000		3.1490E+000
		270.24*	3.55	1.7081E+000		3.2990E+000
		328.00*	3.04	1.8228E+000		4.2521E+000
		338.32*	11.40	6.0139E-001		3.2308E+000
		409.46*	2.02	2.7917E+000		3.1464E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.2599E+000	3.22E-001	3.4174E+000
		755.31*	1.03	5.4528E+000		2.2224E+000
		772.29*	1.52	3.3739E+000		2.4862E+000
		794.94*	4.31	1.7149E+000		3.7040E+000
		835.70*	1.70	3.8891E+000		2.5758E+000
		911.20*	26.20	3.2221E-001		3.5644E+000
		964.79*	4.99	1.1650E+000		3.2813E+000
		968.96*	15.90	4.1261E-001		3.3359E+000
		1588.20*	3.06	2.3676E+000		3.3471E+000
		1630.62	1.52	6.5651E+000		-5.3707E-001
	Th-228	84.37	1.26	1.1102E+001	1.11E+001	2.8280E+000
		131.61	0.13	7.3880E+001		4.5576E+001
		166.41	0.10	7.6628E+001		-4.1685E+001
		215.98	0.25	3.3536E+001		-4.8702E+000
	Pa-234m	258.23	0.07	1.0217E+002	1.07E+001	5.6522E+001
		742.81	0.09	9.9497E+001		2.1120E+001
		766.36	0.32	3.0166E+001		-2.1822E+000
		786.27	0.05	1.8902E+002		1.7121E+002
		1001.03	0.85	1.0688E+001		1.9861E+000
		1737.77	0.02	3.4877E+002		-5.5799E+002
+	Th-234	63.30*	3.75	5.9224E+000	1.68E+000	5.0239E-001
		92.59*	4.33	1.6849E+000		2.7681E+000
		112.81	0.22	3.8288E+001		-1.6566E+001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S003-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.984	1460.82*		10.55	1.85635E+001	6.97875E-001
Eu-152m	0.992	89.85*		69.90	1.82410E-001	1.80848E-002
Tl-208	0.948	72.80	@	2.02		
		74.97*	@	3.41	1.22940E+001	8.14749E-001
		84.90	@	1.51		
		277.36*		6.31	8.76205E-001	2.84337E-001
		510.77*	@	22.60	1.28384E+000	1.34665E-001
		583.19*		84.50	1.11525E+000	5.01166E-002
		763.13*	@	1.81	1.37678E+000	3.89875E-001
		860.56*		12.42	1.45924E+000	1.71885E-001
Bi-211	0.896	351.03*		13.00	2.95334E+000	1.97073E-001
Bi-212	0.947	39.86	@	1.06		
		727.33*		6.74	3.65124E+000	3.57631E-001
		785.37*		1.11	3.23348E+000	1.38051E+000
		1620.74*		1.51	3.67239E+000	8.83126E-001
		1806.00	@	0.09		
Pb-212	0.986	74.81*		10.40	4.03103E+000	2.91353E-001
		77.11*		17.50	3.45800E+000	2.10185E-001
		87.30*		7.81	2.28556E+000	2.08343E-001
		115.18	@	0.59		
		238.63*		43.30	3.46713E+000	1.66220E-001
		300.09*		3.28	4.27389E+000	5.37828E-001
Bi-214	0.730	76.86*	@	0.43	1.39697E+002	8.62213E+000
		89.81*	@	0.24	5.21335E+001	5.49665E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	1.12854E+000	6.52670E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	1.13069E+000	1.90982E-001
		786.10*	@	0.31	1.13858E+001	5.19541E+000
		806.17	@	1.26		
		934.06*		3.10	1.69400E+000	4.31490E-001
		964.08*	@	0.36	4.43591E+001	4.28905E+000
		1051.96	@	0.31		
		1120.29*		14.91	9.32817E-001	1.29844E-001
		1133.66	@	0.25		
		1155.19	@	1.63		
		1207.68	@	0.45		
		1238.11*		5.79	1.07425E+000	3.07766E-001

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.730	1280.96	@	1.43		
		1377.67*		4.00	1.19968E+000	3.45705E-001
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28*	@	1.15	9.64046E-001	7.66390E-001
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	1.08953E+000	1.32744E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.953	53.28	@	1.20		
		74.81*		6.44	6.40172E+000	4.72830E-001
		77.11*		10.80	5.51027E+000	3.59220E-001
		87.30*		4.84	3.62686E+000	3.37666E-001
		242.00*		7.43	2.48950E+000	1.77434E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	1.01882E+000	9.15391E-002
		351.93*		37.60	1.01962E+000	6.72664E-002
		462.00*	@	0.22	6.76700E+001	7.57102E+000
		533.66	@	0.19		
		785.96*	@	1.07	3.29869E+000	1.42948E+000
		839.04	@	0.59		
Ra-224	0.878	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	4.58758E+000	3.24694E-001
Ra-226	0.773	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	1.86710E+000	5.31983E-001
Ac-228	0.945	99.50	@	1.26		
		129.07*	@	2.50	2.37935E+000	5.62631E-001
		209.25*		3.97	3.14898E+000	4.83267E-001
		270.24*		3.55	3.29903E+000	4.40475E-001
		328.00*		3.04	4.25213E+000	5.09054E-001
		338.32*		11.40	3.23080E+000	2.38862E-001
		409.46*	@	2.02	3.14635E+000	6.66527E-001
		463.00*		4.45	3.41736E+000	4.00980E-001
		755.31*	@	1.03	2.22238E+000	1.20553E+000
		772.29*	@	1.52	2.48619E+000	5.70050E-001
		794.94*		4.31	3.70399E+000	4.70037E-001

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.945	835.70* @	1.70	2.57578E+000	8.91710E-001
		911.20*	26.20	3.56437E+000	1.88388E-001
		964.79*	4.99	3.28134E+000	3.18420E-001
		968.96*	15.90	3.33590E+000	2.00168E-001
		1588.20*	3.06	3.34708E+000	6.34569E-001
		1630.62 @	1.52		
Th-234	0.893	63.30*	3.75	5.02389E-001	1.26046E+000
		92.59*	4.33	2.76807E+000	3.11218E-001
		112.81 @	0.22		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.984	1.856351E+001	6.978752E-001
X	Mn-54		0.959		
X	Cd-109		0.936		
	Eu-152m		0.992	1.785574E-001	1.801777E-002
	Tl-208	@	0.948	1.136583E+000	4.663273E-002
	Bi-211		0.896	4.265893E-001	3.173386E-001
	Bi-212	@	0.947	3.569940E+000	3.178263E-001
	Pb-212	@	0.986	2.881387E+000	1.012212E-001
	Bi-214	@	0.730	1.101022E+000	4.971534E-002
	Pb-214	@	0.953	8.723442E-001	8.715555E-002
	Ra-224	@	0.878	2.980052E+000	3.578982E-001
	Ra-226	@	0.773	1.867101E+000	5.319828E-001
	Ac-228	@	0.945	3.412425E+000	8.450946E-002
	Th-234	@	0.893	2.637881E+000	3.021444E-001

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 12/5/2016 10:21:32 AM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
22	562.06	9.5597E-003	31.97	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S003-1218-01.CNF

Report Generated On	: 12/5/2016 12:40:17 PM
Sample Title	: UMR001-S003-1218-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 5.345E+002 GWET
Sample Taken On	: 11/18/2016 11:18:00 AM
Acquisition Started	: 12/5/2016 10:40:13 AM
Live Time	: 7200.0 seconds
Real Time	: 7201.9 seconds
Dead Time	: 0.03 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S003-1218-01
Peak Analysis Performed on: 12/5/2016 12:40:17 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	294-	318	299.90	74.93	1.01	3.46E+002	26.38	4.79E+002
m	2	294-	318	308.99	77.20	1.02	6.23E+002	31.77	5.11E+002
M	3	343-	387	349.35	87.29	1.01	1.75E+002	23.11	5.58E+002
m	4	343-	387	360.61	90.11	1.01	1.42E+002	21.14	5.11E+002
m	5	343-	387	372.52	93.09	1.02	2.71E+002	25.38	4.57E+002
	6	513-	523	516.77	129.15	0.43	9.64E+001	31.09	3.65E+002
	7	733-	752	744.05	185.98	1.31	2.98E+002	43.88	4.65E+002
	8	828-	843	837.51	209.35	1.12	1.22E+002	36.27	3.96E+002
M	9	942-	974	954.58	238.61	1.14	1.88E+003	46.70	2.95E+002
m	10	942-	974	965.92	241.45	1.14	2.96E+002	21.01	2.28E+002
	11	1073-	1090	1080.61	270.13	1.09	1.36E+002	32.53	2.83E+002
	12	1173-	1190	1180.90	295.20	0.90	3.25E+002	35.51	2.87E+002
	13	1195-	1208	1200.54	300.11	0.75	9.87E+001	23.71	1.67E+002
	14	1306-	1322	1311.13	327.76	0.91	1.29E+002	26.04	1.73E+002
	15	1344-	1361	1352.88	338.20	1.11	3.37E+002	32.99	2.30E+002
	16	1391-	1416	1407.39	351.83	1.16	6.15E+002	42.54	2.74E+002
	17	1632-	1642	1637.01	409.24	1.00	6.34E+001	17.66	1.04E+002
	18	1843-	1859	1851.67	462.91	1.10	1.24E+002	22.32	1.19E+002
	19	2027-	2054	2042.05	510.51	1.32	4.23E+002	35.44	1.85E+002
	20	2325-	2342	2331.86	582.97	1.38	6.55E+002	31.49	1.03E+002
	21	2426-	2449	2436.36	609.09	1.31	5.15E+002	31.64	1.22E+002
	22	2901-	2915	2908.29	727.08	0.96	1.27E+002	17.48	6.20E+001
	23	3065-	3076	3071.56	767.91	0.61	1.15E+001	14.77	8.25E+001
	24	3170-	3187	3179.01	794.77	0.99	6.98E+001	17.32	7.02E+001
	25	3433-	3451	3441.54	860.41	1.29	6.86E+001	16.82	6.34E+001
	26	3634-	3654	3643.36	910.87	1.42	4.42E+002	26.21	6.84E+001
M	27	3849-	3887	3858.20	964.58	1.65	7.63E+001	11.36	7.41E+001
m	28	3849-	3887	3874.92	968.76	1.65	2.57E+002	17.59	5.74E+001
	29	4470-	4490	4479.46	1119.91	1.77	1.07E+002	17.32	5.28E+001
	30	5830-	5856	5844.04	1461.09	1.87	1.64E+003	42.46	3.72E+001
	31	6346-	6361	6353.01	1588.34	1.14	4.35E+001	9.09	1.25E+001
	32	6481-	6492	6486.07	1621.61	0.53	1.54E+001	6.09	8.58E+000
	33	7053-	7069	7060.27	1765.17	0.66	7.73E+001	10.84	1.28E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S003-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	7.5908E-001	7.59E-001	1.8615E+001
	Co-60	1173.23	99.85	9.7819E-002	7.91E-002	3.6455E-002
		1332.49	99.98	7.9060E-002		1.5065E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.1937E+003	8.03E-002	4.0372E+002
		661.66	84.99	8.0264E-002		3.0338E-002
+	Tl-208	72.80	2.02	8.7140E+000	6.92E-002	-1.7196E+000
		74.97*	3.41	2.7927E+000		6.5788E+000
		84.90	1.51	6.8826E+000		2.5314E+000
		277.36	6.31	9.5948E-001		3.3538E-001
		510.77*	22.60	4.0019E-001		6.6188E-001
		583.19*	84.50	6.9168E-002		4.9951E-001
		763.13	1.81	4.3643E+000		-1.3167E+000
		860.56*	12.42	4.8937E-001		4.7402E-001
+	Bi-212	39.86	1.06	6.5143E+002	7.34E-001	3.3632E+002
		727.33*	6.74	7.3418E-001		1.4387E+000
		785.37	1.11	7.0483E+000		2.0743E+000
		1620.74*	1.51	2.1364E+000		1.3528E+000
		1806.00	0.09	6.3558E+001		-1.7120E+001
+	Pb-212	74.81*	10.40	9.1567E-001	9.87E-002	2.1571E+000
		77.11*	17.50	5.0752E-001		2.0879E+000
		87.30*	7.81	8.5273E-001		9.4133E-001
		115.18	0.59	1.0620E+001		3.4530E+000
		238.63*	43.30	9.8731E-002		1.5459E+000
		300.09*	3.28	1.2822E+000		1.2308E+000
+	Bi-214	76.86*	0.43	2.0501E+001	1.53E-001	8.4338E+001
		89.81*	0.24	2.4113E+001		2.2610E+001
		386.77	0.30	1.9842E+001		4.2251E+000
		454.77	0.29	2.1871E+001		1.3051E-001
		609.31*	45.49	1.5302E-001		7.4805E-001
		665.45	1.53	4.4828E+000		-2.0492E+000
		703.11	0.48	1.5674E+001		7.0537E+000
		719.86	0.39	1.8499E+001		-1.4354E+000
		768.36*	4.89	1.1086E+000		1.8322E-001
		786.10	0.31	2.6089E+001		2.4613E+001
		806.17	1.26	6.0599E+000		3.2410E+000
		934.06	3.10	2.5631E+000		1.7168E+000
		964.08*	0.36	1.4916E+001		1.9202E+001
		1051.96	0.31	2.6645E+001		1.0376E+001
		1120.29*	14.91	4.5595E-001		7.2660E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.4862E+001	1.53E-001	-2.0053E-001
		1155.19	1.63	5.6447E+000		9.2748E-001
		1207.68	0.45	2.2231E+001		2.2583E+000
		1238.11	5.79	1.9170E+000		9.9554E-001
		1280.96	1.43	6.0998E+000		3.4625E+000
		1377.67	4.00	2.0562E+000		8.9008E-001
		1385.31	0.76	9.7658E+000		-1.0927E+001
		1401.50	1.27	6.1888E+000		-7.8956E+000
		1407.98	2.15	3.4376E+000		5.1043E-001
		1509.23	2.11	3.3653E+000		2.2317E+000
		1538.50	0.38	1.5132E+001		-1.2320E-001
		1543.32	0.20	2.8829E+001		9.2413E+000
		1583.22	0.69	1.2275E+001		-5.6435E+000
		1594.73	0.25	3.7076E+001		1.2994E+001
		1599.31	0.23	3.2381E+001		1.3229E+001
		1661.28	1.15	4.6006E+000		1.3590E+000
		1683.99	0.22	2.5093E+001		-1.7396E+001
		1729.59	2.92	2.5667E+000		1.9077E+000
		1764.49*	15.40	3.1293E-001		6.4755E-001
		1847.42	2.11	2.7893E+000		8.4925E-001
		1873.16	0.22	2.8958E+001		6.9456E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	5.3230E+001	1.95E-001	4.6375E+000
		74.81*	6.44	1.4540E+000		3.4254E+000
		77.11*	10.80	8.0865E-001		3.3267E+000
		87.30*	4.84	1.3530E+000		1.4936E+000
		242.00*	7.43	4.8844E-001		1.4167E+000
		258.87	0.52	1.0363E+001		7.2146E-001
		274.80	0.47	1.2355E+001		2.6348E+000
		295.22*	19.30	2.9895E-001		6.7101E-001
		351.93*	37.60	1.9529E-001		7.2166E-001
		462.00*	0.22	2.2732E+001		3.0315E+001
		533.66	0.19	3.3719E+001		-2.7693E+000
		785.96	1.07	7.5252E+000		5.5282E+000
		839.04	0.59	1.4601E+001		1.2460E+001
+	Ra-224	81.07	0.13	8.0902E+001	9.00E-001	-5.0722E+001
		83.78	0.22	4.6264E+001		2.9204E+001
		240.99*	4.10	9.0017E-001		2.6108E+000
+	Ra-226	81.07	0.20	5.2900E+001	1.74E+000	-3.3166E+001
		83.78	0.33	3.0097E+001		1.8999E+001
		94.90	0.15	5.3687E+001		3.3889E-001
		186.21*	3.59	1.7432E+000		2.2253E+000
+	Ac-228	99.50	1.26	5.1779E+000	2.62E-001	1.2247E+000
		129.07*	2.50	1.8245E+000		1.2576E+000
		209.25*	3.97	1.3978E+000		1.0410E+000
		270.24*	3.55	1.5572E+000		1.4746E+000
		328.00*	3.04	1.5897E+000		1.8407E+000
		338.32*	11.40	5.0476E-001		1.3058E+000
		409.46*	2.02	1.8979E+000		1.5834E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.1481E+000	2.62E-001	1.5311E+000
		755.31	1.03	7.3733E+000		2.7220E+000
		772.29	1.52	5.3100E+000		-3.3503E+000
		794.94*	4.31	1.3814E+000		1.3164E+000
		835.70	1.70	4.8955E+000		-9.7404E-001
		911.20*	26.20	2.6206E-001		1.4867E+000
		964.79*	4.99	1.1035E+000		1.4206E+000
		968.96*	15.90	3.0764E-001		1.5049E+000
		1588.20*	3.06	1.3553E+000		1.8575E+000
		1630.62	1.52	4.2245E+000		-2.7076E-001
	Th-228	84.37	1.26	8.1700E+000	8.17E+000	3.5172E+000
		131.61	0.13	5.2689E+001		1.6326E+001
		166.41	0.10	6.0170E+001		1.3037E+000
		215.98	0.25	2.4121E+001		2.9744E+000
	Pa-234m	258.23	0.07	7.3555E+001	1.03E+001	-2.7093E+001
		742.81	0.09	8.0718E+001		3.5245E+001
		766.36	0.32	2.5523E+001		-6.0281E-001
		786.27	0.05	1.4994E+002		1.3682E+002
		1001.03	0.85	1.0347E+001		4.2055E+000
		1737.77	0.02	2.6278E+002		-3.7209E+002
	Th-234	63.30	3.75	7.1085E+000	2.06E+000	4.5708E+000
		92.59	4.33	2.0633E+000		4.2498E+000
		112.81	0.22	2.8939E+001		1.7084E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S003-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.989	1460.82*		10.55	1.86150E+001	6.94798E-001
Eu-152m	0.989	89.85*		69.90	7.91112E-002	1.20824E-002
Tl-208	0.833	72.80	@	2.02		
		74.97*	@	3.41	6.57882E+000	5.51622E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	6.61880E-001	9.68798E-002
		583.19*		84.50	4.99510E-001	2.92531E-002
		763.13	@	1.81		
		860.56*		12.42	4.74023E-001	1.16871E-001
Bi-211	0.903	351.03*		13.00	2.09031E+000	1.69578E-001
Bi-212	0.751	39.86	@	1.06		
		727.33*		6.74	1.43872E+000	2.03073E-001
		785.37		1.11		
		1620.74*		1.51	1.35277E+000	5.36070E-001
		1806.00	@	0.09		
Pb-212	0.986	74.81*		10.40	2.15709E+000	1.91272E-001
		77.11*		17.50	2.08787E+000	1.42100E-001
		87.30*		7.81	9.41331E-001	1.31993E-001
		115.18	@	0.59		
		238.63*		43.30	1.54588E+000	7.96989E-002
		300.09*		3.28	1.23079E+000	2.99975E-001
Bi-214	0.556	76.86*	@	0.43	8.43377E+001	5.81079E+000
		89.81*	@	0.24	2.26100E+001	3.54713E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	7.48050E-001	5.13785E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	1.83221E-001	2.35460E-001
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08*	@	0.36	1.92022E+001	2.96084E+000
		1051.96	@	0.31		
		1120.29*		14.91	7.26605E-001	1.18736E-001
		1133.66	@	0.25		
		1155.19	@	1.63		
		1207.68	@	0.45		
		1238.11		5.79		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.556	1280.96	@	1.43		
		1377.67		4.00		
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	6.47553E-001	1.00934E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.943	53.28	@	1.20		
		74.81*		6.44	3.42536E+000	3.08166E-001
		77.11*		10.80	3.32665E+000	2.39602E-001
		87.30*		4.84	1.49361E+000	2.11334E-001
		242.00*		7.43	1.41667E+000	1.20067E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	6.71012E-001	7.83953E-002
		351.93*		37.60	7.21658E-001	5.80969E-002
		462.00*	@	0.22	3.03152E+001	5.71247E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.859	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	2.61085E+000	2.20189E-001
Ra-226	0.772	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	2.22531E+000	4.09291E-001
Ac-228	0.876	99.50	@	1.26		
		129.07*	@	2.50	1.25764E+000	4.08787E-001
		209.25*		3.97	1.04103E+000	3.15700E-001
		270.24*		3.55	1.47463E+000	3.59800E-001
		328.00*		3.04	1.84071E+000	3.83436E-001
		338.32*		11.40	1.30576E+000	1.44849E-001
		409.46*	@	2.02	1.58342E+000	4.47252E-001
		463.00*		4.45	1.53108E+000	2.93546E-001
		755.31	@	1.03		
		772.29	@	1.52		
		794.94*		4.31	1.31642E+000	3.30928E-001

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.876	835.70	@	1.70		
		911.20*		26.20	1.48665E+000	1.06204E-001
		964.79*		4.99	1.42057E+000	2.19354E-001
		968.96*		15.90	1.50493E+000	1.18721E-001
		1588.20*		3.06	1.85749E+000	3.97286E-001
		1630.62	@	1.52		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.989	1.861501E+001	6.947977E-001
X	Cd-109		0.916		
	Eu-152m		0.989	7.662510E-002	1.206419E-002
	Tl-208	@	0.833	4.999014E-001	2.807566E-002
	Bi-211		0.903	4.068677E-001	2.657501E-001
	Bi-212	@	0.751	1.427936E+000	1.899039E-001
	Pb-212	@	0.986	1.391393E+000	5.928204E-002
	Bi-214	@	0.556	7.105388E-001	4.195194E-002
	Pb-214	@	0.943	5.811908E-001	7.142356E-002
	Ra-224	@	0.859	1.539742E+000	2.545507E-001
	Ra-226	@	0.772	2.225311E+000	4.092915E-001
	Ac-228	@	0.876	1.450133E+000	5.580887E-002

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 12/5/2016 12:40:17 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m	5	93.09	2.7127E-002	13.35	Tol.	Yb-169 Th-227 Th-234

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S003-1824-01.CNF

Report Generated On	: 12/5/2016 2:43:52 PM
Sample Title	: UMR001-S003-1824-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 4.935E+002 GWET
Sample Taken On	: 11/18/2016 11:15:00 AM
Acquisition Started	: 12/5/2016 12:43:49 PM
Live Time	: 7200.0 seconds
Real Time	: 7201.8 seconds
Dead Time	: 0.03 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: ERT01
Sample Title: UMR001-S003-1824-01
Peak Analysis Performed on: 12/5/2016 2:43:53 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	294-	321	300.05	74.97	0.95	2.29E+002	24.67	5.74E+002
m	2	294-	321	309.09	77.23	0.95	4.77E+002	29.78	5.01E+002
M	3	344-	382	349.48	87.33	1.29	1.96E+002	24.08	5.12E+002
m	4	344-	382	360.98	90.20	1.30	1.44E+002	22.15	5.61E+002
m	5	344-	382	372.32	93.04	1.30	2.89E+002	26.42	5.64E+002
	6	507-	527	516.14	129.00	0.52	7.61E+001	49.12	6.42E+002
	7	738-	752	744.09	185.99	1.18	2.79E+002	36.43	3.63E+002
	8	830-	844	837.16	209.26	1.20	1.76E+002	33.26	3.23E+002
M	9	947-	975	954.58	238.62	1.10	1.63E+003	43.80	3.22E+002
m	10	947-	975	966.81	241.67	1.10	2.60E+002	20.08	2.32E+002
	11	1075-	1089	1080.45	270.09	1.03	1.20E+002	27.96	2.27E+002
	12	1172-	1189	1180.45	295.09	1.11	3.50E+002	34.14	2.51E+002
	13	1191-	1205	1199.61	299.88	0.70	9.79E+001	25.55	1.93E+002
	14	1347-	1358	1353.09	338.25	0.96	2.81E+002	25.50	1.47E+002
	15	1399-	1419	1407.01	351.73	1.13	6.74E+002	38.75	2.26E+002
	16	1847-	1860	1851.47	462.86	1.49	1.07E+002	19.41	9.62E+001
	17	2028-	2052	2041.38	510.34	1.14	3.00E+002	33.67	2.02E+002
	18	2322-	2341	2331.87	582.97	1.38	6.00E+002	32.67	1.33E+002
	19	2429-	2443	2436.16	609.04	1.46	4.34E+002	27.32	1.09E+002
	20	2898-	2914	2907.73	726.94	1.11	1.28E+002	18.88	7.26E+001
	21	3063-	3078	3072.63	768.17	0.75	3.76E+001	16.79	8.04E+001
	22	3171-	3186	3179.08	794.79	0.63	9.97E+001	15.74	4.93E+001
	23	3432-	3449	3440.00	860.02	0.85	5.73E+001	17.62	7.57E+001
	24	3634-	3653	3643.51	910.91	1.31	3.81E+002	24.33	5.87E+001
M	25	3850-	3884	3857.66	964.45	1.61	5.14E+001	10.42	7.72E+001
m	26	3850-	3884	3874.55	968.67	1.61	2.14E+002	16.91	7.77E+001
	27	4472-	4490	4480.58	1120.19	0.60	8.86E+001	18.80	7.84E+001
	28	5505-	5516	5510.80	1377.77	0.33	1.12E+001	8.42	2.38E+001
	29	5829-	5856	5843.65	1460.99	1.84	1.83E+003	43.71	1.76E+001
	30	6348-	6360	6354.40	1588.68	0.65	2.72E+001	7.30	9.78E+000
	31	7051-	7069	7060.80	1765.30	1.96	9.58E+001	11.99	1.43E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** N U C L I D E M D A R E P O R T *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S003-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	6.2051E-001	6.21E-001	2.2529E+001
	Co-60	1173.23	99.85	1.0595E-001	9.00E-002	1.2871E-002
		1332.49	99.98	8.9953E-002		-3.3757E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	1.2599E+003	8.55E-002	2.8930E+002
		661.66	84.99	8.5484E-002		-5.3720E-003
+	Tl-208	72.80	2.02	9.4388E+000	8.74E-002	1.0920E+000
		74.97*	3.41	3.2999E+000		4.7232E+000
		84.90	1.51	7.1636E+000		-8.2884E-001
		277.36	6.31	1.0421E+000		5.0528E-001
		510.77*	22.60	4.3335E-001		3.6903E-001
		583.19*	84.50	8.7370E-002		4.9546E-001
		763.13	1.81	4.4457E+000		7.3891E-002
		860.56*	12.42	5.7412E-001		4.2906E-001
+	Bi-212	39.86	1.06	6.5856E+002	8.94E-001	6.2090E+001
		727.33*	6.74	8.9441E-001		1.5752E+000
		785.37	1.11	7.6166E+000		7.6511E-001
		1620.74	1.51	4.5863E+000		1.9883E+000
		1806.00	0.09	7.2737E+001		-1.0422E+001
+	Pb-212	74.81*	10.40	1.0820E+000	1.11E-001	1.5487E+000
		77.11*	17.50	5.4348E-001		1.7282E+000
		87.30*	7.81	8.8440E-001		1.1467E+000
		115.18	0.59	1.1098E+001		2.1099E+000
		238.63*	43.30	1.1132E-001		1.4483E+000
		300.09*	3.28	1.5157E+000		1.3224E+000
+	Bi-214	76.86*	0.43	2.1952E+001	1.34E-001	6.9805E+001
		89.81*	0.24	2.7301E+001		2.4782E+001
		386.77	0.30	2.1770E+001		-3.1409E+000
		454.77	0.29	2.2997E+001		8.6076E+000
		609.31*	45.49	1.3355E-001		6.8407E-001
		665.45	1.53	4.7631E+000		-3.8362E-001
		703.11	0.48	1.6796E+001		3.5328E+000
		719.86	0.39	1.9320E+001		1.1635E+000
		768.36*	4.89	1.3023E+000		6.4940E-001
		786.10	0.31	2.8317E+001		1.5154E+001
		806.17	1.26	6.1948E+000		1.5789E+000
		934.06	3.10	2.7127E+000		1.3771E+000
		964.08*	0.36	1.6477E+001		1.4011E+001
		1051.96	0.31	2.7988E+001		1.0805E+001
		1120.29*	14.91	5.7532E-001		6.5029E-001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	3.8421E+001	1.34E-001	2.3750E+000
		1155.19	1.63	6.1137E+000		8.5646E-001
		1207.68	0.45	2.3343E+001		-1.2628E+001
		1238.11	5.79	2.0675E+000		5.5829E-001
		1280.96	1.43	6.7942E+000		1.7460E+000
		1377.67*	4.00	1.2172E+000		3.5173E-001
		1385.31	0.76	9.7708E+000		1.7870E+000
		1401.50	1.27	6.0618E+000		-2.6716E+000
		1407.98	2.15	3.8704E+000		4.2939E-003
		1509.23	2.11	3.5942E+000		5.2471E-001
		1538.50	0.38	1.8290E+001		6.8563E+000
		1543.32	0.20	3.4153E+001		1.3527E+001
		1583.22	0.69	1.2147E+001		-2.7388E+000
		1594.73	0.25	3.4524E+001		-5.4899E+000
		1599.31	0.23	2.9035E+001		8.2563E+000
		1661.28	1.15	5.6593E+000		-4.4442E-001
		1683.99	0.22	2.9738E+001		6.3939E+000
		1729.59	2.92	2.5150E+000		1.8639E+000
		1764.49*	15.40	3.6361E-001		8.8169E-001
		1847.42	2.11	3.0210E+000		-3.7117E-001
		1873.16	0.22	3.0210E+001		-4.8360E+000
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	5.7164E+001	1.77E-001	2.9701E+001
		74.81*	6.44	1.7180E+000		2.4590E+000
		77.11*	10.80	8.6587E-001		2.7534E+000
		87.30*	4.84	1.4032E+000		1.8194E+000
		242.00*	7.43	5.3412E-001		1.3460E+000
		258.87	0.52	1.0924E+001		-5.3661E+000
		274.80	0.47	1.3493E+001		5.9984E+000
		295.22*	19.30	3.0260E-001		7.8214E-001
		351.93*	37.60	1.7721E-001		8.5690E-001
		462.00*	0.22	2.1003E+001		2.8356E+001
		533.66	0.19	3.5309E+001		8.4669E+000
		785.96	1.07	8.1504E+000		3.2480E+000
		839.04	0.59	1.4933E+001		7.7221E+000
+	Ra-224	81.07	0.13	8.4740E+001	9.84E-001	-2.1529E+001
		83.78	0.22	4.8447E+001		5.3092E+000
		240.99*	4.10	9.8445E-001		2.4809E+000
+	Ra-226	81.07	0.20	5.5404E+001	1.54E+000	-1.4076E+001
		83.78	0.33	3.1514E+001		3.4535E+000
		94.90	0.15	5.7841E+001		3.3394E+000
		186.21*	3.59	1.5387E+000		2.2262E+000
+	Ac-228	99.50	1.26	5.5221E+000	2.65E-001	7.8253E-001
		129.07*	2.50	3.2154E+000		1.0752E+000
		209.25*	3.97	1.3395E+000		1.6278E+000
		270.24*	3.55	1.4334E+000		1.4093E+000
		328.00	3.04	2.3667E+000		2.6932E+000
		338.32*	11.40	3.8683E-001		1.1784E+000
		409.46	2.02	3.3491E+000		1.1069E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	1.0608E+000	2.65E-001	1.4323E+000
		755.31	1.03	7.8142E+000		2.7171E+000
		772.29	1.52	6.2059E+000		7.4500E-001
		794.94*	4.31	1.2105E+000		2.0349E+000
		835.70	1.70	5.4570E+000		3.4403E+000
		911.20*	26.20	2.6451E-001		1.3879E+000
		964.79*	4.99	1.2191E+000		1.0366E+000
		968.96*	15.90	3.8498E-001		1.3579E+000
		1588.20*	3.06	1.2228E+000		1.2580E+000
		1630.62	1.52	4.5306E+000		6.2828E-001
	Th-228	84.37	1.26	8.4975E+000	8.50E+000	4.7508E-001
		131.61	0.13	5.6258E+001		4.9857E+000
		166.41	0.10	6.0883E+001		1.9503E+000
		215.98	0.25	2.6415E+001		1.0596E+001
	Pa-234m	258.23	0.07	7.7703E+001	1.07E+001	-9.1183E+000
		742.81	0.09	7.9620E+001		6.3081E+001
		766.36	0.32	2.7699E+001		2.7205E+000
		786.27	0.05	1.6483E+002		9.0278E+001
		1001.03	0.85	1.0651E+001		8.0190E+000
		1737.77	0.02	3.0349E+002		-2.1455E+002
	Th-234	63.30	3.75	7.4560E+000	2.20E+000	1.4077E+000
		92.59	4.33	2.1998E+000		3.9052E+000
		112.81	0.22	3.0496E+001		2.7225E-002

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

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*********************************************************************
*****  N U C L I D E   I D E N T I F I C A T I O N   R E P O R T  *****
*********************************************************************
```

Sample Title: UMR001-S003-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.996	1460.82*		10.55	2.25287E+001	8.08828E-001
Eu-152m	0.980	89.85*		69.90	8.67108E-002	1.36587E-002
Tl-208	0.827	72.80	@	2.02		
		74.97*	@	3.41	4.72324E+000	5.33610E-001
		84.90	@	1.51		
		277.36		6.31		
		510.77*	@	22.60	3.69026E-001	9.78948E-002
		583.19*		84.50	4.95458E-001	3.17339E-002
		763.13	@	1.81		
		860.56*		12.42	4.29060E-001	1.32328E-001
Bi-211	0.924	351.03*		13.00	2.48207E+000	1.76586E-001
Bi-212	0.559	39.86	@	1.06		
		727.33*		6.74	1.57517E+000	2.36823E-001
		785.37		1.11		
		1620.74		1.51		
		1806.00	@	0.09		
Pb-212	0.986	74.81*		10.40	1.54868E+000	1.80576E-001
		77.11*		17.50	1.72824E+000	1.33165E-001
		87.30*		7.81	1.14675E+000	1.50197E-001
		115.18	@	0.59		
		238.63*		43.30	1.44825E+000	7.62201E-002
		300.09*		3.28	1.32241E+000	3.49280E-001
Bi-214	0.600	76.86*	@	0.43	6.98047E+001	5.43042E+000
		89.81*	@	0.24	2.47817E+001	4.00355E+000
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	6.84072E-001	4.78399E-002
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	6.49398E-001	2.90485E-001
		786.10	@	0.31		
		806.17	@	1.26		
		934.06		3.10		
		964.08*	@	0.36	1.40108E+001	2.89372E+000
		1051.96	@	0.31		
		1120.29*		14.91	6.50286E-001	1.38912E-001
		1133.66	@	0.25		
		1155.19	@	1.63		
		1207.68	@	0.45		
		1238.11		5.79		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.600	1280.96	@	1.43		
		1377.67*		4.00	3.51734E-001	2.65373E-001
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98	@	2.15		
		1509.23	@	2.11		
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28	@	1.15		
		1683.99	@	0.22		
		1729.59	@	2.92		
		1764.49*		15.40	8.81688E-001	1.21649E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.942	53.28	@	1.20		
		74.81*		6.44	2.45901E+000	2.89149E-001
		77.11*		10.80	2.75341E+000	2.21858E-001
		87.30*		4.84	1.81939E+000	2.40775E-001
		242.00*		7.43	1.34603E+000	1.21375E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	7.82137E-001	8.29233E-002
		351.93*		37.60	8.56905E-001	6.03563E-002
		462.00*	@	0.22	2.83563E+001	5.37573E+000
		533.66	@	0.19		
		785.96	@	1.07		
		839.04	@	0.59		
Ra-224	0.823	81.07	@	0.13		
		83.78	@	0.22		
		240.99*		4.10	2.48089E+000	2.22736E-001
Ra-226	0.772	81.07	@	0.20		
		83.78	@	0.33		
		94.90	@	0.15		
		186.21*		3.59	2.22624E+000	3.71925E-001
Ac-228	0.769	99.50	@	1.26		
		129.07*	@	2.50	1.07520E+000	6.95687E-001
		209.25*		3.97	1.62785E+000	3.21294E-001
		270.24*		3.55	1.40925E+000	3.35320E-001
		328.00		3.04		
		338.32*		11.40	1.17844E+000	1.23417E-001
		409.46	@	2.02		
		463.00*		4.45	1.43227E+000	2.76210E-001
		755.31	@	1.03		
		772.29	@	1.52		
		794.94*		4.31	2.03494E+000	3.31801E-001

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.769	835.70	@	1.70		
		911.20*		26.20	1.38786E+000	1.04677E-001
		964.79*		4.99	1.03661E+000	2.14265E-001
		968.96*		15.90	1.35789E+000	1.19747E-001
		1588.20*		3.06	1.25801E+000	3.42502E-001
		1630.62	@	1.52		

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.996	2.252869E+001	8.088276E-001
X	Cd-109		0.924		
	Eu-152m		0.980	8.428086E-002	1.363914E-002
	Tl-208	@	0.827	4.890099E-001	3.056893E-002
	Bi-211		0.924	6.140373E-001	2.769704E-001
	Bi-212	@	0.559	1.575169E+000	2.368227E-001
	Pb-212	@	0.986	1.270250E+000	5.870955E-002
	Bi-214	@	0.600	6.944658E-001	4.135516E-002
	Pb-214	@	0.942	6.449158E-001	7.472304E-002
	Ra-224	@	0.823	1.292240E+000	2.601226E-001
	Ra-226	@	0.772	2.226240E+000	3.719253E-001
	Ac-228	@	0.769	1.330980E+000	5.449348E-002

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

********** UNIDENTIFIED PEAKS **********

Peak Locate Performed on: 12/5/2016 2:43:53 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

	Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m	5	93.04	2.9636E-002	12.69	Tol.	Yb-169 Th-227 Th-234

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

Date: _____

9626 Niagara Falls Blvd Onsite Gamma Spec Screening Lab

Gamma Spectroscopy Detector work sheet.

Counted by (Initial,date)	Geometry Description	Analysis Number/Sample ID/Remarks	Sample Collection mmddyy hh:mm	Sample Quantity	Sample Units (GWET,GDRY,L, ft^3, etc)	Count Time (s)	Report Matches Sample Parameters (Initial, date)
cc/120516	450 cc SOIL	[redacted] UMR001-S001-0612-[redacted] 01	11-18-16 0955	490.3	GWET	7200	
cc/120516	450 cc SOIL	UMR001-S001-1824-01	11-18-16 0945	541.6 [redacted]	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S001-1218-01	11-18-16 0950	576.1	GWET	7200	
cc/120616	450 cc SOIL	Duplicate UMR001-S001-0612-02	11-18-16 0955	452.0	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S004-0612-01	11-18-16 1225	712.4	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S004-1218-01	11-18-16 1223	593.5	GWET	7200	
cc/120616	450 cc SOIL	UMR001-S004-1824-01	11-18-16 1220	490.4	GWET	7200	
cc/120716	450 cc SOIL	161207 STANDARD-2HR	12-07-16 09[redacted]33	771.0	STD	7200	
cc/120816	450 cc SOIL	STANDARD-2HR-161208	12-08-16 1553	1	STD	7200	
	450 cc SOIL					7200	

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S004-0612-01.CNF

Report Generated On	: 12/6/2016 3:55:45 PM
Sample Title	: UMR001-S004-0612-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 7.124E+002 GWET
Sample Taken On	: 11/18/2016 12:25:00 PM
Acquisition Started	: 12/6/2016 1:54:58 PM
Live Time	: 7200.0 seconds
Real Time	: 7245.0 seconds
Dead Time	: 0.62 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: ERT01
Sample Title: UMR001-S004-0612-01
Peak Analysis Performed on: 12/6/2016 3:55:45 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	284-	320	300.01	74.96	1.03	1.96E+004	187.27	2.44E+004
m	2	284-	320	309.05	77.22	1.03	3.10E+004	219.59	2.38E+004
M	3	330-	384	338.25	84.52	1.21	4.82E+003	141.44	2.62E+004
m	4	330-	384	349.50	87.33	1.22	1.56E+004	182.71	2.41E+004
m	5	330-	384	360.40	90.06	1.22	1.26E+004	167.98	2.35E+004
m	6	330-	384	373.73	93.39	1.23	1.35E+004	173.12	2.44E+004
	7	386-	407	398.64	99.62	0.96	3.52E+003	357.21	3.31E+004
M	8	413-	447	422.21	105.51	1.39	4.34E+003	160.89	2.78E+004
m	9	413-	447	436.07	108.98	1.40	1.61E+003	134.18	2.83E+004
	10	455-	470	461.51	115.34	0.93	1.74E+003	276.76	2.49E+004
	11	511-	522	516.81	129.16	0.96	6.49E+003	243.16	2.10E+004
	12	572-	579	575.44	143.82	0.43	2.00E+002	159.35	1.25E+004
	13	610-	624	616.55	154.10	1.12	2.57E+003	257.60	2.21E+004
	14	734-	754	744.55	186.10	1.36	4.63E+003	323.57	2.76E+004
	15	761-	769	765.40	191.32	0.57	2.06E+002	159.90	1.19E+004
	16	792-	805	797.76	199.41	0.95	1.22E+003	221.08	1.72E+004
	17	831-	851	837.24	209.28	1.11	1.38E+004	326.73	2.51E+004
	18	858-	872	864.63	216.13	1.14	1.20E+003	225.79	1.73E+004
M	19	946-	977	954.64	238.63	1.10	1.57E+005	411.63	1.36E+004
m	20	946-	977	964.59	241.12	1.10	1.66E+004	153.85	1.15E+004
	21	1001-	1018	1010.67	252.64	1.12	7.42E+002	204.19	1.26E+004
	22	1073-	1089	1080.97	270.22	1.17	1.03E+004	211.42	1.10E+004
	23	1104-	1123	1109.32	277.30	1.12	6.60E+003	227.71	1.27E+004
	24	1144-	1159	1152.73	288.16	0.95	1.13E+003	171.45	9.40E+003
	25	1170-	1189	1180.84	295.18	1.13	9.99E+003	226.05	1.17E+004
	26	1194-	1213	1200.33	300.06	1.12	9.70E+003	224.32	1.13E+004
	27	1276-	1291	1286.16	321.52	1.04	3.02E+002	159.55	8.37E+003
M	28	1300-	1340	1311.80	327.93	1.17	8.25E+003	120.95	7.71E+003
m	29	1300-	1340	1329.15	332.27	1.17	1.09E+003	73.02	7.35E+003
M	30	1342-	1374	1353.02	338.24	1.16	3.21E+004	196.03	7.06E+003
m	31	1342-	1374	1363.54	340.87	1.17	1.02E+003	70.78	6.86E+003
	32	1400-	1420	1407.40	351.83	1.15	1.76E+004	226.94	9.09E+003
	33	1550-	1559	1554.89	388.71	0.95	1.12E+002	97.76	4.18E+003
	34	1626-	1643	1637.36	409.33	1.20	4.53E+003	162.21	6.67E+003
	35	1801-	1825	1810.92	452.72	1.23	9.14E+002	177.73	7.42E+003
	36	1841-	1861	1851.44	462.85	1.33	9.12E+003	178.02	6.23E+003
	37	2009-	2024	2014.63	503.65	0.77	2.88E+002	115.47	4.33E+003
	38	2026-	2053	2042.31	510.57	1.40	1.78E+004	229.06	7.67E+003
M	39	2181-	2212	2186.05	546.51	0.67	1.80E+002	40.70	2.33E+003
m	40	2181-	2212	2198.04	549.51	0.68	2.28E+002	39.87	2.52E+003
	41	2237-	2255	2249.07	562.27	1.23	1.41E+003	132.10	4.75E+003
	42	2315-	2343	2331.97	582.99	1.33	5.39E+004	294.89	7.02E+003

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	43	2351-	2360	2355.26	588.81	0.86	1.07E+001	71.71	2.27E+003
	44	2424-	2449	2436.43	609.11	1.38	1.39E+004	190.64	5.28E+003
	45	2651-	2670	2661.70	665.43	1.10	4.31E+002	121.54	4.09E+003
M	46	2796-	2842	2807.01	701.76	1.51	3.40E+002	55.79	4.23E+003
m	47	2796-	2842	2828.59	707.16	1.52	3.60E+002	55.12	3.80E+003
	48	2894-	2918	2908.18	727.06	1.44	1.22E+004	175.75	4.51E+003
	49	3010-	3030	3020.22	755.07	1.16	1.46E+003	116.50	3.34E+003
M	50	3047-	3100	3052.69	763.19	1.44	8.90E+002	51.59	2.34E+003
m	51	3047-	3100	3072.61	768.17	1.44	1.09E+003	52.84	2.80E+003
m	52	3047-	3100	3088.37	772.11	1.44	2.12E+003	63.97	2.63E+003
M	53	3118-	3151	3127.50	781.89	1.50	8.30E+002	47.48	2.23E+003
m	54	3118-	3151	3141.29	785.34	1.50	1.88E+003	60.55	2.25E+003
	55	3159-	3196	3178.77	794.71	1.54	6.57E+003	175.13	4.19E+003
	56	3216-	3237	3223.23	805.83	1.37	3.61E+002	93.01	2.21E+003
M	57	3314-	3370	3321.17	830.31	1.45	7.75E+002	44.49	1.63E+003
m	58	3314-	3370	3342.02	835.53	1.45	2.28E+003	61.04	1.77E+003
m	59	3314-	3370	3360.12	840.05	1.45	1.33E+003	50.48	1.70E+003
M	60	3431-	3462	3441.29	860.35	1.54	6.73E+003	90.25	1.50E+003
m	61	3431-	3462	3457.89	864.50	1.54	9.06E+001	30.98	1.16E+003
	62	3562-	3583	3572.92	893.26	1.56	6.38E+002	79.64	1.52E+003
	63	3597-	3624	3615.77	903.97	1.13	1.08E+003	99.61	1.95E+003
	64	3626-	3658	3643.95	911.02	1.54	3.86E+004	224.59	2.28E+003
	65	3725-	3749	3735.50	933.90	1.73	5.78E+002	84.08	1.57E+003
	66	3770-	3783	3775.73	943.96	0.99	9.15E+001	49.80	8.64E+002
	67	3799-	3818	3807.33	951.86	1.23	1.39E+002	65.54	1.18E+003
M	68	3824-	3887	3833.78	958.48	1.58	4.05E+002	33.06	1.10E+003
m	69	3824-	3887	3858.27	964.60	1.58	6.95E+003	88.70	1.10E+003
m	70	3824-	3887	3875.07	968.80	1.58	2.26E+004	153.76	1.09E+003
	71	3941-	3961	3951.32	987.86	1.28	2.08E+002	63.83	1.06E+003
	72	3993-	4010	4003.97	1001.03	1.64	2.88E+002	53.89	8.05E+002
	73	4122-	4141	4131.29	1032.86	1.22	2.76E+002	57.60	8.65E+002
	74	4154-	4169	4160.35	1040.13	0.75	1.22E+002	48.59	7.42E+002
	75	4247-	4267	4260.22	1065.10	1.04	4.06E+002	60.50	8.98E+002
	76	4305-	4328	4313.88	1078.51	1.27	6.96E+002	68.41	9.89E+002
	77	4366-	4392	4375.55	1093.93	1.57	7.25E+002	77.36	1.19E+003
	78	4428-	4455	4441.91	1110.52	1.70	5.77E+002	75.74	1.15E+003
	79	4463-	4495	4480.65	1120.21	1.65	3.20E+003	102.04	1.41E+003
	80	4608-	4635	4620.46	1155.16	1.06	3.32E+002	78.45	1.29E+003
	81	4943-	4968	4952.42	1238.16	1.65	1.14E+003	74.72	1.03E+003
	82	4969-	4997	4988.51	1247.18	1.86	5.27E+002	80.92	1.30E+003
	83	5119-	5134	5125.53	1281.44	0.62	1.90E+002	47.32	6.79E+002
M	84	5484-	5525	5497.17	1374.36	1.90	2.18E+002	26.29	7.92E+002
m	85	5484-	5525	5511.26	1377.88	1.90	8.15E+002	38.51	8.10E+002
	86	5533-	5550	5543.53	1385.95	0.90	1.57E+002	46.65	6.20E+002
M	87	5596-	5644	5606.62	1401.72	1.78	2.19E+002	27.50	8.07E+002
m	88	5596-	5644	5632.00	1408.07	1.78	4.10E+002	32.20	7.54E+002
	89	5828-	5857	5838.41	1459.68	2.63	1.27E+003	74.53	9.03E+002
M	90	5974-	6023	5984.68	1496.25	2.02	9.26E+002	37.86	5.65E+002
m	91	5974-	6023	6007.41	1501.93	2.03	5.70E+002	31.59	5.97E+002
M	92	6027-	6062	6037.83	1509.54	1.95	3.90E+002	28.40	5.61E+002

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
m 93	6027-	6062	6052.58	1513.22	1.95	3.81E+002	28.76	5.95E+002
94	6169-	6187	6175.09	1543.85	0.54	6.82E+001	40.16	4.57E+002
M 95	6206-	6238	6211.42	1552.94	1.71	4.45E+001	17.45	3.44E+002
m 96	6206-	6238	6230.20	1557.63	1.71	1.36E+002	23.47	4.70E+002
97	6313-	6333	6323.34	1580.92	1.58	5.24E+002	54.44	6.72E+002
M 98	6342-	6390	6354.28	1588.66	1.87	3.08E+003	61.47	7.76E+002
m 99	6342-	6390	6371.86	1593.05	1.87	1.76E+003	47.95	7.21E+002
M100	6472-	6537	6484.81	1621.29	1.91	1.58E+003	45.44	6.05E+002
m101	6472-	6537	6502.32	1625.67	1.91	2.47E+002	24.33	5.89E+002
m102	6472-	6537	6524.37	1631.18	1.91	1.66E+003	46.40	5.72E+002
103	6543-	6565	6555.20	1638.89	1.87	5.44E+002	50.51	5.18E+002
M104	6638-	6675	6646.44	1661.70	1.48	2.16E+002	22.42	3.79E+002
m105	6638-	6675	6667.54	1666.98	1.48	2.02E+002	22.08	3.81E+002
106	6739-	6754	6747.88	1687.06	0.75	8.33E+001	35.49	3.90E+002
107	6911-	6934	6920.87	1730.31	1.32	5.34E+002	50.92	5.11E+002
108	7048-	7075	7060.79	1765.30	2.09	2.47E+003	73.21	6.41E+002
109	7220-	7243	7227.32	1806.93	1.19	1.16E+002	45.73	4.92E+002
110	7381-	7401	7393.60	1848.51	1.92	3.69E+002	45.62	4.73E+002

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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***** N U C L I D E M D A R E P O R T *****
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Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S004-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
	K-40	1460.82	10.55	3.0123E+000	3.01E+000	1.1498E+001
	Co-60	1173.23	99.85	2.3558E-001	2.36E-001	2.6492E-002
		1332.49	99.98	2.5352E-001		7.4564E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	5.7853E+003	3.85E-001	-1.7797E+003
		661.66	84.99	3.8488E-001		-5.4387E-002
+	Tl-208	72.80	2.02	4.5403E+001	4.91E-001	-2.1804E+000
		74.97*	3.41	1.4720E+001		2.7982E+002
		84.90*	1.51	2.4076E+001		1.0865E+002
		277.36*	6.31	4.6040E+000		3.0648E+001
		510.77*	22.60	1.7129E+000		3.4693E+001
		583.19*	84.50	4.9131E-001		3.1215E+001
		763.13*	1.81	1.0520E+001		2.9181E+001
		860.56*	12.42	1.3359E+000		3.4961E+001
+	Bi-212	39.86	1.06	3.1443E+003	5.43E+000	3.0994E+002
		727.33*	6.74	5.4326E+000		1.0360E+002
		785.37*	1.11	1.7145E+001		1.0236E+002
		1620.74*	1.51	1.0835E+001		1.0388E+002
		1806.00*	0.09	2.5051E+002		1.3897E+002
+	Pb-212	74.81*	10.40	4.8266E+000	4.80E-001	9.1750E+001
		77.11*	17.50	2.5581E+000		7.8021E+001
		87.30*	7.81	4.1397E+000		6.3292E+001
		115.18*	0.59	5.3559E+001		7.3111E+001
		238.63*	43.30	4.8043E-001		9.7821E+001
		300.09*	3.28	8.8019E+000		9.0883E+001
+	Bi-214	76.86*	0.43	1.0322E+002	7.63E-001	3.1482E+003
		89.81*	0.24	1.2102E+002		1.5030E+003
		386.77	0.30	9.6499E+001		2.3040E+001
		454.77	0.29	1.0028E+002		-4.8668E+000
		609.31*	45.49	7.6312E-001		1.5141E+001
		665.45*	1.53	1.9338E+001		1.4902E+001
		703.11	0.48	7.2730E+001		2.1044E+000
		719.86	0.39	8.2171E+001		7.0450E+000
		768.36*	4.89	4.1983E+000		1.3076E+001
		786.10*	0.31	6.0301E+001		3.6001E+002
		806.17*	1.26	2.0435E+001		1.7301E+001
		934.06*	3.10	8.1575E+000		1.2488E+001
		964.08*	0.36	4.1608E+001		1.3115E+003
		1051.96	0.31	7.1417E+001		3.1692E+000
		1120.29*	14.91	2.0222E+000		1.6255E+001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	8.7994E+001	7.63E-001	5.9564E+001
		1155.19*	1.63	1.6926E+001		1.5698E+001
		1207.68	0.45	5.2050E+001		2.1081E+001
		1238.11*	5.79	4.3790E+000		1.6020E+001
		1280.96*	1.43	1.2380E+001		1.1058E+001
		1377.67*	4.00	4.1423E+000		1.7776E+001
		1385.31*	0.76	2.4489E+001		1.8194E+001
		1401.50*	1.27	1.3176E+001		1.5218E+001
		1407.98*	2.15	7.5502E+000		1.6907E+001
		1509.23*	2.11	6.9791E+000		1.7170E+001
		1538.50	0.38	6.4302E+001		2.0600E+001
		1543.32*	0.20	8.7558E+001		3.2202E+001
		1583.22	0.69	6.6595E+001		1.0077E+002
		1594.73	0.25	2.0107E+002		3.5713E+001
		1599.31	0.23	1.5390E+002		3.1228E+001
		1661.28*	1.15	1.1311E+001		1.8660E+001
		1683.99	0.22	1.1834E+002		1.2876E+002
		1729.59*	2.92	7.4972E+000		1.8750E+001
		1764.49*	15.40	1.7080E+000		1.6636E+001
		1847.42	2.11	1.4068E+001		2.5274E+001
		1873.16	0.22	1.2446E+002		3.7895E+001
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	2.6051E+002	7.65E-001	1.9761E+001
		74.81*	6.44	7.6561E+000		1.4554E+002
		77.11*	10.80	4.0715E+000		1.2418E+002
		87.30*	4.84	6.5613E+000		1.0032E+002
		242.00*	7.43	2.5412E+000		5.9589E+001
		258.87	0.52	5.1172E+001		1.8954E+001
		274.80	0.47	6.5716E+001		-1.0654E+002
		295.22*	19.30	1.4632E+000		1.5468E+001
		351.93*	37.60	7.6512E-001		1.5666E+001
		462.00*	0.22	1.2902E+002		1.6767E+003
		533.66	0.19	1.6069E+002		8.4208E+001
		785.96*	1.07	1.7470E+001		1.0430E+002
		839.04	0.59	6.2233E+001		1.0755E+001
+	Ra-224	81.07	0.13	4.0313E+002	4.69E+000	3.1092E+000
		83.78*	0.22	1.6753E+002		7.5606E+002
		240.99*	4.10	4.6883E+000		1.0994E+002
+	Ra-226	81.07	0.20	2.6331E+002	9.91E+000	2.0309E+000
		83.78*	0.33	1.0887E+002		4.9132E+002
		94.90	0.15	2.7127E+002		1.5735E+003
		186.21*	3.59	9.9099E+000		3.0778E+001
+	Ac-228	99.50*	1.26	3.3651E+001	9.66E-001	7.2224E+001
		129.07*	2.50	1.0478E+001		6.3604E+001
		209.25*	3.97	9.1277E+000		8.8459E+001
		270.24*	3.55	7.0318E+000		8.3680E+001
		328.00*	3.04	6.2040E+000		8.8244E+001
		338.32*	11.40	1.6168E+000		9.3522E+001
		409.46*	2.02	1.2924E+001		8.4899E+001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	6.5234E+000	9.66E-001	8.4776E+001
		755.31*	1.03	2.9407E+001		8.3400E+001
		772.29*	1.52	1.3366E+001		8.3233E+001
		794.94*	4.31	1.0259E+001		9.3033E+001
		835.70*	1.70	1.0379E+001		8.4804E+001
		911.20*	26.20	1.3012E+000		9.8871E+001
		964.79*	4.99	3.0814E+000		9.7130E+001
		968.96*	15.90	9.6583E-001		9.9419E+001
		1588.20*	3.06	5.9598E+000		9.8781E+001
		1630.62*	1.52	1.0518E+001		1.0896E+002
+	Th-228	84.37*	1.26	2.8853E+001	2.89E+001	1.3021E+002
		131.61	0.13	2.9058E+002		-3.6253E+002
		166.41	0.10	3.0594E+002		-3.2993E+000
		215.98*	0.25	1.0580E+002		1.2182E+002
	Pa-234m	258.23	0.07	3.6239E+002	2.78E+001	1.2226E+001
		742.81	0.09	3.2937E+002		-1.4432E+001
		766.36	0.32	1.0918E+002		-1.1993E+001
		786.27	0.05	6.5697E+002		-1.9936E+001
		1001.03	0.85	2.7849E+001		3.7244E+001
		1737.77	0.02	1.2043E+003		-3.5887E+001
	Th-234	63.30	3.75	3.4124E+001	1.07E+001	2.2466E+001
		92.59	4.33	1.0729E+001		1.4539E+002
		112.81	0.22	1.5109E+002		4.5833E+000

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

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***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
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Sample Title: UMR001-S004-0612-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Eu-152m	0.993	89.85*	69.90	5.25968E+000	1.88891E-001
Eu-155	0.919	45.30	1.31		
		60.01	1.22		
		86.55*	30.70	1.59296E+001	5.81044E-001
		105.31*	21.10	5.05708E+000	2.74678E-001
Tl-208	0.971	72.80 @	2.02		
		74.97* @	3.41	2.79824E+002	1.00664E+001
		84.90* @	1.51	1.08653E+002	4.87714E+000
		277.36*	6.31	3.06479E+001	1.70911E+000
		510.77* @	22.60	3.46925E+001	1.26280E+000
		583.19*	84.50	3.12152E+001	1.02673E+000
		763.13* @	1.81	2.91813E+001	1.84172E+000
		860.56*	12.42	3.49605E+001	9.85837E-001
TL-208e	0.958	1592.53*	99.16	1.73989E+000	1.16582E-001
Bi-211	0.902	351.03*	13.00	4.53807E+001	1.93969E+000
Bi-212	0.958	39.86 @	1.06		
		727.33*	6.74	1.03600E+002	3.59274E+000
		785.37*	1.11	1.02359E+002	4.24909E+000
		1620.74*	1.51	1.03884E+002	4.53092E+000
		1806.00* @	0.09	1.38969E+002	6.30210E+001
Pb-212	0.999	74.81*	10.40	9.17499E+001	4.23068E+000
		77.11*	17.50	7.80214E+001	3.55901E+000
		87.30*	7.81	6.32917E+001	3.00862E+000
		115.18* @	0.59	7.31106E+001	1.18789E+001
		238.63*	43.30	9.78213E+001	4.40947E+000
		300.09*	3.28	9.08829E+001	4.28736E+000
Bi-214	0.902	76.86* @	0.43	3.14821E+003	1.47521E+002
		89.81* @	0.24	1.50299E+003	7.62918E+001
		386.77 @	0.30		
		454.77 @	0.29		
		609.31*	45.49	1.51414E+001	5.08029E-001
		665.45* @	1.53	1.49019E+001	4.22172E+000
		703.11 @	0.48		
		719.86 @	0.39		
		768.36*	4.89	1.30757E+001	7.12448E-001
		786.10* @	0.31	3.60007E+002	5.98702E+001
		806.17* @	1.26	1.73015E+001	4.48088E+000
		934.06*	3.10	1.24885E+001	1.84109E+000
		964.08* @	0.36	1.31151E+003	5.56852E+001
		1051.96 @	0.31		
		1120.29*	14.91	1.62550E+001	6.54841E-001

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.902	1133.66	@	0.25		
		1155.19*	@	1.63	1.56979E+001	3.73466E+000
		1207.68	@	0.45		
		1238.11*		5.79	1.60202E+001	1.14230E+000
		1280.96*	@	1.43	1.10580E+001	2.76609E+000
		1377.67*		4.00	1.77756E+001	9.84402E-001
		1385.31*	@	0.76	1.81944E+001	5.43354E+000
		1401.50*	@	1.27	1.52179E+001	1.96234E+000
		1407.98*	@	2.15	1.69070E+001	1.44436E+000
		1509.23*	@	2.11	1.71701E+001	1.35926E+000
		1538.50	@	0.38		
		1543.32*	@	0.20	3.22019E+001	2.06136E+001
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28*	@	1.15	1.86599E+001	2.06341E+000
		1683.99	@	0.22		
		1729.59*	@	2.92	1.87499E+001	1.89235E+000
		1764.49*		15.40	1.66358E+001	7.62572E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.950	53.28	@	1.20		
		74.81*		6.44	1.45537E+002	7.06636E+000
		77.11*		10.80	1.24179E+002	6.37588E+000
		87.30*		4.84	1.00317E+002	5.13295E+000
		242.00*		7.43	5.95891E+001	2.81459E+000
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	1.54676E+001	7.33317E-001
		351.93*		37.60	1.56658E+001	6.50930E-001
		462.00*	@	0.22	1.67674E+003	9.62386E+001
		533.66	@	0.19		
		785.96*	@	1.07	1.04301E+002	8.86991E+000
		839.04	@	0.59		
Rn-220	0.992	549.73*		0.11	9.39389E+001	2.17825E+001
Ra-224	0.953	81.07	@	0.13		
		83.78*	@	0.22	7.56065E+002	4.39169E+001
		240.99*		4.10	1.09939E+002	5.11010E+000
Ra-226	0.877	81.07	@	0.20		
		83.78*	@	0.33	4.91322E+002	2.84516E+001
		94.90	@	0.15		
		186.21*		3.59	3.07780E+001	2.61243E+000
Ac-228	0.994	99.50*	@	1.26	7.22243E+001	7.95258E+000
		129.07*	@	2.50	6.36041E+001	3.53432E+000
		209.25*		3.97	8.84591E+001	5.36296E+000
		270.24*		3.55	8.36805E+001	4.56129E+000
		328.00*		3.04	8.82440E+001	4.85908E+000
		338.32*		11.40	9.35218E+001	4.90222E+000

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.994	409.46* @	2.02	8.48988E+001	5.03113E+000
		463.00*	4.45	8.47756E+001	5.71505E+000
		755.31* @	1.03	8.34002E+001	7.69822E+000
		772.29* @	1.52	8.32327E+001	4.62561E+000
		794.94*	4.31	9.30327E+001	4.51764E+000
		835.70* @	1.70	8.48041E+001	4.62438E+000
		911.20*	26.20	9.88714E+001	3.83869E+000
		964.79*	4.99	9.71298E+001	4.20086E+000
		968.96*	15.90	9.94186E+001	3.95576E+000
		1588.20*	3.06	9.87812E+001	5.01417E+000
		1630.62* @	1.52	1.08955E+002	5.99998E+000
Th-228	0.754	84.37*	1.26	1.30211E+002	6.19951E+000
		131.61 @	0.13		
		166.41 @	0.10		
		215.98*	0.25	1.21816E+002	2.36551E+001

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** INTERFERENCE CORRECTED REPORT *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
X	Mn-54		0.927		
X	Cd-109		0.924		
	Eu-152m		0.993	5.205566E+000	1.834186E-001
	Eu-155		0.919	3.976591E+000	2.223009E-001
X	Tm-170		0.989		
	Tl-208	@	0.971	3.287477E+001	6.312041E-001
	TL-208e		0.958	1.739890E+000	1.165817E-001
	Bi-211		0.902	5.014829E+000	2.731010E+000
	Bi-212	@	0.958	9.868418E+001	2.116771E+000
	Pb-212	@	0.999	6.326450E+001	1.450846E+000
	Bi-214	@	0.902	1.546292E+001	2.847906E-001
	Pb-214	@	0.950	1.393461E+001	7.020498E-001
	Rn-220		0.992	9.393891E+001	2.178247E+001
	Ra-224	@	0.953	8.385091E+001	5.095056E+000
	Ra-226	@	0.877	3.062063E+001	2.560296E+000
	Ac-228	@	0.994	9.420590E+001	9.832203E-001
	Th-228	@	0.754	7.134993E+001	5.812688E+000
X	Th-231		0.827		

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/6/2016 3:55:45 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m 6	93.39	1.8625E+000	1.29	Tol.	Yb-169
m 9	108.98	2.2389E-001	8.32	Tol.	Yb-169
12	143.82	2.6567E-002	83.32	Tol.	Ra-223
13	154.10	3.5671E-001	10.03	Sum	
15	191.32	2.8572E-002	77.73		
16	199.41	1.6961E-001	18.10	Sum	
21	252.64	1.0300E-001	27.53	Tol.	Sb-127
24	288.16	1.5679E-001	15.19	Tol.	Ra-223
27	321.52	4.2003E-002	52.76	Sum	
m 29	332.27	1.5077E-001	6.73	Sum	
m 31	340.87	1.4142E-001	6.95	Sum	
33	388.71	1.5593E-002	87.08		
35	452.72	1.2693E-001	19.45	Sum	
37	503.65	3.9943E-002	40.15	Sum	
M 39	546.51	2.4944E-002	22.66	Sum	
41	562.27	1.9614E-001	9.35	Sum	
43	588.81	1.4801E-003	672.90		
M 46	701.76	4.7190E-002	16.42	Sum	
m 47	707.16	5.0048E-002	15.30		
M 53	781.89	1.1526E-001	5.72	Tol.	Sb-127
M 57	830.31	1.0758E-001	5.74	Sum	
m 59	840.05	1.8458E-001	3.80	Sum	
m 61	864.50	1.2577E-002	34.21		
62	893.26	8.8653E-002	12.48	Sum	
63	903.97	1.5060E-001	9.19	Sum	
66	943.96	1.2703E-002	54.45	Sum	
67	951.86	1.9324E-002	47.11	Sum	
M 68	958.48	5.6224E-002	8.17	Sum	
71	987.86	2.8895E-002	30.68	Sum	
72	1001.03	3.9430E-002	18.99	Sum	
73	1032.86	3.8315E-002	20.88	S-Esc.	
74	1040.13	1.6898E-002	39.94	Sum	
75	1065.10	5.6447E-002	14.89	Sum	
76	1078.51	9.6613E-002	9.84	S-Esc.	
77	1093.93	1.0074E-001	10.67	Sum	
78	1110.52	8.0110E-002	13.13	S-Esc.	
82	1247.18	7.3264E-002	15.34		
M 84	1374.36	3.0289E-002	12.06	Sum	
89	1459.68	1.7328E-001	5.98	Sum	
M 90	1496.25	1.2863E-001	4.09	Sum	
m 91	1501.93	7.9183E-002	5.54	Sum	
m 93	1513.22	5.2952E-002	7.54	Sum	
M 95	1552.94	6.1824E-003	39.20	Sum	
m 96	1557.63	1.8832E-002	17.31	Sum	

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
97	1580.92	7.2756E-002	10.39	Sum	
m101	1625.67	3.4340E-002	9.84	Sum	
103	1638.89	7.5608E-002	9.28	Sum	
m105	1666.98	2.7990E-002	10.96	Sum	
106	1687.06	1.1571E-002	42.60		
110	1848.51	5.1181E-002	12.38	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
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Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S004-1218-01.CNF

Report Generated On	: 12/6/2016 6:02:58 PM
Sample Title	: UMR001-S004-1218-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 5.935E+002 GWET
Sample Taken On	: 11/18/2016 12:22:00 PM
Acquisition Started	: 12/6/2016 4:01:44 PM
Live Time	: 7200.0 seconds
Real Time	: 7271.4 seconds
Dead Time	: 0.98 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** PEAK ANALYSIS REPORT *****
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Detector Name: ERT01
Sample Title: UMR001-S004-1218-01
Peak Analysis Performed on: 12/6/2016 6:02:59 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	246-	260	254.77	63.65	0.36	6.68E+002	316.30	3.44E+004
M	2	285-	315	300.02	74.96	1.01	2.68E+004	223.71	3.76E+004
m	3	285-	315	309.05	77.22	1.02	4.29E+004	263.43	3.66E+004
M	4	331-	387	338.34	84.54	1.22	7.24E+003	175.70	3.82E+004
m	5	331-	387	349.46	87.32	1.22	2.28E+004	220.46	3.75E+004
m	6	331-	387	360.37	90.05	1.23	1.82E+004	207.41	3.67E+004
m	7	331-	387	373.72	93.39	1.23	2.00E+004	212.60	3.83E+004
	8	389-	406	398.63	99.62	1.09	5.24E+003	379.09	4.25E+004
M	9	406-	443	422.24	105.52	1.30	6.56E+003	196.45	4.21E+004
m	10	406-	443	435.62	108.87	1.31	2.34E+003	163.54	4.20E+004
M	11	443-	467	452.23	113.02	0.99	1.64E+002	53.44	3.23E+004
m	12	443-	467	461.33	115.29	0.99	2.75E+003	82.05	3.17E+004
M	13	507-	535	516.89	129.18	1.03	1.19E+004	200.33	3.67E+004
m	14	507-	535	527.45	131.82	1.03	7.41E+002	139.84	3.35E+004
	15	610-	628	616.44	154.08	1.00	4.62E+003	392.68	4.42E+004
	16	660-	671	665.91	166.44	0.98	5.70E+002	258.57	2.64E+004
	17	734-	754	744.47	186.08	1.14	6.30E+003	415.50	4.58E+004
	18	763-	772	766.09	191.49	1.15	4.54E+002	220.37	2.13E+004
	19	791-	805	798.07	199.49	1.05	1.61E+003	303.84	3.14E+004
	20	810-	829	815.68	203.89	0.94	3.50E+002	384.81	4.21E+004
	21	831-	854	837.27	209.28	1.08	2.18E+004	465.07	4.77E+004
	22	856-	869	863.98	215.96	1.13	1.19E+003	275.11	2.70E+004
	23	930-	939	934.25	233.53	0.76	7.93E+001	205.84	1.87E+004
M	24	939-	982	954.63	238.63	1.10	2.45E+005	515.25	2.19E+004
m	25	939-	982	964.57	241.11	1.10	2.55E+004	192.23	1.91E+004
	26	1005-	1016	1010.31	252.55	0.85	9.19E+002	190.59	1.41E+004
	27	1073-	1090	1080.99	270.22	1.10	1.72E+004	282.97	1.93E+004
	28	1102-	1123	1109.37	277.32	1.13	1.01E+004	316.66	2.38E+004
	29	1124-	1134	1128.38	282.07	0.90	1.38E+002	163.61	1.12E+004
	30	1141-	1158	1152.56	288.11	1.10	1.85E+003	243.78	1.77E+004
	31	1171-	1191	1180.85	295.19	1.15	1.54E+004	299.90	2.05E+004
	32	1193-	1209	1200.39	300.07	1.16	1.55E+004	255.97	1.59E+004
	33	1277-	1291	1285.56	321.37	0.67	7.93E+002	197.31	1.32E+004
M	34	1305-	1335	1311.78	327.92	1.15	1.35E+004	155.95	1.22E+004
m	35	1305-	1335	1329.28	332.30	1.16	1.72E+003	95.67	1.20E+004
M	36	1345-	1374	1353.03	338.24	1.17	5.11E+004	248.23	1.16E+004
m	37	1345-	1374	1363.82	340.93	1.17	1.75E+003	90.50	1.10E+004
	38	1392-	1419	1407.40	351.83	1.18	2.80E+004	343.53	2.00E+004
M	39	1613-	1649	1619.12	404.76	1.21	2.41E+002	76.89	9.11E+003
m	40	1613-	1649	1637.42	409.34	1.21	7.31E+003	123.39	9.15E+003
	41	1754-	1768	1761.65	440.40	1.27	3.10E+002	150.51	7.76E+003
	42	1803-	1819	1810.46	452.60	1.15	1.34E+003	167.86	8.56E+003

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	43	1838-	1872	1851.43	462.85	1.26	1.55E+004	129.07	7.76E+003
m	44	1838-	1872	1866.03	466.50	1.26	1.19E+002	55.23	7.20E+003
	45	1904-	1918	1911.90	477.97	0.84	2.99E+002	145.28	7.21E+003
	46	2002-	2019	2014.14	503.53	0.40	4.02E+002	164.06	8.15E+003
	47	2029-	2056	2042.32	510.57	1.38	2.98E+004	297.38	1.30E+004
	48	2088-	2103	2092.41	523.10	0.84	4.00E+002	143.55	6.70E+003
M	49	2177-	2204	2185.64	546.41	1.35	5.82E+002	77.58	6.99E+003
m	50	2177-	2204	2199.28	549.82	1.35	2.58E+002	67.11	5.77E+003
	51	2241-	2257	2249.15	562.29	1.34	2.48E+003	156.72	7.04E+003
	52	2323-	2351	2331.96	582.99	1.33	8.96E+004	379.55	1.10E+004
	53	2426-	2446	2436.42	609.11	1.37	2.22E+004	218.81	7.08E+003
	54	2457-	2470	2463.47	615.87	0.75	2.33E+002	115.48	4.75E+003
	55	2651-	2670	2661.49	665.38	1.55	9.03E+002	154.80	6.58E+003
M	56	2800-	2834	2806.91	701.74	1.30	5.90E+002	69.99	5.07E+003
m	57	2800-	2834	2829.37	707.35	1.30	2.89E+002	60.79	4.68E+003
	58	2898-	2920	2908.19	727.06	1.41	2.01E+004	212.64	6.43E+003
	59	2928-	2943	2932.22	733.07	0.28	7.89E+001	113.41	4.25E+003
	60	3011-	3029	3020.23	755.07	1.44	2.54E+003	140.04	5.05E+003
M	61	3042-	3099	3052.36	763.11	1.43	1.38E+003	65.88	4.66E+003
m	62	3042-	3099	3072.61	768.17	1.44	1.80E+003	67.41	4.31E+003
m	63	3042-	3099	3088.25	772.08	1.44	3.47E+003	81.76	4.01E+003
M	64	3119-	3152	3127.32	781.85	1.48	1.32E+003	61.28	3.67E+003
m	65	3119-	3152	3141.15	785.30	1.48	3.15E+003	78.86	3.86E+003
	66	3169-	3190	3178.79	794.72	1.38	1.03E+004	162.18	4.25E+003
	67	3216-	3231	3223.78	805.96	1.57	4.13E+002	91.94	2.67E+003
M	68	3275-	3372	3283.98	821.02	1.53	1.53E+002	43.19	2.89E+003
m	69	3275-	3372	3299.00	824.77	1.53	2.99E+002	47.79	3.01E+003
m	70	3275-	3372	3321.25	830.33	1.53	1.48E+003	61.40	2.79E+003
m	71	3275-	3372	3341.82	835.48	1.53	4.58E+003	88.20	2.85E+003
m	72	3275-	3372	3360.29	840.09	1.53	2.43E+003	65.42	2.62E+003
	73	3429-	3455	3441.34	860.36	1.53	1.07E+004	162.62	3.57E+003
	74	3565-	3590	3573.16	893.32	1.30	8.02E+002	119.02	3.13E+003
	75	3607-	3626	3616.11	904.05	1.33	1.46E+003	101.16	2.50E+003
	76	3632-	3657	3643.96	911.02	1.53	6.28E+004	274.40	2.95E+003
	77	3724-	3747	3735.39	933.88	1.48	9.50E+002	102.31	2.38E+003
M	78	3770-	3815	3776.72	944.21	1.26	1.91E+002	34.04	1.41E+003
m	79	3770-	3815	3791.00	947.78	1.26	1.64E+002	32.65	1.51E+003
m	80	3770-	3815	3807.99	952.03	1.26	2.95E+002	37.78	1.52E+003
M	81	3821-	3889	3833.77	958.47	1.57	6.41E+002	43.22	1.92E+003
m	82	3821-	3889	3858.31	964.61	1.57	1.15E+004	114.49	1.87E+003
m	83	3821-	3889	3875.09	968.81	1.58	3.72E+004	197.11	1.73E+003
M	84	3923-	3958	3929.16	982.32	1.50	1.09E+002	32.93	1.35E+003
m	85	3923-	3958	3951.18	987.83	1.50	2.52E+002	38.83	1.38E+003
	86	3995-	4011	4003.40	1000.88	0.87	3.13E+002	67.55	1.35E+003
M	87	4123-	4163	4132.16	1033.08	1.20	3.80E+002	22.93	1.19E+003
m	88	4123-	4163	4157.44	1039.40	1.20	5.34E+001	15.03	1.12E+003
	89	4198-	4219	4207.92	1052.02	1.00	1.81E+002	75.85	1.48E+003
	90	4250-	4270	4260.04	1065.05	1.50	5.01E+002	76.25	1.46E+003
	91	4301-	4325	4314.38	1078.64	1.61	1.20E+003	91.46	1.74E+003
	92	4366-	4398	4375.24	1093.85	2.14	1.16E+003	108.80	2.06E+003

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
93	4427-	4454	4441.99	1110.54	1.55	8.60E+002	96.02	1.86E+003
94	4463-	4498	4480.77	1120.24	1.75	5.22E+003	138.07	2.52E+003
M 95	4593-	4630	4598.32	1149.63	2.38	5.73E+001	32.66	1.36E+003
m 96	4593-	4630	4619.03	1154.81	2.38	7.43E+002	49.22	1.78E+003
97	4822-	4845	4830.79	1207.75	0.75	1.75E+002	80.08	1.56E+003
98	4941-	4965	4952.54	1238.19	1.80	1.78E+003	93.54	1.68E+003
99	4971-	4997	4988.36	1247.15	1.40	8.67E+002	97.08	1.96E+003
100	5110-	5133	5124.09	1281.08	1.68	4.36E+002	80.13	1.50E+003
M101	5489-	5523	5498.17	1374.61	1.56	1.84E+002	30.07	1.19E+003
m102	5489-	5523	5511.36	1377.91	1.56	1.23E+003	47.69	1.26E+003
103	5536-	5551	5542.68	1385.74	1.62	1.63E+002	54.63	9.37E+002
M104	5595-	5643	5606.53	1401.70	1.69	3.53E+002	33.93	1.19E+003
m105	5595-	5643	5632.40	1408.17	1.69	6.98E+002	40.51	1.13E+003
106	5822-	5858	5840.34	1460.16	2.89	2.36E+003	111.09	1.77E+003
M107	5971-	6021	5984.83	1496.29	1.80	1.60E+003	49.07	9.57E+002
m108	5971-	6021	6007.64	1501.99	1.80	8.59E+002	39.19	9.57E+002
M109	6028-	6063	6038.43	1509.69	1.92	5.94E+002	36.42	9.53E+002
m110	6028-	6063	6052.47	1513.20	1.92	6.75E+002	37.32	9.84E+002
111	6145-	6163	6154.67	1538.75	0.69	1.85E+002	52.17	7.51E+002
112	6216-	6238	6229.44	1557.44	1.28	3.18E+002	60.49	8.60E+002
113	6311-	6332	6323.37	1580.93	1.81	8.75E+002	69.28	1.05E+003
M114	6343-	6392	6354.32	1588.66	1.85	5.20E+003	78.62	1.14E+003
m115	6343-	6392	6371.73	1593.02	1.85	2.85E+003	60.43	1.06E+003
M116	6472-	6537	6484.72	1621.27	1.91	2.48E+003	56.82	9.05E+002
m117	6472-	6537	6502.53	1625.72	1.91	3.99E+002	30.68	8.65E+002
m118	6472-	6537	6524.35	1631.18	1.91	2.66E+003	58.37	9.01E+002
119	6539-	6568	6554.96	1638.83	1.99	8.21E+002	76.33	1.05E+003
M120	6634-	6683	6646.77	1661.78	2.29	3.79E+002	32.52	8.88E+002
m121	6634-	6683	6668.80	1667.29	2.29	3.64E+002	32.47	9.40E+002
122	6733-	6756	6746.78	1686.79	0.41	2.09E+002	60.11	8.46E+002
123	6908-	6933	6921.07	1730.36	2.22	7.98E+002	69.59	9.51E+002
124	7049-	7075	7060.90	1765.32	1.92	4.06E+003	90.46	9.35E+002
125	7214-	7237	7226.45	1806.72	1.67	2.95E+002	57.75	7.59E+002
126	7286-	7304	7296.67	1824.27	0.44	8.19E+001	48.15	6.58E+002
127	7380-	7404	7392.99	1848.36	2.07	6.06E+002	64.66	8.66E+002
128	7545-	7559	7551.63	1888.02	0.95	9.60E+001	42.84	6.03E+002

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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***** N U C L I D E M D A R E P O R T *****
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Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S004-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	4.8319E+000	4.83E+000	2.4248E+001
	Co-60	1173.23	99.85	3.6163E-001	3.62E-001	1.8865E-001
		1332.49	99.98	3.8750E-001		6.7985E-002
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	8.6208E+003	5.90E-001	1.1463E+003
		661.66	84.99	5.9035E-001		-2.0809E-001
+	Tl-208	72.80	2.02	6.6130E+001	7.57E-001	3.8529E+000
		74.97*	3.41	2.1910E+001		4.5938E+002
		84.90*	1.51	3.4840E+001		1.9582E+002
		277.36*	6.31	7.7954E+000		5.6363E+001
		510.77*	22.60	2.6703E+000		6.9847E+001
		583.19*	84.50	7.5676E-001		6.2258E+001
		763.13*	1.81	1.7765E+001		5.4271E+001
		860.56*	12.42	3.6534E+000		6.6683E+001
+	Bi-212	39.86	1.06	4.6752E+003	7.55E+000	-2.7445E+002
		727.33*	6.74	7.5477E+000		2.0553E+002
		785.37*	1.11	2.6929E+001		2.0601E+002
		1620.74*	1.51	1.5861E+001		1.9649E+002
		1806.00*	0.09	3.7213E+002		4.2355E+002
+	Pb-212	74.81*	10.40	7.1841E+000	7.32E-001	1.5063E+002
		77.11*	17.50	3.8088E+000		1.2961E+002
		87.30*	7.81	6.2017E+000		1.1058E+002
		115.18*	0.59	5.9142E+001		1.3841E+002
		238.63*	43.30	7.3183E-001		1.8315E+002
		300.09*	3.28	1.1724E+001		1.7415E+002
+	Bi-214	76.86*	0.43	1.5367E+002	9.79E-001	5.2295E+003
		89.81*	0.24	1.8154E+002		2.6176E+003
		386.77	0.30	1.4963E+002		4.7704E+001
		454.77	0.29	1.5555E+002		2.8380E+002
		609.31*	45.49	9.7906E-001		2.9068E+001
		665.45*	1.53	2.9401E+001		3.7462E+001
		703.11	0.48	1.1035E+002		1.3339E+000
		719.86	0.39	1.2483E+002		6.9916E+000
		768.36*	4.89	6.2421E+000		2.5902E+001
		786.10*	0.31	9.4705E+001		7.2450E+002
		806.17*	1.26	2.4161E+001		2.3806E+001
		934.06*	3.10	1.1840E+001		2.4660E+001
		964.08*	0.36	6.5074E+001		2.5984E+003
		1051.96*	0.31	9.6868E+001		5.0033E+001
		1120.29*	14.91	3.3553E+000		3.1881E+001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	1.3105E+002	9.79E-001	2.5986E+001
		1155.19*	1.63	1.5930E+001		4.2232E+001
		1207.68*	0.45	7.8551E+001		3.7127E+001
		1238.11*	5.79	6.5727E+000		3.0003E+001
		1280.96*	1.43	2.5256E+001		3.0400E+001
		1377.67*	4.00	6.1854E+000		3.2201E+001
		1385.31*	0.76	3.4679E+001		2.2682E+001
		1401.50*	1.27	1.9126E+001		2.9413E+001
		1407.98*	2.15	1.1045E+001		3.4506E+001
		1509.23*	2.11	1.0879E+001		3.1400E+001
		1538.50*	0.38	7.1233E+001		5.5567E+001
		1543.32	0.20	1.8468E+002		9.8641E+001
		1583.22	0.69	1.0203E+002		1.5427E+002
		1594.73	0.25	3.0814E+002		2.8277E+001
		1599.31	0.23	2.3340E+002		2.2851E+001
		1661.28*	1.15	2.0634E+001		3.9390E+001
		1683.99	0.22	1.7941E+002		3.2287E+002
		1729.59*	2.92	1.2570E+001		3.3591E+001
		1764.49*	15.40	2.4450E+000		3.2823E+001
		1847.42*	2.11	1.7184E+001		3.7089E+001
		1873.16	0.22	1.8607E+002		-5.4227E+001
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	3.8938E+002	1.49E+000	8.4465E+001
		74.81*	6.44	1.1395E+001		2.3891E+002
		77.11*	10.80	6.0616E+000		2.0627E+002
		87.30*	4.84	9.8288E+000		1.7525E+002
		242.00*	7.43	3.9315E+000		1.0973E+002
		258.87	0.52	7.9365E+001		2.7792E+001
		274.80	0.47	1.0157E+002		-1.7154E+000
		295.22*	19.30	2.3642E+000		2.8522E+001
		351.93*	37.60	1.4940E+000		2.9961E+001
		462.00*	0.22	1.2849E+002		3.4128E+003
		533.66	0.19	2.4741E+002		1.3253E+002
		785.96*	1.07	2.7438E+001		2.0990E+002
		839.04	0.59	9.5492E+001		-7.4900E-001
+	Ra-224	81.07	0.13	5.9783E+002	7.25E+000	-1.9169E+003
		83.78*	0.22	2.4244E+002		1.3626E+003
		240.99*	4.10	7.2540E+000		2.0246E+002
+	Ra-226	81.07	0.20	3.9045E+002	1.53E+001	-1.2520E+003
		83.78*	0.33	1.5753E+002		8.8539E+002
		94.90	0.15	4.0295E+002		2.6086E+003
		186.21*	3.59	1.5327E+001		5.0407E+001
+	Ac-228	99.50*	1.26	4.2674E+001	1.46E+000	1.2892E+002
		129.07*	2.50	1.4851E+001		1.3994E+002
		209.25*	3.97	1.5839E+001		1.6802E+002
		270.24*	3.55	1.1406E+001		1.6755E+002
		328.00*	3.04	9.3699E+000		1.7304E+002
		338.32*	11.40	2.4837E+000		1.7878E+002
		409.46*	2.02	1.4223E+001		1.6467E+002

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	6.4971E+000	1.46E+000	1.7257E+002
		755.31*	1.03	4.1879E+001		1.7402E+002
		772.29*	1.52	1.9806E+001		1.6407E+002
		794.94*	4.31	1.0030E+001		1.7581E+002
		835.70*	1.70	1.5783E+001		2.0455E+002
		911.20*	26.20	1.6089E+000		1.9286E+002
		964.79*	4.99	4.8198E+000		1.9246E+002
		968.96*	15.90	1.4588E+000		1.9635E+002
		1588.20*	3.06	8.6432E+000		2.0015E+002
		1630.62*	1.52	1.5797E+001		2.0998E+002
+	Th-228	84.37*	1.26	4.1753E+001	4.18E+001	2.3467E+002
		131.61*	0.13	2.7030E+002		1.6612E+002
		166.41*	0.10	3.3444E+002		1.5876E+002
		215.98*	0.25	1.5524E+002		1.4544E+002
	Pa-234m	258.23	0.07	5.6367E+002	4.18E+001	3.1476E+002
		742.81	0.09	5.0461E+002		-1.4091E+002
		766.36	0.32	1.6825E+002		-1.4494E+003
		786.27	0.05	1.0214E+003		-7.2952E+000
		1001.03	0.85	4.1832E+001		5.3214E+001
		1737.77	0.02	1.8005E+003		8.3094E+002
+	Th-234	63.30*	3.75	4.5232E+001	9.83E+000	1.9540E+001
		92.59*	4.33	9.8319E+000		1.5169E+002
		112.81*	0.22	1.6055E+002		2.2192E+001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
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Sample Title: UMR001-S004-1218-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Be-7	0.979	477.60*		10.44	1.81585E+000	8.83185E-001
K-40	0.932	1460.82*		10.55	2.42475E+001	1.31637E+000
Mn-54	0.937	834.84*		99.97	3.55698E+000	1.08612E-001
Ce-139	0.947	165.86*		79.89	2.21600E-001	1.00981E-001
Eu-152m	0.993	89.85*		69.90	9.16033E+000	3.22646E-001
Eu-155	0.920	45.30		1.31		
		60.01		1.22		
		86.55*		30.70	2.78295E+001	9.98788E-001
		105.31*		21.10	9.18635E+000	4.56533E-001
Tl-208	0.972	72.80	@	2.02		
		74.97*	@	3.41	4.59385E+002	1.63871E+001
		84.90*	@	1.51	1.95816E+002	8.17238E+000
		277.36*		6.31	5.63628E+001	3.03548E+000
		510.77*	@	22.60	6.98474E+001	2.47665E+000
		583.19*		84.50	6.22578E+001	2.03642E+000
		763.13*	@	1.81	5.42711E+001	2.92616E+000
		860.56*		12.42	6.66832E+001	1.94016E+000
TL-208e	0.963	1592.53*		99.16	3.39566E+000	2.19856E-001
Bi-211	0.903	351.03*		13.00	8.67922E+001	3.69320E+000
Bi-212	0.959	39.86	@	1.06		
		727.33*		6.74	2.05526E+002	6.83513E+000
		785.37*		1.11	2.06012E+002	7.45822E+000
		1620.74*		1.51	1.96494E+002	7.84630E+000
		1806.00*	@	0.09	4.23546E+002	1.26341E+002
Pb-212	0.999	74.81*		10.40	1.50625E+002	6.91005E+000
		77.11*		17.50	1.29612E+002	5.89463E+000
		87.30*		7.81	1.10579E+002	5.20686E+000
		115.18*	@	0.59	1.38410E+002	6.19302E+000
		238.63*		43.30	1.83151E+002	8.25091E+000
		300.09*		3.28	1.74146E+002	7.71788E+000
Bi-214	0.932	76.86*	@	0.43	5.22945E+003	2.44349E+002
		89.81*	@	0.24	2.61759E+003	1.31596E+002
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	2.90679E+001	9.34835E-001
		665.45*	@	1.53	3.74623E+001	6.50900E+000
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	2.59016E+001	1.16658E+000
		786.10*	@	0.31	7.24497E+002	1.19584E+002
		806.17*	@	1.26	2.38056E+001	5.32571E+000

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.932	934.06*	3.10	2.46597E+001	2.71709E+000
		964.08* @	0.36	2.59844E+003	1.08373E+002
		1051.96* @	0.31	5.00327E+001	2.11096E+001
		1120.29*	14.91	3.18811E+001	1.15072E+000
		1133.66 @	0.25		
		1155.19* @	1.63	4.22317E+001	2.99013E+000
		1207.68* @	0.45	3.71265E+001	1.70783E+001
		1238.11*	5.79	3.00034E+001	1.79098E+000
		1280.96* @	1.43	3.03998E+001	5.65111E+000
		1377.67*	4.00	3.22015E+001	1.55679E+000
		1385.31* @	0.76	2.26821E+001	7.62715E+000
		1401.50* @	1.27	2.94135E+001	2.95832E+000
		1407.98* @	2.15	3.45061E+001	2.31809E+000
		1509.23* @	2.11	3.14002E+001	2.15723E+000
		1538.50* @	0.38	5.55673E+001	1.58809E+001
		1543.32 @	0.20		
		1583.22 @	0.69		
		1594.73 @	0.25		
		1599.31 @	0.23		
		1661.28* @	1.15	3.93898E+001	3.68918E+000
		1683.99 @	0.22		
		1729.59* @	2.92	3.35914E+001	3.13672E+000
		1764.49*	15.40	3.28230E+001	1.36021E+000
		1847.42* @	2.11	3.70887E+001	4.24266E+000
		1873.16 @	0.22		
		2118.55 @	1.14		
		2204.21 @	5.08		
Pb-214	0.950	53.28 @	1.20		
		74.81*	6.44	2.38907E+002	1.15464E+001
		77.11*	10.80	2.06273E+002	1.05658E+001
		87.30*	4.84	1.75251E+002	8.89416E+000
		242.00*	7.43	1.09731E+002	5.14927E+000
		258.87 @	0.52		
		274.80 @	0.47		
		295.22*	19.30	2.85223E+001	1.31253E+000
		351.93*	37.60	2.99611E+001	1.23905E+000
		462.00* @	0.22	3.41279E+003	1.86385E+002
		533.66 @	0.19		
		785.96* @	1.07	2.09901E+002	1.73337E+001
		839.04 @	0.59		
Rn-220	0.999	549.73*	0.11	1.27303E+002	3.84225E+001
Ra-224	0.953	81.07 @	0.13		
		83.78* @	0.22	1.36259E+003	7.58773E+001
		240.99*	4.10	2.02465E+002	9.34772E+000
Ra-226	0.876	81.07 @	0.20		
		83.78* @	0.33	8.85388E+002	4.91394E+001
		94.90 @	0.15		
		186.21*	3.59	5.04070E+001	4.10529E+000
Ac-228	0.994	99.50* @	1.26	1.28921E+002	1.08445E+001
		129.07* @	2.50	1.39939E+002	6.20756E+000

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.994	209.25*	3.97	1.68024E+002	1.00368E+001
		270.24*	3.55	1.67553E+002	8.89927E+000
		328.00*	3.04	1.73044E+002	9.40035E+000
		338.32*	11.40	1.78781E+002	9.34796E+000
		409.46* @	2.02	1.64672E+002	8.25357E+000
		463.00*	4.45	1.72566E+002	1.12273E+001
		755.31* @	1.03	1.74023E+002	1.25419E+001
		772.29* @	1.52	1.64075E+002	8.56984E+000
		794.94*	4.31	1.75809E+002	7.65031E+000
		835.70* @	1.70	2.04549E+002	1.04858E+001
		911.20*	26.20	1.92857E+002	7.45110E+000
		964.79*	4.99	1.92456E+002	8.18170E+000
		968.96*	15.90	1.96351E+002	7.76757E+000
		1588.20*	3.06	2.00147E+002	9.81988E+000
		1630.62* @	1.52	2.09981E+002	1.09711E+001
Th-228	0.996	84.37*	1.26	2.34668E+002	1.04783E+001
		131.61* @	0.13	1.66123E+002	3.17994E+001
		166.41* @	0.10	1.58758E+002	7.23809E+001
		215.98*	0.25	1.45442E+002	3.42559E+001
Th-234	0.940	63.30*	3.75	1.95404E+001	9.76738E+000
		92.59*	4.33	1.51687E+002	8.30412E+000
		112.81* @	0.22	2.21919E+001	7.61723E+000

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

UMR001-S004-1218-1

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	Be-7		0.979	1.815846E+000	8.831846E-001
	K-40		0.932	2.424755E+001	1.316373E+000
	Mn-54		0.937	3.446054E-001	1.131519E-001
X	Cd-109		0.922		
	Ce-139		0.947	5.293276E-002	1.018801E-001
	Eu-152m		0.993	9.056012E+000	3.129225E-001
	Eu-155		0.920	7.572367E+000	3.578313E-001
X	Tm-170		0.987		
X	Lu-177		0.885		
	Tl-208	@	0.972	6.322638E+001	1.225190E+000
	TL-208e		0.963	3.395659E+000	2.198557E-001
	Bi-211		0.903	1.315589E+001	5.023144E+000
	Bi-212	@	0.959	1.938488E+002	3.774361E+000
	Pb-212	@	0.999	1.067042E+002	2.478962E+000
	Bi-214	@	0.932	2.980756E+001	4.889778E-001
	Pb-214	@	0.950	2.541966E+001	1.254256E+000
	Rn-220		0.999	1.273027E+002	3.842251E+001
	Ra-224	@	0.953	1.552685E+002	9.298642E+000
	Ra-226	@	0.876	5.031707E+001	4.016132E+000
	Ac-228	@	0.994	1.847319E+002	1.824721E+000
	Th-228	@	0.996	1.208363E+002	9.676924E+000
X	Th-231		0.826		
	Th-234	@	0.940	9.624392E+001	6.326645E+000

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/6/2016 6:02:59 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m 10	108.87	3.2449E-001	7.00	Tol.	Cs-136
15	154.08	6.4124E-001	8.51	Sum	
18	191.49	6.3108E-002	48.50		
19	199.49	2.2410E-001	18.83	Sum	
20	203.89	4.8603E-002	109.96	Sum	
23	233.53	1.1013E-002	259.59	Tol.	Bi-206
26	252.55	1.2762E-001	20.74	Tol.	Sb-127
29	282.07	1.9234E-002	118.15	Sum	
30	288.11	2.5708E-001	13.17	Tol.	Pm-148x
33	321.37	1.1017E-001	24.88	Sum	
m 35	332.30	2.3824E-001	5.58	Sum	
m 37	340.93	2.4289E-001	5.17	Sum	
M 39	404.76	3.3437E-002	31.94	Sum	
41	440.40	4.3098E-002	48.50	Sum	
42	452.60	1.8568E-001	12.56	Sum	
m 44	466.50	1.6533E-002	46.40	Sum	
46	503.53	5.5841E-002	40.81	Sum	
48	523.10	5.5596E-002	35.86	Sum	
M 49	546.41	8.0786E-002	13.34	Sum	
51	562.29	3.4384E-001	6.33	Sum	
54	615.87	3.2347E-002	49.58	Sum	
M 56	701.74	8.1929E-002	11.87	Sum	
m 57	707.35	4.0164E-002	21.02	Tol.	Ag-110m
59	733.07	1.0957E-002	143.76	Sum	
M 64	781.85	1.8273E-001	4.66	Tol.	Sb-127
M 68	821.02	2.1194E-002	28.30	Sum	
m 69	824.77	4.1554E-002	15.97	Sum	
m 70	830.33	2.0491E-001	4.16	Sum	
m 72	840.09	3.3717E-001	2.69	Sum	
74	893.32	1.1133E-001	14.85	Sum	
75	904.05	2.0325E-001	6.91	Sum	
M 78	944.21	2.6500E-002	17.84	Sum	
m 79	947.78	2.2767E-002	19.92	Sum	
m 80	952.03	4.0961E-002	12.81	Sum	
M 81	958.47	8.9084E-002	6.74	Sum	
M 84	982.32	1.5146E-002	30.20	Sum	
m 85	987.83	3.4952E-002	15.43	Sum	
86	1000.88	4.2846E-002	21.90	Sum	
M 87	1033.08	5.2830E-002	6.03	Sum	
m 88	1039.40	7.4184E-003	28.13	Sum	
90	1065.05	6.9542E-002	15.23	Sum	
91	1078.64	1.6686E-001	7.61	S-Esc.	
92	1093.85	1.6059E-001	9.41	Sum	
93	1110.54	1.1947E-001	11.16	S-Esc.	

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
M 95	1149.63	7.9563E-003	57.02	Sum	
99	1247.15	1.2035E-001	11.20		
M101	1374.61	2.5570E-002	16.33	Sum	
M107	1496.29	2.2217E-001	3.07	Sum	
m108	1501.99	1.1927E-001	4.56	Sum	
m110	1513.20	9.3807E-002	5.52	Sum	
112	1557.44	4.4198E-002	19.01	Sum	
113	1580.93	1.2148E-001	7.92	Sum	
m117	1625.72	5.5369E-002	7.69	Sum	
119	1638.83	1.1409E-001	9.29	Sum	
m121	1667.29	5.0589E-002	8.92	Sum	
122	1686.79	2.9034E-002	28.75	Sum	
126	1824.27	1.1381E-002	58.76	Sum	
128	1888.02	1.3330E-002	44.64	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

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*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************
```

Filename: ERT01,C:\GENIE2K\CAMFILES\SMP-UMR001-S004-1824-01.CNF

Report Generated On	: 12/6/2016 8:09:46 PM
Sample Title	: UMR001-S004-1824-01
Sample Description	: 450 cc Soil
Sample Identification	:
Sample Type	:
Sample Geometry	:
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 100 - 8192
Peak Area Range (in channels)	: 100 - 8192
Identification Energy Tolerance	: 1.000 keV
Sample Size	: 4.904E+002 GWET
Sample Taken On	: 11/18/2016 12:20:00 PM
Acquisition Started	: 12/6/2016 6:09:34 PM
Live Time	: 7200.0 seconds
Real Time	: 7210.5 seconds
Dead Time	: 0.15 %

Energy Calibration Used Done On	: 10/24/2016
Efficiency Calibration Used Done On	: 9/27/2016
Efficiency ID	: ERT0101

****
***** PEAK ANALYSIS REPORT *****
****

Detector Name: ERT01
Sample Title: UMR001-S004-1824-01
Peak Analysis Performed on: 12/6/2016 8:09:46 PM
Peak Analysis From Channel: 100
Peak Analysis To Channel: 8192

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	1	285-	317	300.01	74.96	1.03	5.51E+003	94.83	5.43E+003
m	2	285-	317	309.11	77.23	1.04	8.64E+003	111.56	5.13E+003
M	3	329-	388	338.09	84.48	1.21	1.19E+003	67.17	5.74E+003
m	4	329-	388	349.50	87.33	1.21	4.00E+003	90.13	5.21E+003
m	5	329-	388	360.41	90.06	1.22	2.86E+003	78.68	5.03E+003
m	6	329-	388	373.70	93.38	1.22	3.17E+003	80.90	5.17E+003
	7	388-	405	398.53	99.59	1.09	6.26E+002	137.64	5.63E+003
	8	408-	430	422.90	105.68	1.29	6.49E+002	174.50	7.68E+003
	9	455-	467	461.62	115.37	0.87	4.65E+002	103.77	3.92E+003
	10	509-	523	516.81	129.16	0.84	1.59E+003	129.01	5.23E+003
	11	608-	627	616.26	154.03	1.12	7.09E+002	146.04	5.88E+003
	12	736-	758	744.27	186.04	1.23	1.19E+003	159.39	6.22E+003
	13	830-	846	837.33	209.30	1.06	3.17E+003	124.63	3.94E+003
	14	859-	873	865.08	216.24	0.58	1.77E+002	102.69	3.59E+003
M	15	945-	974	954.65	238.63	1.10	3.45E+004	192.62	2.74E+003
m	16	945-	974	964.59	241.12	1.10	3.77E+003	72.16	2.33E+003
	17	1006-	1015	1010.41	252.57	0.46	6.50E+001	58.91	1.50E+003
	18	1072-	1092	1080.98	270.22	1.26	2.29E+003	113.03	2.88E+003
	19	1102-	1121	1109.31	277.30	1.34	1.64E+003	104.78	2.65E+003
	20	1148-	1159	1152.95	288.21	0.77	1.59E+002	63.86	1.56E+003
	21	1172-	1191	1180.84	295.19	1.11	2.37E+003	103.49	2.37E+003
	22	1191-	1209	1200.38	300.07	1.22	2.19E+003	97.88	2.19E+003
M	23	1302-	1339	1311.83	327.94	1.17	1.82E+003	56.68	1.63E+003
m	24	1302-	1339	1329.56	332.37	1.18	2.08E+002	33.83	1.60E+003
	25	1346-	1360	1353.05	338.24	1.21	6.87E+003	109.25	1.75E+003
	26	1398-	1425	1407.39	351.83	1.18	4.02E+003	127.69	2.62E+003
	27	1628-	1642	1637.38	409.33	1.00	8.92E+002	67.55	1.27E+003
	28	1803-	1824	1811.12	452.77	1.11	1.89E+002	74.30	1.42E+003
	29	1841-	1862	1851.50	462.86	1.15	2.07E+003	84.29	1.34E+003
	30	2027-	2056	2042.34	510.58	1.36	4.11E+003	110.10	1.69E+003
	31	2243-	2254	2248.96	562.24	1.38	3.01E+002	43.75	6.44E+002
	32	2320-	2345	2332.02	583.01	1.31	1.20E+004	133.52	1.38E+003
	33	2428-	2445	2436.40	609.10	1.36	3.33E+003	76.12	7.57E+002
	34	2693-	2704	2698.26	674.57	0.56	4.37E+001	37.73	5.45E+002
	35	2895-	2919	2908.24	727.07	1.43	2.71E+003	79.82	8.87E+002
	36	3015-	3031	3020.27	755.08	1.40	2.94E+002	47.25	6.15E+002
M	37	3044-	3098	3052.40	763.11	1.32	1.76E+002	23.31	5.96E+002
m	38	3044-	3098	3072.89	768.24	1.32	2.60E+002	24.94	5.79E+002
m	39	3044-	3098	3088.11	772.04	1.32	4.24E+002	29.75	5.62E+002
M	40	3121-	3155	3128.27	782.08	1.50	1.18E+002	20.99	4.80E+002
m	41	3121-	3155	3141.66	785.43	1.50	4.43E+002	29.02	4.85E+002
	42	3170-	3197	3178.76	794.71	1.41	1.42E+003	67.48	6.85E+002

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	43	3312-	3370	3321.35	830.36	1.34	1.50E+002	19.84	3.90E+002
m	44	3312-	3370	3342.19	835.57	1.34	4.66E+002	28.03	3.76E+002
m	45	3312-	3370	3360.31	840.10	1.34	2.70E+002	22.75	3.63E+002
	46	3431-	3452	3441.43	860.38	1.58	1.42E+003	54.13	3.98E+002
	47	3606-	3626	3616.07	904.05	0.84	2.50E+002	37.55	3.20E+002
	48	3630-	3656	3644.02	911.03	1.50	8.41E+003	100.34	3.80E+002
	49	3722-	3744	3735.34	933.86	1.18	1.75E+002	37.47	3.17E+002
M	50	3847-	3889	3858.42	964.64	1.57	1.46E+003	41.46	3.03E+002
m	51	3847-	3889	3875.24	968.84	1.57	4.89E+003	71.68	2.58E+002
	52	3946-	3957	3951.17	987.83	0.51	4.53E+001	20.50	1.49E+002
M	53	4126-	4163	4133.50	1033.41	0.73	4.50E+001	11.03	9.55E+001
m	54	4126-	4163	4156.62	1039.19	0.73	3.18E+001	10.05	1.09E+002
	55	4306-	4323	4314.04	1078.55	1.02	1.33E+002	27.65	1.94E+002
	56	4366-	4384	4375.98	1094.04	0.43	1.12E+002	28.13	2.00E+002
	57	4433-	4452	4442.55	1110.68	1.11	1.31E+002	28.50	1.93E+002
	58	4467-	4493	4481.01	1120.30	1.52	7.10E+002	44.83	2.97E+002
	59	4943-	4965	4952.00	1238.05	1.53	2.79E+002	36.08	2.62E+002
	60	5501-	5521	5511.96	1378.06	1.26	1.77E+002	31.36	2.22E+002
	61	5626-	5644	5633.89	1408.54	0.35	1.11E+002	22.78	1.21E+002
	62	5829-	5856	5844.27	1461.14	1.77	1.74E+003	52.07	2.13E+002
M	63	5975-	6018	5984.54	1496.21	1.79	1.94E+002	17.05	1.09E+002
m	64	5975-	6018	6007.90	1502.05	1.79	1.09E+002	14.22	1.30E+002
	65	6029-	6043	6037.75	1509.52	1.66	5.23E+001	19.58	1.14E+002
	66	6315-	6331	6323.72	1581.02	0.35	8.31E+001	21.28	1.17E+002
M	67	6343-	6384	6354.29	1588.66	1.86	7.03E+002	28.75	1.42E+002
m	68	6343-	6384	6371.66	1593.00	1.86	3.61E+002	21.48	1.31E+002
	69	6473-	6495	6484.90	1621.31	1.75	2.91E+002	30.23	1.60E+002
	70	6511-	6535	6524.57	1631.23	1.30	3.42E+002	28.79	1.18E+002
	71	6544-	6565	6554.58	1638.73	2.06	1.19E+002	19.92	7.42E+001
	72	6641-	6653	6647.24	1661.90	1.08	4.89E+001	14.60	6.21E+001
	73	6911-	6930	6921.03	1730.36	1.56	1.32E+002	20.29	7.98E+001
	74	7048-	7072	7060.90	1765.33	1.61	6.58E+002	32.91	1.03E+002
	75	7151-	7164	7157.12	1789.38	0.34	1.85E+001	13.10	5.55E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

****
***** NUCLIDE MDA REPORT *****
****

Detector Name: ERT01
Sample Geometry:
Sample Title: UMR001-S004-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	K-40	1460.82*	10.55	1.8663E+000	1.87E+000	2.1572E+001
	Co-60	1173.23	99.85	1.8762E-001	1.77E-001	1.1020E-001
		1332.49	99.98	1.7716E-001		2.3658E-003
>		2505.71	0.10	0.0000E+000		0.0000E+000
	Cs-137	32.06	5.54	4.0066E+003	2.61E-001	2.0405E+003
		661.66	84.99	2.6080E-001		1.2498E-001
+	Tl-208	72.80	2.02	3.2732E+001	3.02E-001	-1.3097E+000
		74.97*	3.41	1.0112E+001		1.1425E+002
		84.90*	1.51	1.6438E+001		3.8931E+001
		277.36*	6.31	3.0481E+000		1.1090E+001
		510.77*	22.60	1.2128E+000		1.1248E+001
		583.19*	84.50	3.0186E-001		1.0076E+001
		763.13*	1.81	7.7726E+000		8.3831E+000
		860.56*	12.42	1.3817E+000		1.0741E+001
+	Bi-212	39.86	1.06	2.1413E+003	3.51E+000	4.8171E+002
		727.33*	6.74	3.5088E+000		3.3543E+001
		785.37*	1.11	1.1684E+001		3.5071E+001
		1620.74*	1.51	1.1373E+001		2.7849E+001
		1806.00	0.09	1.9320E+002		1.5144E+002
+	Pb-212	74.81*	10.40	3.3155E+000	3.15E-001	3.7460E+001
		77.11*	17.50	1.7315E+000		3.1569E+001
		87.30*	7.81	2.8083E+000		2.3517E+001
		115.18*	0.59	2.8979E+001		2.8368E+001
		238.63*	43.30	3.1527E-001		3.1283E+001
		300.09*	3.28	5.4787E+000		2.9744E+001
+	Bi-214	76.86*	0.43	6.9856E+001	3.70E-001	1.2736E+003
		89.81*	0.24	8.1599E+001		4.9684E+002
		386.77	0.30	6.5737E+001		1.6892E+001
		454.77	0.29	6.7183E+001		-1.7555E+000
		609.31*	45.49	3.7027E-001		5.2707E+000
		665.45	1.53	1.4696E+001		-4.6843E+000
		703.11	0.48	4.9276E+001		1.4978E+001
		719.86	0.39	5.5198E+001		3.1951E+001
		768.36*	4.89	2.7979E+000		4.5277E+000
		786.10*	0.31	4.1085E+001		1.2333E+002
		806.17	1.26	1.5298E+001		9.8700E+000
		934.06*	3.10	5.2032E+000		5.4959E+000
		964.08*	0.36	3.2101E+001		4.0101E+002
		1051.96	0.31	5.4750E+001		-5.1410E+000
		1120.29*	14.91	1.2584E+000		5.2454E+000

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Bi-214	1133.66	0.25	6.4621E+001	3.70E-001	-2.1567E+001
		1155.19	1.63	1.1753E+001		5.3094E+000
		1207.68	0.45	3.9557E+001		-1.0216E+001
		1238.11*	5.79	3.0811E+000		5.6805E+000
		1280.96	1.43	1.3802E+001		6.0490E+000
		1377.67*	4.00	4.2722E+000		5.5959E+000
		1385.31	0.76	2.4768E+001		-2.4838E+000
		1401.50	1.27	1.4233E+001		6.4590E+000
		1407.98*	2.15	5.7822E+000		6.6548E+000
		1509.23*	2.11	5.5871E+000		3.3436E+000
		1538.50	0.38	4.6950E+001		9.0150E+000
		1543.32	0.20	8.3135E+001		3.6921E+000
		1583.22	0.69	4.5629E+001		2.1921E+001
		1594.73	0.25	1.3593E+002		-1.1421E+001
		1599.31	0.23	1.0265E+002		-1.6378E+001
		1661.28*	1.15	7.8335E+000		6.1419E+000
		1683.99	0.22	8.2895E+001		5.2554E+001
		1729.59*	2.92	4.1002E+000		6.7374E+000
		1764.49*	15.40	9.7520E-001		6.4003E+000
		1847.42	2.11	9.5548E+000		9.6866E-001
		1873.16	0.22	8.0720E+001		-4.2424E+001
>		2118.55	1.14	0.0000E+000		0.0000E+000
>		2204.21	5.08	0.0000E+000		0.0000E+000
+	Pb-214	53.28	1.20	1.7848E+002	6.71E-001	5.0463E+001
		74.81*	6.44	5.2583E+000		5.9410E+001
		77.11*	10.80	2.7554E+000		5.0236E+001
		87.30*	4.84	4.4503E+000		3.7268E+001
		242.00*	7.43	1.6688E+000		1.9655E+001
		258.87	0.52	3.4058E+001		1.0263E+001
		274.80	0.47	4.4790E+001		1.7656E+000
		295.22*	19.30	9.6075E-001		5.3307E+000
		351.93*	37.60	6.7082E-001		5.1869E+000
		462.00*	0.22	8.8916E+001		5.5239E+002
		533.66	0.19	1.0699E+002		-2.4422E+001
		785.96*	1.07	1.1903E+001		3.5730E+001
		839.04	0.59	4.2430E+001		-1.8878E+000
+	Ra-224	81.07	0.13	2.7612E+002	3.08E+000	3.9216E+000
		83.78*	0.22	1.1438E+002		2.7090E+002
		240.99*	4.10	3.0793E+000		3.6269E+001
+	Ra-226	81.07	0.20	1.8032E+002	7.10E+000	2.5610E+000
		83.78*	0.33	7.4318E+001		1.7601E+002
		94.90	0.15	1.8324E+002		5.2834E+002
		186.21*	3.59	7.1032E+000		1.1097E+001
+	Ac-228	99.50*	1.26	1.8842E+001	6.93E-001	1.8654E+001
		129.07*	2.50	8.1588E+000		2.2677E+001
		209.25*	3.97	4.8518E+000		2.9608E+001
		270.24*	3.55	5.6550E+000		2.7061E+001
		328.00*	3.04	4.1716E+000		2.8333E+001
		338.32*	11.40	1.4117E+000		2.9066E+001
		409.46*	2.02	7.7512E+000		2.4308E+001

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GWET)	Nuclide MDA (pCi/GWET)	Activity (pCi/GWET)
+	Ac-228	463.00*	4.45	4.4964E+000	6.93E-001	2.7934E+001
		755.31*	1.03	1.7226E+001		2.4439E+001
		772.29*	1.52	9.0697E+000		2.4214E+001
		794.94*	4.31	5.4113E+000		2.9203E+001
		835.70*	1.70	7.0360E+000		2.5193E+001
		911.20*	26.20	7.1683E-001		3.1250E+001
		964.79*	4.99	2.3778E+000		2.9704E+001
		968.96*	15.90	6.9272E-001		3.1279E+001
		1588.20*	3.06	3.7745E+000		3.2747E+001
		1630.62*	1.52	1.0062E+001		3.2651E+001
+	Th-228	84.37*	1.26	1.9699E+001	1.97E+001	4.6655E+001
		131.61	0.13	1.9145E+002		-1.0783E+001
		166.41	0.10	1.9906E+002		9.6191E+001
		215.98*	0.25	7.0381E+001		2.6200E+001
	Pa-234m	258.23	0.07	2.4125E+002	1.99E+001	-6.4191E+001
		742.81	0.09	2.2725E+002		1.8296E+002
		766.36	0.32	7.5288E+001		-2.3780E+002
		786.27	0.05	4.4959E+002		-5.3195E+000
		1001.03	0.85	1.9912E+001		4.9821E+000
		1737.77	0.02	8.1351E+002		-3.5628E+002
	Th-234	63.30	3.75	2.3931E+001	7.31E+000	1.2917E+001
		92.59	4.33	7.3141E+000		4.9093E+001
		112.81	0.22	9.8176E+001		-5.5230E+001

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = Calculated MDA is zero due to zero counts in the region, or the region is outside the spectrum, or has not been calculated
@ = Half-life too short to be able to perform the decay correction

****
***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****
****

Sample Title: UMR001-S004-1824-01
Nuclide Library Used: C:\GENIE2K\CAMFILES\ERT_LIBRARY_LMDA.NLB

..... IDENTIFIED NUCLIDES .....

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
K-40	0.984	1460.82*		10.55	2.15724E+001	8.68110E-001
Eu-152m	0.993	89.85*		69.90	1.73873E+000	7.51674E-002
Tl-208	0.972	72.80	@	2.02		
		74.97*	@	3.41	1.14247E+002	4.42380E+000
		84.90*	@	1.51	3.89310E+001	2.57026E+000
		277.36*		6.31	1.10897E+001	8.57626E-001
		510.77*	@	22.60	1.12482E+001	4.95559E-001
		583.19*		84.50	1.00758E+001	3.45575E-001
		763.13*	@	1.81	8.38312E+000	1.12964E+000
		860.56*		12.42	1.07408E+001	4.87582E-001
TL-208e	0.966	1592.53*		99.16	5.20188E-001	4.43789E-002
Bi-211	0.903	351.03*		13.00	1.50256E+001	7.77185E-001
Bi-212	0.948	39.86	@	1.06		
		727.33*		6.74	3.35433E+001	1.44636E+000
		785.37*		1.11	3.50715E+001	2.47473E+000
		1620.74*		1.51	2.78494E+001	3.03478E+000
		1806.00	@	0.09		
Pb-212	0.999	74.81*		10.40	3.74599E+001	1.80875E+000
		77.11*		17.50	3.15688E+001	1.47983E+000
		87.30*		7.81	2.35174E+001	1.20631E+000
		115.18*	@	0.59	2.83680E+001	6.40490E+000
		238.63*		43.30	3.12835E+001	1.41855E+000
		300.09*		3.28	2.97442E+001	1.80843E+000
Bi-214	0.800	76.86*	@	0.43	1.27359E+003	6.12427E+001
		89.81*	@	0.24	4.96841E+002	2.79107E+001
		386.77	@	0.30		
		454.77	@	0.29		
		609.31*		45.49	5.27065E+000	2.01445E-001
		665.45	@	1.53		
		703.11	@	0.48		
		719.86	@	0.39		
		768.36*		4.89	4.52772E+000	4.48224E-001
		786.10*	@	0.31	1.23327E+002	2.16833E+001
		806.17	@	1.26		
		934.06*		3.10	5.49589E+000	1.18353E+000
		964.08*	@	0.36	4.01006E+002	1.98217E+001
		1051.96	@	0.31		
		1120.29*		14.91	5.24544E+000	3.55388E-001
		1133.66	@	0.25		
		1155.19	@	1.63		
		1207.68	@	0.45		

Nuclide Name	Id Confidence	Energy (keV)		Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Bi-214	0.800	1238.11*		5.79	5.68046E+000	7.51896E-001
		1280.96	@	1.43		
		1377.67*		4.00	5.59593E+000	1.00695E+000
		1385.31	@	0.76		
		1401.50	@	1.27		
		1407.98*	@	2.15	6.65477E+000	1.38192E+000
		1509.23*	@	2.11	3.34356E+000	1.25703E+000
		1538.50	@	0.38		
		1543.32	@	0.20		
		1583.22	@	0.69		
		1594.73	@	0.25		
		1599.31	@	0.23		
		1661.28*	@	1.15	6.14191E+000	1.84989E+000
		1683.99	@	0.22		
		1729.59*	@	2.92	6.73740E+000	1.05814E+000
		1764.49*		15.40	6.40029E+000	3.92809E-001
		1847.42	@	2.11		
		1873.16	@	0.22		
		2118.55	@	1.14		
		2204.21	@	5.08		
Pb-214	0.950	53.28	@	1.20		
		74.81*		6.44	5.94098E+001	3.00749E+000
		77.11*		10.80	5.02361E+001	2.63575E+000
		87.30*		4.84	3.72683E+001	2.03770E+000
		242.00*		7.43	1.96552E+001	9.85026E-001
		258.87	@	0.52		
		274.80	@	0.47		
		295.22*		19.30	5.33065E+000	3.21663E-001
		351.93*		37.60	5.18687E+000	2.63202E-001
		462.00*	@	0.22	5.52388E+002	3.73649E+001
		533.66	@	0.19		
		785.96*	@	1.07	3.57303E+001	3.65916E+000
		839.04	@	0.59		
Ra-224	0.953	81.07	@	0.13		
		83.78*	@	0.22	2.70902E+002	2.04848E+001
		240.99*		4.10	3.62692E+001	1.79197E+000
Ra-226	0.875	81.07	@	0.20		
		83.78*	@	0.33	1.76012E+002	1.32854E+001
		94.90	@	0.15		
		186.21*		3.59	1.10967E+001	1.64208E+000
Ac-228	0.995	99.50*	@	1.26	1.86537E+001	4.18011E+000
		129.07*	@	2.50	2.26766E+001	2.05882E+000
		209.25*		3.97	2.96075E+001	2.02041E+000
		270.24*		3.55	2.70614E+001	1.91021E+000
		328.00*		3.04	2.83329E+001	1.74283E+000
		338.32*		11.40	2.90656E+001	1.58221E+000
		409.46*	@	2.02	2.43082E+001	2.16901E+000
		463.00*		4.45	2.79337E+001	2.13209E+000
		755.31*	@	1.03	2.44385E+001	4.08379E+000
		772.29*	@	1.52	2.42137E+001	2.04118E+000

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GWET)	Activity Uncertainty
Ac-228	0.995	794.94*	4.31	2.92029E+001	1.82549E+000
		835.70* @	1.70	2.51929E+001	1.93009E+000
		911.20*	26.20	3.12500E+001	1.25633E+000
		964.79*	4.99	2.97036E+001	1.48848E+000
		968.96*	15.90	3.12788E+001	1.30904E+000
		1588.20*	3.06	3.27467E+001	2.03197E+000
		1630.62* @	1.52	3.26510E+001	3.15612E+000
Th-228	0.754	84.37*	1.26	4.66554E+001	3.16801E+000
		131.61 @	0.13		
		166.41 @	0.10		
		215.98*	0.25	2.62000E+001	1.52266E+001
Th-231	0.830	81.23 @	0.90		
		84.21*	6.60	8.74708E+000	7.83920E-001
		89.95* @	1.00	1.21227E+002	8.90440E+000

* = Energy line found in the spectrum.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.45
Errors quoted at 1.000 sigma

****
***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****
****

	Nuclide Name		Nuclide Id Confidence	Wt mean Activity (pCi/GWET)	Wt mean Activity Uncertainty
	K-40		0.984	2.157242E+001	8.681097E-001
X	Mn-54		0.918		
X	Cd-109		0.925		
	Eu-152m		0.993	1.718890E+000	8.470430E-002
X	Eu-155		0.913		
X	Tm-170		0.992		
	Tl-208	@	0.972	1.041725E+001	2.609429E-001
	TL-208e		0.966	5.201880E-001	4.437893E-002
	Bi-211		0.903	3.998359E-001	1.169626E+000
	Bi-212	@	0.948	3.183252E+001	1.083400E+000
	Pb-212	@	0.999	2.647013E+001	5.810399E-001
	Bi-214	@	0.800	5.370667E+000	1.441225E-001
	Pb-214	@	0.950	5.048845E+000	3.111108E-001
	Ra-224	@	0.953	2.695270E+001	1.828955E+000
	Ra-226	@	0.875	1.109668E+001	1.631576E+000
	Ac-228	@	0.995	3.002992E+001	3.845743E-001
	Th-228	@	0.754	2.620002E+001	1.522348E+001
	Th-231	@	0.830	7.274371E-002	2.914293E+000

? = Nuclide is part of an undetermined solution
X = Nuclide rejected by the interference analysis
@ = Nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

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

Peak Locate Performed on: 12/6/2016 8:09:46 PM
Peak Locate From Channel: 100
Peak Locate To Channel: 8192

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
m 6	93.38	4.2957E-001	2.62	Tol.	Th-227 Th-234
8	105.68	9.0196E-002	26.87	Tol.	Np-239
11	154.03	9.8439E-002	20.61	Sum	
17	252.57	9.0335E-003	90.57		
20	288.21	2.2043E-002	40.24	Tol.	Pm-148x Ra-223
m 24	332.37	2.8868E-002	16.28	Sum	
28	452.77	2.6198E-002	39.39	Sum	
31	562.24	4.1862E-002	14.52	Sum	
34	674.57	6.0688E-003	86.35		
M 40	782.08	1.6412E-002	17.76		
M 43	830.36	2.0886E-002	13.19	Sum	
m 45	840.10	3.7493E-002	8.43	Sum	
47	904.05	3.4776E-002	15.00	Sum	
52	987.83	6.2956E-003	45.22	Sum	
M 53	1033.41	6.2524E-003	24.51	Sum	
m 54	1039.19	4.4129E-003	31.64	Sum	
55	1078.55	1.8486E-002	20.78	S-Esc.	
56	1094.04	1.5538E-002	25.14	Sum	
57	1110.68	1.8141E-002	21.82	S-Esc.	
M 63	1496.21	2.6883E-002	8.81	Sum	
m 64	1502.05	1.5110E-002	13.07		
66	1581.02	1.1541E-002	25.61	Sum	
71	1638.73	1.6502E-002	16.77	Sum	
75	1789.38	2.5657E-003	70.92	Sum	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

ATTACHMENT G

PACE Laboratory Analytical Data Package

Pace Analytical™
www.pacelabs.com

Weston Solutions, Inc

Client Ref.:Case#:416

Pace-Pittsburgh Project No. 30204854

Pace Analytical Services, Inc.-Pittsburgh
1638 Roseytown Road
Suites 2, 3, & 4
Greensburg, PA 15601

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441	Gamma Calibration Documentation
469	Gamma Spectrocopy Routine Checks
486	Standards

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

February 27, 2017

Smita Sumbaly
Weston Solutions, Inc
1090 King Georges Post Road
Edison, NJ 08837

RE: Project: Case#: 416
Pace Project No.: 30204854

Dear Smita Sumbaly:
Enclosed are the analytical results for sample(s) received by the laboratory on December 08, 2016. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Carin A. Ferris

Carin Ferris
carin.ferris@pacelabs.com
Project Manager

Enclosures

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project: Case#: 416
Pace Project No.: 30204854

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

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Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

SAMPLE SUMMARY

Project: Case#: 416
Pace Project No.: 30204854

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30204854001	**UMR001-S001-0006-01**	Solid	11/18/16 09:58	12/08/16 10:20
30204854002	**UMR001-S001-0612-01**	Solid	11/18/16 09:55	12/08/16 10:20
30204854003	**UMR001-S001-0612-01**	Solid	11/18/16 09:55	12/08/16 10:20
30204854004	**UMR001-S001-0612-02**	Solid	11/18/16 09:55	12/08/16 10:20
30204854005	**UMR001-S001-1218-01**	Solid	11/18/16 09:50	12/08/16 10:20
30204854006	**UMR001-S001-1824-01**	Solid	11/18/16 09:45	12/08/16 10:20
30204854007	**UMR001-S002-0006-01**	Solid	11/18/16 10:40	12/08/16 10:20
30204854008	**UMR001-S002-0612-01**	Solid	11/18/16 10:38	12/08/16 10:20
30204854009	**UMR001-S002-1218-01**	Solid	11/18/16 10:35	12/08/16 10:20
30204854010	**UMR001-S002-1824-01**	Solid	11/18/16 10:30	12/08/16 10:20
30204854011	**UMR001-S003-0006-01**	Solid	11/18/16 11:25	12/08/16 10:20
30204854012	**UMR001-S003-0612-01**	Solid	11/18/16 11:22	12/08/16 10:20
30204854013	**UMR001-S003-1218-01**	Solid	11/18/16 11:18	12/08/16 10:20
30204854014	**UMR001-S003-1824-01**	Solid	11/18/16 11:15	12/08/16 10:20
30204854015	**UMR001-S004-0006-01**	Solid	11/18/16 12:30	12/08/16 10:20
30204854016	**UMR001-S004-0612-01**	Solid	11/18/16 12:25	12/08/16 10:20
30204854017	**UMR001-S004-1218-01**	Solid	11/18/16 12:22	12/08/16 10:20
30204854018	**UMR001-S004-1824-01**	Solid	11/18/16 12:20	12/08/16 10:20

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1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

SAMPLE ANALYTE COUNT

Project: Case#: 416
Pace Project No.: 30204854

Lab ID	Sample ID	Method	Analysts	Analytes Reported
30204854001	**UMR001-S001-0006-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854002	**UMR001-S001-0612-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854003	**UMR001-S001-0612-01**	HSL-300	LAL	3
30204854004	**UMR001-S001-0612-02**	HSL-300	LAL	3
30204854005	**UMR001-S001-1218-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854006	**UMR001-S001-1824-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854007	**UMR001-S002-0006-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854008	**UMR001-S002-0612-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854009	**UMR001-S002-1218-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854010	**UMR001-S002-1824-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854011	**UMR001-S003-0006-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854012	**UMR001-S003-0612-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854013	**UMR001-S003-1218-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854014	**UMR001-S003-1824-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854015	**UMR001-S004-0006-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854016	**UMR001-S004-0612-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854017	**UMR001-S004-1218-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6
30204854018	**UMR001-S004-1824-01**	EPA 901.1	MAH	11
		HSL-300	LAL	6

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PROJECT NARRATIVE

Project: Case#: 416
Pace Project No.: 30204854

Method: **EPA 901.1**
Description: 901.1 Gamma Spec INGROWTH
Client: Weston Solutions, Inc. (NJ)
Date: February 27, 2017

General Information:
16 samples were analyzed for EPA 901.1. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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PROJECT NARRATIVE

Project: Case#: 416
Pace Project No.: 30204854

Method: **HSL-300**
Description: HSL300(AS) Actinides
Client: Weston Solutions, Inc. (NJ)
Date: February 27, 2017

General Information:
18 samples were analyzed for HSL-300. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Analyte Comments:

QC Batch: 248114

1c: The alpha spectroscopy spectrum for this analyte extended outside of the established region of interest for analysis. Results may be considered biased low. The high activity of the sample contributed to the spectral resolution issue. The spectrum did not overlap with any other identified regions.

- UMR001-S004-0006-01 (Lab ID: 30204854015)
  - Thorium-228
  - Thorium-230
  - Thorium-232
- UMR001-S004-0612-01 (Lab ID: 30204854016)
  - Thorium-228
  - Thorium-230
  - Thorium-232
- UMR001-S004-1218-01 (Lab ID: 30204854017)
  - Thorium-228
  - Thorium-230
  - Thorium-232
- UMR001-S004-1824-01 (Lab ID: 30204854018)
  - Thorium-228
  - Thorium-230
  - Thorium-232

N2: The lab does not hold NELAC/TNI accreditation for this parameter.

- BLANK (Lab ID: 1220308)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234

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PROJECT NARRATIVE

Project: Case#: 416
Pace Project No.: 30204854

Method: **HSL-300**
Description: HSL300(AS) Actinides
Client: Weston Solutions, Inc. (NJ)
Date: February 27, 2017

Analyte Comments:

QC Batch: 248114

N2: The lab does not hold NELAC/TNI accreditation for this parameter.

- BLANK (Lab ID: 1220308)
  - Uranium-238
  - U-235/236
- UMR001-S001-0006-01 (Lab ID: 30204854001)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S001-0612-01 (Lab ID: 30204854002)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S001-0612-01 (Lab ID: 30204854003)
  - Thorium-230
  - U-233/234
  - Uranium-238
- UMR001-S001-0612-02 (Lab ID: 30204854004)
  - Thorium-230
  - U-233/234
  - Uranium-238
- UMR001-S001-1218-01 (Lab ID: 30204854005)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S001-1824-01 (Lab ID: 30204854006)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S002-0006-01 (Lab ID: 30204854007)
  - Thorium-228
  - Thorium-230
  - Thorium-232

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PROJECT NARRATIVE

Project: Case#: 416
Pace Project No.: 30204854

Method: **HSL-300**
Description: HSL300(AS) Actinides
Client: Weston Solutions, Inc. (NJ)
Date: February 27, 2017

Analyte Comments:

QC Batch: 248114

N2: The lab does not hold NELAC/TNI accreditation for this parameter.

- UMR001-S002-0006-01 (Lab ID: 30204854007)
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S002-0612-01 (Lab ID: 30204854008)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S002-1218-01 (Lab ID: 30204854009)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S002-1824-01 (Lab ID: 30204854010)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S003-0006-01 (Lab ID: 30204854011)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S003-0612-01 (Lab ID: 30204854012)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S003-1218-01 (Lab ID: 30204854013)
  - Thorium-228
  - Thorium-230
  - Thorium-232

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PROJECT NARRATIVE

Project: Case#: 416
Pace Project No.: 30204854

Method: **HSL-300**
Description: HSL300(AS) Actinides
Client: Weston Solutions, Inc. (NJ)
Date: February 27, 2017

Analyte Comments:

QC Batch: 248114

N2: The lab does not hold NELAC/TNI accreditation for this parameter.

- UMR001-S003-1218-01 (Lab ID: 30204854013)
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S003-1824-01 (Lab ID: 30204854014)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S004-0006-01 (Lab ID: 30204854015)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S004-0612-01 (Lab ID: 30204854016)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S004-1218-01 (Lab ID: 30204854017)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236
- UMR001-S004-1824-01 (Lab ID: 30204854018)
  - Thorium-228
  - Thorium-230
  - Thorium-232
  - U-233/234
  - Uranium-238
  - U-235/236

This data package has been reviewed for quality and completeness and is approved for release.

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S001-0006-01 **Lab ID: 30204854001** Collected: 11/18/16 09:58 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**2.423 ± 1.802 (2.030) C:NA T:NA**	pCi/g	02/21/17 15:23	14913-49-6	
Cesium-137	EPA 901.1	**0.489 ± 0.159 (0.078) C:NA T:NA**	pCi/g	02/21/17 15:23	10045-97-3	
Lead-212	EPA 901.1	**1.228 ± 0.326 (0.302) C:NA T:NA**	pCi/g	02/21/17 15:23	15092-94-1	
Potassium-40	EPA 901.1	**17.298 ± 3.990 (1.667) C:NA T:NA**	pCi/g	02/21/17 15:23	13966-00-2	
Protactinium-234M	EPA 901.1	**0.000 ± 4.030 (24.690) C:NA T:NA**	pCi/g	02/21/17 15:23	15100-28-4	
Radium-226	EPA 901.1	**1.326 ± 0.371 (0.212) C:NA T:NA**	pCi/g	02/21/17 15:23	13982-63-3	Ra
Radium-228	EPA 901.1	**1.248 ± 0.564 (0.645) C:NA T:NA**	pCi/g	02/21/17 15:23	15262-20-1	
Thallium-208	EPA 901.1	**0.387 ± 0.214 (0.209) C:NA T:NA**	pCi/g	02/21/17 15:23	14913-50-9	
Thorium-228	EPA 901.1	**2.974 ± 5.663 (13.080) C:NA T:NA**	pCi/g	02/21/17 15:23	14274-82-9	
Thorium-234	EPA 901.1	**0.509 ± 2.833 (3.680) C:NA T:NA**	pCi/g	02/21/17 15:23	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.665 (2.546) C:NA T:NA**	pCi/g	02/21/17 15:23	15117-96-1	
Thorium-228	HSL-300	**1.22 ± 0.367 (0.254) C:NA T:78%**	pCi/g	02/08/17 11:14	14274-82-9	N2
Thorium-230	HSL-300	**1.31 ± 0.364 (0.136) C:NA T:78%**	pCi/g	02/08/17 11:14	14269-63-7	N2
Thorium-232	HSL-300	**0.668 ± 0.237 (0.087) C:NA T:78%**	pCi/g	02/08/17 11:14	7440-29-1	N2
U-233/234	HSL-300	**0.823 ± 0.239 (0.116) C:NA T:108%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.095 ± 0.081 (0.082) C:NA T:108%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**0.709 ± 0.216 (0.092) C:NA T:108%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S001-0612-01 **Lab ID: 30204854002** Collected: 11/18/16 09:55 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis
Comments: • One jar arrived broken.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**1.070 ± 1.083 (2.974) C:NA T:NA**	pCi/g	02/21/17 15:44	14913-49-6	
Cesium-137	EPA 901.1	**0.299 ± 0.095 (0.046) C:NA T:NA**	pCi/g	02/21/17 15:44	10045-97-3	
Lead-212	EPA 901.1	**1.425 ± 0.323 (0.270) C:NA T:NA**	pCi/g	02/21/17 15:44	15092-94-1	
Potassium-40	EPA 901.1	**17.073 ± 4.240 (2.589) C:NA T:NA**	pCi/g	02/21/17 15:44	13966-00-2	
Protactinium-234M	EPA 901.1	**13.308 ± 7.356 (6.373) C:NA T:NA**	pCi/g	02/21/17 15:44	15100-28-4	
Radium-226	EPA 901.1	**1.353 ± 0.322 (0.288) C:NA T:NA**	pCi/g	02/21/17 15:44	13982-63-3	Ra

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S001-0612-01 **Lab ID: 30204854002** Collected: 11/18/16 09:55 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis
Comments: • One jar arrived broken.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 901.1	**1.922 ± 0.484 (0.210) C:NA T:NA**	pCi/g	02/21/17 15:44	15262-20-1	
Thallium-208	EPA 901.1	**0.551 ± 0.177 (0.136) C:NA T:NA**	pCi/g	02/21/17 15:44	14913-50-9	
Thorium-228	EPA 901.1	**1.060 ± 11.237 (14.260) C:NA T:NA**	pCi/g	02/21/17 15:44	14274-82-9	
Thorium-234	EPA 901.1	**3.583 ± 3.207 (5.115) C:NA T:NA**	pCi/g	02/21/17 15:44	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.574 (2.394) C:NA T:NA**	pCi/g	02/21/17 15:44	15117-96-1	
Thorium-228	HSL-300	**1.26 ± 0.380 (0.259) C:NA T:79%**	pCi/g	02/08/17 11:14	14274-82-9	N2
Thorium-230	HSL-300	**0.892 ± 0.289 (0.129) C:NA T:79%**	pCi/g	02/08/17 11:14	14269-63-7	N2
Thorium-232	HSL-300	**0.861 ± 0.281 (0.091) C:NA T:79%**	pCi/g	02/08/17 11:14	7440-29-1	N2
U-233/234	HSL-300	**0.697 ± 0.236 (0.148) C:NA T:93%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.019 ± 0.073 (0.153) C:NA T:93%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**0.960 ± 0.287 (0.157) C:NA T:93%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S001-0612-01 **Lab ID: 30204854003** Collected: 11/18/16 09:55 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Thorium-230	HSL-300	**91 %REC +/- NA (NA) C:NA T:NA**	pCi/g	02/08/17 11:14	14269-63-7	N2
U-233/234	HSL-300	**98 %REC +/- NA (NA) C:NA T:NA**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**90 %REC +/- NA (NA) C:NA T:NA**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S001-0612-02 **Lab ID: 30204854004** Collected: 11/18/16 09:55 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Thorium-230	HSL-300	**95 %REC 4.3 RPD +/- NA (NA) C:NA T:NA**	pCi/g	02/08/17 11:14	14269-63-7	N2
U-233/234	HSL-300	**94 %REC 4.3 RPD +/- NA (NA) C:NA T:NA**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**91 %REC 1.1 RPD +/- NA (NA) C:NA T:NA**	pCi/g	02/07/17 15:12		N2

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S001-1218-01 **Lab ID: 30204854005** Collected: 11/18/16 09:50 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**0.000 ± 1.761 (3.747)** **C:NA T:NA**	pCi/g	02/21/17 15:45	14913-49-6	
Cesium-137	EPA 901.1	**0.000 ± 0.027 (0.178)** **C:NA T:NA**	pCi/g	02/21/17 15:45	10045-97-3	
Lead-212	EPA 901.1	**1.605 ± 0.358 (0.264)** **C:NA T:NA**	pCi/g	02/21/17 15:45	15092-94-1	
Potassium-40	EPA 901.1	**29.001 ± 5.508 (1.495)** **C:NA T:NA**	pCi/g	02/21/17 15:45	13966-00-2	
Protactinium-234M	EPA 901.1	**8.501 ± 14.801 (17.230)** **C:NA T:NA**	pCi/g	02/21/17 15:45	15100-28-4	
Radium-226	EPA 901.1	**1.252 ± 0.361 (0.574)** **C:NA T:NA**	pCi/g	02/21/17 15:45	13982-63-3	Ra
Radium-228	EPA 901.1	**2.567 ± 0.629 (0.382)** **C:NA T:NA**	pCi/g	02/21/17 15:45	15262-20-1	
Thallium-208	EPA 901.1	**0.400 ± 0.268 (0.278)** **C:NA T:NA**	pCi/g	02/21/17 15:45	14913-50-9	
Thorium-228	EPA 901.1	**4.039 ± 7.337 (9.359)** **C:NA T:NA**	pCi/g	02/21/17 15:45	14274-82-9	
Thorium-234	EPA 901.1	**3.483 ± 2.714 (3.128)** **C:NA T:NA**	pCi/g	02/21/17 15:45	15065-10-8	
Uranium-235	EPA 901.1	**0.510 ± 0.605 (2.217)** **C:NA T:NA**	pCi/g	02/21/17 15:45	15117-96-1	
Thorium-228	HSL-300	**1.51 ± 0.411 (0.198)** **C:NA T:79%**	pCi/g	02/08/17 11:14	14274-82-9	N2
Thorium-230	HSL-300	**0.999 ± 0.305 (0.165)** **C:NA T:79%**	pCi/g	02/08/17 11:14	14269-63-7	N2
Thorium-232	HSL-300	**1.08 ± 0.316 (0.046)** **C:NA T:79%**	pCi/g	02/08/17 11:14	7440-29-1	N2
U-233/234	HSL-300	**1.23 ± 0.319 (0.138)** **C:NA T:97%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.081 ± 0.080 (0.106)** **C:NA T:97%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**0.991 ± 0.275 (0.081)** **C:NA T:97%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S001-1824-01 **Lab ID: 30204854006** Collected: 11/18/16 09:45 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**1.763 ± 2.337 (2.360)** **C:NA T:NA**	pCi/g	02/21/17 16:01	14913-49-6	
Cesium-137	EPA 901.1	**-0.003 ± 0.148 (0.162)** **C:NA T:NA**	pCi/g	02/21/17 16:01	10045-97-3	
Lead-212	EPA 901.1	**1.541 ± 0.333 (0.273)** **C:NA T:NA**	pCi/g	02/21/17 16:01	15092-94-1	
Potassium-40	EPA 901.1	**27.280 ± 4.720 (1.255)** **C:NA T:NA**	pCi/g	02/21/17 16:01	13966-00-2	
Protactinium-234M	EPA 901.1	**2.305 ± 15.326 (16.060)** **C:NA T:NA**	pCi/g	02/21/17 16:01	15100-28-4	
Radium-226	EPA 901.1	**1.516 ± 0.334 (0.236)** **C:NA T:NA**	pCi/g	02/21/17 16:01	13982-63-3	Ra

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1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S001-1824-01 **Lab ID: 30204854006** Collected: 11/18/16 09:45 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 901.1	**1.546 ± 0.394 (0.402) C:NA T:NA**	pCi/g	02/21/17 16:01	15262-20-1	
Thallium-208	EPA 901.1	**0.728 ± 0.182 (0.098) C:NA T:NA**	pCi/g	02/21/17 16:01	14913-50-9	
Thorium-228	EPA 901.1	**2.949 ± 11.117 (13.890) C:NA T:NA**	pCi/g	02/21/17 16:01	14274-82-9	
Thorium-234	EPA 901.1	**2.952 ± 1.438 (5.548) C:NA T:NA**	pCi/g	02/21/17 16:01	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.732 (2.158) C:NA T:NA**	pCi/g	02/21/17 16:01	15117-96-1	
Thorium-228	HSL-300	**1.23 ± 0.385 (0.312) C:NA T:69%**	pCi/g	02/08/17 11:14	14274-82-9	N2
Thorium-230	HSL-300	**1.34 ± 0.379 (0.146) C:NA T:69%**	pCi/g	02/08/17 11:14	14269-63-7	N2
Thorium-232	HSL-300	**1.59 ± 0.422 (0.093) C:NA T:69%**	pCi/g	02/08/17 11:14	7440-29-1	N2
U-233/234	HSL-300	**1.37 ± 0.347 (0.121) C:NA T:92%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.070 ± 0.083 (0.143) C:NA T:92%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**1.30 ± 0.333 (0.083) C:NA T:92%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S002-0006-01 **Lab ID: 30204854007** Collected: 11/18/16 10:40 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**3.645 ± 1.611 (1.304) C:NA T:NA**	pCi/g	02/21/17 16:02	14913-49-6	
Cesium-137	EPA 901.1	**0.083 ± 0.164 (0.188) C:NA T:NA**	pCi/g	02/21/17 16:02	10045-97-3	
Lead-212	EPA 901.1	**3.243 ± 0.572 (0.325) C:NA T:NA**	pCi/g	02/21/17 16:02	15092-94-1	
Potassium-40	EPA 901.1	**6.619 ± 2.015 (1.271) C:NA T:NA**	pCi/g	02/21/17 16:02	13966-00-2	
Protactinium-234M	EPA 901.1	**0.166 ± 15.598 (18.820) C:NA T:NA**	pCi/g	02/21/17 16:02	15100-28-4	
Radium-226	EPA 901.1	**1.670 ± 0.404 (0.222) C:NA T:NA**	pCi/g	02/21/17 16:02	13982-63-3	Ra
Radium-228	EPA 901.1	**3.547 ± 0.673 (0.506) C:NA T:NA**	pCi/g	02/21/17 16:02	15262-20-1	
Thallium-208	EPA 901.1	**1.133 ± 0.265 (0.148) C:NA T:NA**	pCi/g	02/21/17 16:02	14913-50-9	
Thorium-228	EPA 901.1	**0.000 ± 3.938 (12.120) C:NA T:NA**	pCi/g	02/21/17 16:02	14274-82-9	
Thorium-234	EPA 901.1	**1.484 ± 2.819 (3.538) C:NA T:NA**	pCi/g	02/21/17 16:02	15065-10-8	
Uranium-235	EPA 901.1	**0.460 ± 1.491 (1.884) C:NA T:NA**	pCi/g	02/21/17 16:02	15117-96-1	
Thorium-228	HSL-300	**2.45 ± 0.586 (0.203) C:NA T:77%**	pCi/g	02/08/17 11:14	14274-82-9	N2

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S002-0006-01 **Lab ID: 30204854007** Collected: 11/18/16 10:40 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Thorium-230	HSL-300	**0.910 ± 0.303 (0.227) C:NA T:77%**	pCi/g	02/08/17 11:14	14269-63-7	N2
Thorium-232	HSL-300	**2.33 ± 0.549 (0.109) C:NA T:77%**	pCi/g	02/08/17 11:14	7440-29-1	N2
U-233/234	HSL-300	**0.917 ± 0.275 (0.202) C:NA T:100%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.061 ± 0.075 (0.123) C:NA T:100%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**0.943 ± 0.271 (0.117) C:NA T:100%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S002-0612-01 **Lab ID: 30204854008** Collected: 11/18/16 10:38 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**1.655 ± 1.402 (1.579) C:NA T:NA**	pCi/g	02/21/17 16:36	14913-49-6	
Cesium-137	EPA 901.1	**0.040 ± 0.105 (0.114) C:NA T:NA**	pCi/g	02/21/17 16:36	10045-97-3	
Lead-212	EPA 901.1	**1.069 ± 0.270 (0.277) C:NA T:NA**	pCi/g	02/21/17 16:36	15092-94-1	
Potassium-40	EPA 901.1	**10.112 ± 2.253 (1.009) C:NA T:NA**	pCi/g	02/21/17 16:36	13966-00-2	
Protactinium-234M	EPA 901.1	**4.326 ± 11.663 (12.280) C:NA T:NA**	pCi/g	02/21/17 16:36	15100-28-4	
Radium-226	EPA 901.1	**2.334 ± 0.432 (0.174) C:NA T:NA**	pCi/g	02/21/17 16:36	13982-63-3	Ra
Radium-228	EPA 901.1	**1.645 ± 0.410 (0.170) C:NA T:NA**	pCi/g	02/21/17 16:36	15262-20-1	
Thallium-208	EPA 901.1	**0.370 ± 0.122 (0.096) C:NA T:NA**	pCi/g	02/21/17 16:36	14913-50-9	
Thorium-228	EPA 901.1	**10.586 ± 8.458 (11.070) C:NA T:NA**	pCi/g	02/21/17 16:36	14274-82-9	
Thorium-234	EPA 901.1	**2.722 ± 2.422 (4.809) C:NA T:NA**	pCi/g	02/21/17 16:36	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.848 (1.895) C:NA T:NA**	pCi/g	02/21/17 16:36	15117-96-1	
Thorium-228	HSL-300	**1.22 ± 0.396 (0.324) C:NA T:76%**	pCi/g	02/08/17 11:14	14274-82-9	N2
Thorium-230	HSL-300	**1.84 ± 0.484 (0.170) C:NA T:76%**	pCi/g	02/08/17 11:14	14269-63-7	N2
Thorium-232	HSL-300	**0.818 ± 0.287 (0.122) C:NA T:76%**	pCi/g	02/08/17 11:14	7440-29-1	N2
U-233/234	HSL-300	**1.77 ± 0.437 (0.152) C:NA T:93%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.153 ± 0.125 (0.158) C:NA T:93%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**1.72 ± 0.429 (0.152) C:NA T:93%**	pCi/g	02/07/17 15:12		N2

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S002-1218-01 **Lab ID: 30204854009** Collected: 11/18/16 10:35 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**2.626 ± 2.788 (2.931)** **C:NA T:NA**	pCi/g	02/21/17 16:37	14913-49-6	
Cesium-137	EPA 901.1	**0.024 ± 0.124 (0.151)** **C:NA T:NA**	pCi/g	02/21/17 16:37	10045-97-3	
Lead-212	EPA 901.1	**2.933 ± 0.529 (0.312)** **C:NA T:NA**	pCi/g	02/21/17 16:37	15092-94-1	
Potassium-40	EPA 901.1	**12.813 ± 2.983 (1.267)** **C:NA T:NA**	pCi/g	02/21/17 16:37	13966-00-2	
Protactinium-234M	EPA 901.1	**14.239 ± 8.620 (7.979)** **C:NA T:NA**	pCi/g	02/21/17 16:37	15100-28-4	
Radium-226	EPA 901.1	**2.400 ± 0.501 (0.291)** **C:NA T:NA**	pCi/g	02/21/17 16:37	13982-63-3	Ra
Radium-228	EPA 901.1	**2.799 ± 0.572 (0.324)** **C:NA T:NA**	pCi/g	02/21/17 16:37	15262-20-1	
Thallium-208	EPA 901.1	**1.000 ± 0.245 (0.137)** **C:NA T:NA**	pCi/g	02/21/17 16:37	14913-50-9	
Thorium-228	EPA 901.1	**6.496 ± 9.029 (11.200)** **C:NA T:NA**	pCi/g	02/21/17 16:37	14274-82-9	
Thorium-234	EPA 901.1	**2.174 ± 2.682 (3.315)** **C:NA T:NA**	pCi/g	02/21/17 16:37	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.480 (2.547)** **C:NA T:NA**	pCi/g	02/21/17 16:37	15117-96-1	
Thorium-228	HSL-300	**1.82 ± 0.481 (0.276)** **C:NA T:87%**	pCi/g	02/08/17 11:14	14274-82-9	N2
Thorium-230	HSL-300	**1.46 ± 0.398 (0.179)** **C:NA T:87%**	pCi/g	02/08/17 11:14	14269-63-7	N2
Thorium-232	HSL-300	**2.17 ± 0.520 (0.107)** **C:NA T:87%**	pCi/g	02/08/17 11:14	7440-29-1	N2
U-233/234	HSL-300	**1.50 ± 0.380 (0.157)** **C:NA T:103%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.142 ± 0.107 (0.054)** **C:NA T:103%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**1.33 ± 0.348 (0.102)** **C:NA T:103%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S002-1824-01 **Lab ID: 30204854010** Collected: 11/18/16 10:30 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**1.664 ± 2.179 (2.224)** **C:NA T:NA**	pCi/g	02/22/17 07:35	14913-49-6	
Cesium-137	EPA 901.1	**-0.054 ± 0.192 (0.204)** **C:NA T:NA**	pCi/g	02/22/17 07:35	10045-97-3	
Lead-212	EPA 901.1	**1.763 ± 0.372 (0.288)** **C:NA T:NA**	pCi/g	02/22/17 07:35	15092-94-1	
Potassium-40	EPA 901.1	**28.213 ± 4.922 (1.315)** **C:NA T:NA**	pCi/g	02/22/17 07:35	13966-00-2	
Protactinium-234M	EPA 901.1	**5.400 ± 14.560 (15.330)** **C:NA T:NA**	pCi/g	02/22/17 07:35	15100-28-4	
Radium-226	EPA 901.1	**1.423 ± 0.350 (0.261)** **C:NA T:NA**	pCi/g	02/22/17 07:35	13982-63-3	Ra

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S002-1824-01 **Lab ID: 30204854010** Collected: 11/18/16 10:30 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 901.1	**2.010 ± 0.622 (0.388) C:NA T:NA**	pCi/g	02/22/17 07:35	15262-20-1	
Thallium-208	EPA 901.1	**0.665 ± 0.198 (0.135) C:NA T:NA**	pCi/g	02/22/17 07:35	14913-50-9	
Thorium-228	EPA 901.1	**0.000 ± 7.404 (12.590) C:NA T:NA**	pCi/g	02/22/17 07:35	14274-82-9	
Thorium-234	EPA 901.1	**0.000 ± 1.269 (6.530) C:NA T:NA**	pCi/g	02/22/17 07:35	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.335 (2.365) C:NA T:NA**	pCi/g	02/22/17 07:35	15117-96-1	
Thorium-228	HSL-300	**1.38 ± 0.405 (0.256) C:NA T:80%**	pCi/g	02/09/17 05:21	14274-82-9	N2
Thorium-230	HSL-300	**1.27 ± 0.366 (0.162) C:NA T:80%**	pCi/g	02/09/17 05:21	14269-63-7	N2
Thorium-232	HSL-300	**1.55 ± 0.413 (0.050) C:NA T:80%**	pCi/g	02/09/17 05:21	7440-29-1	N2
U-233/234	HSL-300	**0.953 ± 0.263 (0.145) C:NA T:104%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.062 ± 0.065 (0.082) C:NA T:104%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**1.41 ± 0.337 (0.075) C:NA T:104%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S003-0006-01 **Lab ID: 30204854011** Collected: 11/18/16 11:25 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**11.672 ± 3.213 (2.315) C:NA T:NA**	pCi/g	02/22/17 07:36	14913-49-6	
Cesium-137	EPA 901.1	**0.000 ± 0.094 (0.275) C:NA T:NA**	pCi/g	02/22/17 07:36	10045-97-3	
Lead-212	EPA 901.1	**8.852 ± 1.305 (0.433) C:NA T:NA**	pCi/g	02/22/17 07:36	15092-94-1	
Potassium-40	EPA 901.1	**6.414 ± 2.096 (1.615) C:NA T:NA**	pCi/g	02/22/17 07:36	13966-00-2	
Protactinium-234M	EPA 901.1	**0.000 ± 2.409 (29.180) C:NA T:NA**	pCi/g	02/22/17 07:36	15100-28-4	
Radium-226	EPA 901.1	**7.824 ± 1.160 (0.347) C:NA T:NA**	pCi/g	02/22/17 07:36	13982-63-3	Ra
Radium-228	EPA 901.1	**7.394 ± 1.411 (0.666) C:NA T:NA**	pCi/g	02/22/17 07:36	15262-20-1	
Thallium-208	EPA 901.1	**3.216 ± 0.535 (0.198) C:NA T:NA**	pCi/g	02/22/17 07:36	14913-50-9	
Thorium-228	EPA 901.1	**15.992 ± 12.500 (15.720) C:NA T:NA**	pCi/g	02/22/17 07:36	14274-82-9	
Thorium-234	EPA 901.1	**8.803 ± 4.205 (4.772) C:NA T:NA**	pCi/g	02/22/17 07:36	15065-10-8	
Uranium-235	EPA 901.1	**0.535 ± 0.782 (3.000) C:NA T:NA**	pCi/g	02/22/17 07:36	15117-96-1	
Thorium-228	HSL-300	**7.56 ± 1.43 (0.269) C:NA T:79%**	pCi/g	02/09/17 05:21	14274-82-9	N2

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S003-0006-01 **Lab ID: 30204854011** Collected: 11/18/16 11:25 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Thorium-230	HSL-300	**6.87 ± 1.30 (0.144) C:NA T:79%**	pCi/g	02/09/17 05:21	14269-63-7	N2
Thorium-232	HSL-300	**6.89 ± 1.30 (0.092) C:NA T:79%**	pCi/g	02/09/17 05:21	7440-29-1	N2
U-233/234	HSL-300	**6.02 ± 1.24 (0.314) C:NA T:73%**	pCi/g	02/07/17 15:12		N2
U-235/236	HSL-300	**0.437 ± 0.240 (0.085) C:NA T:73%**	pCi/g	02/07/17 15:12		N2
Uranium-238	HSL-300	**5.87 ± 1.21 (0.142) C:NA T:73%**	pCi/g	02/07/17 15:12		N2

Sample: UMR001-S003-0612-01 **Lab ID: 30204854012** Collected: 11/18/16 11:22 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**10.126 ± 2.446 (1.146) C:NA T:NA**	pCi/g	02/22/17 07:52	14913-49-6	
Cesium-137	EPA 901.1	**0.017 ± 0.138 (0.151) C:NA T:NA**	pCi/g	02/22/17 07:52	10045-97-3	
Lead-212	EPA 901.1	**7.021 ± 1.073 (0.439) C:NA T:NA**	pCi/g	02/22/17 07:52	15092-94-1	
Potassium-40	EPA 901.1	**28.246 ± 4.688 (0.675) C:NA T:NA**	pCi/g	02/22/17 07:52	13966-00-2	
Protactinium-234M	EPA 901.1	**8.375 ± 18.021 (18.020) C:NA T:NA**	pCi/g	02/22/17 07:52	15100-28-4	
Radium-226	EPA 901.1	**2.386 ± 0.551 (0.357) C:NA T:NA**	pCi/g	02/22/17 07:52	13982-63-3	Ra
Radium-228	EPA 901.1	**7.125 ± 1.291 (0.585) C:NA T:NA**	pCi/g	02/22/17 07:52	15262-20-1	
Thallium-208	EPA 901.1	**2.273 ± 0.405 (0.167) C:NA T:NA**	pCi/g	02/22/17 07:52	14913-50-9	
Thorium-228	EPA 901.1	**0.953 ± 12.964 (16.220) C:NA T:NA**	pCi/g	02/22/17 07:52	14274-82-9	
Thorium-234	EPA 901.1	**2.013 ± 6.952 (8.527) C:NA T:NA**	pCi/g	02/22/17 07:52	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 1.473 (3.139) C:NA T:NA**	pCi/g	02/22/17 07:52	15117-96-1	
Thorium-228	HSL-300	**5.96 ± 1.17 (0.265) C:NA T:77%**	pCi/g	02/09/17 05:21	14274-82-9	N2
Thorium-230	HSL-300	**1.18 ± 0.347 (0.132) C:NA T:77%**	pCi/g	02/09/17 05:21	14269-63-7	N2
Thorium-232	HSL-300	**5.16 ± 1.02 (0.093) C:NA T:77%**	pCi/g	02/09/17 05:21	7440-29-1	N2
U-233/234	HSL-300	**1.16 ± 0.322 (0.159) C:NA T:99%**	pCi/g	02/08/17 07:08		N2
U-235/236	HSL-300	**0.041 ± 0.073 (0.055) C:NA T:99%**	pCi/g	02/08/17 07:08		N2
Uranium-238	HSL-300	**1.35 ± 0.354 (0.103) C:NA T:99%**	pCi/g	02/08/17 07:08		N2

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S003-1218-01 **Lab ID: 30204854013** Collected: 11/18/16 11:18 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**3.923 ± 1.740 (1.159)** **C:NA T:NA**	pCi/g	02/22/17 07:53	14913-49-6	
Cesium-137	EPA 901.1	**0.039 ± 0.135 (0.167)** **C:NA T:NA**	pCi/g	02/22/17 07:53	10045-97-3	
Lead-212	EPA 901.1	**2.544 ± 0.497 (0.290)** **C:NA T:NA**	pCi/g	02/22/17 07:53	15092-94-1	
Potassium-40	EPA 901.1	**29.895 ± 5.779 (1.646)** **C:NA T:NA**	pCi/g	02/22/17 07:53	13966-00-2	
Protactinium-234M	EPA 901.1	**0.000 ± 12.577 (35.470)** **C:NA T:NA**	pCi/g	02/22/17 07:53	15100-28-4	
Radium-226	EPA 901.1	**1.544 ± 0.416 (0.274)** **C:NA T:NA**	pCi/g	02/22/17 07:53	13982-63-3	Ra
Radium-228	EPA 901.1	**2.689 ± 0.676 (0.420)** **C:NA T:NA**	pCi/g	02/22/17 07:53	15262-20-1	
Thallium-208	EPA 901.1	**1.048 ± 0.257 (0.095)** **C:NA T:NA**	pCi/g	02/22/17 07:53	14913-50-9	
Thorium-228	EPA 901.1	**0.000 ± 5.649 (13.670)** **C:NA T:NA**	pCi/g	02/22/17 07:53	14274-82-9	
Thorium-234	EPA 901.1	**1.731 ± 3.010 (3.799)** **C:NA T:NA**	pCi/g	02/22/17 07:53	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.974 (2.583)** **C:NA T:NA**	pCi/g	02/22/17 07:53	15117-96-1	
Thorium-228	HSL-300	**1.81 ± 0.472 (0.250)** **C:NA T:82%**	pCi/g	02/09/17 05:21	14274-82-9	N2
Thorium-230	HSL-300	**0.903 ± 0.289 (0.145)** **C:NA T:82%**	pCi/g	02/09/17 05:21	14269-63-7	N2
Thorium-232	HSL-300	**1.66 ± 0.426 (0.047)** **C:NA T:82%**	pCi/g	02/09/17 05:21	7440-29-1	N2
U-233/234	HSL-300	**0.903 ± 0.264 (0.158)** **C:NA T:93%**	pCi/g	02/08/17 07:08		N2
U-235/236	HSL-300	**0.121 ± 0.095 (0.089)** **C:NA T:93%**	pCi/g	02/08/17 07:08		N2
Uranium-238	HSL-300	**0.994 ± 0.275 (0.081)** **C:NA T:93%**	pCi/g	02/08/17 07:08		N2

Sample: UMR001-S003-1824-01 **Lab ID: 30204854014** Collected: 11/18/16 11:15 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**3.698 ± 1.598 (1.237)** **C:NA T:NA**	pCi/g	02/22/17 08:13	14913-49-6	
Cesium-137	EPA 901.1	**0.000 ± 0.029 (0.170)** **C:NA T:NA**	pCi/g	02/22/17 08:13	10045-97-3	
Lead-212	EPA 901.1	**2.103 ± 0.408 (0.276)** **C:NA T:NA**	pCi/g	02/22/17 08:13	15092-94-1	
Potassium-40	EPA 901.1	**26.288 ± 4.629 (1.439)** **C:NA T:NA**	pCi/g	02/22/17 08:13	13966-00-2	
Protactinium-234M	EPA 901.1	**11.843 ± 6.775 (6.033)** **C:NA T:NA**	pCi/g	02/22/17 08:13	15100-28-4	
Radium-226	EPA 901.1	**1.522 ± 0.310 (0.227)** **C:NA T:NA**	pCi/g	02/22/17 08:13	13982-63-3	Ra

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S003-1824-01 **Lab ID: 30204854014** Collected: 11/18/16 11:15 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 901.1	**2.135 ± 0.486 (0.347)** **C:NA T:NA**	pCi/g	02/22/17 08:13	15262-20-1	
Thallium-208	EPA 901.1	**0.763 ± 0.210 (0.147)** **C:NA T:NA**	pCi/g	02/22/17 08:13	14913-50-9	
Thorium-228	EPA 901.1	**7.101 ± 8.728 (14.600)** **C:NA T:NA**	pCi/g	02/22/17 08:13	14274-82-9	
Thorium-234	EPA 901.1	**0.682 ± 4.624 (5.826)** **C:NA T:NA**	pCi/g	02/22/17 08:13	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 0.608 (2.457)** **C:NA T:NA**	pCi/g	02/22/17 08:13	15117-96-1	
Thorium-228	HSL-300	**2.20 ± 0.537 (0.242)** **C:NA T:80%**	pCi/g	02/09/17 05:21	14274-82-9	N2
Thorium-230	HSL-300	**1.01 ± 0.317 (0.239)** **C:NA T:80%**	pCi/g	02/09/17 05:21	14269-63-7	N2
Thorium-232	HSL-300	**1.66 ± 0.423 (0.086)** **C:NA T:80%**	pCi/g	02/09/17 05:21	7440-29-1	N2
U-233/234	HSL-300	**0.616 ± 0.233 (0.214)** **C:NA T:102%**	pCi/g	02/08/17 07:08		N2
U-235/236	HSL-300	**0.042 ± 0.076 (0.057)** **C:NA T:102%**	pCi/g	02/08/17 07:08		N2
Uranium-238	HSL-300	**0.885 ± 0.274 (0.096)** **C:NA T:102%**	pCi/g	02/08/17 07:08		N2

Sample: UMR001-S004-0006-01 **Lab ID: 30204854015** Collected: 11/18/16 12:30 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**133.840 ± 20.082 (9.870)** **C:NA T:NA**	pCi/g	02/22/17 08:14	14913-49-6	
Cesium-137	EPA 901.1	**0.037 ± 0.669 (0.728)** **C:NA T:NA**	pCi/g	02/22/17 08:14	10045-97-3	
Lead-212	EPA 901.1	**125.400 ± 16.994 (1.611)** **C:NA T:NA**	pCi/g	02/22/17 08:14	15092-94-1	
Potassium-40	EPA 901.1	**8.952 ± 6.183 (5.587)** **C:NA T:NA**	pCi/g	02/22/17 08:14	13966-00-2	
Protactinium-234M	EPA 901.1	**17.053 ± 58.277 (59.940)** **C:NA T:NA**	pCi/g	02/22/17 08:14	15100-28-4	
Radium-226	EPA 901.1	**20.387 ± 2.950 (1.312)** **C:NA T:NA**	pCi/g	02/22/17 08:14	13982-63-3	Ra
Radium-228	EPA 901.1	**121.200 ± 16.267 (2.033)** **C:NA T:NA**	pCi/g	02/22/17 08:14	15262-20-1	
Thallium-208	EPA 901.1	**44.850 ± 6.096 (0.830)** **C:NA T:NA**	pCi/g	02/22/17 08:14	14913-50-9	
Thorium-228	EPA 901.1	**169.250 ± 37.684 (45.130)** **C:NA T:NA**	pCi/g	02/22/17 08:14	14274-82-9	
Thorium-234	EPA 901.1	**13.509 ± 8.427 (13.390)** **C:NA T:NA**	pCi/g	02/22/17 08:14	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 6.356 (10.420)** **C:NA T:NA**	pCi/g	02/22/17 08:14	15117-96-1	
Thorium-228	HSL-300	**67.4 ± 11.3 (0.353)** **C:NA T:107%**	pCi/g	02/09/17 05:21	14274-82-9	1c,N2

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S004-0006-01 **Lab ID: 30204854015** Collected: 11/18/16 12:30 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Thorium-230	HSL-300	**10.6 ± 2.18 (0.301) C:NA T:107%**	pCi/g	02/09/17 05:21	14269-63-7	1c,N2
Thorium-232	HSL-300	**56.5 ± 9.53 (0.128) C:NA T:107%**	pCi/g	02/09/17 05:21	7440-29-1	1c,N2
U-233/234	HSL-300	**16.0 ± 2.70 (0.171) C:NA T:87%**	pCi/g	02/08/17 15:22		N2
U-235/236	HSL-300	**1.21 ± 0.370 (0.108) C:NA T:87%**	pCi/g	02/08/17 15:22		N2
Uranium-238	HSL-300	**15.6 ± 2.63 (0.111) C:NA T:87%**	pCi/g	02/08/17 15:22		N2

Sample: UMR001-S004-0612-01 **Lab ID: 30204854016** Collected: 11/18/16 12:25 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**104.270 ± 15.317 (7.192) C:NA T:NA**	pCi/g	02/22/17 08:30	14913-49-6	
Cesium-137	EPA 901.1	**0.115 ± 0.481 (0.487) C:NA T:NA**	pCi/g	02/22/17 08:30	10045-97-3	
Lead-212	EPA 901.1	**107.010 ± 14.455 (1.382) C:NA T:NA**	pCi/g	02/22/17 08:30	15092-94-1	
Potassium-40	EPA 901.1	**12.193 ± 3.949 (2.904) C:NA T:NA**	pCi/g	02/22/17 08:30	13966-00-2	
Protactinium-234M	EPA 901.1	**32.995 ± 40.188 (37.230) C:NA T:NA**	pCi/g	02/22/17 08:30	15100-28-4	
Radium-226	EPA 901.1	**17.171 ± 2.560 (0.913) C:NA T:NA**	pCi/g	02/22/17 08:30	13982-63-3	Ra
Radium-228	EPA 901.1	**101.250 ± 13.553 (1.711) C:NA T:NA**	pCi/g	02/22/17 08:30	15262-20-1	
Thallium-208	EPA 901.1	**35.772 ± 4.826 (0.607) C:NA T:NA**	pCi/g	02/22/17 08:30	14913-50-9	
Thorium-228	EPA 901.1	**153.110 ± 39.461 (49.450) C:NA T:NA**	pCi/g	02/22/17 08:30	14274-82-9	
Thorium-234	EPA 901.1	**22.436 ± 13.181 (22.990) C:NA T:NA**	pCi/g	02/22/17 08:30	15065-10-8	
Uranium-235	EPA 901.1	**2.401 ± 3.048 (8.999) C:NA T:NA**	pCi/g	02/22/17 08:30	15117-96-1	
Thorium-228	HSL-300	**54.5 ± 9.26 (0.491) C:NA T:105%**	pCi/g	02/09/17 05:21	14274-82-9	1c,N2
Thorium-230	HSL-300	**7.19 ± 1.63 (0.260) C:NA T:105%**	pCi/g	02/09/17 05:21	14269-63-7	1c,N2
Thorium-232	HSL-300	**45.9 ± 7.85 (0.189) C:NA T:105%**	pCi/g	02/09/17 05:21	7440-29-1	1c,N2
U-233/234	HSL-300	**12.6 ± 2.65 (0.347) C:NA T:38%**	pCi/g	02/08/17 15:22		N2
U-235/236	HSL-300	**0.878 ± 0.441 (0.247) C:NA T:38%**	pCi/g	02/08/17 15:22		N2
Uranium-238	HSL-300	**10.5 ± 2.27 (0.275) C:NA T:38%**	pCi/g	02/08/17 15:22		N2

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S004-1218-01 **Lab ID: 30204854017** Collected: 11/18/16 12:22 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**58.144 ± 10.790 (5.005)** **C:NA T:NA**	pCi/g	02/22/17 08:31	14913-49-6	
Cesium-137	EPA 901.1	**0.000 ± 0.091 (0.520)** **C:NA T:NA**	pCi/g	02/22/17 08:31	10045-97-3	
Lead-212	EPA 901.1	**43.400 ± 6.013 (0.986)** **C:NA T:NA**	pCi/g	02/22/17 08:31	15092-94-1	
Potassium-40	EPA 901.1	**29.517 ± 6.155 (3.048)** **C:NA T:NA**	pCi/g	02/22/17 08:31	13966-00-2	
Protactinium-234M	EPA 901.1	**0.897 ± 41.284 (44.930)** **C:NA T:NA**	pCi/g	02/22/17 08:31	15100-28-4	
Radium-226	EPA 901.1	**7.840 ± 1.448 (0.837)** **C:NA T:NA**	pCi/g	02/22/17 08:31	13982-63-3	Ra
Radium-228	EPA 901.1	**41.051 ± 5.833 (1.222)** **C:NA T:NA**	pCi/g	02/22/17 08:31	15262-20-1	
Thallium-208	EPA 901.1	**14.038 ± 2.065 (0.514)** **C:NA T:NA**	pCi/g	02/22/17 08:31	14913-50-9	
Thorium-228	EPA 901.1	**60.470 ± 22.484 (30.590)** **C:NA T:NA**	pCi/g	02/22/17 08:31	14274-82-9	
Thorium-234	EPA 901.1	**8.073 ± 8.388 (10.160)** **C:NA T:NA**	pCi/g	02/22/17 08:31	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 2.656 (6.571)** **C:NA T:NA**	pCi/g	02/22/17 08:31	15117-96-1	
Thorium-228	HSL-300	**26.5 ± 5.01 (0.473)** **C:NA T:79%**	pCi/g	02/09/17 05:21	14274-82-9	1c,N2
Thorium-230	HSL-300	**4.68 ± 1.33 (0.511)** **C:NA T:79%**	pCi/g	02/09/17 05:21	14269-63-7	1c,N2
Thorium-232	HSL-300	**23.8 ± 4.51 (0.290)** **C:NA T:79%**	pCi/g	02/09/17 05:21	7440-29-1	1c,N2
U-233/234	HSL-300	**4.50 ± 0.846 (0.132)** **C:NA T:99%**	pCi/g	02/08/17 15:22		N2
U-235/236	HSL-300	**0.197 ± 0.127 (0.136)** **C:NA T:99%**	pCi/g	02/08/17 15:22		N2
Uranium-238	HSL-300	**4.17 ± 0.794 (0.140)** **C:NA T:99%**	pCi/g	02/08/17 15:22		N2

Sample: UMR001-S004-1824-01 **Lab ID: 30204854018** Collected: 11/18/16 12:20 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Bismuth-212	EPA 901.1	**244.510 ± 34.048 (11.130)** **C:NA T:NA**	pCi/g	02/22/17 08:46	14913-49-6	
Cesium-137	EPA 901.1	**0.021 ± 0.772 (0.779)** **C:NA T:NA**	pCi/g	02/22/17 08:46	10045-97-3	
Lead-212	EPA 901.1	**232.950 ± 31.355 (2.085)** **C:NA T:NA**	pCi/g	02/22/17 08:46	15092-94-1	
Potassium-40	EPA 901.1	**21.018 ± 7.619 (5.901)** **C:NA T:NA**	pCi/g	02/22/17 08:46	13966-00-2	
Protactinium-234M	EPA 901.1	**22.633 ± 65.987 (61.560)** **C:NA T:NA**	pCi/g	02/22/17 08:46	15100-28-4	
Radium-226	EPA 901.1	**36.575 ± 5.021 (1.573)** **C:NA T:NA**	pCi/g	02/22/17 08:46	13982-63-3	Ra

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

Sample: UMR001-S004-1824-01 **Lab ID: 30204854018** Collected: 11/18/16 12:20 Received: 12/08/16 10:20 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 901.1	**221.460 ± 29.416 (2.833)** **C:NA T:NA**	pCi/g	02/22/17 08:46	15262-20-1	
Thallium-208	EPA 901.1	**78.922 ± 10.525 (0.877)** **C:NA T:NA**	pCi/g	02/22/17 08:46	14913-50-9	
Thorium-228	EPA 901.1	**323.850 ± 66.646 (75.390)** **C:NA T:NA**	pCi/g	02/22/17 08:46	14274-82-9	
Thorium-234	EPA 901.1	**15.308 ± 23.142 (31.350)** **C:NA T:NA**	pCi/g	02/22/17 08:46	15065-10-8	
Uranium-235	EPA 901.1	**0.000 ± 4.514 (13.890)** **C:NA T:NA**	pCi/g	02/22/17 08:46	15117-96-1	
Thorium-228	HSL-300	**74.7 ± 12.5 (0.479)** **C:NA T:113%**	pCi/g	02/09/17 05:21	14274-82-9	1c,N2
Thorium-230	HSL-300	**12.2 ± 2.46 (0.280)** **C:NA T:113%**	pCi/g	02/09/17 05:21	14269-63-7	1c,N2
Thorium-232	HSL-300	**59.1 ± 9.97 (0.219)** **C:NA T:113%**	pCi/g	02/09/17 05:21	7440-29-1	1c,N2
U-233/234	HSL-300	**23.5 ± 3.88 (0.155)** **C:NA T:85%**	pCi/g	02/08/17 15:22		N2
U-235/236	HSL-300	**1.68 ± 0.459 (0.060)** **C:NA T:85%**	pCi/g	02/08/17 15:22		N2
Uranium-238	HSL-300	**24.2 ± 3.98 (0.084)** **C:NA T:85%**	pCi/g	02/08/17 15:22		N2

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QUALITY CONTROL - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

QC Batch: 248114 Analysis Method: HSL-300
QC Batch Method: HSL-300 Analysis Description: HSL300(AS) Actinides
Associated Lab Samples: 30204854001, 30204854002, 30204854003, 30204854004, 30204854005, 30204854006, 30204854007, 30204854008, 30204854009, 30204854010, 30204854011, 30204854012, 30204854013

METHOD BLANK: 1220308 Matrix: Solid
Associated Lab Samples: 30204854001, 30204854002, 30204854003, 30204854004, 30204854005, 30204854006, 30204854007, 30204854008, 30204854009, 30204854010, 30204854011, 30204854012, 30204854013, 30204854014, 30204854015, 30204854016, 30204854017, 30204854018

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Thorium-228	0.078 ± 0.100 (0.196) C:NA T:87%	pCi/g	02/08/17 11:14	N2
Thorium-230	-0.010 ± 0.055 (0.135) C:NA T:87%	pCi/g	02/08/17 11:14	N2
Thorium-232	0.000 ± 0.055 (0.042) C:NA T:87%	pCi/g	02/08/17 11:14	N2
U-233/234	0.070 ± 0.076 (0.135) C:NA T:103%	pCi/g	02/07/17 15:12	N2
U-235/236	-0.004 ± 0.061 (0.085) C:NA T:103%	pCi/g	02/07/17 15:12	N2
Uranium-238	0.043 ± 0.053 (0.087) C:NA T:103%	pCi/g	02/07/17 15:12	N2

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: Case#: 416
Pace Project No.: 30204854

QC Batch: 248280 Analysis Method: EPA 901.1
QC Batch Method: EPA 901.1 Analysis Description: 901.1 Gamma Spec Ingrowth
Associated Lab Samples: 30204854001, 30204854002, 30204854005, 30204854006, 30204854007, 30204854008, 30204854009, 30204854010, 30204854011, 30204854012, 30204854013, 30204854014, 30204854015, 30204854016, 30204854017, 30204854018

METHOD BLANK: 1221147 Matrix: Solid
Associated Lab Samples: 30204854001, 30204854002, 30204854005, 30204854006, 30204854007, 30204854008, 30204854009, 30204854010, 30204854011, 30204854012, 30204854013, 30204854014, 30204854015, 30204854016, 30204854017, 30204854018

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Bismuth-212	0.000 ± 0.156 (1.305) C:NA T:NA	pCi/g	02/21/17 08:30	
Cesium-137	0.004 ± 0.057 (0.067) C:NA T:NA	pCi/g	02/21/17 08:30	
Lead-212	0.000 ± 0.038 (0.115) C:NA T:NA	pCi/g	02/21/17 08:30	
Potassium-40	0.000 ± 0.254 (0.849) C:NA T:NA	pCi/g	02/21/17 08:30	
Protactinium-234M	0.109 ± 6.522 (7.718) C:NA T:NA	pCi/g	02/21/17 08:30	
Radium-226	0.055 ± 0.085 (0.191) C:NA T:NA	pCi/g	02/21/17 08:30	Ra
Radium-228	0.085 ± 0.107 (0.230) C:NA T:NA	pCi/g	02/21/17 08:30	
Thallium-208	0.014 ± 0.057 (0.072) C:NA T:NA	pCi/g	02/21/17 08:30	
Thorium-228	3.222 ± 3.686 (4.144) C:NA T:NA	pCi/g	02/21/17 08:30	
Thorium-234	0.424 ± 0.439 (2.887) C:NA T:NA	pCi/g	02/21/17 08:30	
Uranium-235	0.000 ± 0.153 (0.891) C:NA T:NA	pCi/g	02/21/17 08:30	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: Case#: 416
Pace Project No.: 30204854

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

1c	The alpha spectroscopy spectrum for this analyte extended outside of the established region of interest for analysis. Results may be considered biased low. The high activity of the sample contributed to the spectral resolution issue. The spectrum did not overlap with any other identified regions.
N2	The lab does not hold NELAC/TNI accreditation for this parameter.
Ra	The reported Ra-226 results were determined by hermetically sealing the dried, processed sample in an appropriate-sized can. Each sample was stored for a minimum of 21 days to ensure that equilibrium between Ra-226 and daughters Bi-214 and Pb-214 was achieved. Reported Ra-226 results were inferred from gamma peaks attributable to Bi-214 and Pb-214.

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Weston Solutions, Inc.
DateShipped: 12/7/2016
CarrierName: FedEx
AirbillNo: 7778 8428 0670

CHAIN OF CUSTODY RECORD
Case #: 416
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-120716-091830-0001
Cooler #:
Lab: PACE Analytical Services
Lab Phone: 724-850-5600

Lab #	Sample #	Location	Analyses	Matrix	Collected	Sample Time	Numb Cont	Container	Preservative	Lab QC	
	UMR001-S001-0006-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:58	1	8 oz glass	4 C	N	
	UMR001-S001-0006-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:58	1	8 oz glass	4 C	N	001
	UMR001-S001-0006-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:58	1	16 oz	4 C	N	
	UMR001-S001-0612-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:55	2	8 oz glass	4 C	Y	
	UMR001-S001-0612-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:55	2	8 oz glass	4 C	Y	002
	UMR001-S001-0612-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:55	2	16 oz	4 C	Y	003
	UMR001-S001-0612-02	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:55	1	8 oz glass	4 C	N	
	UMR001-S001-0612-02	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:55	1	8 oz glass	4 C	N	004
	UMR001-S001-0612-02	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:55	1	16 oz	4 C	N	
	UMR001-S001-1218-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:50	1	8 oz glass	4 C	N	
	UMR001-S001-1218-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:50	1	8 oz glass	4 C	N	005
	UMR001-S001-1218-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:50	1	16 oz	4 C	N	
	UMR001-S001-1824-01	UMR001-S001	Isotopic Thorium	Soil	11/18/2016	09:45	1	8 oz glass	4 C	N	
	UMR001-S001-1824-01	UMR001-S001	Isotopic Uranium	Soil	11/18/2016	09:45	1	8 oz glass	4 C	N	006
	UMR001-S001-1824-01	UMR001-S001	Gamma Spec (modified)	Soil	11/18/2016	09:45	1	16 oz	4 C	N	
	UMR001-S002-0006-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:40	1	8 oz glass	4 C	N	
	UMR001-S002-0006-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:40	1	8 oz glass	4 C	N	007
	UMR001-S002-0006-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:40	1	16 oz	4 C	N	
	UMR001-S002-0612-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:38	1	8 oz glass	4 C	N	008

Special Instructions: Gamma Spec: K-40, Tl-208, Bi-212, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-234, U-235, & Cs-137.
Standard TAT, RFP# 416, PO# 0093240
All materials in the sample, including rock fragments and soil, must be analyzed.

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
All samples All analysis	[signature] (Weston)	12/7/16 1700	[signature] / Pace	12-8-16 1020	

WO#: 30204854

30204854

30204854

Weston Solutions, Inc.
DateShipped: 12/7/2016
CarrierName: FedEx
AirbillNo: 7778 8428 0670

CHAIN OF CUSTODY RECORD
Case #: 416
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-120716-091830-0001
Cooler #:
Lab: PACE Analytical Services
Lab Phone: 724-850-5600

Lab #	Sample #	Location	Analyses	Matrix	Collected	Sample Time	Numb Cont	Container	Preservative	Lab QC
	UMR001-S002-0612-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:38	1	8 oz glass	4 C	N
	UMR001-S002-0612-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:38	1	16 oz	4 C	N
	UMR001-S002-1218-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:35	1	8 oz glass	4 C	N
	UMR001-S002-1218-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:35	1	8 oz glass	4 C	N
	UMR001-S002-1218-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:35	1	16 oz	4 C	N
	UMR001-S002-1824-01	UMR001-S002	Isotopic Thorium	Soil	11/18/2016	10:30	1	8 oz glass	4 C	N
	UMR001-S002-1824-01	UMR001-S002	Isotopic Uranium	Soil	11/18/2016	10:30	1	8 oz glass	4 C	N
	UMR001-S002-1824-01	UMR001-S002	Gamma Spec (modified)	Soil	11/18/2016	10:30	1	16 oz	4 C	N
	UMR001-S003-0006-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:25	1	8 oz glass	4 C	N
	UMR001-S003-0006-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:25	1	8 oz glass	4 C	N
	UMR001-S003-0006-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:25	1	16 oz	4 C	N
	UMR001-S003-0612-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:22	1	8 oz glass	4 C	N
	UMR001-S003-0612-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:22	1	8 oz glass	4 C	N
	UMR001-S003-0612-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:22	1	16 oz	4 C	N
	UMR001-S003-1218-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:18	1	8 oz glass	4 C	N
	UMR001-S003-1218-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:18	1	8 oz glass	4 C	N
	UMR001-S003-1218-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:18	1	16 oz	4 C	N
	UMR001-S003-1824-01	UMR001-S003	Isotopic Thorium	Soil	11/18/2016	11:15	1	8 oz glass	4 C	N
	UMR001-S003-1824-01	UMR001-S003	Isotopic Uranium	Soil	11/18/2016	11:15	1	8 oz glass	4 C	N

008
009
010
011
012
013
014

Special Instructions: Gamma Spec: K-40, Tl-208, Bi-212, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-234, U-235, & Cs-137.
Standard TAT, RFP# 416, PO# 0093240
All materials in the sample, including rock fragments and soil, must be analyzed.

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES ALL ANALYSIS	[signature] (Weston)	12/7/16 1700 HRS	[signature] / Pace	12-8-16 1020	

30204854

Weston Solutions, Inc.
DateShipped: 12/7/2016
CarrierName: FedEx
AirbillNo: 7778 8428 0670

CHAIN OF CUSTODY RECORD
Case #: 416
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-120716-091830-0001
Cooler #:
Lab: PACE Analytical Services
Lab Phone: 724-850-5600

Lab #	Sample #	Location	Analyses	Matrix	Collected	Sample Time	Numb Cont	Container	Preservative	Lab QC	
	UMR001-S003-1824-01	UMR001-S003	Gamma Spec (modified)	Soil	11/18/2016	11:15	1	16 oz	4 C	N	014
	UMR001-S004-0006-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:30	1	8 oz glass	4 C	N	
	UMR001-S004-0006-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:30	1	8 oz glass	4 C	N	015
	UMR001-S004-0006-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:30	1	16 oz	4 C	N	
	UMR001-S004-0612-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:25	1	8 oz glass	4 C	N	
	UMR001-S004-0612-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:25	1	8 oz glass	4 C	N	016
	UMR001-S004-0612-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:25	1	16 oz	4 C	N	
	UMR001-S004-1218-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:22	1	8 oz glass	4 C	N	
	UMR001-S004-1218-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:22	1	8 oz glass	4 C	N	017
	UMR001-S004-1218-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:22	1	16 oz	4 C	N	
	UMR001-S004-1824-01	UMR001-S004	Isotopic Thorium	Soil	11/18/2016	12:20	1	8 oz glass	4 C	N	
	UMR001-S004-1824-01	UMR001-S004	Isotopic Uranium	Soil	11/18/2016	12:20	1	8 oz glass	4 C	N	018
	UMR001-S004-1824-01	UMR001-S004	Gamma Spec (modified)	Soil	11/18/2016	12:20	1	16 oz	4 C	N	

Special Instructions: Gamma Spec: K-40, Tl-208, Bi-212, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-234, U-235, & Cs-137.
Standard TAT, RFP# 416, PO# 0093240
All materials in the sample, including rock fragments and soil, must be analyzed.

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES ALL ANALYSIS	[signature] (WESTON)	12/7/16 1700 hrs	[signature] Pace	12-8-16/1020	

Sample Condition Upon Receipt Pittsburgh 30204854

Pace Analytical

Client Name: Weston Project #

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other

Tracking #: 7778 8428 0670

Custody Seal on Cooler/Box Present: ☑ yes ☐ no Seal's intact: ☑ yes ☐ no

Thermometer Used 7 Type of Ice: (Wet) Blue None

Cooler Temperature Observed Temp 6.1, 4.8 °C Correction Factor: -0.2 °C Final Temp: 5.9, 4.6 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: KH 12-9-16

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:		✓		4.
Sample Labels match COC: -Includes date/time/ID/Analysis Matrix: SL	✓			5.
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:		✓		
Containers Intact:		✓		11. Cracked lid on BP2U in sample 002
Filtered volume received for Dissolved tests			✓	12.
All containers needing preservation have been checked.			✓	13.
All containers needing preservation are found to be in compliance with EPA recommendation.			✓	
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed KH / Date/time of preservation / Lot # of added preservative
Headspace in VOA Vials (>6mm):			✓	14.
Trip Blank Present:			✓	15.
Trip Blank Custody Seals Present			✓	
Rad Aqueous Samples Screened > 0.5 mrem/hr			✓	Initial when completed: KH Date: 12-9-16

Client Notification/ Resolution:

Person Contacted: Date/Time: Contacted By:

Comments/ Resolution: One jar in sample arrived broken. Transferred sample to a new jar.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder edit Screen.

Precautionary Measures Against Hidden Hazards in Laboratory Samples

Notice to Laboratory Personnel

Background

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) of 1980, as amended, Section 311 of the Clean Water Act (CWA), as amended, by the Oil Pollution Act of 1990 (OPA), Subtitle I of the Resource Conversation and Recovery Act (RCRA), and pursuant to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and Presidential Decision Document (PDD) #39, the Environmental Protection Agency (EPA) has been delegated the responsibility to undertake response actions with respect to, as a general matter, the release or threat of release of oil, petroleum products, hazardous substances, or pollutant and contaminants, that pose an actual or potential threat to human health or welfare, or to the environment. EPA is responsible for conducting evaluations and cleanups of uncontrolled hazardous substance disposal sites and placing those that are considered to pose a significant threat to the public health or the environment on the National Priorities List (NPL).

EPA's successful implementation of these emergency response action responsibilities requires that technical support capabilities be provided in the form of a contracted Removal Support Team (RST) for EPA. The WESTON RST Contract EP-W-06-072, provides this support to EPA Region II.

Hazard Communication

The samples which accompany this notice were shipped to your laboratory for analysis in accordance with applicable D.O.T. or IATA Regulations and were collected by the WESTON RST and tentatively designated by the field response team, as either environmental or hazardous material samples.

In general, *Environmental Samples* are collected from streams, farm ponds, small lakes, wells, and off-site soil locations that are not reasonable expected to be contaminated with hazardous materials. Samples of on-site soils or water, and materials collected from drums, bulk storage tanks, obviously contaminated ponds, impoundments, lagoons, pools, and leachates from hazardous waste sites are considered *Hazardous Samples*. Samples which are obtained from a known radioactive material contamination site or which demonstrate beta or gamma activity greater than three times average background as scanned with a radiation survey meter are considered *Radioactive Samples*.

The samples which accompany this notice were tentatively classified by the field response team as:

XXX Environmental _____ Hazardous _____ Comb. (Enviro. & Hazard.) XXX Radioactive

The field team which collected the samples, used the following Level(s) of personal protection as designated by EPA and OSHA conventions to provide protection against possible radiological or chemical exposure:

_____ Level A _____ Level B _____ Level C XXX Level D

The information is intended for use as a guide for the safe handling of these laboratory samples in accordance with EPA and OSHA regulations. The Sample classification(s) and Levels of personal protection used by the WESTON RST are not represented to be, nor are they adequate or applicable in all situations, nor are they intended to serve as substitutes for professional/personal judgment.

Laboratory Name Pace *RFP No.* 419
Prepared by: Lisichenko *Date* 12/7/2016

WESTON Office: Region II RST, Edison, NJ; Phone: 732-585-4400 Fax: 732-225-7037

Isotopic Uranium Sample Analysis Documentation

Alpha Emitting Actinides Preparation Logbook/Method HASL 300, Po-01-RC, Po-02-RC, Pu-241

Prep Date: [illegible] Method [illegible] Prep Analyst: [illegible] Balance ID: [illegible]
Work List: [illegible] Matrix: [illegible] Report Units: [illegible] Pipette ID: [illegible]

Logbook ID: 5-R003-6 SOP ID: PGH-R-009, R041 Aliquot Units: g, L, F, S Aliquot Basis: Dry/Wet, Filter/Unfiltered

Bottle ID:	MB	Sample ID	Aliquot	Reagents	Reagent ID	Reagents	Reagent ID
[illegible]	1	[illegible]	[illegible]	Anion Resin	[illegible]	3N HNO_3	N/A
	2		[illegible]	Cation Resin	N/A	3N HNO_3/1.0M $Al(NO_3)_3$	
	3		[illegible]	TEVA Resin		6N HCl	
	4		[illegible]	TRU Resin		0.01 N HCl	
	5		[illegible]	UTEVA Resin		KSCN indicator	
	6		[illegible]	Ascorbic Acid		TiCl	[illegible]
	7		[illegible]	HF	[illegible]	25% Hydrazine HCl_5	N/A
	8		[illegible]	HCl	[illegible]	NH4OH	[illegible]
	9		[illegible]	Nitric	[illegible]	9N HCl/0.1% H_2O_2	N/A
	10		[illegible]	Boric Acid 5% Stn	[illegible]	9N HCl/0.05M NH_4I	
	11		[illegible]	Iron Carrier	[illegible]	1M Ascorbic Acid	
	12		[illegible]	8N HNO_3	[illegible]	1M NH_4SCN/0.1N Formic	
	13		[illegible]	9N HCl	[illegible]	3M NH_4SCN/0.1N Formic	
	14		[illegible]	3N HCl / 0.52N HF	[illegible]	3N HCl/0.05M Oxalic Acid	
	15		[illegible]	0.1N HCl	[illegible]		
	16		[illegible]	Neodymium Carrier	[illegible]	N/A	
	17		[illegible]	80% Ethanol	[illegible]		
	18		[illegible]	0.1% HF	[illegible]		
	19	[illegible]	[illegible]	2N HNO_3	N/A		
	20	[illegible]		2N HNO_3/0.5N $Al(NO_3)_3$			
	QC			2N HCl			
N/A	QC			4N HCl			
N/A	QC			0.1N HNO_3			
N/A	QC			1.0N HNO_3			
	QC			pH 10 DI Water			

Isotopes	Tracer ID/Volume	LCS Spike ID/Volume	MS Spike ID/ Volume	Separation Date/Time	Comments
U	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Th	[illegible]	[illegible]	[illegible]		[illegible]
Pu	N/A	N/A	N/A		
Am					
Cm					
Np					
Po					
Ra-224					

Analyst:_____ Date:_____ Peer Review:_____ Date:_____

Pace Analytical Services, Inc.-Pittsburgh

Alpha Spectroscopy Run Logbook

Logbook ID: 1-R054-6
SOP ID: PGH-R-020

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
36	[illegible]	U	360	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
37	[illegible]								
38	[illegible]								
39	[illegible]								
40	[illegible]								
26	[illegible]	U	240	2/7/17 0[illegible]	[illegible]	[illegible]			
27	4								
28	[illegible]								
31	2								
32	3								
35	[illegible]								
36	[illegible]								
37	[illegible]								
38	[illegible]	U	240	2/7/17 [illegible]	[illegible]	[illegible]			
39	[illegible]								
26	[illegible]	U	240	2/7/17 [illegible]	[illegible]	[illegible]			
27	[illegible]								
28	2								
31	3								
32	4								
33	5								
34	6								
35	7								

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract RL
4. Re-Prep of sample
5. Other Noted Comments

[illegible]

[illegible]

Alpha Spectroscopy Run Logbook

Logbook ID: 1-R054-6
SOP ID: PGH-R-028

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
27	[illegible]	U	240	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]								
29	[illegible]								
30	[illegible]								
31	[illegible]			[illegible]	[illegible]				
32	[illegible]								
33	[illegible]								[illegible]
34	[illegible]			[illegible]	[illegible]				
35	[illegible]								
36	[illegible]								
37	[illegible]								
38	[illegible]								
39	[illegible]								
40	[illegible]	U	240	[illegible]	[illegible]	[illegible]			
41	[illegible]								
42	[illegible]								
43	[illegible]								
44	[illegible]								
45	[illegible]								
46	[illegible]								
47	[illegible]								
48	[illegible]								
49	[illegible]								
50	[illegible]								
51	[illegible]								
52	[illegible]								
53	[illegible]								
54	[illegible]								
55	[illegible]								
56	[illegible]								
57	[illegible]								
58	[illegible]	U	240	[illegible]	[illegible]	[illegible]			
59	[illegible]	U							

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract RL
4. Re Prep of sample
5. Other Noted Comments

[illegible]

[illegible] 7/19/17

J:\QAQC\Master\Document Management\Radiological\Logbooks Updated\Alpha Spec Run Log (R054-6 16Sept2016)

Pace Analytical Services Inc
Actinides Sample Info

Analyst LAL
Matrix SL
Batch ID 33792
Prep Start Date/Time: 2/8/2017 15:00
PrepSOP1 PGH-R-008
PrepSOP2 N/A
AnalSOP1 PGH-R-008
AnalSOP2 N/A

Act. Rpt Units pCi
Zero Fact. 2.71
Rpt. Sig Figs 2
Sigma 1.96

To Report Select with an X
Iso U X
Iso Th X
Iso Pu
Iso Am

	Sample COC and aliquot information				Uranium			Thorium			Plutonium			Americium/Curium		
	Sample ID	Collection Date	Aliquot	Aliq. units	Count Date	Det. ID	Det. Eff. (cpm/dpm)	Count Date	Det. ID	Det. Eff. (cpm/dpm)	Count Date	Det. ID	Det. Eff. (cpm/dpm)	Count Date	Det. ID	Det. Eff. (cpm/dpm)
1	1227[illegible]	2/7/2017 15:12	0.4803	g	2/7/2017 15:12	Det 25	0.2783	2/8/2017 11:14	Det 26	0.2793						
2	30204954001	11/18/2016 9:58	0.4803	g	2/7/2017 15:12	Det 27	0.2803	2/8/2017 11:14	Det 27	0.2853						
3	30204954002	11/18/2016 9:55	0.4416	g	2/7/2017 15:12	Det 29	0.2808	2/8/2017 11:14	Det 28	0.2809						
4	30204954003	11/18/2016 9:55	0.4461	g	2/7/2017 15:12	Det 31	0.2830	2/8/2017 11:14	Det 31	0.2870						
5	30204954004	11/18/2016 9:55	0.4451	g	2/7/2017 15:12	Det 32	0.2822	2/8/2017 11:14	Det 32	0.2862						
6	30204954005	11/18/2016 9:55	0.4[illegible]	g	2/7/2017 15:12	Det 34	0.2837	2/8/2017 11:14	Det 33	0.2877						
7	30204954006	11/18/2016 9:[illegible]	0.4863	g	2/7/2017 15:12	Det 37	0.2867	2/8/2017 11:14	Det 34	0.2887						
8	30204954007	11/18/2016 10:40	0.4809	g	2/7/2017 15:12	Det 36	0.2851	2/8/2017 11:14	Det 36	0.2861						
9	30204954008	11/18/2016 10:38	0.4476	g	2/7/2017 15:12	Det 37	0.2845	2/8/2017 11:14	Det 37	0.2855						
10	30204954009	11/18/2016 10:35	0.4416	g	2/7/2017 15:12	Det 38	0.2715	2/8/2017 11:14	Det 38	0.2710						
11	30204954010	11/18/2016 10:30	0.4524	g	2/7/2017 15:12	Det 39	0.2772	2/8/2017 5:21	Det 26	0.2783						
12	30204954011	11/18/2016 10:25	0.4516	g	2/7/2017 15:12	Det 40	0.2790	2/8/2017 5:21	Det 27	0.2853						
13	30204954012	11/18/2016 11:22	0.4510	g	2/8/2017 7:56	Det 39	0.2716	2/8/2017 5:21	Det 28	0.2809						
14	30204954013	11/18/2016 11:19	0.4530	g	2/8/2017 7:08	Det 33	0.3172	2/8/2017 5:21	Det 31	0.2830						
15	30204954014	11/18/2016 11:15	0.4762	g	2/8/2017 7:08	Det 40	0.2330	2/8/2017 5:21	Det 32	0.2822						
16	30204954015	11/18/2016 12:30	0.4567	g	2/8/2017 15:22	Det 26	0.2793	2/8/2017 5:21	Det 33	0.2867						
17	30204954016	11/18/2016 12:25	0.4604	g	2/8/2017 15:22	Det 27	0.2838	2/8/2017 5:21	Det 34	0.2887						
18	30204954017	11/18/2016 12:22	0.4708	g	2/8/2017 15:22	Det 28	0.2803	2/8/2017 5:21	Det 36	0.2861						
19	30204954018	11/18/2016 12:20	0.4083	g	2/8/2017 15:22	Det 31	0.2830	2/8/2017 5:21	Det 37	0.2845						
20	LCS33792	2/8/2017 15:22	0.5000	g	2/8/2017 15:22	Det 32	0.2762	2/8/2017 5:21	Det 38	0.2710						
21	LCSD33792	2/8/2017 15:22	0.5000	g	2/8/2017 15:22	Det 33	0.2887	2/8/2017 5:21	Det 39	0.3172						
22																
23																
24																

Note: Decay correction insignificant for for nuclides longer than 10 years analyzed within 2 months of collection. Prep start date may be entered as reference date if a sample collection date has not been supplied.

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batch Comscon Information
Printed: 2/8/2017 10:29 AM

isoUTh_33792_S.xls
Actinides (R089-3 05Oct2015).xls

Pace Analytical Services
Isotopic Uranium Analysis

Test Code: U Iso	Analyst: JAL		Nuclide	Tracer	Abund.	U21	UE2	UE3	Tracer ID	15-046	
Matrix: SL	PrepSOP1: ADH-R-003	Tracer Nuc	U-232	7.20E-01	100.0%	12.00%	6.00%	y/c uncer	Tracer Conc	105.83	dpm/ml
Batch ID: 33702	PrepSOP2: N/A	Analyte 1	U-233/234	2.46E-05	100.0%	12.00%	6.00%	y/c uncer	Tracer Vol.	0.10	ml.
Prep Start: 2/1/2017 15:00	AnalSOP1: ADH-R-002	Analyte 2	U-235/236	7.04E-05	76.5%	12.00%	6.00%	y/c uncer	Tracer Ref Date	2/5/2014 0:00	
Prep Finish: 02/05/17	AnalSOP2: N/A	Analyte 3	U-238	4.70E-09	100.0%	12.00%	6.00%	y/c uncer	Zero Fact.	2.71	
Act. Rpt Units: pCi		Analyte 4							Sigma	1.96	

	Sample ID	Reference Date	Aliquot	Alq Units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (ref to sample time)	Sample Time (min)	Bkg Time (min)	Net CPM	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	abnd	Act. Conv. From dpm to pCi	Fract. Remain
1	1220000	12/5/2014 0:00	0.5	g	2/7/2017 15:12	0.2793	U-232	712.44	6.5320	240	1000	2.605	10.3853	10.6603	102.65%	100%	2.22	0.9732
1	1220000	2/7/2017 15:12	0.5	g	2/7/2017 15:12	0.2793	U-233/234	5.38	2.6420	240	1000	0.022	10.3853	10.6603	102.65%	100%	2.22	1.0000
1	1220000	2/7/2017 15:12	0.5	g	2/7/2017 15:12	0.2793	U-235/236	-0.24	0.2420	240	1000	-0.001	10.3853	10.6603	102.65%	77%	2.22	1.0000
1	1220000	2/7/2017 15:12	0.5	g	2/7/2017 15:12	0.2793	U-238	3.29	0.7220	240	1000	0.014	10.3853	10.6603	102.65%	100%	2.22	1.0000
1																		
2	3020485001	12/5/2014 0:00	0.4603	g	2/7/2017 15:12	0.2868	U-232	688.76	4.5432	240	1000	3.201	10.3853	11.1818	107.67%	100%	2.22	0.9732
2	3020485001	11/18/2016 9:55	0.4603	g	2/7/2017 15:12	0.2868	U-233/234	66.04	1.5200	240	1000	0.271	10.3853	11.1818	107.67%	100%	2.22	1.0000
2	3020485001	11/18/2016 9:55	0.4603	g	2/7/2017 15:12	0.2868	U-235/236	5.70	0.2400	240	1000	0.024	10.3853	11.1818	107.67%	77%	2.22	1.0000
2	3020485001	11/18/2016 9:55	0.4603	g	2/7/2017 15:12	0.2868	U-238	56.04	0.9800	240	1000	0.234	10.3853	11.1818	107.67%	100%	2.22	1.0000
2																		
3	3020485002	12/5/2014 0:00	0.4491	g	2/7/2017 15:12	0.2898	U-232	888.88	3.3774	240	1000	2.737	10.3853	9.5918	92.34%	100%	2.22	0.9732
3	3020485002	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2898	U-233/234	44.94	2.1620	240	1000	0.187	10.3853	9.5918	92.34%	100%	2.22	1.0000
3	3020485002	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2898	U-235/236	0.22	1.0721	240	1000	0.001	10.3853	9.5918	92.34%	77%	2.22	1.0000
3	3020485002	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2898	U-238	61.75	2.5294	240	1000	0.257	10.3853	9.5918	92.34%	100%	2.22	1.0000
3																		
4	3020485003	12/5/2014 0:00	0.4491	g	2/7/2017 15:12	0.2830	U-232	886.72	3.3217	240	1000	2.695	10.3853	8.8150	85.04%	100%	2.22	0.9732
4	3020485003	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2830	U-233/234	1145.68	1.8200	240	1000	4.774	10.3853	8.8150	85.04%	100%	2.22	1.0000
4	3020485003	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2830	U-235/236	47.00	0.3000	240	1000	0.196	10.3853	8.8150	85.04%	77%	2.22	1.0000
4	3020485003	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2830	U-238	1091.78	0.7400	240	1000	4.574	10.3853	8.8150	85.04%	100%	2.22	1.0000
4																		
5	3020485004	12/5/2014 0:00	0.4491	g	2/7/2017 15:12	0.2862	U-232	829.65	7.2534	240	1000	2.624	10.3853	9.1797	88.48%	100%	2.22	0.9732
5	3020485004	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2862	U-233/234	1155.40	6.0000	240	1000	4.814	10.3853	9.1797	88.48%	100%	2.22	1.0000
5	3020485004	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2862	U-235/236	54.22	0.7200	240	1000	0.226	10.3853	9.1797	88.48%	77%	2.22	1.0000
5	3020485004	11/18/2016 9:55	0.4491	g	2/7/2017 15:12	0.2862	U-238	1155.43	0.7200	240	1000	4.814	10.3853	9.1797	88.48%	100%	2.22	1.0000
5																		
6	3020485005	12/5/2014 0:00	0.4710	g	2/7/2017 15:12	0.2887	U-232	723.87	3.1200	240	1000	3.018	10.3853	10.0080	97.41%	100%	2.22	0.9732
6	3020485005	11/18/2016 9:55	0.4710	g	2/7/2017 15:12	0.2887	U-233/234	89.88	2.5167	240	1000	0.375	10.3853	10.0080	97.41%	100%	2.22	1.0000
6	3020485005	11/18/2016 9:55	0.4710	g	2/7/2017 15:12	0.2887	U-235/236	4.60	0.4700	240	1000	0.019	10.3853	10.0080	97.41%	77%	2.22	1.0000
6	3020485005	11/18/2016 9:55	0.4710	g	2/7/2017 15:12	0.2887	U-238	72.52	0.7900	240	1000	0.302	10.3853	10.0080	97.41%	100%	2.22	1.0000
6																		

Paco Analytical Services
Isotopic Uranium Analysis

Activity	1.96 Sigma Det Uncert.	Backgrnd	Efficiency	TPU U FE	TPU U EZ	TPU U E3	TPU	MDC	Det	1.96 sigma CSU	Index	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Gross CPM	Bkg CPM
0.311563	0.703018	0.038952	0.703018	12.00%	6.00%	7.37%	1.5703	0.1682	9.5300	1.6703	0.1682	pCi/g	0.0775	1220606	1	Det 26	12/7/2018 13:48	2/1/2017 13:59	2.9575	0.0130
0.317889	0.075466	0.047094	0.075466	12.00%	6.00%	7.37%	0.0752	0.1340	0.0703	0.0767	0.1346	pCi/g	0.0251	1220606	1	Det 26	12/2/2018 13:48	2/1/2017 13:59	0.0833	0.0110
0.323554	0.008040	0.031400	0.064486	12.00%	6.00%	7.37%	0.0645	0.0854	-0.0041	0.0645	0.0854	pCi/g	0.0754	1220606	1	Det 26	12/2/2018 13:48	2/1/2017 13:59	0.0000	0.0010
0.317933	0.063476	0.047094	0.052478	12.00%	6.00%	7.37%	0.0529	0.0872	0.0430	0.0529	0.0872	pCi/g	0.0204	1220606	1	Det 26	12/2/2018 13:48	2/1/2017 13:59	0.0167	0.0030
0.322451	0.204277	0.046428	0.204277	12.00%	6.00%	7.00%	1.0021	0.1558	9.0272	1.0031	0.1558	pCi/g	0.0477	3020485403[illegible]	2	Det 27	6/5/2018 6:44	2/1/2017 13:59	3.2179	0.0169
0.322226	0.203647	0.046464	0.203647	12.00%	6.00%	7.00%	0.2006	0.1166	0.8730	0.2009	0.1168	pCi/g	0.0322	3020485403[illegible]	2	Det 27	6/5/2018 6:44	2/1/2017 13:59	0.2793	0.0000
0.262203	0.079660	0.043313	0.079660	12.00%	6.00%	7.00%	0.0810	0.0524	0.0557	0.0810	0.0524	pCi/g	0.0143	3020485403[illegible]	2	Det 27	6/5/2018 6:44	2/1/2017 13:59	0.0250	0.0010
0.276286	0.187523	0.046464	0.187523	12.00%	6.00%	7.00%	0.2168	0.0918	0.7091	0.2168	0.0918	pCi/g	0.0275	3020485403[illegible]	2	Det 27	6/5/2018 6:44	2/1/2017 13:59	0.2375	0.0040
															2					
0.292549	0.207047	0.057021	0.207047	12.00%	6.00%	7.00%	1.0733	0.1786	10.0160	1.0753	0.1786	pCi/g	0.0336	3020485400[illegible]	3	Det 28	6/5/2018 6:47	2/1/2017 13:59	2.5015	0.0141
0.298117	0.206971	0.055037	0.206971	12.00%	6.00%	7.00%	0.2369	0.1483	0.0968	0.2369	0.1483	pCi/g	0.0430	3020485400[illegible]	3	Det 28	6/5/2018 6:47	2/1/2017 13:59	0.1004	0.0080
0.295374	0.065744	0.072895	0.072895	12.00%	6.00%	7.00%	0.0730	0.1527	0.0100	0.0730	0.1527	pCi/g	0.0305	3020485400[illegible]	3	Det 28	6/5/2018 6:47	2/1/2017 13:59	0.0023	0.0045
0.296117	0.246377	0.055837	0.246377	12.00%	6.00%	7.00%	0.2866	0.1579	0.0506	0.2866	0.1579	pCi/g	0.0454	3020485400[illegible]	3	Det 28	6/5/2018 6:47	2/1/2017 13:59	0.2095	0.0135
															3					
0.231460	0.055255	0.065664	0.055255	12.00%	6.00%	8.04%	1.0711	0.1968	10.6105	1.0711	0.1968	pCi/g	0.0595	3020485403[illegible]	4	Det 31	6/5/2018 10:21	2/1/2017 13:59	2.5085	0.0138
0.268419	1.155762	0.067526	1.155762	12.00%	6.00%	8.04%	3.3258	0.1698	19.9385	3.3258	0.1698	pCi/g	0.0143	3020485403[illegible]	4	Det 31	6/5/2018 10:21	2/1/2017 13:59	4.1017	0.0080
0.268362	0.305288	0.067637	0.305288	12.00%	6.00%	8.04%	0.3480	0.0916	1.0678	0.3480	0.0916	pCi/g	0.0000	3020485403[illegible]	4	Det 31	6/5/2018 10:21	2/1/2017 13:59	0.1958	0.0000
0.268416	1.124118	0.067526	1.124118	12.00%	6.00%	8.04%	3.1619	0.0968	18.8067	3.1618	0.0968	pCi/g	0.0157	3020485403[illegible]	4	Det 31	6/5/2018 10:21	2/1/2017 13:59	5.5250	0.0010
															4					
0.243995	0.646266	0.061303	0.646266	12.00%	6.00%	7.97%	1.9755	0.2503	10.7605	1.9758	0.2503	pCi/g	0.0845	3020485400[illegible]	5	Det 32	12/2/2018 14:55	2/1/2017 13:59	2.3543	0.0207
0.249068	1.118166	0.060139	1.118166	12.00%	6.00%	7.97%	3.2973	0.2359	19.3296	3.2979	0.2359	pCi/g	0.0768	3020485400[illegible]	5	Det 32	12/2/2018 14:55	2/1/2017 13:59	4.3382	0.0250
0.100777	0.345418	0.073472	0.345418	12.00%	6.00%	7.97%	0.4046	0.1151	1.4325	0.4046	0.1154	pCi/g	0.0341	3020485400[illegible]	5	Det 32	12/2/2018 14:55	2/1/2017 13:59	0.2708	0.0020
0.249067	1.115028	0.060109	1.115028	12.00%	6.00%	7.97%	3.2963	0.1113	19.3304	3.2963	0.1113	pCi/g	0.0251	3020485400[illegible]	5	Det 32	12/2/2018 14:55	2/1/2017 13:59	4.6175	0.0030
															5					
0.299518	0.738020	0.050158	0.738020	12.00%	6.00%	7.30%	1.7108	0.1575	10.1039	1.7108	0.1575	pCi/g	0.0450	3020485403[illegible]	6	Det 33	6/5/2018 12:10	2/1/2017 13:59	2.0262	0.0150
0.301072	0.254404	0.049103	0.254404	12.00%	6.00%	7.30%	0.2194	0.1384	1.2205	0.2194	0.1384	pCi/g	0.0401	3020485403[illegible]	6	Det 33	6/5/2018 12:10	2/1/2017 13:59	0.3951	0.0100
0.293500	0.078669	0.055112	0.078669	12.00%	6.00%	7.30%	0.0801	0.1358	0.0007	0.0801	0.1358	pCi/g	0.0227	3020485403[illegible]	6	Det 33	6/5/2018 12:10	2/1/2017 13:59	0.0200	0.0030
0.304813	0.229073	0.049109	0.229073	12.00%	6.00%	7.30%	0.2746	0.0811	0.8012	0.2746	0.0811	pCi/g	0.0214	3020485403[illegible]	6	Det 33	6/5/2018 12:10	2/1/2017 13:59	0.3047	0.0020
															6					

Pace Analytical Services
Isotopic Uranium Analysis

Test Code	J Iso
Matrix	SL
Batch ID	33792
Prep Start	2/1/2017 15:00
Prep Finish	02/05/17 [illegible]
Act. Rpt Units	pCi

Analyst	LAL
PrepSOP1	PGS-R-008
PrepSOP2	N/A
AnalSOP1	PGS-R-009
AnalSOP2	N/A

	Nuclide	T1/2 (y)	Abund.	UST	UER	UES
Tracer Nuc	U-232	7.20E+01	100.0%	12.00%	5.00%	yy unspec.
Analyte 1	U-233/234	2.48E+05	100.0%	12.00%	5.00%	yy unspec.
Analyte 2	U-235/236	7.04E+08	76.0%	12.00%	5.00%	yy unspec.
Analyte 3	U-238	4.70E+09	100.0%	12.00%	5.00%	yy unspec.
Analyte 4						

Tracer ID	15-040	
Tracer Conc	106.85	dpm/ml
Tracer Vol.	0.10	mL
Tracer Ref Date	12/5/2014 0:00	
Zero Fact	2.71	
Sigma	1.08	

	Sample ID	Reference Date	Aliquot	Aliq. Units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (ref to sample time)	Sample Time (min)	Bkg Time (min)	Net CPM	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	abund	Act. Conv. From dpm to pCi	Fract. Remain.
7	3020954038	12/5/2014 0:00	0.4652	g	2/7/2017 15:12	0.2967	U-232	694.31	5.5283	240	1000	2.892	10.3853	9.5467	92.10%	100%	2.22	0.9792
7	3020954038	11/18/2016 10:35	0.4652	g	2/7/2017 15:12	0.2967	U-233/234	97.79	1.6206	240	1000	0.407	10.3853	9.5467	92.10%	100%	2.22	1.0000
7	3020954038	11/18/2016 10:35	0.4652	g	2/7/2017 15:12	0.2967	U-235/236	3.60	1.2000	240	1000	0.015	10.3853	9.5467	92.10%	77%	2.22	1.0000
7	3020954038	11/18/2016 10:35	0.4652	g	2/7/2017 15:12	0.2967	U-238	92.60	0.4800	240	1000	0.385	10.3853	9.5467	92.10%	100%	2.22	1.0000
7																		
8	3020954037	12/5/2014 0:00	0.4520	g	2/7/2017 15:12	0.2967	U-232	712.79	5.8033	240	1000	2.970	10.3853	10.6795	103.14%	100%	2.22	0.9792
8	3020954037	11/18/2016 10:40	0.4520	g	2/7/2017 15:12	0.2967	U-233/234	94.93	6.1695	240	1000	0.270	10.3853	10.6795	103.14%	100%	2.22	1.0000
8	3020954037	11/18/2016 10:40	0.4520	g	2/7/2017 15:12	0.2967	U-235/236	5.38	0.7200	240	1000	0.014	10.3853	10.6795	103.14%	77%	2.22	1.0000
8	3020954037	11/18/2016 10:40	0.4520	g	2/7/2017 15:12	0.2967	U-238	86.65	1.4400	240	1000	0.278	10.3853	10.6795	103.14%	100%	2.22	1.0000
8																		
9	3020954039	12/5/2014 0:00	0.4416	g	2/7/2017 15:12	0.2966	U-232	626.41	5.7142	240	1000	2.610	10.3853	9.6844	93.19%	100%	2.22	0.9792
9	3020954039	11/18/2016 10:38	0.4416	g	2/7/2017 15:12	0.2966	U-233/234	126.09	1.6200	240	1000	0.472	10.3853	9.6844	93.19%	100%	2.22	1.0000
9	3020954039	11/18/2016 10:38	0.4416	g	2/7/2017 15:12	0.2966	U-235/236	7.04	0.7800	240	1000	0.029	10.3853	9.6844	93.19%	77%	2.22	1.0000
9	3020954039	11/18/2016 10:38	0.4416	g	2/7/2017 15:12	0.2966	U-238	100.28	1.4200	240	1000	0.420	10.3853	9.6844	93.19%	100%	2.22	1.0000
9																		
10	3020954040	12/5/2014 0:00	0.441	g	2/7/2017 15:12	0.2716	U-232	593.37	7.6524	240	1000	2.338	10.3853	10.6386	102.54%	100%	2.22	0.9792
10	3020954040	11/18/2016 10:30	0.441	g	2/7/2017 15:12	0.2716	U-233/234	58.35	2.6400	240	1000	0.410	10.3853	10.6386	102.54%	100%	2.22	1.0000
10	3020954040	11/18/2016 10:30	0.441	g	2/7/2017 15:12	0.2716	U-235/236	7.13	0.6000	240	1000	0.030	10.3853	10.6386	102.54%	77%	2.22	1.0000
10	3020954040	11/18/2016 10:30	0.441	g	2/7/2017 15:12	0.2716	U-238	87.78	0.7200	240	1000	0.364	10.3853	10.6386	102.54%	100%	2.22	1.0000
10																		
11	3020954010	12/5/2014 0:00	0.4524	g	2/7/2017 15:12	0.3172	U-232	311.72	4.5785	240	1000	3.422	10.3853	10.7989	104.0%	100%	2.22	0.9792
11	3020954010	11/18/2016 10:30	0.4524	g	2/7/2017 15:12	0.3172	U-233/234	75.88	3.6000	240	1000	0.319	10.3853	10.7989	104.0%	100%	2.22	1.0000
11	3020954010	11/18/2016 10:30	0.4524	g	2/7/2017 15:12	0.3172	U-235/236	3.70	3.2400	240	1000	0.016	10.3853	10.7989	104.0%	77%	2.22	1.0000
11	3020954010	11/18/2016 10:30	0.4524	g	2/7/2017 15:12	0.3172	U-238	112.17	0.4800	240	1000	0.437	10.3853	10.7989	104.0%	100%	2.22	1.0000
11																		
12	3020954011	12/5/2014 0:00	0.4515	g	2/7/2017 15:12	0.2990	U-232	422.84	5.3018	240	1000	1.802	10.3853	7.5411	72.75%	100%	2.22	0.9792
12	3020954011	11/18/2016 11:25	0.4515	g	2/7/2017 15:12	0.2990	U-233/234	251.58	5.0400	240	1000	1.056	10.3853	7.5411	72.75%	100%	2.22	1.0000
12	3020954011	11/18/2016 11:25	0.4515	g	2/7/2017 15:12	0.2990	U-235/236	14.00	0.9000	240	1000	0.058	10.3853	7.5411	72.75%	77%	2.22	1.0000
12	3020954011	11/18/2016 11:25	0.4515	g	2/7/2017 15:12	0.2990	U-238	245.52	0.4800	240	1000	1.023	10.3853	7.5411	72.75%	100%	2.22	1.0000
12																		

Uranium	1.96 Sigma Cnr Uncert.	Zerounc	Usetunc	TPU UE1	TPU UE2	TPU UE3	TPU	MDC	4sl	1.96 sigma DBU	Uncle	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Gross CPM	Bkg CPM
0.260237	0.736645	0.051581	0.736645	12.00%	6.00%	7.23%	1.6828	0.1973	5.6740	1.6028	0.1973	pCi/g	0.0628	3020854008	7	Det 34	6/6/2016 10:25	2/1/2017 13:59	2.0758	0.0736
0.238998	0.275208	0.050570	0.275208	12.00%	6.00%	7.23%	0.3471	0.1213	1.3746	0.3471	0.1213	pCi/g	0.0320	3020854008	7	Det 34	6/6/2016 10:25	2/1/2017 13:59	0.4142	0.0068
0.227034	0.062716	0.055540	0.062716	12.00%	6.00%	7.23%	0.0824	0.1432	0.6637	0.0834	0.1432	pCi/g	0.0060	3020854008	7	Det 34	6/6/2016 10:25	2/1/2017 13:59	0.0202	0.0030
0.266369	0.265663	0.050570	0.265663	12.00%	6.00%	7.23%	0.2230	0.0834	1.3047	0.3330	0.0834	pCi/g	0.0179	3020854008	7	Det 34	6/6/2016 10:25	2/1/2017 13:59	0.2070	0.0020
															7					
0.286335	0.760075	0.051597	0.760075	12.00%	6.00%	7.23%	1.7508	0.2024	10.2003	1.7508	0.2028	pCi/g	0.0647	3020854007	8	Det 33	6/6/2016 10:31	2/1/2017 13:59	2.6947	0.0247
0.284447	0.736920	0.050947	0.736920	12.00%	6.00%	7.23%	0.2749	0.2018	0.9174	0.2748	0.2018	pCi/g	0.0646	3020854007	8	Det 33	6/6/2016 10:31	2/1/2017 13:59	0.2560	0.0257
0.235545	0.073064	0.055375	0.073064	12.00%	6.00%	7.23%	0.0745	0.1280	0.0006	0.0745	0.1280	pCi/g	0.0255	3020854007	8	Det 33	6/6/2016 10:31	2/1/2017 13:59	0.0187	0.0030
0.284437	0.320403	0.050843	0.320403	12.00%	6.00%	7.23%	0.2711	0.1172	0.9432	0.2711	0.1172	pCi/g	0.0312	3020854007	8	Det 33	6/6/2016 10:31	2/1/2017 13:59	0.2687	0.0030
															8					
0.275019	0.202654	0.051100	0.202654	12.00%	6.00%	7.23%	1.8571	0.2277	10.8574	1.8571	0.2277	pCi/g	0.0710	3020854009	9	Det 37	6/6/2016 12:14	2/1/2017 13:59	2.6270	0.0035
0.250210	0.259916	0.050832	0.259916	12.00%	6.00%	7.23%	0.4371	0.1574	1.7666	0.4371	0.1574	pCi/g	0.0424	3020854009	9	Det 37	6/6/2016 12:14	2/1/2017 13:59	0.4600	0.0060
0.191551	0.122242	0.078110	0.122242	12.00%	6.00%	7.23%	0.1245	0.1285	0.1630	0.1245	0.1560	pCi/g	0.0351	3020854009	9	Det 37	6/6/2016 12:14	2/1/2017 13:59	0.0222	0.0040
0.253711	0.355603	0.050832	0.355603	12.00%	6.00%	7.23%	0.4391	0.1524	1.7199	0.4391	0.1574	pCi/g	0.0434	3020854009	9	Det 37	6/6/2016 12:14	2/1/2017 13:59	0.4202	0.0030
															9					
0.267213	0.810400	0.055375	0.810400	12.00%	6.00%	7.23%	1.8497	0.2454	10.0118	1.8487	0.2454	pCi/g	0.0703	3020854010	10	Det 35	6/6/2016 12:17	2/1/2017 13:59	2.5270	0.0027
0.272206	0.301716	0.054852	0.301716	12.00%	6.00%	7.23%	0.3799	0.1567	1.5015	0.3799	0.1567	pCi/g	0.0456	3020854010	10	Det 35	6/6/2016 12:17	2/1/2017 13:59	0.4200	0.0150
0.269025	0.104203	0.071527	0.104203	12.00%	6.00%	7.23%	0.1399	0.0540	0.1420	0.1036	0.0540	pCi/g	0.0050	3020854010	10	Det 35	6/6/2016 12:17	2/1/2017 13:59	0.0257	0.0000
0.272276	0.281076	0.054852	0.281076	12.00%	6.00%	7.23%	0.3477	0.1013	1.3327	0.3477	0.1016	pCi/g	0.0738	3020854010	10	Det 35	6/6/2016 12:17	2/1/2017 13:59	0.3887	0.0030
															10					
0.324602	0.733333	0.046111	0.733333	12.00%	6.00%	8.85%	1.7452	0.1325	10.5384	1.7452	0.1325	pCi/g	0.0555	3020854010	11	Det 39	6/6/2016 12:20	2/1/2017 13:59	2.4400	0.0191
0.351543	0.320718	0.045154	0.320718	12.00%	6.00%	8.85%	0.7833	0.1449	0.0530	0.2633	0.1449	pCi/g	0.0428	3020854010	11	Det 39	6/6/2016 12:20	2/1/2017 13:59	0.2309	0.0150
0.350462	0.087718	0.050945	0.087718	12.00%	6.00%	8.85%	0.0654	0.0818	0.0817	0.0654	0.0818	pCi/g	0.0248	3020854010	11	Det 39	6/6/2016 12:20	2/1/2017 13:59	0.0187	0.0010
0.351543	0.281575	0.045154	0.281575	12.00%	6.00%	8.85%	0.3370	0.1705	1.4007	0.3370	0.0745	pCi/g	0.0180	3020854010	11	Det 39	6/6/2016 12:20	2/1/2017 13:59	0.1994	0.0020
															11					
0.370737	0.000501	0.057082	0.000501	12.00%	6.00%	9.47%	2.0012	0.2723	10.5381	2.0012	0.2723	pCi/g	0.0915	3020854011	12	Det 40	6/6/2016 12:23	2/1/2017 13:59	1.8134	0.0138
0.374367	0.757848	0.056662	0.757848	12.00%	6.00%	9.47%	1.2420	0.3142	6.0717	1.2420	0.3142	pCi/g	0.0998	3020854011	12	Det 40	6/6/2016 12:23	2/1/2017 13:59	1.0703	0.0210
[illegible]	[illegible]	[illegible]	[illegible]	12.00%	6.00%	9.47%	0.2390	0.0045	0.4988	0.2390	0.0045	pCi/g	0.0000	3020854011	12	Det 40	6/6/2016 12:23	2/1/2017 13:59	0.0552	0.0000
0.374367	0.734510	0.056662	0.734510	12.00%	6.00%	9.47%	1.2117	0.1417	6.0673	1.2117	0.1417	pCi/g	0.0331	3020854011	12	Det 40	6/6/2016 12:23	2/1/2017 13:59	1.0750	0.0000
															12					

Pace Analytical Services
Isotopic Uranium Analysis

Test Code	U Iso
Matrix	SL
Batch ID	33792
Prep Start	2/1/2017 15:02
Prep Finish	02/03/17 [illegible]
Act. Rpt Units	pCi

Analyst	LVL
PrepSOP1	PSI-R-009
PrepSOP2	N/A
AnalSOP1	PSI-R-009
AnalSOP2	N/A

	Nuclide	Tracer	Abund.	UE1	UE2	UE3
Tracer Run	U-232	7.20E+01	100.0%	12.00%	8.00%	yld unden
Analyte 1	U-233/234	2.49E+05	100.0%	12.00%	8.00%	yld unden
Analyte 2	U-235/236	7.04E+06	70.3%	12.00%	8.00%	yld unden
Analyte 3	U-238	4.70E+09	100.0%	12.00%	8.00%	yld unden
Analyte 4						

Tracer ID	[illegible]
Tracer Conc	105.65 dpm/ml
Tracer Vol.	0.10 ml
Tracer Ref Date	12/5/2014 0:00
Zero Fact.	2.71
Sigma	1.96

	Sample ID	Reference Date	Aliquot	Aliq. Units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (ref to sample time)	Sample Time (min)	Bkg Time (min)	Net CPM	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	abnC	Act. Conc. From dpm to pCi	Front. Resolv.
13	3020485401[illegible]	12/5/2014 0:00	0.461	g	2/8/2017 7:03	0.2716	U-232	197.37	7.6524	240	1000	2.781	10.3691	10.2397	98.75%	100%	2.22	0.9792
13	3020485401[illegible]	11/18/2016 11:22	0.461	g	2/8/2017 7:03	0.2716	U-233/234	77.56	2.6400	240	1000	0.311	10.3691	10.2397	98.75%	100%	2.22	1.0000
13	3020485401[illegible]	11/18/2016 11:22	0.461	g	2/8/2017 7:03	0.2716	U-235/236	2.00	0.5000	240	1000	-0.008	10.3691	10.2397	98.75%	77%	2.22	1.0000
13	3020485401[illegible]	11/18/2016 11:22	0.461	g	2/8/2017 7:03	0.2716	U-238	87.78	0.7200	240	1000	0.361	10.3691	10.2397	98.75%	100%	2.22	1.0000
13																		
14	3020485401[illegible]	12/5/2014 0:00	0.403	g	2/8/2017 7:08	0.3172	U-232	737.27	4.0760	240	1000	3.072	10.3851	9.9835	96.12%	100%	2.22	0.9792
14	3020485401[illegible]	11/18/2016 [illegible]	0.403	g	2/8/2017 7:08	0.3172	U-233/234	68.01	2.6000	240	1000	0.278	10.3851	9.9835	96.12%	100%	2.22	1.0000
14	3020485401[illegible]	11/18/2016 [illegible]	0.403	g	2/8/2017 7:08	0.3172	U-235/236	5.79	0.2400	240	1000	0.024	10.3851	9.9835	96.12%	77%	2.22	1.0000
14	3020485401[illegible]	11/18/2016 [illegible]	0.403	g	2/8/2017 7:08	0.3172	U-238	72.63	0.4800	240	1000	0.302	10.3851	9.9835	96.12%	100%	2.22	1.0000
14																		
15	3020485401[illegible]	12/5/2014 0:00	0.4752	g	2/8/2017 7:08	0.2356	U-232	105.00	3.3013	240	1000	2.521	10.3691	10.5492	101.74%	100%	2.22	0.9792
15	3020485401[illegible]	11/18/2016 11:15	0.4752	g	2/8/2017 7:08	0.2356	U-233/234	37.88	0.5400	240	1000	0.158	10.3691	10.5492	101.74%	100%	2.22	1.0000
15	3020485401[illegible]	11/18/2016 11:15	0.4752	g	2/8/2017 7:08	0.2356	U-235/236	2.00	0.0000	240	1000	0.008	10.3691	10.5492	101.74%	77%	2.22	1.0000
15	3020485401[illegible]	11/18/2016 [illegible]	0.4752	g	2/8/2017 7:08	0.2356	U-238	54.52	0.4800	240	1000	0.227	10.3691	10.5492	101.74%	100%	2.22	1.0000
16																		
16	3020485401[illegible]	12/5/2014 0:00	0.4607	g	2/8/2017 15:22	0.2763	U-232	606.44	4.5600	240	1000	2.527	10.3850	9.9886	96.22%	100%	2.22	0.9792
16	3020485401[illegible]	11/18/2016 12:50	0.4607	g	2/8/2017 15:22	0.2763	U-233/234	962.08	2.1000	240	1000	4.001	10.3850	9.9886	96.22%	100%	2.22	1.0000
16	3020485401[illegible]	11/18/2016 12:50	0.4607	g	2/8/2017 15:22	0.2763	U-235/236	55.41	0.2400	240	1000	0.231	10.3850	9.9886	96.22%	77%	2.22	1.0000
16	3020485401[illegible]	11/18/2016 12:50	0.4607	g	2/8/2017 15:22	0.2763	U-238	903.55	0.7200	240	1000	3.893	10.3850	9.9886	96.22%	100%	2.22	1.0000
16																		
17	3020485401[illegible]	12/5/2014 0:00	0.4574	g	2/8/2017 15:22	0.2883	U-232	259.50	4.0400	240	1000	1.123	10.3691	9.9228	97.85%	100%	2.22	0.9792
17	3020485401[illegible]	11/18/2016 12:25	0.4574	g	2/8/2017 15:22	0.2883	U-233/234	335.71	1.9200	240	1000	1.390	10.3691	9.9228	97.85%	100%	2.22	1.0000
17	3020485401[illegible]	11/18/2016 12:25	0.4574	g	2/8/2017 15:22	0.2883	U-235/236	17.77	0.2400	240	1000	0.074	10.3691	9.9228	97.85%	77%	2.22	1.0000
17	3020485401[illegible]	11/18/2016 12:25	0.4574	g	2/8/2017 15:22	0.2883	U-238	277.57	0.9600	240	1000	[illegible]	10.3691	9.9228	97.85%	100%	2.22	1.0000
17																		
18	3020485401[illegible]	12/5/2014 0:00	0.4701	g	2/8/2017 15:22	0.2906	U-232	718.02	5.3774	240	1000	2.99[illegible]	10.3850	10.3304	99.40%	100%	2.22	0.9792
18	3020485401[illegible]	11/18/2016 12:22	0.4701	g	2/8/2017 15:22	0.2906	U-233/234	326.94	2.1600	240	1000	1.359	10.3850	10.3304	99.40%	100%	2.22	1.0000
18	3020485401[illegible]	11/18/2016 12:22	0.4701	g	2/8/2017 15:22	0.2906	U-235/236	10.33	0.0721	240	1000	[illegible]	10.3850	10.3304	99.40%	77%	2.22	1.0000
18	3020485401[illegible]	11/18/2016 12:22	0.4701	g	2/8/2017 15:22	0.2906	U-238	321.83	2.3761	240	1000	1.255	10.3850	10.3304	99.40%	100%	2.22	1.0000
18																		

Activity	1.96 Sigma Cnt Uncert.	zerocunc	tissueinc	TPU UB1	TPU UB2	TPU UB3	TPU	MDC	act	1.96 sigma CSU	rxde	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Gross CPM	Bkg CPM
0.383375	0.607966	0.059917	0.607966	12.00%	6.00%	7.84%	1.6714	0.2493	10.5721	1.6714	0.2493	pCi/g	0.0316	302040504012	13	Det 36	6/6/2016 12:17	2/1/2017 13:59	2.6134	0.3337
0.266834	0.268032	0.055735	0.268732	12.00%	6.00%	7.84%	0.7332	0.1592	1.1566	0.7332	0.1592	pCi/g	0.0462	302040504012	13	Det 36	6/6/2016 12:17	2/1/2017 13:59	0.5217	0.0113
0.203751	0.056153	0.072761	0.072761	12.00%	6.00%	7.84%	0.0730	0.0569	0.0405	0.0730	0.0569	pCi/g	0.0000	302040504012	13	Det 36	6/6/2016 12:17	2/1/2017 13:59	0.0062	0.0000
0.208914	0.285456	0.055735	0.205495	12.00%	6.00%	7.84%	0.2538	0.1032	1.3538	0.3538	0.1032	pCi/g	0.0242	302040504012	13	Det 36	6/6/2016 12:17	2/1/2017 13:59	0.0667	0.0000
															13					
0.268262	0.748244	0.060190	0.748244	12.00%	6.00%	7.84%	1.7309	0.1768	10.2061	1.7309	0.1768	pCi/g	0.0548	302040504013	14	Det 33	6/6/2016 12:20	2/1/2017 13:59	2.0603	0.0191
0.204609	0.225095	0.045147	0.225095	12.00%	6.00%	7.84%	0.2839	0.1573	0.3075	0.2839	0.1573	pCi/g	0.0477	302040504013	14	Det 33	6/6/2016 12:20	2/1/2017 13:59	0.2800	0.0150
0.239977	0.092977	0.064161	0.092977	12.00%	6.00%	7.84%	0.0915	0.1707	0.0348	0.0915	0.1707	pCi/g	0.0151	302040504013	14	Det 33	6/6/2016 12:20	2/1/2017 13:59	0.0282	0.0010
0.301605	0.229427	0.045147	0.229427	12.00%	6.00%	7.84%	0.2749	0.0844	0.5936	0.2749	0.0844	pCi/g	0.0174	302040504013	14	Det 33	6/6/2016 12:20	2/1/2017 13:59	0.3045	0.0020
															14					
0.251738	0.842241	0.059599	0.842241	12.00%	6.00%	8.33%	1.7605	0.1951	10.0337	1.7605	0.1951	pCi/g	0.0314	302040504014	15	Det 40	6/6/2016 12:22	2/1/2017 13:59	2.5345	0.0178
0.245765	0.211644	0.059599	0.211644	12.00%	6.00%	8.33%	0.2575	0.2135	0.0165	0.2575	0.2135	pCi/g	0.0670	302040504014	15	Det 40	6/6/2016 12:22	2/1/2017 13:59	0.1792	0.0210
0.109709	0.097787	0.070175	0.070175	12.00%	6.00%	8.33%	0.0765	0.0575	0.0424	0.0765	0.0575	pCi/g	0.0000	302040504014	15	Det 40	6/6/2016 12:22	2/1/2017 13:59	0.0053	0.0000
0.256565	0.236340	0.056350	0.236340	12.00%	6.00%	8.33%	0.2738	0.0963	0.9654	0.2738	0.0963	pCi/g	0.0207	302040504014	15	Det 40	6/6/2016 12:22	2/1/2017 13:59	0.2242	0.0020
															15					
0.244803	0.921026	0.061134	0.921026	12.00%	6.00%	8.04%	1.7904	0.2151	10.2195	1.7904	0.2151	pCi/g	0.0200	302040504015	16	Det 26	12/2/2015 13:49	2/1/2017 13:59	2.5206	0.0159
0.260079	1.013732	0.066861	1.013732	12.00%	6.00%	8.04%	2.3999	0.1710	16.0006	2.3999	0.1710	pCi/g	0.0487	302040504015	16	Det 26	12/2/2015 13:49	2/1/2017 13:59	4.0125	0.0110
0.161551	0.318207	0.078161	0.348207	12.00%	6.00%	8.04%	0.3598	0.1085	1.2068	0.3598	0.1085	pCi/g	0.0155	302040504015	16	Det 26	12/2/2015 13:49	2/1/2017 13:59	0.2349	0.0010
1.250078	0.959259	0.065864	0.959259	12.00%	6.00%	8.04%	2.6204	0.1109	15.6347	2.6204	0.1109	pCi/g	0.0753	302040504015	16	Det 26	12/2/2015 13:49	2/1/2017 13:59	5.6026	0.0030
															16					
0.107734	1.256019	0.139959	1.256019	12.00%	6.00%	12.05%	7.7608	0.4035	10.4242	7.7608	0.4035	pCi/g	0.1420	302040504016	17	Det 27	6/6/2016 6:44	2/1/2017 13:59	1.1358	0.0156
0.110030	1.360809	0.139971	1.360809	12.00%	6.00%	12.05%	7.8641	0.3433	12.0380	7.8641	0.3433	pCi/g	0.0064	302040504016	17	Det 27	6/6/2016 6:44	2/1/2017 13:59	1.3584	0.0080
0.084776	0.411787	0.170359	0.411787	12.00%	6.00%	12.05%	0.4417	0.2488	0.9781	0.4417	0.2488	pCi/g	0.0446	302040504016	17	Det 27	6/6/2016 6:44	2/1/2017 13:59	0.0755	0.0010
0.000021	1.239543	0.139971	1.239543	12.00%	6.00%	12.05%	7.7656	0.2752	10.5157	7.7656	0.2752	pCi/g	0.0637	302040504016	17	Det 27	6/6/2016 6:44	2/1/2017 13:59	< 1.539	0.0040
															17					
0.295317	0.743730	0.060214	0.743730	12.00%	6.00%	7.33%	1.7199	0.1685	10.1426	1.7199	0.1685	pCi/g	0.0477	302040504017	18	Det 28	6/6/2016 6:47	2/1/2017 13:59	3.0053	0.0141
0.331193	0.491057	0.046857	0.491057	12.00%	6.00%	7.33%	0.9459	0.1315	4.5049	0.9459	0.1315	pCi/g	0.0373	302040504017	18	Det 28	6/6/2016 6:47	2/1/2017 13:59	1.3072	0.0550
0.230035	0.123809	0.051025	0.123809	12.00%	6.00%	7.33%	0.1274	0.1309	0.1172	0.1274	0.1309	pCi/g	0.0373	302040504017	18	Det 28	6/6/2016 6:47	2/1/2017 13:59	0.0000	0.0045
0.301132	0.473050	0.043557	0.473050	12.00%	6.00%	7.33%	0.7941	0.1335	4.1715	0.7941	0.1335	pCi/g	0.0104	302040504017	18	Det 28	6/6/2016 6:47	2/1/2017 13:59	1.2602	0.0123
															18					

J Iso
Printed: 2/3/2017 1:02:00 AM

IsoUTF_33792_5.xls
Act Index (R039-0.05Cnt2-0.15) xls

Pace Analytical Services
Isotopic Uranium Analysis

Test Code	U Iso	Analyst	[illegible]
Matrix	S	PrepSOP1	PGH-R-025
Batch ID	33792	PrepSOP2	N/A
Prep Start	0[illegible]/2017 10:00	AnalSOP1	PGH-R-005
Prep Finish	02/09/17 [illegible]	AnalSOP2	N/A
Act. Rpt Units	pCi		

	Nuclide	T1/2 (y)	Abund.	UE1	UE2	UE3
Tracer Nuc	U-232	7.20E-01	100.0%	12.00%	6.00%	y/c uncert
Analyte 1	U-233/234	2.48E+05	100.0%	12.00%	6.00%	y/c uncert
Analyte 2	U-235/236	7.04E+08	76.5%	12.00%	6.00%	y/c uncert
Analyte 3	U-238	4.70E+09	100.0%	12.00%	6.00%	y/c uncert
Analyte 4						

Tracer ID	U-[illegible]	
Tracer Conc	105.95	dpm/mL
Tracer Vol.	0.10	mL
Tracer Ref Date	12/9/2014 [illegible]	

Zero Fact.	2.71
Sigma	1.96

	Sample ID	Reference Date	Aliquot	Aliq. units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (ref to sample time)	Sample Time (min)	Bkg Time (min)	Net CPM	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	abnd	Act. Conv. From dpm to pCi	Fract. Sample
18	3070486408	12/5/2014 0:00	0.4666	g	2/9/2017 15:22	0.2830	U-232	820.76	3.3217	240	1000	2.802	10.3850	8.8451	85.31%	100%	2.22	0.9792
19	3070486408	11/18/2016 12:00	0.4669	g	2/9/2017 15:22	0.2830	U-233/234	1085.16	1.8220	240	1000	2.805	10.3850	8.8451	85.31%	100%	2.22	1.0000
19	3070486408	11/18/2016 12:00	0.4669	g	2/9/2017 15:22	0.2830	U-235/236	78.03	0.0000	240	1000	0.317	10.3850	8.8451	85.31%	77%	2.22	1.0000
19	3070486408	11/18/2016 12:00	0.4669	g	2/9/2017 15:22	0.2830	U-238	1430.77	0.2430	240	1000	5.967	10.3850	8.8451	85.31%	100%	2.22	1.0000
19																		
20	LCS33792	12/9/2014 0:00	0.5	g	2/9/2017 15:22	0.2862	U-232	715.85	7.2031	240	1000	2.983	10.3850	10.4229	100.36%	100%	2.22	0.9792
20	LCS33792	2/9/2017 15:22	0.5	g	2/9/2017 15:22	0.2862	U-233/234	1179.35	6.0010	240	1000	2.879	10.3850	10.4229	100.36%	100%	2.22	1.0000
20	LCS33792	2/9/2017 15:22	0.5	g	2/9/2017 15:22	0.2862	U-235/236	34.28	0.7200	240	1000	0.136	10.3850	10.4229	100.36%	77%	2.22	1.0000
20	LCS33792	2/9/2017 15:22	0.5	g	2/9/2017 15:22	0.2862	U-238	849.82	0.7200	240	1000	2.870	10.3850	10.4229	100.36%	100%	2.22	1.0000
20																		
21	LCSD33792	12/9/2014 0:00	0.5	g	2/9/2017 15:22	0.2867	U-232	665.47	3.1240	240	1000	2.773	10.3850	9.2622	89.56%	100%	2.22	0.9792
21	LCSD33792	2/9/2017 15:22	0.5	g	2/9/2017 15:22	0.2867	U-233/234	605.05	2.5457	240	1000	2.521	10.3850	9.2622	89.56%	100%	2.22	1.0000
21	LCSD33792	2/9/2017 15:22	0.5	g	2/9/2017 15:22	0.2867	U-235/236	28.52	0.4795	240	1000	0.119	10.3850	9.2622	89.56%	77%	2.22	1.0000
21	LCSD33792	2/9/2017 15:22	0.5	g	2/9/2017 15:22	0.2867	U-238	505.04	0.4800	240	1000	2.104	10.3850	9.2622	89.56%	100%	2.22	1.0000
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Conam	1.96 Sigma Crit Uncert.	zerounc	Uselric	TPU UC1	TPU UC2	TPU UC3	TPU	MDC	act	1.96 sigma CSU	unk.	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Gross CPM	Sky CPM
0.241445	0.031533	0.357334	0.834883	12.00%	6.00%	6.07%	1.8218	0.1930	10.3673	1.8218	0.1939	pCi/g	0.0076	30204834018	18	Det 31	06/20/16 10:21	2/1/2017 13:11	2.5170	0.0138
0.246809	1.257320	0.353715	1.737329	12.00%	6.00%	6.07%	3.8828	0.1547	23.3429	3.8828	0.1547	pCi/g	0.0430	30204834018	19	Det 31	6/6/2016 10:21	2/1/2017 13:55	6.4126	0.0399
0.188972	0.377070	0.379254	0.377070	12.00%	6.00%	6.07%	0.4693	0.0668	5.0777	0.4693	0.0668	pCi/g	0.0100	30204834018	19	Det 31	6/6/2016 10:21	2/1/2017 13:55	0.3198	0.0039
0.243509	1.262550	0.350716	1.262550	12.00%	6.00%	6.07%	2.5818	0.0645	24.1790	3.9818	0.0643	pCi/g	0.0152	30204834018	19	Det 31	6/6/2016 10:21	2/1/2017 13:55	6.5629	0.0010
															19					
0.312733	0.702950	0.047265	0.702950	12.00%	6.00%	7.37%	1.5332	0.2025	9.5360	1.5202	0.2029	pCi/g	0.0859	LCS533782	20	Det 32	12/2/2016 14:55	2/1/2017 13:59	3.0125	0.0332
0.310420	0.841553	0.040533	0.841553	12.00%	6.00%	7.37%	1.4106	0.1930	8.1960	1.4106	0.1939	pCi/g	0.0587	LCS533782	20	Det 32	12/2/2016 14:55	2/1/2017 13:59	2.6428	0.0219
0.244676	0.139321	0.061160	0.139321	12.00%	6.00%	7.37%	0.2061	0.1133	0.5327	0.2061	0.1133	pCi/g	0.0765	LCS533782	20	Det 32	12/2/2016 14:55	2/1/2017 13:59	0.1233	0.0030
0.319420	0.571457	0.046868	0.571457	12.00%	6.00%	7.37%	1.5306	0.0860	8.0854	1.5306	0.0860	pCi/g	0.0233	LCS533782	20	Det 32	12/2/2016 14:55	2/1/2017 13:59	2.6721	0.0030
															20					
0.260170	0.728339	0.051466	0.728339	12.00%	6.00%	7.02%	1.6410	0.1565	9.5360	1.6410	0.1565	pCi/g	0.0605	LCS533797	21	Det 33	3/3/2016 12:10	2/1/2017 13:59	2.7559	0.0150
0.298541	0.673275	0.050415	0.673273	12.00%	6.00%	7.02%	1.4752	0.1421	8.4902	1.4752	0.1421	pCi/g	0.0411	LCS533797	21	Det 33	3/3/2016 12:10	2/1/2017 13:59	2.5317	0.0100
0.227457	0.193737	0.055918	0.193737	12.00%	6.00%	7.02%	0.3658	0.1068	0.5225	0.3658	0.1068	pCi/g	0.0203	LCS533797	21	Det 33	3/3/2016 12:10	2/1/2017 13:59	0.1235	0.0020
0.258941	0.704754	0.053415	0.704754	12.00%	6.00%	7.02%	1.5856	0.0930	8.2040	1.5856	0.0930	pCi/g	0.0119	LCS533797	21	Det 33	3/3/2016 12:10	2/1/2017 13:59	2.7355	0.0020
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Pace Analytical Services
Isotopic Uranium Analysis

Test Code U Iso
Matrix SL
Batch ID (ALR) 33752
Prep Start 2/1/2017 16:00
Prep Finish 02/09/17

Analyst LAL
PrepSOP1 PCH-R-008
PrepSOP2 N/A
AnalSOP1 PCH-R-008
AnalSOP2 N/A

Yield Acceptance Criteria
Upper 110%
Lower 30%
With Permission 10-130%

	Sample ID	U-233/234 Activity	U-233/234 1.96 sigma CSU	U-233/234 MDC	U-235/236 Activity	U-235/236 1.96 sigma CSU	U-235/236 MDC	U-238 Activity	U-238 1.96 sigma CSU	U-238 MDC				Units	Chemical Yield	Date Analyzed	
1	1220308	0.070	0.076	0.135	-0.004	0.061	0.085	0.043	0.053	0.087				pCi/g	102.89%	2/7/2017	1
2	30204854001	0.323	0.239	0.116	0.095	0.061	0.082	0.709	0.216	0.092				pCi/g	107.87%	2/7/2017	2
3	30204854002	0.897	0.236	0.148	0.019	0.073	0.153	0.960	0.287	0.157				pCi/g	92.54%	2/7/2017	3
4	30204854003	19.9	3.33	0.159	1.07	0.348	0.082	18.9	3.16	0.087				pCi/g	85.04%	2/7/2017	4
5	30204854004	19.3	3.21	0.236	1.40	0.409	0.145	19.3	3.21	0.111				pCi/g	98.48%	2/7/2017	5
6	30204854005	1.23	0.319	0.138	0.081	0.080	0.108	0.991	0.275	0.091				pCi/g	97.41%	2/7/2017	6
7	30204854006	1.37	0.347	0.121	0.070	0.083	0.143	1.30	0.333	0.083				pCi/g	92.10%	2/7/2017	7
8	30204854007	0.917	0.275	0.202	0.061	0.075	0.123	0.943	0.271	0.117				pCi/g	100.14%	2/7/2017	8
9	30204854008	1.77	0.437	0.152	0.155	0.125	0.158	1.72	0.429	0.152				pCi/g	93.43%	2/7/2017	9
10	30204854009	1.50	0.380	0.157	0.142	0.107	0.054	1.33	0.348	0.102				pCi/g	102.64%	2/7/2017	10
11	30204854010	0.953	0.263	0.145	0.062	0.065	0.082	1.41	0.337	0.075				pCi/g	104.07%	2/7/2017	11
12	30204854011	6.02	1.24	0.314	0.437	0.240	0.095	5.87	1.21	0.142				pCi/g	72.75%	2/7/2017	12
13	30204854012	1.16	0.322	0.159	0.041	0.073	0.055	1.35	0.354	0.103				pCi/g	98.79%	2/8/2017	13
14	30204854013	0.903	0.264	0.158	0.121	0.095	0.089	0.954	0.275	0.081				pCi/g	93.42%	2/8/2017	14
15	30204854014	0.618	0.233	0.214	0.042	0.076	0.067	0.885	0.274	0.096				pCi/g	101.74%	2/8/2017	15
16	30204854015	16.0	2.70	0.171	1.21	0.370	0.108	15.6	2.63	0.111				pCi/g	85.72%	2/8/2017	16
17	30204854016	12.6	2.65	0.347	0.878	0.441	0.247	10.5	2.27	0.275				pCi/g	37.65%	2/8/2017	17
18	30204854017	4.50	0.846	0.132	0.197	0.127	0.136	4.17	0.794	0.140				pCi/g	99.40%	2/8/2017	18
19	30204854018	23.5	3.88	0.155	1.68	0.459	0.060	24.2	3.96	0.084				pCi/g	85.34%	2/8/2017	19
20	LCS33792	8.20	1.41	0.184	0.533	0.206	0.113	8.99	1.53	0.067				pCi/g	100.56%	2/8/2017	20
21	LCSD33792	8.49	1.48	0.142	0.522	0.210	0.109	9.21	1.59	0.083				pCi/g	89.55%	2/8/2017	21
22																	22
23																	23
24																	24

Quality Control Sample Performance Assessment

Pace Analytical Services

Analyst:	LAM		
Date:	2/6/2017	Method:	HSL-300
Worklist:	33792	SOP:	PSH-3-008
Matrix:	Soil	MB Sample ID:	1260335

Method Blank Assessment

Analyte	Activity	1.96 Sig Unc.	MDC	Critical Value	Flag	Assessment
U-233/234	0.0103	0.0762	0.1240	0.0316		
U-235/236	-0.0041	0.0515	0.0354	0.0145		
Uranium-238	0.0450	0.0629	0.0872	0.0240		

Laboratory Control Sample Assessment

	LCS	LCSD	LCS	LCSD	LCS	LCSD
Analyte:	U-233/234		Uranium-238			
Count Date:	2/6/17 15:22	2/6/17 15:22	2/6/17 15:22	2/6/17 15:22		
Spike I.D.:	15-0251U234	15-0251U234	15-0251U238	15-0251U238		
Spike Concentration (pCi/L):	43.975	43.975	44.825	44.825		
Volume Used (mL):	0.100	0.100	0.100	0.100		
Aliquot Volume (L, g, F):	0.500	0.500	0.500	0.500		
Target Conc. (pCi/L, g, F):	8.795	8.795	8.965	8.965		
1.96 Sigma Uncertainty (Calculated):	0.310	0.310	0.313	0.313		
Result (pCi/L, g, F):	9.260	8.480	8.990	8.910		
1.96 Sigma Unc:	1.410	1.400	1.530	1.590		
% Recovery:	95.34%	96.56%	100.28%	102.75%		
Assessment:	Pass	Pass	Pass	Pass		
Upper % Recovery Limits:	125.00%	125.00%	125.00%	125.00%		
Lower % Recovery Limits:	75.00%	75.00%	75.00%	75.00%		

Duplicate Sample Assessment

LCS/LCSD Y or N?:	Y	Y				
Analyte:	U-233/234	Uranium-238				
Sample I.D.:	LCS33792	LCS33792				
Duplicate Sample I.D.:	LCSD33792	LCSD33792				
Sample % Recovery:	1.0354	1.0028				
Duplicate Sample %Recovery:	0.9554	1.0275				
Relative Percent Difference:	3.47%	2.41%				
Assessment:	Pass	Pass				
% RPD Limit:	25.00%	25.00%				

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Sample Matrix Spike Control Assessment

Analyte:	U-233/234	Uranium-238	
Sample Collection Date:	1/18/2016	1/18/2016	
Sample I.D.:	30204654002	30204654002	
Sample MS I.D.:	30204654003	30204654003	
Sample MSD I.D.:	30204654004	30204654004	
Spike I.D.:	15-0251U234	15-0251U234	
MS/MSD Decay Corrected Spike Conc. (pCi/L):	43.975	44.825	
Spike Volume Used in MS (mL):	0.20	0.20	
Spike Volume Used in MSD (mL):	0.20	0.20	
MS Aliquot (L, g, F):	0.4401	0.4481	
MS Target Conc.(pCi/L, g, F):	19.605	20.007	
MSD Aliquot (L, g, F):	0.4401	0.4481	
MSD Target Conc. (pCi/L, g, F):	19.605	20.007	
MS Spike uncertainty (calculated):	0.392	0.706	
MSD Spike uncertainty (calculated):	0.396	0.714	
Sample Result:	0.587	0.660	
Sample 1.96 Sigma Unc.:	0.336	0.267	
Sample Matrix Spike Result:	19.500	19.500	
Sample MS 1.96 Sigma Unc.:	0.330	0.430	
Sample Matrix Spike Duplicate Result:	19.500	19.200	
Sample MSD 1.96 Sigma Unc.:	0.310	0.310	
MS % Recovery:	97.95%	89.67%	
MSD % Recovery:	97.95%	90.05%	
MS Assessment:	Pass	Pass	
MSD Assessment:	Pass	Pass	
MS/MSD Upper % Recovery Limits:	125.00%	125.00%	
MS/MSD Lower % Recovery Limits:	75.00%	75.00%	

Matrix Spike/Matrix Spike Duplicate Sample Assessment

Analyte:	U-233/234	Uranium-238	
Sample I.D.	30204654002	30204654002	
Sample MS I.D.	30204654003	30204654003	
Sample MSD I.D.	30204654004	30204654004	
Sample Matrix Spike % Recovery:	97.95%	89.67%	
Sample Matrix Spike Duplicate % Recovery:	97.95%	90.05%	
MS/MSD Relative Percent Difference:	4.33%	1.36%	
MS/ MSD RPD Assessment:	Pass	Pass	
% RPD Limit:	25.00%	25.00%	

Comments:

AlphaVision v5.3 **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
7:12:48PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 1220306 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

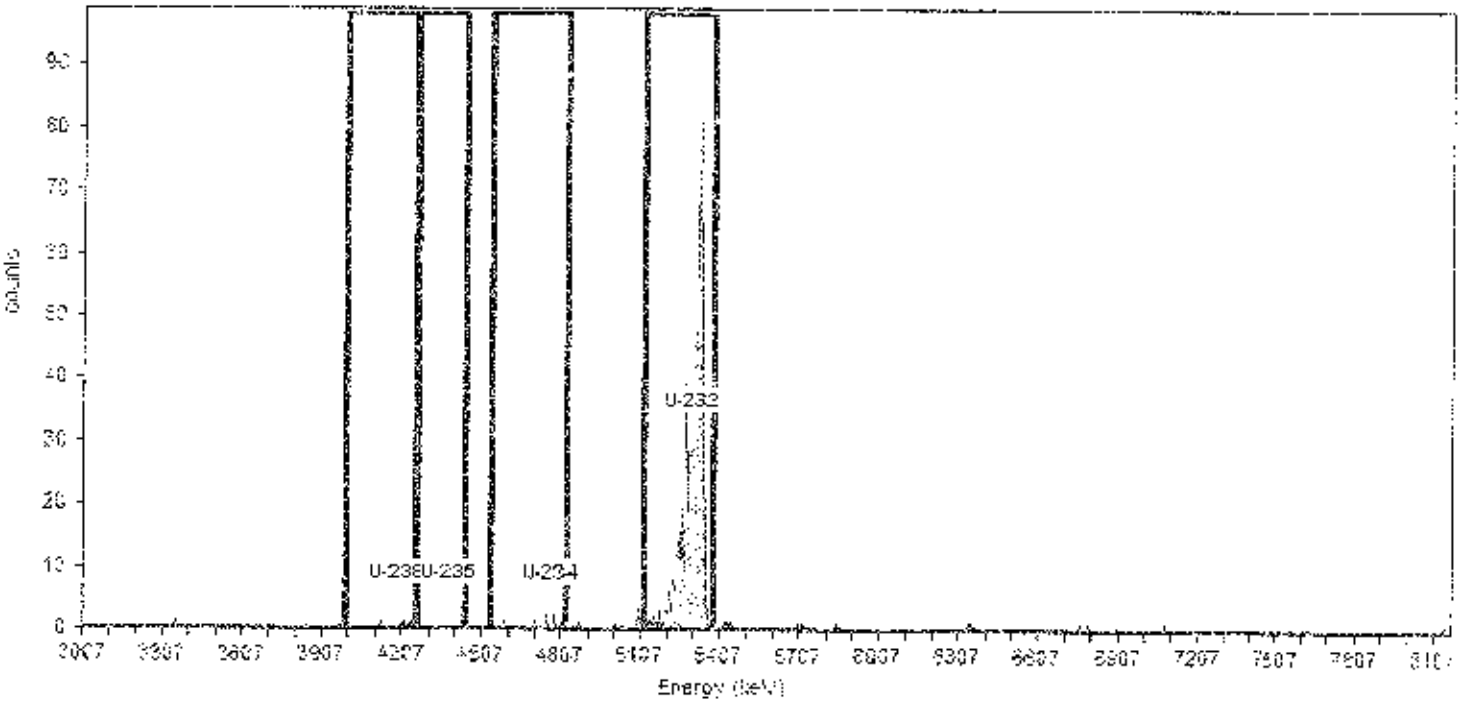
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 99.79%

Acquisition

Detector: Det 26 SN:
Acquisition Start Date: 2/7/2017 3:12:24PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 26; Det: Det 26; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 007
Efficiency Calibration:2016.12.02 007
Calibration Date: 12/2/2016 1:48:37PM
Energy Cal: Gain = 5.0577 keV / Ch
Offset = 3.002.39 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.63% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	S.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	10.842	100.0	4.00	0.7200	3	2.216E-002	1.472E-002	1.050E-002	3.929E-002
U-235	4335.000	4260.000	4445.000	.000	76.5	0.00	0.2400	0	0.000E+000	9.924E-003	7.917E-003	3.971E-002
U-234	4765.000	4640.000	4825.000	7.258	99.8	8.00	2.6400	5	3.629E-002	2.215E-002	2.015E-002	5.863E-002
U-232	5300.000	5120.000	5380.000	45.823	99.8	717.00	4.5600	712	4.915E+000	1.870E-001	2.706E-002	7.280E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
7:12:42PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 30204854001 Type: Sample
Spectrum #1 Analysis #1

Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792

Description:

Client Name: Undefined
Client Contact:

Tracer

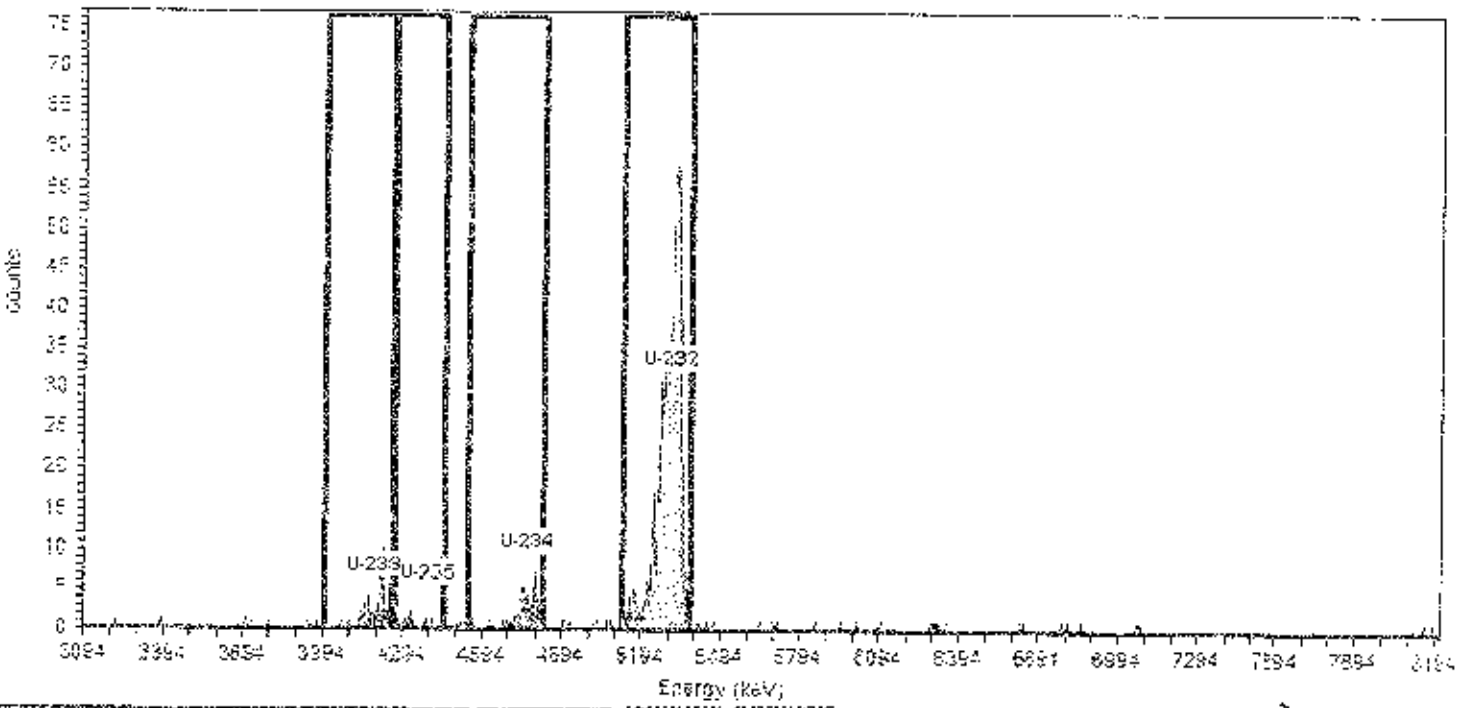
Tracer Name: U-232 15-011
Tracer Activity: 109.38 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 104.62%

Acquisition

Detector: Det 27 SN:
Acquisition Start Date: 2/7/2017 3:12:24PM
Live Time: 240.00 min
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 27; Det: Det 27, Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 27
Efficiency Calibration:2016.06.06 001 det 27
Calibration Date: 6/6/2016 9:44:44AM
Energy Cal: Gain = 5.0148 keV / Ch
Offset = 3,089.69 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.53% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.66 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4186.000	3990.000	4265.000	41.688	100.0	57.00	0.8600	56	3.512E-001	5.021E-002	1.125E-002	3.945E-002
U-235	4395.000	4260.000	4445.000	65.974	76.6	6.00	0.2400	6	4.712E-002	2.054E-002	7.342E-003	3.582E-002
U-234	4765.000	4540.000	4825.000	8.391	99.8	66.96	1.9200	65	4.084E-001	5.520E-002	1.594E-002	4.897E-002
U-232	5300.000	5120.000	5380.000	71.102	99.6	772.29	4.0432	768	5.154E+000	1.884E-001	2.362E-002	6.459E-002

AlphaVision v5.3 — *Alpha Spectroscopy Analysis Report*

ORTEC
Oak Ridge, TN 37830
7:12:35PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 3020485400 2 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

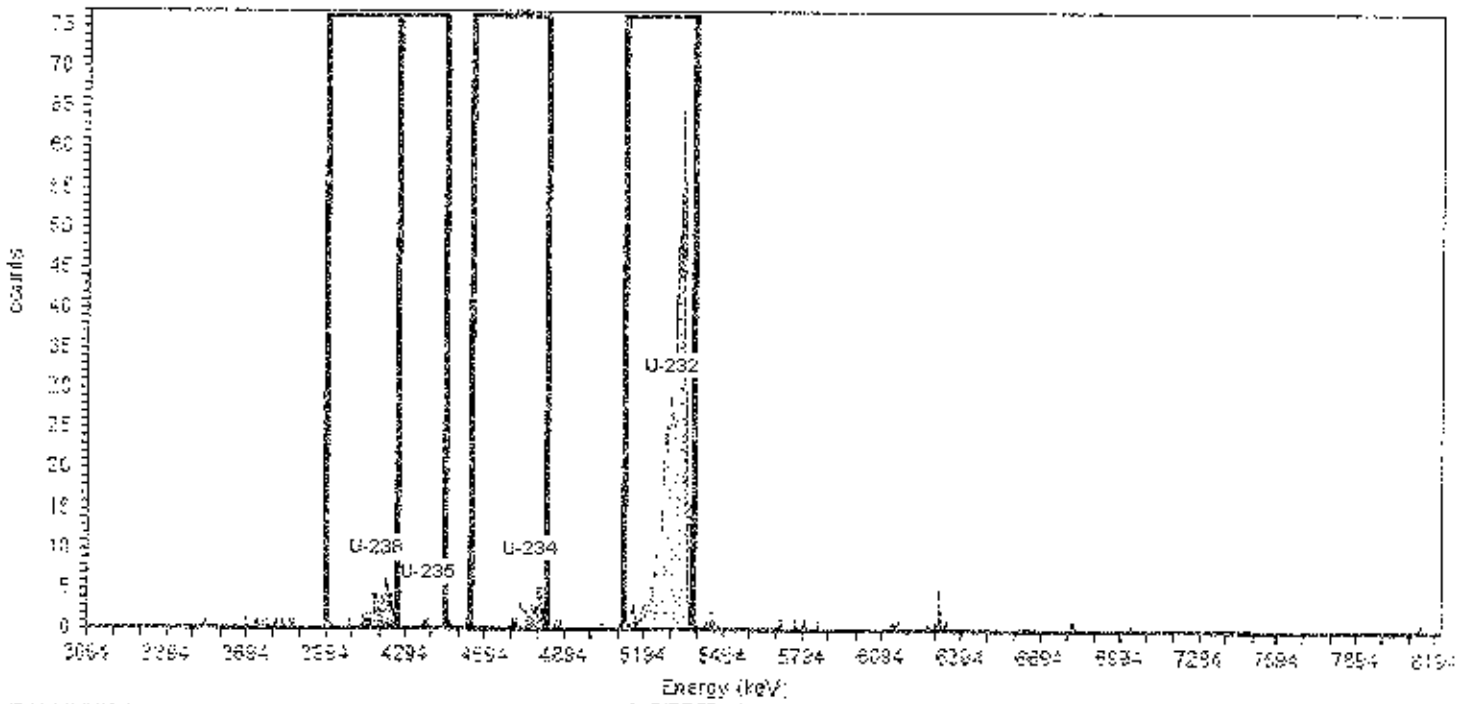
Tracer Name: U-232 16-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 89.74%

Acquisition

Detector: Det-28 SN:
Acquisition Start Date: 2/7/2017 3:12:23PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:52PM
Bkgd Info: Sample: Det 28; Det: Det-28, Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 28
Efficiency Calibration:2016.06.06 001 det 28
Calibration Date: 6/6/2016 8:47:14AM
Energy Cal: Gain = 5.0103 keV / Ch
Offset = 3.089.93 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.06% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	22.169	100.0	64.29	2.5264	62	4.445E-001	6.237E-002	2.096E-002	6.140E-002
U-235	4385.000	4260.000	4445.000	29.153	76.6	2.00	1.0721	1	8.718E-003	1.847E-002	1.782E-002	6.106E-002
U-234	4765.000	4640.000	4925.000	16.735	99.8	47.00	2.1600	45	3.233E-001	5.279E-002	1.941E-002	5.634E-002
U-232	5300.000	5120.000	5380.000	53.567	99.8	672.36	3.3774	669	4.421E+000	1.730E-001	2.479E-002	6.950E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830

Analyst: ORTEC

7:12:46PM 2/7/2017

Sample

Sample: 30204854003 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

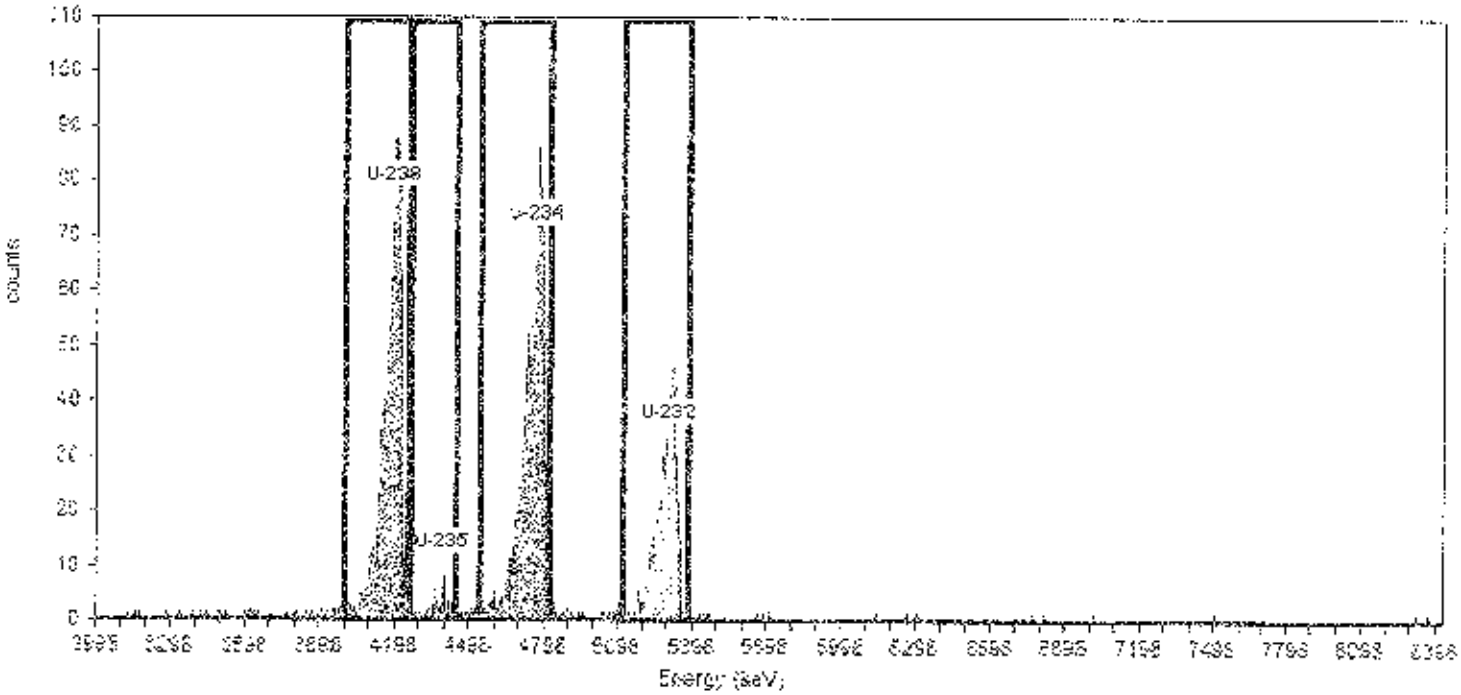
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 62.48%

Acquisition

Detector: Det 31 SN:
Acquisition Start Date: 2/7/2017 3:12:24PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 31; Det: Det 31; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 31
Efficiency Calibration:2016.06.06 001 det 31
Calibration Date: 6/6/2016 10:21:27AM
Energy Cal: Gain = 5.3188 keV / Ch
Offset = 2,992.72 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4186.000	3990.000	4255.000	67.406	100.0	1,086.00	0.2400	1,086	3.731E+000	5.008E-001	7.216E-003	3.619E-002
U-235	4366.000	4260.000	4445.000	53.919	76.6	47.00	0.5000	47	4.934E-001	7.559E-002	0.000E+000	2.841E-002
U-234	4766.000	4540.000	4825.000	45.672	99.8	1,147.60	1.9200	1,146	9.231E+000	5.258E-001	2.045E-002	6.270E-002
U-232	5300.000	5120.000	5380.000	56.402	99.8	602.04	3.3217	599	4.063E+000	1.683E-001	2.747E-002	7.720E-002

AlphaVision v5.3 **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
7:12:51PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 30204854004 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

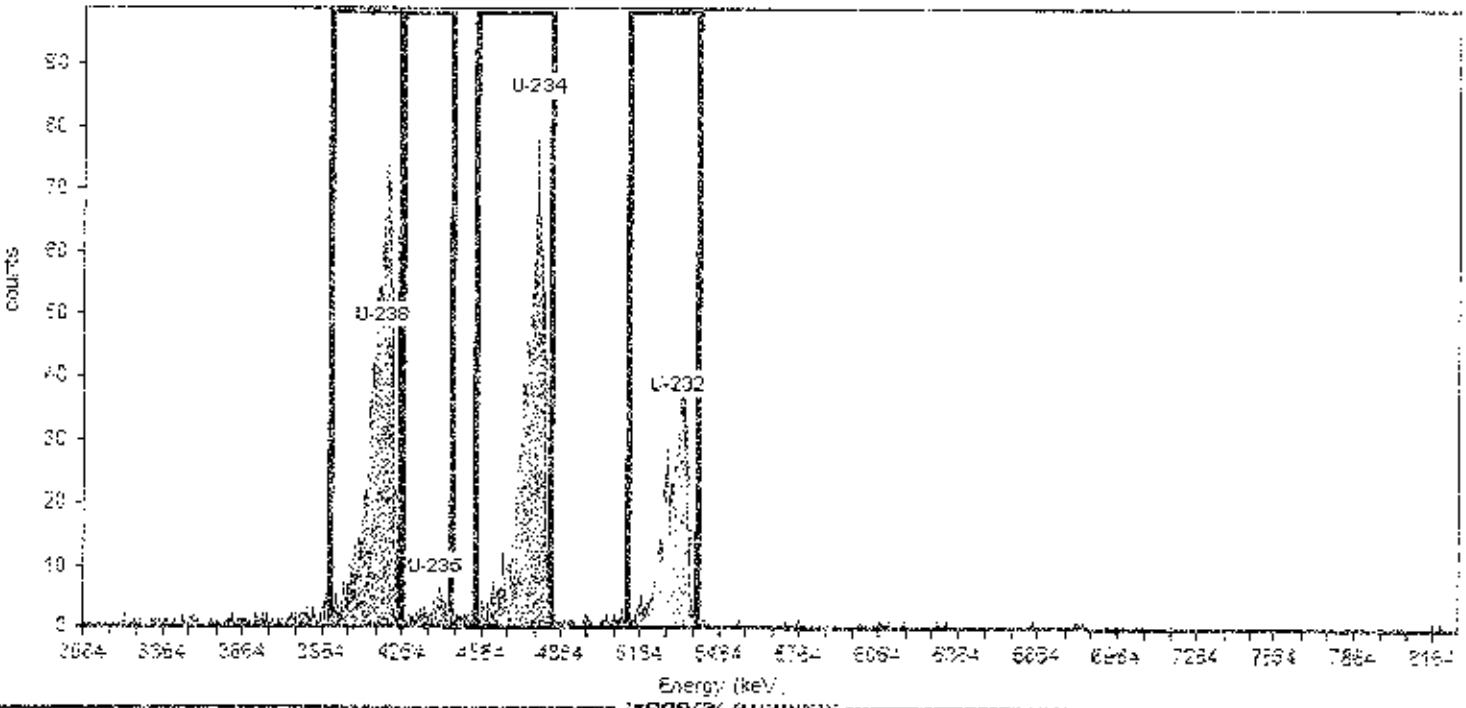
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 85.81%

Acquisition

Detector: Det 32 SN:
Acquisition Start Date: 2/7/2017 3:12:20PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:49PM
Bkgd Info: Sample: Det 32; Det: Det 32; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 010
Efficiency Calibration:2016.12.02 010
Calibration Date: 12/2/2016 2:55:41PM
Energy Cal: Gain = 5.0818 keV / Ch
Offset = 3,059.66 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.62% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	75.605	100.0	1,155.15	0.7200	1,155	8.832E+000	4.969E-001	1.188E-002	4.445E-002
U-235	4385.000	4260.000	4445.000	26.865	76.6	64.94	0.7200	64	6.408E-001	8.650E-002	1.551E-002	5.802E-002
U-234	4765.000	4540.000	4825.000	87.224	99.8	1,161.40	6.0000	1,155	8.849E+000	4.985E-001	3.437E-002	8.946E-002
U-232	5300.000	5120.000	5380.000	92.908	99.8	637.10	7.2534	630	4.227E+000	1.716E-001	3.858E-002	9.833E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

Analyst: ORTEC

ORTEC
Oak Ridge, TN 37830
7:12:55PM 2/7/2017

Sample

Sample: 3020-3854005 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

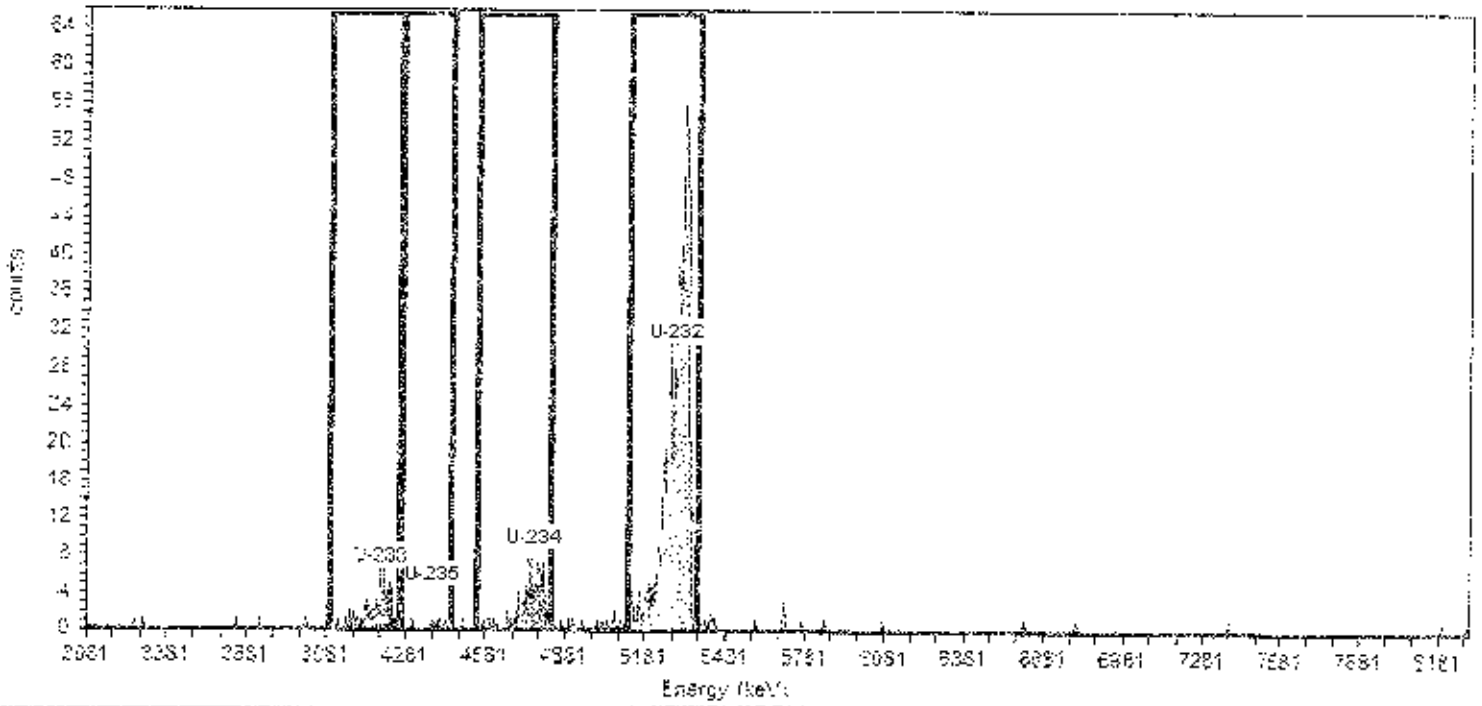
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 94.47%

Acquisition

Detector: Det 33 SN:
Acquisition Start Date. 2/7/2017 3:12:20PM
Live Time: 240.00 min.
Real Time: 240.00 min
Background Date: 2/1/2017 1:59:49PM
Bkgd Info: Sample: Det 33; Det: Det 33; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 33c
Efficiency Calibration:2016.06.06 001 det 33b
Calibration Date: 6/6/2016 12:10:27PM
Energy Cal: Gain = 5.1058 keV / Ch
Offset = 3.076.65 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 29.87% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	54.562	100.0	73.00	0.4800	73	4.823E-001	8.109E-002	8.440E-003	3.488E-002
U-235	4385.000	4260.000	4445.000	6.952	76.6	5.00	0.4796	6	3.925E-002	2.040E-002	1.102E-002	4.553E-002
U-234	4765.000	4540.000	4925.000	21.675	99.8	92.43	2.5457	90	5.990E-001	7.043E-002	1.948E-002	5.693E-002
U-232	5300.000	5120.000	5380.000	68.103	99.8	727.00	3.1200	724	4.654E+000	1.754E-001	2.202E-002	6.246E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
7:12:58PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 30204854006 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

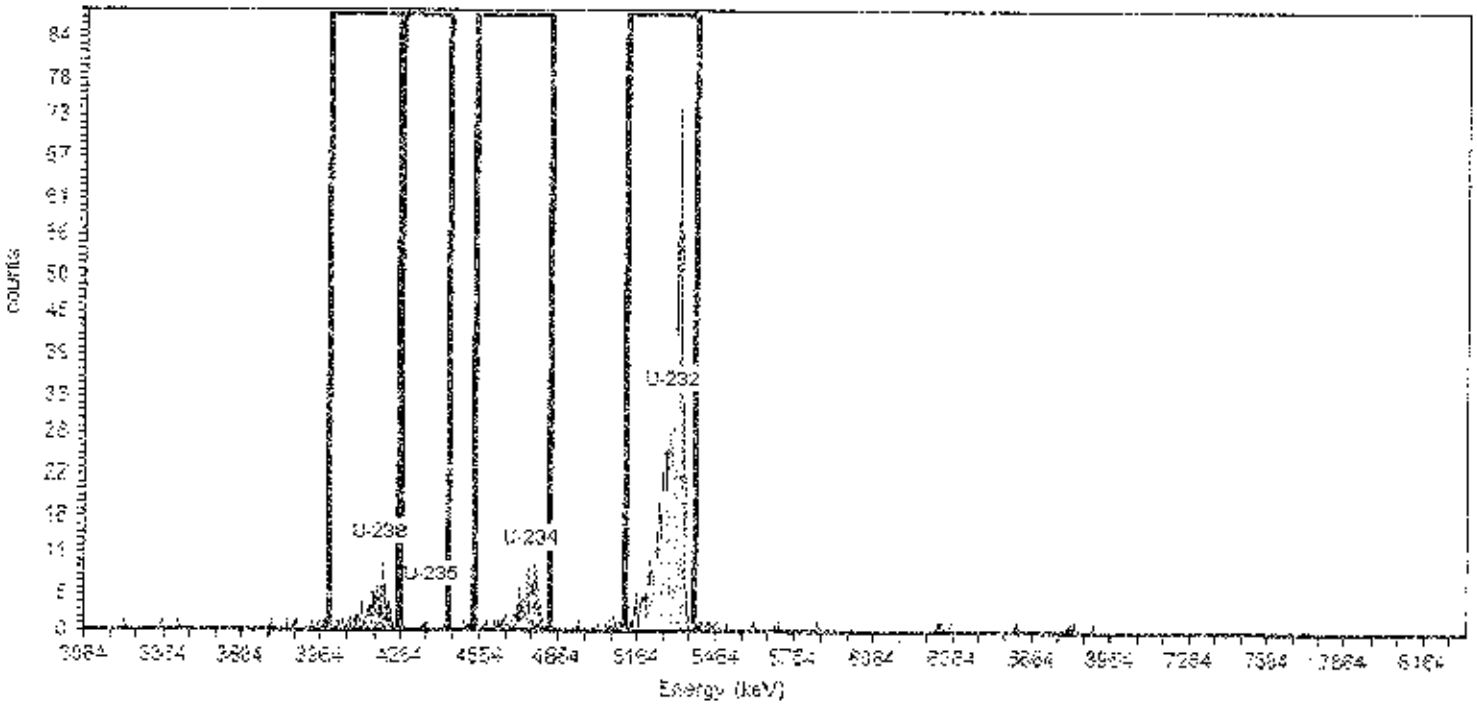
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 89.32%

Acquisition

Detector: Det 34 SN:
Acquisition Start Date: 2/7/2017 3:12:21PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:50PM
Bkgd Info: Sample: Det 34; Det: Det 34; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 34
Efficiency Calibration:2016.06.06 001 det 34
Calibration Date: 6/6/2016 10:25:49AM
Energy Cal: Gain = 5.1501 keV / Ch
Offset = 3.059.78 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.87% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	67.424	100.0	93.08	0.4800	93	6.514E-001	7.445E-002	8.928E-003	3.889E-002
U-235	4385.000	4260.000	4445.000	7.040	76.6	5.00	1.2000	4	3.490E-002	2.292E-002	1.943E-002	6.171E-002
U-234	4765.000	4540.000	4825.000	63.667	99.8	99.41	1.6208	98	6.893E-001	7.773E-002	1.644E-002	5.195E-002
U-232	5300.000	5120.000	5380.000	52.675	99.8	890.00	5.6283	884	4.400E+000	1.707E-001	3.128E-002	8.704E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
7:13:01PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 30204954007 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

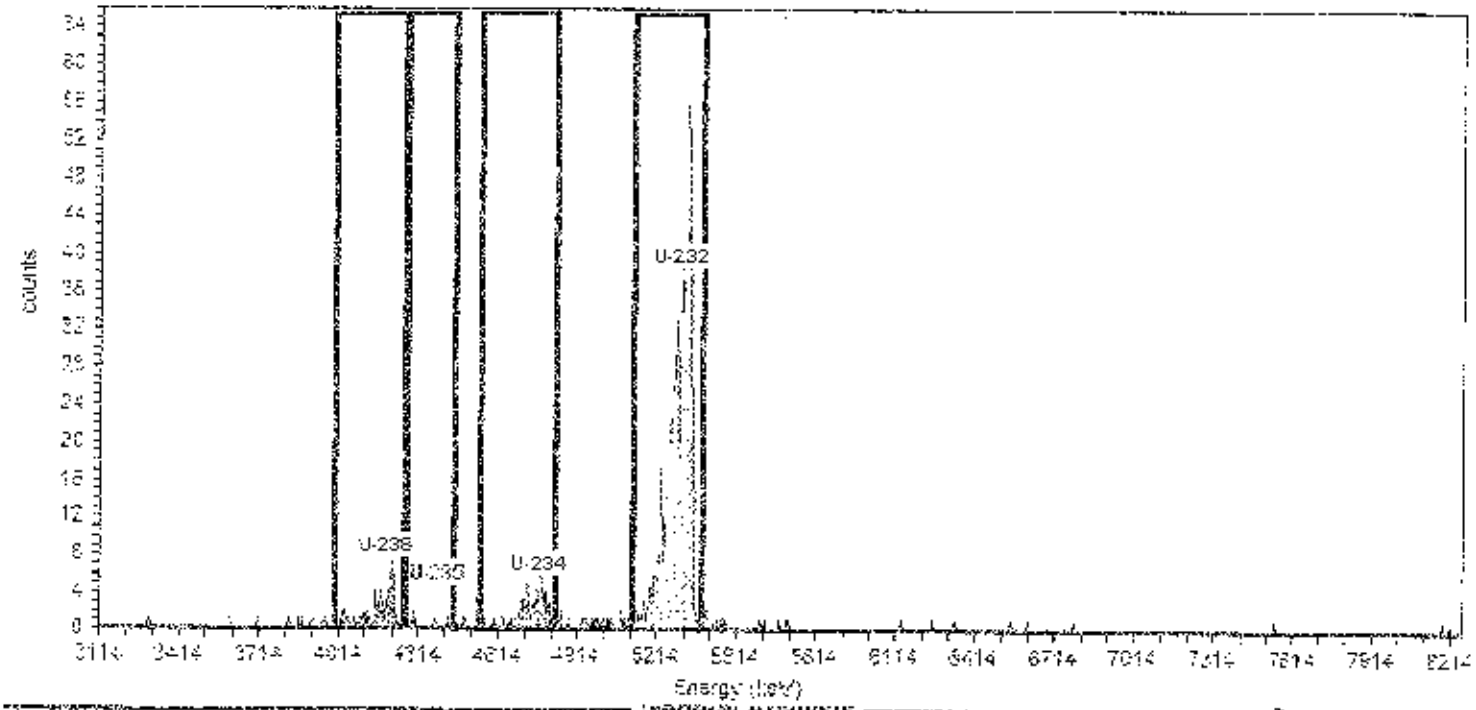
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 97.12%

Acquisition

Detector: Det 36 SN:
Acquisition Start Date: 2/7/2017 3:12:21PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:50PM
Bkgd Info: Sample: Det 36; Det: Det 36; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 36
Efficiency Calibration:2016.06.06 001 det 36
Calibration Date: 6/6/2016 10:31:59AM
Energy Cal: Gain = 5.0362 keV / Ch
Offset = 3,109.16 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.61% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: iso U
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	S.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4186.000	3990.000	4255.000	36.357	100.0	68.10	1.4400	67	1.503E-003	5.999E-002	1.485E-002	4.797E-002
U-235	4366.000	4260.000	4445.000	6.619	76.6	4.00	0.7200	3	2.892E-002	1.920E-002	1.371E-002	5.127E-002
U-234	4766.000	4540.000	4825.000	95.183	99.8	71.00	6.1685	65	4.380E-001	6.277E-002	3.079E-002	7.989E-002
U-232	5300.000	5120.000	5380.000	75.812	99.8	738.72	5.9333	713	4.784E+000	1.824E-001	3.084E-002	8.038E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
7:13:04PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 30204854008 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

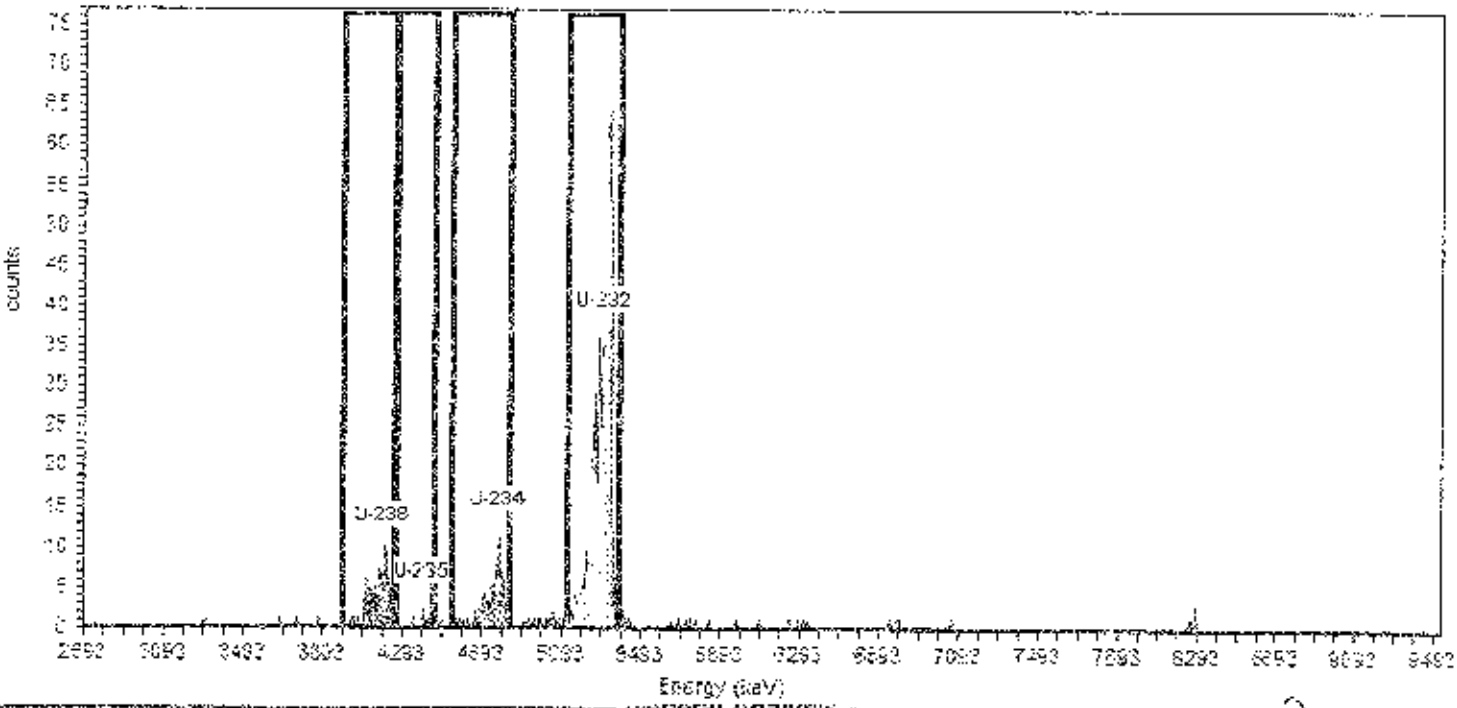
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 90.61%

Acquisition

Detector: Det 37 SN:
Acquisition Start Date: 2/7/2017 3:12:21PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 37; Det: Det 37; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 37
Efficiency Calibration:2016.06.06 001 det 37
Calibration Date: 6/6/2016 12:14:29PM
Energy Cal: Gain = 6.9919 keV / Ch
Offset = 2,686.41 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 26.95% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4265.000	51.517	100.0	105.20	1.9200	103	7.938E-001	8.821E-002	1.951E-002	5.981E-002
U-235	4385.000	4250.000	4445.000	43.212	76.6	8.00	0.9600	7	7.064E-002	3.022E-002	1.601E-002	6.317E-002
U-234	4768.000	4540.000	4825.000	26.813	99.8	108.00	1.9200	106	8.189E-001	8.977E-002	1.955E-002	5.993E-002
U-232	5300.000	5120.000	5380.000	40.365	99.8	831.68	5.2742	826	4.464E+000	1.814E-001	3.308E-002	8.745E-002

AlphaVision v5.3 **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
7:13:07PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 30204854009 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

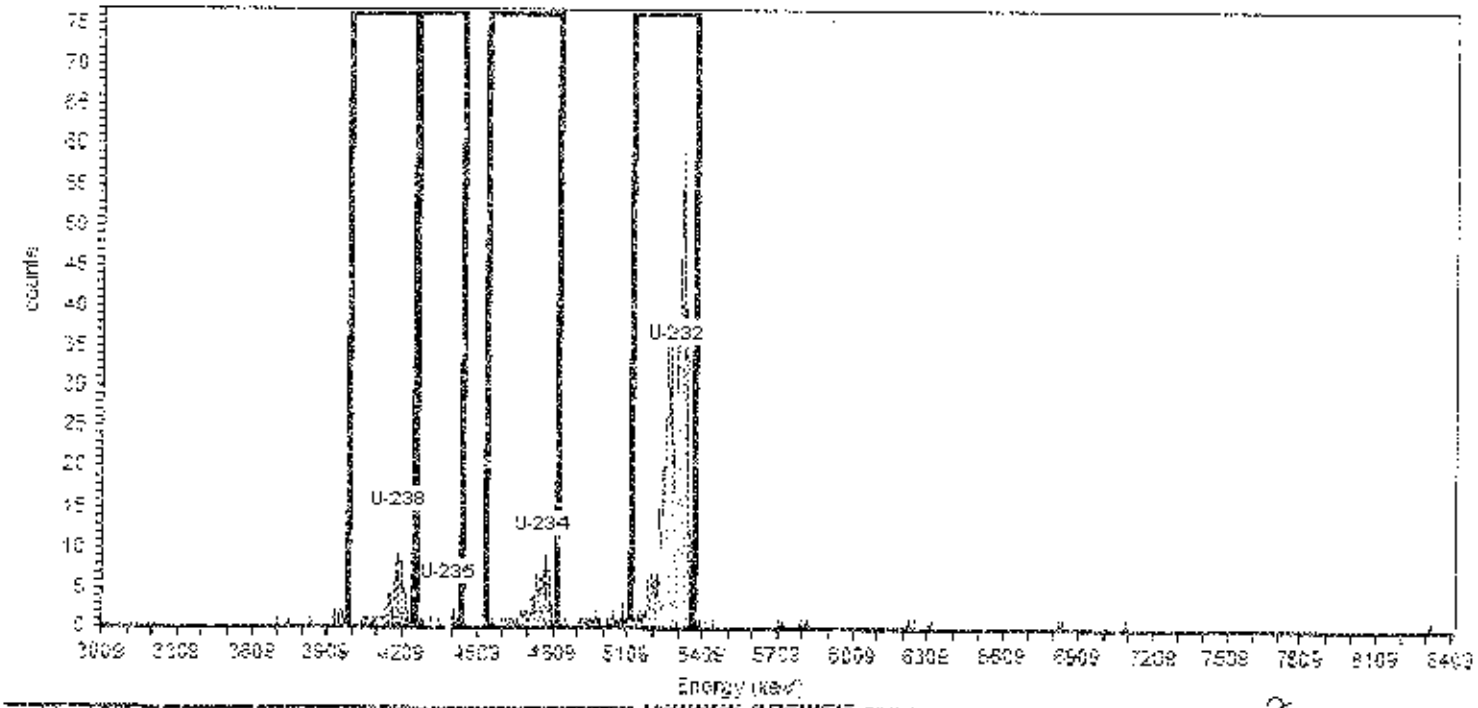
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 99.54%

Acquisition

Detector: Det 38 SN:
Acquisition Start Date: 2/7/2017 3:12:22PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 38; Det: Det 38; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 38
Efficiency Calibration:2016.06.06 001 det 38
Calibration Date: 6/6/2016 12:17:52PM
Energy Cal: Gain = 5.3002 keV / Ch
Offset = 3.904.00 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.16% +/- 0.26% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	62.445	100.0	88.00	0.7200	87	6.080E-001	7.119E-002	1.07ME-002	4.037E-002
U-235	4385.000	4260.000	4445.000	7.092	76.5	7.13	0.0000	7	6.458E-002	2.601E-002	0.000E+000	2.453E-002
U-234	4785.000	4640.000	4825.000	29.064	99.8	101.00	2.8400	98	6.943E-001	7.762E-002	2.971E-002	6.024E-002
U-232	5300.000	5120.000	5380.000	61.771	99.8	701.23	7.8524	693	4.903E+000	1.900E-001	3.647E-002	9.218E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
7:13:10PM 2/7/2017

Analyst: ORTEC

Sample

Sample: 30204854010 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

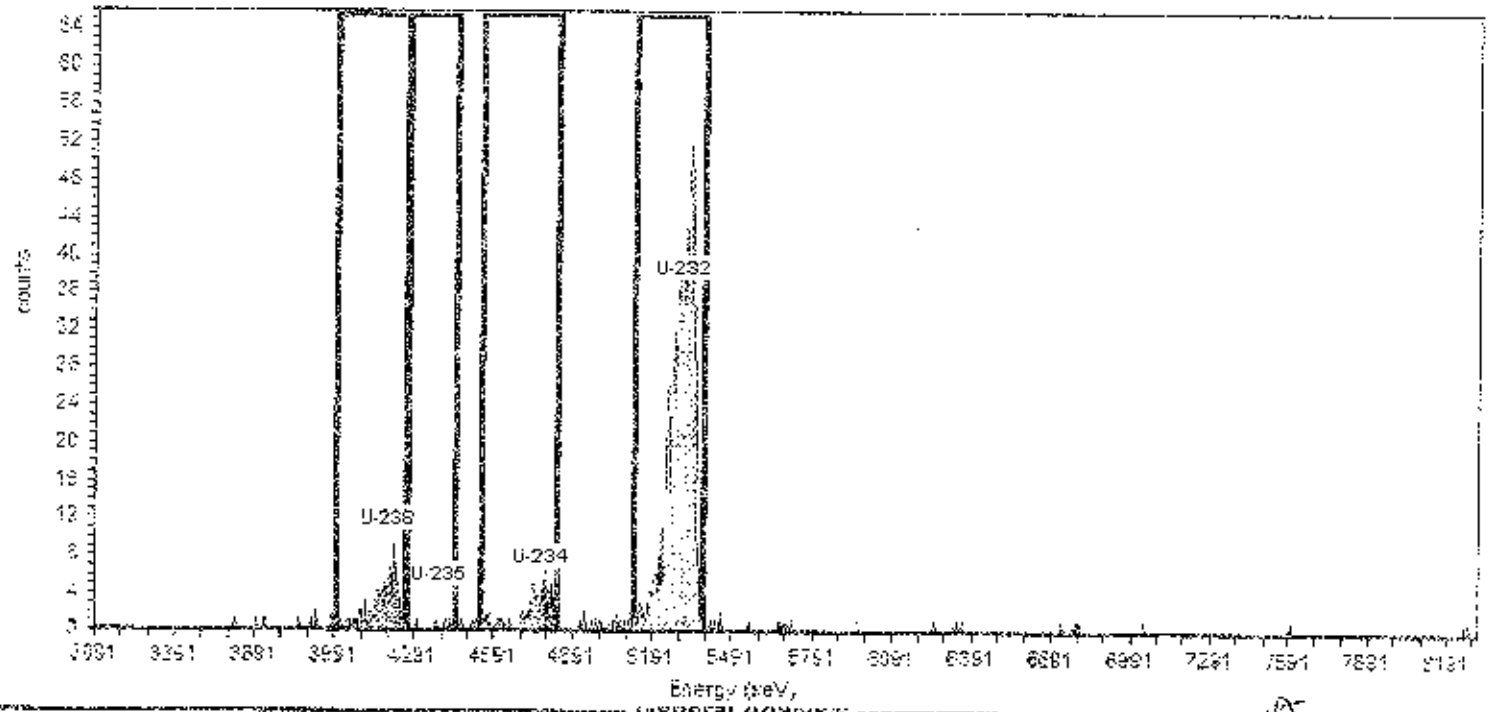
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/6/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 100.93%

Acquisition

Detector: Det 39 SN:
Acquisition Start Date: 2/7/2017 3:12:22PM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 39; Det. Det 39; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 39
Efficiency Calibration:2016.06.06 001 det 39
Calibration Date: 6/6/2016 12:20:36PM
Energy Cal: Gain = 5.1058 keV / Ch
Offset = 3,086.86 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 31.72% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	39.678	100.0	112.65	0.4800	112	6.576E-001	6.851E-002	7.440E-003	3.074E-002
U-235	4385.000	4260.000	4445.000	6.900	76.6	4.00	0.2400	4	2.678E-002	1.581E-002	6.866E-003	3.445E-002
U-234	4765.000	4540.000	4825.000	36.957	99.8	79.43	3.6000	76	4.454E-001	5.695E-002	2.042E-002	5.673E-002
U-232	5300.000	5120.000	5380.000	93.333	99.8	825.80	4.5785	821	4.972E+000	1.758E-001	2.351E-002	8.326E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830

Analyst: ORTEC

7:12:39PM 2/7/2017

Sample

Sample: 30204854011 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

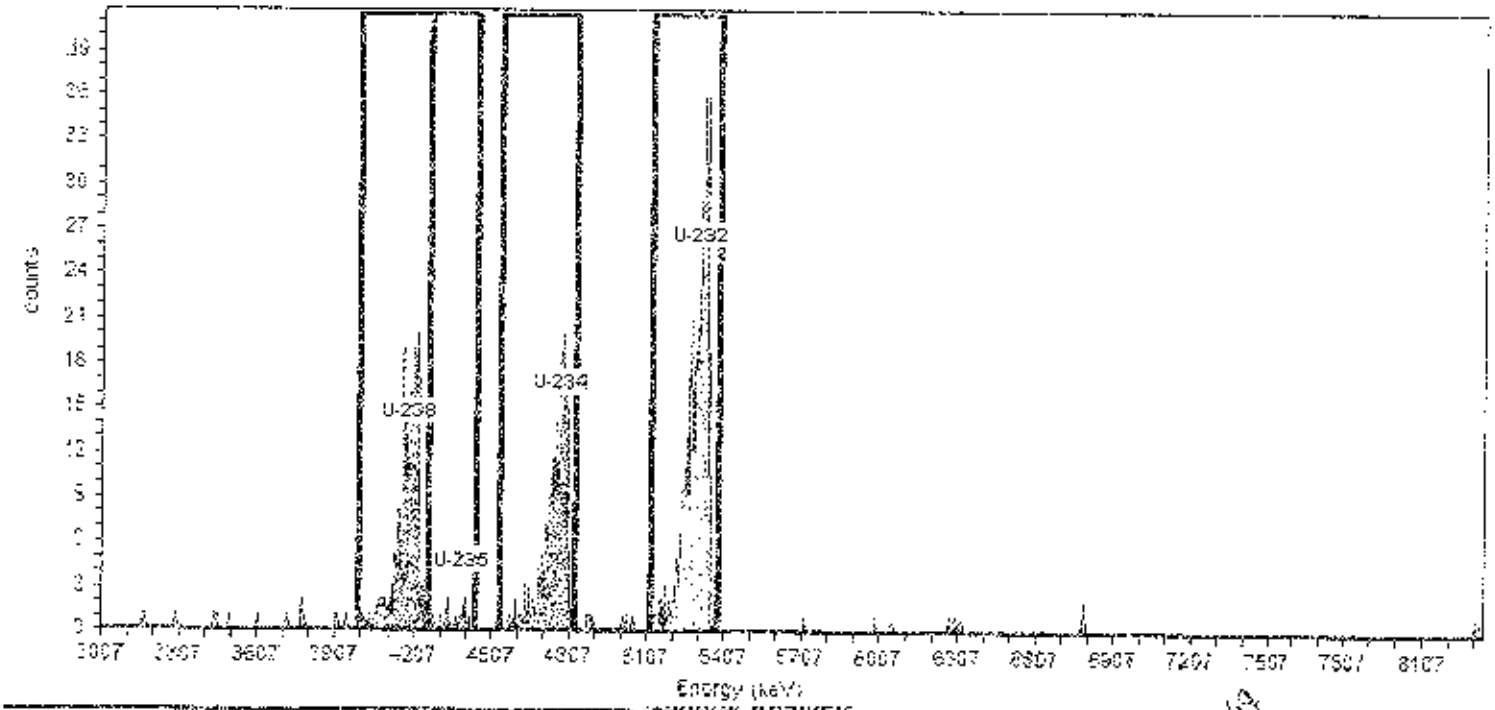
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 10/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 70.50%

Acquisition

Detector: Det 40 SN:
Acquisition Start Date: 2/7/2017 3:12:22PM
Live Time: 240.00 min.
Real Time: 240.00 min
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample, Det 40; Det: Det 40; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 40
Efficiency Calibration:2016.06.06 001 det 40
Calibration Date: 6/6/2016 12:23:46PM
Energy Cal: Gain = 5.2253 keV / Ch
Offset = 3.002.17 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 23.90% +/- 0.24% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4265.000	74.330	100.0	246.00	0.4800	246	2.732E+000	2.304E-001	1.412E-002	5.636E-002
U-235	4385.000	4265.000	4445.000	92.972	76.6	14.00	0.0000	14	2.034E-001	5.736E-002	0.000E+000	3.931E-002
U-234	4765.000	4540.000	4825.000	46.507	99.8	257.00	5.0400	252	2.509E+000	2.376E-001	4.585E-002	1.219E-001
U-232	5300.000	5120.000	5380.000	58.673	99.8	435.94	3.3013	433	3.475E+000	1.693E-001	3.790E-002	1.035E-001

AlphaVision v5.3 — *Alpha Spectroscopy Analysis Report*

ORTEC
Oak Ridge, TN 37830
11:09:23AM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204854012 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

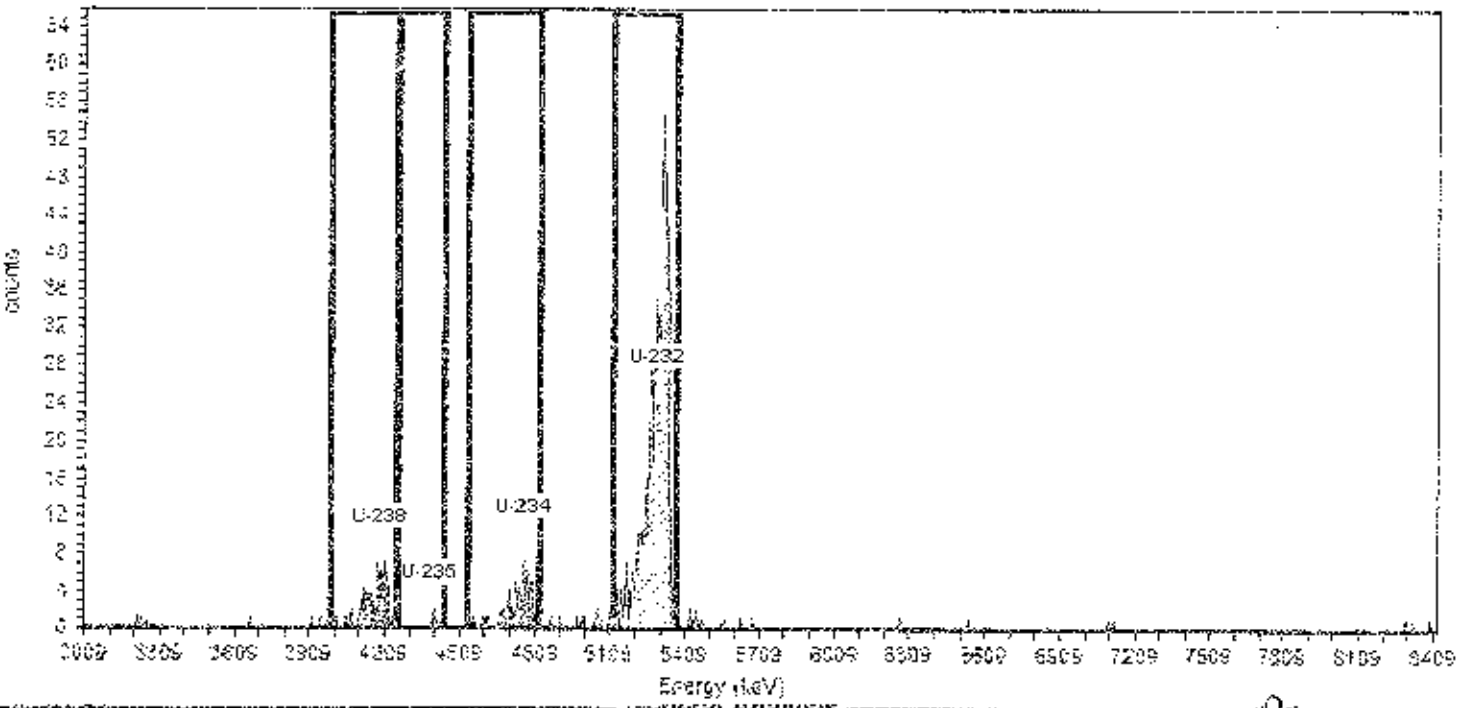
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 95.81%

Acquisition

Detector: Det 38 SN:
Acquisition Start Date: 2/8/2017 7:08:37AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 38; Det: Det 38; Spectrum #1: Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 38
Efficiency Calibration:2016.06.06 001 det 38
Calibration Date: 6/6/2016 12:17:52PM
Energy Cal: Gain = 5.3002 keV / Ch
Offset = 3.004.00 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.16% +/- 0.26% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4265.000	95.353	100.0	88.00	0.7200	87	6.296E-001	7.412E-002	1.121E-002	4.195E-002
U-235	4385.000	4260.000	4445.000	28.254	76.6	2.00	0.0000	2	1.863E-002	1.634E-002	0.000E+000	2.543E-002
U-234	4765.000	4540.000	4825.000	34.236	99.8	77.20	2.6400	75	5.389E-001	5.938E-002	2.151E-002	8.259E-002
U-232	5300.000	5120.000	5380.000	86.741	99.8	675.23	7.8624	667	4.720E+000	1.864E-001	3.789E-002	9.575E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
11:09:26AM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204854013 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

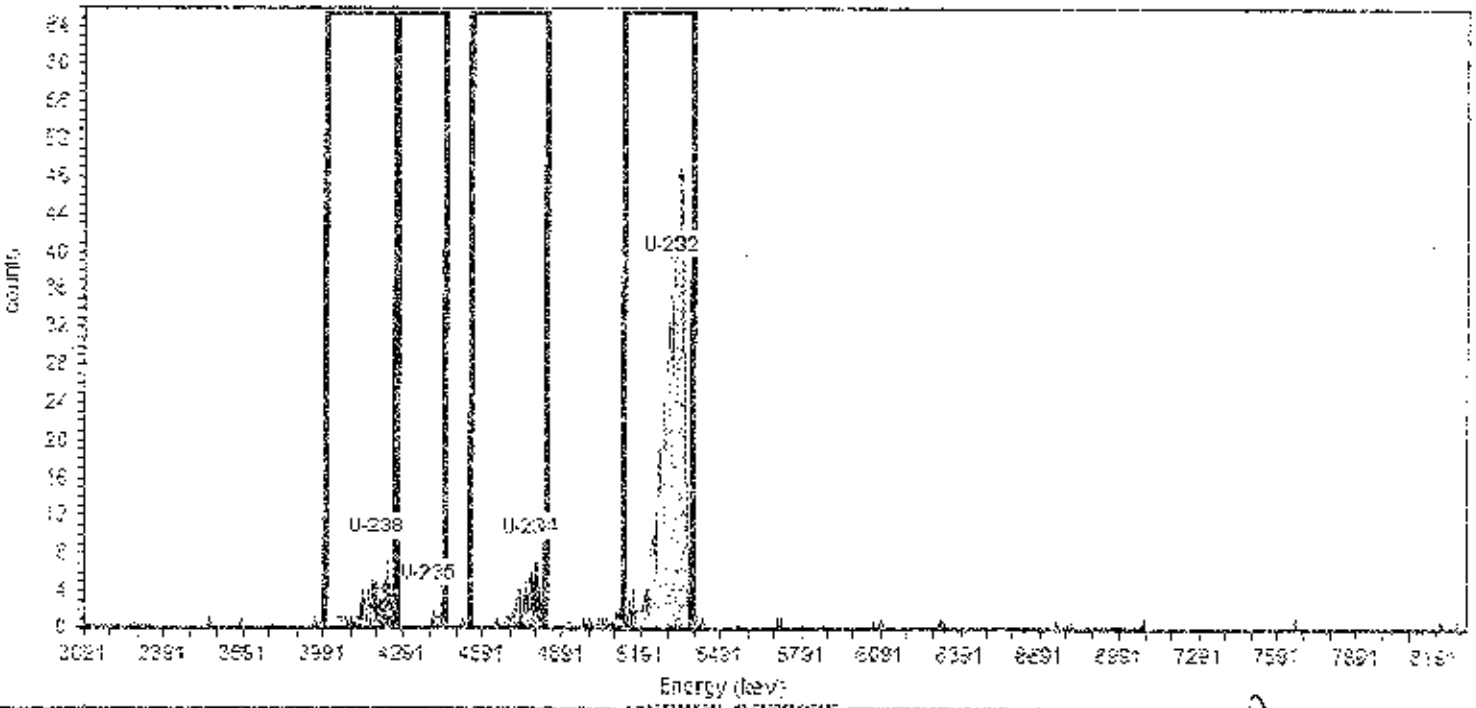
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 90.61%

Acquisition

Detector: Det 39 SN:
Acquisition Start Date: 2/8/2017 7:08:37AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 39; Det: Det 39; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 39
Efficiency Calibration:2016.06.06 001 det 39
Calibration Date: 6/6/2016 12:20:36PM
Energy Cal: Gain = 5.1053 keV / Ch
Offset = 3.086 95 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 31.72% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.05

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	17.352	100.0	73.11	0.4800	73	4.743E-001	5.997E-002	8.289E-003	3.425E-002
U-235	4385.000	4260.000	4445.000	11.395	76.6	7.00	0.2400	7	5.762E-002	2.308E-002	7.650E-003	3.837E-002
U-234	4765.000	4540.000	4825.000	11.057	99.8	69.61	3.6000	66	4.319E-001	5.928E-002	2.274E-002	6.319E-002
U-232	5300.000	5120.000	5380.000	75.223	99.8	741.80	4.5786	737	4.463E+000	1.666E-001	2.619E-002	7.048E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
11:09:20AM 2/8/2017

Analyst. ORTEC

Sample

Sample: 30204854014 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

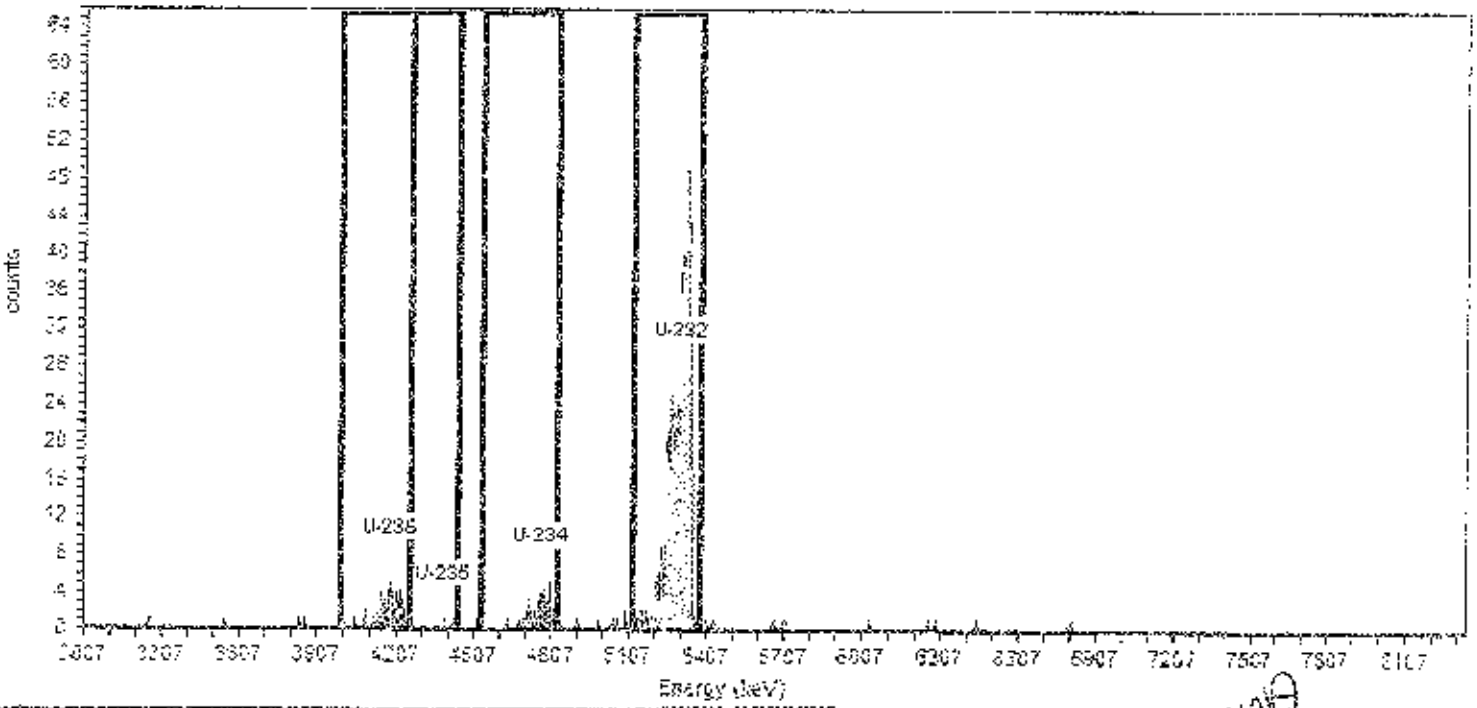
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 98.67%

Acquisition

Detector: Det 40 SN:
Acquisition Start Date: 2/8/2017 7:08:37AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 40; Det: Det 40; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 40
Efficiency Calibration:2016.06.06 001 det 40
Calibration Date: 6/6/2016 12:23:46PM
Energy Cal: Gain = 5.2253 keV / Ch
Offset = 3.002.17 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 23.90% +/- 0.24% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	70.628	100.0	55.00	0.4800	55	4.338E-001	6.289E-002	1.013E-002	4.173E-002
U-235	4385.000	4265.000	4445.000	7.483	75.6	2.00	0.0000	2	2.078E-002	1.602E-002	0.000E+000	2.813E-002
U-234	4765.000	4540.000	4825.000	10.315	99.8	43.00	5.0400	38	3.027E-001	5.718E-002	3.279E-002	8.715E-002
U-232	5300.000	5120.000	5380.000	52.878	99.8	608.30	3.3018	606	4.861E+000	2.002E-001	2.710E-002	7.674E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
7:22:32PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204654015 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

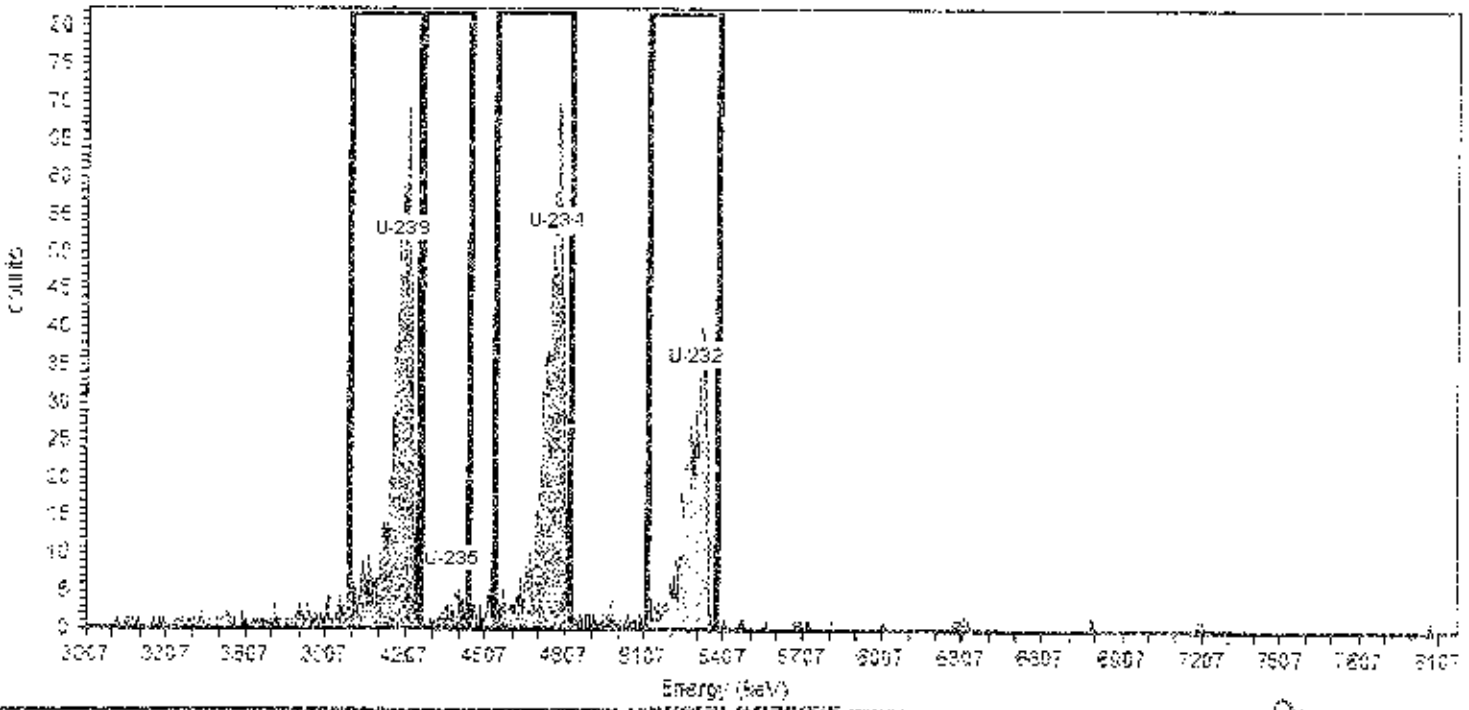
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 84.10%

Acquisition

Detector: Det 26 SN:
Acquisition Start Date: 2/8/2017 3:22:15PM
Live Time: 240.00 min.
Real Time: 240.01 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 26; Det: Det 26; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 007
Efficiency Calibration:2016.12.02 007
Calibration Date: 12/2/2016 1:46:37PM
Energy Cal: Gain = 5.0577 keV / Ch
Offset = 3,002.39 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.83% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	68.435	100.0	934.27	0.7200	934	7.485E+000	4.390E-001	1.248E-002	4.662E-002
U-235	4385.000	4260.000	4445.000	24.922	76.6	55.65	0.2400	55	5.800E-001	6.319E-002	9.393E-003	4.711E-002
U-234	4785.000	4540.000	4825.000	65.492	99.8	963.00	2.6400	960	7.715E+000	4.508E-001	2.391E-002	6.066E-002
U-232	5300.000	5120.000	5380.000	93.679	99.8	605.00	4.5600	600	4.143E+000	1.716E-001	3.209E-002	8.636E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
7:22:22PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204864016 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

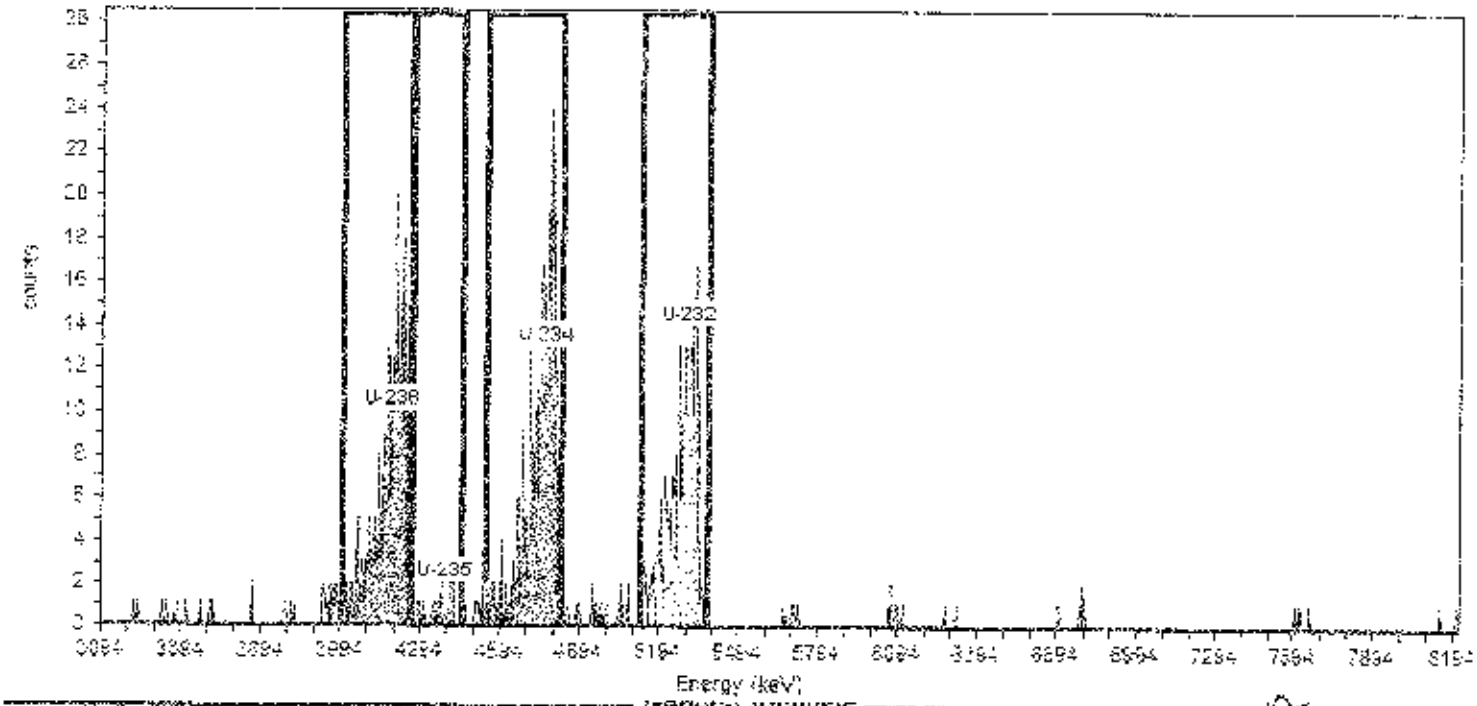
Tracer Name: U-232 15-011
Tracer Activity: 109.38 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 36.70%

Acquisition

Detector: Det 27 SN:
Acquisition Start Date: 2/8/2017 3:22:16PM
Live Time: 240.00 min.
Real Time: 240.01 min.
Background Date: 2/1/2017 1:58:54PM
Bkgd Info: Sample: Det 27, Det: Det 27; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 27
Efficiency Calibration:2016.06.06 001 det 27
Calibration Date: 6/6/2016 8:44:44AM
Energy Cal: Gain = 5.0148 keV / Ch
Offset = 3,089.69 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.63% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	41.414	100.0	278.82	0.9600	278	4.960E+000	4.468E-001	3.209E-002	1.124E-001
U-235	4395.000	4260.000	4445.000	8.080	76.6	18.00	0.2400	18	4.141E-001	1.034E-001	2.093E-002	1.049E-001
U-234	4768.000	4540.000	4825.000	49.011	99.8	335.69	1.9200	334	5.972E+000	5.180E-001	4.543E-002	1.393E-001
U-232	5300.000	5120.000	5380.000	76.214	99.8	273.57	4.0432	270	1.808E+000	1.121E-001	6.732E-002	1.841E-001

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830

Analyst: ORTEC

7:22:35PM 2/8/2017

Sample

Sample: 30204854017 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

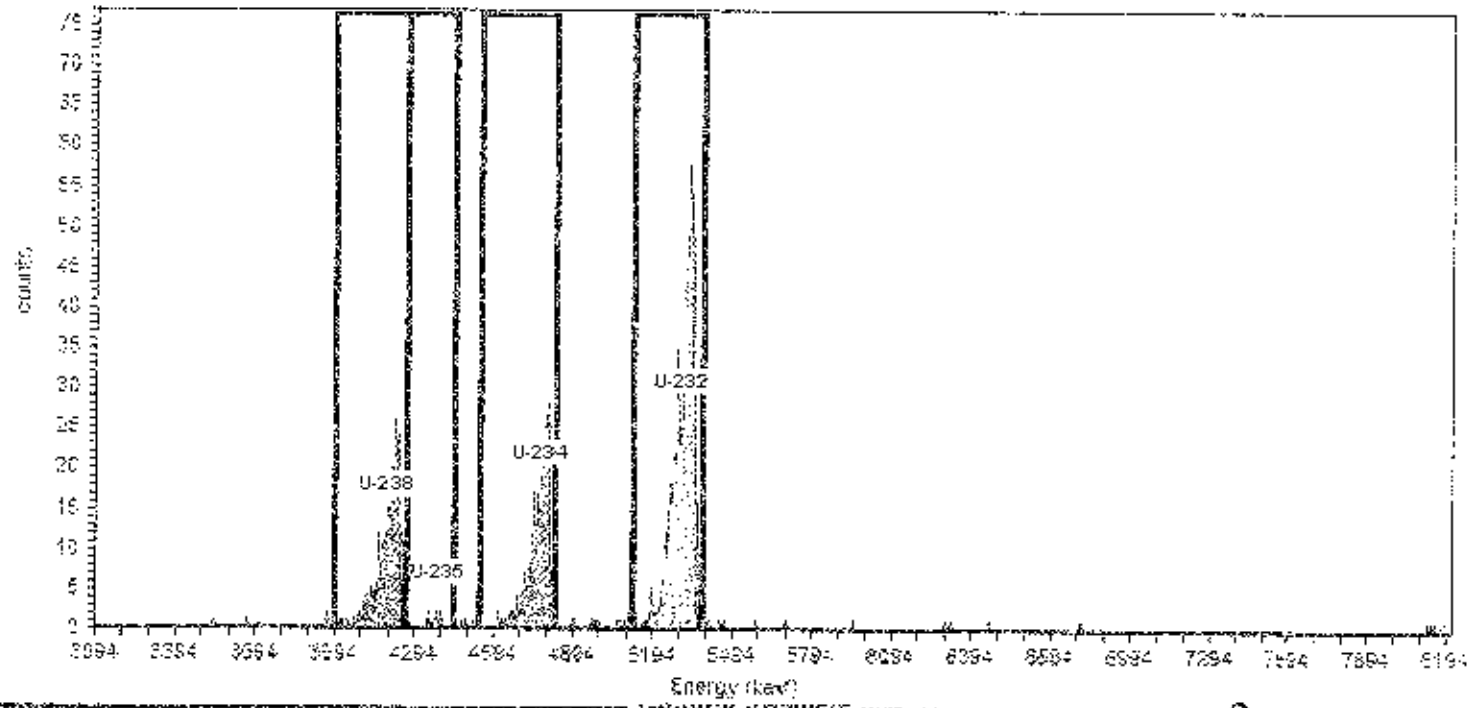
Tracer Name: U-232 15-011
Tracer Activity: 109.38 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 96.41%

Acquisition

Detector: Det-28 SN:
Acquisition Start Date: 2/8/2017 3:22:18PM
Live Time: 240.00 min.
Real Time: 240.01 min.
Background Date: 2/7/2017 1:59:52PM
Bkgd Info: Sample: Det 28, Det: Det-28; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 28
Efficiency Calibration:2016.06.06 001 det 28
Calibration Date: 6/6/2016 8:47:14AM
Energy Cal: Gain = 6.0103 keV / Ch
Offset = 3,089.93 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.06% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4186.000	3990.000	4255.000	17.773	100.0	304.36	2.5284	302	2.022E+000	1.491E-001	1.951E-002	5.715E-002
U-235	4386.000	4260.000	4445.000	84.633	76.6	12.00	1.0721	11	9.557E-002	3.192E-002	1.658E-002	5.684E-002
U-234	4766.000	4540.000	4825.000	13.519	99.8	328.12	2.1600	326	2.188E+000	1.575E-001	1.807E-002	5.431E-002
U-232	5300.000	5120.000	5380.000	50.415	99.8	722.00	3.3774	719	4.749E+000	1.793E-001	2.308E-002	6.470E-002

AlphaVision v5.3 **Alpha Spectrum Analysis Report**

ORTEC
Oak Ridge, TN 37830

Analyst: ORTEC

7:22:26PM 2/8/2017

Sample

Sample: 30204864018 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

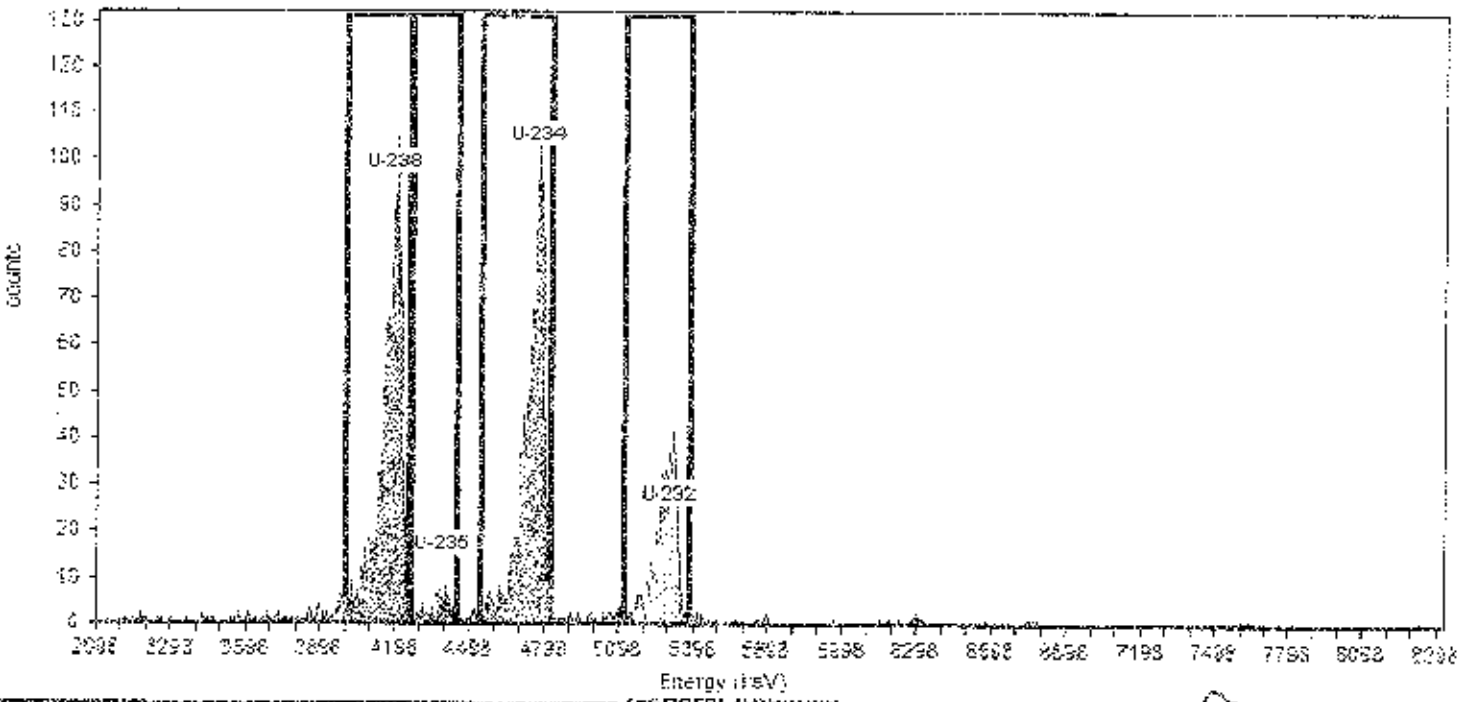
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 82.76%

Acquisition

Detector: Det 31 SN:
Acquisition Start Date: 2/8/2017 3:22:15PM
Live Time: 240.00 min.
Real Time: 240.01 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 31; Det: Det 31; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 31
Efficiency Calibration: 2016.06.06 001 det 31
Calibration Date: 6/6/2016 10:21:27AM
Energy Cal: Gain = 5.3188 keV / Ch
Offset = 2,992.72 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction: 2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4255.000	82.307	100.0	1,431.01	0.2400	1,431	1.147E+001	6.345E-001	7.191E-003	3.607E-002
U-235	4365.000	4260.000	4445.000	49.656	76.6	76.05	0.0000	76	7.956E-001	9.964E-002	0.000E+000	2.831E-002
U-234	4765.000	4540.000	4825.000	58.923	99.8	1,395.11	1.9202	1,393	1.119E+001	6.212E-001	2.038E-002	6.249E-002
U-232	5300.000	5120.000	5380.000	94.661	99.8	604.09	3.3217	601	4.077E+000	1.685E-001	2.738E-002	7.694E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

Analyst: ORTEC

ORTEC
Oak Ridge, TN 37830
7:22:29PM 2/8/2017

Sample

Sample: LCS33792 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

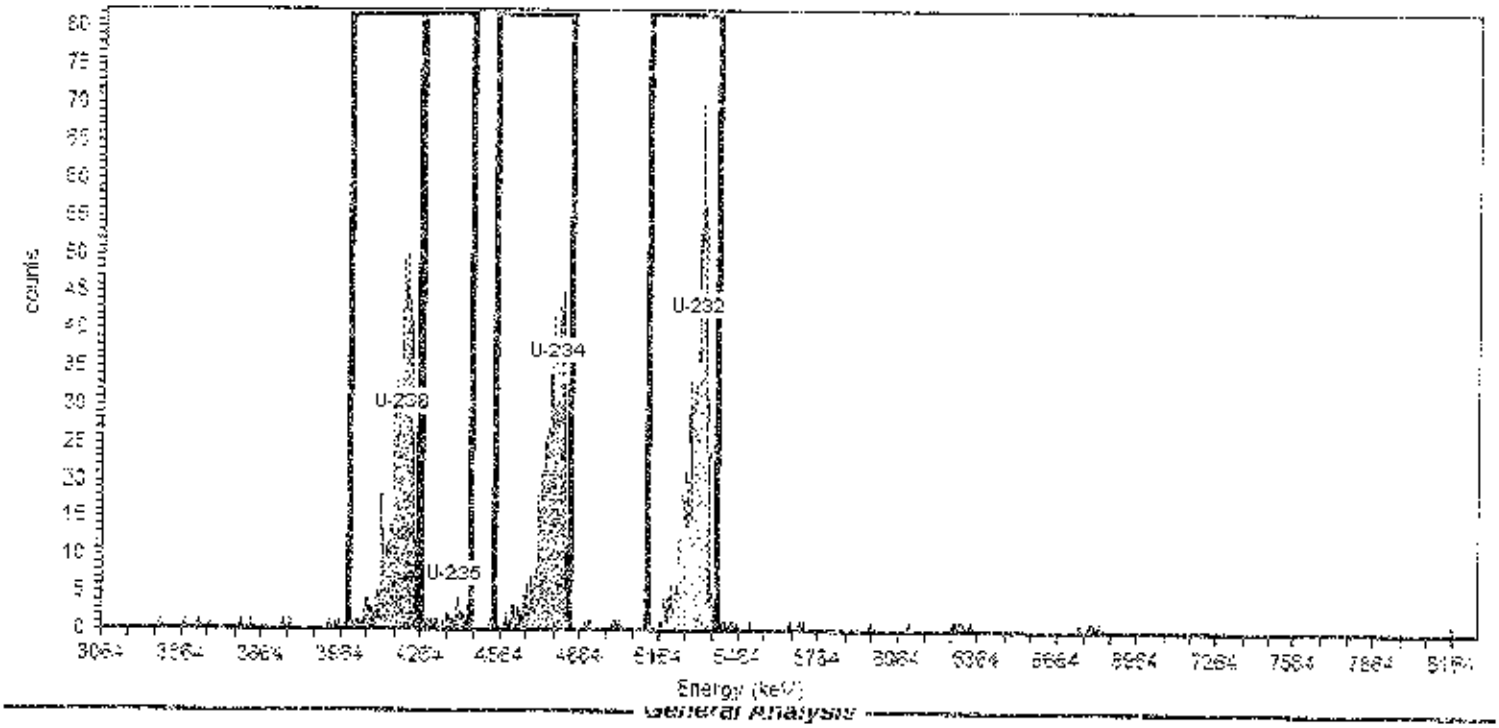
Tracer Name: U-232 15-011
Tracer Activity: 109.38 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 97.52%

Acquisition

Detector: Det 32 SN:
Acquisition Start Date: 2/8/2017 3:22:15PM
Live Time: 240.00 min.
Real Time: 240.01 min.
Background Date: 2/1/2017 1:59:49PM
Bkgd Info: Sample: Det 32; Det: Det 32; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 010
Efficiency Calibration:2016.12.02 010
Calibration Date: 12/2/2016 2:55:41PM
Energy Cal: Gain = 5.0818 keV / Ch
Offset = 3,059.66 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.82% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3990.000	4266.000	73.988	100.0	668.54	0.7200	669	4.632E+000	2.762E-001	1.045E-002	3.910E-002
U-235	4385.000	4260.000	4445.000	35.432	76.6	32.00	0.7200	31	2.746E-001	5.177E-002	1.365E-002	5.105E-002
U-234	4765.000	4540.000	4825.000	71.364	99.8	634.31	6.0000	628	4.234E+000	2.583E-001	3.024E-002	7.871E-002
U-232	5300.000	5120.000	5380.000	48.946	99.8	723.10	7.2534	716	4.804E+000	1.829E-001	3.395E-002	8.652E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
7:22:38PM 2/8/2017

Analyst: ORTEC

Sample

Sample: LCSO33792 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: U33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

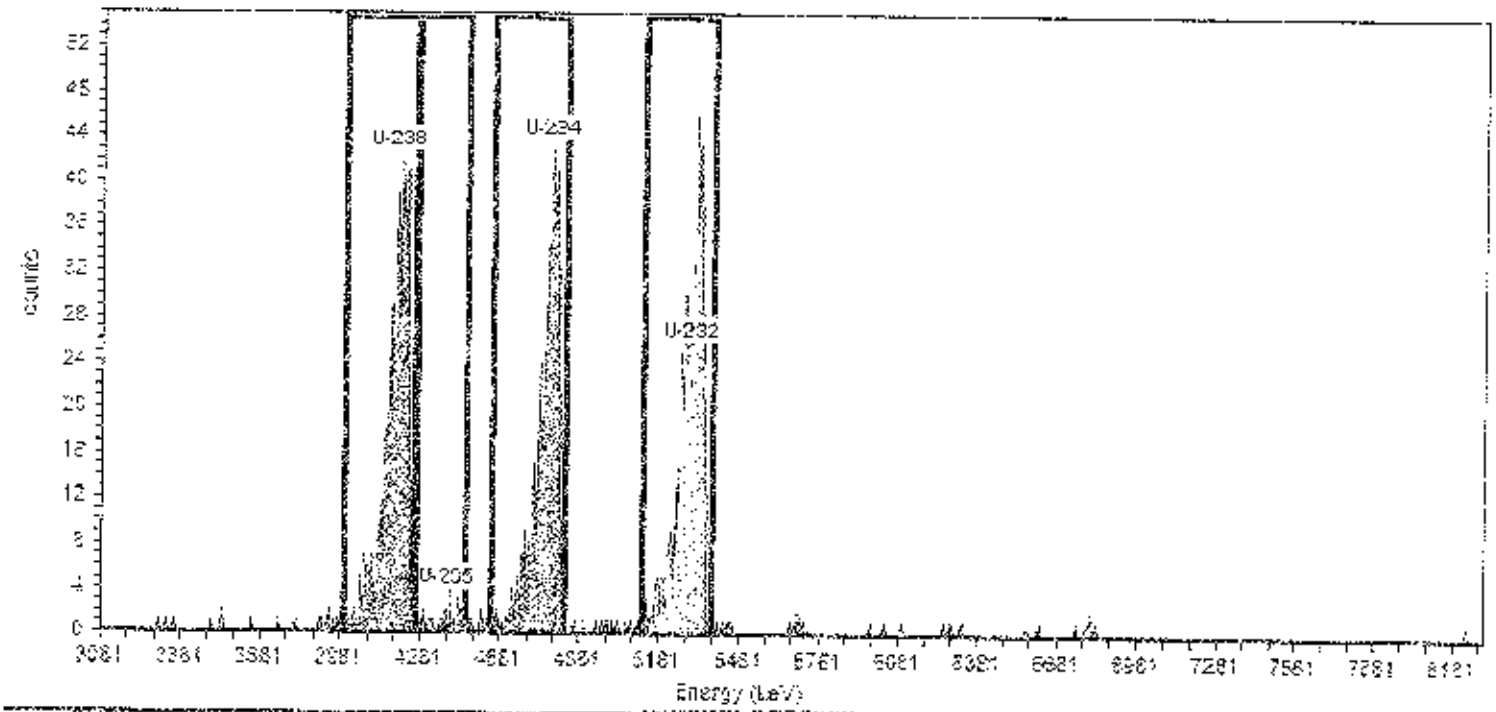
Tracer Name: U-232 15-011
Tracer Activity: 109.36 DPM/mL x (Vol.)0.10 mL = 10.94 DPM
Tracer Ref. Date: 12/5/2014 12:00:00PM

Tracer Nuclide: U-232
Tracer Recovery: 86.85%

Acquisition

Detector: Det 33 SN:
Acquisition Start Date: 2/8/2017 3:22:15PM
Live Time: 240.00 min.
Real Time: 240.01 min.
Background Date: 2/1/2017 1:59:49PM
Bkgd Info: Sample: Det 33; Det: Det 33; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 33b
Efficiency Calibration:2016.06.06 001 det 33b
Calibration Date: 6/6/2016 12:10:27PM
Energy Cal: Gain = 5.1058 keV / Ch
Offset = 3,076.65 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.87% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso u by energy
Decay Correction:2/7/2017 3:05:45PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: iso U
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
U-238	4185.000	3930.000	4255.000	32.274	100.0	656.52	0.4800	656	4.746E+000	2.895E-001	9.181E-003	3.794E-002
U-235	4385.000	4260.000	4445.000	11.139	76.6	29.00	0.4798	29	2.694E-001	6.281E-002	1.198E-002	4.992E-002
U-234	4765.000	4540.000	4825.000	54.259	99.8	607.61	2.5457	605	4.386E+000	2.728E-001	2.119E-002	6.199E-002
U-232	5300.000	5120.000	5380.000	92.697	99.0	668.59	3.1200	665	4.278E+000	1.681E-001	2.395E-002	5.793E-002

Isotopic Thorium Sample Analysis Documentation

Alpha Emitting Actinides Preparation Logbook/Method HASL 300, Po-01-RC, Po-02-RC, Pu-241

Pace Analytical

Prep Date: [illegible] Method: [illegible] Prep Analyst: [illegible] Balance ID: [illegible]
Work List: [illegible] Matrix: [illegible] Report Units: [illegible] Pipette ID: [illegible]

Logbook ID: S-R003-6 SOP ID: PGH-R-005, R041 Aliquot Units: g, L, F, S Aliquot Basis: Dry/Wet, Filter/Unfiltered

Bottle ID:	MB	Sample ID	Aliquot	Reagents	Reagent ID	Reagents	Reagent ID
	1	[illegible]	[illegible]	Anion Resin	[illegible]	3N HNO_3	n/a
	2	[illegible]	[illegible]	Cation Resin	n/a	3N HNO_3/1.0M $Al(NO_3)_3$	
	3	[illegible]	[illegible]	TEVA Resin		8N HCl	
	4	[illegible]	[illegible]	TRU Resin		0.01 N HCl	
	5	[illegible]	[illegible]	UTEVA Resin		KSCN indicator	
	6	[illegible]	[illegible]	Ascorbic Acid		TiCl	[illegible]
	7	[illegible]	[illegible]	HF	[illegible]	25% Hydrazine HCl_2	n/a
	8	[illegible]	[illegible]	HCl	[illegible]	NH_4OH	[illegible]
	9	[illegible]	[illegible]	Nitric	[illegible]	9N HCl/0.1% H_2O_2	n/a
	10	[illegible]	[illegible]	Boric Acid 5% Soln	[illegible]	9N HCl/0.05M NH_4I	
	11	[illegible]	[illegible]	Iron Carrier	[illegible]	1M Ascorbic Acid	
	12	[illegible]	[illegible]	8N HNO_3	[illegible]	1M NH_4SCN/0.1N Formic	
	13	[illegible]	[illegible]	9N HCl	[illegible]	3M NH_4SCN/0.1N Formic	
	14	[illegible]	[illegible]	6N HCl / 0.52N HF	[illegible]	5N HCl/0.05M Oxalic Acid	
	15	[illegible]	[illegible]	0.1N HCl	[illegible]		
	16	[illegible]	[illegible]	Neodymium Carrier	[illegible]		
	17	[illegible]	[illegible]	80% Ethanol	[illegible]		
	18	[illegible]	[illegible]	0.1% HF	[illegible]		
	19	[illegible]	[illegible]	2N HNO_3	n/a		
	20	[illegible]	[illegible]	2N HNO_3/0.5N $Al(NO_3)_3$			
	QC			2N HCl			
	QC			4N HCl			
	QC			0.1N HNO_3			
	QC			1.0N HNO_3			
	QC			pH 10 DI Water			

Isotopes	Tracer ID/Volume	LCS Spike ID/Volume	MS Spike ID/ Volume	Separation Date/Time	Comments
U	[illegible]	[illegible]	[illegible]	n/a	[illegible]
Th	[illegible]	[illegible]	[illegible]		[illegible]
Pa	n/a	n/a	n/a		
Am					
Cm					
Np					
Po					
Ra-224					

Analyst:_____ Date:_____ Peer Review:_____ Date:_____

Alpha Spectroscopy Run Logbook

Logbook ID: 1-R054-6
SOP ID: PGH-R-020

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	12			[illegible]	[illegible]				
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]			[illegible]	[illegible]				
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]								

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract RL
4. Re-Prep of sample
5. Other Noted Comments

Logbooks Updated\Alpha Spec Run Log (R054-6 16Sept2016)

Pace Analytical Services, Inc.-Pittsburgh

Alpha Spectroscopy Run Logbook

Logbook ID: 1-R054-6
SOP ID: PGH-R-020

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
[illegible]	[illegible]	Th	[illegible]	[illegible]	[illegible]	[illegible]	N/A	N/A	N/A
[illegible]	3								
[illegible]	4								
[illegible]	5								
[illegible]	6								
[illegible]	7								
[illegible]	8								
[illegible]	9								
[illegible]	10			[illegible]	[illegible]				
[illegible]	11								
[illegible]	12								
[illegible]	13								
[illegible]	14								[illegible]
[illegible]	15								
[illegible]	16								
[illegible]	17								
[illegible]	18								
[illegible]	[illegible]								
[illegible]	[illegible]								
[illegible]	[illegible]	U	240	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]								
[illegible]	[illegible]	U	240	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]								
[illegible]	2								

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract RL
4. Re-Prep of sample
5. Other Noted Comments

Pace Analytical Services Inc
Actinides Sample Info

Analyst LAL
Matrix SL
Batch ID 33792
Prep Start Date/Time: 2/1/2017 15:00
PrepSOP1 PGH-R-008
PrepSOP2 N/A
AnalSOP1 PCH-R-008
AnalSOP2 N/A

Act. Rpt Units pCi
Zero Fact. 2.71
Rpt. Sig Figs 2
Sigma 1.96

To Report Select with an X
Iso U X
Iso Th X
Iso Pu
Iso Am

	Sample COC and Aliquot Information				Uranium			Thorium			Plutonium			Americium/Curium		
	Sample ID	Collection Date	Aliquot	Aliq. units	Count Date	Det. ID	Det. Eff. (cpm/dpm)	Count Date	Det. ID	Det. Eff. (cpm/dpm)	Count Date	Det. ID	Det. Eff. (cpm/dpm)	Count Date	Det. ID	Det. Eff. (cpm/dpm)
1	12V0302	2/7/2017 5:12	0.5002	g	2/7/2017 15:12	Det 25	0.2783	2/8/2017 11:14	Det 26	0.2783						
2	30204854001	1/18/2016 9:55	0.4509	g	2/7/2017 15:12	Det 27	0.2863	2/8/2017 11:14	Det 27	0.2863						
3	30204854002	1/18/2016 9:55	0.4491	g	2/7/2017 15:12	Det 28	0.2906	2/8/2017 11:14	Det 28	0.2906						
4	30204854003	1/18/2016 9:55	0.4481	g	2/7/2017 15:12	Det 31	0.2830	2/8/2017 11:14	Det 31	0.2830						
5	30204054004	1/18/2016 9:55	0.4431	g	2/7/2017 15:12	Det 32	0.2852	2/8/2017 11:14	Det 32	0.2852						
6	30204854005	1/18/2016 9:50	0.4719	g	2/7/2017 15:12	Det 33	0.2937	2/8/2017 11:14	Det 33	0.2937						
7	30204054006	1/18/2016 9:45	0.4854	g	2/7/2017 15:12	Det 34	0.2907	2/8/2017 11:14	Det 34	0.2907						
8	30204854007	1/18/2016 10:43	0.4639	g	2/7/2017 15:12	Det 36	0.2851	2/8/2017 11:14	Det 36	0.2851						
9	30204854008	1/18/2016 10:48	0.4470	g	2/7/2017 15:12	Det 37	0.2805	2/8/2017 11:14	Det 37	0.2805						
10	30204854009	1/18/2016 10:35	0.4410	g	2/7/2017 15:12	Det 38	0.2715	2/8/2017 11:14	Det 38	0.2715						
11	30204854010	1/18/2016 10:40	0.4724	g	2/7/2017 15:12	Det 39	0.3172	2/8/2017 5:21	Det 28	0.2783						
12	30204854011	1/18/2016 11:25	0.4516	g	2/7/2017 15:12	Det 40	0.2890	2/8/2017 5:21	Det 27	0.2863						
13	30204854012	1/18/2016 11:27	0.4510	g	2/8/2017 7:08	Det 28	0.2715	2/8/2017 5:21	Det 28	0.2906						
14	30204854013	1/18/2016 11:18	0.4630	g	2/8/2017 7:08	Det 39	0.3172	2/8/2017 5:21	Det 37	0.2830						
15	30204854014	1/18/2016 11:10	0.4732	g	2/8/2017 7:08	Det 40	0.2890	2/8/2017 5:21	Det 32	0.2852						
16	30204854015	1/18/2016 12:30	0.4067	g	2/8/2017 15:22	Det 28	0.2783	2/8/2017 5:21	Det 33	0.2937						
17	30204854016	1/18/2016 12:28	0.4574	g	2/8/2017 15:22	Det 27	0.2863	2/8/2017 5:21	Det 34	0.2907						
18	30204854017	1/18/2016 12:22	0.4701	g	2/8/2017 15:22	Det 28	0.2906	2/8/2017 5:21	Det 36	0.2851						
19	30204054018	1/18/2016 12:20	0.4599	g	2/8/2017 15:22	Det 31	0.2830	2/8/2017 5:21	Det 37	0.2805						
20	LCSS33792	2/8/2017 15:22	3.0000	g	2/8/2017 15:22	Det 31	0.2830	2/8/2017 5:21	Det 38	0.2715						
21	LCSD33792	2/8/2017 15:22	3.0000	g	2/8/2017 15:22	Det 33	0.2937	2/8/2017 5:21	Det 39	0.3172						
22																
23																
24																

Note: decay correction insignificant for for nuclides longer than 70 years and yield with 6 months of collection. Prep start date may be entered as reference date if a sample collect on date has not been supplied.

Pace Analytical Services
Isotopic Thorium Analysis

Test Code	Th ISO
Matrix	SL
Batch ID	53792
Prep Start	02/7/2017 15:00
Prep Finish	02/08/17
Act. Rpt Units	pCi

Analyst	LAL
PrepSOP1	PGH-R-008
PrepSOP2	N/A
AnalSOP1	PG-R-008
AnalSOP2	N/A

	Nuclide	T1/2 (yr)	Abund.	UE1	UE2	UE3
Tracer Nuc	Th-234	6.00E-02	100.0%	12.00%	6.00%	5.45%
Analyte 1	Th-232	1.41E+10	100.0%	12.00%	6.00%	5.45%
Analyte 2	Th-230	7.70E+04	100.0%	12.00%	6.00%	5.48%
Analyte 3	Th-228	1.91E+00	100.0%	12.00%	6.00%	5.48%
Analyte 4						

Tracer ID	17-031	
Tracer Conc	0.99	dpm/mL
Tracer Vol.		mL
Tracer Ref Date		
Zero Fact.	2.71	
Sigma	1.95	

	Sample ID	Reference Date	Aliquot	Aliq. units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (adj to sample time)	Sample Time (min)	Bkg Time (min)	Net CPS	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	abnd	Act. Conv. from dpm to pCi	Fract. Remain.
5	1220339		3.5	g			Th-234				1000		See External	See External	87.36%			
1	1220339	2/7/2017 15:12	3.5	g	2/8/2017 11:14	0.2763	Th-232	0.00	0.0000	240	1000	0.000	See External	See External	87.36%	100%	2.22	1.0000
1	1220339	2/7/2017 15:12	3.5	g	2/8/2017 11:14	0.2763	Th-230	-0.68	1.6820	240	1000	0.006	See External	See External	87.36%	100%	2.22	1.0000
1	1220339	2/7/2017 15:12	3.5	g	2/8/2017 11:14	0.2763	Th-228	0.08	4.6200	240	1000	0.07	See External	See External	87.36%	100%	2.22	0.0000
1																		
2	3020485400[illegible]		0.4802	g			Th-234				1000		See External	See External	79.23%			
2	3020485400[illegible]	11/18/2016 9:58	0.4802	g	2/8/2017 11:14	0.2763	Th-232	38.27	0.2400	240	1000	0.159	See External	See External	79.23%	100%	2.22	1.0000
2	3020485400[illegible]	11/18/2016 9:58	0.4802	g	2/8/2017 11:14	0.2763	Th-230	74.80	1.2000	240	1000	0.312	See External	See External	79.23%	100%	2.22	1.0000
2	3020485400[illegible]	11/18/2016 9:58	0.4802	g	2/8/2017 11:14	0.2763	Th-228	64.19	5.2920	240	1000	0.267	See External	See External	79.23%	100%	2.22	0.9210
2																		
3	3020485400[illegible]		0.4491	g			Th-234				1000		See External	See External	79.18%			
3	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2808	Th-232	47.38	0.2400	240	1000	0.197	See External	See External	79.18%	100%	2.22	1.0000
3	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2808	Th-230	49.12	0.8400	240	1000	0.205	See External	See External	79.18%	100%	2.22	1.0000
3	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2808	Th-228	63.04	5.0114	240	1000	0.263	See External	See External	79.18%	100%	2.22	0.9210
3																		
4	3020485400[illegible]		0.4491	g			Th-234				1000		See External	See External	90.00%			
4	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2830	Th-232	56.00	0.0000	240	1000	0.233	See External	See External	90.00%	100%	2.22	1.0000
4	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2830	Th-230	717.00	1.4400	240	1000	2.988	See External	See External	90.00%	100%	2.22	1.0000
4	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2830	Th-228	60.00	5.0031	240	1000	0.250	See External	See External	90.00%	100%	2.22	0.9210
4																		
5	3020485400[illegible]		0.4491	g			Th-234				1000		See External	See External	82.25%			
5	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2857	Th-232	52.50	0.2400	240	1000	0.219	See External	See External	82.25%	100%	2.22	1.0000
5	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2857	Th-230	734.51	1.7900	240	1000	3.185	See External	See External	82.25%	100%	2.22	1.0000
5	3020485400[illegible]	11/18/2016 9:55	0.4491	g	2/8/2017 11:14	0.2857	Th-228	52.40	4.9854	240	1000	0.218	See External	See External	82.25%	100%	2.22	0.9210
5																		
6	3020485400[illegible]		0.4719	g			Th-234				1000		See External	See External	78.71%			
6	3020485400[illegible]	11/18/2016 9:50	0.4719	g	2/8/2017 11:14	0.2897	Th-232	64.02	0.3000	240	1000	0.267	See External	See External	78.71%	100%	2.22	1.0000
6	3020485400[illegible]	11/18/2016 9:50	0.4719	g	2/8/2017 11:14	0.2897	Th-230	58.08	2.0667	240	1000	0.242	See External	See External	78.71%	100%	2.22	1.0000
6	3020485400[illegible]	11/18/2016 9:50	0.4719	g	2/8/2017 11:14	0.2897	Th-228	82.20	3.0000	240	1000	0.343	See External	See External	78.71%	100%	2.22	0.9210
6																		

Uncorr	1.96 Sigma Cnt Uncert.	Tcrtrunc	Uncalibr	TPU U21	TPU U22	TPU U23	TPU	MDC	act	1.96 sigma CSU	rnlc	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Gross CPM	Blk CPM
						5.49%								1223335	1		#N/A	#N/A	#VALUE!	#DIV/0!
0.268834	0.000000	0.055159	0.055159	12.00%	6.00%	5.49%	0.0556	0.1418	0.0000	0.0555	0.0410	pCi/g	0.3000	1223335	1	Det 25	12/27/2016 13:48	2/1/2017 13:55	0.0000	0.0000
0.268834	0.056643	0.055159	0.056643	12.00%	6.00%	5.49%	0.0555	0.1369	-0.0105	0.0555	0.1049	pCi/g	0.3000	1223335	1	Det 25	12/27/2016 13:48	2/1/2017 13:55	0.0047	0.0073
0.268875	0.055541	0.055517	0.055541	12.00%	6.00%	5.49%	0.1002	0.1905	0.0784	0.1003	0.1993	pCi/g	0.3000	1223335	1	Det 25	12/27/2016 13:48	2/1/2017 13:55	0.0404	0.0107
						5.49%								3020465400	2		#N/A	#N/A	#VALUE!	#DIV/0!
0.238000	0.212371	0.062601	0.212371	12.00%	6.00%	5.49%	0.2374	0.0670	0.8077	0.2374	0.0870	pCi/g	0.0157	3020465400	2	Det 27	6/8/2016 8:44	2/1/2017 13:55	0.1004	0.0010
0.238000	0.298703	0.062601	0.298703	12.00%	6.00%	5.49%	0.3535	0.1767	1.3051	0.3535	0.1357	pCi/g	0.0551	3020465400	2	Det 27	6/8/2016 8:44	2/1/2017 13:55	0.3101	0.0050
0.238000	0.312032	0.062601	0.312032	12.00%	6.00%	5.49%	0.3558	0.2236	1.2150	0.3558	0.2535	pCi/g	0.0799	3020465400	2	Det 27	6/8/2016 8:44	2/1/2017 13:55	0.2666	0.0029
															2					
						5.49%								3020465400	3		#N/A	#N/A	#VALUE!	#DIV/0!
0.229357	0.245850	0.055272	0.245850	12.00%	6.00%	5.49%	0.2515	0.0535	0.8607	0.2515	0.0806	pCi/g	0.0184	3020465400	3	Det 26	6/8/2016 8:47	2/1/2017 13:59	0.1584	0.0010
0.229357	0.252310	0.055272	0.252310	12.00%	6.00%	5.49%	0.2601	0.1205	0.8923	0.2601	0.1295	pCi/g	0.0313	3020465400	3	Det 26	6/8/2016 8:47	2/1/2017 13:59	0.2083	0.0037
0.211427	0.323526	0.074389	0.323526	12.00%	6.00%	5.49%	0.3404	0.2593	1.2601	0.3401	0.2585	pCi/g	0.0811	3020465400	3	Det 26	6/8/2016 8:47	2/1/2017 13:59	0.2273	0.0096
															3					
						5.49%								3020465400	4		#N/A	#N/A	#VALUE!	#DIV/0!
0.266826	0.240402	0.055535	0.240402	12.00%	6.00%	5.49%	0.2016	0.0442	0.9034	0.2016	0.0442	pCi/g	0.0330	3020465400	4	Det 31	3/9/2016 10:21	2/1/2017 13:59	0.2591	0.0097
0.266826	0.256523	0.055535	0.256523	12.00%	6.00%	5.49%	2.0439	0.1361	11.6878	2.0439	0.1361	pCi/g	0.0359	3020465400	4	Det 31	3/9/2016 10:21	2/1/2017 13:59	2.0937	0.0060
0.266846	0.282262	0.055551	0.282262	12.00%	6.00%	5.49%	0.3288	0.2328	1.0920	0.3288	0.2328	pCi/g	0.0731	3020465400	4	Det 31	3/9/2016 10:21	2/1/2017 13:59	0.2410	0.0211
															4					
						5.49%								3020465400	5		#N/A	#N/A	#VALUE!	#DIV/0!
0.255626	0.228591	0.057662	0.228591	12.00%	6.00%	5.49%	0.2350	0.0607	0.8434	0.2350	0.0601	pCi/g	0.0144	3020465400	5	Det 32	12/2/2016 14:55	2/1/2017 13:59	0.2209	0.0015
0.255626	0.973790	0.057662	0.973790	12.00%	6.00%	5.49%	2.1350	0.2228	12.7694	2.1350	0.2228	pCi/g	0.0776	3020465400	5	Det 32	12/2/2016 14:55	2/1/2017 13:59	3.2094	0.0345
0.255626	0.260803	0.057662	0.260803	12.00%	6.00%	5.49%	0.2361	0.2281	0.5173	0.2361	0.2281	pCi/g	0.0793	3020465400	5	Det 32	12/2/2016 14:55	2/1/2017 13:59	0.2367	0.0224
															5					
						5.49%								3020465400	6		#N/A	#N/A	#VALUE!	#DIV/0!
0.243329	0.206200	0.057777	0.206200	12.00%	6.00%	5.49%	0.3161	0.0456	1.0850	0.3161	0.0456	pCi/g	0.0000	3020465400	6	Det 33	6/8/2016 12:10	2/1/2017 13:59	0.3669	0.0000
0.243329	0.200947	0.057777	0.200947	12.00%	6.00%	5.49%	0.3054	0.1653	0.9846	0.3054	0.1653	pCi/g	0.0472	3020465400	6	Det 33	6/8/2016 12:10	2/1/2017 13:59	0.2213	0.0006
0.277094	0.222382	0.066951	0.222382	12.00%	6.00%	5.49%	0.4105	0.1975	1.5085	0.4105	0.1975	pCi/g	0.0564	3020465400	6	Det 33	6/8/2016 12:10	2/1/2017 13:59	0.3550	0.0125
															6					

Pace Analytical Services
Isotopic Thorium Analysis

Test Code: Th ISO	Analyst: LAL		Nuclide	Th-234	Abund.	UE1	UE2	UE3	Tracer ID	17-001	
Matrix: S	PrepSOP1: PGI R 008	Tracer Nuc	Th-234	6.60E-07	100.0%	12.00%	5.00%	8.49%	Tracer Conc	-	dpm/mL
Batch ID: 32702	PrepSOP2: N/A	Analyte 1	Th-232	1.41E+10	100.0%	12.00%	5.00%	8.49%	Tracer Vol.	0.20	mL
Prep Start: 2/8/2017 10:00	AnalSOP1: PGI R 009	Analyte 2	Th-230	7.70E+04	100.0%	12.00%	5.00%	8.49%	Tracer Ref Date	-	
Prep Finish: 0/00/00	AnalSOP2: N/A	Analyte 3	Th-228	1.91E+00	100.0%	12.00%	5.00%	8.49%	Zero Fact.	2.71	
Act. Rpt Units: pCi		Analyte 4							Sigma	1.96	

	Sample ID	Reference Date	Aliquot	Aliq. Units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (ref to sample time)	Sample Time (min)	Bkg Time (min)	Net CPS	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	sbrd	Act. Conv. From dpm to pCi	Front. Resolu.
7	30204854006		0.4653	g			Th-234				1000		See External	See External	69.20%			
7	30204854006	11/18/2016 9:45	0.4652	g	2/8/2017 11:14	0.2987	Th-232	35.09	0.2400	240	1000	0.351	See External	See External	69.20%	100%	2.22	1.0000
7	30204854006	11/18/2016 9:45	0.4652	g	2/8/2017 11:14	0.2987	Th-230	71.50	1.2000	240	1000	0.299	See External	See External	69.20%	100%	2.22	1.0000
7	30204854006	11/18/2016 9:45	0.4652	g	2/8/2017 11:14	0.2987	Th-228	60.55	7.4500	240	1000	0.252	See External	See External	69.20%	100%	2.22	0.9219
7																		
8	30204854007		0.4629	g			Th-234				1000		See External	See External	77.97%			
8	30204854007	11/18/2016 10:40	0.4629	g	2/8/2017 11:14	0.2981	Th-232	127.27	0.4800	240	1000	0.530	See External	See External	77.97%	100%	2.22	1.0000
8	30204854007	11/18/2016 10:40	0.4629	g	2/8/2017 11:14	0.2981	Th-230	40.56	4.3200	240	1000	0.207	See External	See External	77.97%	100%	2.22	1.0000
8	30204854007	11/18/2016 10:40	0.4629	g	2/8/2017 11:14	0.2981	Th-228	273.40	2.5575	240	1000	0.614	See External	See External	77.97%	100%	2.22	0.9219
8																		
9	30204854008		0.4479	g			Th-234				1000		See External	See External	75.66%			
9	30204854008	11/18/2016 10:35	0.4479	g	2/8/2017 11:14	0.2905	Th-232	29.75	0.4800	240	1000	0.156	See External	See External	75.66%	100%	2.22	1.0000
9	30204854008	11/18/2016 10:35	0.4479	g	2/8/2017 11:14	0.2905	Th-230	86.58	1.4400	240	1000	0.379	See External	See External	75.66%	100%	2.22	1.0000
9	30204854008	11/18/2016 10:35	0.4479	g	2/8/2017 11:14	0.2905	Th-228	54.52	0.4750	240	1000	0.237	See External	See External	75.66%	100%	2.22	0.9219
9																		
10	30204854009		0.441	g			Th-234				1000		See External	See External	86.79%			
10	30204854009	11/18/2016 10:30	0.441	g	2/8/2017 11:14	0.2716	Th-232	120.24	0.4800	240	1000	0.501	See External	See External	86.79%	100%	2.22	1.0000
10	30204854009	11/18/2016 10:30	0.441	g	2/8/2017 11:14	0.2716	Th-230	83.60	2.4000	240	1000	0.348	See External	See External	86.79%	100%	2.22	1.0000
10	30204854009	11/18/2016 10:30	0.441	g	2/8/2017 11:14	0.2716	Th-228	97.83	0.8625	240	1000	0.407	See External	See External	86.79%	100%	2.22	0.9219
10																		
11	30204854010		0.4524	g			Th-234				1000		See External	See External	90.31%			
11	30204854010	11/18/2016 10:20	0.4524	g	2/8/2017 5:21	0.2783	Th-232	80.39	0.5500	240	1000	0.335	See External	See External	90.31%	100%	2.22	1.0000
11	30204854010	11/18/2016 10:20	0.4524	g	2/8/2017 5:21	0.2783	Th-230	83.39	1.6500	240	1000	0.346	See External	See External	90.31%	100%	2.22	1.0000
11	30204854010	11/18/2016 10:20	0.4524	g	2/8/2017 5:21	0.2783	Th-228	85.40	4.6200	240	1000	0.355	See External	See External	90.31%	100%	2.22	0.9219
11																		
12	30204854011		0.4513	g			Th-234				1000		See External	See External	78.61%			
12	30204854011	11/18/2016 11:25	0.4513	g	2/8/2017 5:21	0.2863	Th-232	273.22	0.2400	240	1000	1.555	See External	See External	78.61%	100%	2.22	1.0000
12	30204854011	11/18/2016 11:25	0.4513	g	2/8/2017 5:21	0.2863	Th-230	371.80	1.2000	240	1000	1.546	See External	See External	78.61%	100%	2.22	1.0000
12	30204854011	11/18/2016 11:25	0.4513	g	2/8/2017 5:21	0.2863	Th-228	377.14	0.2829	240	1000	1.571	See External	See External	78.61%	100%	2.22	0.9219
12																		

density	1.96 Sigma Cnt Uncert	zerocnt	tecount	TPU 1/E1	TPU 1/E2	TPU 1/E3	TPU	MDC	act	1.96 sigma CSU	Indc	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Grams CPM	Blkg CPM
						8.49%								3020485-0038	7		#N/A	#N/A	#VALUE!	#DIV/0!
0.222850	0.338515	0.067176	0.338515	12.00%	6.00%	8.49%	0.4223	0.0633	1.5090	0.4223	0.0003	pCi/g	0.0165	3020485-0038	7	Det 34	6/8/2016 10:25	2/1/2017 13:59	0.3555	0.0010
0.222850	0.313725	0.067176	0.313725	12.00%	6.00%	8.49%	0.3790	0.1468	1.3425	0.3790	0.1458	pCi/g	0.3578	3020485-0038	7	Det 34	6/8/2016 10:25	2/1/2017 13:59	0.3042	0.0050
0.205427	0.332107	0.072876	0.332107	12.00%	6.00%	8.49%	0.3951	0.3174	1.2201	0.3951	0.3175	pCi/g	0.1017	3020485-0038	7	Det 34	6/8/2016 10:25	2/1/2017 13:59	0.2853	0.0311
															7					
						8.49%								3020485-0037	8		#N/A	#N/A	#VALUE!	#DIV/0!
0.227502	0.405610	0.066834	0.405610	12.00%	6.00%	8.49%	0.5460	0.1093	2.3310	0.5460	0.1086	pCi/g	0.0733	3020485-0037	8	Det 35	6/8/2016 10:31	2/1/2017 13:59	0.5377	0.0020
0.227502	0.262210	0.066834	0.262210	12.00%	6.00%	8.49%	0.3080	0.2239	0.9399	0.3080	0.2235	pCi/g	0.0658	3020485-0037	8	Det 35	6/8/2016 10:31	2/1/2017 13:59	0.2200	0.0130
0.208724	0.438102	0.071383	0.438102	12.00%	6.00%	8.49%	0.5261	0.2527	2.4517	0.5261	0.2527	pCi/g	0.0580	3020485-0037	8	Det 35	6/8/2016 10:31	2/1/2017 13:59	0.5255	0.0109
															9					
						8.49%								3020485-0036	9		#N/A	#N/A	#VALUE!	#DIV/0!
0.202020	0.329024	0.079665	0.329024	12.00%	6.00%	8.49%	0.3870	0.1720	0.0175	0.3870	0.1720	pCi/g	0.0432	3020485-0036	9	Det 37	6/8/2016 12:14	2/1/2017 13:59	0.3575	0.0020
0.202020	0.345215	0.079665	0.345215	12.00%	6.00%	8.49%	0.4059	0.1706	1.0417	0.4059	0.1706	pCi/g	0.0453	3020485-0036	9	Det 37	6/8/2016 12:14	2/1/2017 13:59	0.3792	0.0060
0.199700	0.345805	0.080148	0.345805	12.00%	6.00%	8.49%	0.3931	0.3245	1.2182	0.3931	0.3245	pCi/g	0.1045	3020485-0036	9	Det 37	6/8/2016 12:14	2/1/2017 13:59	0.2542	0.0210
															9					
						8.49%								3020485-0035	10		#N/A	#N/A	#VALUE!	#DIV/0!
0.200745	0.381026	0.064873	0.381026	12.00%	6.00%	8.49%	0.4196	0.1071	2.1713	0.4196	0.1071	pCi/g	0.0730	3020485-0035	10	Det 38	6/8/2016 12:17	2/1/2017 13:59	0.3920	0.0020
0.200745	0.322559	0.064873	0.322559	12.00%	6.00%	8.49%	0.3578	0.1790	1.4554	0.3578	0.1790	pCi/g	0.0614	3020485-0035	10	Det 38	6/8/2016 12:17	2/1/2017 13:59	0.3466	0.0100
0.212713	0.384524	0.070250	0.384524	12.00%	6.00%	8.49%	0.4810	0.2759	1.8196	0.4810	0.2759	pCi/g	0.0880	3020485-0035	10	Det 38	6/8/2016 12:17	2/1/2017 13:59	0.4110	0.0249
															10					
						8.49%								3020485-0010	11		#N/A	#N/A	#VALUE!	#DIV/0!
0.224457	0.332190	0.066885	0.332190	12.00%	6.00%	8.49%	0.4132	0.0503	1.5417	0.4132	0.0503	pCi/g	0.0330	3020485-0010	11	Det 26	12/2/2016 12:40	2/1/2017 13:59	0.3874	0.0030
0.224457	0.303233	0.066885	0.303233	12.00%	6.00%	8.49%	0.3555	0.1622	1.2080	0.3555	0.1622	pCi/g	0.0442	3020485-0010	11	Det 26	12/2/2016 12:40	2/1/2017 13:59	0.3517	0.0070
0.208787	0.340157	0.072953	0.340157	12.00%	6.00%	8.49%	0.4046	0.2550	1.3794	0.4046	0.2550	pCi/g	0.0796	3020485-0010	11	Det 26	12/2/2016 12:40	2/1/2017 13:59	0.3945	0.0160
															11					
						8.49%								3020485-0011	12		#N/A	#N/A	#VALUE!	#DIV/0!
0.225021	0.898558	0.066363	0.898558	12.00%	6.00%	8.49%	1.2988	0.0971	6.8024	1.2988	0.0971	pCi/g	0.0188	3020485-0011	12	Det 27	6/8/2016 5:44	2/1/2017 13:59	1.3561	0.0010
0.225021	0.898338	0.066363	0.898338	12.00%	6.00%	8.49%	1.2952	0.1441	6.8007	1.2952	0.1440	pCi/g	0.0372	3020485-0011	12	Det 27	6/8/2016 5:44	2/1/2017 13:59	1.3542	0.0050
0.207841	0.768375	0.072078	0.768375	12.00%	6.00%	8.49%	1.4260	0.2300	7.2667	1.4260	0.2298	pCi/g	0.0847	3020485-0011	12	Det 27	6/8/2016 5:44	2/1/2017 13:59	1.5004	0.0210
															12					

Pace Analytical Services
Isotopic Thorium Analysis

Test Code	Th ISO
Matrix	Ss
Batch ID	23791
Prep Start	2/10/2017 10:00
Prep Finish	2/10/2017 [illegible]
Act. Rpt Units	pCi

Analyst	LA
PrepSOP1	PGH-R-001
PrepSOP2	N/A
AnalSOP1	PGH-R-001
AnalSOP2	N/A

	Nuclide	T1/2 (y)	Abund.	UE1	UE2	UE3
Tracer Std.	Th-234	6.00E-02	100.0%	12.00%	6.00%	8.46%
Analyte 1	Th-232	1.41E+10	100.0%	12.00%	6.00%	8.49%
Analyte 2	Th-230	7.70E+04	100.0%	12.00%	6.00%	9.46%
Analyte 3	Th-228	1.91E+00	100.0%	12.00%	6.00%	9.46%
Analyte 4						

Tracer ID	17-331
Tracer Conc.	- dpm/ml
Tracer Vol.	0.20 mL
Tracer Ref Date	
Zero Fact.	2.77
Sigma	1.96

	Sample ID	Reference Date	Aliquot	Aliq. Units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (est to sample time)	Sample Time (min)	Bkg Time (min)	Net CPM	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	abnd	Act. Conv. Fmu dpm to pCi	Frac. Remain.
13	3020485401J		0.451	g			Th-234				1000		See External	See External	76.59%			
13	3020485401J	11/16/2016 11:22	0.451	g	2/9/2017 5:21	0.2906	Th-232	277.24	0.2430	240	1000	[illegible]	See External	See External	76.59%	100%	2.22	1.0000
13	3020485401J	11/16/2016 11:22	0.451	g	2/9/2017 5:21	0.2906	Th-230	32.12	0.8311	240	1000	0.262	See External	See External	76.59%	100%	2.22	1.0000
13	3020485401J	11/16/2016 11:22	0.451	g	2/9/2017 5:21	0.2906	Th-228	234.32	5.0114	240	1000	[illegible]	See External	See External	76.59%	100%	2.22	0.9212
13																		
14	3020485401G		0.462	g			Th-234				1000		See External	See External	81.62%			
14	3020485401G	11/16/2016 11:18	0.462	g	2/9/2017 5:21	0.2830	Th-232	94.96	0.0000	240	1000	0.346	See External	See External	81.62%	100%	2.22	1.0000
14	3020485401G	11/16/2016 11:18	0.462	g	2/9/2017 5:21	0.2830	Th-230	51.56	1.1400	240	1000	0.215	See External	See External	81.62%	100%	2.22	1.0000
14	3020485401G	11/16/2016 11:18	0.462	g	2/9/2017 5:21	0.2830	Th-228	154.14	5.0561	240	1000	0.636	See External	See External	81.62%	100%	2.22	0.9212
14																		
15	3020485401H		0.4752	g			Th-234				1000		See External	See External	80.26%			
15	3020485401H	11/16/2016 11:15	0.4752	g	2/9/2017 5:21	0.2867	Th-232	98.44	0.2430	240	1000	0.402	See External	See External	80.26%	100%	2.22	1.0000
15	3020485401H	11/16/2016 11:15	0.4752	g	2/9/2017 5:21	0.2867	Th-230	58.55	1.1400	240	1000	0.244	See External	See External	80.26%	100%	2.22	1.0000
15	3020485401H	11/16/2016 11:15	0.4752	g	2/9/2017 5:21	0.2867	Th-228	116.02	4.9614	240	1000	0.483	See External	See External	80.26%	100%	2.22	0.9212
15																		
16	3020485401I		0.4667	g			Th-234				1000		See External	See External	100.54%			
16	3020485401I	11/16/2016 12:30	0.4667	g	2/9/2017 5:21	0.2867	Th-232	1193.34	0.0000	64.05	1000	18.631	See External	See External	100.54%	100%	2.22	1.0000
16	3020485401I	11/16/2016 12:30	0.4667	g	2/9/2017 5:21	0.2867	Th-230	224.04	0.6150	64.05	1000	3.498	See External	See External	100.54%	100%	2.22	1.0000
16	3020485401I	11/16/2016 12:30	0.4667	g	2/9/2017 5:21	0.2867	Th-228	1311.40	5.6208	64.05	1000	20.476	See External	See External	100.54%	100%	2.22	0.9212
16																		
17	3020485401J		0.4674	g			Th-234				1000		See External	See External	105.26%			
17	3020485401J	11/16/2016 12:25	0.4674	g	2/9/2017 5:21	0.2867	Th-232	941.76	0.0643	64.32283246	1000	14.641	See External	See External	105.26%	100%	2.22	1.0000
17	3020485401J	11/16/2016 12:25	0.4674	g	2/9/2017 5:21	0.2867	Th-230	147.98	0.3215	64.32283246	1000	2.296	See External	See External	105.26%	100%	2.22	1.0000
17	3020485401J	11/16/2016 12:25	0.4674	g	2/9/2017 5:21	0.2867	Th-228	1030.08	1.3973	64.32283246	1000	16.011	See External	See External	105.26%	100%	2.22	0.9212
17																		
18	3020485401K		0.4701	g			Th-234				1000		See External	See External	78.51%			
18	3020485401K	11/16/2016 12:22	0.4701	g	2/9/2017 5:21	0.2861	Th-232	359.61	0.1190	64.5	1000	5.575	See External	See External	78.51%	100%	2.22	1.0000
18	3020485401K	11/16/2016 12:22	0.4701	g	2/9/2017 5:21	0.2861	Th-230	70.75	1.1910	64.5	1000	1.097	See External	See External	78.51%	100%	2.22	1.0000
18	3020485401K	11/16/2016 12:22	0.4701	g	2/9/2017 5:21	0.2861	Th-228	389.59	5.6821	64.5	1000	5.420	See External	See External	78.51%	100%	2.22	0.9212
18																		

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Pace Analytical Services
Isotopic Thorium Analysis

dilution	1.96 Sigma Cnt Uncert.	2sd error	uncertainty	TPU UE1	TPU UE2	TPU UE3	TPU	MDC	act	1.96 sigma (cts)	mdc	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Gross CPM	Bkg CPM
						8.49%								3020485401[illegible]	13		#N/A	#N/A	#VALUE!	#DIV/0!
0.225656	0.808152	0.089947	0.808152	12.00%	0.00%	8.49%	1.0205	0.3929	5.1618	4.0765	0.0928	pCi/g	0.0120	3020485401[illegible]	13	Det 25	6/8/2016 8:47	2/1/2017 13:59	1.1556	0.0110
0.225656	0.292925	0.066842	0.292925	12.00%	0.00%	8.49%	0.5471	0.1316	1.1700	0.3471	0.0318	pCi/g	0.0224	3020485401[illegible]	13	Det 25	6/8/2016 8:47	2/1/2017 13:59	0.2317	0.0227
0.209011	0.397914	0.072069	0.397914	12.00%	0.00%	8.49%	1.1773	0.2864	5.9649	1.1765	0.2864	pCi/g	0.0932	3020485401[illegible]	13	Det 25	6/8/2016 8:47	2/1/2017 13:59	1.2137	0.0289
															13					
						8.49%								3020495301[illegible]	14		#N/A	#N/A	#VALUE!	#DIV/0!
0.239989	0.534378	0.062301	0.534378	12.00%	6.00%	8.49%	0.4280	0.0474	5.6625	0.4280	0.0474	pCi/g	0.0000	3020495301[illegible]	14	Det 31	6/8/2016 13:21	2/1/2017 13:59	0.3957	0.0000
0.239334	0.250617	0.062301	0.250617	12.00%	6.00%	8.49%	0.2087	0.0474	0.9026	0.2087	0.1451	pCi/g	0.0553	3020495301[illegible]	14	Det 31	6/8/2016 13:21	2/1/2017 13:59	0.2708	0.0050
0.219247	0.375110	0.066282	0.375110	12.00%	6.00%	8.49%	0.3221	0.2552	1.6861	0.4724	0.2552	pCi/g	0.0755	3020495301[illegible]	14	Det 31	6/8/2016 13:21	2/1/2017 13:59	0.4175	0.1211
															14					
						8.49%								3020485401[illegible]	15		#N/A	#N/A	#VALUE!	#DIV/0!
0.242266	0.331505	0.061785	0.331505	12.00%	0.00%	8.49%	0.4234	0.0553	1.0584	0.4234	0.0553	pCi/g	0.0125	3020485401[illegible]	15	Det 32	12/2/2016 14:55	2/1/2017 13:59	0.4230	0.0010
0.242266	0.273106	0.061756	0.273106	12.00%	0.00%	8.49%	0.3486	0.3355	1.0009	0.3486	0.2346	pCi/g	0.0750	3020485401[illegible]	15	Det 32	12/2/2016 14:55	2/1/2017 13:59	0.2880	0.0240
0.225202	0.407558	0.067072	0.407558	12.00%	0.00%	8.49%	0.5371	0.2425	2.2051	0.5371	0.2425	pCi/g	0.0150	3020485401[illegible]	15	Det 32	12/2/2016 14:55	2/1/2017 13:59	0.5121	0.0204
															15					
						8.49%								3020485401[illegible]	16		#N/A	#N/A	#VALUE!	#DIV/0!
0.328748	3.205881	0.167561	3.205881	12.00%	6.00%	8.49%	6.5288	0.1783	66.5037	6.5288	0.1783	pCi/g	0.0000	3020485401[illegible]	16	Det 33	6/8/2016 12:10	2/1/2017 13:59	18.5313	0.0000
0.328735	1.391121	0.167561	1.391121	12.00%	6.00%	8.49%	2.1845	0.3010	18.6562	2.1845	0.3010	pCi/g	0.0832	3020485401[illegible]	16	Det 33	6/8/2016 12:10	2/1/2017 13:59	3.5375	0.0096
0.303797	2.649287	0.171066	2.649287	12.00%	6.00%	8.49%	11.3083	0.3521	67.4026	11.3083	0.3521	pCi/g	0.0753	3020485401[illegible]	16	Det 33	6/8/2016 12:10	2/1/2017 13:59	23.4972	0.0125
															16					
						8.49%								3020485401[illegible]	17		#N/A	#N/A	#VALUE!	#DIV/0!
0.318226	2.929391	0.162111	2.929391	12.00%	6.00%	8.49%	7.5490	0.1596	45.8644	7.5490	0.1596	pCi/g	0.0210	3020485401[illegible]	17	Det 34	6/8/2016 10:25	2/1/2017 13:59	14.6472	0.0113
0.318227	1.139973	0.162111	1.139973	12.00%	6.00%	8.49%	1.6278	0.2604	7.1877	1.6278	0.2604	pCi/g	0.0470	3020485401[illegible]	17	Det 34	6/8/2016 10:25	2/1/2017 13:59	2.2686	0.0060
0.334082	3.329365	0.172972	3.329365	12.00%	6.00%	8.49%	9.2947	0.4907	54.4558	9.2947	0.4907	pCi/g	0.1272	3020485401[illegible]	17	Det 34	6/8/2016 10:25	2/1/2017 13:59	16.0466	0.0311
															17					
						8.49%								3020485401[illegible]	18		#N/A	#N/A	#VALUE!	#DIV/0!
0.334465	2.456093	0.220147	2.456093	12.00%	6.00%	8.49%	4.5077	0.5887	23.7843	4.5077	0.5887	pCi/g	0.0404	3020485401[illegible]	18	Det 35	6/8/2016 10:37	2/1/2017 13:59	5.5935	0.0070
0.334444	1.099648	0.220148	1.099648	12.00%	6.00%	8.49%	1.3268	0.5105	4.8772	1.3268	0.5105	pCi/g	0.1215	3020485401[illegible]	18	Det 35	6/8/2016 10:37	2/1/2017 13:59	1.1115	0.0186
0.218977	2.707558	0.238971	2.707558	12.00%	6.00%	8.49%	5.0075	0.4734	76.5300	5.0075	0.4734	pCi/g	0.1021	3020485401[illegible]	18	Det 35	6/8/2016 10:37	2/1/2017 13:59	5.7739	0.0108
															18					

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As initial (PC99-2 15Oct2016).xls

Pace Analytical Services
Isotopic Thorium Analysis

Test Code	Th_SO	Analyst	AL		Nuclide	t1/2 (y)	Abund.	UE1	UE2	UE3	Tracer ID	17-001	
Matrix	SL	PrepSOP1	HSH-R-036	Tracer Nuc	Th-229	6.60E-02	100.0%	12.00%	6.00%	8.49%	Tracer Conc	-	dpm/mL
Batch ID	35792	PrepSOP2	N/A	Analyte 1	Th-230	7.41E+04	100.0%	12.00%	6.00%	8.49%	Tracer Vol.	0.20	mL
Prep Start	2/1/2017 15:00	AnalSOP1	HSH-R-036	Analyte 2	Th-232	7.70E+04	100.0%	12.00%	6.00%	8.49%	Tracer Ref Date	-	
Prep Finish	2/2/2017	AnalSOP2	N/A	Analyte 3	Th-228	1.91E+00	100.0%	12.00%	6.00%	8.49%	Zero Fact.	2.71	
Act. Rpt Units	pCi			Analyte 4							Slope	1.00	

	Sample ID	Reference Date	Aliquot	Alq. Units	Count Date	Det. Eff. (cpm/dpm)	Nuclide	Peak Net Cts	Bkg Cts (ref to sample time)	Sample Time (min)	Bkg Time (min)	Net CPM	Tracer DPM Expected	Tracer DPM Recovered	Chemical Yield	sfund	Act. Conv. From dpm/dr pCi	Fract Recovery
19	30204824018		0.4399	g			Th-234				1000		See External	See External	112.73%			
19	30204824018	11/18/2016 12:20	0.4399	g	2/8/2017 5:21	0.2895	Th-232	1130.20	0.1233	64.85	1000	15.333	See External	See External	112.73%	100%	5.22	1.0000
19	30204824018	11/18/2016 12:20	0.4399	g	2/8/2017 5:21	0.2895	Th-230	243.37	0.3879	64.85	1000	3.753	See External	See External	112.73%	100%	5.22	1.0000
19	30204824018	11/18/2016 12:20	0.4399	g	2/8/2017 5:21	0.2895	Th-228	1373.58	1.7452	64.85	1000	21.339	See External	See External	112.73%	100%	5.22	0.9[illegible]
19																		
20	LCS33792		0.5	g			Th-234				1000		See External	See External	66.10%			
20	LCS33792	2/8/2017 15:22	0.5	g	2/8/2017 5:21	0.2713	Th-232	[illegible]	0.4300	240	1000	0.071	See External	See External	66.10%	100%	5.22	1.0000
20	LCS33792	2/8/2017 15:22	0.5	g	2/8/2017 5:21	0.2713	Th-230	300.40	2.4500	240	1000	1.254	See External	See External	66.10%	100%	5.22	1.0000
20	LCS33792	2/8/2017 15:22	0.5	g	2/8/2017 5:21	0.2713	Th-228	11.54	3.0842	240	1000	0.048	See External	See External	66.10%	100%	5.22	0.9884
20																		
21	LCSD33792		0.5	g			Th-234				1000		See External	See External	53.14%			
21	LCSD33792	2/8/2017 15:22	0.5	g	2/8/2017 5:21	0.2972	Th-232	7.76	0.2400	240	1000	0.032	See External	See External	53.14%	100%	5.22	1.0000
21	LCSD33792	2/8/2017 15:22	0.5	g	2/8/2017 5:21	0.2972	Th-230	370.48	3.5850	240	1000	1.544	See External	See External	53.14%	100%	5.22	1.0000
21	LCSD33792	2/8/2017 15:22	0.5	g	2/8/2017 5:21	0.2972	Th-228	12.21	3.6351	240	1000	0.051	See External	See External	53.14%	100%	5.22	0.9991
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dpm/sm	1.96 Sigma Cnt Uncert.	zerouac	uamin	TPU UE1	TPU UE2	TPU UE3	TPU	MDC	sct	1.96 sigma CSU	mde	Units	Critical Limit	Sample ID		Det ID	Efficiency Cal Date	Background Date	Sample Gross CPM	Bkg CPM
						8.49%								3020135401B	18		#N/A	#N/A	#VALUE!	#DIV/0!
0.313191	0.204942	0.189014	0.304949	12.00%	6.00%	8.49%	0.5665	0.2165	58.1907	0.5665	0.2165	pCi/g	0.3335	3020135401B	19	Det 87	6/8/2018 12:14	2/1/2017 13:56	15.3315	0.0033
0.313191	1.526845	0.189010	1.526845	12.00%	6.00%	8.49%	2.4603	0.2728	12.1506	2.4603	0.2728	pCi/g	0.0520	3020135401B	19	Det 87	6/8/2018 12:14	2/1/2017 13:56	3.7750	0.0080
0.265757	0.843243	0.160710	0.843243	12.00%	6.00%	8.49%	12.4547	0.4792	74.6760	12.4547	0.4792	pCi/g	0.1217	3020135401B	19	Det 87	6/8/2018 12:14	2/1/2017 13:56	21.0066	0.0270
															19					
						8.49%								1C833792	20		#N/A	#N/A	#VALUE!	#DIV/0!
0.265856	0.111237	0.058377	0.111237	12.00%	6.00%	8.49%	0.1155	0.0230	0.1983	0.1155	0.0230	pCi/g	0.0100	1C833792	20	Det 36	6/8/2018 12:17	2/1/2017 13:58	0.0547	0.0020
0.265856	0.537761	0.058332	0.537761	12.00%	6.00%	8.49%	0.9270	0.1554	4.7559	0.9270	0.1554	pCi/g	0.0470	1C833792	20	Det 36	6/8/2018 12:17	2/1/2017 13:58	1.2747	0.0100
0.265856	0.134014	0.058354	0.134014	12.00%	6.00%	8.49%	0.1875	0.2209	0.1875	0.1875	0.2209	pCi/g	0.0705	1C833792	20	Det 36	6/8/2018 12:17	2/1/2017 13:58	0.0734	0.0245
															20					
						8.49%								1C1D33792	21		#N/A	#N/A	#VALUE!	#DIV/0!
0.377550	0.070687	0.045645	0.070687	12.00%	6.00%	8.49%	0.0724	0.0134	0.0906	0.0724	0.0134	pCi/g	0.0114	1C1D33792	21	Det 38	6/8/2018 12:20	2/1/2017 13:59	0.0333	0.0013
0.377550	0.151999	0.045645	0.151999	12.00%	6.00%	8.49%	0.3095	0.1427	4.7070	0.8853	0.1427	pCi/g	0.0473	1C1D33792	21	Det 38	6/8/2018 12:20	2/1/2017 13:59	1.5576	0.0143
0.377751	0.109134	0.045675	0.109134	12.00%	6.00%	8.49%	0.1001	0.0518	0.1559	0.1001	0.0518	pCi/g	0.0484	1C1D33792	21	Det 38	6/8/2018 12:20	2/1/2017 13:59	0.0375	0.0194
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Pace Analytical Services
Isotopic Thorium Analysis

Test Code Th ISO
Matrix SL
Batch ID (ALR) 33792
Prep Start 2/1/2017 16:00
Prep Finish 02/09/17

Analyst JAL
PrepSOP1 PGH-R-003
PrepSOP2 N/A
AnalSOP1 PGH-R-003
AnalSOP2 N/A

Yield Acceptance Criteria
Upper 110%
Lower 30%
With Permission [illegible]

	Sample ID	Th-232 Activity	Th-232 1.96 sigma CSU	Th-232 MDC	Th-230 Activity	Th-230 1.96 sigma CSU	Th-230 MDC	Th-228 Activity	Th-228 1.96 sigma CSU	Th-228 MDC				Units	Chemical Yield	Date Analyzed	
1	1220306	0.000	0.055	0.042	-0.010	0.055	0.135	0.078	0.100	0.196					87.30%	2/9/2017	1
2	30204854001	0.668	0.237	0.087	1.31	0.364	0.136	1.22	0.367	0.254					73.23%	2/8/2017	2
3	30204854002	0.861	0.281	0.091	0.892	0.289	0.129	1.26	0.380	0.258					79.16%	2/8/2017	3
4	30204854003	0.923	0.282	0.044	11.7	2.04	0.135	1.06	0.323	0.233					90.80%	2/8/2017	4
5	30204854004	0.843	0.265	0.080	12.3	2.14	0.223	0.912	0.256	0.226					92.23%	2/8/2017	5
6	30204854005	1.08	0.316	0.046	0.989	0.305	0.165	1.51	0.411	0.195					78.71%	2/8/2017	6
7	30204854006	1.59	0.422	0.083	1.34	0.379	0.146	1.23	0.385	0.312					69.25%	2/8/2017	7
8	30204854007	2.33	0.549	0.109	0.910	0.303	0.227	2.45	0.586	0.203					77.37%	2/8/2017	8
9	30204854008	0.818	0.287	0.122	1.84	0.484	0.170	1.22	0.398	0.324					75.66%	2/8/2017	9
10	30204854009	2.17	0.520	0.107	1.46	0.398	0.179	1.82	0.481	0.276					88.79%	2/8/2017	10
11	30204854010	1.55	0.413	0.050	1.27	0.366	0.162	1.38	0.405	0.256					80.31%	2/9/2017	11
12	30204854011	6.89	1.39	0.092	6.87	1.30	0.144	7.56	1.43	0.269					78.61%	2/9/2017	12
13	30204854012	5.16	1.02	0.093	1.18	0.347	0.132	5.96	1.17	0.265					76.85%	2/9/2017	13
14	30204854013	1.66	0.426	0.047	0.903	0.289	0.145	1.81	0.472	0.250					81.82%	2/9/2017	14
15	30204854014	1.69	0.423	0.088	1.01	0.317	0.239	2.20	0.537	0.242					80.28%	2/9/2017	15
16	30204854015	56.5	9.53	0.128	10.6	2.18	0.301	67.4	11.3	0.353					106.54%	2/9/2017	16
17	30204854016	45.9	7.85	0.189	7.19	1.63	0.260	54.5	9.26	0.431					105.25%	2/9/2017	17
18	30204854017	23.8	4.51	0.290	4.68	1.33	0.511	26.5	5.01	0.473					76.51%	2/9/2017	18
19	30204854018	59.1	9.97	0.219	12.2	2.46	0.200	74.7	12.5	0.479					112.73%	2/9/2017	19
20	LCS33792	0.196	0.116	0.093	4.78	0.927	0.155	0.183	0.137	0.221					88.18%	2/8/2017	20
21	LCSD33792	0.099	0.072	0.063	4.71	0.889	0.143	0.156	0.106	0.152					93.14%	2/9/2017	21
22																	22
23																	23
24																	24

Quality Control Sample Performance Assessment

Pace Analytical

Analyst:	LAK		
Date:	2/9/2017	Method:	HSL-300
Worksheet:	33752	SOP:	PS1R-0 008
Matrix:	Soil	MB Sample ID:	1520335

Method Blank Assessment

Analyte	Activity	1.96 Sig Unc.	MDC	Critical Value	Flag	Assessment
Thorium-232	0.0000	0.0593	0.0418	0.00000		
Thorium-230	-0.0105	0.0509	0.1349	0.06603		
Thorium-228	0.2784	0.1006	0.1963	0.08192		

Laboratory Control Sample Assessment

	LCS	LCSD	LCS	LCSD	LCS	LCSD
Analyte:	Thorium-230					
Count Date:	2/2/17 15:21	2/2/17 15:21				
Spike I.D.:	12-019	12-019				
Spike Concentration (pCi/L):	25.490	25.490				
Volume Used (mL):	0.100	0.100				
Aliquot Volume (L, g, F):	0.500	0.500				
Target Conc. (pCi/L, g, F):	5.098	5.098				
1.96 Sigma Uncertainty (Calculated):	0.312	0.312				
Result (pCi/L, g, F):	4.750	4.715				
1.96 Sigma Unc.:	0.927	0.899				
% Recovery:	93.13%	92.43%				
Assessment:	Pass	Pass				
Upper % Recovery Limits:	125.00%	125.00%				
Lower % Recovery Limits:	75.00%	75.00%				

Duplicate Sample Assessment

LCS/LCSD Y or N?:	Y
Analyte:	Thorium-230
Sample I.D.:	LCS33792
Duplicate Sample I.D.:	LCSD33792
Sample % Recovery:	0.0393
Duplicate Sample %Recovery:	0.0396
Relative Percent Difference:	1.06%
Assessment:	Pass
% RPD Limit:	25.00%

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC

Sample Matrix Spike Control Assessment

Analyte:	Thorium-230
Sample Collection Date:	1/13/2016
Sample I.D.:	3020485-002
Sample MS I.D.:	3020485-002
Sample MSD I.D.:	3020485-004
Spike I.D.:	12-019
MS/MSD Decay Corrected Spike Conc. (pCi/L):	25.498
Spike Volume Used in MS (mL):	0.20
Spike Volume Used in MSD (mL):	0.20
MS Aliquot (L, g, F):	0.4481
MS Target Conc.(pCi/L, g, F):	11.609
MSD Aliquot (L, g, F):	0.4431
MSD Target Conc. (pCi/L, g, F):	11.609
MS Spike uncertainty (calculated):	3.595
MSD Spike uncertainty (calculated):	3.705
Sample Result:	0.852
Sample 1.96 Sigma Unc.:	0.269
Sample Matrix Spike Result:	11.700
Sample MS 1.96 Sigma Unc.:	2.948
Sample Matrix Spike Duplicate Result:	12.300
Sample MSD 1.96 Sigma Unc.:	3.140
MS % Recovery:	91.39%
MSD % Recovery:	96.39%
MS Assessment:	Pass
MSD Assessment:	Pass
MS/MSD Upper % Recovery Limits:	125.00%
MS/MSD Lower % Recovery Limits:	75.00%

Matrix Spike/Matrix Spike Duplicate Sample Assessment

Analyte:	Thorium-230
Sample I.D.:	3020485-002
Sample MS I.D.:	3020485-002
Sample MSD I.D.:	3020485-004
Sample Matrix Spike % Recovery:	91.39%
Sample Matrix Spike Duplicate % Recovery:	96.39%
MS/MSD Relative Percent Difference:	4.20%
MS/MSD RPD Assessment:	Pass
% RPD Limit:	25.00%

Comments:

Th-234 Recovery Calculations

Th-234 Half Life 24.1 days
578.4 hours

Reference Counts Information

Ref Source	Detector ID	Ref Count Date/Time	Detector Bkg CPM	Standard ID / Gross Beta CPM	17-001 / Net Ref Beta CPM	1.000 mL / Source Ct Duration (min)	Total Beta Counts
REF#1-11	11				0.000	30	0
REF#2-12	12				0.000	30	0
REF#3-13	13				0.000	30	0
REF#4-14	14				0.000	30	0
REF#5-15	15				0.000	30	0
REF#6-16	16				0.000	30	0
REF#7-17	17				0.000	30	0
REF#8-18	18				0.000	30	0
REF#1-19	19				0.000	30	0
REF#2-20	20				0.000	30	0
REF#3-21	21				0.000	30	0
REF#4-22	22				0.000	30	0
REF#5-23	23				0.000	30	0
REF#6-24	24				0.000	30	0
REF#7-25	25				0.000	30	0
REF#8-26	26				0.000	30	0
REF#1-27	27				0.000	30	0
REF#2-28	28				0.000	30	0
REF#3-29	29				0.000	30	0
REF#4-30	30				0.000	30	0
REF#5-31	31				0.000	30	0
REF#6-33	33				0.000	30	0
REF#7-34	34				0.000	30	0
REF#8-36	36				0.000	30	0
REF#1-37	37				0.000	30	0
REF#2-38	38				0.000	30	0
REF#3-39	39	1/22/2017 14:19	0.493	840.0	839.540	30	25201
REF#4-40	40	1/22/2017 14:19	0.452	903.6	903.115	30	27107
REF#5-41	41	1/22/2017 14:19	0.418	866.6	866.182	30	26466
REF#6-42	42	1/22/2017 14:20	0.559	908.8	908.274	30	27254.9996
REF#7-43	43	1/22/2017 14:20	0.445	922.9	922.488	30	27688
REF#8-44	44	1/22/2017 14:20	0.403	916.2	915.830	30	27487
REF#1-45	45	1/22/2017 14:20	0.454	901.9	901.446	30	27067
REF#2-46	46	1/22/2017 14:20	0.532	887.2	886.635	30	26615
REF#3-47	47	1/16/2017 10:52	0.427	959.7	959.240	30	29059.9996
REF#4-48	48	1/16/2017 10:52	0.392	1065.1	1064.741	30	31963.999
REF#5-49	49	1/16/2017 10:52	0.390	1066.8	1066.443	30	32004.999
REF#6-50	50	1/16/2017 10:52	0.572	1072.0	1071.428	30	32160
REF#7-51	51	1/16/2017 10:52	0.384	1115.4	1115.016	30	33462
REF#8-52	52	1/16/2017 10:52	0.414	1083.3	1082.886	30	32459
REF#1-53	53	1/16/2017 10:52	0.341	1083.9	1083.559	30	32517
REF#1-55	55	1/10/2017 9:44	0.309	1179.8	1179.524	30	35394.95
REF#2-56	56	1/10/2017 9:44	0.271	1293.3	1293.062	30	38799.98
REF#3-57	57	1/10/2017 9:44	0.276	1295.2	1295.924	30	38855
REF#4-58	58	1/10/2017 9:44	0.312	1301.6	1301.321	30	39045.989
REF#5-59	59	1/10/2017 9:44	0.270	1326.0	1325.697	30	39779.001
REF#6-60	60	1/10/2017 9:45	0.198	1293.8	1293.634	30	38814.999
REF#7-61	61	1/10/2017 9:45	0.390	1295.3	1294.910	30	38859
REF#8-62	62	1/10/2017 9:45	0.290	1298.5	1298.177	30	38954.001
REF#1-63	63	1/10/2017 10:29	0.295	1188.2	1187.905	30	35646
REF#2-64	64	1/10/2017 10:30	0.151	1262.9	1262.933	30	37887.99
REF#3-65	65	1/10/2017 10:30	0.260	1299.8	1299.767	30	38813.001
REF#4-66	66	1/10/2017 10:30	0.364	1298.5	1298.500	30	38955
REF#5-67	67	1/10/2017 10:30	0.404	1320.3	1320.300	30	39609
REF#6-68	68	1/10/2017 10:30	0.337	1300.1	1300.087	30	39002.001
REF#7-69	69	1/10/2017 10:30	0.287	1285.4	1285.400	30	38562
REF#8-70	70	1/10/2017 10:30	0.394	1279.2	1279.233	30	38376.99
REF#1-71	71	1/10/2017 11:13	0.321	1242.1	1241.812	30	37283.95
REF#2-72	72	1/10/2017 11:13	0.236	1262.7	1262.431	30	37880.001
REF#3-73	73	1/10/2017 11:13	0.270	1281.4	1281.097	30	38441.001
REF#4-74	74	1/10/2017 11:13	0.326	1280.3	1279.941	30	38406.001

Pace Analytical Services
Isotopic Thorium Analysis

Sample Counting Information — Amount used in Samples: 0.200 mL

Sample ID	Detector ID	Count Start Date/Time	Sample Beta CPM	Beta Bkg CPM	Decay from Ref Ct to Sample Ct (hrs)	Th-234 Decay Factor	Recovery%	Sample Ct Time
1220308	55	2/8/2017 9:44	89.600	0.3050	696.000	0.4343	87.36%	10.00
30204854001	56	2/8/2017 9:44	88.200	0.3360	696.000	0.4343	78.23%	10.00
30204854002	57	2/8/2017 9:44	89.400	0.2980	696.000	0.4343	79.16%	10.00
30204854003	58	2/8/2017 9:44	102.500	0.2930	696.000	0.4343	90.60%	10.00
30204854004	59	2/8/2017 9:44	104.100	0.2930	696.000	0.4343	92.23%	10.00
30204854005	60	2/8/2017 9:44	88.800	0.2100	696.000	0.4343	78.71%	10.00
30204854006	61	2/8/2017 9:45	79.300	0.3550	696.017	0.4343	69.25%	10.00
30204854007	62	2/8/2017 9:45	87.400	0.3120	696.017	0.4343	77.37%	10.00
30204854008	63	2/8/2017 9:47	85.400	0.2420	696.050	0.4342	75.66%	10.00
30204854009	64	2/8/2017 9:47	97.900	0.2130	696.050	0.4342	86.79%	10.00
30204854010	65	2/8/2017 9:47	90.700	0.3080	696.050	0.4342	80.31%	10.00
30204854011	66	2/8/2017 9:47	86.800	0.3250	696.050	0.4342	76.91%	10.00
30204854012	67	2/8/2017 9:47	86.900	0.3900	696.050	0.4342	76.96%	10.00
30204854013	68	2/8/2017 9:47	92.400	0.2130	696.050	0.4342	81.82%	10.00
30204854014	69	2/8/2017 9:47	90.600	0.2870	696.050	0.4342	80.26%	10.00
30204854015	70	2/8/2017 9:47	120.300	0.3980	696.050	0.4342	106.54%	10.00
30204854016	71	2/8/2017 9:47	118.800	0.3390	696.050	0.4342	105.25%	10.00
30204854017	72	2/8/2017 9:48	88.600	0.2410	696.067	0.4342	78.51%	10.00
30204854018	73	2/8/2017 9:48	127.100	0.2240	696.067	0.4342	112.73%	10.00
LCS33792	74	2/8/2017 9:45	99.900	0.3580	696.067	0.4342	88.19%	10.00
LCSD33792	55	2/8/2017 9:56	95.700	0.3050	696.200	0.4342	93.14%	10.00

Pace Analytical Protean GFPC System #3 Count Data

SAMPLE_ID	DET#	Count Start Date	Count Time (min)	ACPM	BCPM	BATCH_ID
1220308	56	2/8/2017 9:44:20 AM	10	0.0000	89.8000	TH33792
30204854001	56	2/8/2017 9:44:27 AM	10	0.3000	88.2000	TH33792
30204854002	57	2/8/2017 9:44:33 AM	10	0.5000	89.4000	TH33792
30204854003	58	2/8/2017 9:44:39 AM	10	0.1000	102.5000	TH33792
30204854004	59	2/8/2017 9:44:50 AM	10	0.1000	104.1000	TH33792
30204854005	60	2/8/2017 9:44:55 AM	10	0.3000	88.8000	TH33792
30204854006	61	2/8/2017 9:45:00 AM	10	0.2000	78.3000	TH33792
30204854007	62	2/8/2017 9:45:06 AM	10	0.3000	87.4000	TH33792
LCSD33792	55	2/8/2017 9:56:39 AM	10	0.1000	95.7000	TH33792

REPORT

SAMPLE_ID	DET#	Count Start Date	Count Time (min)	ACPM	BCPM	BATCH_ID
30204854008	63	2/8/2017 9:47:12 AM	10	0.1000	85.4000	TH33792
30204854009	64	2/8/2017 9:47:20 AM	10	0.5000	97.9000	TH33792
30204854010	65	2/8/2017 9:47:26 AM	10	0.4000	90.7000	TH33792
30204854011	66	2/8/2017 9:47:32 AM	10	0.8000	88.8000	TH33792
30204854012	67	2/8/2017 9:47:37 AM	10	1.2000	86.0000	TH33792
30204854013	68	2/8/2017 9:47:41 AM	10	0.3000	92.4000	TH33792
30204854014	69	2/8/2017 9:47:46 AM	10	0.5000	90.6000	TH33792
30204854015	70	2/8/2017 9:47:52 AM	10	18.0000	120.3000	TH33792
30204854016	71	2/8/2017 9:47:56 AM	10	11.8000	118.8000	TH33792
30204854017	72	2/8/2017 9:48:01 AM	10	3.5000	88.6000	TH33792
30204854018	73	2/8/2017 9:48:08 AM	10	20.9000	127.1000	TH33792
LCS33792	74	2/8/2017 9:48:15 AM	10	0.4000	99.6000	TH33792

Pace Analytical Services-Pittsburgh

Gas Flow Proportional Counter Run Log

Logbook ID 3-R002-6

SOP ID: PGH-R-002

Analysis	Detector #	Sample ID	Batch ID	Count Time (min)	Count Start date/ time	Analyst	Re-Analysis Code	Comments
CAP	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	7	[illegible]	[illegible]					
	8	[illegible]	[illegible]					
	9	[illegible]	[illegible]					
	10	[illegible]						
Th	56	[illegible]	[illegible]	10	2/8/17 [illegible]	[illegible]	N/A	N/A
	56	[illegible]						
	57							
	58							
	59							
	60							
	61							
	62							
	63				2/8/17 [illegible]	[illegible]	N/A	N/A
	64							
	65							
	66							
	67							
	68							
	69							
	[illegible]							
	[illegible]							
	72							
	73							

Legend:
1. Detector daily check failure
2. MDC > Contract RL
3. Sample re-ingrowth
4. Sample was re-prepped
5. Other noted comments

Logbook reivew is documented on the Rad Data Review Verification form.

Pace Analytical Services-Pittsburgh

Gas Flow Proportional Counter Run Log

Logbook ID 3-R002-6

SOP ID: PGH-R-002

Analysis	Detector #	Sample ID	Batch ID	Count Time (min)	Count Start date/ time	Analyst	Re-Analysis Code	Comments
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] [illegible]	[illegible]	N/A	N/A
	[illegible]	[illegible]			[illegible] [illegible]	[illegible]	N/A	N/A
	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]						
	[illegible]	[illegible]						
	[illegible]	[illegible]						
	[illegible]	[illegible]						
	[illegible]	5						
	[illegible]	[illegible]						
	[illegible]	[illegible]			[illegible] [illegible]	[illegible]	N/A	N/A
	[illegible]	[illegible]						
	[illegible]	[illegible]						
	[illegible]	[illegible]						
	[illegible]	[illegible]						
	[illegible]	[illegible]						

Legend:
1. Detector daily check failure
2. MDC > Contract RL
3. Sample re-ingrowth
4. Sample was re-prepped
5. Other noted comments

[illegible]

Logbook reivew is documented on the Rad Data Review Verification form.

[illegible]

J:\QAQC\Master\Document Management\Radiological\Logbooks Updated\GFPC Run Log (R002 6 3Nov2016)

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:18PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 1220308 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

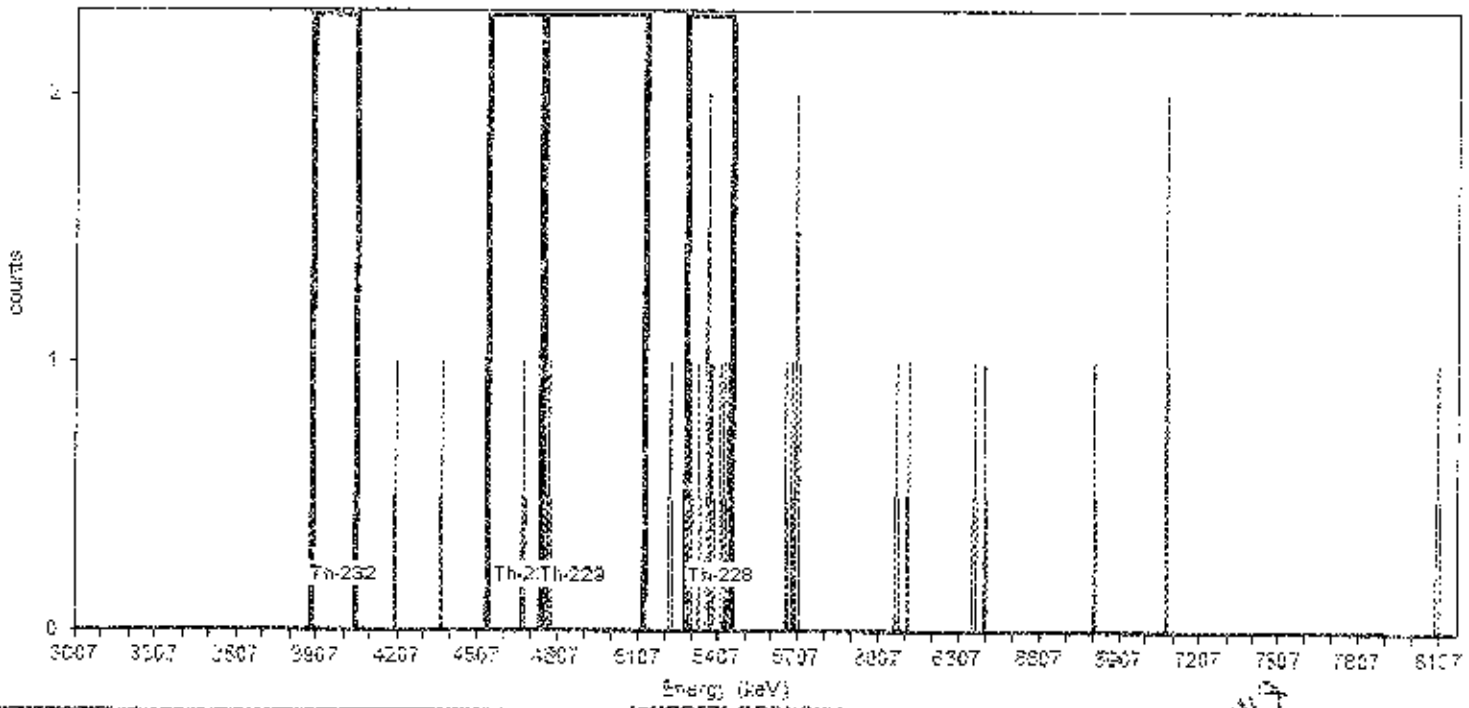
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 26 SN:
Acquisition Start Date: 2/8/2017 11:14:40AM
Live Time: 240.00 min.
Real Time: 240.00 min
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 26; Det: Det 26; Spectrum: #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 007
Efficiency Calibration:2016.12.02 007
Calibration Date: 12/2/2016 1:48:37PM
Energy Cal: Gain = 5.0577 keV / Ch
Offset = 3,002.39 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.83% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	.000	100.0	0.00	0.0000	0	0.000E+000	9.536E-003	0.000E+000	1.825E-002
Th-230	4690.000	4540.000	4740.000	30.156	99.7	1.00	1.6800	-1	0.000E+000	1.107E-002	1.606E-002	5.042E-002
Th-229	4865.000	4750.000	5125.000	25.316	99.6	2.00	3.8400	-2	0.000E+000	1.635E-002	2.429E-002	5.689E-002
Th-228	5420.000	5290.000	5460.000	36.753	99.4	9.70	4.0200	5	3.443E-002	2.567E-002	2.671E-002	7.178E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:21PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204854001 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

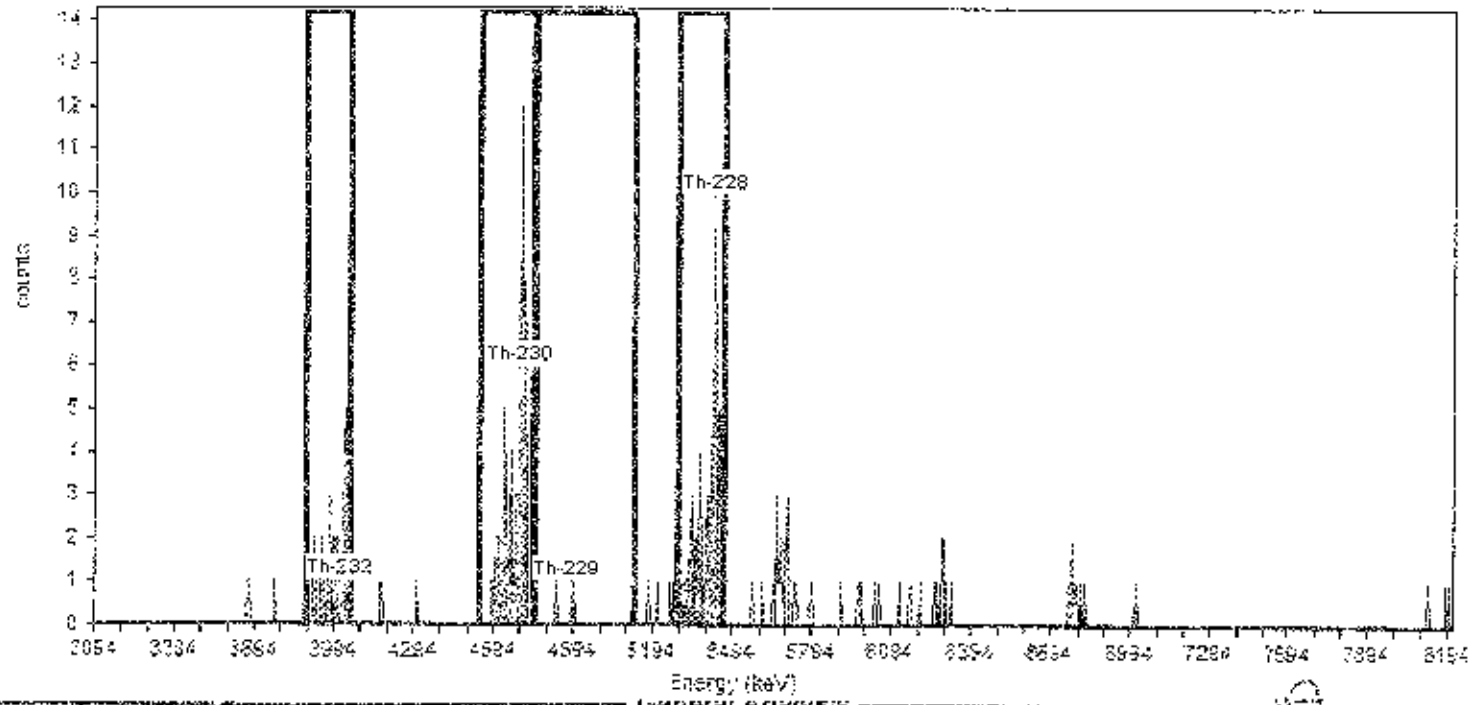
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 27 SN:
Acquisition Start Date: 2/8/2017 11:14:41AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 27; Det: Det 27; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 27
Efficiency Calibration:2016.06.06 001 det 27
Calibration Date: 6/6/2016 8:44:44AM
Energy Cal: Gain = 5.0148 keV / Ch
Offset = 3,069.69 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.63% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	24.319	100.0	38.61	0.2400	38	2.509E-001	4.083E-002	6.883E-003	2.951E-002
Th-230	4690.000	4640.000	4740.000	27.252	99.7	76.00	1.2000	75	4.919E-001	5.782E-002	1.320E-002	4.418E-002
Th-229	4865.000	4760.000	5125.000	29.899	99.6	2.00	1.6800	0	2.105E-003	1.262E-002	1.562E-002	4.905E-002
Th-228	5420.000	5290.000	5460.000	15.314	99.4	69.47	5.2829	64	4.234E-001	5.706E-002	2.777E-002	7.439E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:16PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204854002 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

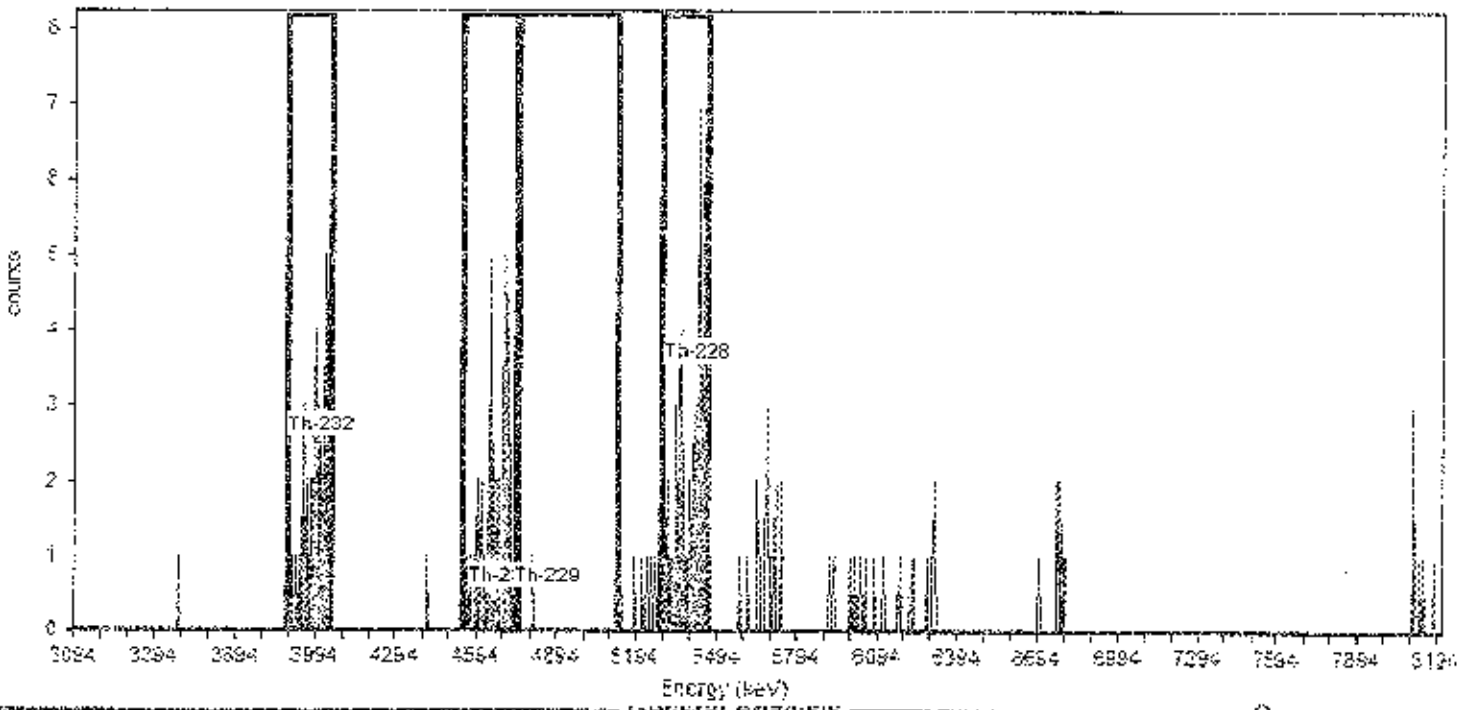
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det-28 SN:
Acquisition Start Date: 2/3/2017 11:14:41AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:52PM
Bkgd Info: Sample: Det 28; Det: Det-28; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 28
Efficiency Calibration:2016.06.06 001 det 28
Calibration Date: 6/6/2016 8:47:14AM
Energy Cal: Gain = 5.0103 keV / Ch
Offset = 3,089.93 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.06% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3800.000	4050.000	17.111	100.0	47.62	0.2400	47	3.060E-001	4.470E-002	5.793E-003	2.907E-002
Th-230	4690.000	4540.000	4740.000	13.162	99.7	50.00	0.8811	49	3.182E-001	4.623E-002	1.114E-002	3.981E-002
Th-229	4865.000	4750.000	5125.000	29.873	99.6	1.18	2.8800	-2	0.000E+000	1.306E-002	2.015E-002	5.763E-002
Th-228	5420.000	5290.000	5460.000	25.591	99.4	68.95	5.0114	64	4.154E-001	5.591E-002	2.564E-002	7.087E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:24PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204854003 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution: 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

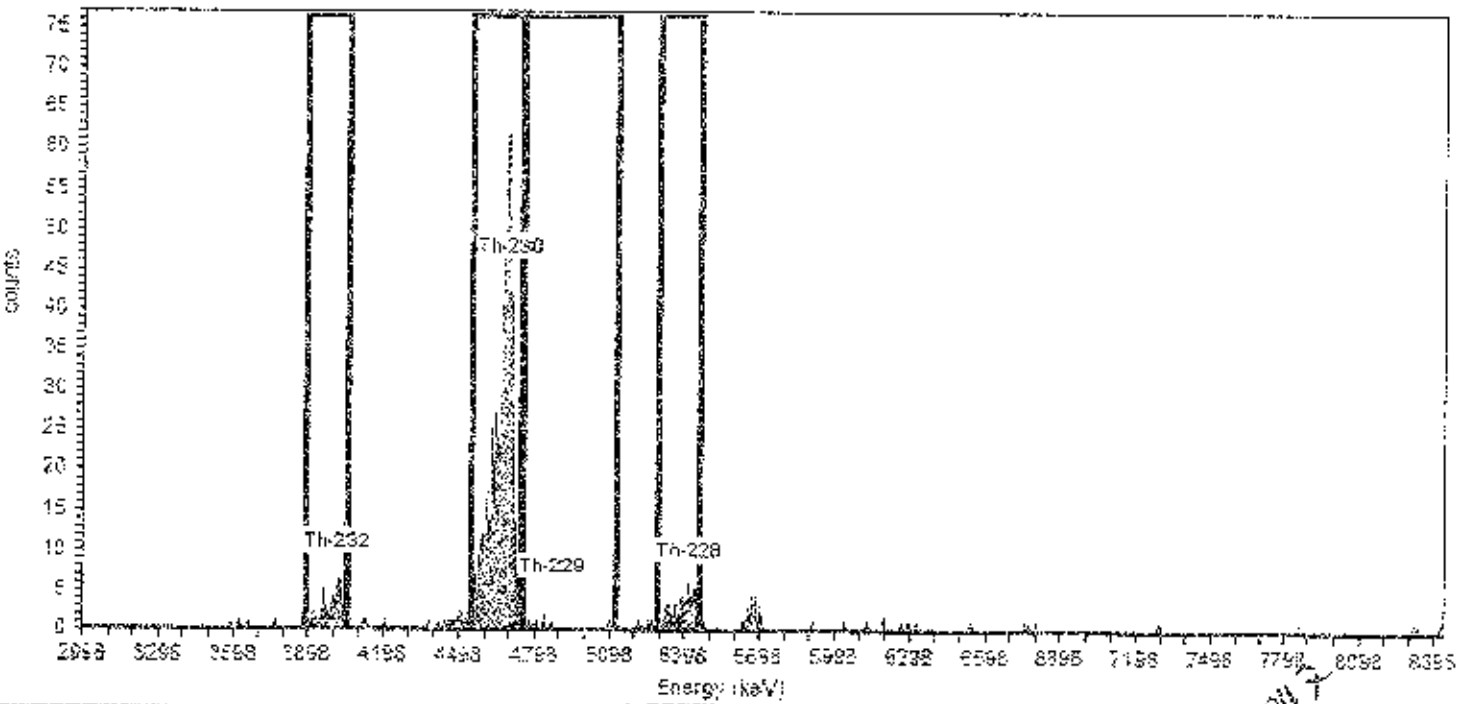
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 31 SN:
Acquisition Start Date: 2/8/2017 11:14:41AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 31; Det: Det 31; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 31
Efficiency Calibration:2016.06.06 001 det 31
Calibration Date: 6/6/2016 10:21:27AM
Energy Cal: Gain = 5.3168 keV / Ch
Offset = 2,992.72 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: iso Th
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	S.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	79.239	100.0	56.65	0.0000	57	3.757E-001	5.039E-002	0.000E+000	1.795E-002
Th-230	4690.000	4540.000	4740.000	56.763	99.7	718.49	1.4400	717	4.770E+000	1.802E-001	1.462E-002	4.724E-002
Th-229	4868.000	4750.000	5125.000	5.991	99.6	8.00	1.4400	7	4.383E-002	2.045E-002	1.463E-002	4.727E-002
Th-228	5420.000	5290.000	5460.000	40.950	99.4	66.12	5.0561	60	4.007E-001	5.593E-002	2.749E-002	7.353E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:28PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204864004 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

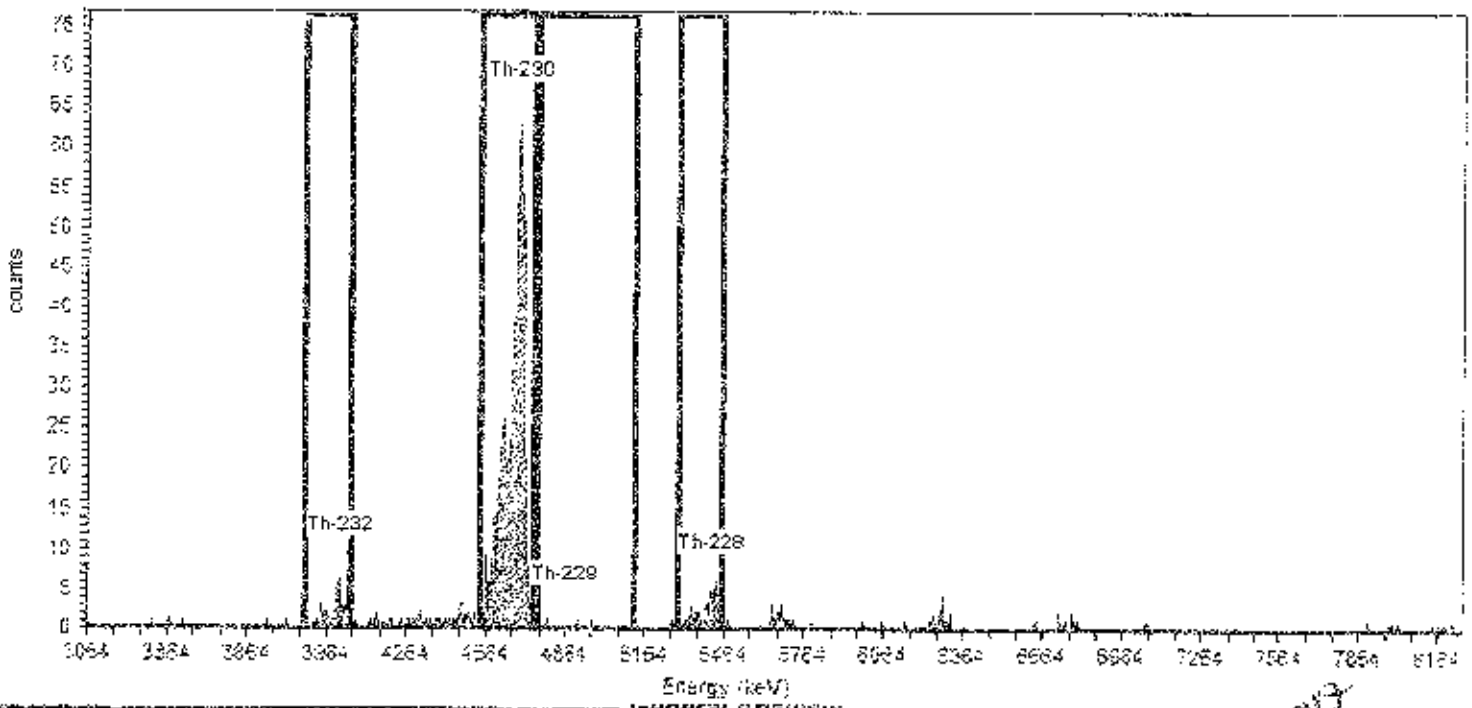
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 32 SN:
Acquisition Start Date: 2/8/2017 11:14:42AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:49PM
Bkgd Info: Sample: Det 32; Det: Det 32; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 010
Efficiency Calibration:2016.12.02 010
Calibration Date: 12/2/2016 2:56:41PM
Energy Cal: Gain = 5.0815 keV / Ch
Offset = 3.059.66 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.62% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	54.045	100.0	52.80	0.2400	53	3.447E-001	4.779E-002	5.886E-003	2.952E-002
Th-230	4690.000	4640.000	4740.000	54.996	99.7	770.27	5.7600	765	5.029E+000	1.850E-001	2.992E-002	7.564E-002
Th-229	4865.000	4750.000	5125.000	30.305	98.6	3.00	1.8163	1	7.791E-003	1.444E-002	1.625E-002	5.031E-002
Th-228	5420.000	5290.000	5450.000	20.213	99.4	57.29	4.8864	52	3.458E-001	5.206E-002	2.672E-002	7.129E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:31PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204854005 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

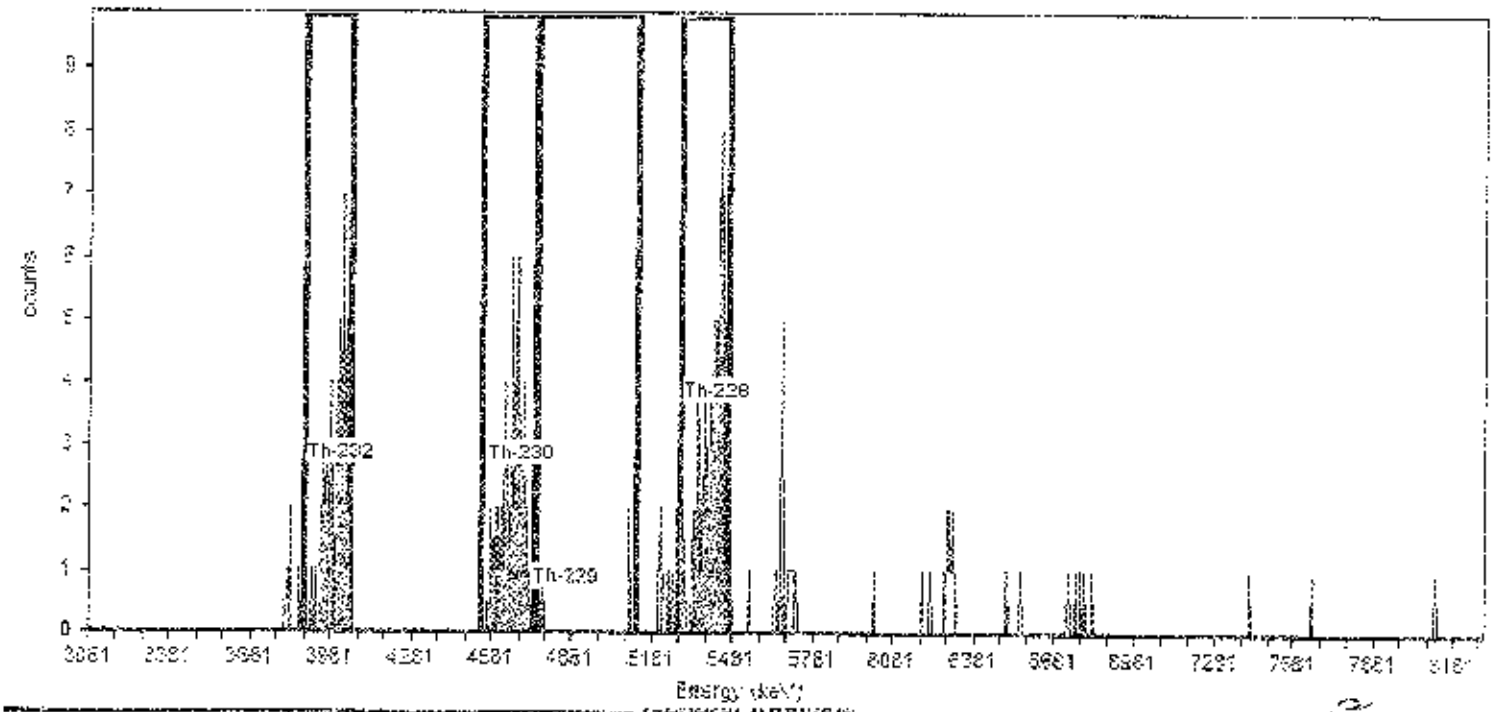
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 33 SN:
Acquisition Start Date: 2/8/2017 11:14:42AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:49PM
Bkgd info: Sample: Det 33; Det: Det 33; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 33b
Efficiency Calibration:2016.06.06 001 det 33b
Calibration Date: 6/6/2016 12:10:27PM
Energy Cal: Gain = 5.1058 keV / Ch
Offset = 3.076.65 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.87% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4013.000	3880.000	4050.000	26.735	100.0	64.02	0.0000	64	4.022E-001	5.071E-002	0.000E+000	1.700E-002
Th-230	4690.000	4540.000	4740.000	94.264	99.7	61.39	2.3057	59	3.724E-001	5.033E-002	1.753E-002	5.211E-002
Th-229	4865.000	4750.000	5125.000	6.880	99.6	3.00	0.4800	3	1.589E-002	1.176E-002	8.002E-003	3.307E-002
Th-228	5420.000	5290.000	5460.000	19.920	99.4	85.20	3.0000	82	5.196E-001	5.943E-002	2.005E-002	5.721E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:02PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204654006 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

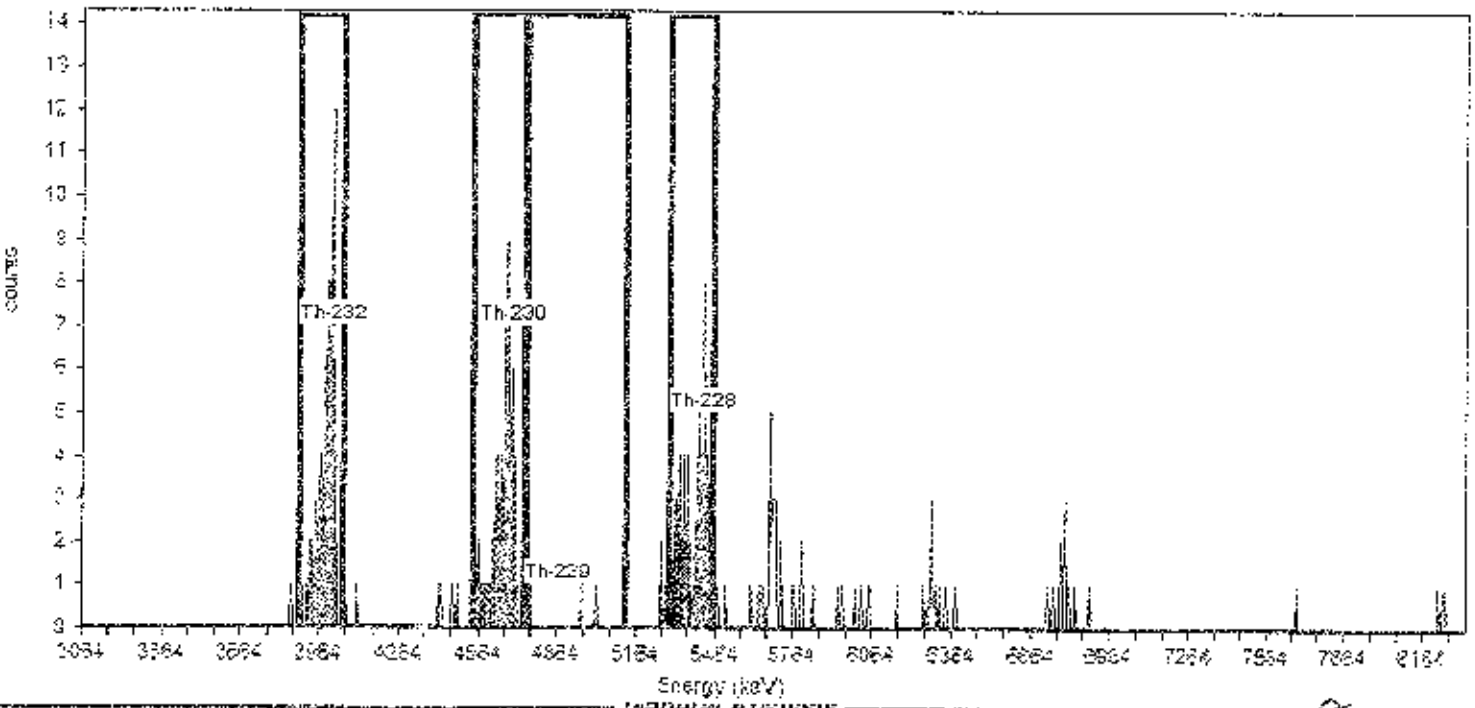
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 34 SN:
Acquisition Start Date: 2/8/2017 11:14:43AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:50PM
Bkgd Info: Sample: Det 34; Det: Det 34; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 34
Efficiency Calibration:2016.06.06 001 det 34
Calibration Date: 6/6/2016 10:25:49AM
Energy Cal: Gain = 5.1501 keV / Ch
Offset = 3,059.78 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.87% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
MDA Source: Background

Qualifiers
Unavailable

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	B.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4080.000	47.925	100.0	85.27	0.2400	85	5.343E-001	5.616E-002	5.639E-001	2.828E-002
Th-230	4690.000	4540.000	4740.000	41.419	99.7	73.00	1.2000	72	4.525E-001	5.433E-002	1.265E-002	4.735E-002
Th-229	4865.000	4750.000	5125.000	.000	99.9	3.61	1.4400	2	1.494E-002	1.446E-002	1.387E-002	4.479E-002
Th-228	5420.000	5290.000	5480.000	38.516	99.4	68.00	7.4521	61	3.828E-001	5.494E-002	3.161E-002	8.033E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:15:05PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204S54007 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33782
:
Description:

Client Name: Undefined
Client Contact:

Tracer

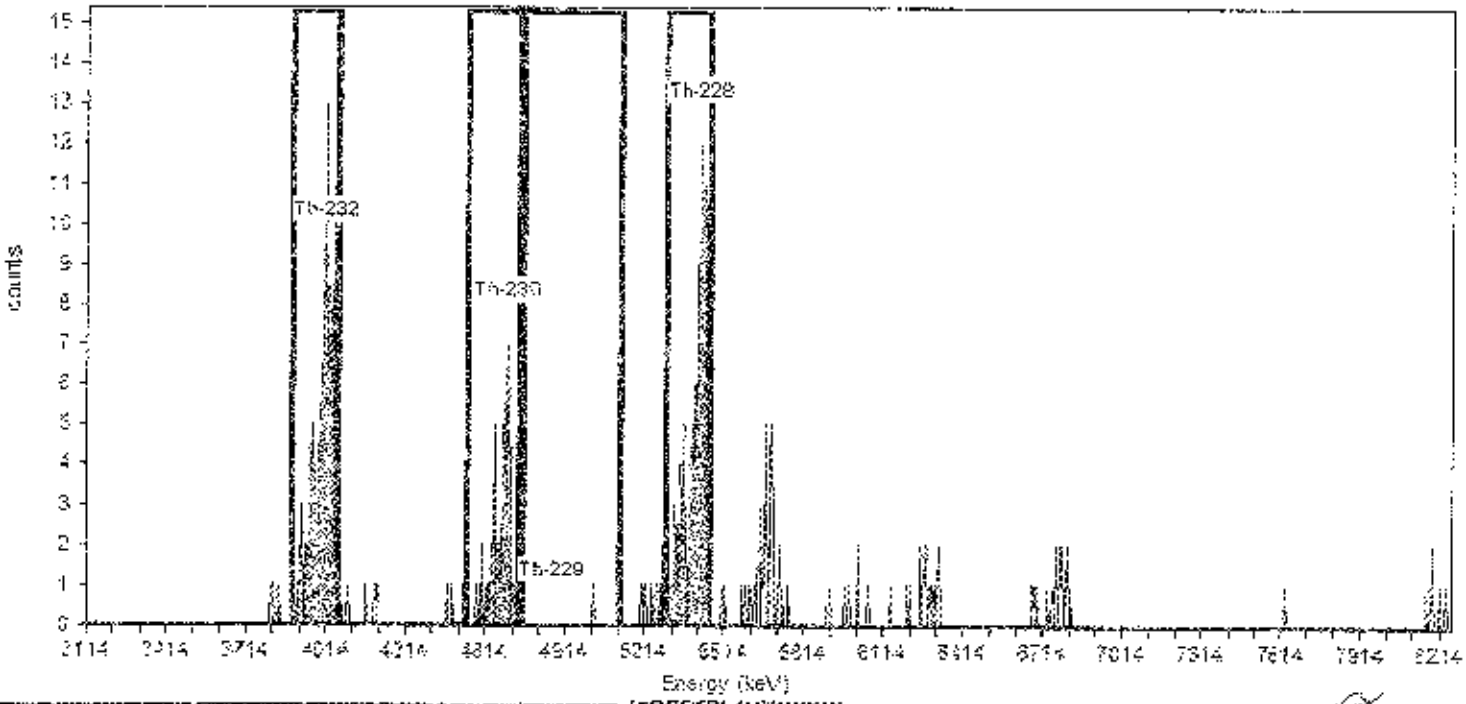
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 36 SN:
Acquisition Start Date: 2/8/2017 11:14:43AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:50PM
Bkgd Info: Sample: Det 36; Det: Det 36; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 36
Efficiency Calibration:2016.06.06 001 det 36
Calibration Date: 6/6/2016 10:31:59AM
Energy Cal: Gain = 5.0362 keV / Ch
Offset = 3,109.16 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.61% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	24.008	100.0	127.75	0.4800	127	8.348E-001	7.441E-002	9.025E-003	3.440E-002
Th-230	4690.000	4540.000	4740.000	35.552	99.7	54.00	4.3200	50	3.269E-001	5.027E-002	2.505E-002	6.790E-002
Th-229	4865.000	4750.000	5125.000	7.194	99.6	3.00	3.0749	0	0.000E+000	1.622E-002	2.114E-002	6.010E-002
Th-228	5420.000	5290.000	5460.000	18.809	99.4	126.00	2.5975	123	8.143E-001	7.496E-002	1.948E-002	5.662E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
3:15:08PM 2/8/2017

Analyst: ORTEC

Sample

Sample: 30204854008 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

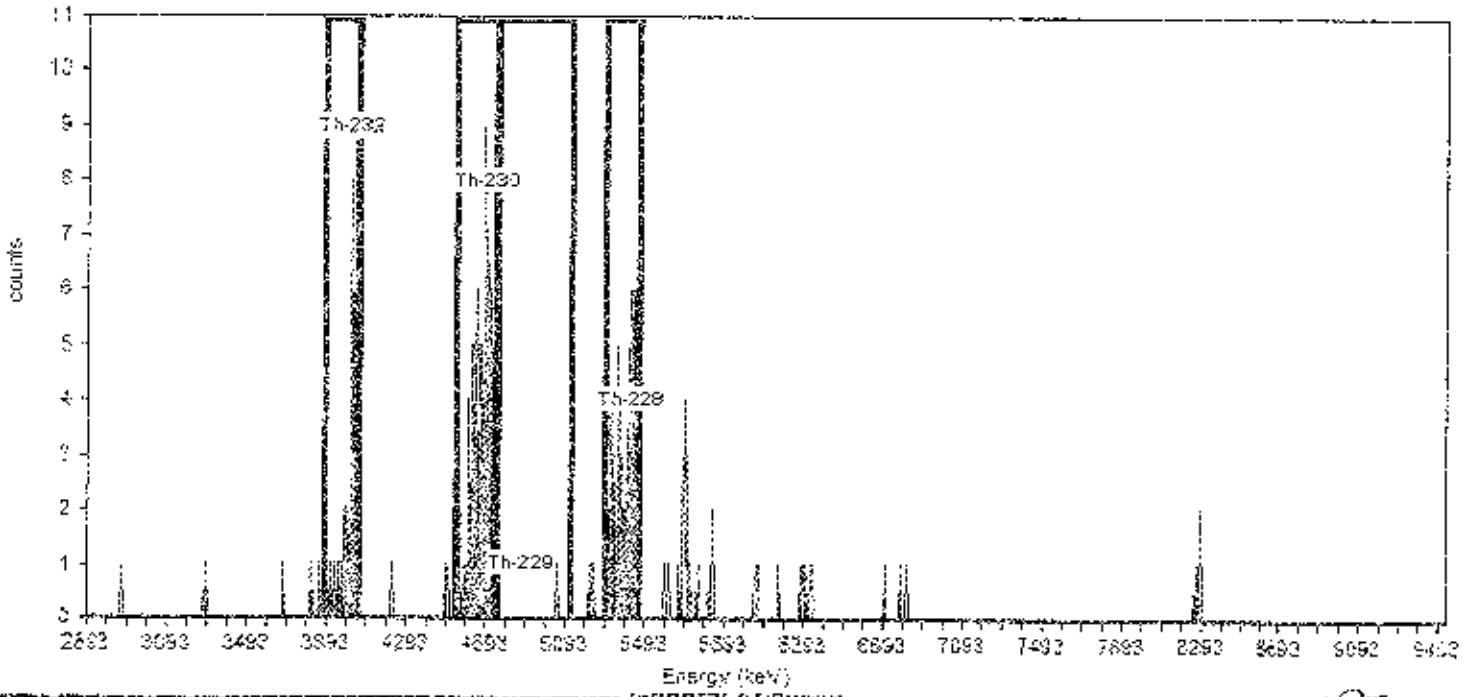
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 37 SN:
Acquisition Start Date: 2/8/2017 11:14:43AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 37; Det: Det 37; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 37
Efficiency Calibration:2016.06.06 001 det 37
Calibration Date: 6/6/2016 12:14:29PM
Energy Cal: Gain = 6.6919 keV / Ch
Offset = 2,686.41 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.95% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	25.828	100.0	40.23	0.4800	40	2.759E-001	4.446E-002	6.838E-003	3.652E-002
Th-230	4690.000	4540.000	4740.000	88.882	99.7	91.00	1.4400	90	6.256E-001	6.724E-002	1.535E-002	4.961E-002
Th-229	4865.000	4750.000	5125.000	39.900	99.6	1.00	1.9200	-1	0.000E+000	1.194E-002	1.774E-002	5.439E-002
Th-228	5420.000	5290.000	5450.000	35.537	99.4	61.00	6.4792	55	3.820E-001	5.759E-002	3.267E-002	8.429E-002

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

Analyst: ORTEC

ORTEC
Oak Ridge, TN 37830
3:15:11PM 2/8/2017

Sample

Sample: 30204854009 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

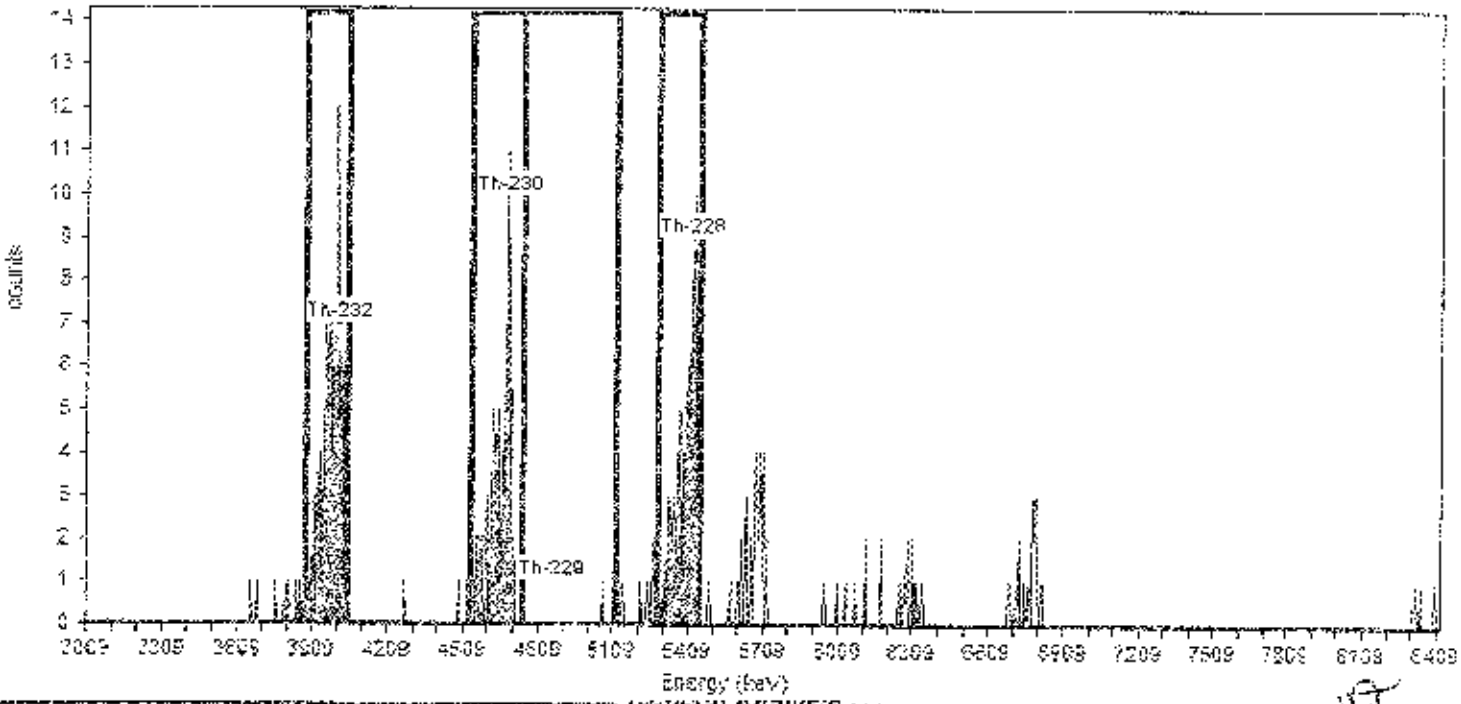
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 38 SN:
Acquisition Start Date: 2/8/2017 11:14:44AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 38; Det: Det 38; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 38
Efficiency Calibration:2016.06.06 001 det 38
Calibration Date: 6/6/2016 12:17:52PM
Energy Cal: Gain = 5.3002 keV / Ch
Offset = 3.904.00 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.16% +/- 0.26% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	72.598	100.0	120.72	0.4800	120	8.311E-001	7.621E-002	8.771E-003	3.624E-002
Th-230	4690.000	4540.000	4740.000	83.032	99.7	83.00	2.4000	81	5.587E-001	5.412E-002	1.967E-002	5.810E-002
Th-229	4865.000	4750.000	5125.000	31.609	99.6	1.00	1.2000	0	0.000E+000	1.029E-002	1.392E-002	4.860E-002
Th-228	5420.000	5290.000	5460.000	12.375	99.4	98.87	5.9822	93	6.459E-001	7.128E-002	3.115E-002	8.112E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830

Analyst: ORTEC

9:21:46AM 2/9/2017

Sample

Sample: 30204854010 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

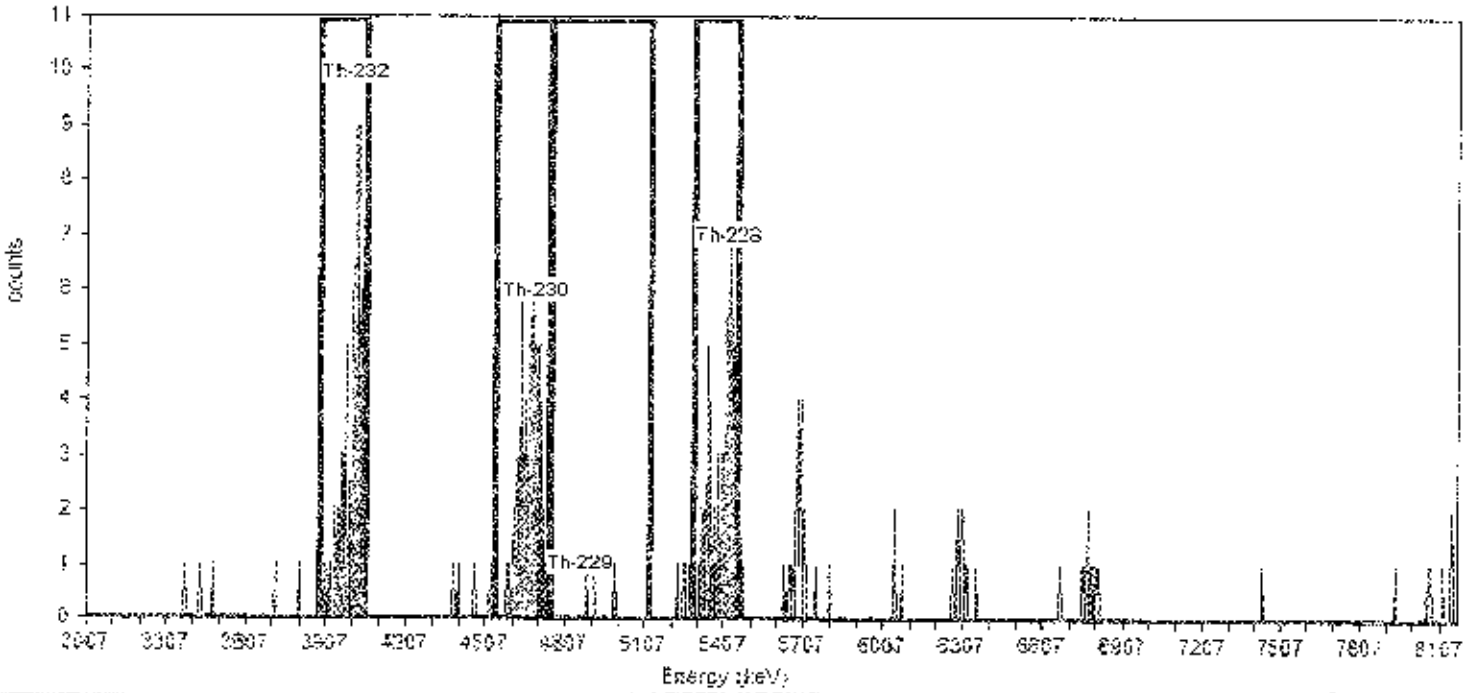
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 26 SN:
Acquisition Start Date: 2/9/2017 9:21:30AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/7/2017 1:59:54PM
Bkgd Info: Sample: Det 26; Det: Det 26; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 007
Efficiency Calibration:2016.12.02 007
Calibration Date: 12/2/2016 1:48:37PM
Energy Cal: Gain = 5.0577 keV / Ch
Offset = 3.002.39 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 27.83% +/- 0.26% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/6/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	21.237	100.0	83.39	0.0000	83	5.623E-001	8.201E-002	0.000E+000	1.825E-002
Th-230	4690.000	4540.000	4740.000	53.974	99.7	73.00	1.6800	68	4.621E-001	5.731E-002	1.606E-002	5.042E-002
Th-229	4865.000	4750.000	5125.000	59.739	99.6	3.00	3.8400	-1	0.000E+000	1.770E-002	2.429E-002	6.689E-002
Th-228	5420.000	5290.000	5460.000	22.663	99.4	73.08	4.6200	68	4.648E-001	5.989E-002	2.673E-002	7.183E-002

AlphaVision v5.3 — *Alpha Spectroscopy Analysis Report*

CRTEC
Oak Ridge, TN 37830
9:21:53AM 2/9/2017

Analyst: CRTEC

Sample

Sample: 30204854011 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

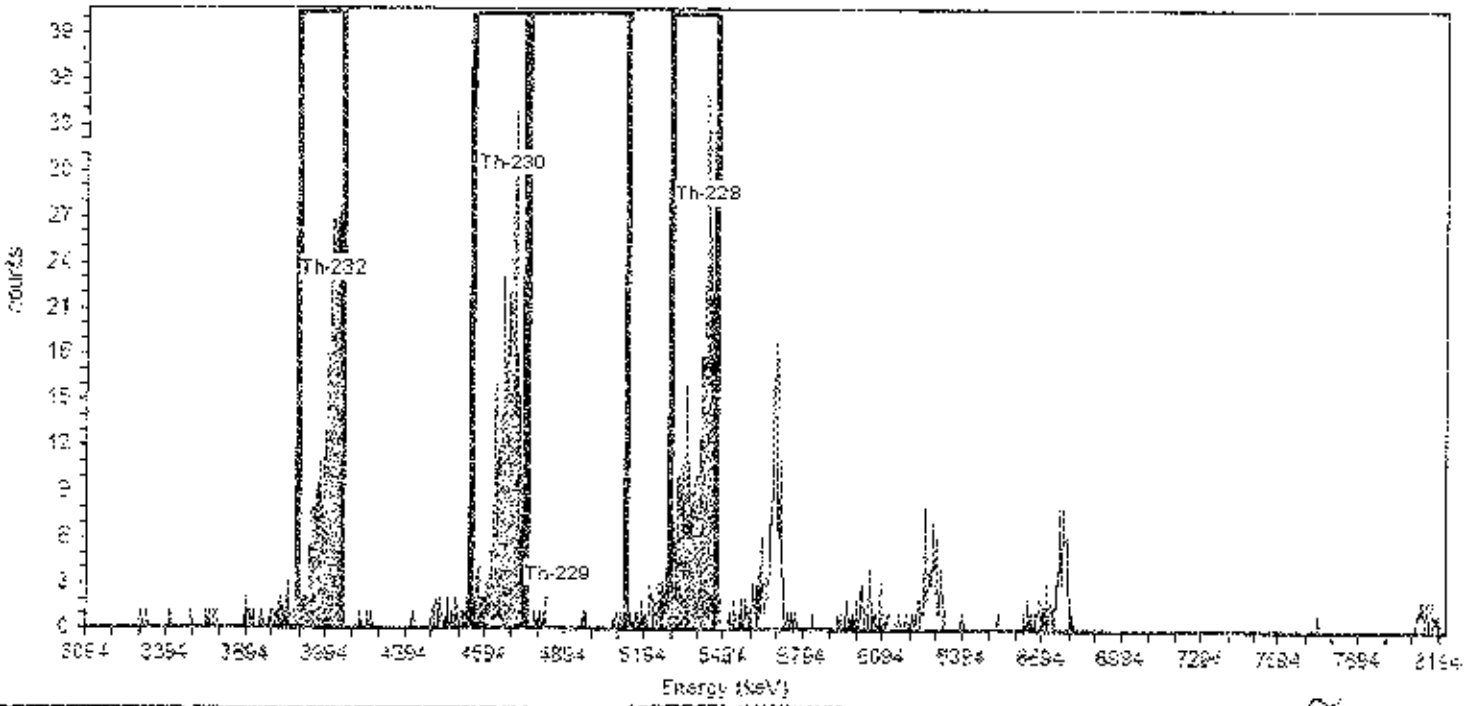
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 27 SN:
Acquisition Start Date: 2/9/2017 5:21:30AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 27: Det: Det 27; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 27
Efficiency Calibration:2016 06.06 001 det 27
Calibration Date: 6/6/2016 8:44:44AM
Energy Cal: Gain = 5.0148 keV / Ch
Offset = 3.089.69 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.63% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
MDA Source: Background

Nuclids Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	S.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	37.393	100.0	373.48	0.2400	373	2.447E+000	1.272E-001	5.883E-003	2.951E-002
Th-230	4690.000	4540.000	4740.000	47.984	99.7	373.00	1.2000	372	2.445E+000	1.277E-001	1.320E-002	4.418E-002
Th-229	4855.000	4750.000	5125.000	20.383	99.6	9.00	1.6800	7	4.836E-002	2.150E-002	1.562E-002	4.905E-002
Th-228	5420.000	5290.000	5460.000	25.774	99.4	382.43	5.2829	377	2.489E+000	1.306E-001	2.779E-002	7.344E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
9:21:49AM 2/9/2017

Analyst: ORTEC

Sample

Sample: 30204854012 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

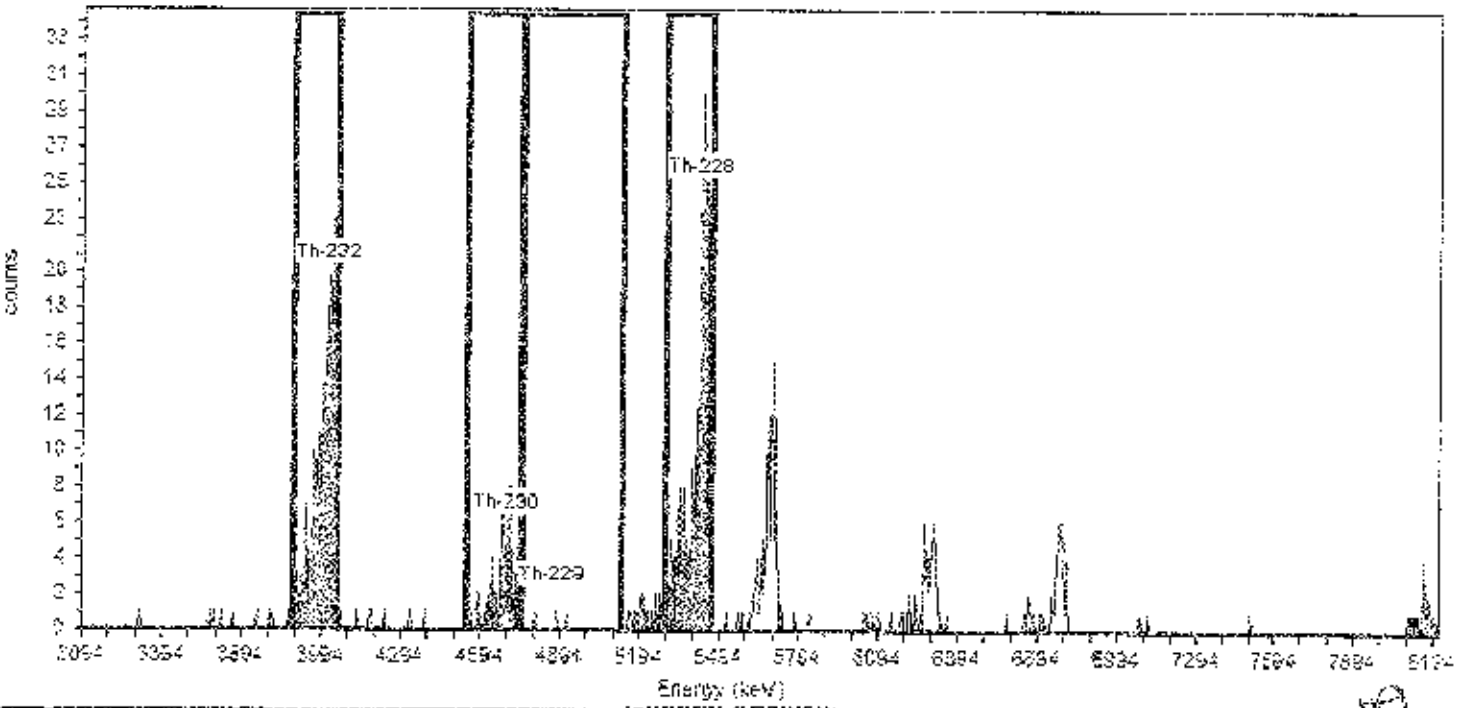
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det-28 SN:
Acquisition Start Date: 2/9/2017 5:21:30AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:52PM
Bkgd Info: Sample: Det 28; Det: Det-28; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 28
Efficiency Calibration: 2016.06.06 001 det 28
Calibration Date: 6/6/2016 8:47:14AM
Energy Cal: Gain = 5.0103 keV / Ch
Offset = 3.083.93 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.06% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction: 2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	37.205	100.0	277.28	0.2400	277	1.789E+000	1.079E-001	5.796E-003	2.907E-002
Th-230	4690.000	4540.000	4740.000	44.186	99.7	64.00	0.8611	63	4.089E-001	5.221E-002	1.114E-002	3.981E-002
Th-229	4865.000	4750.000	5125.000	29.873	99.6	3.00	2.8800	0	7.778E-004	1.572E-002	2.016E-002	5.783E-002
Th-228	5420.000	5290.000	5450.000	23.585	99.4	299.93	5.0114	295	1.918E+000	1.139E-001	2.666E-002	7.092E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge TN 37830
9:21:56AM 2/9/2017

Analyst: ORTEC

Sample

Sample: 30204864013 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

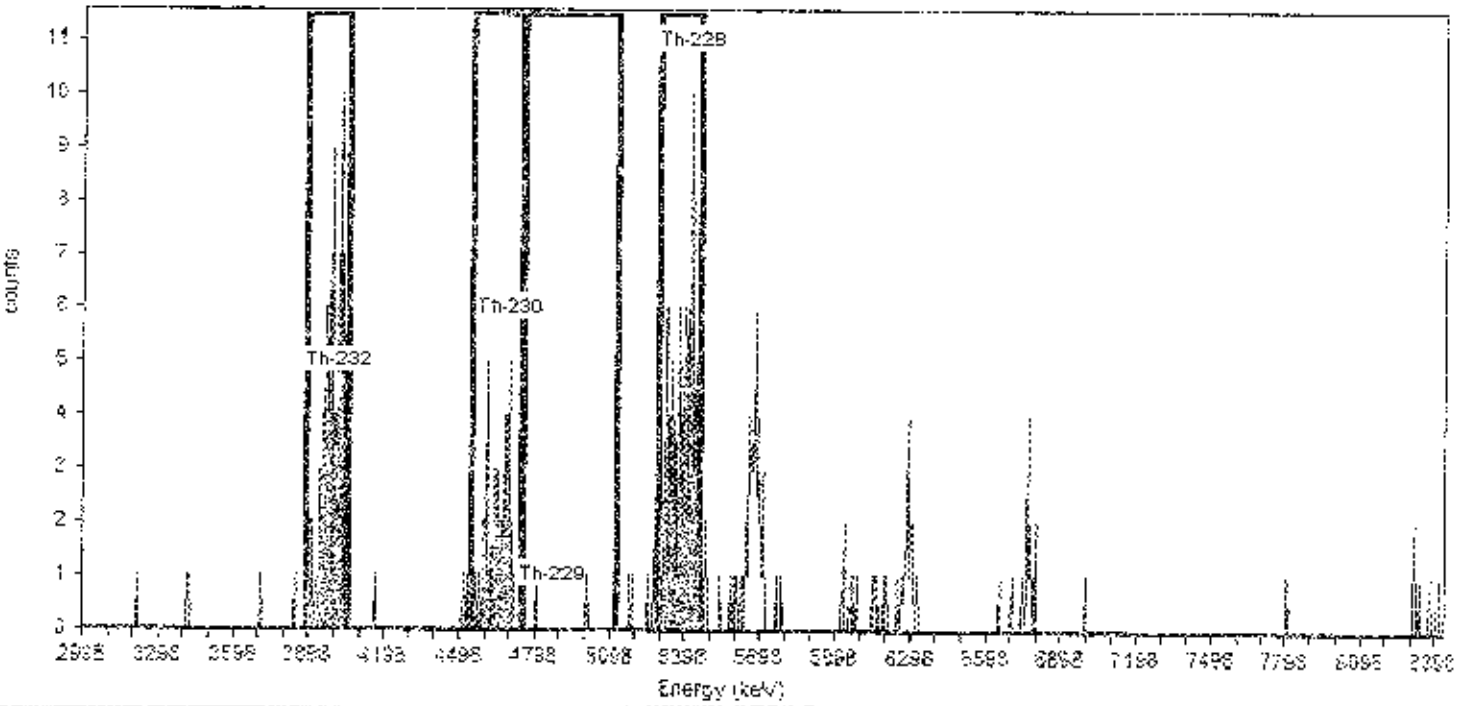
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 31 SN:
Acquisition Start Date: 2/9/2017 5:21:31AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:54PM
Bkgd Info: Sample: Det 31; Det: Det 31; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 31
Efficiency Calibration:2016.06.06 001 det 31
Calibration Date: 6/6/2016 10:21:27AM
Energy Cal: Gain = 5.3186 keV / Ch
Offset = 2.992.72 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4060.000	76.838	100.0	94.96	0.0000	95	6.298E-001	6.605E-002	0.000E+000	1.785E-002
Th-230	4690.000	4540.000	4740.000	114.889	99.7	53.00	1.4400	52	3.430E-001	4.911E-002	1.462E-002	4.724E-002
Th-229	4865.000	4750.000	5125.000	31.713	99.6	2.00	1.4400	1	3.727E-003	1.234E-002	1.463E-002	4.727E-002
Th-228	5420.000	5290.000	5460.000	49.570	99.4	100.20	5.0581	95	6.353E-001	6.858E-002	2.751E-002	7.308E-002

AlphaVision v5.3 — Alpha Spectrum Analysis Report

ORTEC
Oak Ridge, TN 37830
9:21:37AM 2/9/2017

Analyst: ORTEC

Sample

Sample: 30204854014 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

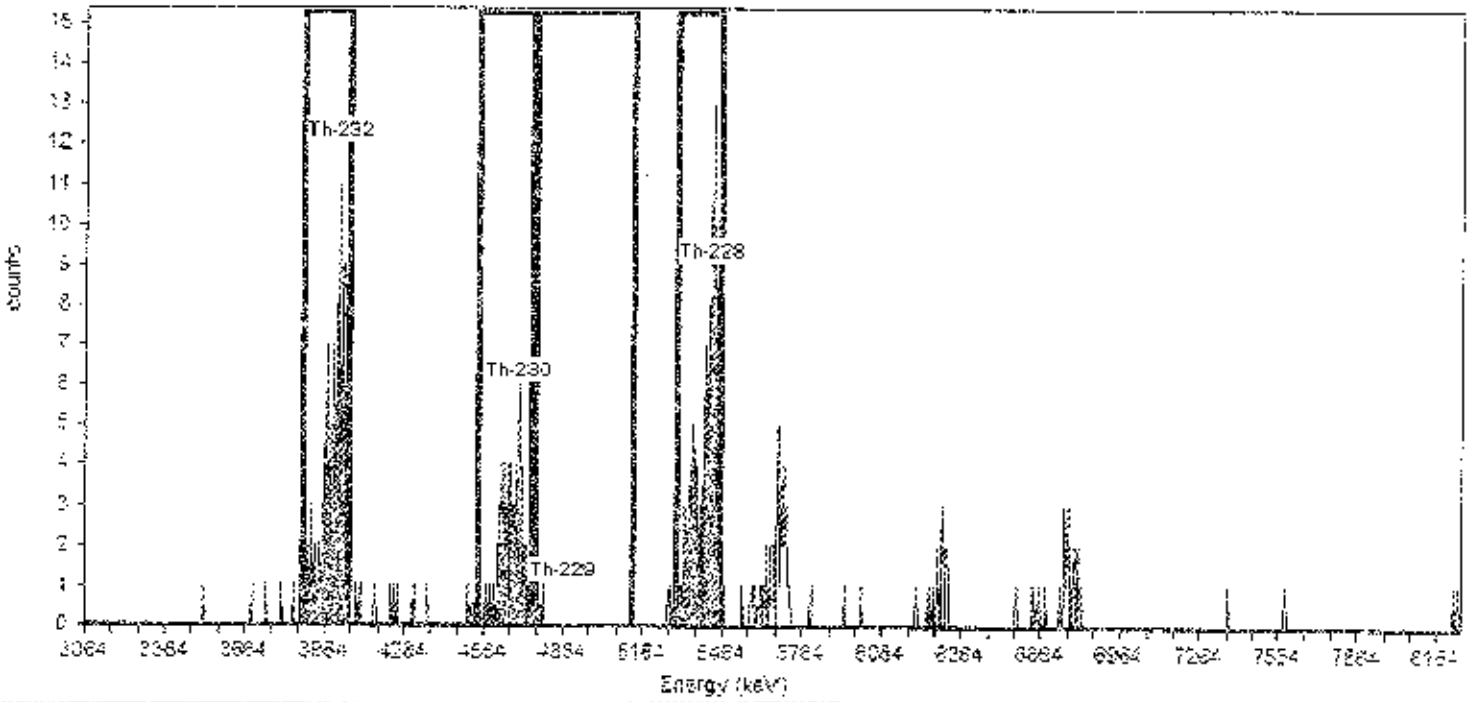
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 32 SN:
Acquisition Start Date: 2/9/2017 5:21:27AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:49PM
Bkgd Info: Sample: Det 32; Det: Det 32; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.12.02 010
Efficiency Calibration:2015.12.02 010
Calibration Date: 12/2/2016 2:55:41PM
Energy Cal: Gain = 5.0816 keV / Ch
Offset = 3,059.66 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.62% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/6/2017 11:13:05AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	19.866	100.0	96.68	0.2400	96	6.325E-001	6.465E-002	5.886E-003	2.952E-002
Th-230	4690.000	4540.000	4740.000	89.649	99.7	64.31	5.7600	59	3.852E-001	5.510E-002	2.892E-002	7.564E-002
Th-229	4865.000	4750.000	5125.000	.000	99.6	1.36	1.6163	0	0.000E+000	1.174E-002	1.626E-002	5.031E-002
Th-228	5420.000	5290.000	5460.000	17.338	99.4	122.90	4.8854	118	7.793E-001	7.475E-002	2.674E-002	7.134E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
6:25:40AM 2/9/2017

Analyst: ORTEC

Sample

Sample: 30204554015 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

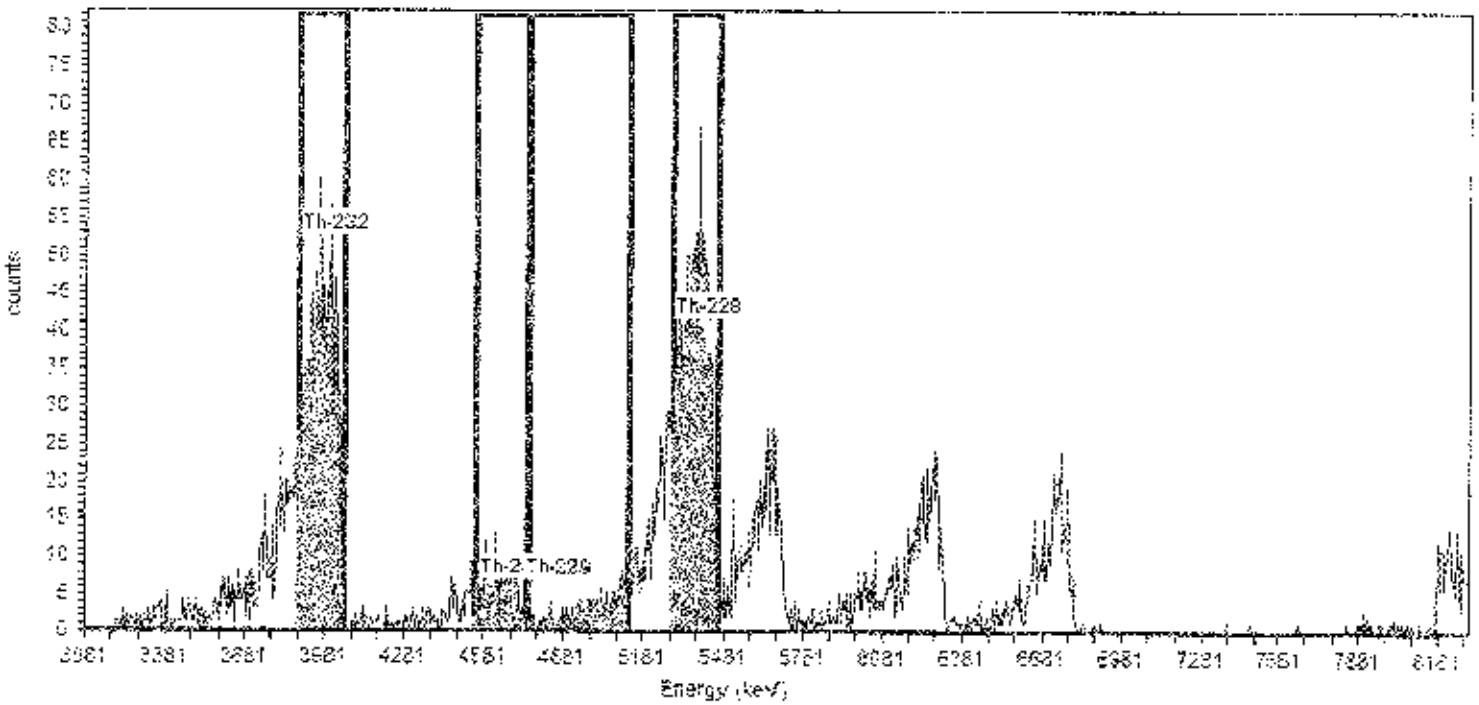
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 33 SN:
Acquisition Start Date: 2/9/2017 5:21:28AM
Live Time: 64.05 min.
Real Time: 64.07 min.
Background Date: 2/1/2017 1:59:49PM
Bkgd Info: Sample: Det 33; Det: Det 33; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 33b
Efficiency Calibration:2016.06.06 001 det 33b
Calibration Date: 6/6/2016 12:10:27PM
Energy Cal: Gain = 5.1053 keV / Ch
Offset = 3,076.65 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.87% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.96Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	138.298	100.0	1,193.34	0.0000	1,193	2.809E+001	8.265E-001	0.000E+000	6.371E-002
Th-230	4690.000	4540.000	4740.000	170.617	99.7	224.66	0.6153	224	5.290E+000	3.556E-001	3.143E-002	1.288E-001
Th-229	4865.000	4750.000	5125.000	36.316	99.6	190.00	0.1281	190	4.486E+000	3.266E-001	1.435E-002	9.263E-002
Th-228	5420.000	5290.000	5460.000	140.911	99.4	1,312.21	0.8006	1,311	3.108E+001	8.738E-001	3.599E-002	1.361E-001

AlphaVision v5.3 — *Alpha Spectroscopy Analysis Report*

Analyst: ORTEC

ORTEC
Oak Ridge, TN 37830
6:25:51AM 2/9/2017

Sample

Sample: 30204854016 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

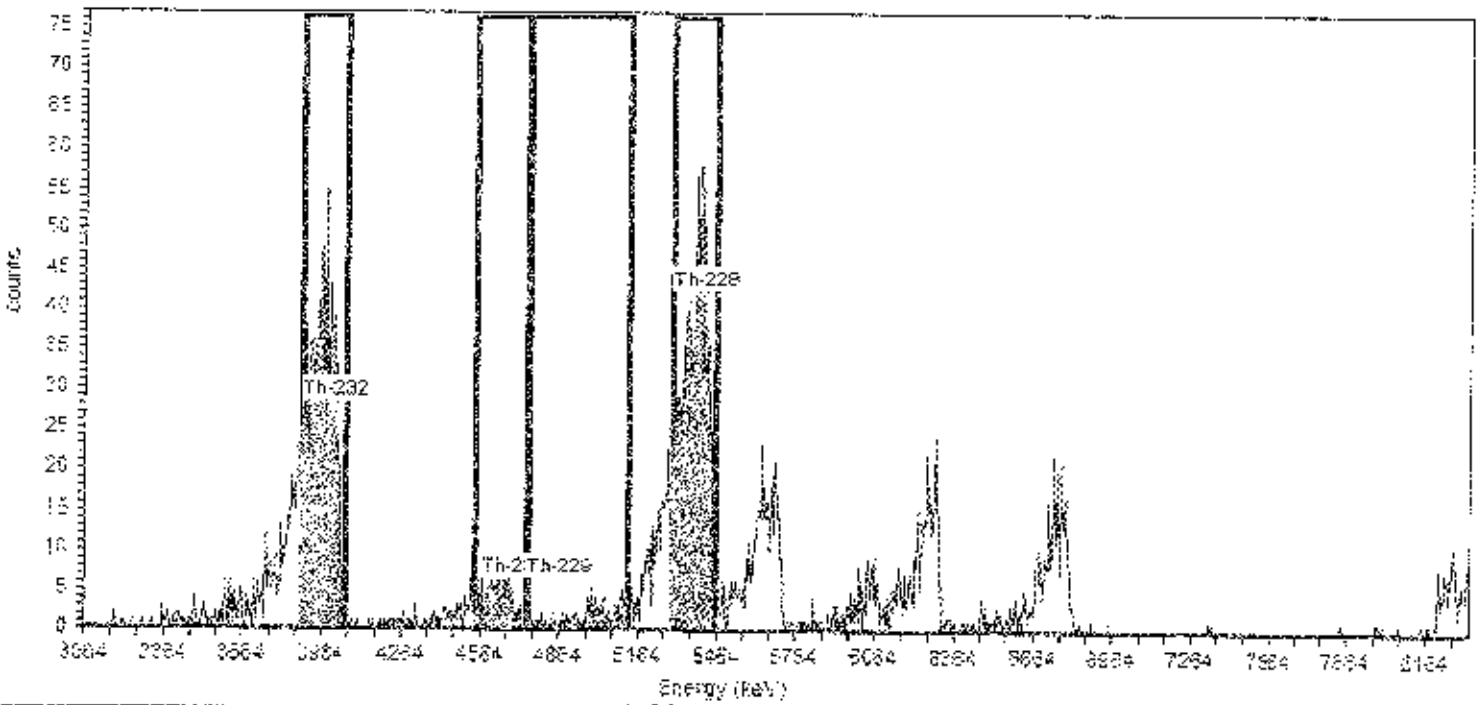
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 34 SN:
Acquisition Start Date: 2/9/2017 5:21:28AM
Live Time: 64.32 min.
Real Time: 64.32 min.
Background Date: 2/1/2017 1:59:50PM
Bkgd Info: Sample: Det 34; Det: Det 34: Spectrum #1; Feb-01-2017 13.59

Energy Calibration: 2016.06.06 001 det 34
Efficiency Calibration:2016.06.06 001 det 34
Calibration Date: 6/6/2016 10:25:49AM
Energy Cal: Gain = 5.1501 keV / Ch
Offset = 3.059.78 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.87% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	000	100.0	941.83	0.0643	942	2.208E+001	7.284E-001	1.309E-002	6.363E-002
Th-230	4690.000	4540.000	4740.000	144.823	99.7	147.91	0.3216	148	3.471E+000	2.867E-001	2.263E-002	1.089E-001
Th-229	4865.000	4750.000	5125.000	20.665	99.6	108.20	0.2862	108	2.537E+000	2.454E-001	2.481E-002	1.133E-001
Th-228	5420.000	5290.000	5460.000	113.988	99.4	1,032.99	1.9973	1,030	2.431E+001	7.670E-001	5.681E-002	1.771E-001

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
8:26:01AM 2/9/2017

Analyst: ORTEC

Sample

Sample: 30204854017 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

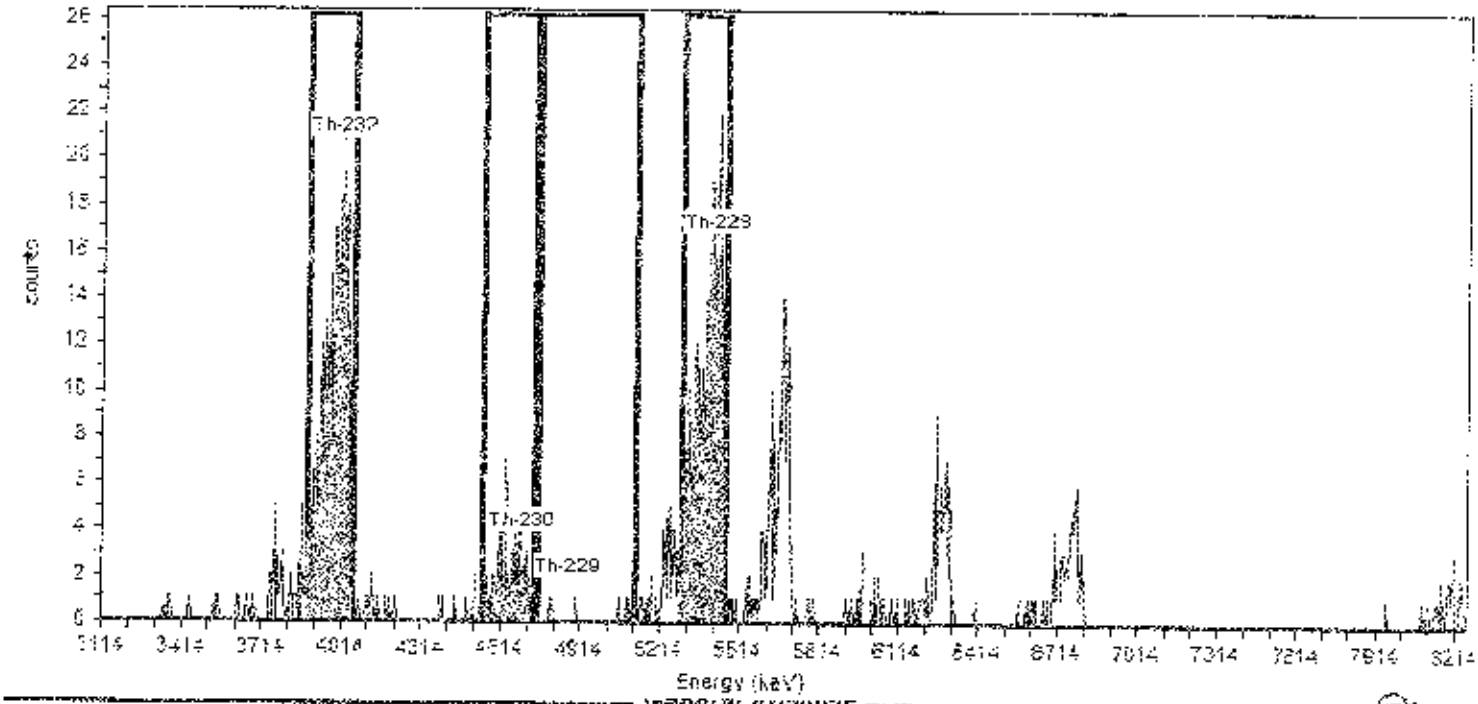
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 36 SN:
Acquisition Start Date: 2/9/2017 5:21:28AM
Live Time: 64.50 min.
Real Time: 64.50 min.
Background Date: 2/1/2017 1:59:50PM
Bkgd Info: Sample: Det 36; Det: Det 36; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 36
Efficiency Calibration:2016.06.06 001 det 36
Calibration Date: 6/6/2016 10:31:59AM
Energy Cal: Gain = 5.0362 keV / Ch
Offset = 3,109.16 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.61% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3880.000	4050.000	30.958	100.0	359.94	0.1290	360	8.782E+000	4.654E-001	3.488E-002	9.580E-002
Th-230	4690.000	4540.000	4740.000	124.098	99.7	71.89	1.1810	71	1.731E+000	2.094E-001	4.477E-002	1.558E-001
Th-229	4865.000	4750.000	5125.000	7.915	99.6	6.73	0.8264	6	1.446E-001	8.733E-002	3.779E-002	1.419E-001
Th-228	5420.000	5290.000	5460.000	23.905	99.4	370.29	0.6981	370	9.082E+000	4.757E-001	3.486E-002	1.362E-001

AlphaVision v5.3 — **Alpha Spectrum Analysis Report**

Analyst: ORTEC

ORTEC
Oak Ridge, TN 37830
8:26:11AM 2/9/2017

Sample

Sample: 30204854018 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

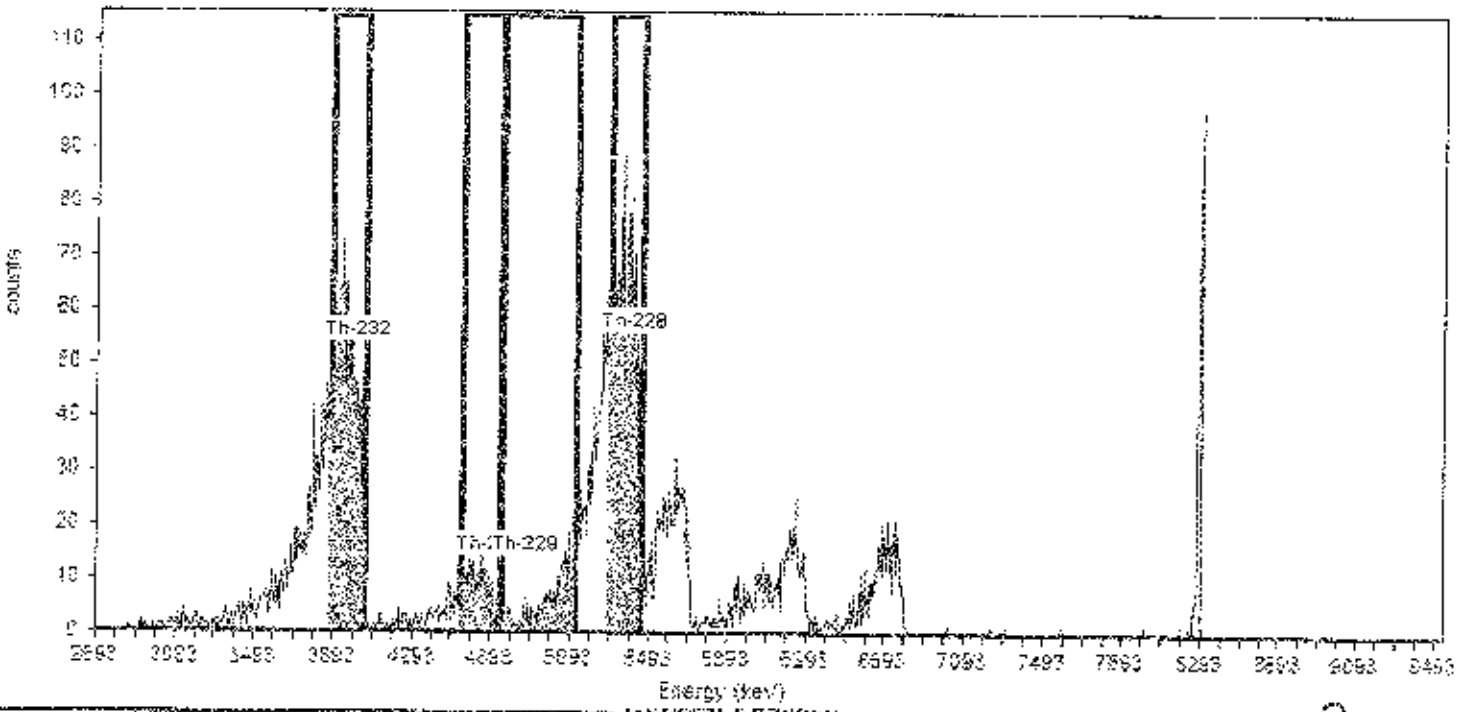
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 37 SN:
Acquisition Start Date: 2/9/2017 5:21:29AM
Live Time: 64.65 min.
Real Time: 64.65 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 37; Det: Det 37; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 37
Efficiency Calibration:2016.06.06 001 det 37
Calibration Date: 6/6/2016 12:14:29PM
Energy Cal: Gain = 6.6919 keV / Ch
Offset = 2,666.41 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.95% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3960.000	4050.000	.000	100.0	1,185.33	0.1293	1,185	3.064E+001	3.053E-001	1.578E-002	1.015E-001
Th-230	4690.000	4540.000	4740.000	99.437	99.7	244.05	0.3879	244	6.318E+000	4.056E-001	2.741E-002	1.260E-001
Th-229	4865.000	4750.000	5125.000	17.660	99.6	313.78	0.5172	313	8.127E+000	4.620E-001	3.167E-002	1.335E-001
Th-228	5420.000	5290.000	5460.000	.000	99.4	1,381.30	1.7453	1,380	3.591E+001	9.872E-001	5.836E-002	1.872E-001

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
9:21:40AM 2/9/2017

Analyst: ORTEC

Sample

Sample: LCS33792 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

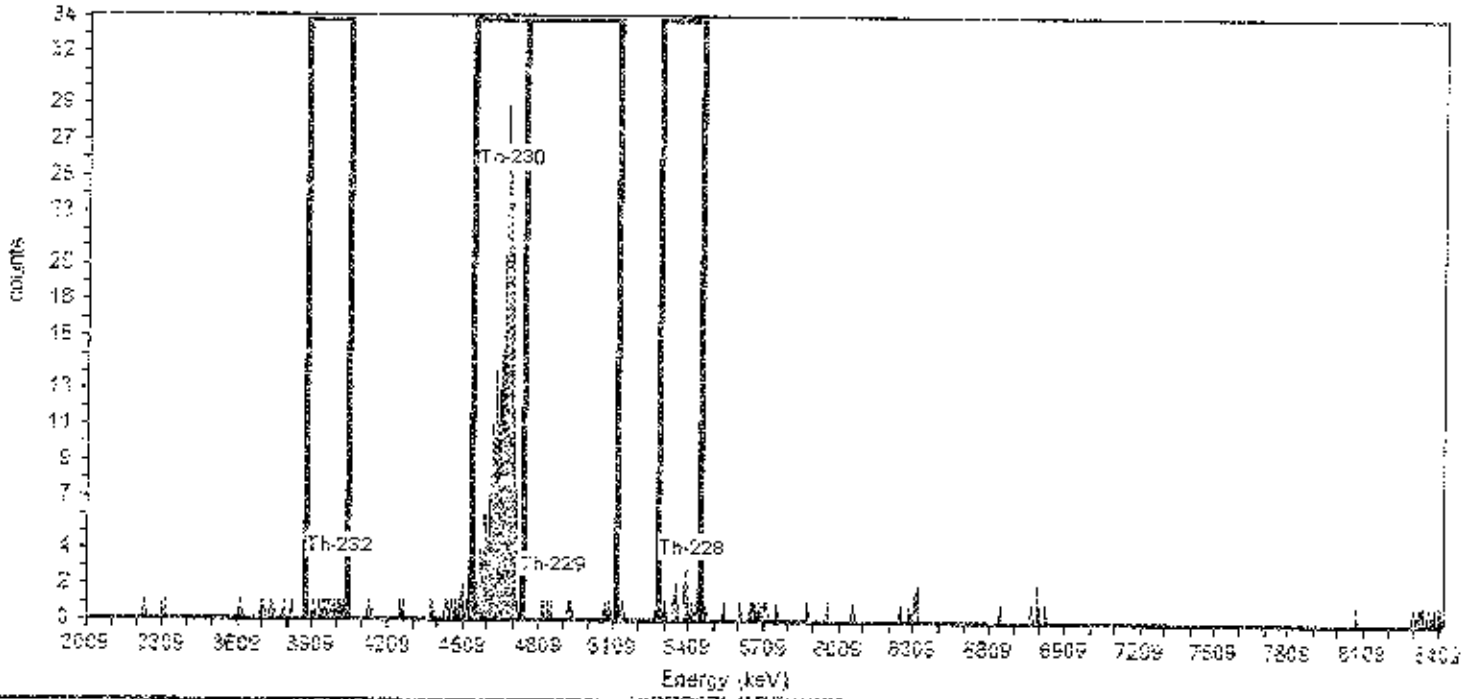
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 38 SN:
Acquisition Start Date: 2/9/2017 6:21:29AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 38; Det: Det 38; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 38
Efficiency Calibration:2016.06.06 001 det 38
Calibration Date: 6/6/2016 12:17:52PM
Energy Cal: Gain = 5.3002 keV / Ch
Offset = 3.004.00 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.16% +/- 0.26% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/8/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	S.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4010.000	3860.000	4050.000	84.123	100.0	13.00	0.4800	13	8.663E-002	2.538E-002	8.771E-003	3.824E-002
Th-230	4690.000	4540.000	4740.000	77.107	99.7	305.80	2.4000	303	2.103E+000	1.222E-001	1.967E-002	8.810E-002
Th-229	4865.000	4750.000	5125.000	7.769	99.6	8.00	1.2000	7	4.716E-002	2.104E-002	1.382E-002	4.660E-002
Th-228	5420.000	5290.000	5460.000	104.877	99.4	17.62	5.9822	12	8.101E-002	3.381E-002	3.118E-002	8.128E-002

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
9:21:43AM 2/9/2017

Analyst: ORTEC

Sample

Sample: LCSD33792 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: 1.00 Aliquot Fraction: 100.00%
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: Th33792
:
Description:

Client Name: Undefined
Client Contact:

Tracer

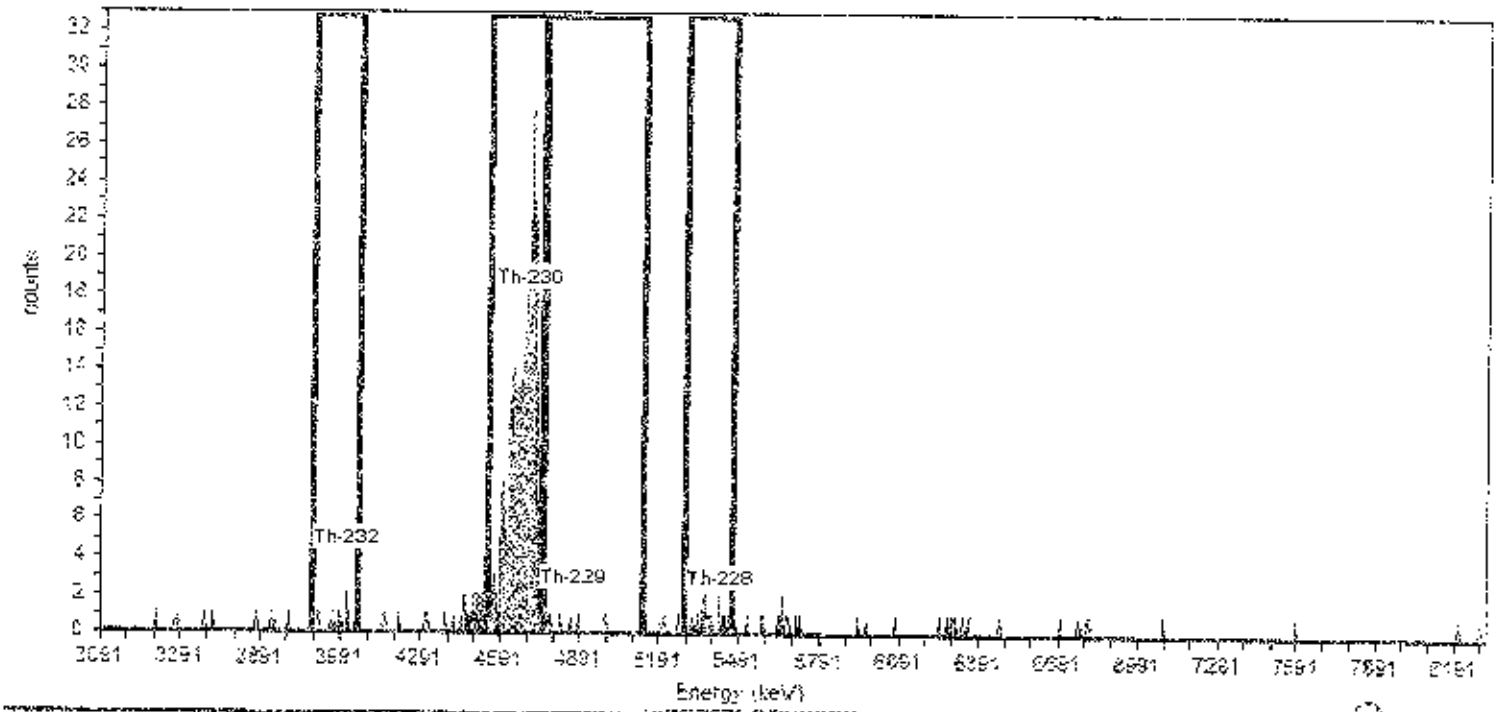
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 39 SN:
Acquisition Start Date: 2/9/2017 6:21:29AM
Live Time: 240.00 min.
Real Time: 240.00 min.
Background Date: 2/1/2017 1:59:51PM
Bkgd Info: Sample: Det 39; Det: Det 39; Spectrum #1; Feb-01-2017 13:59

Energy Calibration: 2016.06.06 001 det 39
Efficiency Calibration:2016.06.06 001 det 39
Calibration Date: 6/6/2016 12:20:36PM
Energy Cal: Gain = 5.1658 keV / Ch
Offset = 3.086.86 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 31.72% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso th by energy
Decay Correction:2/6/2017 11:13:08AM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: Iso Th
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 pCi	1.00Sigma TPU pCi	Critical Level pCi	MDA pCi
Th-232	4015.000	3880.000	4050.000	7.428	100.0	8.00	0.2400	8	4.591E-002	1.699E-002	5.310E-003	2.663E-002
Th-230	4690.000	4540.000	4740.000	28.990	99.7	373.84	3.3660	370	2.199E+000	1.157E-001	1.993E-002	5.591E-002
Th-229	4865.000	4750.000	5125.000	133.829	99.6	5.18	1.6319	3	1.980E-002	1.573E-002	1.472E-002	4.661E-002
Th-228	5420.000	5290.000	5460.000	7.703	99.4	16.20	3.9381	12	7.307E-002	2.674E-002	2.135E-002	5.943E-002

Alpha Spectroscopy Calibration Documentation

Alpha Spectroscopy Calibration Source Preparation
Sources Prepared on: 1/28/2010
Prepared By: JLK

Calibration Source Preparation Description

Five (5) sources were prepared by adding portions of Cm-244, Pu-239, and Th-230 to a centrifuge tube containing 15 ml of 2N HCl. The weight of each standard was recorded and is listed on the table on the following page.

The sources were micro-precipitated by adding 0.1 ml of 0.5 mg/ml neodymium carrier, 14 drops of 25% hydrazine di-hydrochloride, and 3 ml of hydrofluoric acid to each tube. The sources were swirled vigorously to mix and allowed to rest for 30 minutes. The sources were filtered through a 0.1 micron Eichrom Resolve TM polypropylene filter. The filters were rinsed with 80% ethanol, and mounted on counting disks, and dried prior to use. The source filtrate was collected and analyzed for gross alpha and beta activity to document any losses of the calibration analytes during the filtration process.

This calibration process is documented as an option in the applicable SOP. Use of the above described calibration source preparation option was utilized to ensure consistency between the detector efficiency determining calibration sources and the source preparation method used for analyzing samples. The micro-precipitated calibration sources are an exact match to the techniques employed in sample counting.

Source Analysis Process

Sources were counted in each detector to obtain a minimum of 10000 net counts for each analyte. Both the energy and efficiency calibration were determined simultaneously with a single source count.

As of 1/1/2016, detectors 1 through 36 of the Canberra operating system are offline and out of service.

Calibration Package Updates

Date of Revision or Change	Description of Changes	Analyst Initials
July 21, 2014	Replaced Energy and Efficiency Calibration spectra for detectors 1, 2, 4, 6, 9, 11, 12, 14, 15, 24, and 28 of the Canberra System. Replaced Energy and Efficiency Calibration spectra for detectors 26, 27, 28, 31, 32, 33, 34, 36, 37, 39, and 40 of the Tennelec System. Replaced calibration verification sections for all detectors.	JAL
Jan 21, 2015	Replaced Energy and Efficiency calibration spectra for detectors 25 through 40 of the Tennelec operating system. Replaced the calibration verification section for detectors 25 through 40 of the Tennelec operating system. Replaced calibration verification for Canberra detectors 1-8, 12, 15, 17, 21, 23, and 25.	JAL
June 6, 2016	Replaced Energy and Efficiency calibration spectra for detectors 25 through 40 of the Tennelec operating system. Replaced the calibration verification section for detectors 25 through 40 of the Tennelec operating system.	LAM

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:52:30AM 6/6/2016

Analyst: ORTEC
Detector: Det 25

Calibration

Energy Calibration: 2016.06.06 001 det 25
Description:

Analysis Date: 6/6/2016 8:40:01AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#1
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

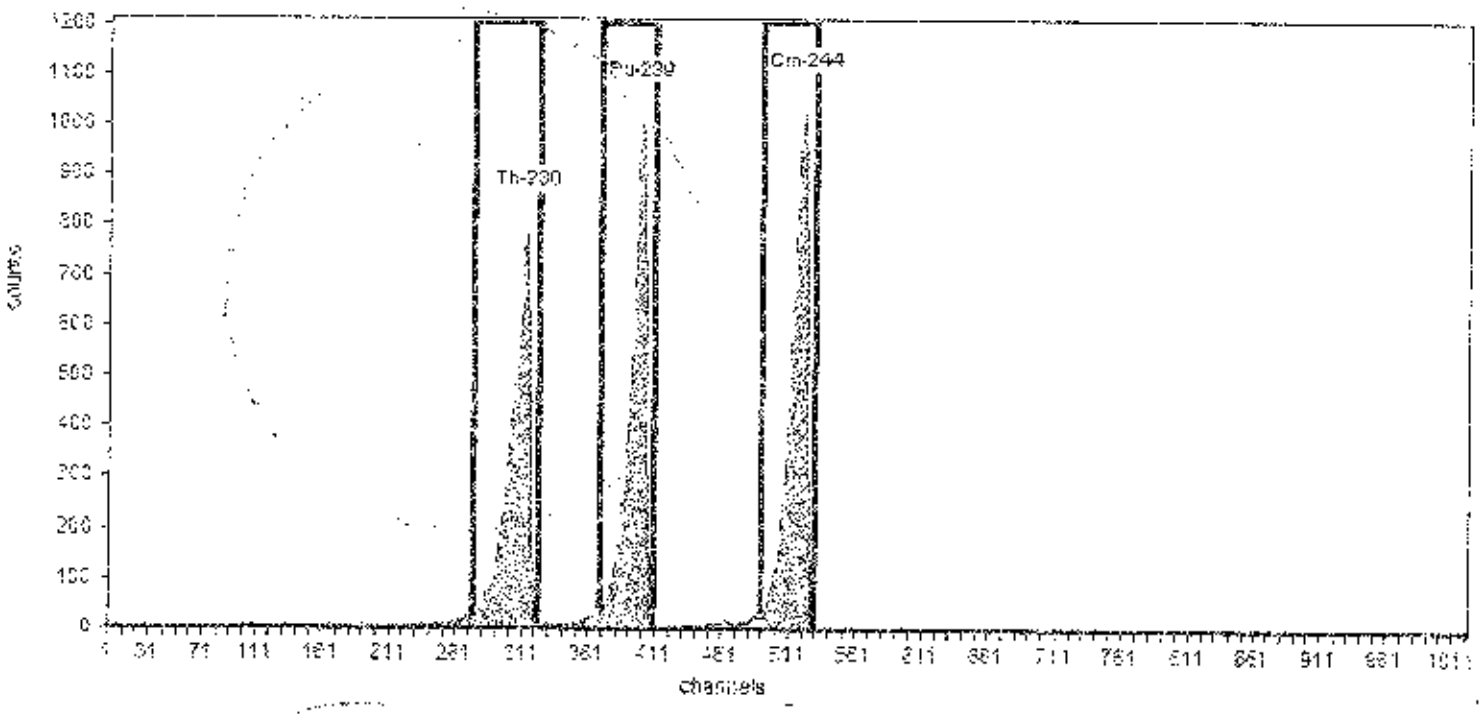
Detector: Det 25 , SN:
Acquisition Start Date: 6/6/2016 7:26:06AM

Live Time: 60.00 min.
Real Time: 60.09 min.

Efficiency Calibration Name: 2016.06.06 001 det 25

Energy Calibration Equation:
Gain = 5.3424 keV / Ch
Offset = 3,016.47 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.31% +/- 0.30% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	313	4.69	274	322	12,020.00	200.33
Pu-239	399	5.16	369	409	13,236.00	220.60
Cm-244	522	5.81	480	530	13,945.00	232.42

AlphaVision v5.3

Alpha Spectroscopy Calibration Report

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
6:52:19AM 6/6/2016

Analyst: ORTEC
Detector: Det 26

Calibration

Energy Calibration: 2016.06.06 001 det 26
Description:

Analysis Date: 6/6/2016 6:42:29AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#2
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

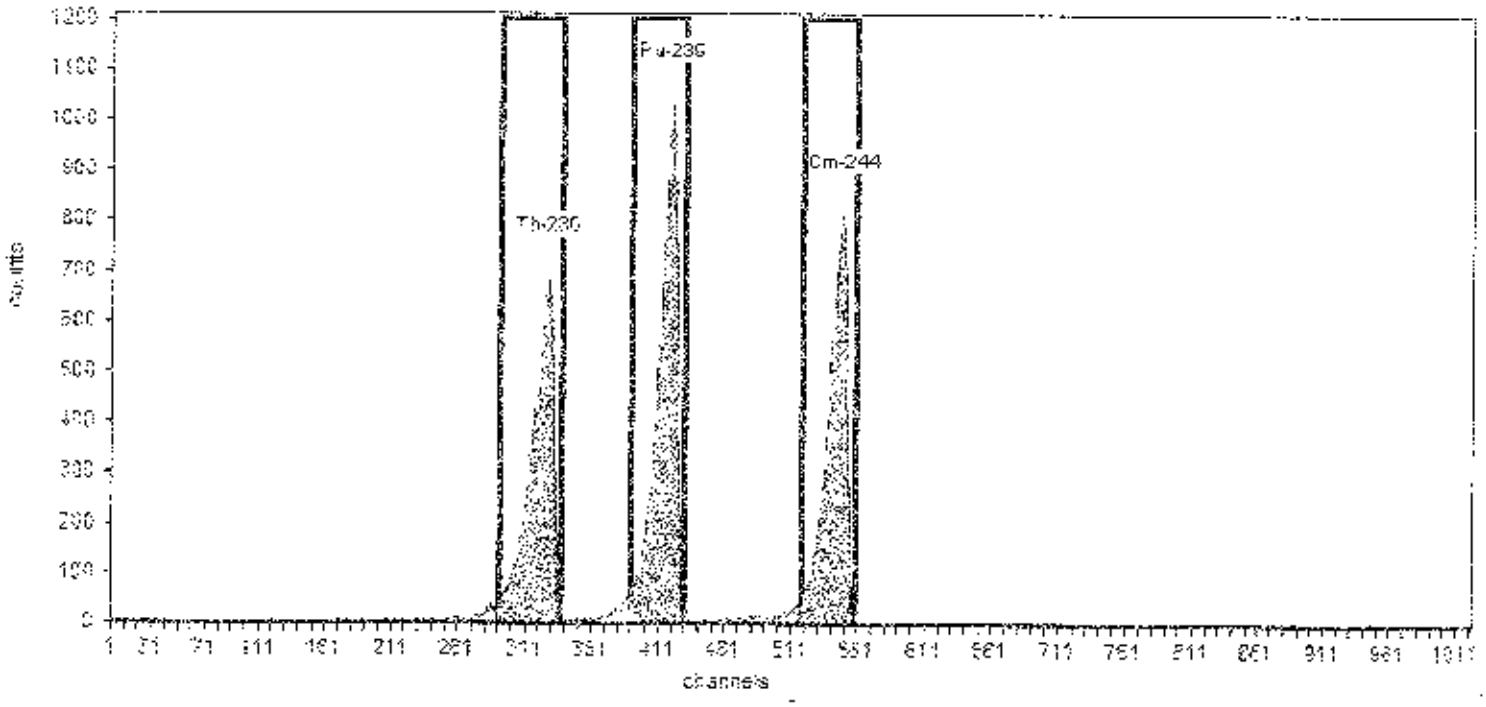
Detector: Det 26 , SN:
Acquisition Start Date: 6/6/2016 7:28:36AM

Live Time: 60.00 min.
Real Time: 60.09 min.

Efficiency Calibration Name: 2016.06.06 001 det 26

Energy Calibration Equation:
Gain = 5.0339 keV / Ch
Offset = 3,041.32 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.21% +/- 0.28% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	327	4.69	292	337	12,568.00	209.47
Pu-239	420	5.16	390	430	16,150.00	269.17
Cm-244	549	5.81	519	559	13,042.00	217.37

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: Det 27

8:52:04AM 6/6/2016

Calibration

Energy Calibration: 2016 06.06 001 det 27
Description:

Analysis Date: 6/6/2016 8:44:44AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#3
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

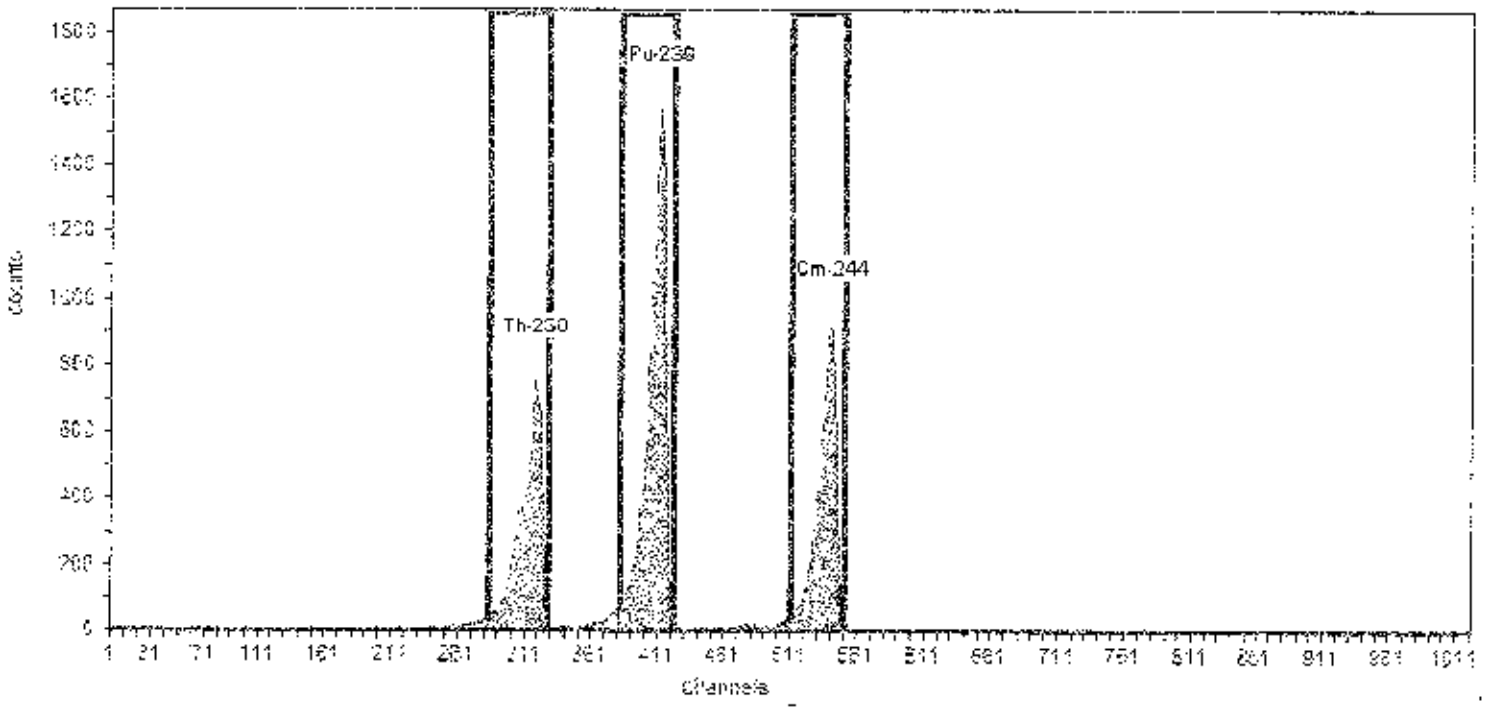
Detector: Det 27 , SN:
Acquisition Start Date: 6/6/2016 7:27:02AM

Live Time: 60.00 min.
Real Time: 60.09 min.

Efficiency Calibration Name: 2016.06.06 001 det 27

Energy Calibration Equation:
Gain = 5.0148 keV / Ch
Offset = 3.089.69 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.63% +/- 0.27% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 0

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	318	4.69	284	329	12,370.00	206.17
Pu-239	413	5.16	383	423	22,159.00	369.32
Cm-244	541	5.81	511	551	13,390.00	223.17

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:51:50AM 6/6/2016

Analyst: ORTEC
Detector: Det-28

Calibration

Energy Calibration: 2016.06.06 001 det 28
Description:

Analysis Date: 6/6/2016 8:47:14AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#4
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

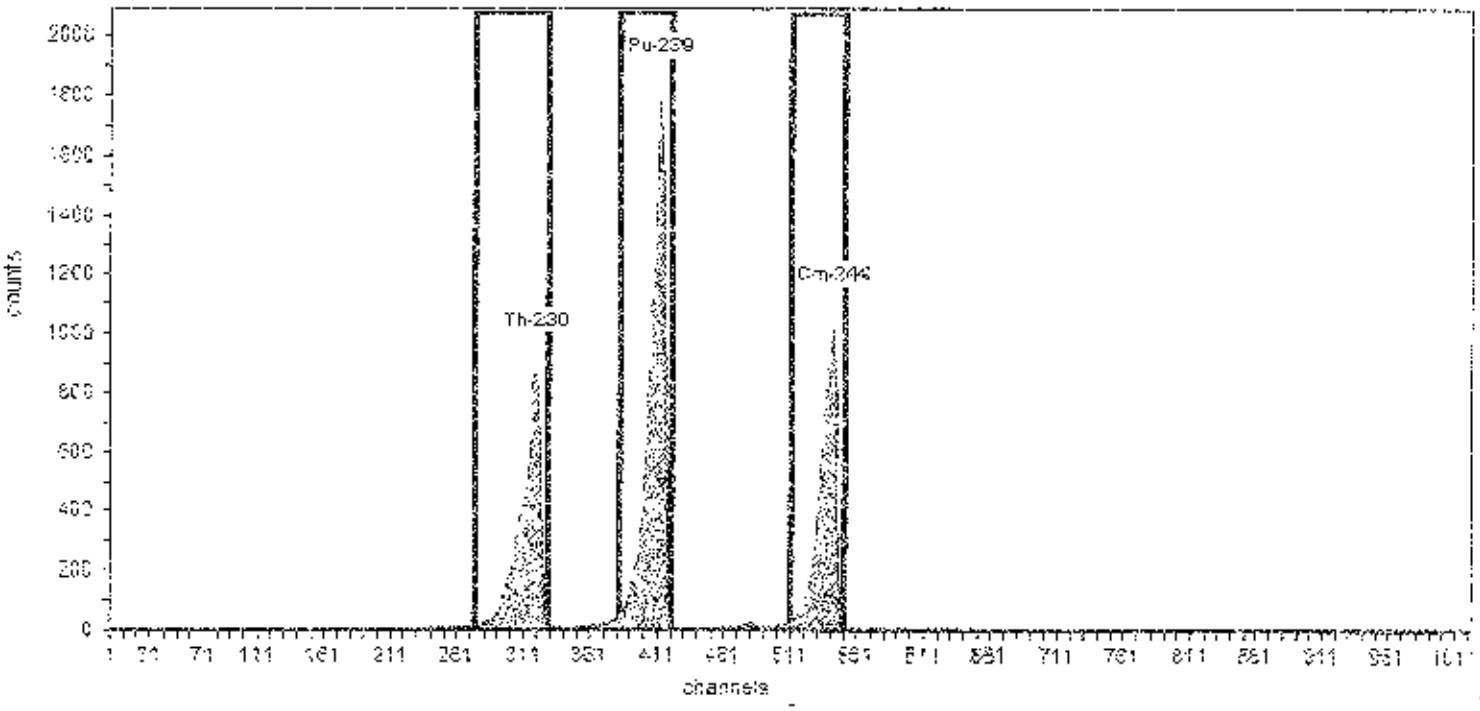
Detector: Det-28 , SN:
Acquisition Start Date: 6/6/2016 7:27:41AM

Live Time: 60.00 min.
Real Time: 60.07 min.

Efficiency Calibration Name: 2016.06.06 001 det 28

Energy Calibration Equation:
Gain = 5.0100 keV / Ch
Offset = 3,039.93 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.66% +/- 0.27% TPIR(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	319	4.69	274	329	13,426.00	223.77
Pu-239	412	5.16	382	422	22,778.00	379.63
Cm-244	542	5.81	511	561	13,487.00	224.78

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:51:38AM 6/6/2016

Analyst: ORTEC
Detector: Det-29

Calibration

Energy Calibration: 2016.06.06 001 det 29
Description:

Analysis Date: 6/5/2016 8:49:11AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#5
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det-29 , SN:
Acquisition Start Date 6/6/2016 7:28:17AM

Live Time: 60.00 min
Real Time: 60.07 min

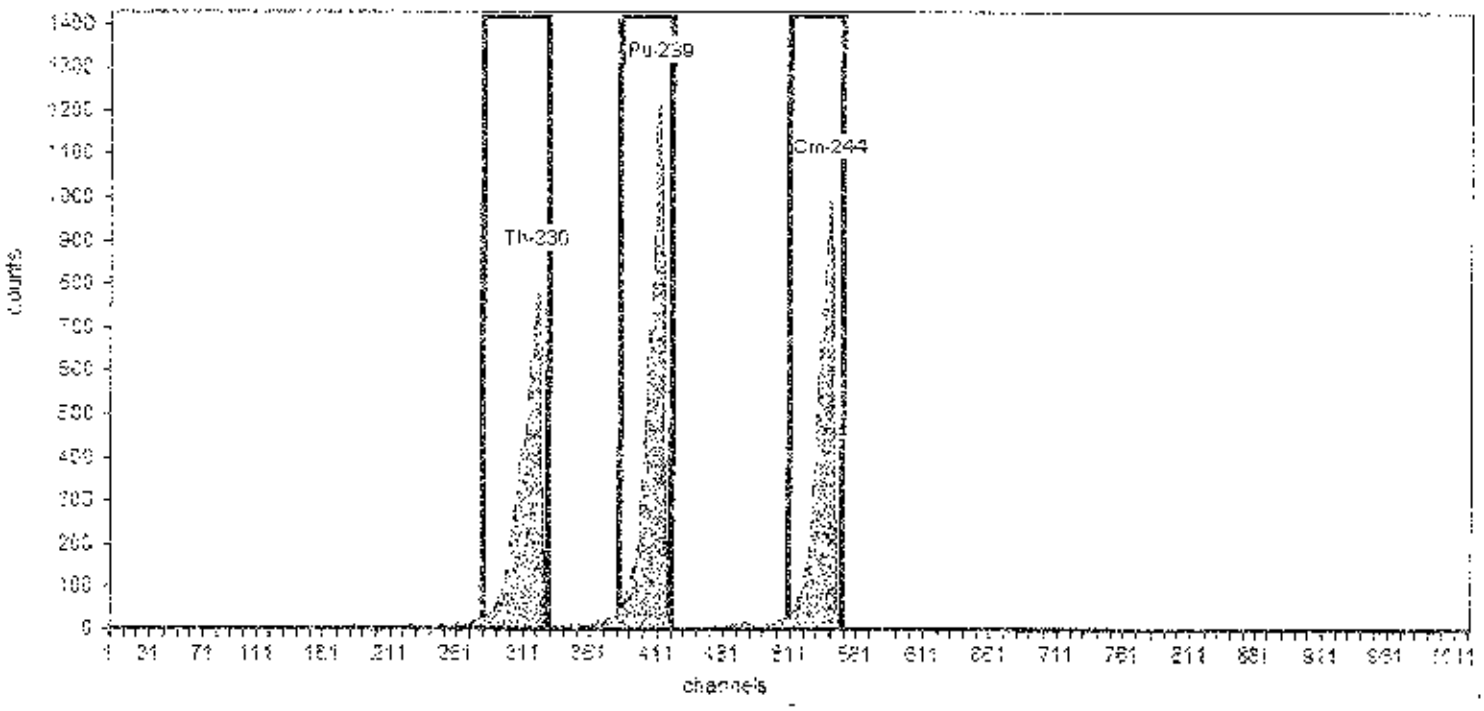
Efficiency Calibration Name: 2016.06.06 001 det 29

Energy Calibration Equation:
Gain = 5.0793 keV / Ch

Offset = 3,062.36 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.03% +/- 0.28% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	320	4.69	279	329	12,923.00	215.38
Pu-239	412	5.16	382	422	16,015.00	266.93
Cm-244	540	5.81	510	550	13,179.00	219.65

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
2:08:30PM 6/6/2016

Analyst: ORTEC
Detector: Det-30

Calibration

Energy Calibration: 2016.06.06 004 Det 30b
Description:

Analysis Date: 6/6/2016 2:08:23PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#6
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det-30 , SN:
Acquisition Start Date: 6/6/2016 1:04:40PM

Live Time: 60.00 min.
Real Time: 60.02 min.

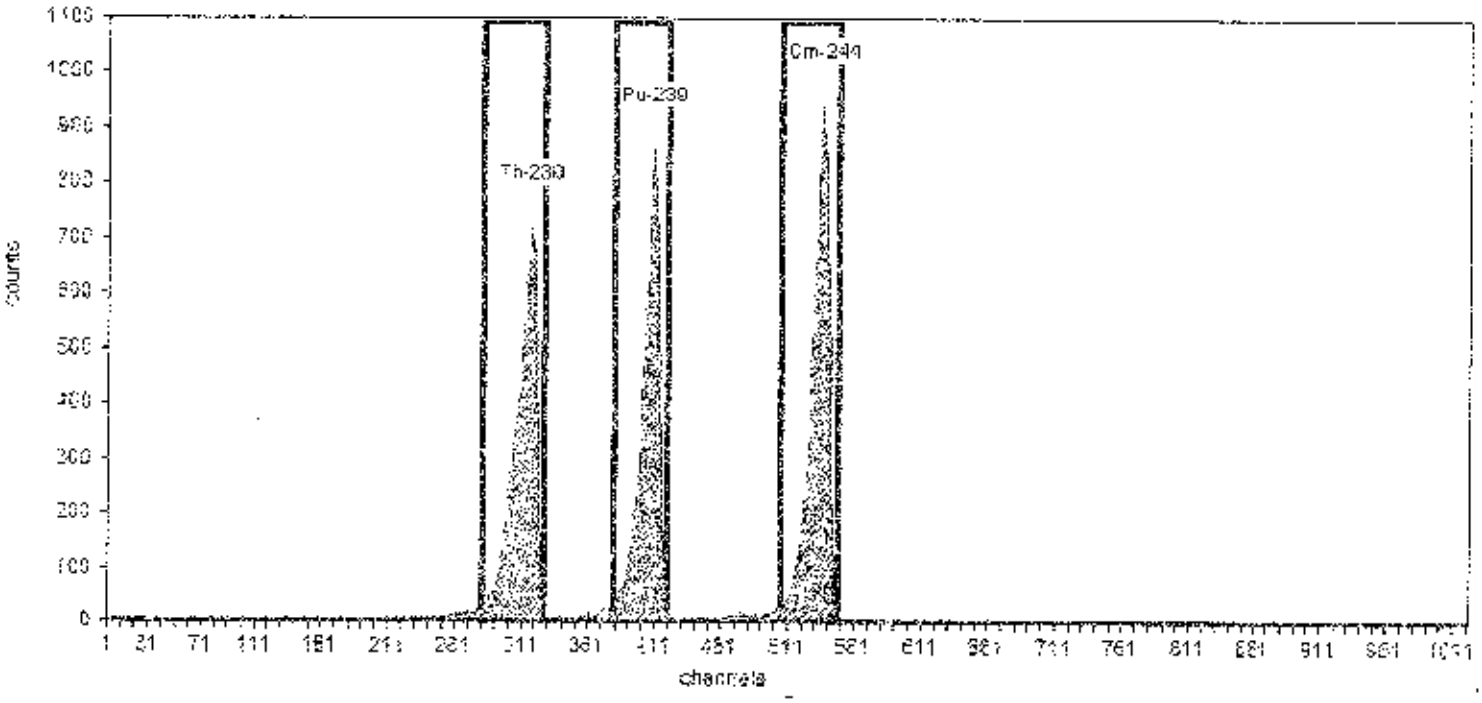
Efficiency Calibration Name: 2016.06.06 004 Det 30b

Energy Calibration Equation:
Gain = 5.0577 keV / Ch

Offset = 3,088.37 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.76% +/- 0.30% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	316	4.69	281	327	12,287.00	204.78
Pu-239	409	5.16	380	420	12,098.00	201.63
Cm-244	537	5.81	505	548	13,653.00	227.55

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
10:32:13AM 6/6/2016

Analyst: ORTEC
Detector: Det 31

Calibration

Energy Calibration: 2016.06.06 001 det 31
Description:

Analysis Date: 6/6/2016 10:21:27AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#1
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det 31 , SN:
Acquisition Start Date: 6/6/2016 8:50:57AM

Live Time: 60.00 min.
Real Time: 60.07 min.

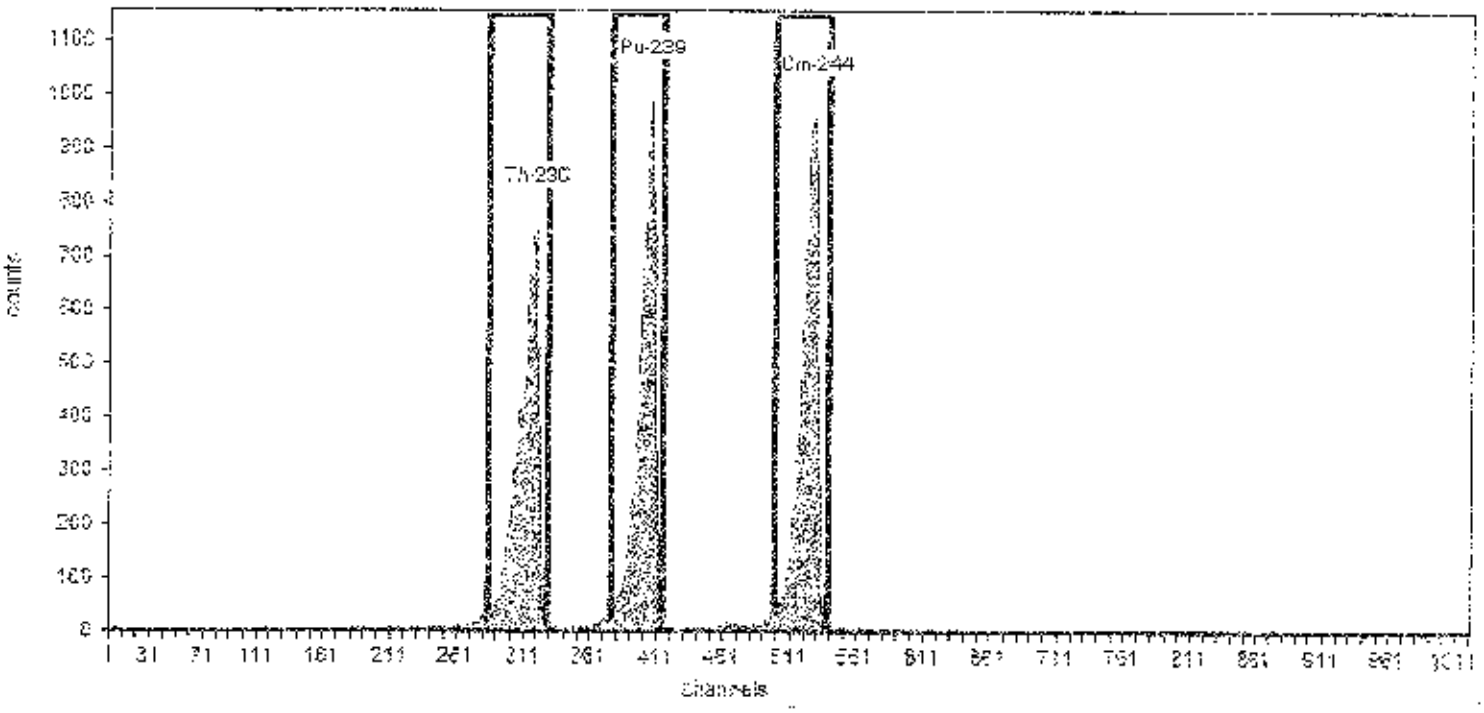
Efficiency Calibration Name: 2016.06.06 001 det 31

Energy Calibration Equation:
Gain = 5.3188 keV / Ch

Offset = 2,992.72 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 23.30% +/- 0.30% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	319	4.69	284	329	11,704.00	195.07
Pu-239	406	5.16	376	416	12,901.00	215.02
Cm-244	529	5.81	499	539	13,237.00	220.62

OK 6/6/16

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: Det 32
12:27:18PM 6/6/2016

Calibration

Energy Calibration: 2016.06.06 001 det 32d
Description:

Analysis Date: 6/6/2016 12:27:08PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#5
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det 32 , SN:
Acquisition Start Date: 6/6/2016 10:58:07AM

Live Time: 60.00 min.
Real Time: 60.06 min.

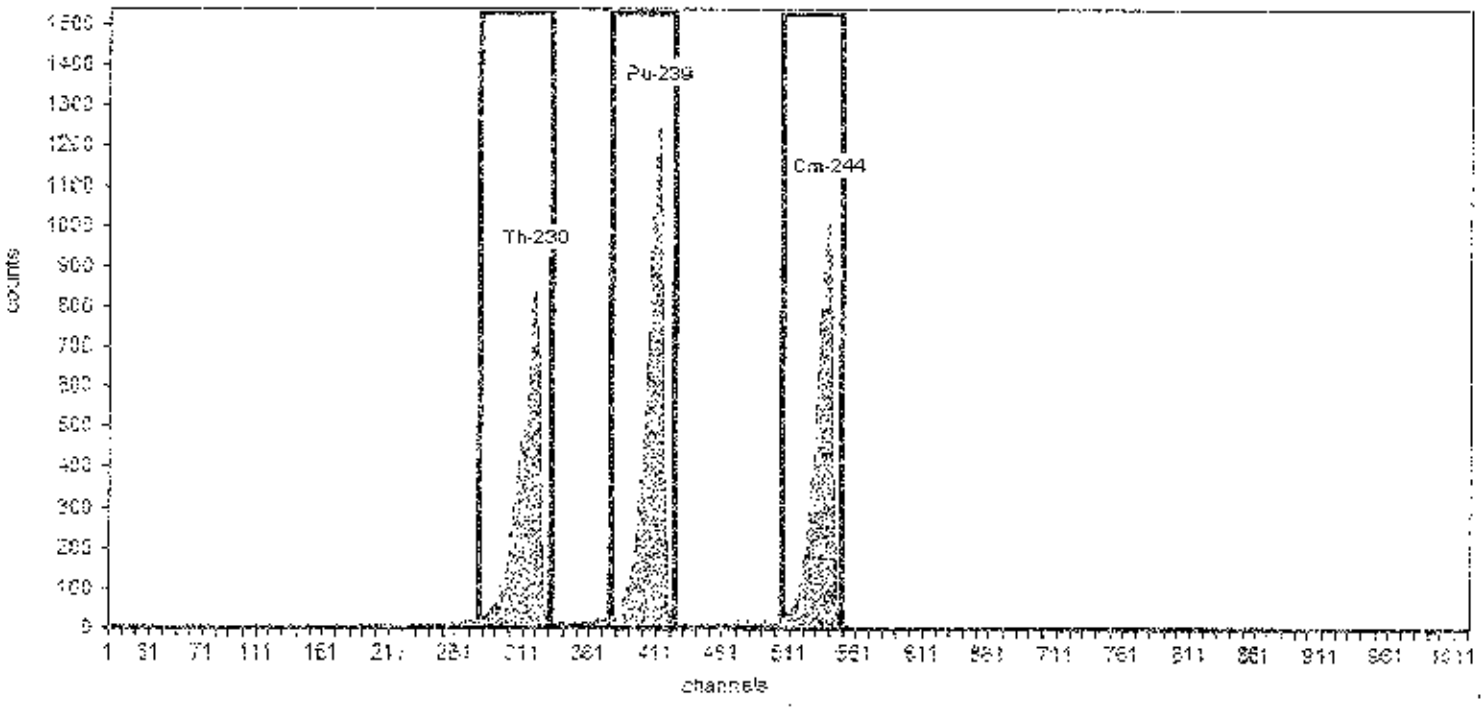
Efficiency Calibration Name: 2016.06.06 001 det 32d

Energy Calibration Equation:
Gain = 6.0816 keV / Ch

Offset = 3,064.74 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.59% +/- 0.29% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	319	4.69	278	331	13,606.00	226.77
Pu-239	412	5.16	377	424	16 959.00	282.65
Cm-244	539	5.81	508	550	13,900.00	231.67

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:27:30PM 6/6/2016

Analyst: ORTEC
Detector: Det 33

Calibration

Energy Calibration: 2016.06.06 001 det 33b
Description:

Analysis Date: 6/6/2016 12:10:27PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2016#6
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det 33 , SN:
Acquisition Start Date: 6/6/2016 10:44:08AM

Live Time: 60.00 min.
Real Time: 60.09 min.

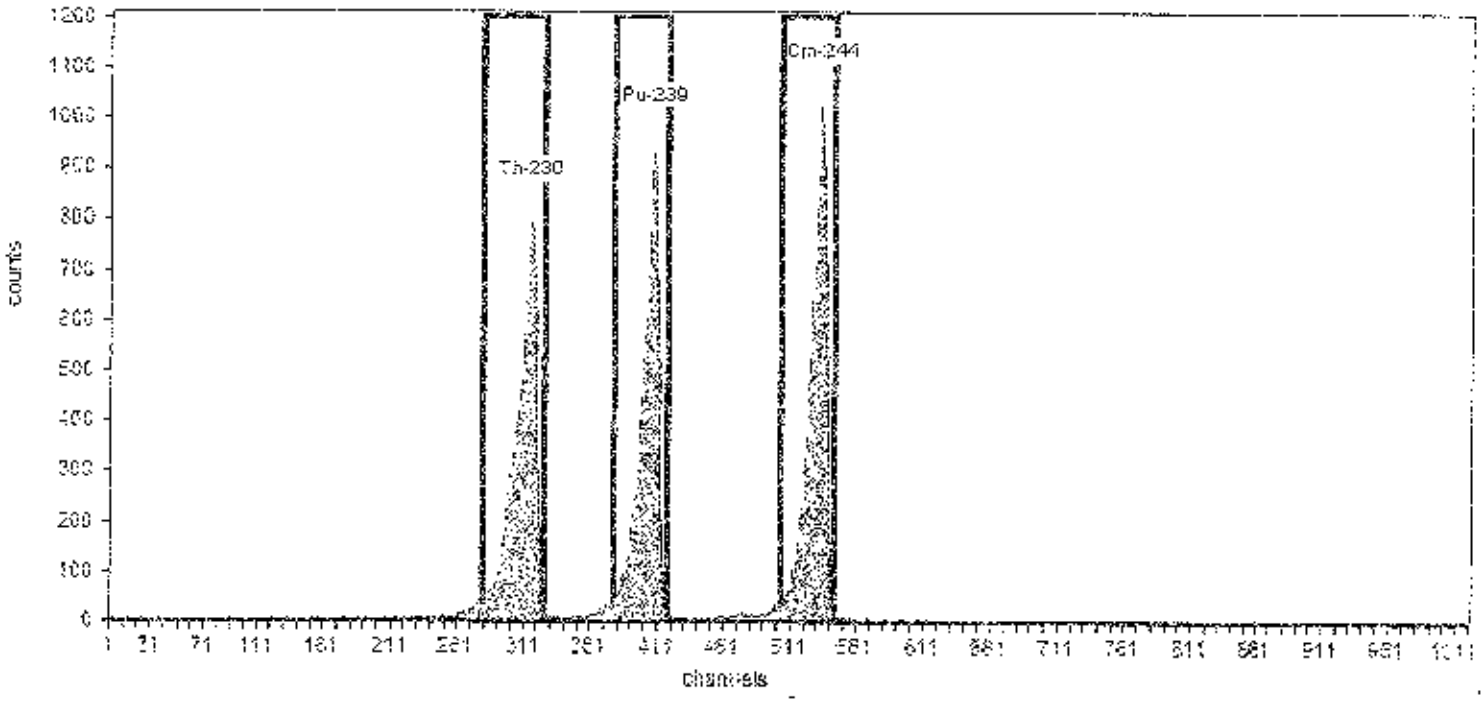
Efficiency Calibration Name: 2016.06.06 001 det 33b

Energy Calibration Equation:
Gain = 5.1059 keV / Ch

Offset = 3,076.65 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.87% +/- 0.31% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	315	4.59	280	325	12,945.00	215.75
Pu-239	408	5.16	378	418	12,706.00	211.77
Cm-244	534	5.81	504	544	13,874.00	231.23

AlphaVision v5.3 **Alpha Spectrum Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
10:32:39AM 6/6/2016

Analyst: ORTEC
Detector: Det 34

Calibration

Energy Calibration: 2016.06.06 001 det 34
Description:

Analysis Date: 6/6/2016 10:25:49AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS13Oct2015#4
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det 34 , SN:
Acquisition Start Date: 6/6/2016 8:58:17AM

Live Time: 60.00 min.
Real Time: 60.06 min.

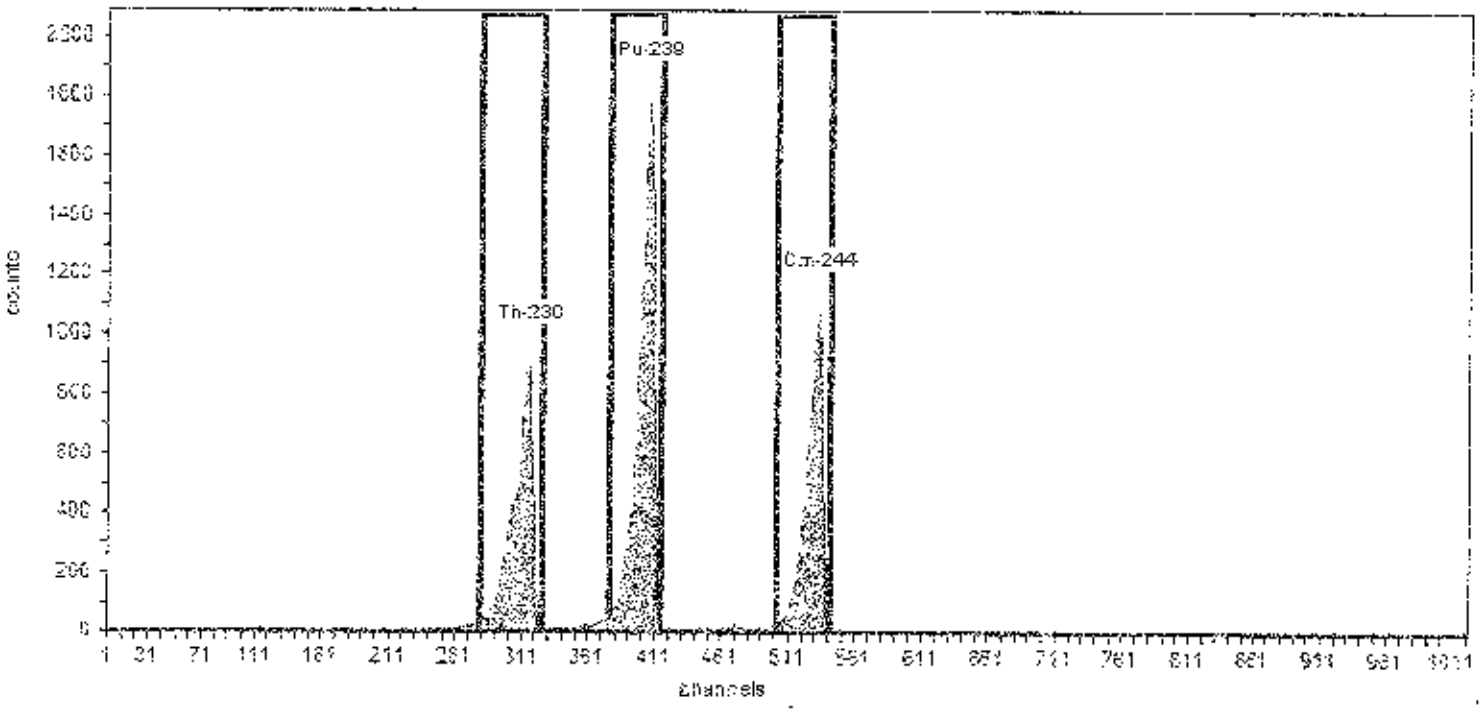
Efficiency Calibration Name: 2016.06.06 001 det 34

Energy Calibration Equation:
Gain = 5.1501 keV / Ch

Offset = 3,059.78 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.87% +/- 0.27% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	316	4.69	280	325	13,651.00	227.52
Pu-239	407	5.16	376	418	23,217.00	386.95
Cm-244	533	5.81	502	542	14,202.00	236.70

AlphaVision v5.3

Alpha Spectroscopy Calibration Report

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
2:50:37PM 7/6/2016

Analyst: ORTEC
Detector: Det 35

Calibration

Energy Calibration: 2016.07.06 002
Description:

Analysis Date: 7/6/2016 2:48:45PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#5
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

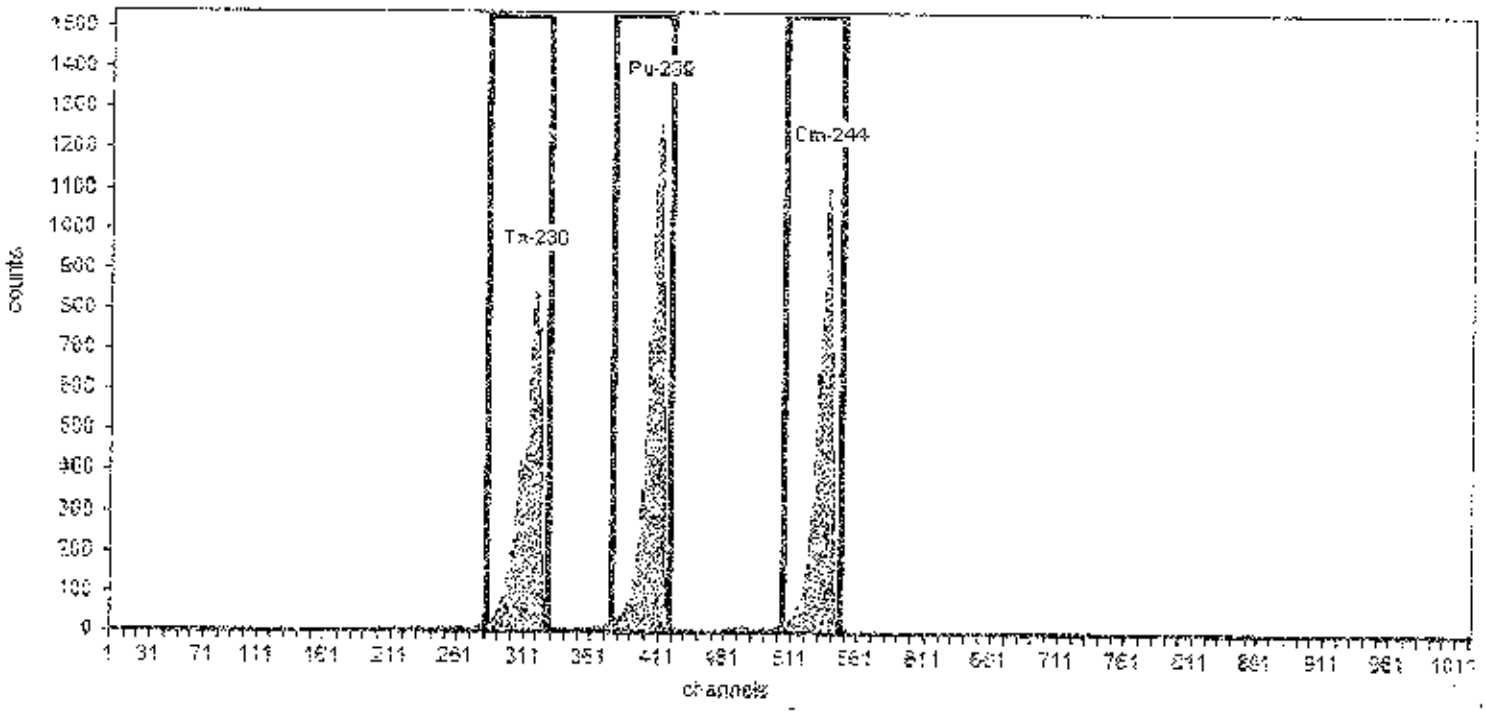
Detector: Det 35 , SN:
Acquisition Start Date: 7/6/2016 1:44:42PM

Live Time: 60.00 min.
Real Time: 60.01 min.

Efficiency Calibration Name: 2016.07.06 002

Energy Calibration Equation:
Gain = 5.0818 keV / Ch
Offset = 3,069.82 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.30% +/- 0.26% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	316	4.69	283	328	12,404.00	206.73
Pu-239	411	5.16	376	420	15,637.00	260.62
Cm-244	538	5.81	505	546	12,944.00	215.73

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC
Detector: Det 36
10:33:12AM 6/6/2016

Calibration

Energy Calibration: 2016.06.06 001 det 36
Description:

Analysis Date: 6/6/2016 10:31:59AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#6
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det 36 , SN:
Acquisition Start Date: 6/6/2016 8:59:04AM

Live Time: 60.00 min.
Real Time: 60.06 min.

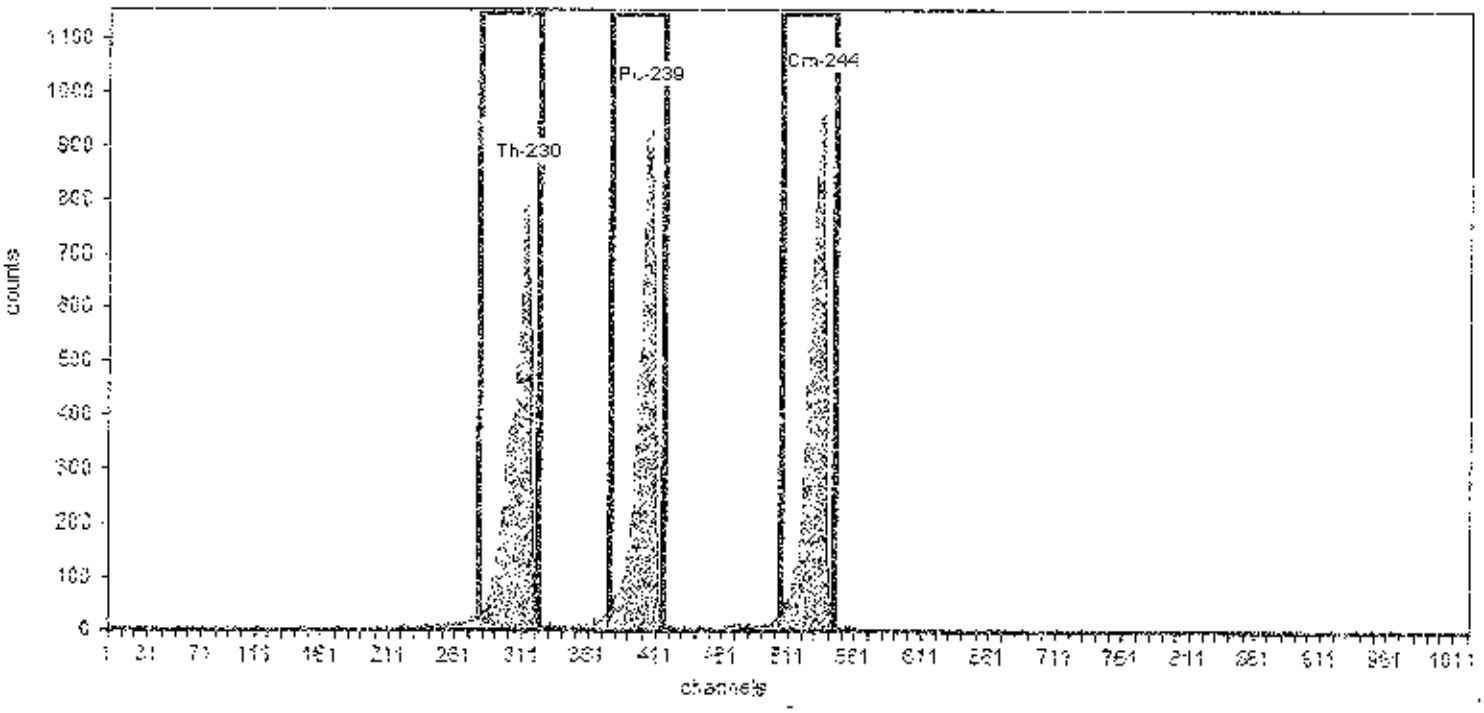
Efficiency Calibration Name: 2016.06.06 001 det 36

Energy Calibration Equation:
Gain = 5.0362 keV / Ch

Offset = 3,109.16 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.61% +/- 0.30% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	313	4.69	278	323	12,162.00	202.70
Pu-239	407	5.16	377	417	12,372.00	206.20
Cm-244	535	5.81	505	545	13,321.00	222.02

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:27:42PM 6/6/2016

Analyst: ORTEC
Detector: Det 37

Calibration

Energy Calibration: 2016.06.06 001 det 37
Description:

Analysis Date: 6/6/2016 12:14:29PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#1
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det 37 , SN:
Acquisition Start Date: 6/6/2016 10:45:05AM

Live Time: 60.00 min.
Real Time: 60.07 min.

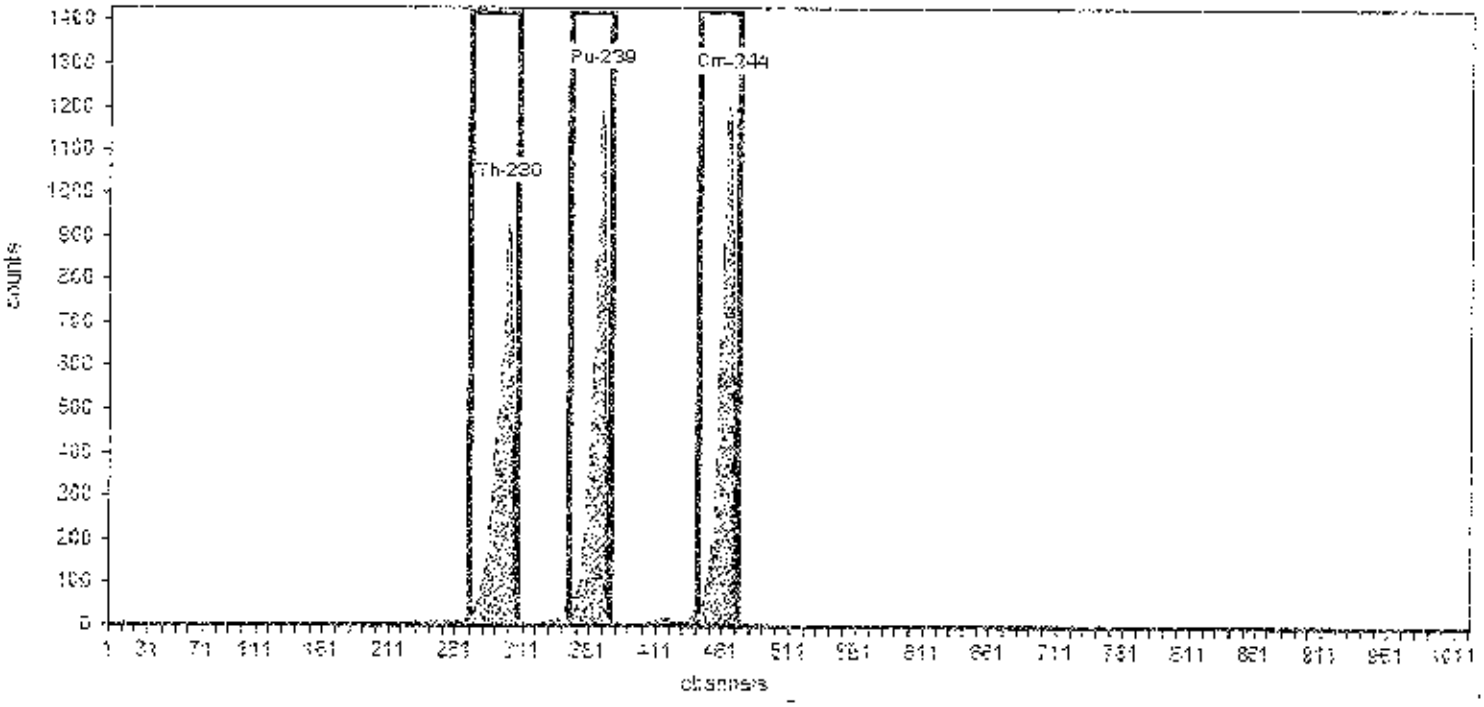
Efficiency Calibration Name: 2016.06.06 001 det 37

Energy Calibration Equation:
Gain = 6.6919 keV / Ch

Offset = 2,686.41 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.95% +/- 0.29% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	299	4.69	271	307	11,028.00	183.80
Pu-239	369	5.16	345	377	12,339.00	205.65
Cm-244	466	5.81	442	473	12,672.00	211.20

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:27:52PM 6/6/2016

Analyst: ORTEC
Detector: Det 38

Calibration

Energy Calibration: 2016 06.06 001 det 38
Description:

Analysis Date: 6/6/2016 12:17:52PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#2
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

Detector: Det 38 , SN:
Acquisition Start Date: 6/6/2016 10:45:45AM

Live Time: 60.00 min.
Real Time: 60.06 min.

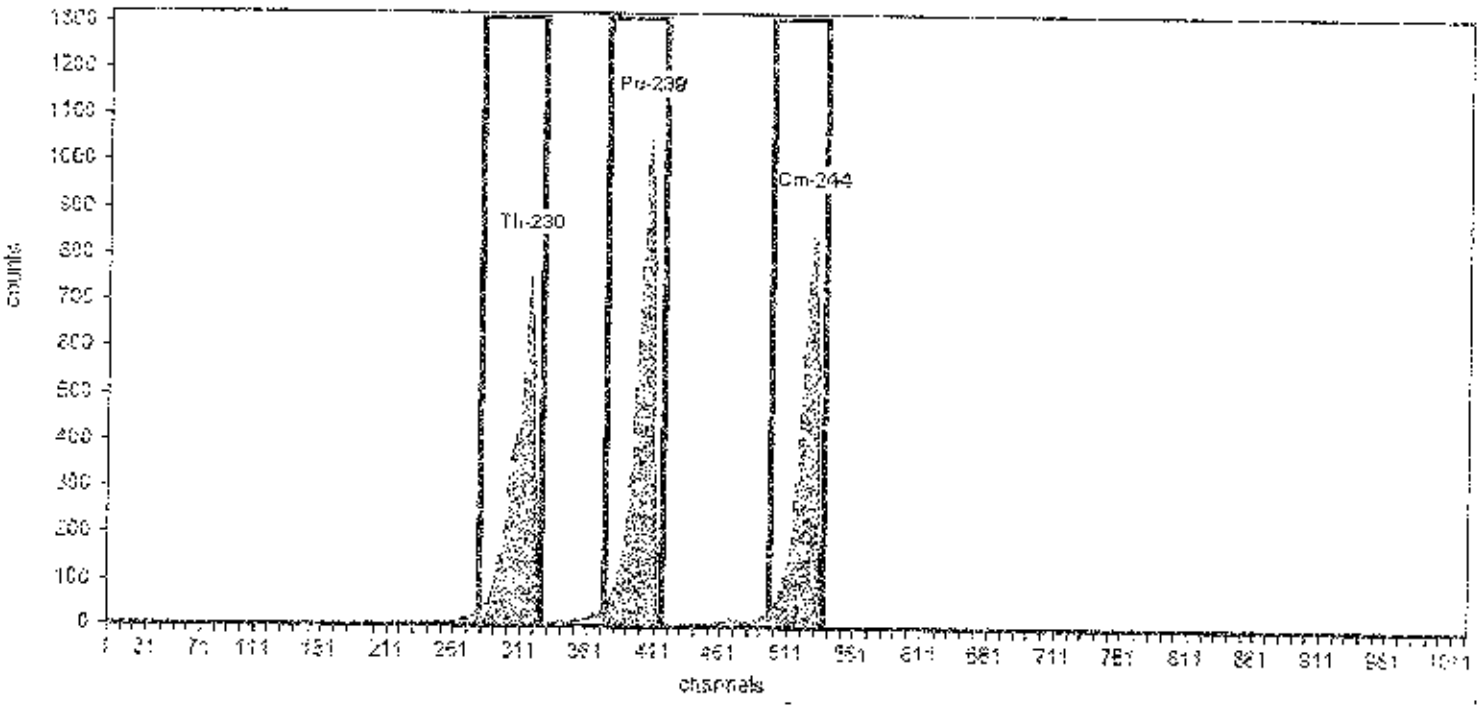
Efficiency Calibration Name: 2016.06.06 001 det 38

Energy Calibration Equation:
Gain = 5.3002 keV / Ch

Offset = 3,004.00 keV

Quadratic = 0.0000 keV / Ch^2

Efficiency: 37.16% +/- 0.29% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	317	4.69	289	325	12,071.00	201.18
Pu-239	407	5.16	373	417	15,418.00	256.97
Cm-244	528	5.81	498	538	12,719.00	211.97

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:28:07PM 6/6/2016

Analyst: ORTEC
Detector: Det 39

Calibration

Energy Calibration: 2016.06.06 001 det 39
Description:

Analysis Date: 6/6/2016 12:20:36PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#3
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

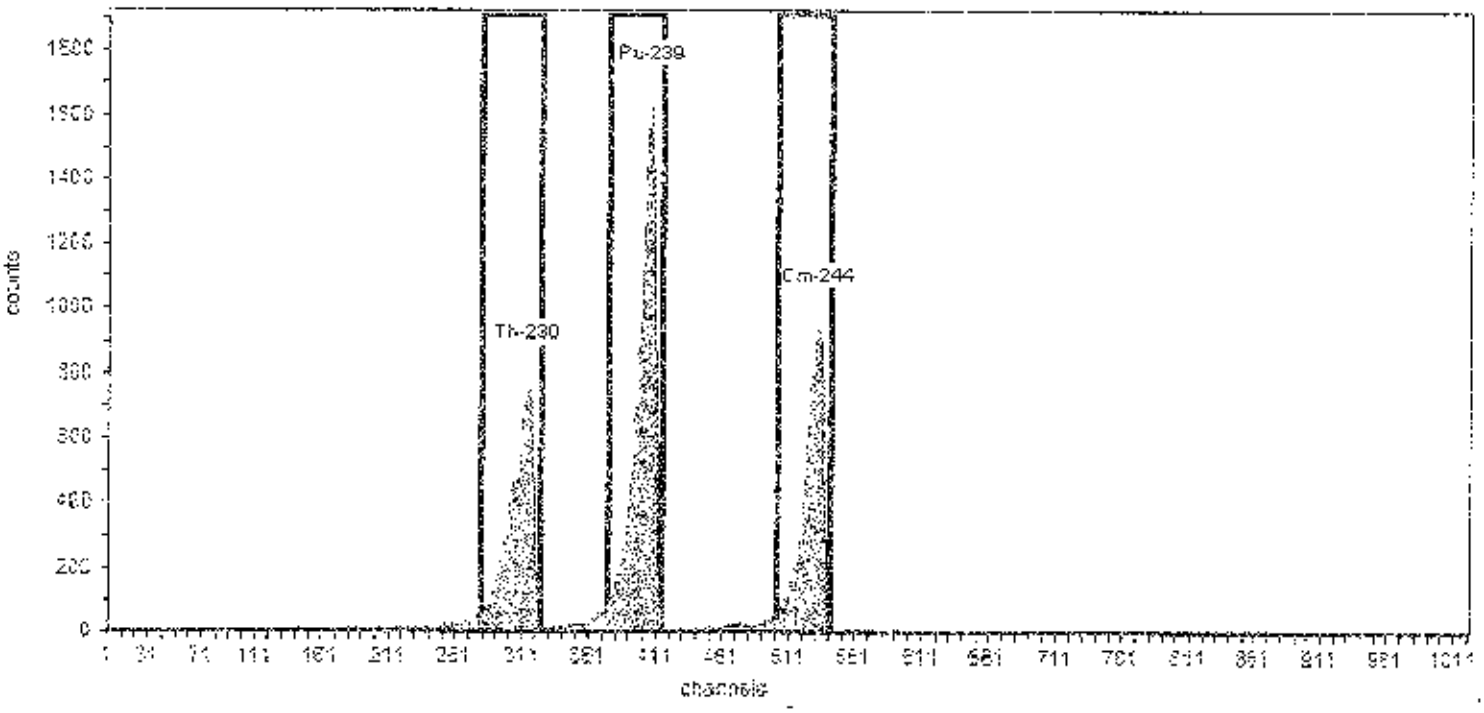
Acquisition

Detector: Det 39 , SN:
Acquisition Start Date: 6/6/2016 10:46:30AM

Live Time: 60.00 min.
Real Time: 60.08 min.

Efficiency Calibration Name: 2016.06.06 001 det 39

Energy Calibration Equation:
Gain = 3.1058 keV / Ch
Offset = 3,086.86 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 31.72% +/- 0.28% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	313	4.69	280	324	13,871.00	231.18
Pu-239	406	5.16	375	416	24,488.00	408.13
Cm-244	532	5.81	502	542	14,762.00	246.03

AlphaVision v5.3 — **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
12:28:22PM 6/6/2016

Analyst: ORTEC
Detector: Det 40

Calibration

Energy Calibration: 2016.06.06 001 det 40
Description:

Analysis Date: 6/6/2016 12:23:48PM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#4
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

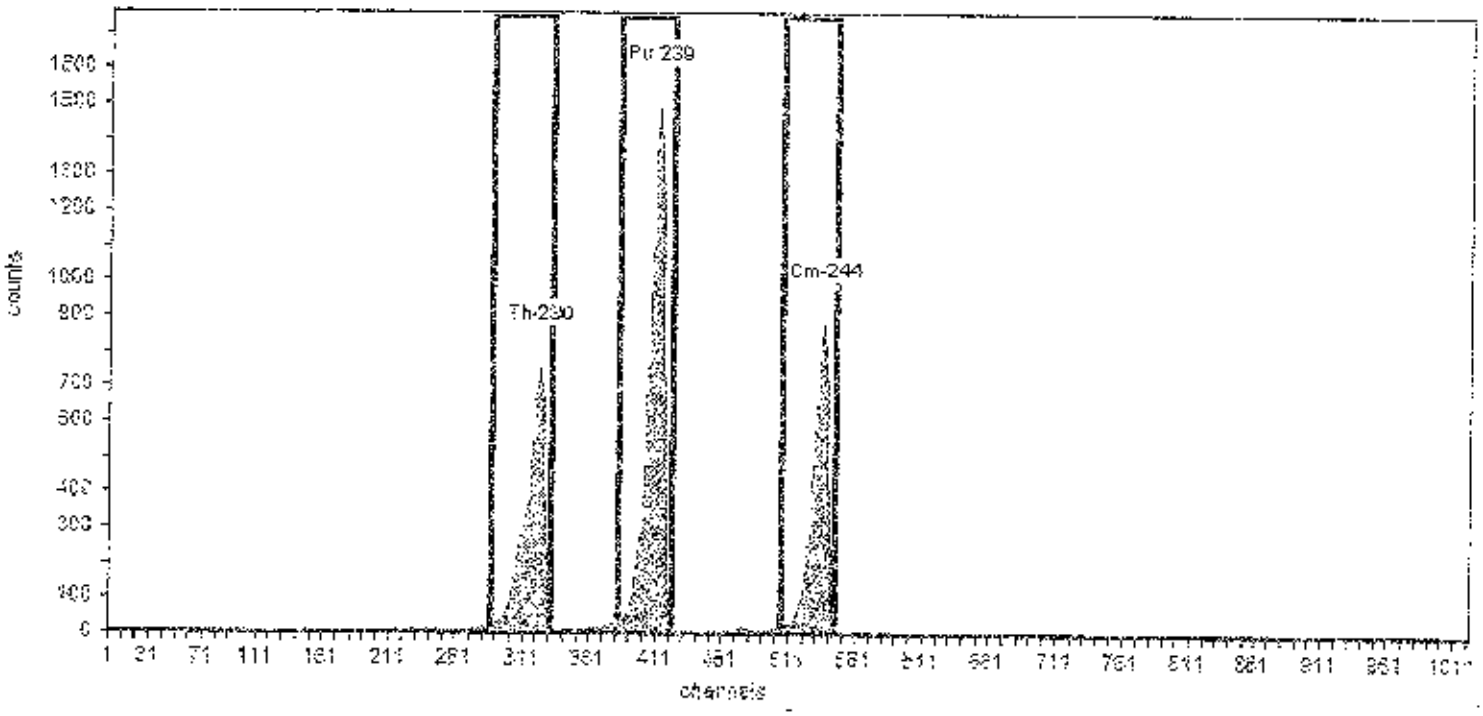
Detector: Det 40 , SN:
Acquisition Start Date: 6/6/2016 10:47:08AM

Live Time: 60.00 min.
Real Time: 60.08 min.

Efficiency Calibration Name: 2016.06.06 001 det 40

Energy Calibration Equation:
Gain = 5.2253 keV / Ch
Offset = 3,002.17 keV
Quadratic = 0.0000 keV / Ch²

Efficiency: 23.90% +/- 0.24% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	322	4.69	287	332	11,054.00	184.23
Pu-239	413	5.16	383	423	18,726.00	312.10
Cm-244	526	5.81	506	546	11,081.00	184.68

Acceptable

AlphaVision v5.3

Alpha Spectroscopy Calibration Report

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
8:51:24AM 6/6/2016

Analyst: ORTEC
Detector: Det-30

Calibration

Energy Calibration: 2016.06.06 001 det 30
Description:

Analysis Date: 6/6/2016 8:51:04AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#6
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

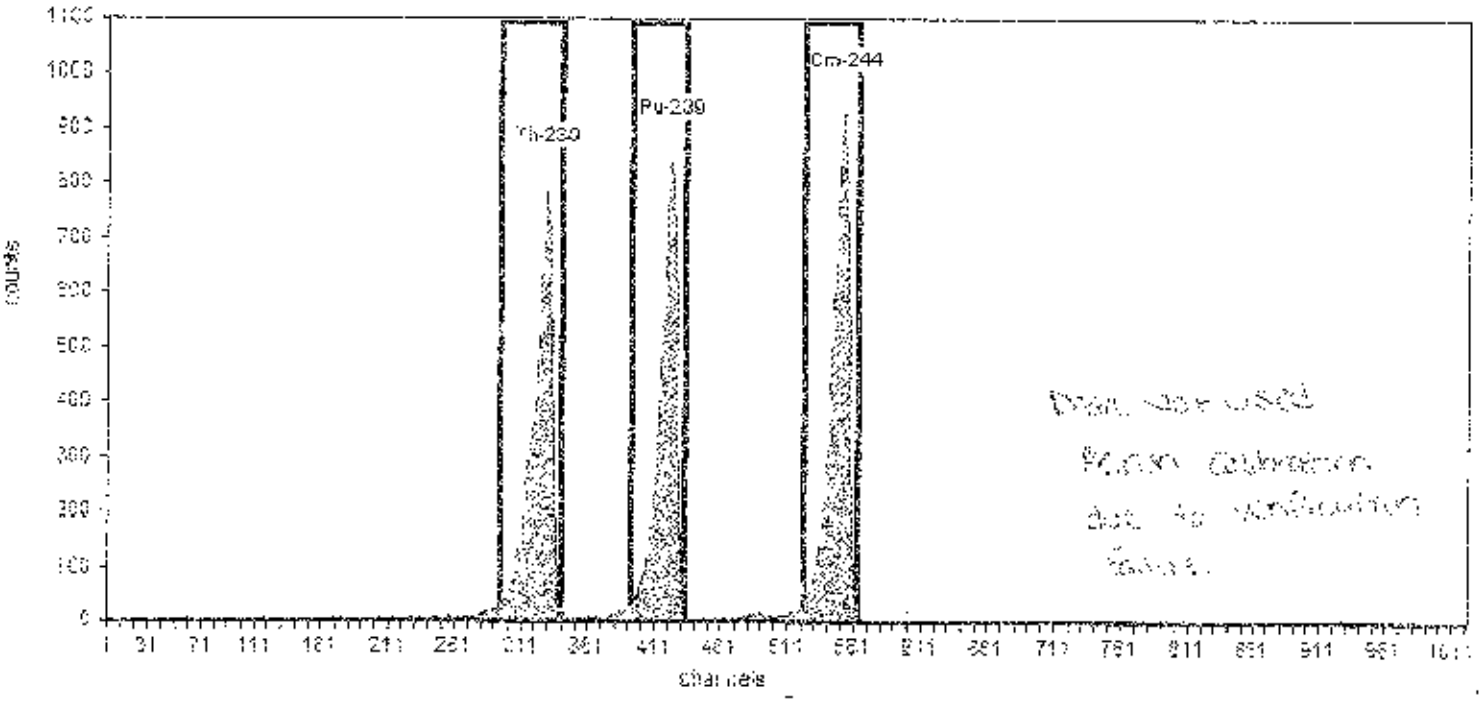
Detector: Det-30 , SN:
Acquisition Start Date: 6/6/2016 7:28:48AM

Live Time: 60.00 min.
Real Time: 60.07 min.

Efficiency Calibration Name: 2016.06.06 001 det 30

Energy Calibration Equation:
Gain = 4.9893 keV / Ch
Offset = 3.045.60 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.73% +/- 0.30% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	329	4.69	295	340	12,340.00	205.67
Pu-239	423	5.16	393	433	12,252.00	204.20
Cm-244	563	5.81	523	563	13,427.00	223.78

AlphaVision v5.3 **Alpha Spectroscopy Calibration Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
10:33:02AM 6/6/2016

Analyst: ORTEC
Detector: Det 35

Calibration

Energy Calibration: 2016.06.06 001 det 35
Description:

Analysis Date: 6/6/2016 10:28:53AM
Calibration Type: Energy And Efficiency

Source Info

Certificate ID: AS12Oct2015#5
Prepared by:
Description:

Certification Date: 10/12/2015 12:00:00PM

Acquisition

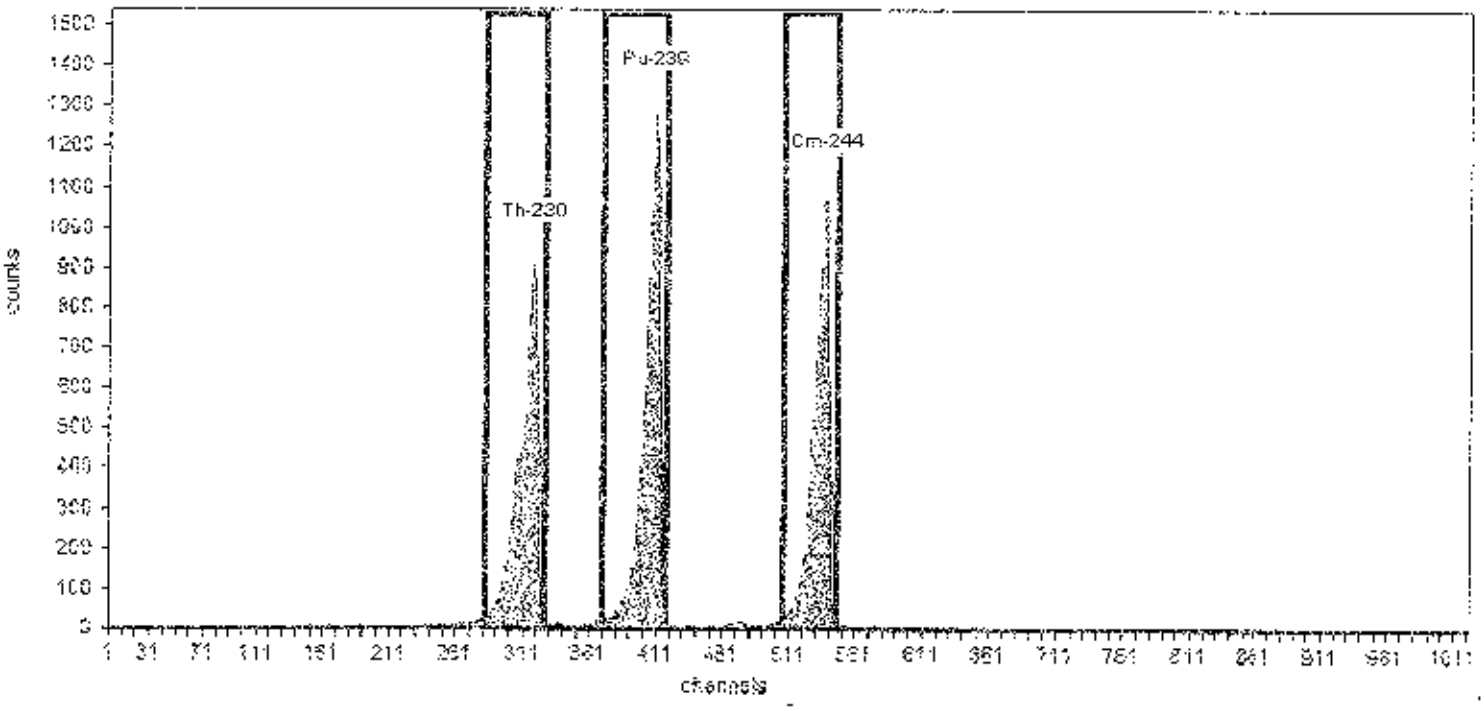
Detector: Det 35 , SN:
Acquisition Start Date: 6/6/2016 8:58:43AM

Live Time: 60.00 min.
Real Time: 60.08 min.

Efficiency Calibration Name: 2016.06.06 001 det 35

Energy Calibration Equation:
Gain = 5.0793 keV / Ch
Offset = 3,072.52 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.40% +/- 0.28% TPU(2 sigma)



Method: Manual (ROI)
Algorithm: Linear

Initial Calibration: Yes
Shelf: 2

Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy MeV	ROI Start Channel	ROI End Channel	Gross Counts	Net Count Rate (cpm)
Th-230	318	4.69	282	327	13,159.00	219.32
Pu-239	410	5.16	370	419	16,092.00	268.20
Cm-244	538	5.81	507	547	13,442.00	224.03

Alpha Spectroscopy Calibration Verification
11/10/2015

Sources previously prepared for the alpha spectroscopy Energy and Efficiency calibrations were cycled through detectors 25 through 40 and analyzed for Cm-244 content in the same manner as samples. Sources used for calibration purposes were subsequently counted and analyzed as samples to determine Cm-244 content. A summary of the decay corrected expected Cm-244 source dpm versus the Cm-244 result dpm for each detector is listed in the table below.

Detector ID	Energy/Eff Cal Source ID	Cal. Verification Source ID	Target DPM of Cal Ver Source	Result DPM of Cal Ver Source	Recovery	Limits
25	15-035	15-036	778.22	771.7	99.2%	90-110
26	15-036	15-037	775.18	768.9	99.2%	90-110
27	15-037	15-038	774.34	798.5	103.1%	90-110
28	15-038	15-039	775.03	757.6	97.8%	90-110
29	15-039	15-040	775.56	762.8	98.4%	90-110
30	15-040	15-039	774.49	803.5	103.7%	90-110
31	15-035	15-036	778.22	765.2	98.3%	90-110
32	15-039	15-037	775.18	735.5	94.9%	90-110
33	15-040	15-038	774.34	740.1	95.6%	90-110
34	15-038	15-039	775.03	748.5	96.6%	90-110
35	15-039	15-040	775.56	810.5	104.5%	90-110
36	15-040	15-035	774.49	790.5	102.1%	90-110
37	15-035	15-036	778.22	704.7	90.6%	90-110
38	15-036	15-037	775.18	753.9	97.3%	90-110
39	15-037	15-038	774.34	790.2	102.0%	90-110
40	15-038	15-039	775.03	754.3	97.3%	90-110

Alpha Spectroscopy Calibration Verification
6/6/2016

Reference date used for Calibration 10/12/2015 0:00
Half life Cm-244 (days) 6611

Source DF	Source Count Date	Decay Corrected Target of Cal Source	Cal. Verification Source ID	Original Target DPM of Cal Ver Source
0.97531	6/6/2016 12:37	778.22	15-035	797.93
0.97531	6/6/2016 12:37	775.18	15-036	794.81
0.97531	6/6/2016 12:37	774.34	15-037	793.95
0.97531	6/6/2016 12:37	775.03	15-038	794.65
0.97531	6/6/2016 12:37	775.56	15-039	795.20
0.97530	6/6/2016 14:09	774.49	15-040	794.10
0.97531	6/6/2016 12:49	778.22	15-035	797.93
0.97531	6/6/2016 12:49	775.18	15-036	794.81
0.97531	6/6/2016 12:49	774.34	15-037	793.95
0.97531	6/6/2016 12:49	775.03	15-038	794.65
0.97531	6/6/2016 12:49	775.56	15-039	795.20
0.97531	6/6/2016 12:49	774.49	15-040	794.10
0.97530	6/6/2016 13:03	778.22	15-035	797.93
0.97530	6/6/2016 13:03	775.18	15-036	794.81
0.97530	6/6/2016 13:03	774.34	15-037	793.95
0.97530	6/6/2016 13:03	775.03	15-038	794.65

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
12:47:42PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-036AS12OCT15#2 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 001
:
Description:

Client Name: Undefined
Client Contact:

Tracer

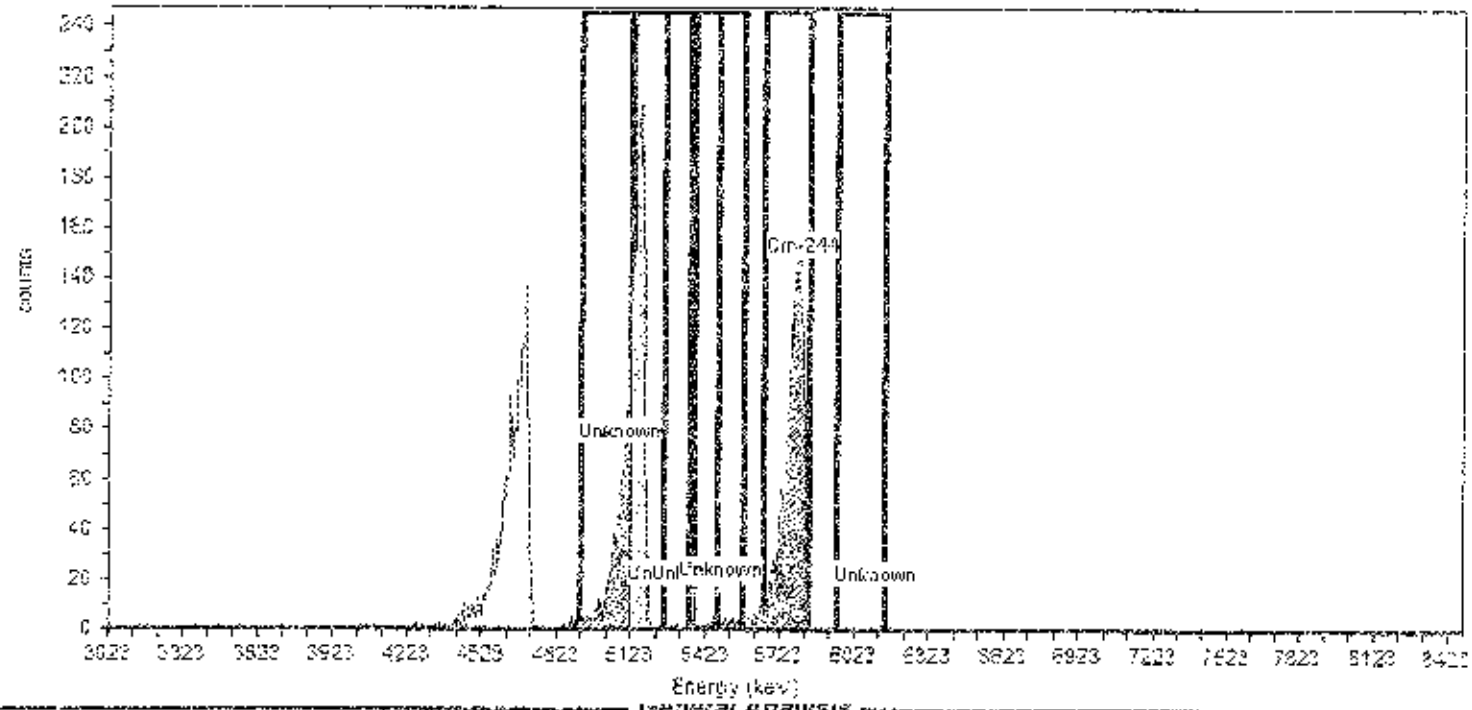
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 25 SN:
Acquisition Start Date: 6/6/2016 12:37:24PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:00PM
Bkgd Info: Sample: Det 25; Det: Det 25; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 25
Efficiency Calibration:2016.06.06 001 det 25
Calibration Date: 6/6/2016 8:40:01AM
Energy Cal: Gain = 5.3424 keV / Ch
Offset = 3,018.47 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 39.31% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:35:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	44.268	100.0	2,262.31	0.2800	2,252	7.717E+002	3.343E+001	2.984E-001	1.520E+000
Unknown	5080.000	4920.000	5120.000	6.372	100.0	1,079.50	0.0300	1,079	3.683E+002	2.274E+001	9.769E-002	1.119E+000
Unknown	5280.000	5130.000	5360.000	.000	100.0	1,546.36	0.0859	1,546	5.275E+002	2.738E+001	1.653E-001	1.254E+000
Unknown	5360.000	5250.000	5470.000	14.652	100.0	25.00	0.2041	25	8.459E+000	3.427E+000	2.548E-001	1.433E+000
Unknown	5485.000	5380.000	5575.000	25.470	100.0	61.61	0.1646	61	2.096E+001	5.267E+000	2.288E-001	1.381E+000
Unknown	6115.000	5950.000	6150.000	31.838	100.0	2.00	0.0800	2	6.550E-001	9.841E-001	1.595E-001	1.242E+000

AlphaVision v5.3

Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
12:47:45PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-037AS12CCT15#3 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 001
:
Description:

Client Name: Undefined
Client Contact:

Tracer

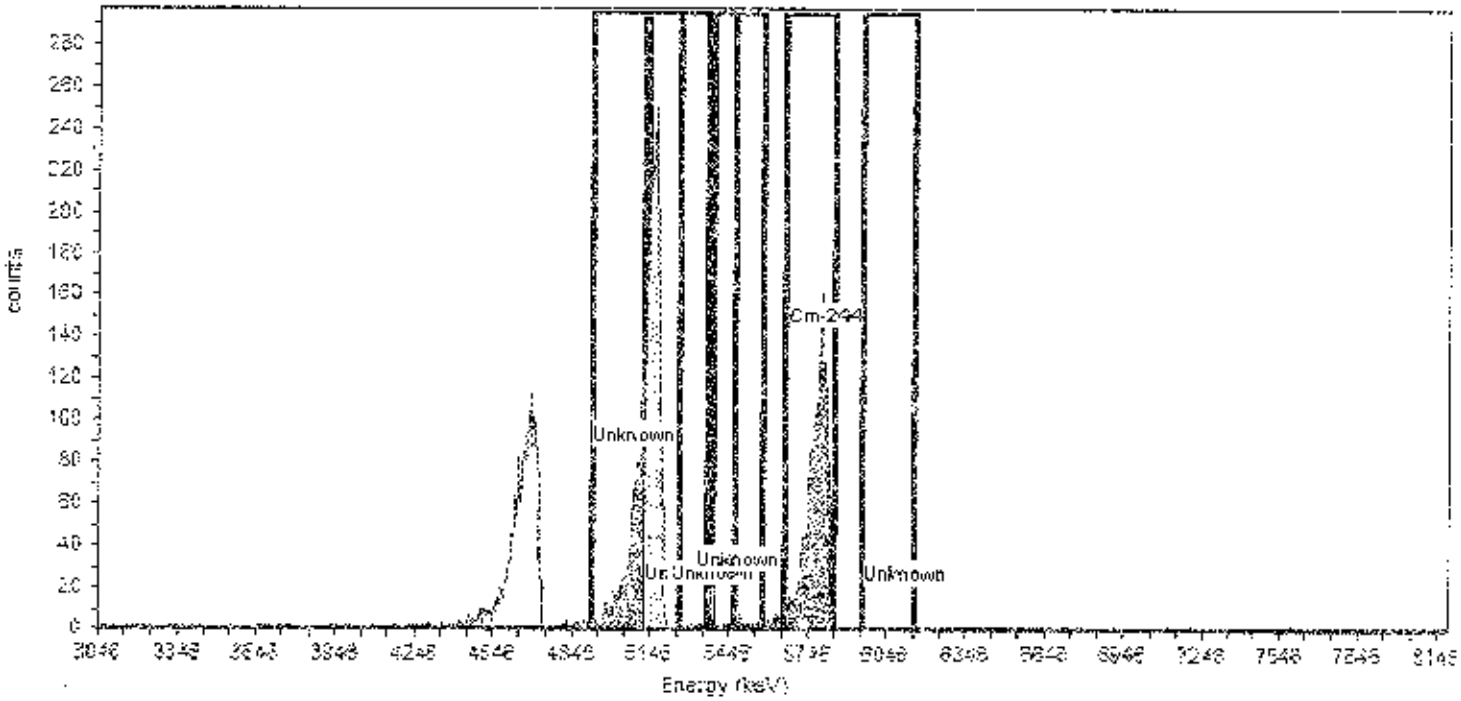
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 26 SN:
Acquisition Start Date: 6/6/2016 12:37:22PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:01PM
Bkgd Info: Sample: Det 26: Det: Det 26; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 26
Efficiency Calibration:2016.06.06 001 det 26
Calibration Date: 6/6/2016 8:42:29AM
Energy Cal: Gain = 5.0339 keV / Ch
Offset = 3,041.32 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.21% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:35:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	45.577	100.0	2,158.67	0.0521	2.169	7.689E+002	3.391E+001	1.339E-001	1.227E+000
Unknown	5080.000	4920.000	5120.000	44.423	100.0	1,116.27	0.0100	1.116	3.958E+002	2.402E+001	5.661E-002	1.077E+000
Unknown	5230.000	5130.000	5360.000	.000	100.0	2,270.66	0.0300	2.271	8.050E+002	3.474E+001	1.015E-001	1.162E+000
Unknown	5380.000	5250.000	5470.000	20.563	100.0	30.70	0.0700	31	1.086E+001	3.935E+000	1.551E-001	1.270E+000
Unknown	5485.000	5380.000	5575.000	85.463	100.0	58.32	0.0600	58	2.066E+001	5.422E+000	1.436E-001	1.247E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.03	0.0100	0	0.000E+000	7.126E-001	5.861E-002	1.077E+000

AlphaVision v5.3 — Alpha Spectrascopy Analysis Report

ORTEC
Oak Ridge, TN 37830
12:47:32PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-038AS12OCT15#4 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 001
:
Description:

Client Name: Undefined
Client Contact:

Tracer

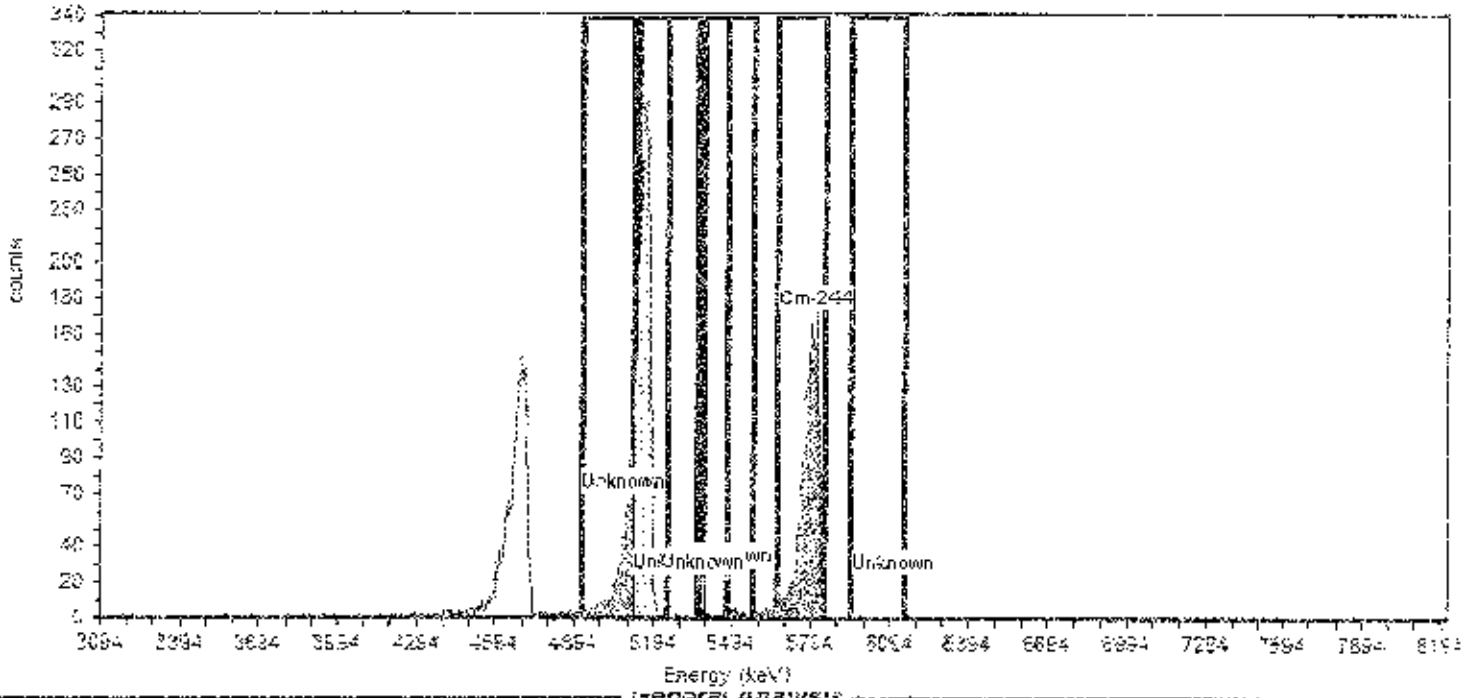
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 27 SN:
Acquisition Start Date: 6/6/2016 12:37:23PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:01PM
Bkgd Info: Sample: Det 27; Det: Det 27; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 27
Efficiency Calibration:2016.06.06 001 det 27
Calibration Date: 6/6/2016 8:44:44AM
Energy Cal: Gain = 5.0148 keV / Ch
Offset = 3.089.69 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.53% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:35:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal var
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Unknown	5485.000	5380.000	5575.000	98.336	100.0	52.00	0.1200	52	1.812E+001	5.046E+000	2.000E-001	1.326E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.00	0.0100	0	0.000E+000	7.021E-001	5.775E-002	1.061E+000
Cm-244	5810.000	5660.000	5845.000	27.435	100.0	2,288.15	0.0600	2,288	7.985E+002	3.422E+001	1.415E-001	1.228E+000
Unknown	5080.000	4920.000	5120.000	7.192	100.0	892.49	0.0302	892	3.117E+002	2.107E+001	1.003E-001	1.146E+000
Unknown	5280.000	5120.000	5360.000	61.109	100.0	2,677.15	0.1128	2,677	9.351E+002	3.718E+001	1.939E-001	1.333E+000
Unknown	5380.000	5250.000	5470.000	15.108	100.0	18.13	0.1834	18	6.289E+000	2.990E-000	2.473E-001	1.440E+000

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
12:47:35PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-039AS12OCT15#5 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 001
:
Description:

Client Name: Undefined
Client Contact:

Tracer

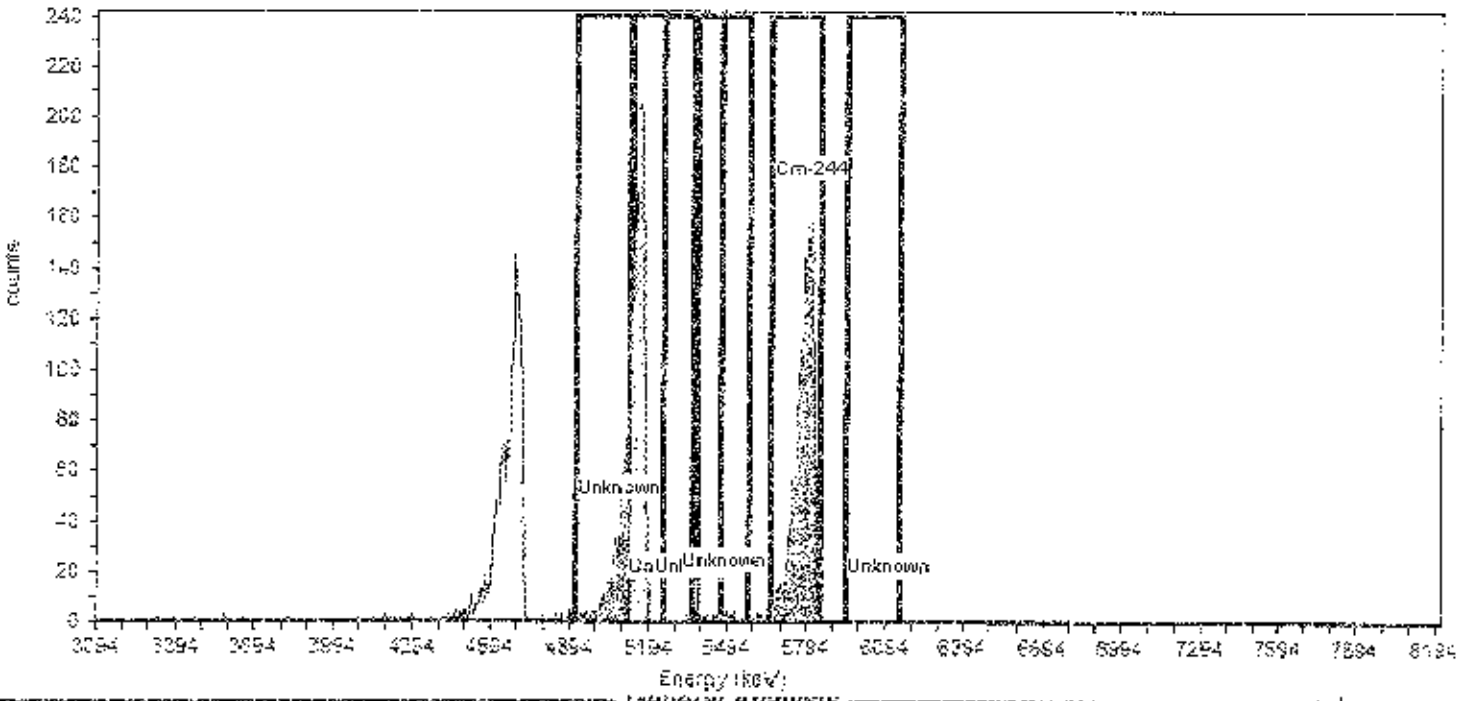
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det-28 SN:
Acquisition Start Date: 6/6/2016 12:37:23PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:08PM
Bkgd Info: Sample: Det 28; Det: Det-28; Spectrum #1: Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 28
Efficiency Calibration:2016.06.06 001 det 28
Calibration Date: 6/6/2016 8:47:14AM
Energy Cal: Gain = 5.0193 keV / Ch
Offset = 3,089.93 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.06% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:35:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5946.000	20.595	100.0	2,201.75	0.0404	2,202	7.576E+002	3.303E+001	1.144E-001	1.160E+000
Unknown	5080.000	4920.000	5120.000	43.400	100.0	758.80	0.0100	759	2.611E+002	1.911E+001	5.689E-002	1.045E+000
Unknown	5280.000	5130.000	5360.000	.000	100.0	1,723.83	0.1016	1,724	5.931E+002	2.909E+001	1.813E-001	1.294E+000
Unknown	5380.000	5250.000	5470.000	21.602	100.0	25.96	0.1913	26	8.889E+000	3.521E+000	2.488E-001	1.429E+000
Unknown	5485.000	5380.000	5575.000	60.619	100.0	43.99	0.0793	44	1.511E+001	4.571E+000	1.602E-001	1.251E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.00	0.0016	0	0.000E+000	6.888E-001	2.268E-002	9.769E-001

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
12:47:48PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-039AS12OCT15#6 Type: Sample
Spectrum: #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 001
:
Description:

Client Name: Undefined
Client Contact:

Tracer

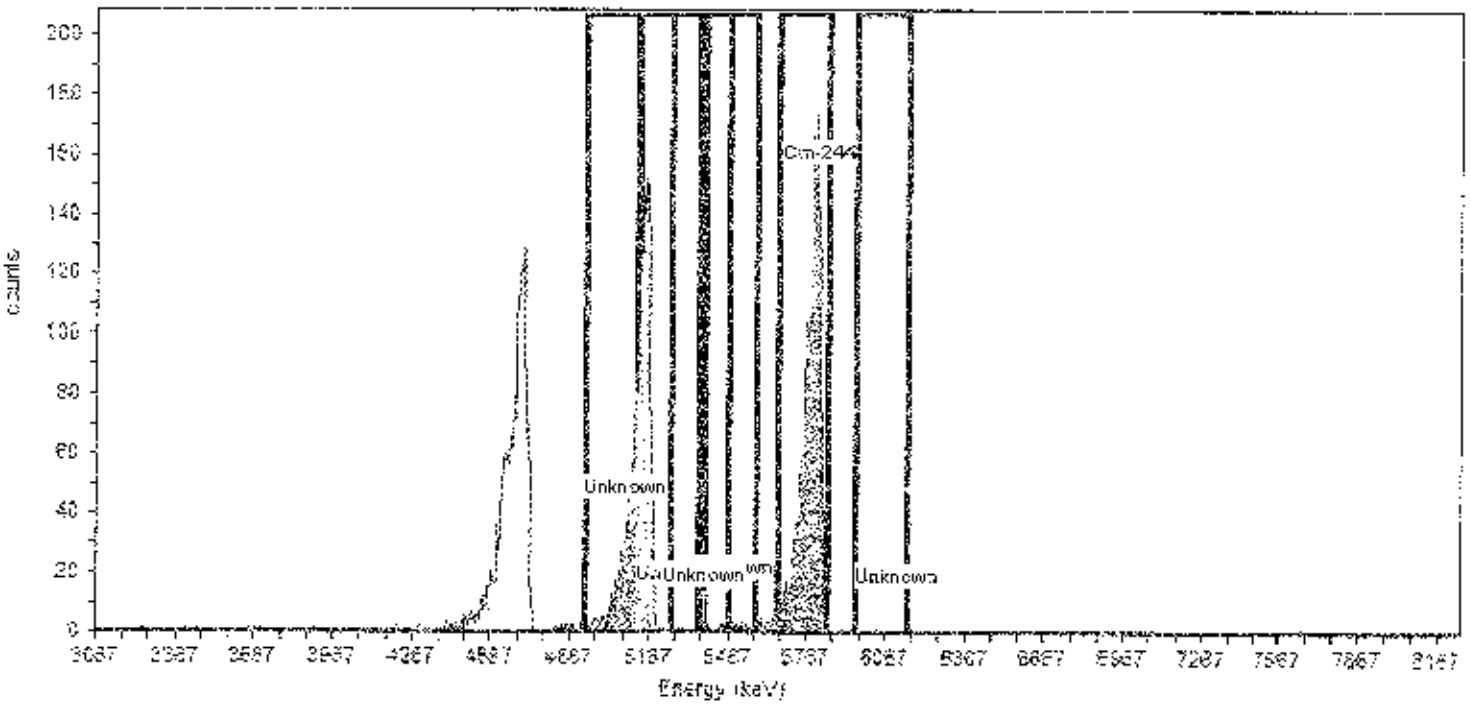
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det-29 SN:
Acquisition Start Date: 6/6/2016 12:37:24PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:01PM
Bkgd Info: Sample: Det 29; Det: Det-29; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 29
Efficiency Calibration:2016.06.06 001 det 29
Calibration Date: 6/6/2016 8:49:11AM
Energy Cal: Gain = 5.0793 keV / Ch
Offset = 3.062.36 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.03% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:35:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Unknown	5485.000	5380.000	5575.000	111.837	100.0	37.53	0.1571	37	1.337E+001	4.089E+000	2.411E-001	1.448E+000
Unknown	6115.000	5950.000	6150.000	30.284	100.0	1.00	0.0989	1	3.215E-001	7.480E-001	1.866E-001	1.336E+000
Cm-244	5810.000	5660.000	5845.000	46.844	100.0	2,138.05	0.1616	2,139	7.628E+002	3.386E+001	2.371E-001	1.440E+000
Unknown	5080.000	4920.000	5120.000	14.765	100.0	717.38	0.0300	717	2.559E+002	1.928E+001	1.022E-001	1.170E+000
Unknown	5280.000	5130.000	5360.000	.000	100.0	1,137.70	0.0900	1,138	4.059E+002	2.441E+001	1.770E-001	1.319E+000
Unknown	5380.000	5250.000	5470.000	19.016	100.0	19.27	0.2100	19	6.901E+000	3.150E+000	2.703E-001	1.506E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
2:20:01PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-039AS12OCT15#5 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 004
:
Description:

Client Name: Undefined
Client Contact:

Tracer

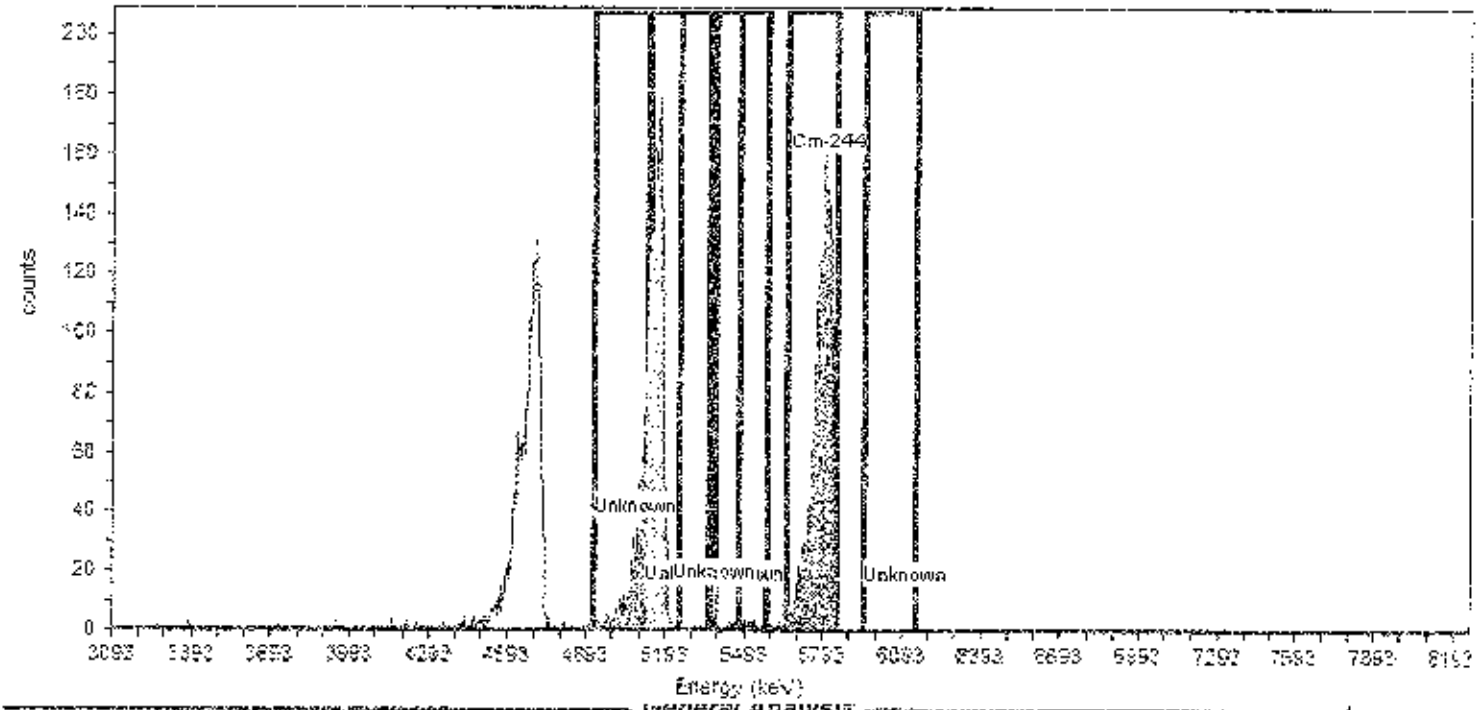
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det-30 SN:
Acquisition Start Date: 6/6/2016 2:09:58PM
Live Time: 10.00 min.
Real Time: 10.00 min.
Background Date: 6/1/2016 1:07:06PM
Bkgd Info: Sample: Det 30; Det: Det-30; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 004 Det 30b
Efficiency Calibration:2016.06.06 004 Det 30b
Calibration Date: 6/6/2016 2:08:23PM
Energy Cal: Gain = 5.0577 keV / Ch
Offset = 3,068.37 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.75% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 2:09:40PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Unknown	5485.000	5380.000	5575.000	104.370	100.0	32.00	0.2099	32	1.106E+001	3.949E+000	2.629E-001	1.467E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.00	0.1303	0	0.000E+000	7.394E-001	2.073E-001	1.356E+000
Cm-244	5810.000	5660.000	5845.000	32.856	100.0	2,310.42	0.0296	2,310	8.035E+002	3.449E+001	9.895E-002	1.139E+000
Unknown	5060.000	4920.000	5120.000	18.131	100.0	626.91	0.1564	627	2.180E+002	1.757E+001	2.288E-001	1.399E+000
Unknown	5280.000	5130.000	5360.000	.000	100.0	1,748.91	0.1000	1,749	6.082E+002	2.979E+001	1.818E-001	1.305E+000
Unknown	5380.000	5250.000	5470.000	17.115	100.0	18.00	0.1940	18	6.193E+000	2.968E+000	2.502E-001	1.448E+000

AlphaVision v5.3 — Alpha Spectroscopy Analysis Report

ORTEC
Oak Ridge, TN 37830
12:59:50PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-036AS12OCT15#2 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 002
:
Description:

Client Name: Undefined
Client Contact:

Tracer

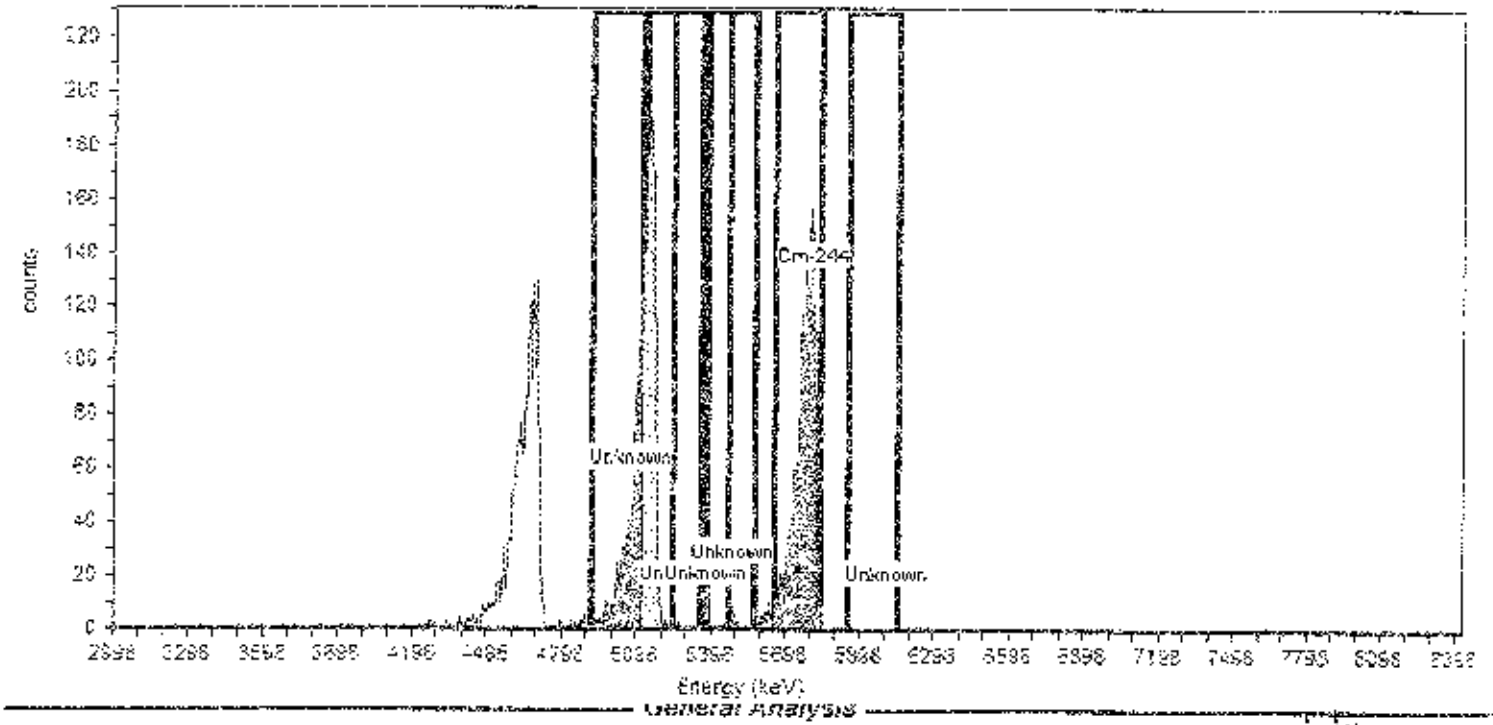
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 31 SN:
Acquisition Start Date: 6/6/2016 12:49:35PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:02PM
Bkgd Info: Sample: Det 31; Det: Det 31; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 31
Efficiency Calibration:2016.06.06 001 det 31
Calibration Date: 6/6/2016 10:21:27AM
Energy Cal: Gain = 5.3188 keV / Ch
Offset = 2,992.72 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:40:39PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
MDA Source: Background

Nuclide Summary (ROI)

Nuclide	Peak Energy keV	ROI Start keV	ROI End keV	FWHM keV	S.R. %	Gross Counts	Bkgd Counts	Net Counts	Activity DPM	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	46.050	100.0	2,165.70	0.1600	2,166	7.652E+002	3.386E+001	2.337E-001	1.424E+000
Unknown	5080.000	4920.000	5120.000	64.145	100.0	1,038.20	0.0100	1,038	3.668E+002	2.310E+001	5.842E-002	1.073E+000
Unknown	5260.000	5130.000	5360.000	000	100.0	1,519.51	0.0900	1,519	5.369E+002	2.812E+001	1.752E-001	1.307E+000
Unknown	5380.000	5250.000	5470.000	9.517	100.0	18.71	0.3671	18	6.483E+000	3.088E+000	3.540E-001	1.664E+000
Unknown	5485.000	5380.000	5575.000	36.934	100.0	41.50	0.3100	41	1.456E+001	4.572E+000	3.252E-001	1.607E+000
Unknown	6115.000	5950.000	6150.000	18.803	100.0	2.00	0.0400	2	8.925E-001	1.009E+000	1.168E-001	1.190E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
12:59:41PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-037AS12OCT15#3 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 002
:
Description:

Client Name: Undefined
Client Contact:

Tracer

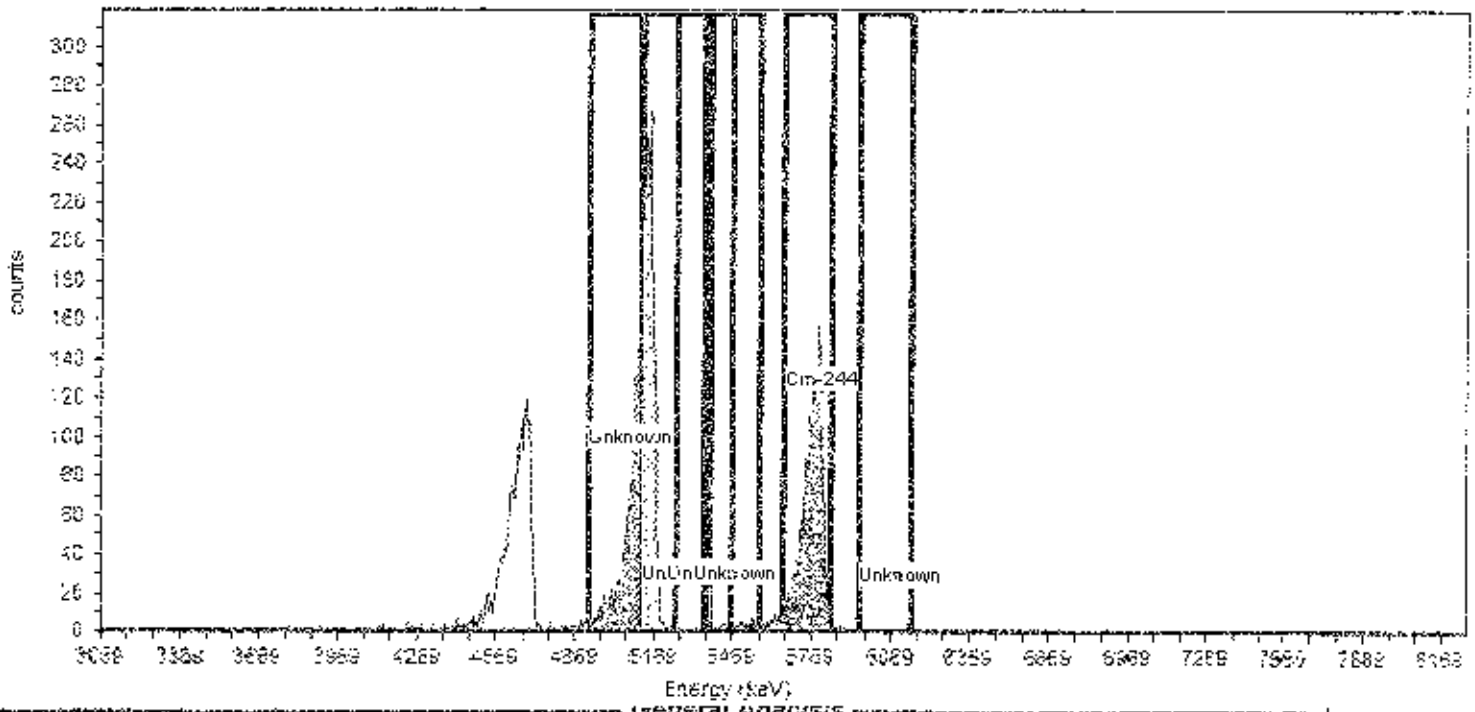
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 32 SN:
Acquisition Start Date: 6/6/2016 12:49:35PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:02PM
Bkgd Info: Sample: Det 32; Det: Det 32; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 32d
Efficiency Calibration:2016.06.06 001 det 32d
Calibration Date: 6/6/2016 12:27:08PM
Energy Cal: Gain = 5.0816 keV / Ch
Offset = 3,064.74 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.69% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:40:39PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	74.740	100.0	2,178.50	0.2200	2,178	7.355E+002	3.233E+001	2.621E-001	1.439E+000
Unknown	5080.000	4920.000	5120.000	.000	100.0	1,641.76	0.0100	1,642	5.549E+002	2.791E+001	5.687E-002	1.026E+000
Unknown	5280.000	5130.000	5350.000	.000	100.0	1,929.69	0.0400	1,930	6.522E+002	3.036E+001	1.117E-001	1.138E+000
Unknown	5380.000	5250.000	5470.000	9.785	100.0	31.00	0.1200	31	1.044E+001	3.772E+000	1.935E-001	1.302E+000
Unknown	5485.000	5380.000	5575.000	9.289	100.0	60.53	0.0739	61	2.046E+001	5.270E+000	1.519E-001	1.218E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.00	0.1000	0	0.000E+000	7.089E-001	1.757E-001	1.268E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
12:59:44PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-038AS12OCT15#4 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 002
:
Description:

Client Name: Undefined
Client Contact:

Tracer

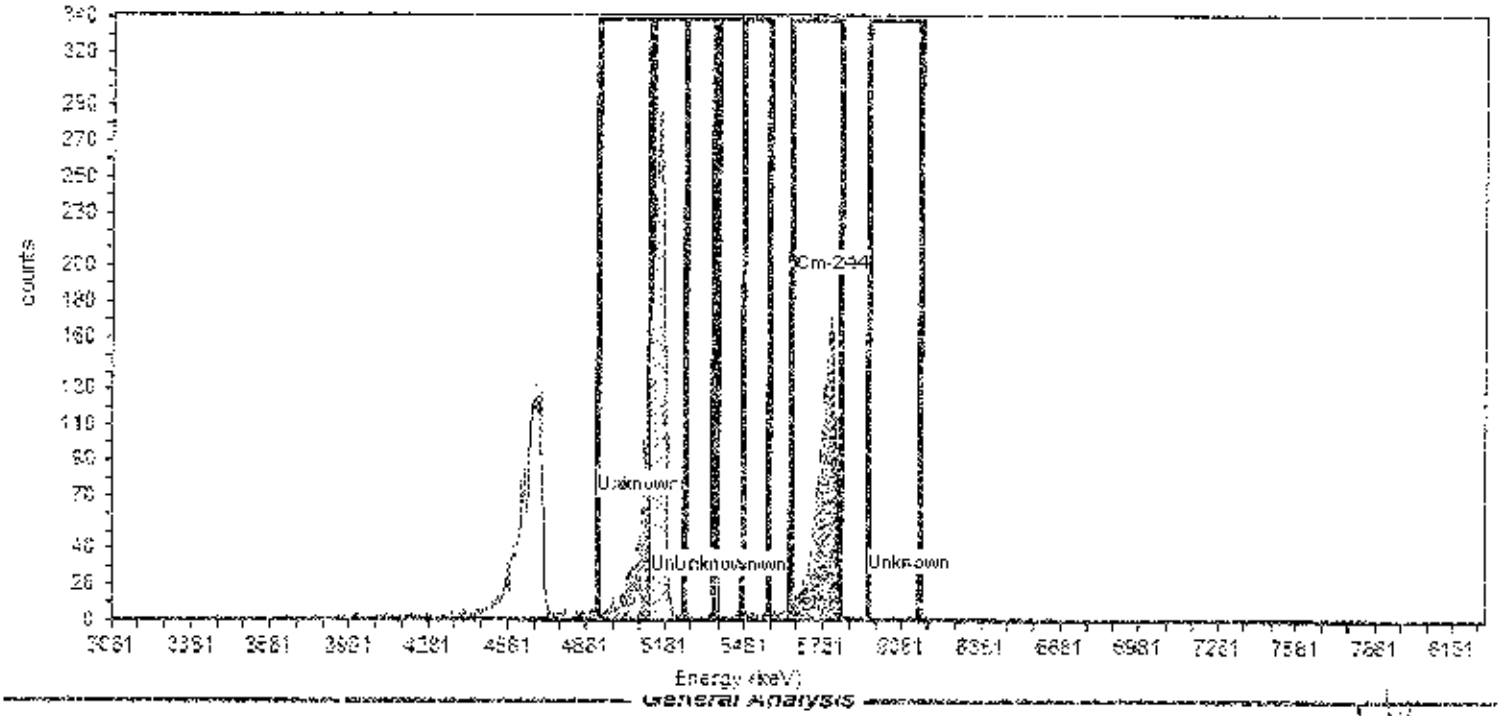
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 33 SN:
Acquisition Start Date: 6/6/2016 12:49:36PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:03PM
Bkgd Info: Sample: Det 33; Det: Det 33; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 33b
Efficiency Calibration:2016.06.06 001 det 33b
Calibration Date: 6/6/2016 12:10:27PM
Energy Cal: Gain = 5.1056 keV / Ch
Offset = 3.078.65 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 29.87% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:40:39PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Unknown	5485.000	5380.000	5575.000	104.079	100.0	58.13	0.0613	58	1.943E+001	5.112E+000	1.578E-001	1.221E+000
Unknown	6115.000	5950.000	6150.000	7.898	100.0	4.00	0.0200	4	1.332E+000	1.342E+000	7.827E-002	1.062E+000
Cm-244	5810.000	5660.000	5845.000	29.599	100.0	2,210.85	0.1000	2.211	7.401E+002	3.240E+001	1.750E-001	1.256E+000
Unknown	5080.000	4920.000	5120.000	11.169	100.0	1,146.05	0.0200	1.146	3.836E+002	2.301E+001	7.827E-002	1.062E+000
Unknown	5280.000	5130.000	5360.000	000	100.0	2,423.02	0.0521	2.423	8.111E+002	3.400E+001	1.253E-001	1.169E+000
Unknown	5380.000	5250.000	5470.000	15.852	100.0	42.84	0.1133	43	1.430E+001	4.391E+000	1.863E-001	1.279E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
12:59:47PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-039AS12OCT15#5 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 002
:
Description:

Client Name: Undefined
Client Contact:

Tracer

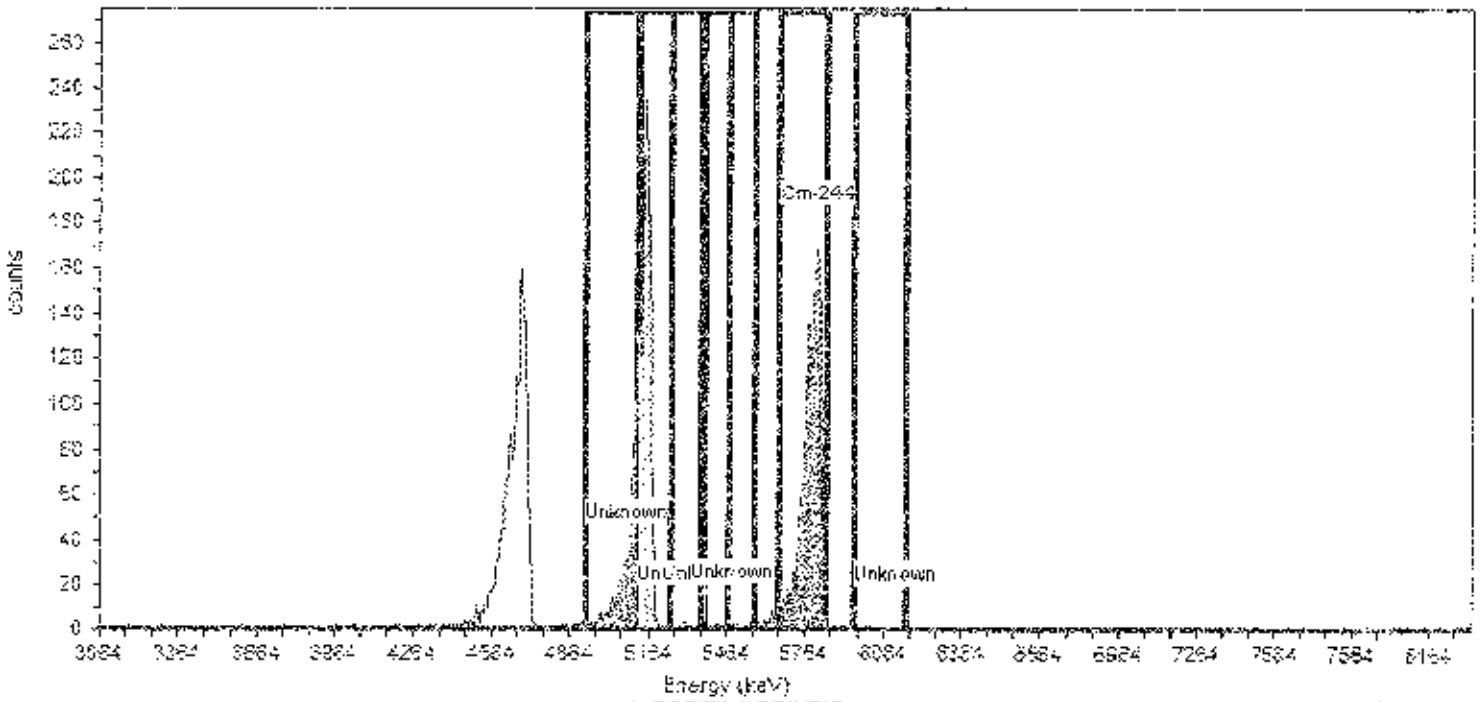
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 34 SN:
Acquisition Start Date: 6/6/2016 12:49:36PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:03PM
Bkgd Info: Sample: Det 34; Det: Det 34; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 34
Efficiency Calibration:2016.06.06 001 det 34
Calibration Date: 6/6/2016 10:25:49AM
Energy Cal: Gain = 5.1501 keV / Ch
Offset = 3,059.78 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 29.87% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/5/2016 12:40:39PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	20.223	100.0	2,238.86	0.1100	2,237	7.468E+002	3.238E+001	1.838E-001	1.273E+000
Unknown	5080.000	4920.000	5120.000	4.707	100.0	859.07	0.0100	859	2.876E+002	1.980E+001	5.536E-002	1.017E+000
Unknown	5280.000	5130.000	5380.000	.000	100.0	1,769.03	0.0700	1,769	5.922E+002	2.867E+001	1.464E-001	1.199E+000
Unknown	5380.000	5260.000	5470.000	205.699	100.0	21.56	0.1800	21	7.157E+000	3.122E+000	2.348E-001	1.376E+000
Unknown	5485.000	5380.000	5575.000	19.620	100.0	33.00	0.1048	33	1.101E+001	3.854E+000	1.792E-001	1.264E+000
Unknown	6115.000	5950.000	6150.000	12.286	100.0	2.19	0.0100	2	7.311E-001	9.940E-001	5.636E-002	1.017E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
12:59:53PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-040AS12OCT15#6 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 002
:
Description:

Client Name: Undefined
Client Contact:

Tracer

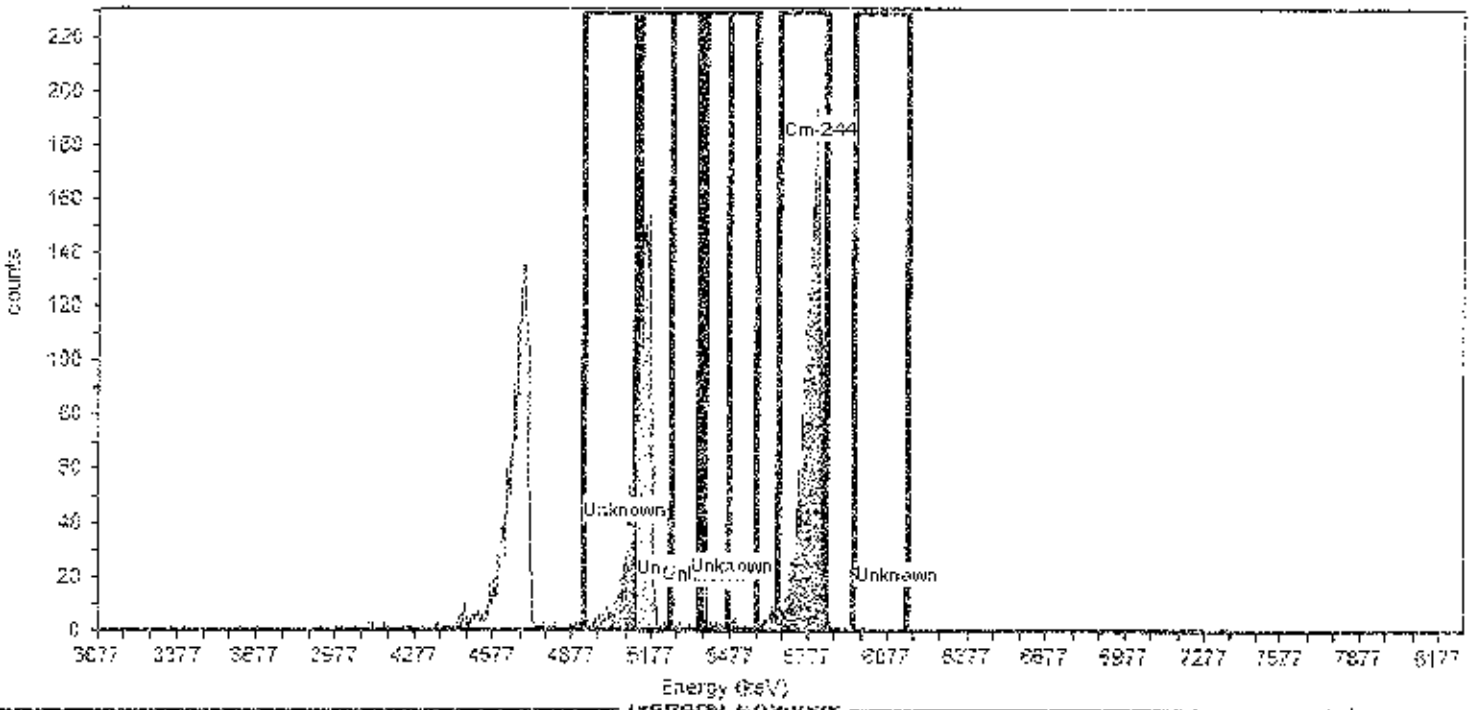
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 35 SN:
Acquisition Start Date: 6/6/2016 12:49:37PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:03PM
Bkgd Info: Sample: Det 35; Det: Det 35; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 35
Efficiency Calibration: 2016.06.06 001 det 35
Calibration Date: 6/6/2016 10:28:53AM
Energy Cal: Gain = 5.0793 keV / Ch
Offset = 3,072.52 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 38.40% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction: 6/6/2016 12:40:39PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	47.161	100.0	2,302.32	0.0900	2,302	8.105E+002	3.472E+001	1.748E-001	1.302E+000
Unknown	5080.000	4920.000	5120.000	16.900	100.0	627.89	0.0000	628	2.210E+002	1.779E+001	0.000E+000	9.527E-001
Unknown	5280.000	5130.000	5330.000	.000	100.0	1,196.67	0.1236	1,196	4.209E+002	2.470E+001	2.048E-001	1.362E+000
Unknown	5380.000	5250.000	5470.000	14.916	100.0	27.27	0.2630	27	9.509E+000	3.696E+000	2.985E-001	1.550E+000
Unknown	5485.000	5380.000	5575.000	92.970	100.0	39.00	0.1471	39	1.368E+001	4.407E+000	2.232E-001	1.399E+000
Unknown	6115.000	5950.000	6150.000	30.310	100.0	1.00	0.0200	1	3.450E-000	7.111E-001	8.231E-002	1.117E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
12:59:56PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-035AS12OCT15#1 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 002
:
Description:

Client Name: Undefined
Client Contact:

Tracer

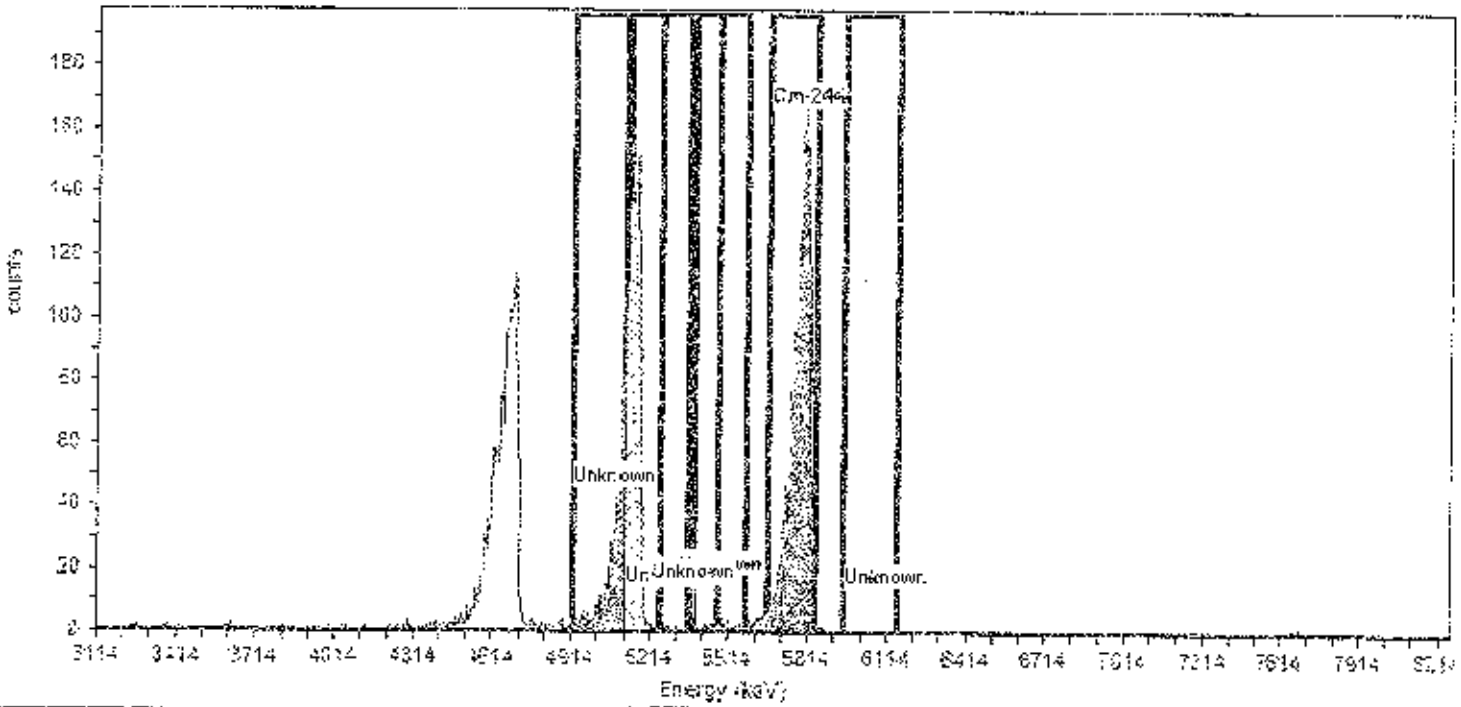
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 36 SN:
Acquisition Start Date: 6/6/2016 12:49:37PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:04PM
Bkgd Info: Sample: Det 36; Det: Det 36; Spectrum #1: Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 36
Efficiency Calibration:2016.06.06 001 det 36
Calibration Date: 6/6/2016 10:31:59AM
Energy Cal: Gain = 5.0362 keV / Ch
Offset = 3,109.16 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 28.61% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:40:39PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Unknown	5485.000	5380.000	5575.000	114.181	100.0	41.53	0.0800	41	1.449E+001	4.611E+000	1.634E-001	1.273E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.00	0.0000	0	0.000E+000	8.885E-001	0.000E+000	9.457E-001
Cm-244	5810.000	5660.000	5845.000	47.477	100.0	2,261.99	0.0550	2,262	7.905E+002	3.427E+001	1.355E-001	1.217E+000
Unknown	5090.000	4920.000	5120.000	.000	100.0	755.13	0.0000	755	2.639E+002	1.342E+001	0.000E+000	9.467E-001
Unknown	5280.000	5130.000	5350.000	.000	100.0	1,271.33	0.0600	1,271	4.443E+002	2.536E+001	1.416E-001	1.229E+000
Unknown	5380.000	5250.000	5470.000	21.808	100.0	26.46	0.1300	26	9.201E+000	3.605E+000	2.083E-001	1.362E+000

AlphaVision v5.3 **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
1:13:49PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-036AS12OCT15#2 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 003
:
Description:

Client Name: Undefined
Client Contact:

Tracer

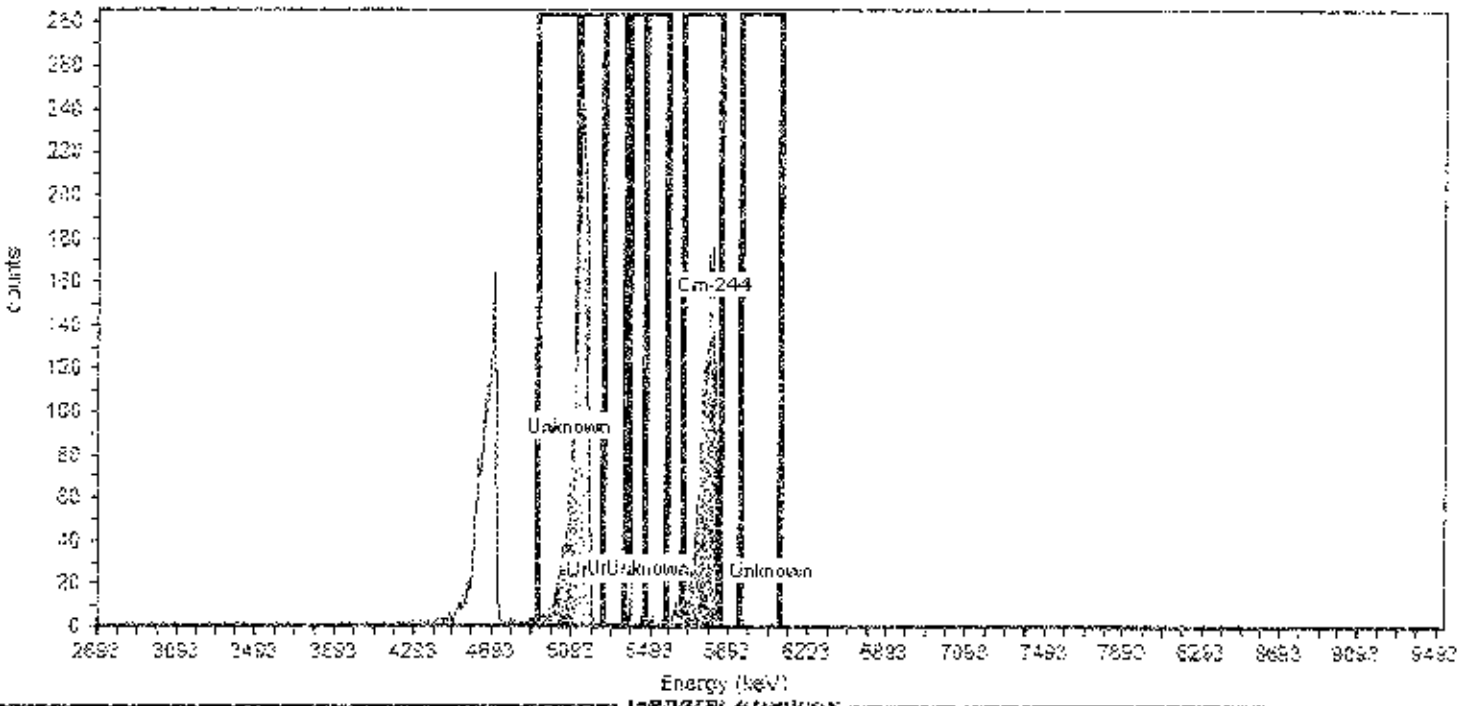
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 37 SN:
Acquisition Start Date: 6/6/2016 1:03:46PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:04PM
Bkgd Info: Sample: Det 37; Det: Det 37; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 37
Efficiency Calibration:2016.06.06 001 det 37
Calibration Date: 6/6/2016 12:14:29PM
Energy Cal: Gain = 6.6919 keV / Ch
Offset = 2,686.41 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 26.95% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 1:02:53PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5630.000	5845.000	73.841	100.0	1,899.36	0.0835	1,899	7.047E+002	3.322E+001	1.773E-001	1.369E+000
Unknown	5080.000	4920.000	5120.000	3.874	100.0	890.29	0.0000	890	3.303E+002	2.264E+001	0.000E+000	1.004E+000
Unknown	5280.000	5130.000	5360.000	.000	100.0	1,479.61	0.0652	1,480	5.490E+002	2.915E+001	1.442E-001	1.292E+000
Unknown	5380.000	5250.000	5470.000	13.070	100.0	16.04	0.1296	16	5.903E+000	2.985E+000	2.208E-001	1.446E+000
Unknown	5485.000	5380.000	5575.000	66.534	100.0	32.47	0.1084	32	1.201E+001	4.237E+000	2.019E-001	1.408E+000
Unknown	5115.000	5950.000	6150.000	16.385	100.0	1.00	0.0000	1	3.710E-001	1.049E+000	0.000E+000	1.004E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
1:13:52PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-037AS12OCT15#3 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 003
:
Description:

Client Name: Undefined
Client Contact:

Tracer

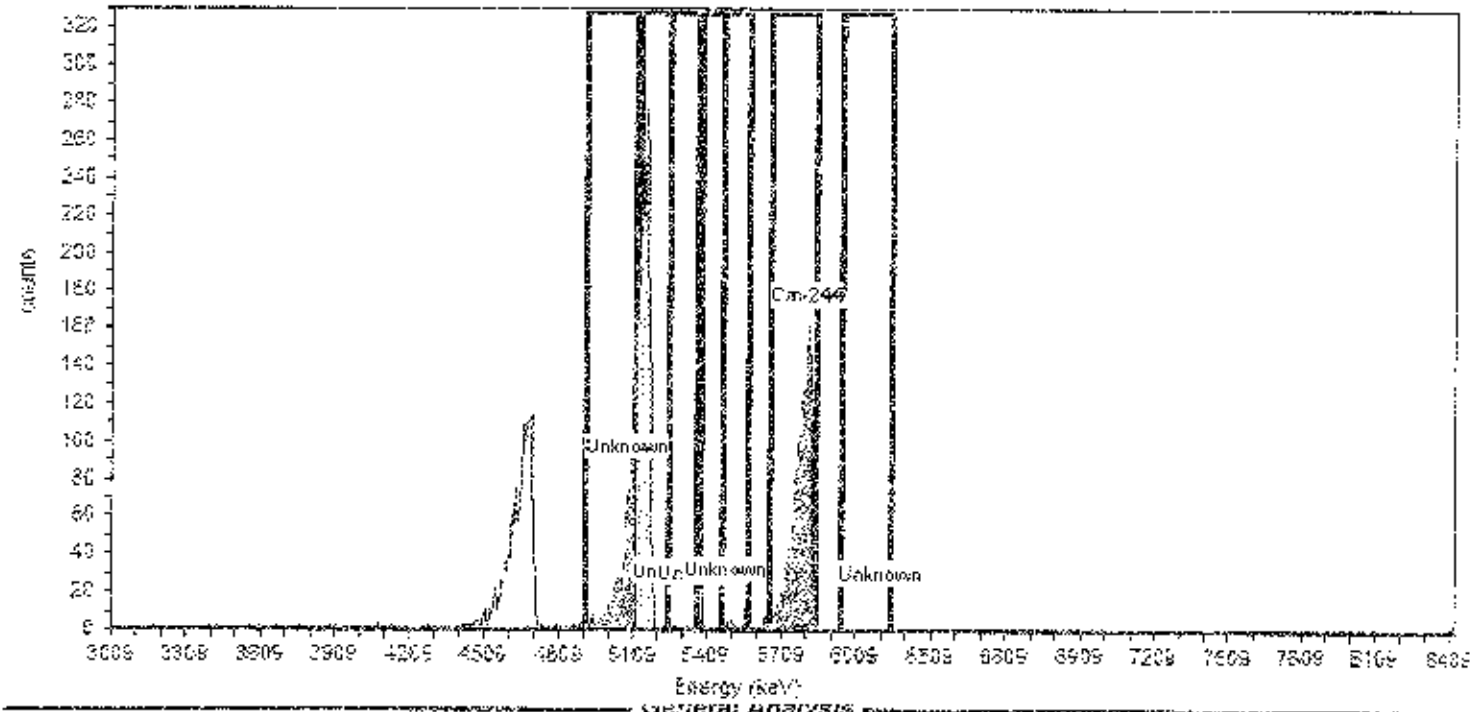
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 38 SN:
Acquisition Start Date: 6/6/2016 1:03:45PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:04PM
Bkgd Info: Sample: Det 38; Det: Det 38; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 38
Efficiency Calibration:2016.06.06 001 det 38
Calibration Date: 6/6/2016 12:17:52PM
Energy Cal. Gain = 5.3002 keV / Ch
Offset = 3,004.00 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.16% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 1:02:53PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	21.105	100.0	2,047.51	0.1200	2,047	7.539E+002	3.420E+001	2.109E-001	1.418E+000
Unknown	5080.000	4920.000	5120.000	.000	100.0	1,157.16	0.0100	1,157	4.261E+002	2.543E+001	8.088E-002	1.118E+000
Unknown	5280.000	5130.000	5360.000	.000	100.0	1,976.37	0.1251	1,976	7.277E+002	3.357E+001	2.153E-001	1.427E+000
Unknown	5380.000	5250.000	5470.000	9.165	100.0	12.21	0.2126	12	4.419E+000	2.597E+000	2.807E-001	1.558E+000
Unknown	5485.000	5380.000	5575.000	94.492	100.0	38.21	0.1472	38	1.402E+001	4.563E+000	2.336E-001	1.464E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.00	0.0400	0	0.000E+000	7.511E-001	1.248E-001	1.240E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
1:13:56PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-038AS12OCT15#4 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 003
:
Description:

Client Name: Undefined
Client Contact:

Tracer

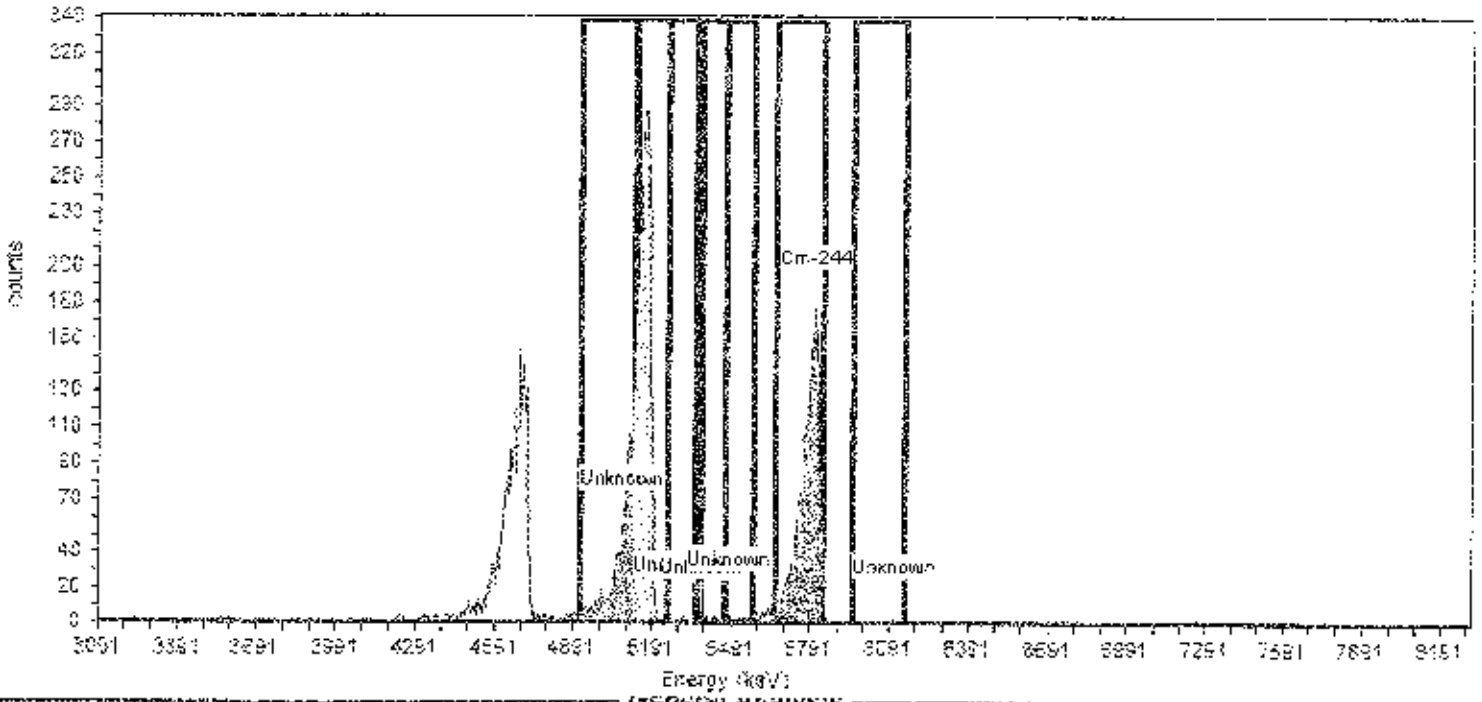
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 39 SN:
Acquisition Start Date: 6/6/2016 1:03:45PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:04PM
Bkgd Info: Sample: Det 39, Det: Det 39: Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 39
Efficiency Calibration:2016.06.06 001 det 39
Calibration Date: 6/6/2016 12:20:36PM
Energy Cal: Gain = 5.1058 keV / Ch
Offset = 3,086.86 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 31.72% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 1:02:53PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	21.826	100.0	2,508.70	0.1367	2,507	7.902E+002	3.234E+001	1.948E-001	1.243E+000
Unknown	5080.000	4920.000	5120.000	13.089	100.0	1,215.11	0.0000	1,215	3.831E+002	2.326E+001	0.000E+000	8.531E-001
Unknown	5290.000	5130.000	5330.000	.000	100.0	2,808.51	0.0500	2,808	8.854E+002	3.432E+001	1.165E-001	1.096E+000
Unknown	5380.000	5250.000	5470.000	7.655	100.0	18.25	0.1225	18	5.713E+000	2.793E+000	1.824E-001	1.218E+000
Unknown	5485.000	5380.000	5575.000	.000	100.0	51.62	0.1400	51	1.623E+001	4.538E+000	1.950E-001	1.243E+000
Unknown	6115.000	5950.000	6150.000	30.468	100.0	1.00	0.0000	1	3.089E-001	6.368E-001	7.370E-002	1.000E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
1:13:59PM 6/6/2016

Analyst: ORTEC

Sample

Sample: 15-039AS12OCT15#5 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 003
:
Description:

Client Name: Undefined
Client Contact:

Tracer

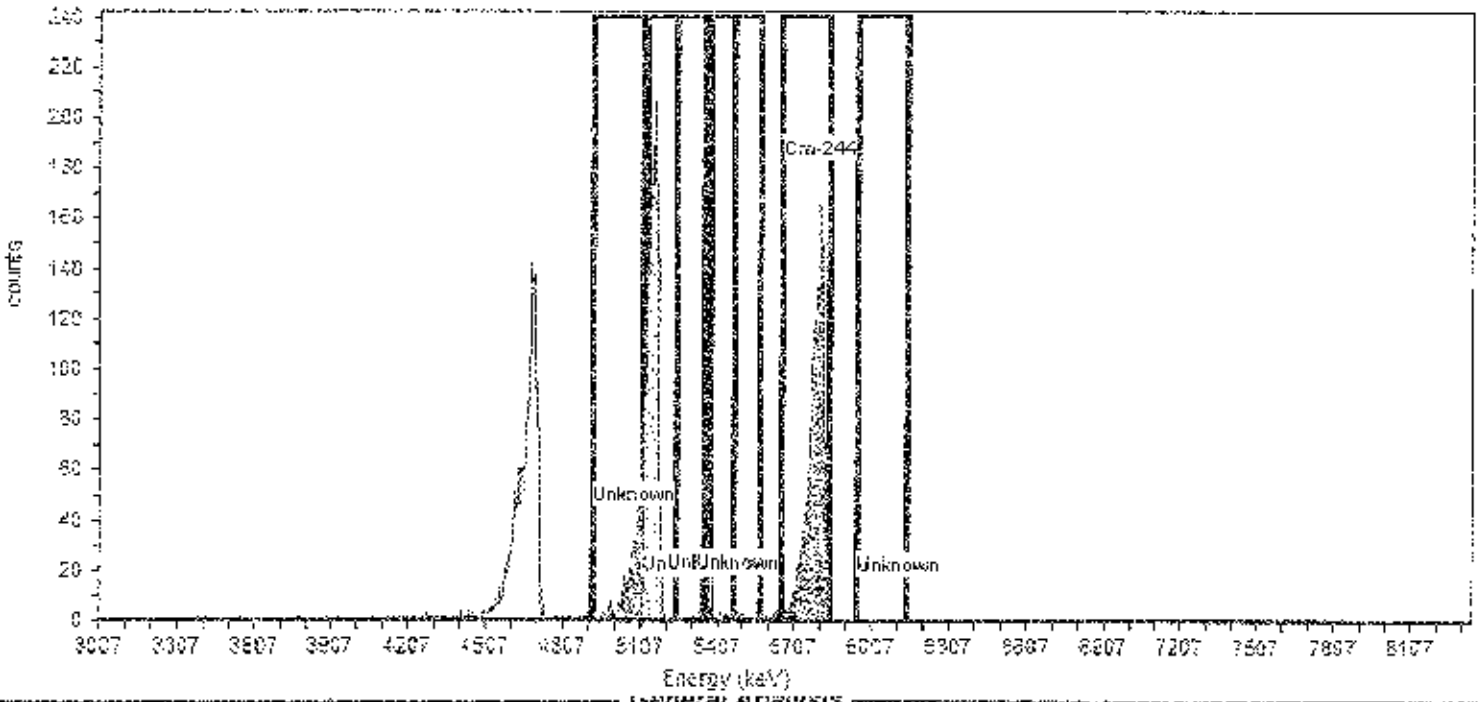
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 40 SN:
Acquisition Start Date: 6/6/2016 1:03:45PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:06PM
Bkgd Info: Sample: Det 40; Det: Det 40; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 40
Efficiency Calibration:2016.06.06 001 det 40
Calibration Date: 6/6/2016 12:23:46PM
Energy Cal: Gain = 5.2253 keV / Ch
Offset = 3.092.17 keV
Quadratic = 0.0000 keV / Ch^2
Efficiency: 23.90% +/- 0.24% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 1:02:53PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5650.000	5945.000	27.721	100.0	1,803.29	0.0600	1,803	7.543E+002	3.633E+001	1.694E-001	1.471E+000
Unknown	5080.000	4920.000	5120.000	31.908	100.0	557.70	0.0000	558	2.333E+002	1.991E+001	0.000E+000	1.132E+000
Unknown	5230.000	5130.000	5380.000	.000	100.0	1,544.17	0.0600	1,544	6.459E+002	3.351E+001	1.694E-001	1.471E+000
Unknown	5380.000	5250.000	5470.000	7.250	100.0	18.00	0.0718	18	7.500E+000	3.557E+000	1.853E-001	1.503E+000
Unknown	5485.000	5380.000	5575.000	71.152	100.0	26.94	0.0400	27	1.125E+001	4.347E+000	1.383E-001	1.409E+000
Unknown	6115.000	5950.000	6150.000	20.057	100.0	2.00	0.0100	2	8.375E-001	1.186E+000	6.916E-002	1.270E+000

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

CRTEC
Oak Ridge, TN 37830
12:47:39PM 6/6/2016

Analyst: CRTEC

Sample

Sample: 15-005AS12OCT15#1 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.06.06 001
:
Description:

Client Name: Undefined
Client Contact:

Tracer

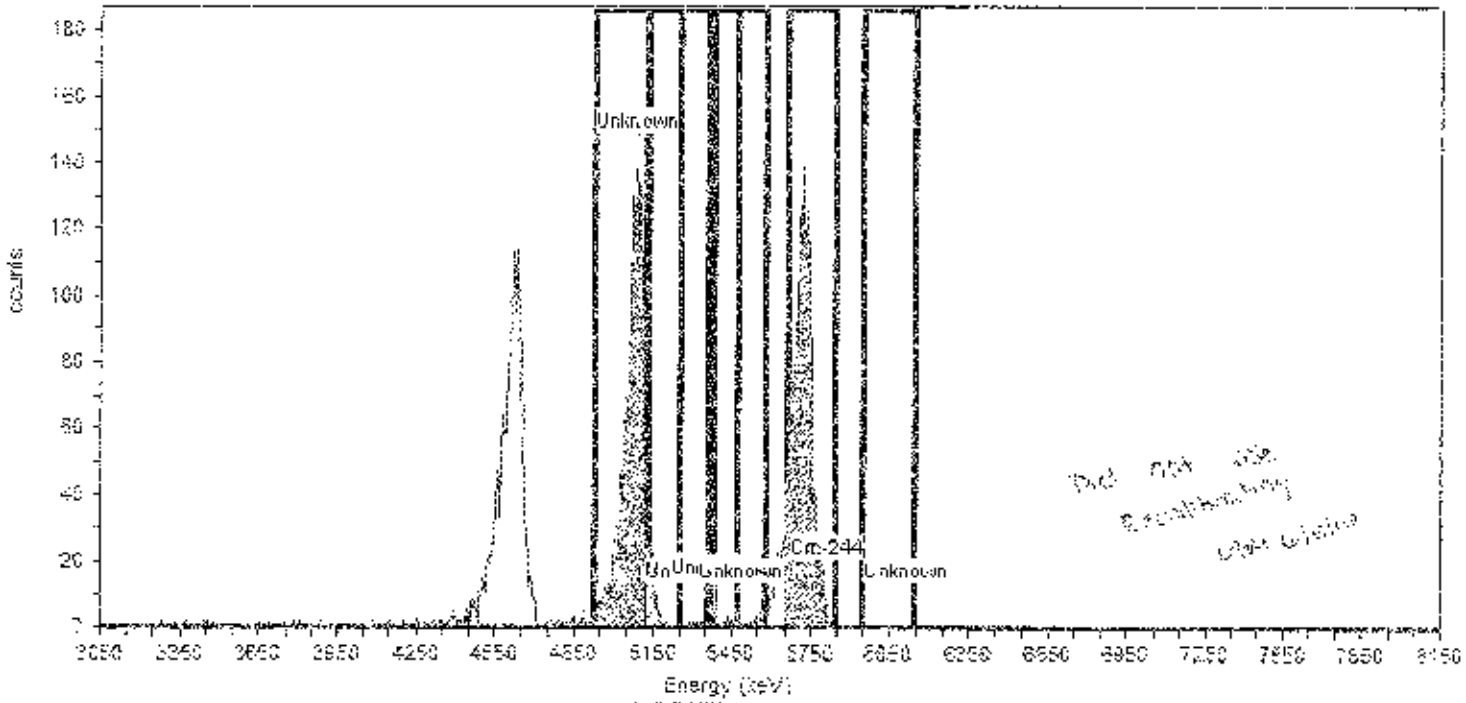
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det-30 SN:
Acquisition Start Date: 6/6/2016 12:37:23PM
Live Time: 10.00 min.
Real Time: 10.01 min.
Background Date: 6/1/2016 1:07:06PM
Bkgd Info: Sample: Det 30; Det: Det-30; Spectrum #1; Jun-01-2016 13:07

Energy Calibration: 2016.06.06 001 det 30
Efficiency Calibration:2016.06.06 001 det 30
Calibration Date: 6/6/2016 8:51:04AM
Energy Cal: Gain = 4.9893 keV / Ch
Offset = 3.045.60 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 28.73% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = iso am by energy
Decay Correction:6/6/2016 12:35:36PM
MDA Constants: Kα = 1.65 , Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	75.435	100.0	2,048.00	0.0400	2,048	7.128E+002	3.238E+001	1.151E-001	1.172E+000
Unknown	5080.000	4920.000	5120.000	34.896	100.0	2,060.10	0.2077	2,060	7.169E+002	3.249E+001	2.622E-001	1.466E+000
Unknown	5280.000	5130.000	5360.000	.000	100.0	139.43	0.1787	139	4.846E+001	8.240E+000	2.432E-001	1.428E+000
Unknown	5380.000	5260.000	5470.000	87.460	100.0	26.74	0.2100	27	9.232E+000	3.615E+000	2.637E-001	1.469E+000
Unknown	5485.000	5380.000	5575.000	142	100.0	35.20	0.0400	35	1.224E+001	4.134E+000	1.151E-001	1.172E+000
Unknown	6115.000	5960.000	6150.000	.000	100.0	0.00	0.0024	0	0.000E+000	6.969E-001	2.823E-002	9.982E-001

Alpha Spectroscopy Calibration Verification
11/10/2015

Sources previously prepared for the alpha spectroscopy Energy and Efficiency calibrations were cycled through detectors 25 through 40 and analyzed for Cm-244 content in the same manner as samples. Sources used for calibration purposes were subsequently counted and analyzed as samples to determine Cm-244 content. A summary of the decay corrected expected Cm-244 source dpm versus the Cm-244 result dpm for each detector is listed in the table below.

Detector ID	Energy/Eff Cal Source ID	Cal. Verification Source ID	Target DPM of Cal Ver Source	Result DPM of Cal Ver Source	Recovery	Limits
25			67169.37		0.0%	90-110
26			66906.73		0.0%	90-110
27			66834.50		0.0%	90-110
28			66893.60		0.0%	90-110
29			66939.56		0.0%	90-110
30			66847.63		0.0%	90-110
31			67169.37		0.0%	90-110
32			66906.73		0.0%	90-110
33			66834.50		0.0%	90-110
34			66893.60		0.0%	90-110
35	15-C39	15-040	773.12	784.4	101.5%	90-110
36			66847.63		0.0%	90-110
37			67169.37		0.0%	90-110
38			66906.73		0.0%	90-110
39			66834.50		0.0%	90-110
40			66893.60		0.0%	90-110

Alpha Spectroscopy Calibration Verification
6/6/2016

Reference date used for
Calibration 10/12/2015 0:00
Half life Cm-244 (days) 6611

Source DF	Source Count Date	Decay Corrected Target of Cal Source	Cal. Verification Source ID	Original Target DPM of Cal Ver Source
84.17995		67169.37	15-035	797.93
84.17995		66906.73	15-036	794.81
84.17995		66834.50	15-037	793.95
84.17995		66893.60	15-038	794.65
84.17995		66939.56	15-039	795.20
84.17995		66847.63	15-040	794.10
84.17995		67169.37	15-035	797.93
84.17995		66906.73	15-036	794.81
84.17995		66834.50	15-037	793.95
84.17995		66893.60	15-038	794.65
0.97223	7/6/2018 14:50	773.12	15-039	795.20
84.17995		66847.63	15-040	794.10
84.17995		67169.37	15-035	797.93
84.17995		66906.73	15-036	794.81
84.17995		66834.50	15-037	793.95
84.17995		66893.60	15-038	794.65

AlphaVision v5.3 — **Alpha Spectroscopy Analysis Report**

ORTEC
Oak Ridge, TN 37830
3:00:30PM 7/6/2016

Analyst: ORTEC

Sample

Sample: 15-040AS12OCT16#6 Type: Sample
Spectrum #1 Analysis #1
:
Sample Collection Date:
Comment:

Sample Volume : 1.00 Sample Units: mL
First Stage Dilution: N/A
Aliquot: N/A Aliquot Fraction: N/A
Dilution 2: N/A
Lab Preparation:

Batch

Batch Name: 2016.07 06 003
:
Description:

Client Name: Undefined
Client Contact:

Tracer

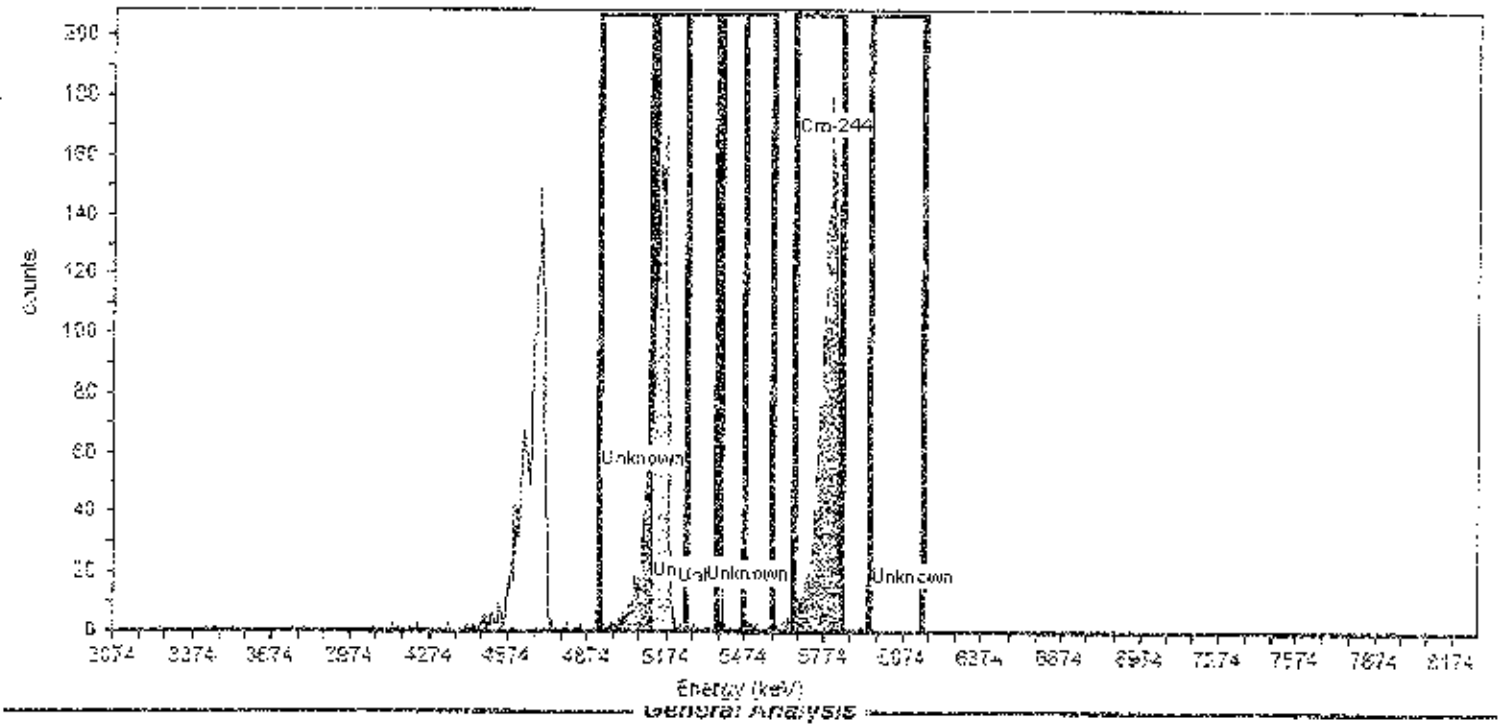
Tracer Name: Undefined
Tracer Activity:
Tracer Ref. Date:

Tracer Nuclide: External Recovery
Tracer Recovery: 100.00%

Acquisition

Detector: Det 35 SN:
Acquisition Start Date: 7/6/2016 2:50:22PM
Live Time: 10.00 min.
Real Time: 10.00 min.
Background Date: 6/6/2016 2:34:12PM
Bkgd Info: Sample: Det 35; Det: Det 35; Spectrum #1; Jun-06-2016 14:34

Energy Calibration: 2016 07.06 002
Efficiency Calibration:2016.07.06 002
Calibration Date: 7/6/2016 2:48:45PM
Energy Cal: Gain = 6.0816 keV / Ch
Offset = 3,069.82 keV
Quadratic = 0.0000 keV / Ch²
Efficiency: 27.30% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = iso am by energy
Decay Correction:7/6/2016 2:49:58PM
MDA Constants: Kα = 1.65 . Kβ = 1.65

Nuclide Library: cal ver
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	2.00Sigma TPU DPM	Critical Level DPM	MDA DPM
Cm-244	5810.000	5660.000	5845.000	32.111	100.0	2,141.24	0.0700	2,141	7.894E+002	3.482E+001	1.602E-001	1.312E+000
Unknown	5080.000	4920.000	5120.000	17.728	100.0	569.29	0.0000	569	2.085E+002	1.762E+001	0.000E+000	9.913E-001
Unknown	5280.000	5130.000	5360.000	.000	100.0	1,321.66	0.1100	1,322	4.841E+002	2.708E+001	2.009E-001	1.383E+000
Unknown	5380.000	5260.000	5470.000	20.373	100.0	17.00	0.1532	17	6.172E+000	3.036E+000	2.371E-001	1.465E+000
Unknown	5485.000	5380.000	5575.000	43.700	100.0	31.00	0.0799	31	1.133E+001	4.086E+000	1.712E-001	1.334E+000
Unknown	6115.000	5950.000	6150.000	.000	100.0	0.00	0.0300	0	0.000E+000	7.436E-001	1.049E-001	1.201E+000

Alpha Spectroscopy Run Logbook

Logbook ID: 4-R054-5
SOP ID: PGH-R-320

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
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[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]							

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract RL
4. Re-Prep of sample
5. Other Noted Comments

Peer Review_____ Date: _____

Alpha Spectroscopy Run Logbook

Logbook ID: 4-R054-5
SOP ID: PSH-R-020

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
34	15-033 Asphalt #1	Cs	60	[illegible] 0857	[illegible]	[illegible]	N/A	N/A	N/A
35	15-037 #2	↓	↓	↓	↓	↓	↓	↓	↓
36	15-038 #3	↓	↓	↓	↓	↓	↓	↓	↓
37	15-039 Incom #1	Cs	60	[illegible] [illegible]	[illegible]	N/A	N/A	N/A	N/A
38	15-040 #2	↓	↓	↓	↓	↓	↓	↓	↓
39	15-041 #3	↓	↓	↓	↓	↓	↓	↓	↓
40	15-042 #4	↓	↓	↓	↓	↓	↓	↓	↓
41	15-043 #5	↓	↓	↓	↓	↓	↓	↓	↓
42	15-044 #6	↓	↓	↓	↓	↓	↓	↓	↓
43	15-045 Asphalt #1	Cs	10	[illegible] 1037	[illegible]	N/A	N/A	N/A	N/A
44	15-046 #2	↓	↓	↓	↓	↓	↓	↓	↓
45	15-047 #3	↓	↓	↓	↓	↓	↓	↓	↓
46	15-048 #4	↓	↓	↓	↓	↓	↓	↓	↓
47	15-049 #5	↓	↓	↓	↓	↓	↓	↓	↓
48	15-050 #6	↓	↓	↓	↓	↓	↓	↓	↓
49	15-051 Asphalt #1	Cs	10	[illegible] 1049	[illegible]	N/A	N/A	N/A	N/A
50	15-052 #2	↓	↓	↓	↓	↓	↓	↓	↓
51	15-053 #3	↓	↓	↓	↓	↓	↓	↓	↓
52	15-054 #4	↓	↓	↓	↓	↓	↓	↓	↓
53	15-055 #5	↓	↓	↓	↓	↓	↓	↓	↓
54	15-056 #6	↓	↓	↓	↓	↓	↓	↓	↓
55	15-057 Asphalt #1	Cs	10	[illegible] 1053	[illegible]	N/A	N/A	N/A	N/A
56	15-058 #2	↓	↓	↓	↓	↓	↓	↓	↓
57	15-059 #3	↓	↓	↓	↓	↓	↓	↓	↓

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract RL
4. Re-Prep of sample
5. Other Noted Comments

Peer Review:_____ Date: _____

Alpha Spectroscopy Run Logbook

Logbook ID: 4-R054-5
SOP ID: PG-I-R-023

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract RL
4. Re-Prep of sample
5. Other Noted Comments

Peer Review_____ Date: _____

[illegible]

Logbook ID: 4-R054-5
SOP ID: FGH-R-020

Alpha Spectroscopy Run Logbook

Det. ID	Sample ID	Isotope	Count Duration (min)	Count Start date/ time	Analyst	Counting Batch ID	Data Processed	Re-Analysis Code	Comments
37	30187279002	Th	720	7/5/16 1733	LAM	Th30120	N/A	N/A	N/A
38	3								
39	4								
40	5								
25	1100395	Th	300	7/6/16 0743	LAM	Th30120	N/A	N/A	N/A
26	30187557001								
27	30187558001								
28	LCS30120								
29	LCSD30120								
30	30187229005	U	240	7/6/16 0743		U30120			
31	30187557001								
32	30187558001								
33	LCS30120								
34	LCSD30120								
36	1102432143	Po	300	7/6/16 0743		Po30174			
37	30186906001								
38	LCS30174								
39	LCSD30174								
35	15-039 [illegible]	CAL	60	7/6/16 1544	LAM	N/A	N/A	N/A	N/A
30	15-[illegible]	[illegible]	10	7/6/16 1550	LAM	N/A	N/A	N/A	N/A

Legend: 1. Detector daily check failure
2. <400 tracer counts
3. MDC > Contract Rt.
4. Re-Prep of sample
5. Other Noted Comments

Peer Review_____ Date: _____

[illegible]

Alpha Spectroscopy Routine Checks

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:41:08AM 2/2/2017

Sample

Sample Name: Det 25 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

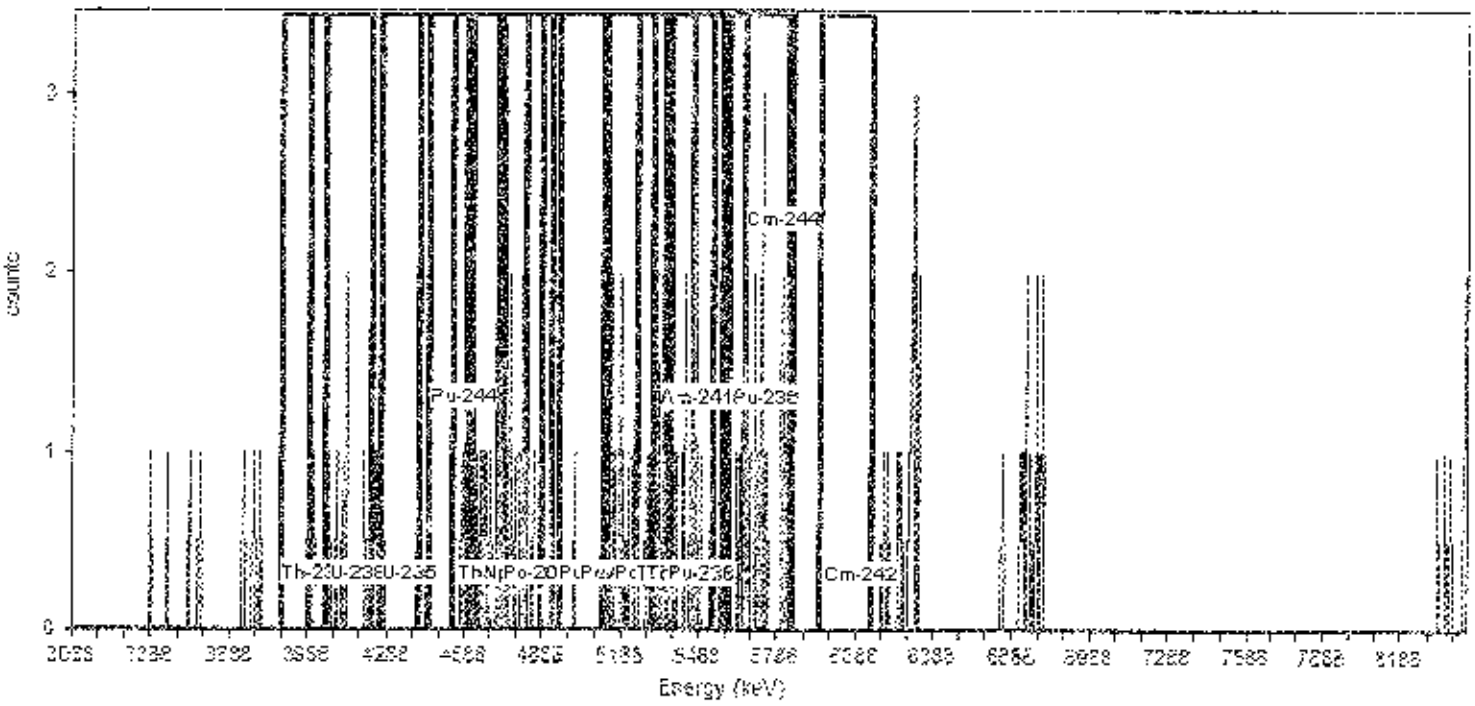
Acquisition

Detector: Det 25 , SN:
Acquisition Start Date: 2/1/2017 1:59:53PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.12.02 005
Calibration Date: 12/2/2016 12:31:46PM

Energy Calibration Equation:

Gain = 5.2386 keV / Ch
Offset = 3,083.47 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.42% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 155.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
U-234	4.77	4.54	4.83	27.00	2.700E-002	5.292E-003
Th-230	4.69	4.54	4.74	17.84	1.784E-002	4.341E-003
Np-237	4.79	4.59	4.88	27.47	2.747E-002	5.336E-003
Po-209	4.69	4.72	4.95	17.34	1.734E-002	4.283E-003
Po-209	4.87	4.73	4.93	16.32	1.632E-002	4.162E-003
Po-209	4.87	4.75	5.13	14.00	1.400E-002	3.873E-003
Pu-239	5.09	4.92	5.12	2.00	2.000E-003	1.732E-003
Pu-239	5.17	4.99	5.22	10.82	1.082E-002	3.437E-003
Po-210	5.30	5.12	5.38	25.00	2.500E-002	5.099E-003
Am-243	5.28	5.13	5.36	23.00	2.300E-002	4.899E-003
Po-210	5.30	5.15	5.37	22.14	2.214E-002	4.810E-003
Th-228	5.38	5.25	5.47	22.97	2.297E-002	4.896E-003
Th-228	5.42	5.29	5.46	17.15	1.715E-002	4.260E-003
Pu-238	5.50	5.33	5.54	26.00	2.600E-002	5.196E-003
Am-241	5.49	5.38	5.58	16.52	1.652E-002	4.186E-003
Pu-238	5.75	5.60	5.83	28.62	2.862E-002	5.442E-003
Cm-244	5.81	5.56	5.95	26.75	2.675E-002	5.267E-003
Cm-242	6.12	5.95	6.15	2.00	0.000E+000	1.414E-003
Th-232	4.01	3.88	4.05	1.00	1.000E-003	1.414E-003
U-238	4.19	3.99	4.23	9.00	9.000E-003	3.162E-003
U-235	4.39	4.26	4.45	1.00	1.000E-003	1.414E-003
Pu-244	4.59	4.41	4.62	3.26	3.256E-003	2.063E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:41:11AM 2/2/2017

Sample

Sample Name: Det 26 Spectrum: #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

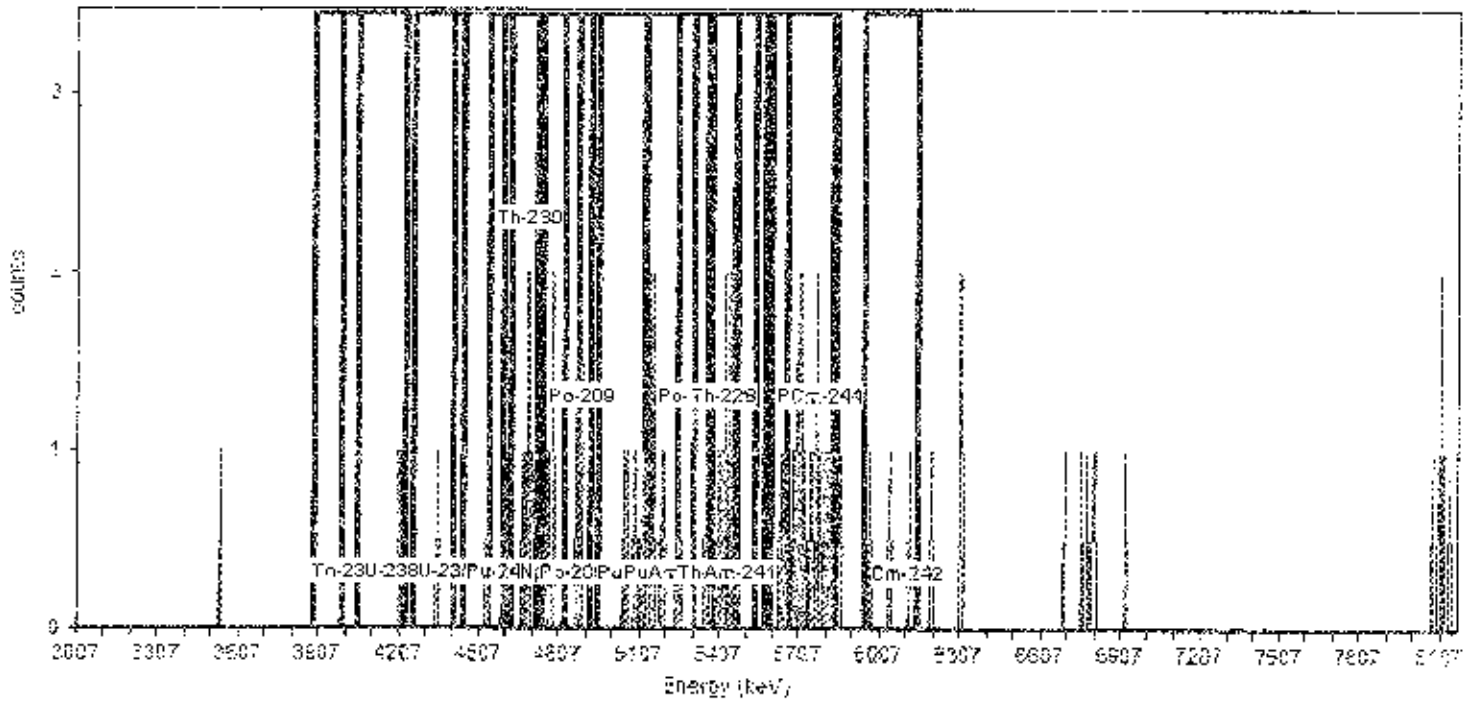
Acquisition

Detector: Det 26 , SN:
Acquisition Start Date: 2/1/2017 1:59:54PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.12.02 007
Calibration Date: 12/2/2016 1:48:37PM

Energy Calibration Equation:

Gain = 5.0577 keV / Ch
Offset = 3,002.39 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.83% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 114.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	0.00	0.000E+000	1.414E-003
U-238	4.19	3.99	4.23	3.00	3.000E-003	2.000E-003
U-235	4.39	4.35	4.45	1.00	1.000E-003	1.414E-003
Pu-244	4.59	4.41	4.62	2.83	2.833E-003	1.950E-003
U-234	4.77	4.54	4.83	11.00	1.100E-002	3.464E-003
Th-230	4.69	4.54	4.74	7.00	7.000E-003	2.828E-003
Np-237	4.79	4.59	4.88	12.48	1.248E-002	3.571E-003
Po-209	4.89	4.72	4.96	8.00	8.000E-003	3.000E-003
Po-209	4.87	4.73	4.93	8.00	8.000E-003	3.000E-003
Po-209	4.87	4.75	5.13	16.00	1.600E-002	4.123E-003
Pu-239	5.08	4.92	5.12	7.00	7.000E-003	2.828E-003
Pu-239	5.17	4.89	5.22	19.00	1.900E-002	4.472E-003
Po-210	5.30	5.12	5.38	19.00	1.900E-002	4.472E-003
Am-243	5.28	5.13	5.36	16.33	1.633E-002	4.163E-003
Po-210	5.30	5.15	5.37	11.87	1.187E-002	3.587E-003
Th-228	5.38	5.25	5.47	24.50	2.450E-002	5.050E-003
Th-228	5.42	5.29	5.46	19.25	1.925E-002	4.500E-003
Pu-238	5.50	5.31	5.54	21.26	2.126E-002	4.718E-003
Am 241	5.49	5.38	5.58	18.00	1.800E-002	4.359E-003
Pu-238	5.75	5.60	5.83	25.93	2.593E-002	5.189E-003
Cm-244	5.81	5.66	5.85	22.46	2.246E-002	4.844E-003
Cm-242	6.12	5.95	6.15	3.00	3.000E-003	2.000E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:41:14AM 2/2/2017

Sample

Sample Name: Det 27 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

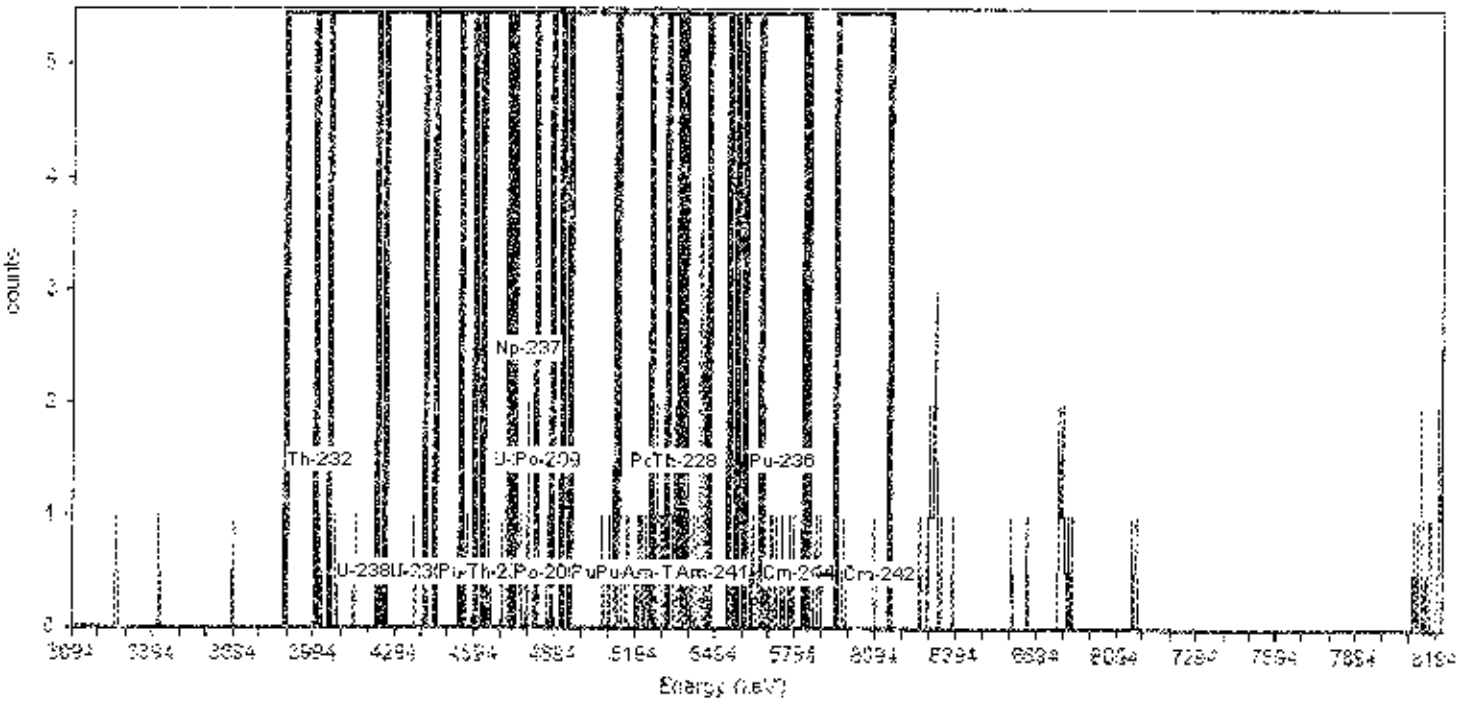
Description:

Acquisition

Detector: Det 27 , SN:
Acquisition Start Date: 2/1/2017 1:59:54PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 27
Calibration Date: 6/6/2016 8:44:44AM

Energy Calibration Equation:
Gain = 5.0148 keV / Ch
Offset = 3.089.69 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.63% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 108.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.96	4.05	1.00	1.000E-003	1.414E-003
U-238	4.19	3.99	4.23	3.00	3.000E-003	2.000E-003
U-235	4.39	4.26	4.45	1.00	1.000E-003	1.414E-003
Pu-244	4.59	4.41	4.62	1.00	1.000E-003	1.414E-003
U-234	4.77	4.54	4.83	8.00	8.000E-003	3.000E-003
Th-230	4.69	4.54	4.74	5.00	5.000E-003	2.449E-003
Np-237	4.79	4.59	4.88	8.00	8.000E-003	3.000E-003
Po-209	4.89	4.72	4.95	4.00	4.000E-003	2.236E-003
Po-209	4.87	4.73	4.93	4.00	4.000E-003	2.236E-003
Po-209	4.87	4.75	5.13	7.00	7.000E-003	2.828E-003
Pu-238	5.08	4.92	5.12	2.14	2.137E-003	1.771E-003
Pu-239	5.17	4.99	5.22	6.19	6.193E-003	2.682E-003
Po-210	5.30	5.12	5.38	18.85	1.885E-002	4.226E-003
Am-243	5.28	5.13	5.36	15.72	1.572E-002	4.069E-003
Po-210	5.30	5.15	5.37	14.28	1.428E-002	3.909E-003
Th-228	5.36	5.25	5.47	27.00	2.700E-002	5.292E-003
Th-228	5.42	5.29	5.48	22.01	2.201E-002	4.797E-003
Pu-239	5.50	5.31	5.54	22.00	2.200E-002	4.796E-003
Am-241	5.49	5.38	5.56	17.71	1.771E-002	4.325E-003
Pu-236	5.75	5.60	5.63	11.00	1.100E-002	3.464E-003
Cm-244	5.81	5.66	5.85	9.46	9.466E-003	3.233E-003
Cm-242	6.12	5.95	6.15	3.26	3.255E-003	2.083E-003

AlphaVision v5.3 **Alpha Spectrum Bkg Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:40:58AM 2/2/2017

Sample

Sample Name: Det 28 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

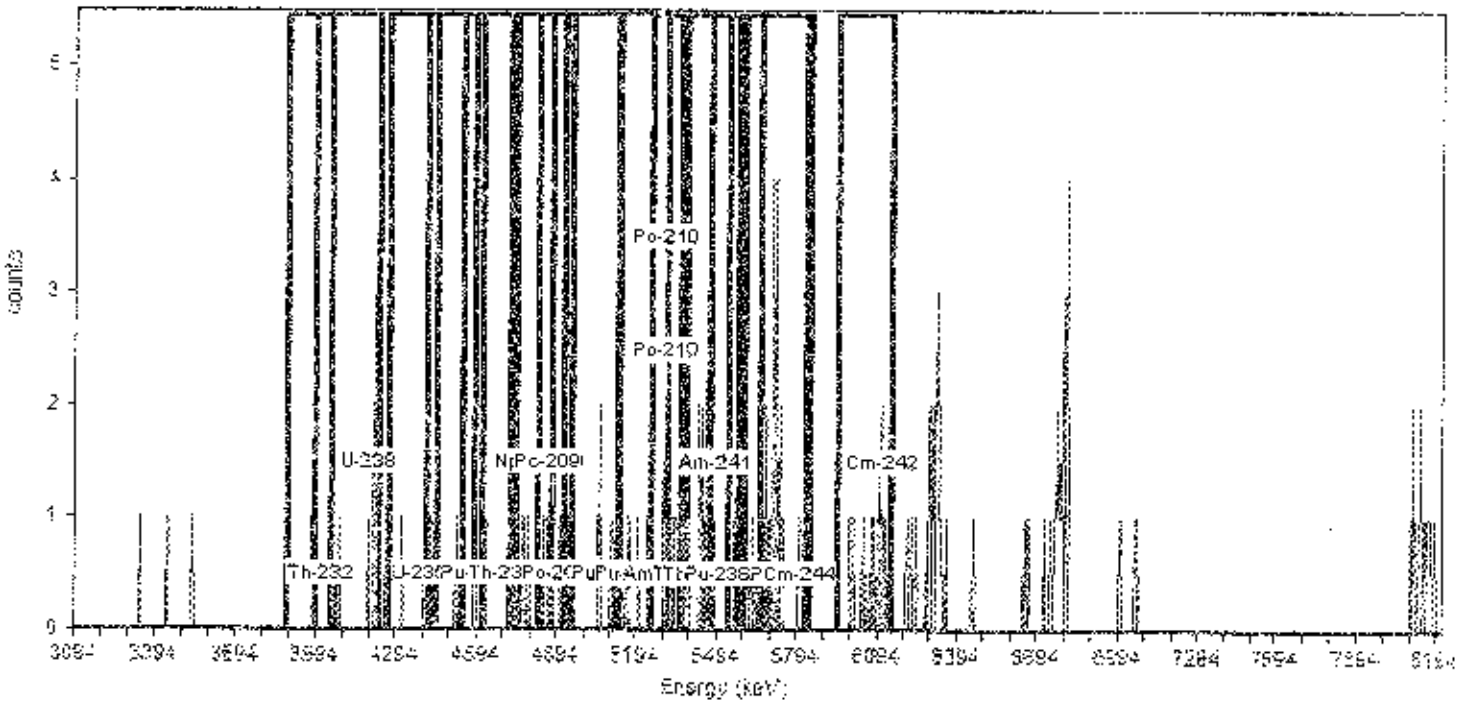
Acquisition

Detector: Det-28 , SN:
Acquisition Start Date: 2/1/2017 1:59:52PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 28
Calibration Date: 6/6/2016 8:47:14AM

Energy Calibration Equation:

Gain = 5.0103 keV / Ch
Offset = 3,089.93 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.08% +/- 0.27% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 159.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	1.00	1.000E-003	1.414E-003
U-238	4.19	3.99	4.23	8.55	8.547E-003	3.090E-003
U-235	4.39	4.26	4.45	4.47	4.467E-003	2.338E-003
Pu-244	4.59	4.41	4.62	4.00	4.000E-003	2.236E-003
U-234	4.77	4.54	4.83	9.00	9.000E-003	3.162E-003
Th-230	4.69	4.54	4.74	3.67	3.671E-003	2.161E-003
Np-237	4.79	4.59	4.88	11.60	1.160E-002	3.550E-003
Po-209	4.89	4.72	4.95	11.34	1.134E-002	3.513E-003
Po-209	4.87	4.73	4.93	10.32	1.032E-002	3.384E-003
Po-209	4.87	4.75	5.13	12.00	1.200E-002	3.606E-003
Pu-239	5.08	4.92	5.12	4.00	4.000E-003	2.236E-003
Pu-239	5.17	4.99	5.22	6.00	6.000E-003	2.646E-003
Po-210	5.30	5.12	5.38	14.07	1.407E-002	3.882E-003
Am-243	5.28	5.13	5.35	12.00	1.200E-002	3.606E-003
Po-210	5.30	5.15	5.37	12.16	1.216E-002	3.627E-003
Th-226	5.38	5.25	5.47	22.93	2.293E-002	4.802E-003
Th-228	5.42	5.29	5.46	20.88	2.088E-002	4.678E-003
Pu-238	5.50	5.31	5.54	19.00	1.900E-002	4.472E-003
Am-241	5.48	5.38	5.58	15.07	1.507E-002	4.003E-003
Pu-236	5.75	5.60	5.83	23.02	2.302E-002	4.901E-003
Cm-244	5.81	5.66	5.88	22.00	2.200E-002	4.796E-003
Cm-242	6.12	5.95	6.15	12.00	1.200E-002	3.606E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:41:01AM 2/2/2017

Sample

Sample Name: Det 29 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

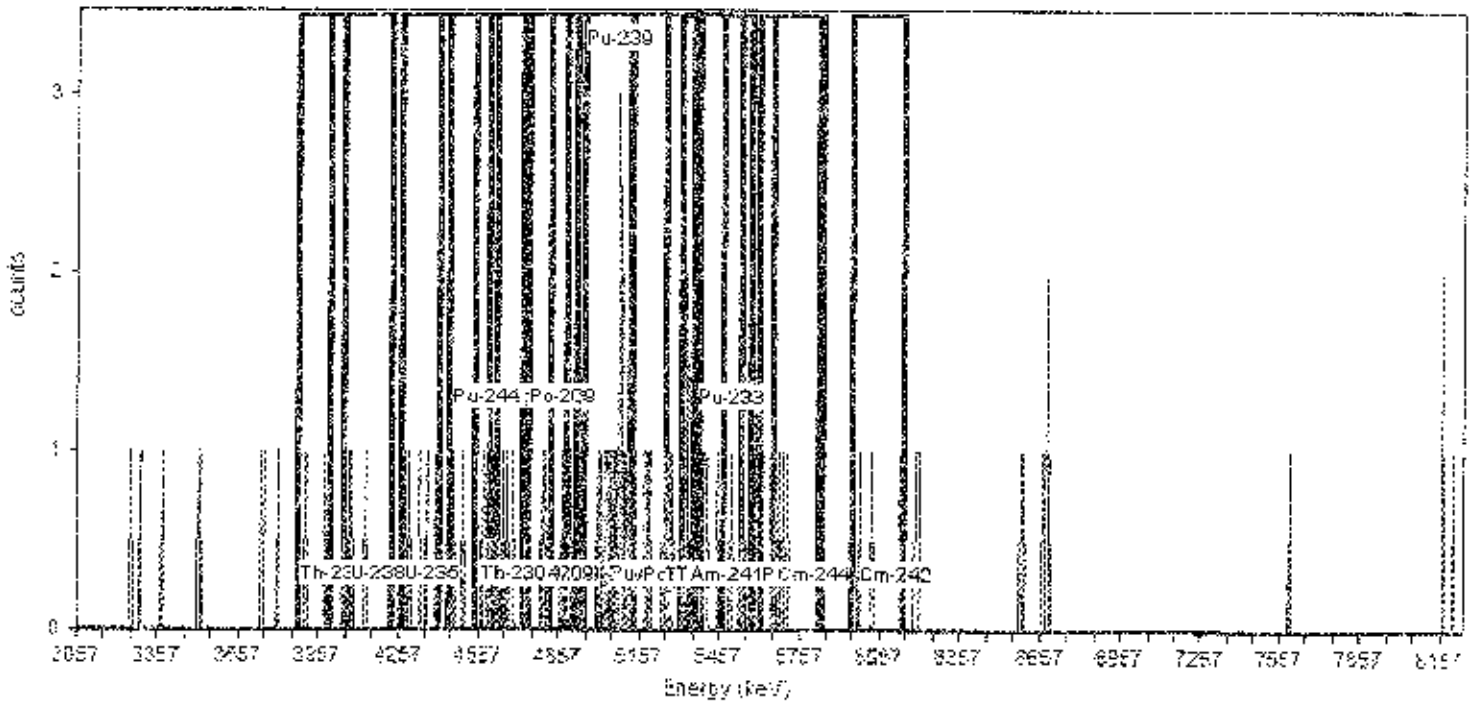
Acquisition

Detector: Det-29 , SN:
Acquisition Start Date: 2/1/2017 1:59:53PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.10 001
Calibration Date: 6/10/2016 11:04:05AM

Energy Calibration Equation:

Gain = 5.0793 keV / Ch
Offset = 3,062.20 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.95% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 115.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Np-237	4.79	4.69	4.88	13.24	1.324E-002	3.774E-003
Po-209	4.89	4.72	4.95	8.00	8.000E-003	3.000E-003
Po-209	4.87	4.73	4.93	6.23	6.235E-003	2.690E-003
Po-209	4.87	4.75	5.13	29.00	2.900E-002	5.477E-003
Pu-239	5.08	4.92	5.12	23.99	2.399E-002	4.969E-003
Pu-239	5.17	4.99	5.22	27.00	2.700E-002	5.292E-003
Po-210	5.30	5.12	5.38	16.89	1.689E-002	4.230E-003
Am-243	5.28	5.13	5.36	18.00	1.800E-002	4.123E-003
Po-210	5.30	5.15	5.37	15.00	1.500E-002	4.000E-003
Th-228	5.38	5.25	5.47	13.00	1.300E-002	3.742E-003
Th-228	5.42	5.29	5.46	8.00	8.000E-003	3.000E-003
Pu-239	5.50	5.31	5.54	10.80	1.080E-002	3.464E-003
Am-241	5.49	5.38	5.58	8.00	8.000E-003	3.000E-003
Pu-238	5.75	5.60	5.83	6.78	6.784E-003	2.790E-003
Cm-244	5.81	5.66	5.85	3.42	3.421E-003	2.133E-003
Cm-242	6.12	5.95	6.15	4.00	4.000E-003	2.236E-003
Th-232	4.01	3.88	4.05	2.55	2.554E-003	1.885E-003
U-238	4.19	3.99	4.23	4.00	4.000E-003	2.236E-003
U-235	4.39	4.26	4.45	5.00	5.000E-003	2.449E-003
Pu-244	4.59	4.41	4.62	7.00	7.000E-003	2.828E-003
U-234	4.77	4.64	4.83	14.00	1.400E-002	3.873E-003
Th-230	4.69	4.54	4.74	11.00	1.100E-002	3.464E-003

AlphaVision v5.3 **Alpha Spectrum Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:41:04AM 2/2/2017

Sample

Sample Name: Det 30 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

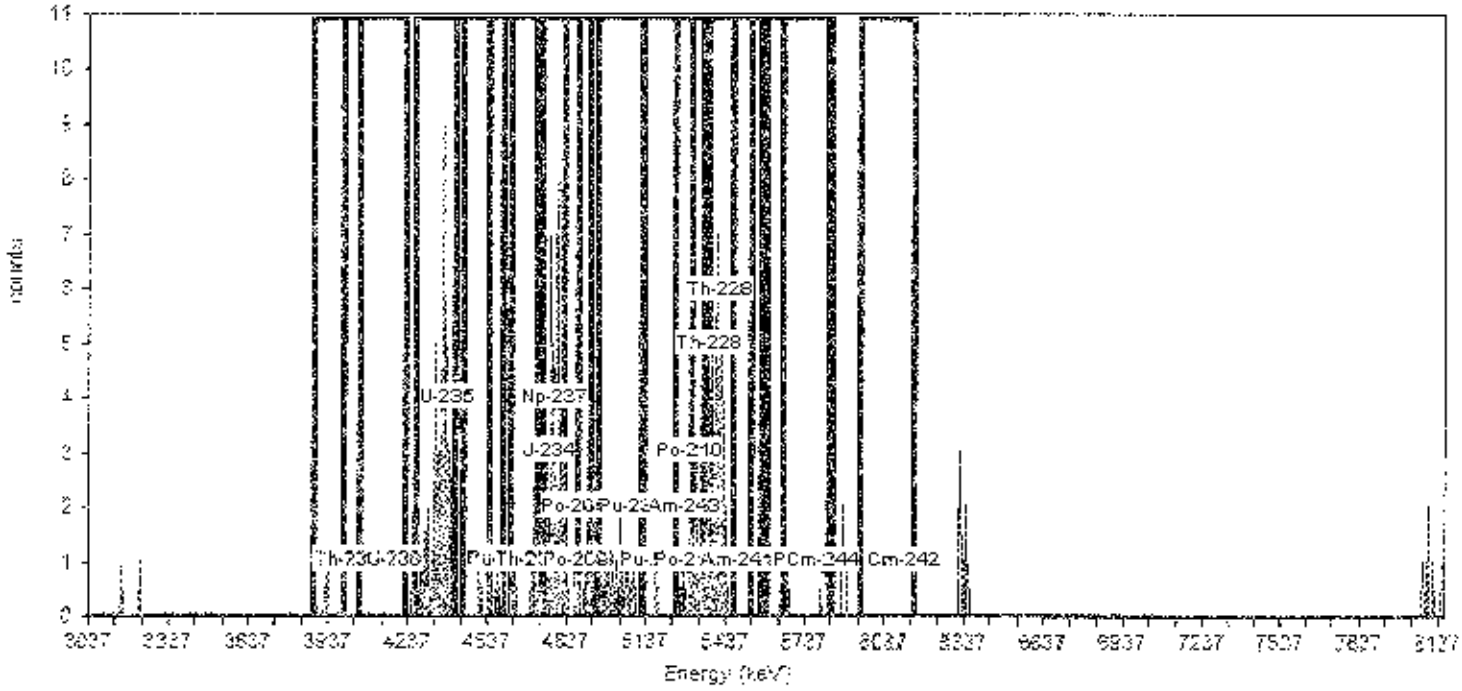
Acquisition

Detector: Det-30 , SN:
Acquisition Start Date: 2/1/2017 1:59:52PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min
Calibration Name: 2016.12.07 006
Calibration Date: 12/7/2016 12:27:33PM

Energy Calibration Equation:

Gain = 5.0127 keV / Ch
Offset = 3,032.11 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.70% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 253.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	2.30	2.298E-003	1.816E-003
U-238	4.19	3.99	4.23	0.00	0.000E+000	1.414E-003
U-235	4.39	4.26	4.45	56.04	5.604E-002	7.553E-003
Pu-244	4.59	4.41	4.62	5.00	5.000E-003	2.469E-003
U-234	4.77	4.54	4.83	64.45	6.445E-002	8.090E-003
Th-230	4.69	4.54	4.74	10.73	1.073E-002	3.425E-003
Np-237	4.79	4.59	4.88	67.00	6.700E-002	8.246E-003
Po-209	4.89	4.72	4.95	70.72	7.072E-002	8.469E-003
Po-209	4.87	4.73	4.93	66.54	6.654E-002	8.218E-003
Po-209	4.87	4.75	5.13	76.29	7.629E-002	8.792E-003
Pu-239	5.08	4.82	5.12	14.38	1.438E-002	3.921E-003
Pu-239	5.17	4.99	5.22	11.41	1.141E-002	3.523E-003
Po-210	5.30	5.12	5.38	32.78	3.278E-002	5.612E-003
Am-243	5.28	5.13	5.36	22.40	2.240E-002	4.837E-003
Po-210	5.30	5.19	5.37	23.60	2.360E-002	4.860E-003
Th-228	5.38	5.25	5.47	78.00	7.800E-002	8.868E-003
Th-228	5.42	5.29	5.46	75.44	7.544E-002	8.743E-003
Pu-238	5.50	5.31	5.54	70.57	7.057E-002	8.460E-003
Am-241	5.49	5.36	5.58	45.78	4.578E-002	6.840E-003
Pu-236	5.75	5.60	5.83	3.00	3.000E-003	2.000E-003
Cm-244	5.81	5.66	5.85	3.00	3.000E-003	2.000E-003
Cm-242	6.12	5.96	6.15	0.00	0.000E+000	1.414E-003

AlphaVision v5.3 **Alpha Spectrum Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
6:41:17AM 2/2/2017

Analyst: ORTEC

Sample

Sample Name: Det 31 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

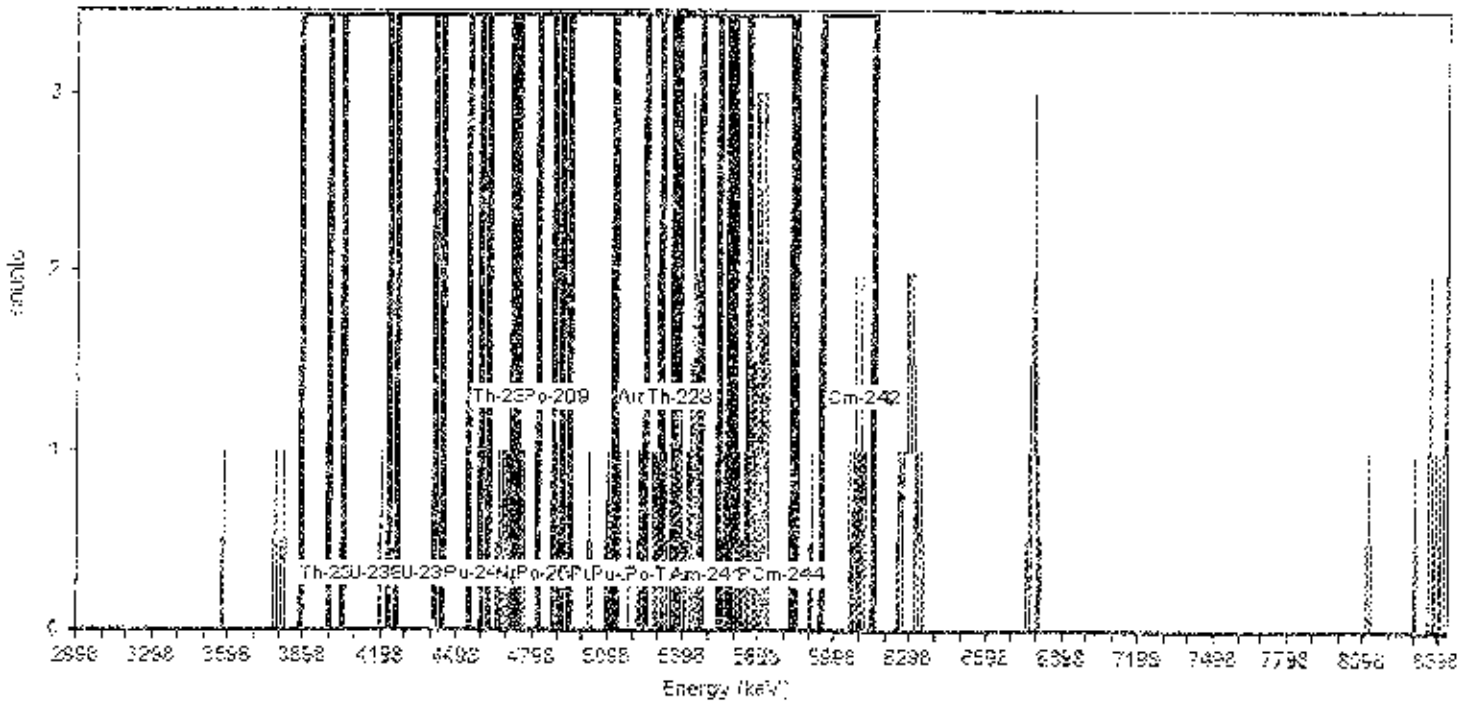
Acquisition

Detector: Det 31 , SN:
Acquisition Start Date: 2/1/2017 1:59:54PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 de: 31
Calibration Date: 6/6/2016 10:21:27AM

Energy Calibration Equation:

Gain = 5.3188 keV / Ch
Offset = 2.922.72 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.30% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 117.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	0.00	0.000E+000	1.414E-003
U-238	4.19	3.99	4.23	1.00	1.000E-003	1.414E-003
U-235	4.39	4.26	4.45	0.00	0.000E+000	1.414E-003
Pu-244	4.59	4.41	4.62	0.95	9.503E-004	1.397E-003
U-234	4.77	4.54	4.83	8.00	8.000E-003	3.000E-003
Th-230	4.69	4.54	4.74	6.00	6.000E-003	2.646E-003
Np-237	4.79	4.59	4.88	8.00	8.000E-003	3.000E-003
Po-209	4.89	4.72	4.96	3.00	3.000E-003	2.000E-003
Po-209	4.87	4.73	4.93	3.00	3.000E-003	2.000E-003
Po-209	4.87	4.75	5.13	6.00	6.000E-003	2.645E-003
Pu-239	5.08	4.92	5.12	3.00	3.000E-003	2.000E-003
Pu-239	5.17	4.99	5.22	5.00	5.000E-003	2.449E-003
Po-210	5.30	5.12	5.38	13.84	1.384E-002	3.852E-003
Am-243	5.28	5.13	5.36	9.92	9.920E-003	3.305E-003
Po-210	5.30	5.15	5.37	9.06	9.061E-003	3.172E-003
Th-228	5.38	5.25	5.47	24.24	2.424E-002	5.024E-003
Th-228	5.42	5.29	5.48	21.08	2.108E-002	4.698E-003
Pu-238	5.50	5.31	5.54	21.32	2.132E-002	4.724E-003
Am-241	5.49	5.38	5.59	17.34	1.734E-002	4.283E-003
Pu-238	5.75	5.60	5.83	25.20	2.520E-002	5.119E-003
Cm-244	5.81	5.66	5.85	21.97	2.197E-002	4.793E-003
Cm-242	6.12	5.95	6.15	6.61	6.611E-003	3.100E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:41:23AM 2/2/2017

Sample

Sample Name: Det 32 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

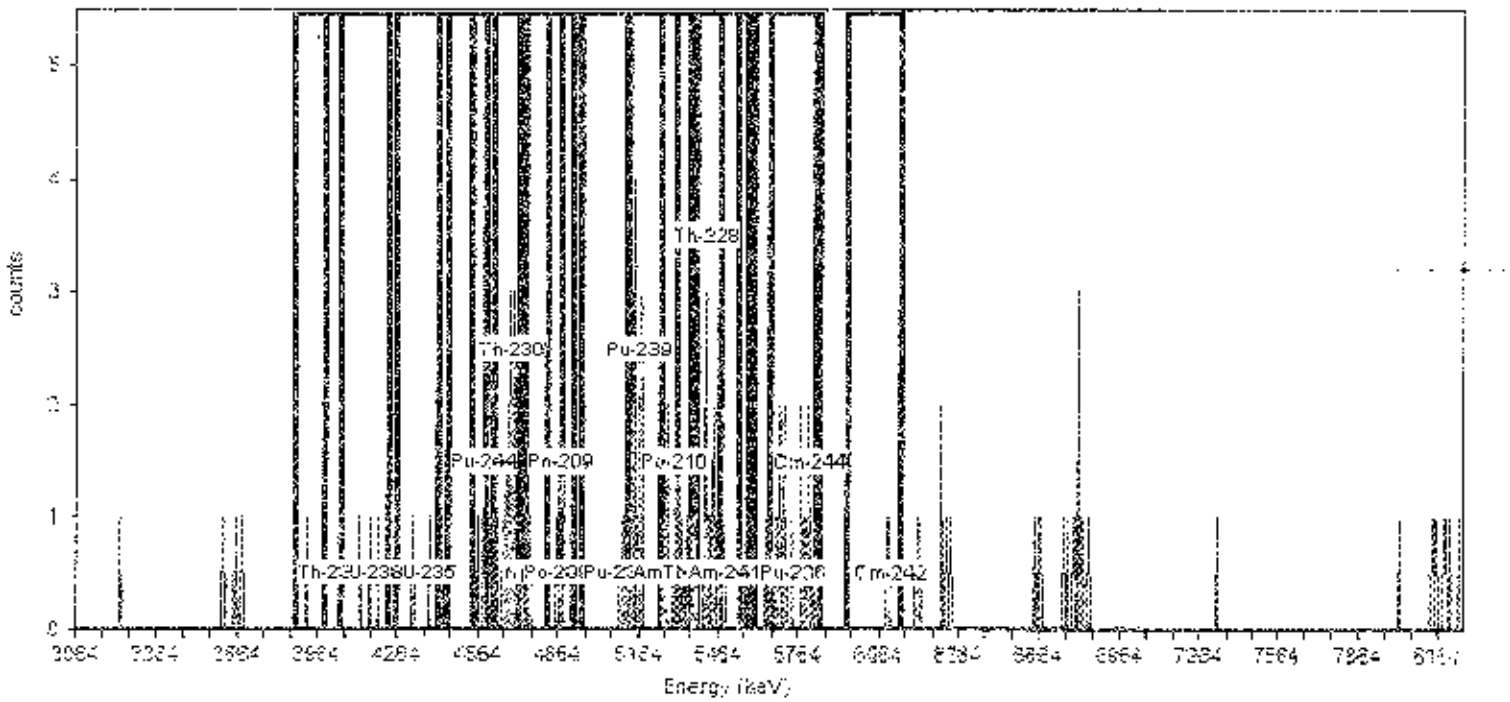
Description:

Acquisition

Detector: Det 32 , SN:
Acquisition Start Date: 2/1/2017 1:59:49PM
Live Time: 1 000.00 min.
Real Time: 1.000.00 min.
Calibration Name: 2016.12.02 010
Calibration Date: 12/2/2016 2:55:41PM

Energy Calibration Equation:
Gain = 5.0516 keV / Ch
Offset = 3.059.66 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.62% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg ilb

Total Background Counts: 144.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.86	4.05	1.00	1.000E-003	1.414E-003
U-238	4.19	3.99	4.23	3.00	3.000E-003	2.000E-003
U-235	4.39	4.25	4.46	3.00	3.000E-003	2.000E-003
Pu-244	4.59	4.41	4.62	5.95	5.945E-003	2.635E-003
U-234	4.77	4.54	4.83	25.00	2.500E-002	5.099E-003
Th-230	4.69	4.54	4.74	24.00	2.400E-002	5.000E-003
Np-237	4.79	4.59	4.88	24.78	2.478E-002	5.077E-003
Po-209	4.89	4.72	4.95	5.00	5.000E-003	2.449E-003
Po-209	4.87	4.73	4.93	4.89	4.889E-003	2.427E-003
Po-209	4.87	4.75	5.13	7.57	7.568E-003	2.927E-003
Pu-239	5.08	4.92	5.12	3.45	3.448E-003	2.109E-003
Pu-239	5.17	4.99	5.22	20.00	2.000E-002	4.583E-003
Po-210	5.30	5.12	5.38	30.22	3.022E-002	5.588E-003
Am-243	5.28	5.13	5.36	27.00	2.700E-002	5.292E-003
Po-210	5.30	5.15	5.37	21.34	2.134E-002	4.727E-003
Th-228	5.38	5.25	5.47	25.33	2.503E-002	5.102E-003
Th-228	5.42	5.29	5.46	20.36	2.036E-002	4.621E-003
Pu-238	5.50	5.31	5.54	22.06	2.206E-002	4.802E-003
Am-241	5.49	5.38	5.58	15.77	1.577E-002	4.098E-003
Pu-236	5.75	5.60	5.83	22.83	2.283E-002	4.882E-003
Cm-244	5.81	5.66	5.85	20.29	2.029E-002	4.614E-003
Cm-242	6.12	5.95	6.15	2.00	2.000E-003	1.732E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
6:41:20AM 2/2/2017

Analyst: ORTEC

Sample

Sample Name: Det 33 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01.002

Description:

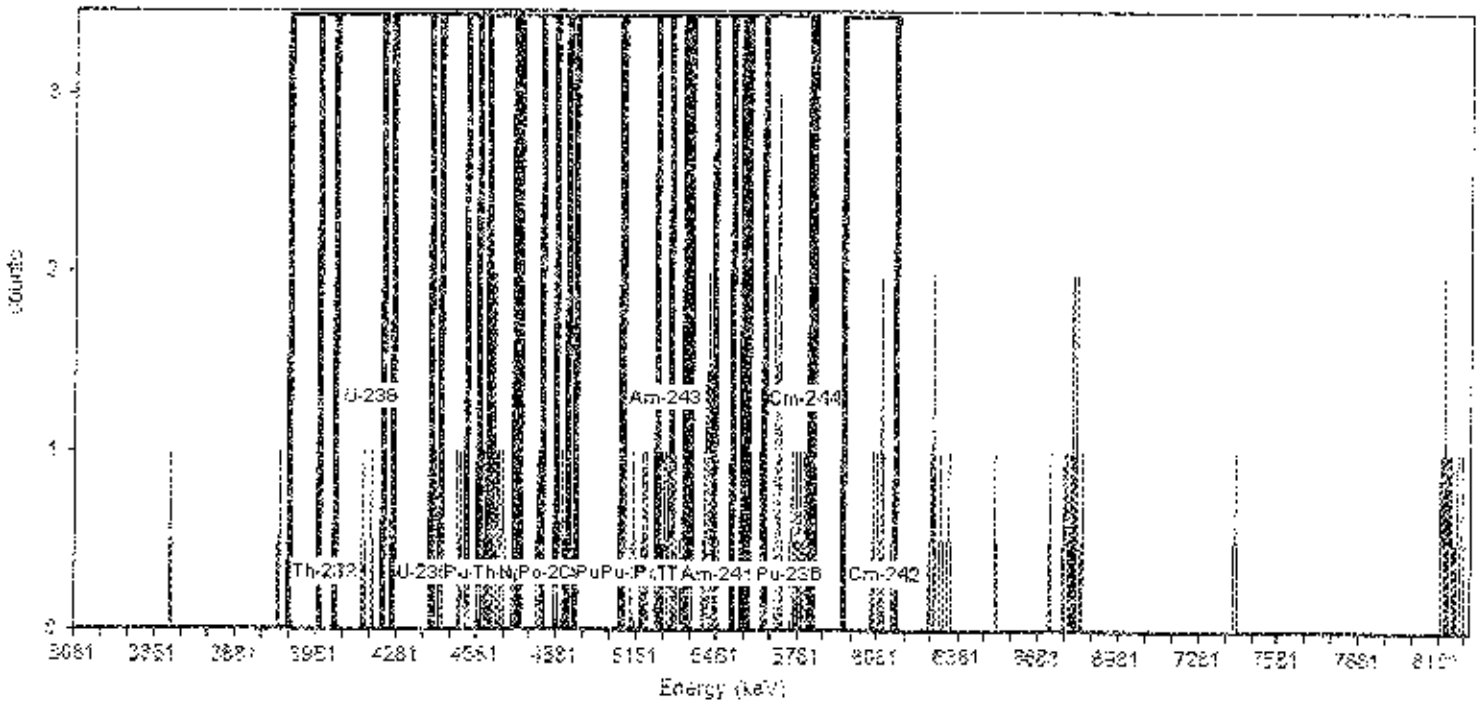
Acquisition

Detector: Det 33 , SN:
Acquisition Start Date: 2/1/2017 1:59:49PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06.001 det 33b
Calibration Date: 6/6/2016 12:10:27PM

Energy Calibration Equation:

Gain = 5.1058 keV / Ch
Offset = 3,079.65 keV
Quadratic = 0.0009 keV / Ch^2

Efficiency: 29.87% +/- 0.31% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 98.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.08	0.00	0.000E+000	1.414E-003
U-238	4.19	3.99	4.23	2.00	2.000E-003	1.732E-003
U-235	4.39	4.26	4.45	2.00	1.999E-003	1.732E-003
Pu-244	4.59	4.41	4.62	6.72	6.724E-003	2.779E-003
U-234	4.77	4.54	4.83	10.61	1.061E-002	3.407E-003
Th-230	4.69	4.54	4.74	9.61	9.607E-003	3.257E-003
Np-237	4.79	4.59	4.88	10.00	1.000E-002	3.317E-003
Po-209	4.89	4.72	4.95	2.86	2.862E-003	1.965E-003
Po-209	4.87	4.73	4.93	2.00	2.000E-003	1.732E-003
Po-209	4.67	4.75	5.13	2.00	2.000E-003	1.732E-003
Pu-239	5.06	4.92	5.12	0.00	0.000E+000	1.414E-003
Pu-239	5.17	4.99	5.22	4.00	4.000E-003	2.236E-003
Po-210	5.30	5.12	5.38	13.00	1.300E-002	3.742E-003
Am-243	5.28	5.13	5.36	12.16	1.216E-002	3.628E-003
Po-210	5.30	5.15	5.37	12.00	1.200E-002	3.606E-003
Th-228	5.33	5.25	5.47	16.00	1.600E-002	4.123E-003
Th-228	5.42	5.29	5.46	12.50	1.250E-002	3.674E-003
Pu-238	5.50	5.31	5.54	13.00	1.300E-002	3.742E-003
Am-241	5.49	5.38	5.58	9.00	9.000E-003	3.162E-003
Pu-236	5.75	5.60	5.83	15.26	1.526E-002	4.033E-003
Cm-244	5.81	5.66	5.85	15.00	1.500E-002	4.000E-003
Cm-242	6.12	5.95	6.15	5.00	5.000E-003	2.449E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:41:26AM 2/2/2017

Sample

Sample Name: Det 34 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

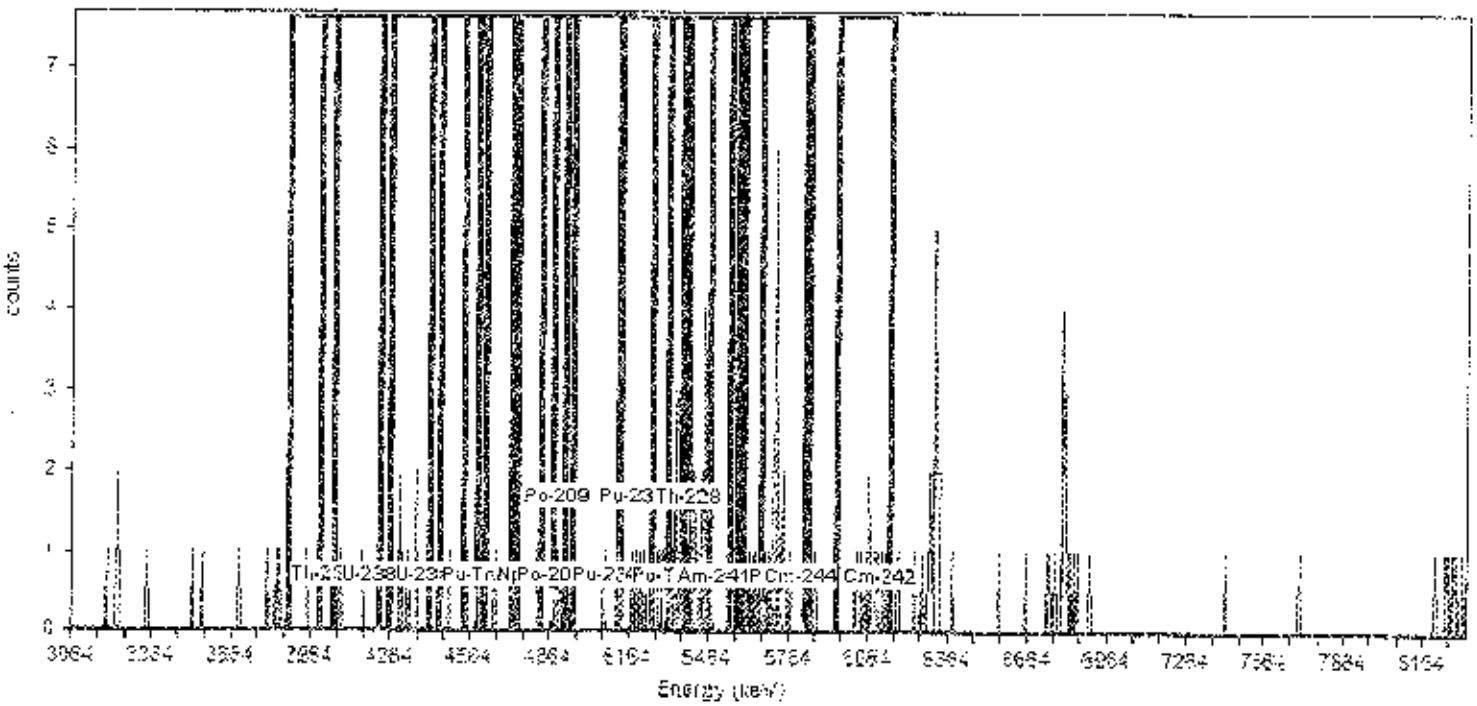
Acquisition

Detector: Det 34 , SN:
Acquisition Start Date: 2/1/2017 1:59:50PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 34
Calibration Date: 6/6/2016 10:25:49AM

Energy Calibration Equation:

Gain = 5.1501 keV / Ch
Offset = 3,059.78 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 29.37% +/- 0.27% TPI(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 166.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	1.00	1.000E-003	1.414E-003
U-238	4.19	3.99	4.23	2.00	2.000E-003	1.732E-003
U-235	4.39	4.26	4.45	5.00	5.000E-003	2.449E-003
Pu-244	4.59	4.41	4.62	4.00	4.000E-003	2.236E-003
U-234	4.77	4.54	4.83	6.75	6.753E-003	2.784E-003
Th 230	4.69	4.54	4.74	5.00	5.000E-003	2.449E-003
Np-237	4.79	4.59	4.88	6.00	6.000E-003	2.646E-003
Po-209	4.89	4.72	4.95	4.00	4.000E-003	2.236E-003
Po-209	4.87	4.73	4.93	3.72	3.724E-003	2.173E-003
Po-209	4.87	4.75	5.13	6.00	6.004E-003	2.646E-003
Pu-239	5.06	4.92	5.12	2.93	2.934E-003	1.984E-003
Pu-239	5.17	4.99	5.22	8.00	8.000E-003	3.000E-003
Po-210	5.30	5.12	5.38	23.45	2.345E-002	4.945E-003
Am-243	5.29	5.13	5.38	15.61	1.561E-002	4.540E-003
Po-210	5.30	5.15	5.37	18.79	1.879E-002	4.449E-003
Th-228	5.38	5.25	5.47	33.73	3.373E-002	5.893E-003
Th-228	5.42	5.29	5.46	31.05	3.105E-002	5.661E-003
Pu-238	5.50	5.31	5.54	33.42	3.342E-002	5.866E-003
Am-241	5.49	5.38	5.58	21.52	2.152E-002	4.745E-003
Pu-236	5.75	5.60	5.83	27.23	2.723E-002	5.314E-003
Cm-244	5.81	5.66	5.85	24.69	2.469E-002	5.069E-003
Cm-242	6.12	5.95	6.15	12.00	1.200E-002	3.606E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:40:39AM 2/2/2017

Sample

Sample Name: Det 35 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

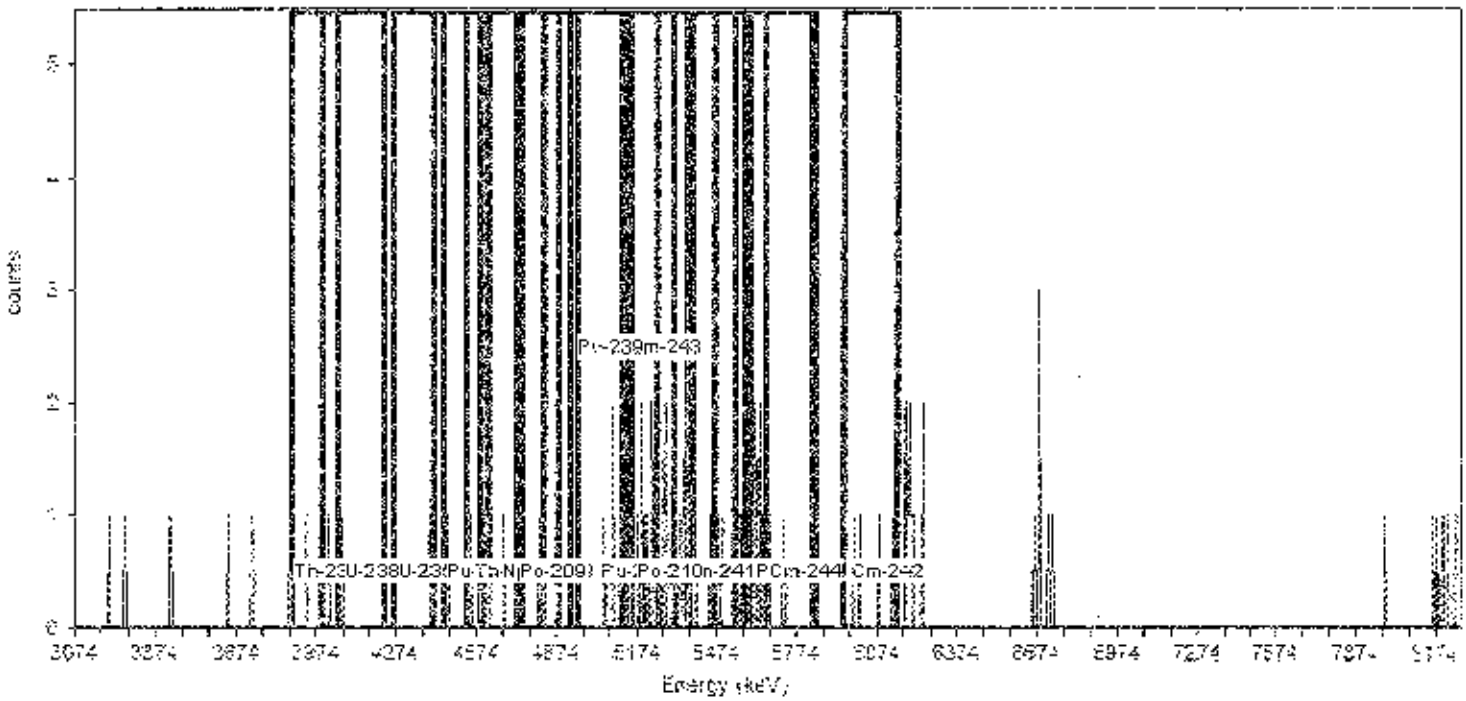
Description:

Acquisition

Detector: Det 35 , SN:
Acquisition Start Date: 2/1/2017 1:59:50PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min
Calibration Name: 2016.07.06 002
Calibration Date: 7/6/2016 2:48:45PM

Energy Calibration Equation:
Gain = 5.0816 keV / Ch
Offset = 3,069.82 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.30% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 102.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	2.00	2.000E-003	1.732E-003
U-238	4.19	3.99	4.23	2.00	2.000E-003	1.732E-003
U-235	4.39	4.26	4.45	1.00	1.000E-003	1.414E-003
Pu-244	4.59	4.41	4.62	6.95	6.945E-003	2.819E-003
U-234	4.77	4.54	4.83	8.31	8.312E-003	3.052E-003
Th-230	4.69	4.54	4.74	6.31	6.312E-003	2.704E-003
Am-243	5.28	5.13	5.36	24.13	2.413E-002	5.012E-003
Po-210	5.30	5.15	5.37	22.93	2.293E-002	4.892E-003
Th-228	5.38	5.25	5.47	20.00	2.000E-002	4.583E-003
Th-228	5.42	5.29	5.46	16.00	1.600E-002	4.123E-003
Pu-238	5.50	5.31	5.54	18.00	1.800E-002	4.359E-003
Am-241	5.49	5.36	5.58	8.00	8.000E-003	3.000E-003
Pu-236	5.75	5.60	5.83	10.09	1.009E-002	3.331E-003
Cm-244	5.81	5.66	5.85	2.00	2.000E-003	1.732E-003
Cm-242	6.12	5.95	6.15	4.00	4.000E-003	2.236E-003
Np-237	4.79	4.59	4.88	8.00	8.000E-003	3.000E-003
Po-209	4.89	4.72	4.96	3.00	3.000E-003	2.000E-003
Po-209	4.87	4.73	4.93	3.00	3.000E-003	2.000E-003
Po-209	4.87	4.75	5.13	6.00	6.000E-003	2.646E-003
Pu-239	5.08	4.92	5.12	3.00	3.000E-003	2.000E-003
Pu-239	5.17	4.99	5.22	10.86	1.086E-002	3.443E-003
Po-210	5.30	5.12	5.38	28.00	2.800E-002	5.385E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
6:40:43AM 2/2/2017

Analyst: ORTEC

Sample

Sample Name: Det 36
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: 2017.02.01 002
Description:

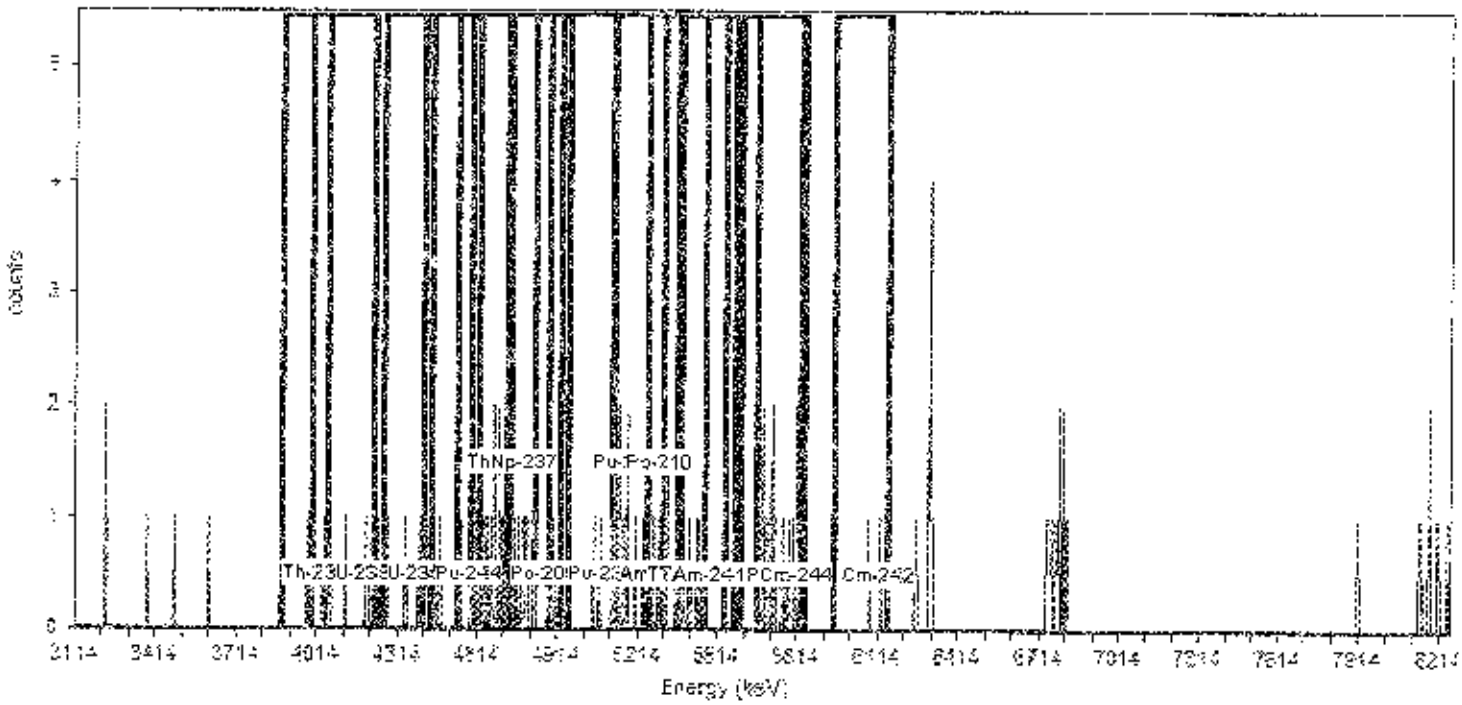
Acquisition

Detector: Det 36 , SN:
Acquisition Start Date: 2/1/2017 1:59:50PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 36
Calibration Date: 6/6/2016 10:31:59AM

Energy Calibration Equation:

Gain = 5.0362 keV / Ch
Offset = 3,109.16 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 28.61% +/- 0.30% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg.lib

Total Background Counts: 125.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	2.00	2.000E-003	1.732E-003
U-238	4.19	3.98	4.23	5.00	5.000E-003	2.449E-003
U-235	4.39	4.26	4.45	3.00	3.000E-003	2.000E-003
Pu-244	4.59	4.41	4.62	5.00	4.997E-003	2.449E-003
U-234	4.77	4.54	4.83	25.70	2.570E-002	5.167E-003
Th-230	4.69	4.54	4.74	18.00	1.800E-002	4.359E-003
Np-237	4.79	4.59	4.88	24.96	2.496E-002	5.095E-003
Po-209	4.89	4.72	4.95	9.15	9.147E-003	3.185E-003
Po-209	4.87	4.73	4.93	9.00	9.000E-003	3.162E-003
Po-209	4.87	4.75	5.13	12.81	1.281E-002	3.716E-003
Pu-239	5.08	4.92	5.12	3.72	3.722E-003	2.173E-003
Pu-239	5.17	4.99	5.22	18.00	1.800E-002	4.359E-003
Po-210	5.30	5.12	5.38	24.72	2.472E-002	5.072E-003
Am-243	5.28	5.13	5.36	22.14	2.214E-002	4.811E-003
Po-210	5.30	5.15	5.37	15.74	1.574E-002	4.091E-003
Th-228	5.38	5.25	5.47	13.91	1.391E-002	3.861E-003
Th-228	5.42	5.29	5.46	10.82	1.082E-002	3.438E-003
Pu-238	5.50	5.31	5.54	10.00	1.000E-002	3.317E-003
Am-241	5.49	5.38	5.59	5.00	5.000E-003	2.449E-003
Pu-238	5.75	5.60	5.83	17.00	1.700E-002	4.243E-003
Cm-244	5.81	5.66	5.85	17.00	1.700E-002	4.243E-003
Cm-242	6.12	5.95	6.15	2.00	2.000E-003	1.732E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
6:40:46AM 2/2/2017

Analyst: ORTEC

Sample

Sample Name: Det 37
Comment:

Spectrum #1 Analysis #1

Batch

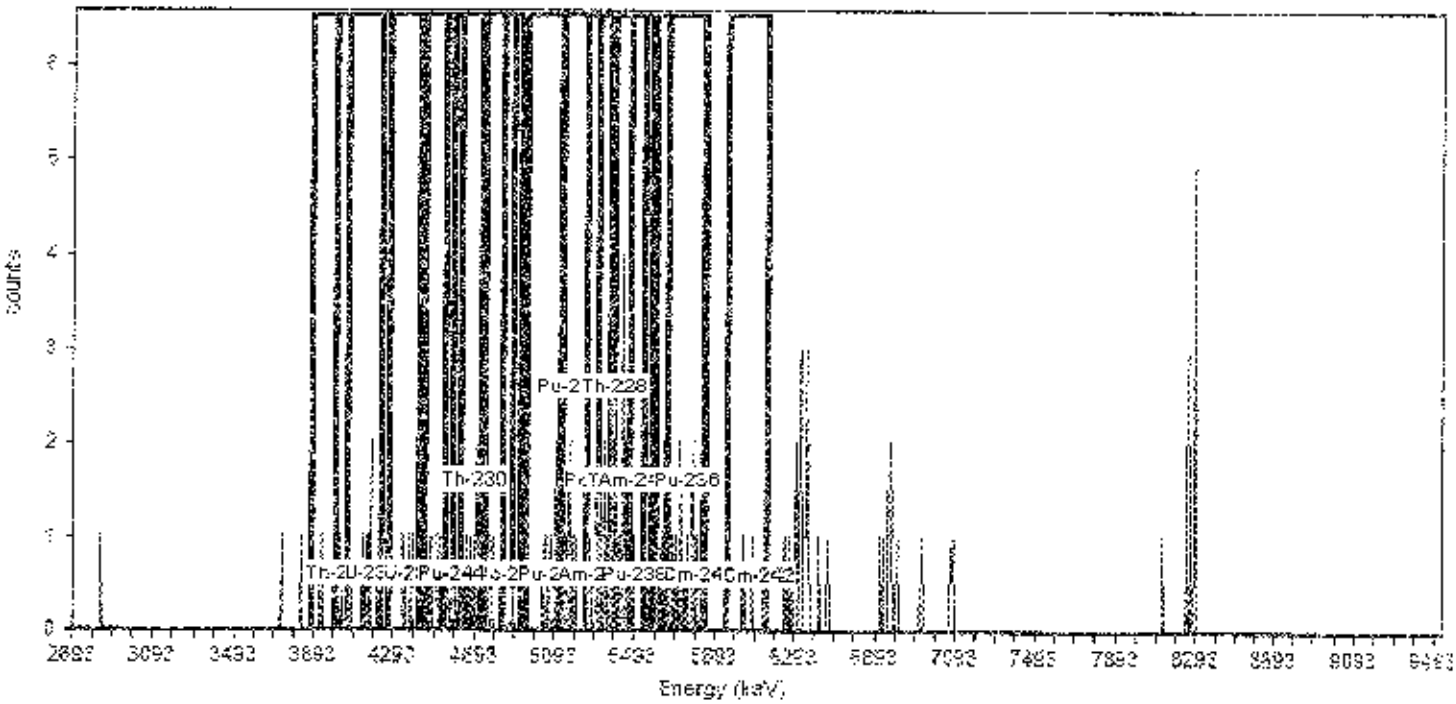
Batch Name: 2017.02.01 002
Description:

Acquisition

Detector: Det 37 , SN:
Acquisition Start Date: 2/1/2017 1:59:51PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 37
Calibration Date: 6/6/2016 12:14:29PM

Energy Calibration Equation:
Gain = 6.6919 keV / Ch
Offset = 2,686.41 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 26.98% +/- 0.29% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg.lib
Total Background Counts: 135.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
U-234	4.77	4.54	4.83	8.00	8.000E-003	3.000E-003
Th-230	4.69	4.54	4.74	6.00	6.000E-003	2.646E-003
Np-237	4.79	4.59	4.88	8.00	8.000E-003	3.000E-003
Po-209	4.89	4.72	4.95	2.00	2.000E-003	1.732E-003
Po-209	4.87	4.73	4.93	2.00	2.000E-003	1.732E-003
Po-209	4.87	4.75	5.13	8.00	8.000E-003	3.000E-003
Pu-239	5.08	4.92	5.12	6.00	6.000E-003	2.646E-003
Pu-239	5.17	4.99	5.22	13.00	1.300E-002	3.742E-003
Po-210	5.30	5.12	5.38	21.98	2.198E-002	4.793E-003
Am-243	5.28	5.13	5.36	17.05	1.705E-002	4.248E-003
Po-210	5.30	5.15	5.37	16.29	1.629E-002	4.158E-003
Th-228	5.38	5.25	5.47	29.08	2.908E-002	5.484E-003
Th-228	5.42	5.29	5.46	27.00	2.700E-002	5.291E-003
Pu-238	5.50	5.31	5.54	27.05	2.705E-002	5.296E-003
Am-241	5.49	5.38	5.58	17.98	1.798E-002	4.358E-003
Pu-235	5.75	5.60	5.83	15.76	1.576E-002	4.094E-003
Cm-244	5.81	5.66	5.85	11.71	1.171E-002	3.565E-003
Cm-242	6.12	5.85	6.15	3.00	3.000E-003	2.000E-003
Th-232	4.01	3.88	4.05	2.00	2.000E-003	1.732E-003
U-238	4.19	3.99	4.23	8.00	8.000E-003	3.000E-003
U-235	4.39	4.26	4.45	4.00	4.000E-003	2.236E-003
Pu-244	4.59	4.41	4.62	3.94	3.940E-003	2.223E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830
6:40:49AM 2/2/2017

Analyst: ORTEC

Sample

Sample Name: Det 38
Comment:

Spectrum #1 Analysis #1

Batch

Batch Name: 2017.02.01 002
Description:

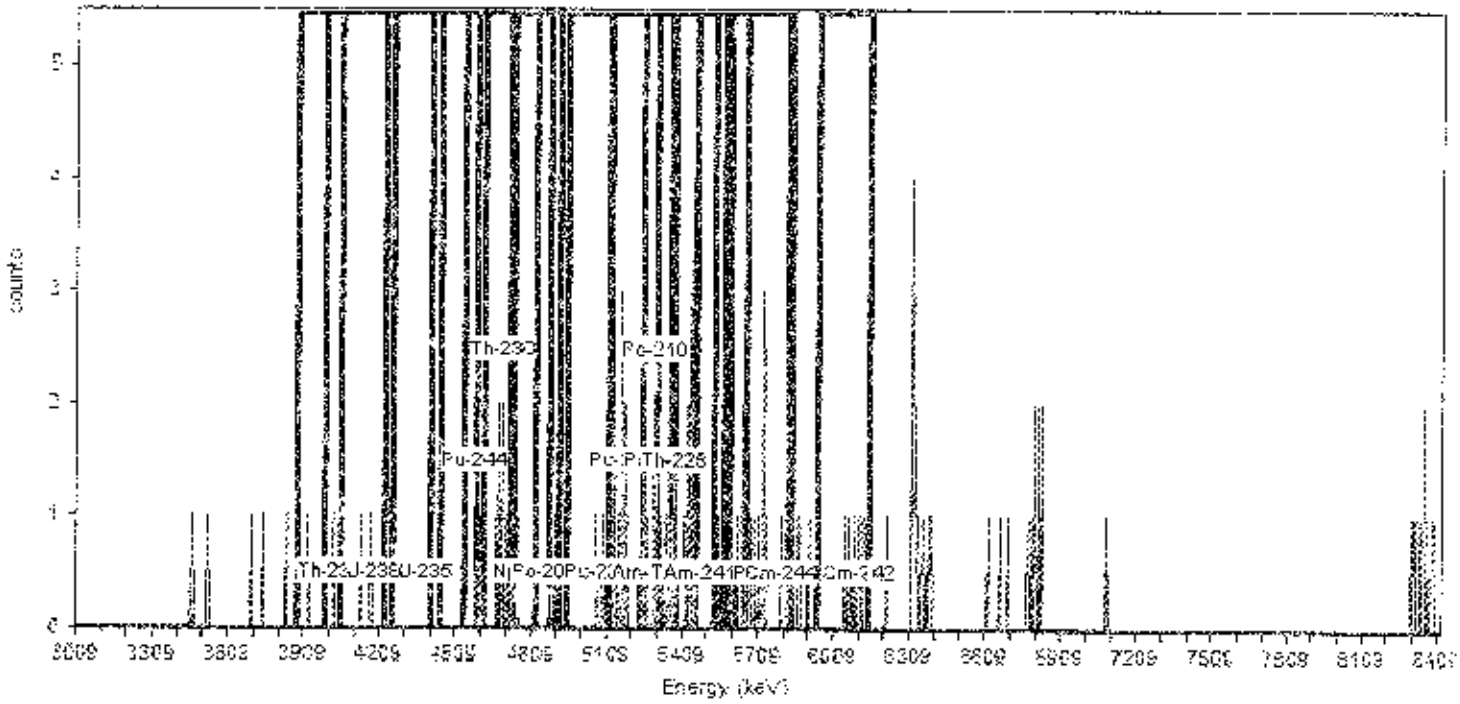
Acquisition

Detector: Det 38 , SN:
Acquisition Start Date: 2/1/2017 1:59:51PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 38
Calibration Date: 6/6/2016 12:17:52PM

Energy Calibration Equation:

Gain = 5.3002 keV / Ch
Offset = 3,004.00 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 27.16% +/- 0.28% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis. Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 138.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	2.00	2.000E-003	1.732E-003
U-238	4.19	3.99	4.23	3.00	3.000E-003	2.000E-003
U-235	4.39	4.26	4.45	0.00	0.000E+000	1.414E-003
Pu-244	4.59	4.41	4.62	2.00	2.000E-003	1.732E-003
U-234	4.77	4.54	4.83	11.00	1.100E-002	3.464E-003
Th-230	4.69	4.54	4.74	10.00	1.000E-002	3.317E-003
Np-237	4.79	4.59	4.88	10.00	1.000E-002	3.317E-003
Po-209	4.89	4.72	4.95	3.00	3.000E-003	2.000E-003
Po-209	4.87	4.73	4.93	2.06	2.060E-003	1.756E-003
Po-209	4.87	4.75	5.13	5.00	5.000E-003	2.449E-003
Pu-239	5.08	4.92	5.12	3.00	3.000E-003	2.000E-003
Pu-239	5.17	4.99	5.22	16.00	1.600E-002	4.123E-003
Po-210	5.30	5.12	5.38	32.72	3.272E-002	5.807E-003
Am-243	5.28	5.13	5.36	27.72	2.772E-002	5.359E-003
Po-210	5.30	5.15	5.37	25.61	2.561E-002	5.178E-003
Th-228	5.36	5.25	5.47	30.51	3.051E-002	5.513E-003
Th-228	5.42	5.29	5.46	24.93	2.493E-002	5.092E-003
Pu-238	5.50	5.31	5.54	21.93	2.193E-002	4.688E-003
Am-241	5.49	5.38	5.58	13.72	1.372E-002	3.836E-003
Pu-236	5.75	5.60	5.83	21.82	2.182E-002	4.777E-003
Cm-244	5.81	5.66	5.86	18.10	1.810E-002	4.370E-003
Cm-242	6.12	5.95	6.15	5.00	5.000E-003	2.449E-003

AlphaVision v5.3 — **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC — 6:40:55AM 2/2/2017

Sample

Sample Name: Det 39 — Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

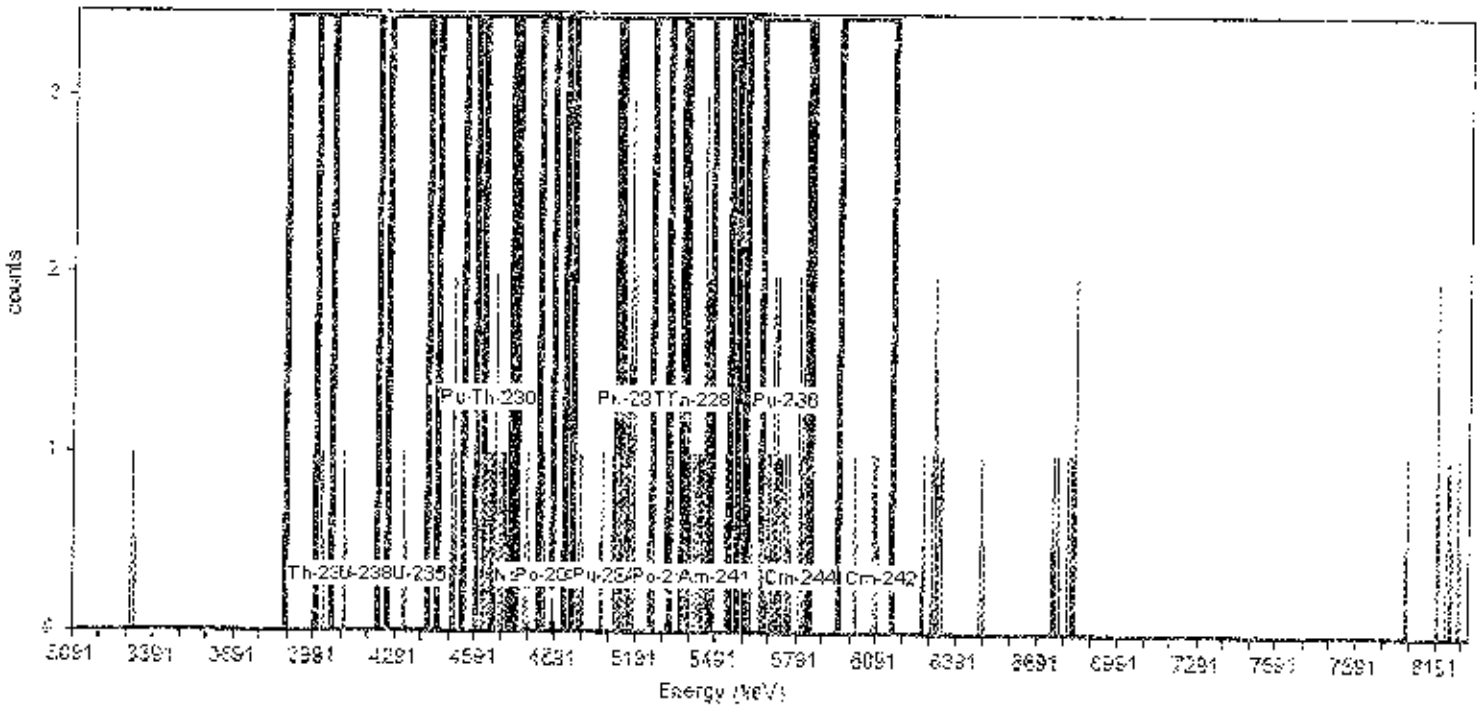
Acquisition

Detector: Det 39 , SN:
Acquisition Start Date: 2/1/2017 1:59:51PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 39
Calibration Date: 6/6/2016 12:20:36PM

Energy Calibration Equation:

Gain = 5.1058 keV / Ch
Offset = 3,086.86 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 31.72% +/- 0.26% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 — Nuclide Library: bkg.lib

Total Background Counts: 109.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.86	4.05	1.00	1.000E-003	1.414E-003
U-238	4.19	3.99	4.23	2.00	2.000E-003	1.732E-003
U-235	4.39	4.26	4.45	1.00	1.000E-003	1.414E-003
Pu-244	4.59	4.4[illegible]	4.62	6.28	6.276E-003	2.697E-003
U-234	4.77	4.54	4.83	15.00	1.500E-002	4.000E-003
Th-230	4.69	4.54	4.74	14.00	1.400E-002	3.873E-003
Np-237	4.79	4.59	4.88	14.00	1.400E-002	3.873E-003
Po-209	4.89	4.72	4.95	2.00	2.000E-003	1.732E-003
Po-209	4.87	4.73	4.93	2.00	2.000E-003	1.732E-003
Po-209	4.87	4.75	5.13	7.63	7.633E-003	2.938E-003
Pu-239	5.08	4.92	5.12	4.20	4.204E-003	2.281E-003
Pu-239	5.17	4.99	5.22	17.24	1.724E-002	4.273E-003
Po-210	5.30	5.12	5.38	19.08	1.908E-002	4.480E-003
Am-243	5.26	5.13	5.36	16.00	1.600E-002	4.123E-003
Po-210	5.30	5.15	5.37	12.19	1.219E-002	3.602E-003
Th-228	5.38	5.25	5.47	19.42	1.942E-002	4.519E-003
Th-228	5.42	5.29	5.46	16.41	1.641E-002	4.172E-003
Pu-238	5.50	5.31	5.54	20.54	2.054E-002	4.641E-003
Am-241	5.49	5.38	5.58	18.55	1.855E-002	4.422E-003
Pu-238	5.75	5.60	5.83	19.74	1.974E-002	4.554E-003
Cm-244	5.81	5.66	5.86	18.03	1.803E-002	4.363E-003
Cm-242	6.12	5.95	6.15	4.00	4.000E-003	2.236E-003

AlphaVision v5.3 **Alpha Spectroscopy Background Report**

ORTEC
801 S. Illinois Ave.
Oak Ridge, TN 37830

Analyst: ORTEC 6:40:52AM 2/2/2017

Sample

Sample Name: Det 40 Spectrum #1 Analysis #1

Comment:

Batch

Batch Name: 2017.02.01 002

Description:

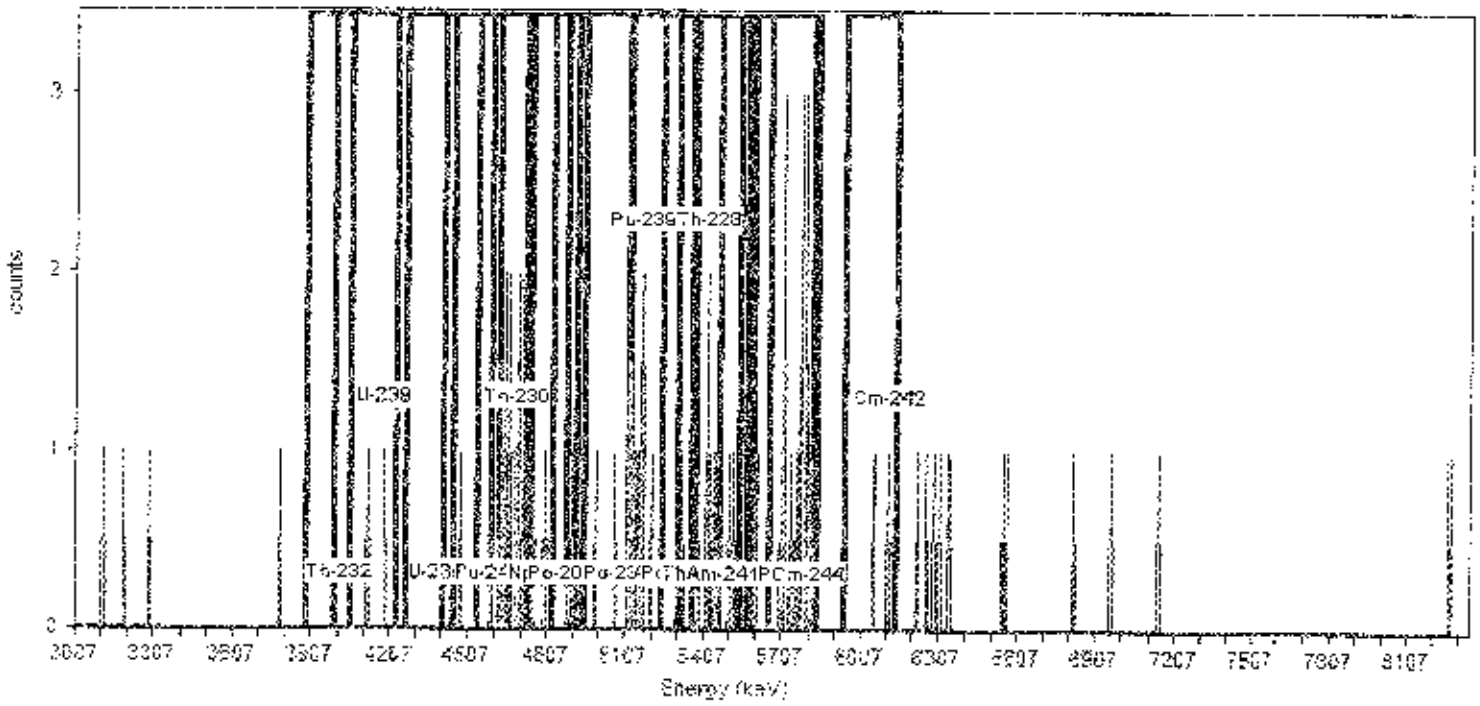
Acquisition

Detector: Det 40 , SN:
Acquisition Start Date: 2/1/2017 1:59:51PM
Live Time: 1,000.00 min.
Real Time: 1,000.00 min.
Calibration Name: 2016.06.06 001 det 40
Calibration Date: 6/6/2016 12:23:46PM

Energy Calibration Equation:

Gain = 5.2253 keV / Ch
Offset = 3,002.17 keV
Quadratic = 0.0000 keV / Ch^2

Efficiency: 23.90% +/- 0.24% TPU(2 sigma)



General Analysis

Analysis Method: ROI Analysis, Set Name = Bkg ROI Set 2-1-2016 Nuclide Library: bkg lib

Total Background Counts: 94.00

Nuclide Summary (ROI)

RegionName	Peak Energy (MeV)	Start Energy (MeV)	End Energy (MeV)	GrossCounts	Count Rate (CPM)	CR Uncertainty (CPM)
Th-232	4.01	3.88	4.05	1.00	9.958E-004	1.413E-003
U-238	4.19	3.99	4.23	2.00	2.000E-003	1.732E-003
U-235	4.39	4.26	4.46	0.00	0.000E+000	1.414E-003
Pu-244	4.59	4.41	4.62	2.39	2.387E-003	1.840E-003
U-234	4.77	4.54	4.83	21.00	2.100E-002	4.690E-003
Th-230	4.59	4.54	4.74	18.00	1.800E-002	4.359E-003
Np-237	4.79	4.59	4.88	21.50	2.150E-002	4.744E-003
Po-209	4.89	4.72	4.95	7.50	7.498E-003	2.915E-003
Po-209	4.87	4.73	4.93	6.66	6.658E-003	2.787E-003
Po-209	4.87	4.75	5.13	10.75	1.075E-002	3.428E-003
Pu-239	5.08	4.92	5.12	4.70	4.699E-003	2.387E-003
Pu-239	5.17	4.99	5.22	16.00	1.600E-002	4.123E-003
Po-210	5.30	5.12	5.38	13.76	1.376E-002	3.842E-003
Am-243	5.26	5.13	5.36	10.79	1.079E-002	3.433E-003
Po-210	5.30	5.16	5.37	6.43	6.425E-003	2.726E-003
Th-228	5.38	5.25	5.47	8.00	8.000E-003	3.000E-003
Th-228	5.42	5.29	5.46	7.37	7.369E-003	2.893E-003
Pu-238	5.50	5.31	5.54	10.00	1.000E-002	3.317E-003
Am-241	5.49	5.38	5.58	8.06	8.059E-003	3.010E-003
Pu-236	5.75	5.60	5.83	16.98	1.698E-002	4.470E-003
Cm-244	5.81	5.66	5.85	18.00	1.800E-002	4.359E-003
Cm-242	6.12	5.95	6.15	2.00	2.000E-003	1.732E-003

Gamma Spectroscopy Sample Analysis Documentation

ORTEC g v - i (3263) Env32 G701W047 2/21/2017 11:00:02 AM Page 1
Pace Analytical Spectrum name: 1221147.Anl

Sample description
WL 33843

Spectrum Filename: C:\User\1221147.Anl

Acquisition information
Start time: 2/21/2017 8:30:08 AM
Live time: 900
Real time: 903
Dead time: 0.33 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).Clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 3.1871E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 3.1871E+02) =
3.1376E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/21/17

ORTEC g v - i (3263) Env32 G701W047 2/21/2017 11:00:02 AM Page 2
Pace Analytical Spectrum name: 1221147.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	2/21/2017 8:30:08 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
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. pCi/G	Nuc
63.60	11.	88.34	1.07	2.195E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	PBC<MDA	Th232
84.27	13.	67.21	1.09	3.875E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
92.75	14.	54.00	1.10	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
92.75	15.	51.37	1.10	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
166.75	8.	91.49	1.18	5.197E-02	166.41	0.108	PBC<MDA	Th228
241.62	7.	85.81	1.26	4.615E-02	241.92	7.470	PBC<MDA	Ra226
283.15	11.	48.93	1.31	4.289E-02	283.70	1.600	PBC<MDA	Pa231
					284.30	6.140	PBC<MDA	I131
302.73	10.	52.89	1.33	4.154E-02	302.85	18.330	PBC<MDA	Ba133
324.29	9.	35.36	1.35	4.015E-02	323.87	3.930	5.369E-01	Ra223
328.30	9.	70.71	1.35	3.985E-02	328.76	20.300	PBC<MDA	La140
338.51	11.	62.72	1.36	3.926E-02	338.32	11.300	PBC<MDA	Ac228
340.15	9.	72.97	1.37	3.913E-02	340.55	42.200	PBC<MDA	Cs136
364.12	7.	79.81	1.39	3.777E-02	364.49	81.700	PBC<MDA	I131
392.08	8.	64.96	1.42	3.636E-02	391.69	64.000	PBC<MDA	Sn113
487.13	9.	63.79	1.52	3.235E-02	487.02	45.500	PBC<MDA	La140
					487.39	1.420	1.800E+00	Te129
487.16	12.	28.87	1.52	3.234E-02	487.02	45.500	PBC<MDA	La140
					487.39	1.420	2.462E+00	Te129
600.97	7.	84.88	1.63	2.887E-02	600.60	17.900	PBC<MDA	Sb125
635.47	11.	73.47	1.66	2.798E-02	635.95	11.300	PBC<MDA	Sb125
					636.99	7.170	PBC<MDA	I131
795.76	7.	37.80	1.82	2.472E-02	795.86	85.530	PBC<MDA	Cs134

ORTEC g v - i (3263) Env32 G701W047 2/21/2017 11:00:02 AM Page 3
Pace Analytical Spectrum name: 1221147.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
815.13	8.	35.36	1.83	2.438E-02	815.77	23.280	1.328E-01	La140

834.73	9.	66.68	1.85	2.406E-02	834.85	99.976	PBC<MDA	Mn54
995.65	11.	30.15	2.00	2.173E-02	996.26	10.530	4.531E-01	Eu154
1047.54	4.	55.94	2.05	2.108E-02	1048.07	80.000	PBC<MDA	Cs136
1111.82	9.	37.17	2.10	2.034E-02	1112.12	13.550	2.926E-01	Eu152
1271.77	4.	50.00	2.24	1.867E-02	1274.44	35.000	PBC<MDA	Eu154
					1274.53	99.944	2.020E-02	Na22
1271.77	4.	50.00	2.24	1.866E-02	1274.44	35.000	5.769E-02	Eu154
					1274.53	99.944	2.020E-02	Na22
1291.63	2.	91.93	2.26	1.850E-02	1291.60	43.200	PBC<MDA	Fe59
1384.96	10.	31.82	2.34	1.757E-02	1384.30	24.120	2.210E-01	Ag110M
1690.07	3.	57.74	2.58	1.533E-02	1690.98	47.300	PBC<MDA	Sb124
1765.05	3.	76.97	2.63	1.484E-02	1764.49	15.360	PBC<MDA	Ra226
1837.11	7.	37.80	2.69	1.439E-02	1836.06	99.200	PBC<MDA	Y88

No unknown peaks passed sensitivity test.

This section based on library: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Th-232	253.29	63.60	20.	11.	0.012	176.67	1.071s
Th-228	335.93	84.27	16.	13.	0.014	134.43	1.094s
U-238	369.87	92.75	15.	14.	0.016	108.00	1.103s
Th-234	369.87	92.75	14.	15.	0.016	102.73	1.103s
Th-228	665.80	166.75	10.	8.	0.008	182.98	1.182s
Ra-226	965.23	241.62	8.	7.	0.008	171.62	1.263s
Pa-231	1131.35	283.15	5.	11.	0.013	97.86	1.307s
Ba-133	1209.63	302.73	4.	10.	0.011	105.79	1.327s
Ra-223	1295.89	324.29	0.	9.	0.010	70.72	1.349s
La-140	1311.94	328.30	7.	9.	0.010	141.42	1.354s
Ac-228	1352.75	338.51	8.	11.	0.012	125.44	1.364s
Cs-136	1359.31	340.15	8.	9.	0.010	145.95	1.366s
I-131	1455.21	364.12	4.	7.	0.007	159.61	1.391s
Sn-113	1567.02	392.08	5.	8.	0.009	129.92	1.419s
La-140	1947.24	487.13	4.	9.	0.010	127.58	1.515s
Te-129	1947.33	487.16	0.	12.	0.013	57.74	1.516s
Sb-125	2402.59	600.97	5.	7.	0.008	169.76	1.628s
Sb-125	2540.60	635.47	10.	11.	0.012	146.94	1.663s
Cs-134	3181.86	795.76	0.	7.	0.008	75.59	1.816s
La-140	3259.38	815.13	0.	8.	0.009	70.71	1.835s
Mn-54	3337.78	834.73	5.	9.	0.010	133.36	1.853s
Eu-154	3981.64	995.65	0.	11.	0.012	60.30	2.001s
Cs-136	4189.25	1047.54	0.	4.	0.004	111.87	2.047s
Eu-152	4446.44	1111.82	0.	9.	0.010	74.34	2.104s

ORTEC g v - 4 (3263) Env32 G701W047 2/21/2017 11:00:02 AM Page 4
Pace Analytical Spectrum name: 1221147.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Eu-154	5086.50	1271.77	0.	4.	0.004	100.00	2.244s
Na-22	5086.50	1271.77	0.	4.	0.004	100.00	2.244s
Fe-59	5166.00	1291.63	1.	2.	0.003	183.86	2.258s
Ag-110M	5539.50	1384.96	0.	10.	0.011	63.25	2.335s
Sb-124	6760.67	1690.07	0.	3.	0.003	115.47	2.578s
Ra-226	7060.80	1765.05	2.	3.	0.004	153.94	2.633s
Y-88	7349.29	1837.11	0.	7.	0.008	75.59	2.685s

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 pCi/G	Peak Energy keV	Activity pCi/G	Code	MDA Value pCi/G		COMMENTS
Be-7	C	-1.0259E-01					5.34E+01	
			477.56	-1.026E-01	%(	6.081E-01	2.58E+02 1.03E+01	G K
Na-22	C	2.0204E-02					9.50E+02	
			1274.53	2.020E-02	?(	3.723E-02	5.00E+01 9.99E+01	G K
Mn-54	C	3.5906E-02					3.12E+02	
			834.85	3.591E-02	?(	5.074E-02	6.57E+01 1.00E+02	G K
Co-56	C	6.4815E-03					7.73E+01	
			1238.28	6.481E-03	%(P	1.069E-01	7.50E+02 6.61E+01	G K
			1771.35	6.858E-03	%	6.126E-01	4.40E+03 1.55E+01	G
Co-57	C	9.2322E-03					2.72E+02	
			122.06	9.232E-03	&(P	3.172E-02	1.33E+02 8.56E+01	G K
			136.47	0.000E+00	% P	5.113E-01	1.00E+03 1.07E+01	G
Fe-59	F	2.9812E-02					4.45E+01	
			1099.25	3.231E-02	%(P	1.153E-01	1.62E+02 5.65E+01	G K
			1291.60	2.655E-02	?(P	8.687E-02	9.19E+01 4.32E+01	G
Zn-65	F	3.5573E-02					2.44E+02	
			1115.55	3.557E-02	%(P	1.306E-01	1.66E+02 5.06E+01	G K
Y-88	C	4.6215E-02					1.07E+02	
			1836.06	4.621E-02	?(	4.866E-02	3.78E+01 9.92E+01	G K
			898.04	2.146E-02	% P	6.185E-02	1.28E+02 9.37E+01	G
Nb-94	I	2.3761E-03					7.41E-06	
			871.09	2.376E-03	%(P	7.409E-02	1.39E+03 9.99E+01	G K
			702.62	8.967E-05	% P	7.313E-02	3.52E+04 9.79E+01	G

ORTEC g v - i (3263) Env32 G701W047 2/21/2017 11:00:02 AM Page 5
Pace Analytical Spectrum name: 1221147.Anl

Nuclide	Ave activity		Energy	Activity	Code	Peak MDA		Comments
Zr-95	I	9.0732E-03					6.40E+01	
			756.73	9.073E-03	&(	1.170E-01	5.70E+02 5.45E+01	G K
			724.20	0.000E+00	% P	1.461E-01	1.00E+03 4.42E+01	G
Ag-108M	C	8.3032E-03					1.53E+05	
			722.94	8.303E-03	%(P	5.189E-02	2.69E+02 9.08E+01	G K
			614.28	1.840E-03	%	7.296E-02	1.73E+03 8.98E+01	G
			433.94	0.000E+00	%	8.121E-02	1.00E+03 9.05E+01	G
			79.13	2.294E-01	&	7.447E-01	1.24E+02 6.60E+00	G
Cd-109	F	-2.0222E-01					4.64E+02	
			88.03	-2.022E-01	&(	1.834E+00	3.50E+02 3.61E+00	G K
Ag-110M	F	4.5132E-02					2.50E+02	
			657.76	0.000E+00	%(P	8.483E-02	1.00E+03 9.40E+01	G K
			1505.04	0.000E+00	%	6.362E-01	1.00E+03 1.29E+01	G

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                                1384.30 2.210E-01 ?(  1.629E-01 3.16E+01 2.41E+01 G
                                 937.49 0.000E+00 % P 2.267E-01 1.00E+03 3.41E+01 G
                                 884.68 4.672E-03 %   7.457E-02 6.86E+02 7.22E+01 G
                                 763.94 3.926E-02 %   2.894E-01 3.28E+02 2.21E+01 G
                                 744.28 0.000E+00 % P 2.019E+00 1.00E+03 4.70E+00 G
                                 706.68 0.000E+00 & P 4.995E-01 1.00E+03 1.63E+01 G

Sn-113    F    3.3849E-02                                          1.15E+02
                                 391.69 3.385E-02 ?(P 5.162E-02 6.50E+01 6.40E+01 G K

Sb-124    F    5.9464E-03                                          6.02E+01
                                 602.73-1.003E-02 %(  7.516E-02 3.37E+02 9.78E+01 G K
                                 645.85-6.902E-02 %   9.125E-01 5.80E+02 7.38E+00 G
                                 722.79 0.000E+00 %   6.868E-01 1.00E+03 1.08E+01 G
                                1690.98 3.898E-02 ?(  9.576E-02 5.77E+01 4.73E+01 G

Sb-125    I    1.1139E-01                                          1.01E+03
                                 427.88 2.142E-02 %(  1.433E-01 2.69E+02 2.96E+01 G K
                                 176.31 0.000E+00 % P 6.818E-01 1.00E+03 6.82E+00 G
                                 463.36 0.000E+00 % P 5.967E-01 1.00E+03 1.05E+01 G
                                 600.60 1.263E-01 &(P 2.407E-01 8.49E+01 1.79E+01 G
                                 635.95 3.234E-01 &(P 5.231E-01 7.35E+01 1.13E+01 G

Te-129    I    5.3301E-01                                          3.36E+01
                                 459.60 1.772E-01 %(  4.481E-01 1.06E+02 7.70E+00 G K
                                 487.39 2.462E+00 ?(  1.512E+00 2.89E+01 1.42E+00 G

I-131     I    2.0022E-02                                          8.02E+00
                                 364.49 2.002E-02 &(P 3.827E-02 7.98E+01 8.17E+01 G K
                                 636.99 2.515E-01 % P 9.366E-01 1.68E+02 7.17E+00 G
                                 284.30 0.000E+00 & P 9.822E-01 1.00E+03 6.14E+00 G
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Pace Analytical Spectrum name: 1221147.An1

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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ba-133    F    2.8055E-02                                          3.84E+03
                                 356.02 1.612E-03 %(P 6.809E-02 1.60E+03 6.20E+01 G K
                                  81.00 0.000E+00 %   1.656E-01 1.00E+03 3.41E+01 G
                                 302.85 1.176E-01 &(  1.414E-01 5.29E+01 1.83E+01 G
                                 276.40-1.363E-01 %   7.805E-01 2.38E+02 7.16E+00 G
                                 383.85 0.000E+00 & P 8.280E-01 1.00E+03 8.94E+00 G

Cs-134    I    1.4569E-02                                          7.52E+02
                                 604.72 0.000E+00 %(P 8.501E-02 1.00E+03 9.76E+01 G K
                                 801.95 1.825E-02 % P 7.209E-01 1.47E+03 8.69E+00 G
                                 795.86 3.120E-02 ?(  3.285E-02 3.78E+01 8.55E+01 G
                                 569.33 6.372E-03 % P 3.699E-01 2.26E+03 1.54E+01 G

Cs-136    F    1.8125E-02                                          1.32E+01
                                 818.51 0.000E+00 %(P 6.723E-02 1.00E+03 9.97E+01 G K
                                 176.60 0.000E+00 & P 4.070E-01 1.00E+03 1.00E+01 G
                                 273.65-8.753E-02 %   5.014E-01 2.38E+02 1.11E+01 G
                                 340.55 5.326E-02 ?(  8.909E-02 7.30E+01 4.22E+01 G
                                1048.07 2.218E-02 ?(P 4.118E-02 5.59E+01 8.00E+01 G
                                1235.36 0.000E+00 % P 3.509E-01 1.00E+03 2.00E+01 G

Cs-137    I    4.0434E-03                                          1.10E+04
                                 661.66 4.043E-03 %(  6.748E-02 7.11E+02 8.51E+01 G K

La-140    I    4.2150E-02                                          1.28E+01
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                          1596.21 0.000E+00 %(  1.438E-01 1.00E+03 9.54E+01 G K
                           487.02 5.616E-02 ?(P 7.868E-02 6.38E+01 4.55E+01 G
                           815.77 1.328E-01 ?(  1.224E-01 3.54E+01 2.33E+01 G
                           328.76 1.048E-01 ?(  1.752E-01 7.07E+01 2.03E+01 G

Ce-144    I   4.6069E-03                                     2.85E+02
                           133.51 4.607E-03 %(P 4.775E-01 4.11E+03 1.11E+01 G K

Eu-152    F   1.0312E-01                                     4.95E+03
                           121.78 1.271E-02 %(P 1.031E-01 2.92E+02 2.84E+01 G K
                          1408.01 0.000E+00 % P 5.882E-01 1.00E+03 2.09E+01 G
                          1112.12 2.926E-01 ?(P 2.520E-01 3.72E+01 1.36E+01 G
                          1085.91 1.061E-01 % P 6.367E-01 2.71E+02 9.92E+00 G
                           964.13-4.450E-02 %   6.247E-01 6.57E+02 1.43E+01 G
                           344.28 0.000E+00 % P 1.916E-01 1.00E+03 2.66E+01 G
                           244.70-9.588E-02 %   6.082E-01 2.59E+02 7.49E+00 G

Eu-154    I   8.1265E-02                                     3.14E+03
                           123.07 5.160E-03 &(P 7.833E-02 5.72E+02 4.06E+01 G K
                          1274.44 5.769E-02 ?(  1.063E-01 5.00E+01 3.50E+01 G
                          1004.72 6.948E-02 % P 3.471E-01 2.24E+02 1.79E+01 G
                           996.26 4.531E-01 ?(  3.035E-01 3.02E+01 1.05E+01 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                           873.19-1.098E-02 %   5.825E-01 2.40E+03 1.22E+01 G
                           723.30 0.000E+00 % P 3.159E-01 1.00E+03 2.01E+01 G
                           247.93 0.000E+00 % P 8.186E-01 1.00E+03 6.91E+00 G

Ir-192    F   2.3639E-02                                     7.38E+01
                           316.51 2.364E-02 %(P 6.228E-02 1.11E+02 8.28E+01 G
                           468.07 0.000E+00 % P 1.458E-01 1.00E+03 4.78E+01 G
                           308.46 0.000E+00 % P 1.984E-01 1.00E+03 3.00E+01 G
                           295.96 0.000E+00 % P 1.675E-01 1.00E+03 2.87E+01 G

Tl-208    N   1.4221E-02                                     6.98E-02
                           583.19 1.422E-02 %(P 7.231E-02 1.99E+02 8.45E+01 G K
                           860.56-1.069E-02 %   5.675E-01 2.40E+03 1.24E+01 G
                           277.36 2.188E-01 % P 5.918E-01 1.05E+02 6.31E+00 G

Ra-223    N   1.1969E-01                                     7.96E+03
                           269.46 0.000E+00 %(P 4.319E-01 1.00E+03 1.37E+01 G K
                            83.78 6.079E-02 %   2.313E-01 1.47E+02 2.49E+01 G
                           323.87 5.369E-01 &(P 4.401E-01 3.54E+01 3.93E+00 G
                           154.21 0.000E+00 % P 7.616E-01 1.00E+03 5.62E+00 G
                            94.90 0.000E+00 % P 6.269E-01 1.00E+03 1.13E+01 G
                            81.07 0.000E+00 %   4.025E-01 1.00E+03 1.50E+01 G

Ra-226    N   5.5114E-02                                     5.84E+05
                           609.31 0.000E+00 %(P 1.908E-01 1.00E+03 4.48E+01 G K
                          1764.49 1.431E-01 ?(P 3.508E-01 7.70E+01 1.54E+01 G
                           295.22 2.858E-02 % P 2.164E-01 2.97E+02 1.92E+01 G
                          1120.29 0.000E+00 % P 7.015E-01 1.00E+03 1.48E+01 G
                           351.99 0.000E+00 % P 1.098E-01 1.00E+03 3.71E+01 G
                           241.92 2.047E-01 &(P 4.231E-01 8.58E+01 7.47E+00 G

Ac-227    N   9.2015E-02                                     7.95E+03
                           235.97 9.201E-02 %(P 2.527E-01 1.12E+02 1.23E+01 G K
                           256.25 8.975E-02 %   7.200E-01 3.29E+02 7.00E+00 G
                           300.00 3.014E-01 % P 1.554E+00 1.99E+02 2.30E+00 G
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                                329.85-4.387E-01 &   2.111E+00 1.99E+02 2.70E+00 G

Ac-228    N   8.4645E-02                                          2.10E+03
                                911.21 1.917E-02 %(P 2.295E-01 4.92E+02 2.66E+01 G K
                                968.97 0.000E+00 % P 5.083E-01 1.00E+03 1.62E+01 G
                                338.32 2.388E-01 ?(P 3.332E-01 6.27E+01 1.13E+01 G

Th-228    N   3.2223E+00                                          6.98E+02
                                 84.37 2.422E+00 ?(P 4.144E+00 6.72E+01 1.27E+00 G K
                                215.99 3.708E-01 &   1.911E+01 2.10E+03 2.63E-01 G
                                166.41 1.265E+01 ?(  2.880E+01 9.15E+01 1.08E-01 G
                                131.61 0.000E+00 %   4.192E+01 1.00E+03 1.35E-01 G
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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pa-231    N   1.5504E+00                                          1.20E+07
                                283.70 1.550E+00 &(P 1.760E+00 4.89E+01 1.60E+00 G K
                                330.00-9.113E-01 &   4.386E+00 1.99E+02 1.30E+00 G

Pa-234M   N   1.0912E-01                                          1.63E+12
                                                                  Energy duplication
                               1001.03 1.091E-01 %(P 7.718E+00 2.99E+03 8.37E-01 G

Th-230    N   3.6939E+00                                          2.75E+07
                                 67.67 3.694E+00 &(  1.951E+01 1.99E+02 3.80E-01 G K

Th-232    N   1.7178E+01                                          4.17E+12
                                 63.81 1.718E+01 ?(P 3.812E+01 8.83E+01 2.67E-01 G K

Th-234    N   4.2391E-01                                          1.63E+12
                                 63.29 0.000E+00 %(P 2.887E+00 1.00E+03 4.80E+00 G K
                                 92.60 1.151E+00 *(P 1.581E+00 5.14E+01 2.80E+00 G

U-238     N   1.0873E-01                                          1.63E+12
                                                                  Energy duplication
                               1001.03 1.087E-01 %(P 7.690E+00 2.99E+03 8.40E-01 G K
                                 92.59 5.535E-01 * P 8.041E-01 5.40E+01 5.60E+00 GA

Am-241    T  -2.4674E-02                                          1.58E+05
                                 59.54-2.467E-02 %(  3.686E-01 5.65E+02 3.63E+01 G K

Am-243    T   1.0017E-02                                          2.69E+06
                                 74.56 1.002E-02 %(P 9.178E-02 3.35E+02 5.82E+01 G K
   ( - 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 2 Sigma %	Activity	
Th-232	63.60	20.	11.	0.012	176.67	1.718E+01	P
Th-228	84.27	16.	13.	0.014	134.43	2.422E+00	P
U-238	92.75	15.	14.	0.016	108.00	5.535E-01	P
Th-234	92.75	14.	15.	0.016	102.73	1.151E+00	P
Th-228	166.75	10.	8.	0.008	182.98	1.265E+01	
Ra-226	241.62	8.	7.	0.008	171.62	2.047E-01	P
Pa-231	283.15	5.	11.	0.013	97.86	1.550E+00	P
Ba-133	302.73	4.	10.	0.011	105.79	1.178E-01	
Ra-223	324.29	0.	9.	0.010	70.72	5.369E-01	P
La-140	328.30	7.	9.	0.010	141.42	1.048E-01	
Ac-228	338.51	8.	11.	0.012	125.44	2.388E-01	P
Cs-136	340.15	8.	9.	0.010	145.95	5.326E-02	
I-131	364.12	4.	7.	0.007	159.61	2.002E-02	P
Sn-113	392.08	5.	8.	0.009	129.92	3.385E-02	P
La-140	487.13	4.	9.	0.010	127.58	5.516E-02	P
Te-129	487.16	0.	12.	0.013	57.74	2.462E+00	
Sb-125	600.97	5.	7.	0.008	169.76	1.263E-01	P
Sb-125	635.47	10.	11.	0.012	146.94	3.234E-01	P
Cs-134	795.76	0.	7.	0.008	75.59	3.120E-02	
La-140	815.13	0.	8.	0.009	70.71	1.328E-01	
Mn-54	834.73	5.	9.	0.010	133.36	3.591E-02	
Eu-154	995.65	0.	11.	0.012	60.30	4.531E-01	
Cs-136	1047.54	0.	4.	0.004	111.87	2.218E-02	P
Eu-152	1111.82	0.	9.	0.010	74.34	2.926E-01	P
Eu-154	1271.77	0.	4.	0.004	100.00	5.769E-02	
Na-22	1271.77	0.	4.	0.004	100.00	2.020E-02	
Fe-59	1291.63	1.	2.	0.003	183.86	2.655E-02	P
Ag-110M	1384.96	0.	10.	0.011	63.25	2.210E-01	
Sb-124	1690.07	0.	3.	0.003	115.47	3.898E-02	
Ra-226	1765.05	2.	3.	0.004	153.94	1.431E-01	P
Y-88	1837.11	0.	7.	0.008	75.59	4.621E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-1.0259E-01	-1.0259E-01	5.3023E-01	5.3041E-01	6.081E-01
Na-22	#A	2.0204E-02	2.0204E-02	2.0204E-02	2.0375E-02	3.723E-02
K-40	#B	0.0000E+00	0.0000E+00	2.5394E-01	2.5395E-01	8.488E-01
Sc-46	#B	0.0000E+00	0.0000E+00	2.2968E-02	2.2969E-02	8.549E-02
Cr-51	#B	0.0000E+00	0.0000E+00	1.1337E-01	1.1337E-01	5.569E-01
Mn-54	#A	3.5906E-02	3.5906E-02	4.7885E-02	4.8119E-02	5.074E-02
Co-56	#B	6.4815E-03	6.4815E-03	9.7202E-02	9.7206E-02	1.069E-01
Co-57	#B	9.2322E-03	9.2322E-03	2.4534E-02	2.4565E-02	3.172E-02
Co-58	#B	0.0000E+00	0.0000E+00	7.7466E-03	7.7468E-03	9.923E-02
Fe-59	#B	2.9812E-02	2.9812E-02	5.4812E-02	5.4950E-02	1.153E-01
Co-60	#B	0.0000E+00	0.0000E+00	1.4702E-02	1.4702E-02	1.135E-01
Zn-65	#B	3.5573E-02	3.5573E-02	1.1836E-01	1.1846E-01	1.306E-01
Y-88	#A	4.6215E-02	4.6215E-02	3.4935E-02	3.5543E-02	4.866E-02
Nb-94	#B	2.3761E-03	2.3761E-03	6.5875E-02	6.5875E-02	7.409E-02
Zr-95	#B	9.0732E-03	9.0732E-03	1.0340E-01	1.0341E-01	1.170E-01
Nb-95	#B	0.0000E+00	0.0000E+00	1.8311E-02	1.8312E-02	7.858E-02
Ru-103	#B	0.0000E+00	0.0000E+00	2.2422E-02	2.2422E-02	7.846E-02
Ag-108M	#B	8.3032E-03	8.3032E-03	4.4600E-02	4.4613E-02	5.189E-02
Ru-106	#B	0.0000E+00	0.0000E+00	6.6992E-02	6.6994E-02	9.668E-01
Cd-109	#B	-2.0222E-01	-2.0222E-01	1.4143E+00	1.4146E+00	1.834E+00
Ag-110M	#B	4.5132E-02	4.5132E-02	2.8544E-02	2.9160E-02	8.483E-02
Sn-113	#A	3.3849E-02	3.3849E-02	4.3976E-02	4.4201E-02	5.162E-02
Sb-124	#B	5.9464E-03	5.9464E-03	6.8663E-03	6.9110E-03	7.516E-02
Sb-125	#B	1.1139E-01	1.1139E-01	1.6367E-01	1.6432E-01	1.433E-01
Te-129	#F	5.3301E-01	5.3301E-01	3.0774E-01	3.1560E-01	4.481E-01
Te-129M	#B	0.0000E+00	0.0000E+00	2.3585E-01	2.3585E-01	2.440E+00
I-131	#A	2.0022E-02	2.0022E-02	3.1958E-02	3.2067E-02	3.827E-02
I-132	#B	0.0000E+00	0.0000E+00	3.1364E-02	3.1365E-02	1.029E-01
Te-132	#B	0.0000E+00	0.0000E+00	2.5614E-02	2.5615E-02	5.566E-02
I-133	#B	0.0000E+00	0.0000E+00	7.0083E-03	7.0084E-03	6.871E-02
Ba-133	#B	2.8055E-02	2.8055E-02	2.9678E-02	2.9880E-02	6.809E-02
Cs-134	#B	1.4569E-02	1.4569E-02	1.1013E-02	1.1180E-02	8.501E-02
Cs-136	#B	1.8125E-02	1.8125E-02	2.0277E-02	2.0418E-02	6.723E-02
Cs-137	#B	4.0434E-03	4.0434E-03	5.7467E-02	5.7469E-02	6.748E-02
Ce-139	#B	0.0000E+00	0.0000E+00	6.4160E-03	6.4161E-03	5.935E-02
Ba-140	#B	0.0000E+00	0.0000E+00	3.5620E-02	3.5621E-02	2.742E-01
La-140	#B	4.2150E-02	4.2150E-02	2.9805E-02	3.0335E-02	1.438E-01
Ce-141	#B	0.0000E+00	0.0000E+00	1.0520E-02	1.0521E-02	9.169E-02
Ce-144	#B	4.6069E-03	4.6069E-03	3.7857E-01	3.7857E-01	4.775E-01
Eu-152	#B	1.0312E-01	1.0312E-01	7.6656E-02	7.7888E-02	1.031E-01
Eu-154	#F	8.1265E-02	8.1265E-02	4.9005E-02	5.0193E-02	7.833E-02
Eu-155	#B	0.0000E+00	0.0000E+00	6.1321E-02	6.1323E-02	2.488E-01
Ir-192	#A	2.3639E-02	2.3639E-02	5.2650E-02	5.2743E-02	6.228E-02

Hg-203	#B	0.0000E+00	0.0000E+00	1.0704E-02	1.0704E-02	6.557E-02
Tl-208	#B	1.4221E-02	1.4221E-02	5.6533E-02	5.6565E-02	7.231E-02
Pb-210	#B	0.0000E+00	0.0000E+00	5.6879E+00	5.6880E+00	1.315E+01
Bi-212	#B	0.0000E+00	0.0000E+00	1.5583E-01	1.5583E-01	1.305E+00
Pb-212	#B	0.0000E+00	0.0000E+00	3.7501E-02	3.7502E-02	1.148E-01
Ra-223	#B	1.1969E-01	1.1969E-01	8.4643E-02	8.6139E-02	4.319E-01
Ra-224	#B	0.0000E+00	0.0000E+00	2.0906E-01	2.0906E-01	1.377E+00
Ra-226	#B	5.5114E-02	5.5114E-02	8.4842E-02	8.5153E-02	1.908E-01

Ac-227 #B	9.2015E-02	9.2015E-02	2.0556E-01	2.0593E-01	2.527E-01
Ac-228 #B	8.4645E-02	8.4645E-02	1.0618E-01	1.0676E-01	2.295E-01
Th-228 #A	3.2223E+00	3.2223E+00	3.6582E+00	3.6860E+00	4.144E+00
Pa-231 #A	1.5504E+00	1.5504E+00	1.5172E+00	1.5312E+00	1.760E+00
Pa-234M#A	1.0912E-01	1.0912E-01	6.5216E+00	6.5216E+00	7.718E+00
Th-230 #B	3.6939E+00	3.6939E+00	1.4695E+01	1.4704E+01	1.951E+01
Th-232 #A	1.7178E+01	1.7178E+01	3.0350E+01	3.0442E+01	3.812E+01
Th-234 #B	4.2391E-01	4.2391E-01	4.3550E-01	4.3942E-01	2.887E+00
U-235 #B	0.0000E+00	0.0000E+00	1.5290E-01	1.5290E-01	8.907E-01
U-238 #B	1.0873E-01	1.0873E-01	6.4983E+00	6.4983E+00	7.690E+00
Am-241 #B	-2.4674E-02	-2.4674E-02	2.7863E-01	2.7865E-01	3.686E-01
Am-243 #B	1.0017E-02	1.0017E-02	6.7210E-02	6.7224E-02	9.178E-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 (30.3 to 2035.6 kev) 0.000E+00 pCi/G
Total Decayed Activity (30.3 to 2035.6 kev) 0.0000000E+00 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854001	**Collection Date**	11/18/2016 09:58
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/21/17 15:23
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	2.423	1.802	2.030
Cesium-137	0.489	0.159	0.078
Lead-212	1.228	0.326	0.302
Potassium-40	17.298	3.990	1.667
Protactinium-234M	0.000	4.030	24.690
Radium-226	1.326	0.371	0.212
Radium-228	1.248	0.564	0.645
Thallium-208	0.387	0.214	0.209
Thorium-228	2.974	5.863	13.080
Thorium-234	0.509	2.833	3.680
Uranium-235	0.000	0.665	2.546

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:24:07 AM Page 1
Pace Analytical Spectrum name: 30204854001.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854001.An1

Acquisition information
Start time: 2/21/2017 3:23:55 PM
Live time: 900
Real time: 901
Dead time: 0.14 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 kev
Gain: 0.250 kev/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.0558E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.0558E+02) =
4.8643E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:24:07 AM Page 2
Pace Analytical Spectrum name: 30204854001.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 9:58:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(BOZ).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.2585

***** 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. pCi/G	Nuc
46.51	12.	96.40	0.95	2.158E-02	46.54	4.250	PBC<MDA	Pb210
					46.54	4.250	PBC<MDA	Pb210
74.71	33.	32.45	0.98	4.124E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	PBC<MDA	Pb212
77.04	104.	14.97	1.15	4.194E-02	77.11	17.500	2.238E+00	Pb212
83.66	24.	58.93	0.99	4.377E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
					83.78	24.900	3.244E-01	Ra223
					84.37	1.266	3.948E+00	Th228
86.86	49.	25.57	0.43	4.456E-02	87.30	7.800	2.264E+00	Pb212
105.28	16.	69.52	1.01	4.704E-02	105.31	21.200	PBC<MDA	Eu155
					105.31	21.200	PBC<MDA	Eu155
153.71	18.	57.97	1.05	4.519E-02	154.21	5.620	PBC<MDA	Ra223
					154.21	5.620	PBC<MDA	Ra223
215.76	11.	94.97	1.10	3.795E-02	215.99	0.263	PBC<MDA	Th228
					215.99	0.263	PBC<MDA	Th228
238.29	127.	13.29	1.14	3.551E-02	238.63	43.300	1.285E+00	Pb212
241.73	26.	33.02	1.13	3.514E-02	241.92	7.470	1.452E+00	Ra226
					241.00	3.900	3.048E+00	Ra224
269.97	17.	62.08	1.15	3.249E-02	269.46	13.700	PBC<MDA	Ra223
					269.46	13.700	5.570E-01	Ra223
274.09	12.	57.74	1.15	3.212E-02	273.65	11.100	PBC<MDA	Cs136
					273.65	11.100	7.721E+01	Cs136
294.99	55.	18.95	0.63	3.033E-02	295.22	19.200	1.382E+00	Ra226
320.08	9.	90.48	1.19	2.849E-02	320.08	10.080	PBC<MDA	Cr51
					320.08	10.080	PBC<MDA	Cr51
338.19	28.	25.17	1.09	2.729E-02	338.32	11.300	1.383E+00	Ac228

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:24:07 AM Page 3
Pace Analytical Spectrum name: 30204854001.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act	nuc
351.46	85.	16.28	1.52	2.646E-02	351.99	37.100	1.270E+00	Ra226

459.52	11.	61.40	1.31	2.151E-02	459.60	7.700	PBC<MDA	Te129
					459.60	7.700	PBC<MDA	Te129
463.24	8.	98.66	1.31	2.138E-02	463.36	10.500	PBC<MDA	Sb125
					463.36	10.500	5.211E-01	Sb125
467.71	5.	89.85	1.32	2.121E-02	468.07	47.830	PBC<MDA	Ir192
					468.07	47.830	PBC<MDA	Ir192
487.01	7.	88.54	1.33	2.058E-02	487.02	45.500	PBC<MDA	La140
					487.39	1.420	2.496E+01	Te129
					487.39	1.420	2.496E+01	Te129
					487.02	45.500	1.954E+01	La140
497.17	7.	75.84	1.34	2.026E-02	497.08	91.000	PBC<MDA	Ru103
					497.08	91.000	PBC<MDA	Ru103
582.72	37.	26.78	1.41	1.798E-02	583.19	84.500	3.870E-01	Tl208
					583.19	84.500	3.870E-01	Tl208
600.35	6.	90.03	1.42	1.760E-02	600.60	17.900	PBC<MDA	Sb125
					600.60	17.900	PBC<MDA	Sb125
609.10	73.	12.32	1.06	1.741E-02	609.31	44.800	1.359E+00	Ra226
614.03	9.	72.97	1.43	1.731E-02	614.28	89.800	PBC<MDA	Ag108M
					614.28	89.800	8.775E-02	Ag108M
629.94	11.	48.80	1.45	1.699E-02	630.19	13.300	HL>Cutoff	I132
					630.19	13.300	HL>Cutoff	I132
661.51	46.	14.86	0.76	1.640E-02	661.66	85.100	4.892E-01	Cs137
702.49	8.	69.17	1.50	1.571E-02	702.62	97.900	PBC<MDA	Nb94
					702.62	97.900	7.442E-02	Nb94
726.76	13.	45.01	1.52	1.532E-02	727.33	6.580	2.128E+00	Bi212
					727.33	6.580	2.128E+00	Bi212
743.97	9.	35.04	1.53	1.507E-02	744.28	4.700	2.370E+00	Ag110M
					744.28	4.700	2.370E+00	Ag110M
795.57	8.	71.62	1.57	1.438E-02	795.86	85.530	PBC<MDA	Cs134
					795.86	85.530	PBC<MDA	Cs134
802.14	6.	93.69	1.58	1.430E-02	801.95	8.690	PBC<MDA	Cs134
					801.95	8.690	PBC<MDA	Cs134
835.34	6.	89.67	1.60	1.390E-02	834.85	99.976	PBC<MDA	Mn54
					834.85	99.976	7.574E-02	Mn54
873.40	5.	44.72	1.63	1.347E-02	873.19	12.200	PBC<MDA	Eu154
					873.19	12.200	4.538E-01	Eu154
911.09	29.	26.30	1.66	1.308E-02	911.21	26.600	1.264E+00	Ac228
964.33	10.	32.67	1.70	1.257E-02	964.13	14.340	8.124E-01	Eu152
					964.13	14.340	8.124E-01	Eu152
969.29	15.	53.67	1.70	1.253E-02	968.97	16.200	PBC<MDA	Ac228
1048.59	7.	37.80	1.75	1.187E-02	1048.07	80.000	PBC<MDA	Cs136
					1048.07	80.000	1.624E+01	Cs136
1119.54	13.	51.84	1.80	1.133E-02	1120.29	14.800	PBC<MDA	Ra226
1236.05	14.	50.11	1.88	1.058E-02	1235.36	20.000	PBC<MDA	Cs136
					1235.36	20.000	PBC<MDA	Cs136
1272.95	4.	50.00	1.91	1.035E-02	1274.44	35.000	PBC<MDA	Eu154
					1274.53	99.944	6.058E-02	Na22

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					1274.53	99.944	6.058E-02	Na22
					1274.44	35.000	1.648E-01	Eu154
1272.95	4.	50.00	1.91	1.035E-02	1274.44	35.000	1.648E-01	Eu154
					1274.53	99.944	6.058E-02	Na22
1291.38	3.	66.67	1.92	1.025E-02	1291.60	43.200	PBC<MDA	Fe59
					1291.60	43.200	PBC<MDA	Fe59
1408.11	5.	44.72	1.99	9.634E-03	1408.01	20.870	PBC<MDA	Eu152
					1408.01	20.870	3.681E-01	Eu152
1460.72	119.	9.46	1.30	9.379E-03	1461.00	10.670	1.730E+01	K40
1618.46	3.	57.74	2.12	8.686E-03	1620.50	1.490	PBC<MDA	Bi212

					1620.50	1.490	3.722E+00	Bi212
1764.23	12.	31.78	2.20	8.138E-03	1764.49	15.360	1.454E+00	Ra226
1771.07	3.	65.57	2.20	8.114E-03	1771.35	15.480	PBC<MDA	Co56
1838.83	2.	86.77	2.23	7.888E-03	1836.06	99.200	PBC<MDA	Y88

No unknown peaks passed sensitivity test.

This section based on library: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-210	185.61	46.51	36.	12.	0.013	192.80	0.954s
Pb-212	298.75	74.81	62.	33.	0.036	64.89	0.980D
Pb-212	307.95	77.11	48.	116.	0.129	25.01	0.982D
Ra-223	334.12	83.66	48.	24.	0.027	117.85	0.988s
Pb-212	346.93	86.86	36.	49.	0.054	51.14	0.428s
Eu-155	420.58	105.28	29.	16.	0.018	139.04	1.007s
Ra-223	614.25	153.71	24.	18.	0.020	115.93	1.051s
Th-228	862.35	215.76	22.	11.	0.012	189.93	1.105s
Pb-212	953.83	238.63	32.	117.	0.130	22.90	1.124D
Ra-226	966.98	241.92	24.	26.	0.029	66.04	1.127D
Ra-223	1079.15	269.97	22.	17.	0.019	124.15	1.151s
Cs-136	1095.64	274.09	10.	12.	0.014	115.47	1.155s
Ra-226	1179.19	294.99	12.	55.	0.061	37.91	0.630s
Cr-51	1279.53	320.08	13.	9.	0.010	180.96	1.194s
Ac-228	1351.95	338.19	6.	28.	0.031	50.33	1.090s
Ra-226	1405.04	351.46	24.	85.	0.095	32.56	1.517s
Te-129	1837.19	459.52	7.	11.	0.012	122.81	1.310s
Sb-125	1852.10	463.24	10.	8.	0.008	197.32	1.313s
Ir-192	1869.96	467.71	5.	5.	0.006	179.70	1.317s
La-140	1947.15	487.01	7.	7.	0.008	177.28	1.333s
Ru-103	1987.80	497.17	4.	7.	0.007	151.69	1.341s
Tl-208	2329.96	582.72	13.	37.	0.041	53.57	1.410s
Sb-125	2400.51	600.35	4.	6.	0.006	180.06	1.424s
Ra-226	2435.49	609.10	3.	73.	0.081	24.64	1.063s

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Pace Analytical Spectrum name: 30204854001.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Ag-108M	2455.23	614.03	8.	9.	0.010	145.95	1.434s
I-132	2518.85	629.94	4.	11.	0.012	97.60	1.447s
Cs-137	2645.15	661.51	1.	45.	0.052	29.72	0.760s
Nb-94	2809.05	702.49	4.	8.	0.009	138.35	1.503s
Bi-212	2906.14	726.76	5.	13.	0.015	90.02	1.522s
Ag-110M	2975.00	743.97	0.	9.	0.010	70.08	1.534s
Cs-134	3181.42	795.57	4.	8.	0.008	143.23	1.573s
Cs-134	3207.72	802.14	4.	6.	0.006	187.38	1.578s
Mn-54	3340.54	835.34	4.	6.	0.006	179.34	1.602s
Eu-154	3492.80	873.40	0.	5.	0.006	89.44	1.630s
Ac-228	3643.58	911.09	7.	29.	0.032	52.60	1.658s
Eu-152	3856.60	964.33	0.	10.	0.011	65.34	1.696s
Ac-228	3876.43	969.29	10.	15.	0.017	107.33	1.699s
Cs-136	4193.71	1048.59	0.	7.	0.008	75.59	1.755s
Ra-226	4477.61	1119.54	5.	13.	0.014	103.69	1.804s
Cs-136	4943.85	1236.05	5.	14.	0.015	100.23	1.881s
Eu-154	5091.50	1272.95	0.	4.	0.004	100.00	1.906s
Na-22	5091.50	1272.95	0.	4.	0.004	100.00	1.906s
Fe-59	5165.25	1291.38	1.	3.	0.004	133.34	1.917s

Eu-152	5632.40	1408.11	0.	5.	0.006	89.44	1.990s
K-40	5842.98	1460.72	3.	119.	0.132	18.92	1.305s
Ag-110M	6017.00	1504.20	0.	1.	0.001	200.00	2.048s
Bi-212	6474.33	1618.46	0.	3.	0.003	115.47	2.117s
Ra-226	7057.86	1764.23	2.	12.	0.014	63.56	2.197s
Co-56	7085.25	1771.07	1.	3.	0.004	131.14	2.200s
Y-88	7356.50	1838.83	0.	2.	0.002	173.55	2.235s

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 pCi/G	Peak Energy kev	Peak Activity pCi/G	Code	Peak MDA Value pCi/G	COMMENTS
Be-7	C	1.4019E+00					5.34E+01
			477.56	1.402E+00	&(	3.514E+00	1.02E+02 1.03E+01 G K
Na-22	C	6.0577E-02					9.50E+02
			1274.53	6.058E-02	?(	1.116E-01	5.00E+01 9.99E+01 G K
K-40	N	1.7298E+01					4.68E+11
			1461.00	1.730E+01	(P	1.667E+00	9.46E+00 1.07E+01 G K
Sc-46	F	7.5319E-02					8.38E+01
			889.28	7.592E-02	%(P	3.134E-01	1.70E+02 1.00E+02 G K

Nuclide	Ave activity		Energy	Activity	Code	Peak MDA	Comments
Cr-51	F	4.8418E+00					2.77E+01
			320.08	4.842E+00	?(P	1.083E+01	9.05E+01 1.01E+01 G K
Mn-54	C	7.5736E-02					3.12E+02
			834.85	7.574E-02	?(	1.587E-01	8.97E+01 1.00E+02 G K
Co-56	C	3.1262E-01					7.73E+01
			1238.28	1.722E-01	&(	1.036E+00	2.84E+02 6.61E+01 G K
			1771.35	9.120E-01	?(P	2.014E+00	6.56E+01 1.55E+01 G
Co-57	C	7.6441E-04					2.72E+02
			122.06	7.644E-04	%(	1.421E-01	7.13E+03 8.56E+01 G K
			136.47	1.181E-01	%	1.156E+00	3.79E+02 1.07E+01 G
Co-58	C	1.0077E-01					7.08E+01
			810.78	1.008E-01	%(	3.213E-01	1.31E+02 9.94E+01 G K
Fe-59	F	2.2395E-01					4.45E+01
			1099.25	2.689E-02	&(P	1.712E+00	2.79E+03 5.65E+01 G K
			1291.60	4.817E-01	?(P	1.072E+00	6.67E+01 4.32E+01 G
Y-88	C	6.1352E-02					1.07E+02
			1836.06	6.135E-02	?(P	2.555E-01	8.68E+01 9.92E+01 G K
			898.04	3.457E-02	% P	2.972E-01	3.38E+02 9.37E+01 G
Nb-94	I	3.6833E-02					7.41E+06

```
                                871.09 0.000E+00 %(P 2.220E-01 1.00E+03 9.99E+01 G K
                                702.62 7.442E-02 ?(  1.161E-01 6.92E+01 9.79E+01 G

Zr-95     I   2.7294E-01                                         6.40E+01
                                756.73 2.729E-01 %(P 8.264E-01 1.30E+02 5.45E+01 G K
                                724.20 0.000E+00 %   1.682E+00 1.00E+03 4.42E+01 G

Ru-103    I   2.7799E-01                                         3.93E+01
                                497.08 2.780E-01 &(P 5.345E-01 7.58E+01 9.10E+01 G K

Ag-108M   C   4.3633E-02                                         1.53E+05
                                722.94 0.000E+00 %(  1.690E-01 1.00E+03 9.08E+01 G K
                                614.28 8.775E-02 ?(  1.468E-01 7.30E+01 8.98E+01 G
                                433.94 7.181E-03 %   1.728E-01 9.77E+02 9.05E+01 G
                                 79.13 6.678E-01 &   1.824E+00 1.09E+02 6.60E+00 G

Ru-106    I   1.3173E-01                                         3.73E+02
                                621.93 1.317E-01 %(P 1.313E+00 3.64E+02 9.93E+00 G K
C
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Pace Analytical Spectrum name: 30204854001.An1

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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ag-110M   F   1.1836E-01                                         2.50E+02
                                657.76 0.000E+00 %(P 2.601E-01 1.00E+03 9.40E+01 G K
                               1505.04 1.601E-01 ?(  1.180E+00 1.00E+02 1.29E+01 G
                               1384.30 0.000E+00 % P 1.723E+00 1.00E+03 2.41E+01 G
                                937.49 1.739E-01 %   7.256E-01 1.83E+02 3.41E+01 G
                                884.68 2.058E-02 % P 2.583E-01 4.99E+02 7.22E+01 G
                                763.94 1.549E-01 %   9.385E-01 2.54E+02 2.21E+01 G
                                744.28 2.370E+00 ?(P 1.979E+00 3.50E+01 4.70E+00 G
                                706.68 1.964E-01 % P 1.206E+00 2.58E+02 1.63E+01 G

Sn-113    F  -9.1495E-02                                         1.15E+02
                                391.69-9.149E-02 %(  4.288E-01 1.96E+02 6.40E+01 G K

Sb-125    I   1.2143E-01                                         1.01E+03
                                427.88-1.159E-01 %(  6.344E-01 2.29E+02 2.96E+01 G K
                                176.31 0.000E+00 & P 1.727E+00 1.00E+03 6.82E+00 G
                                463.36 5.211E-01 ?(  1.237E+00 9.87E+01 1.05E+01 G
                                600.60 2.795E-01 ?(P 6.157E-01 9.00E+01 1.79E+01 G
                                635.95 3.514E-01 % P 1.048E+00 1.16E+02 1.13E+01 G

Te-129    I   6.7284E+00                                         3.36E+01
                                459.60 6.728E+00 ?(P 9.621E+00 6.14E+01 7.70E+00 G K
                                487.39 1.248E+01 %   6.351E+01 2.04E+02 1.42E+00 G

I-131     I   9.1183E+01                                         8.02E+00
                                364.49 9.118E+01 %(  4.640E+02 2.04E+02 8.17E+01 G K
                                636.99 0.000E+00 %   9.505E+03 1.00E+03 7.17E+00 G
                                284.30-5.245E+02 %   6.080E+03 4.49E+02 6.14E+00 G

I-132     I   1.1434E-01                                         3.20E+00
                                772.60 7.458E-03 %(P 2.138E-01 1.17E+03 7.56E+01 G K
                                522.65 0.000E+00 % P 1.184E+00 1.00E+03 1.60E+01 G
                                630.19 7.219E-01 &(  7.650E-01 4.88E+01 1.33E+01 G
                                954.55 3.192E-01 % P 8.695E-01 1.15E+02 1.76E+01 G

Te-132    I   3.5176E-02                                         3.20E+00
                                228.16 3.518E-02 %(P 1.206E-01 1.39E+02 8.80E+01 G K
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Ba-133    F    9.1308E-03                                                  3.84E+03
                                356.02 9.131E-03 %(  2.102E-01 8.95E+02 6.20E+01 G K
                                 81.00 0.000E+00 % P 4.559E-01 1.00E+03 3.41E+01 G
                                302.85-8.633E-02 &   8.890E-01 4.17E+02 1.83E+01 G
                                276.40 0.000E+00 % P 2.205E+00 1.00E+03 7.16E+00 G
                                383.85 2.588E-02 % P 1.638E+00 2.55E+03 8.94E+00 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Cs-134    I    7.6983E-02                                                  7.52E+02
                                604.72 0.000E+00 %(  1.955E-01 1.00E+03 9.76E+01 G K
                                801.95 7.248E-01 ?(P 1.595E+00 9.37E+01 8.69E+00 G
                                795.86 9.903E-02 ?(P 1.614E-01 7.16E+01 8.55E+01 G
                                569.33 2.015E-01 & P 7.694E-01 1.43E+02 1.54E+01 G

Cs-136    F    2.6015E+01                                                  1.32E+01
                                818.51 5.043E+00 %(P 2.021E+01 1.59E+02 9.97E+01 G K
                                176.60 1.711E+01 & P 1.495E+02 3.37E+02 1.00E+01 G
                                273.65 7.721E+01 &(  1.055E+02 5.77E+01 1.11E+01 G
                                340.55 0.000E+00 % P 5.324E+01 1.00E+03 4.22E+01 G
                               1048.07 1.624E+01 ?(  1.710E+01 3.78E+01 8.00E+01 G
                               1235.36 1.413E+02 &(P 1.413E+02 5.01E+01 2.00E+01 G

Cs-137    I    4.8920E-01                                                  1.10E+04
                                661.66 4.892E-01  (P 7.761E-02 1.49E+01 8.51E+01 G K

Ce-139    F    3.7818E-02                                                  1.38E+02
                                165.85 3.782E-02 %(P 1.852E-01 1.91E+02 7.99E+01 G K

Ba-140    I   -1.2027E+01                                                  1.28E+01
                                537.26-1.203E+01 &(  1.283E+02 4.49E+02 2.44E+01 G K
                                162.66 0.000E+00 % P 3.312E+02 1.00E+03 6.22E+00 G

La-140    I    6.2458E+00                                                  1.28E+01
                               1596.21 0.000E+00 %(  8.382E+01 1.00E+03 9.54E+01 G K
                                487.02 1.934E+01 &(  4.155E+01 8.86E+01 4.55E+01 G
                                815.77-1.311E+00 %   9.615E+01 2.79E+03 2.33E+01 G
                                328.76 3.454E+01 % P 1.062E+02 1.24E+02 2.03E+01 G

Ce-141    I    1.6720E-02                                                  3.25E+01
                                145.44 1.672E-02 %(  1.608E+00 3.70E+03 4.82E+01 G K

Eu-152    F    3.0392E-01                                                  4.95E+03
                                121.78 0.000E+00 %(P 3.761E-01 1.00E+03 2.84E+01 G K
                               1408.01 3.681E-01 ?(  5.426E-01 4.47E+01 2.09E+01 G
                               1112.12 0.000E+00 %   1.963E+00 1.00E+03 1.36E+01 G
                               1085.91 6.660E-01 %   1.670E+00 1.12E+02 9.92E+00 G
                                964.13 8.124E-01 ?(P 6.051E-01 3.27E+01 1.43E+01 G
                                344.28 0.000E+00 % P 5.521E-01 1.00E+03 2.66E+01 G
                                244.70 0.000E+00 % P 1.726E+00 1.00E+03 7.49E+00 G

Eu-154    I    1.2875E-01                                                  3.14E+03
                                123.07 0.000E+00 %(P 2.818E-01 1.00E+03 4.06E+01 C K
                               1274.44 1.648E-01 ?(  3.036E-01 5.00E+01 3.50E+01 G
                               1004.72 0.000E+00 % P 1.153E+00 1.00E+03 1.79E+01 G
                                996.26 0.000E+00 %   1.452E+00 1.00E+03 1.05E+01 G
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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                        873.19 4.538E-01 ?(  6.689E-01 4.47E+01 1.22E+01 G
                        723.30 0.000E+00 %   1.254E+00 1.00E-03 2.01E+01 G
                        247.93 0.000E+00 & P 1.641E+00 1.00E+03 6.91E+00 G

Eu-155   I   1.0061E-01                                        1.74E+03
                         86.54 0.000E+00 %(P 4.599E-01 1.00E+03 3.07E+01 G K
                        105.31 2.463E-01 ?(P 4.218E-01 6.95E+01 2.12E+01 G

Ir-192   F   4.9238E-02                                        7.38E+01
                        316.51-3.251E-02 %(  3.699E-01 4.49E+02 8.28E+01 G
                        468.07 1.908E-01 ?(P 4.464E-01 8.98E+01 4.78E-01 G
                        308.46 0.000E+00 &   9.347E-01 1.00E+03 3.00E+01 G
                        295.96 0.000E+00 % P 1.083E+00 1.00E+03 2.87E+01 G

Tl-208   N   3.8704E-01                                        6.98E+02
                        583.19 3.870E-01  (P 2.087E-01 2.68E+01 8.45E+01 G K
                        860.56 0.000E+00 % P 1.920E+00 1.00E+03 1.24E+01 G
                        277.36 5.262E-01 & P 1.851E+00 1.42E+02 6.31E+00 G

Pb-210   N   1.9503E+00                                        8.14E+03
                         46.54 1.950E+00  (P 4.916E+00 9.64E+01 4.25E+00 G K

Bi-212   N   2.4225E+00                                        6.98E+02
                        727.33 2.128E+00 ?(P 2.030E+00 4.50E+01 6.58E+00 G K
                       1620.50 3.722E+00 ?(  9.144E+00 5.77E+01 1.49E+00 G

Pb-212   N   1.2276E+00                                        6.98E+02
                        238.63 1.228E+00  (P 3.020E-01 1.15E+01 4.33E+01 G K
                         77.11 2.546E+00 + P 7.619E-01 1.25E+01 1.75E+01 GA
                         74.81 1.228E+00 } P 1.476E+00 3.24E+01 1.04E+01 GA
                         87.30 2.264E+00 +   1.417E+00 2.56E+01 7.80E+00 GA

Ra-223   N   4.8760E-01                                        7.96E-03
                        269.46 5.570E-01 ?(  8.157E-01 6.21E+01 1.37E+01 G K
                         83.78 3.244E-01 &(  4.730E-01 5.89E+01 2.49E+01 G
                        323.87 0.000E+00 % P 3.720E+00 1.00E+03 3.93E+00 G
                        154.21 1.041E+00 &(P 1.482E+00 5.80E+01 5.62E+00 G
                         94.90 0.000E+00 % P 1.256E+00 1.00E+03 1.13E+01 G
                         81.07 0.000E+00 % P 9.832E-01 1.00E+03 1.50E+01 G

Ra-226   N   1.3256E+00                                        5.84E+05
                        609.31 1.359E+00 @(P 2.123E-01 1.23E+01 4.48E+01 G K
                       1764.49 1.454E+00 ?(P 9.959E-01 3.18E+01 1.54E+01 G
                        295.22 1.382E+00  (P 4.719E-01 1.90E+01 1.92E+01 G
                       1120.29 1.093E+00 ?(P 1.185E+00 5.18E+01 1.48E+01 G
                        351.99 1.270E+00  (P 3.774E-01 1.63E+01 3.71E+01 G
                        241.92 1.452E+00  (P 1.419E+00 3.30E+01 7.47E+00 G
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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ac-228   N   1.2479E+00                                        2.10E+03
                        911.21 1.264E+00 ?(P 6.451E-01 2.63E+01 2.66E+01 G K
                        968.97 1.128E+00 ?(P 1.285E+00 5.37E+01 1.62E+01 G
                        338.32 1.383E+00 *(P 6.767E-01 2.52E+01 1.13E+01 G

Th-228   N   2.9736E+00                                        6.98E+02
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                                 84.37 0.000E+00 &(P 1.308E+01 1.00E+03 1.27E+00 G K
                                215.99 1.729E+01 ?(P 3.973E+01 9.50E+01 2.63E-01 G
                                166.41 0.000E+00 % P 1.265E+02 1.00E+03 1.08E-01 G
                                131.61 1.751E+01 & P 8.838E-01 2.00E+02 1.35E-01 G

Pa-231    N  -2.4340E-01                                        1.20E+07
                                283.70-2.434E-01 %(  6.208E+00 9.81E+02 1.60E+00 G K
                                330.00 0.000E+00 %   1.269E+01 1.00E+03 1.30E+00 G

Th-230    N  -9.2856E+00                                        2.75E+07
                                 67.67-9.286E+00 &(  4.399E+01 1.90E+02 3.80E-01 G K

Th-232    N   1.2840E+01                                        4.17E+12
                                 63.81 1.284E+01 %(  6.473E+01 1.97E+02 2.67E-01 G K

Th-234    N   5.0932E-01                                        1.63E+12
                                 63.29 5.093E-01 %(P 3.680E+00 2.78E+02 4.80E+00 G K
                                 92.60 1.454E+00 % P 5.240E+00 1.41E+02 2.80E+00 G

Am-241    T   6.3885E-02                                        1.58E+05
                                 59.54 6.389E-02 %(  4.045E-01 2.38E+02 3.63E+01 G K

Am-243    T   8.4529E-02                                        2.69E+06
                                                                Derived Ave Activity
                                 74.66 8.453E-02 }(P 3.623E-01 1.27E+02 6.82E+01 G K
```

(- 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 2 Sigma %	Activity	
Pb-210	46.51	36.	12.	0.013	192.80	1.950E+00	P
Ra-223	83.66	48.	24.	0.027	117.85	3.244E-01	
Eu-155	105.28	29.	16.	0.018	139.04	2.463E-01	P
Ra-223	153.71	24.	18.	0.020	115.93	1.041E+00	P
Th-228	215.76	22.	11.	0.012	189.93	1.729E+01	P
Ra-223	269.97	22.	17.	0.019	124.15	5.570E-01	
Cs-136	274.09	10.	12.	0.014	115.47	7.721E+01	
Cr-51	320.08	13.	9.	0.010	180.96	4.842E+00	P
Te-129	459.52	7.	11.	0.012	122.81	6.728E+00	P
Sb-125	463.24	10.	8.	0.008	197.32	5.211E-01	
Ir-192	467.71	5.	5.	0.006	179.70	1.908E-01	P
La-140	487.01	7.	7.	0.008	177.28	1.934E+01	
Ru-103	497.17	4.	7.	0.007	151.69	2.780E-01	P
Tl-208	582.72	13.	37.	0.041	53.57	3.870E-01	P
Sb-125	600.35	4.	6.	0.006	180.06	2.795E-01	P
Ag-108M	614.03	8.	9.	0.010	145.95	8.775E-02	
I-132	629.94	4.	11.	0.012	97.60	0.000E+00	
Nb-94	702.49	4.	8.	0.009	138.35	7.442E-02	
Bi-212	726.76	5.	13.	0.015	90.02	2.128E+00	P
Ag-110M	743.97	0.	9.	0.010	70.08	2.370E+00	P
Cs-134	795.57	4.	8.	0.008	143.23	9.903E-02	P
Cs-134	802.14	4.	6.	0.006	187.38	7.248E-01	P
Mn-54	835.34	4.	6.	0.006	179.34	7.574E-02	
Eu-154	873.40	0.	5.	0.006	89.44	4.538E-01	
Eu-152	954.33	0.	10.	0.011	65.34	8.124E-01	P
Cs-136	1048.59	0.	7.	0.008	75.59	1.624E+01	
Cs-136	1236.05	5.	14.	0.015	100.23	1.413E+02	P
Eu-154	1272.95	0.	4.	0.004	100.00	1.648E-01	
Na-22	1272.95	0.	4.	0.004	100.00	6.058E-02	
Fe-59	1291.38	1.	3.	0.004	133.34	4.817E-01	P
Eu-152	1408.11	0.	5.	0.006	89.44	3.681E-01	
Bi-212	1618.46	0.	3.	0.003	115.47	3.722E+00	

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Pace Analytical Spectrum name: 30204854001.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Co-56	1771.07		1.	3.	0.004	131.14	9.120E-01 P
Y-88	1838.83		0.	2.	0.002	173.55	6.135E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	4.0730E-01	1.4019E+00	2.8617E+00	2.8677E+00	3.514E+00
Na-22	#A	5.6509E-02	6.0577E-02	6.0577E-02	6.1092E-02	1.116E-01
K-40	#	1.7298E+01	1.7298E+01	3.2722E+00	3.9902E+00	1.667E+00
Sc-46	#B	3.4533E-02	7.5919E-02	2.5867E-01	2.5887E-01	3.134E-01
Cr-51	#A	4.4682E-01	4.8418E+00	8.7617E+00	8.7853E+00	1.083E+01
Mn-54	#A	6.1308E-02	7.5736E-02	1.3583E-01	1.3620E-01	1.587E-01
Co-56	#B	1.3306E-01	3.1262E-01	4.0997E-01	4.1200E-01	1.036E+00
Co-57	#B	5.9959E-04	7.6441E-04	1.0906E-01	1.0906E-01	1.421E-01
Co-58	#B	3.9679E-02	1.0077E-01	2.6477E-01	2.6511E-01	3.213E-01
Fe-59	#B	5.0813E-02	2.2395E-01	2.9861E-01	3.0005E-01	1.712E+00
Co-60	#B	0.0000E+00	0.0000E+00	7.3897E-02	7.3898E-02	2.978E-01

Zn-65	#B	0.0000E+00	0.0000E+00	1.3318E-01	1.3318E-01	7.004E-01
Y-88	#A	3.3040E-02	6.1352E-02	1.0648E-01	1.0683E-01	2.555E-01
Nb-94	#B	3.6833E-02	3.6833E-02	5.0957E-02	5.1190E-02	2.220E-01
Zr-95	#B	9.7342E-02	2.7294E-01	7.0888E-01	7.0980E-01	8.264E-01
Nb-95	#B	0.0000E+00	0.0000E+00	1.6017E-01	1.6017E-01	1.583E+00
Ru-103	#A	5.1745E-02	2.7799E-01	4.2168E-01	4.2327E-01	5.345E-01
Ag-108M	#B	4.3614E-02	4.3633E-02	6.3682E-02	6.3944E-02	1.690E-01
Ru-106	#B	1.1034E-01	1.3173E-01	9.5945E-01	9.5961E-01	1.313E+00
Cd-109	#B	0.0000E+00	0.0000E+00	9.7883E-01	9.7885E-01	5.394E+00
Ag-110M	#B	9.0872E-02	1.1836E-01	8.2943E-02	8.4414E-02	2.601E-01
Sn-113	#B	-5.1561E-02	-9.1495E-02	3.5795E-01	3.5815E-01	4.288E-01
Sb-124	#B	0.0000E+00	0.0000E+00	1.4411E-01	1.4411E-01	5.339E-01
Sb-125	#B	1.1374E-01	1.2143E-01	2.1455E-01	2.1515E-01	6.344E-01
Te-129	#A	9.4354E-01	6.7284E+00	8.2629E+00	8.3103E+00	9.621E+00
Te-129M	#B	0.0000E+00	0.0000E+00	1.2420E+01	1.2420E+01	5.272E+01
I-131	#B	2.4300E-02	9.1183E+01	3.7119E+02	3.7138E+02	4.640E+02
I-132	#B	1.1434E-01	>12 Halflives	1.1160E-01	1.1262E-01	2.138E-01
Te-132	#B	3.5176E-02	>12 Halflives	9.7667E-02	9.7782E-02	1.206E-01
I-133	#B	0.0000E+00	>12 Halflives	2.4591E-02	2.4592E-02	1.646E-01
Ba-133	#B	8.9751E-03	9.1308E-03	1.6351E-01	1.6351E-01	2.102E-01
Cs-134	#B	7.0517E-02	7.6983E-02	1.1027E-01	1.1074E-01	1.955E-01
Cs-136	#F	1.7257E-01	2.6015E+01	1.9666E+01	1.9965E+01	2.021E+01
Cs-137		4.8627E-01	4.8920E-01	1.4539E-01	1.5919E-01	7.761E-02
Ce-139	#B	2.3411E-02	3.7818E-02	1.4439E-01	1.4448E-01	1.852E-01
Ba-140	#B	-6.7895E-02	-1.2027E+01	1.0810E+02	1.0811E+02	1.283E+02
La-140	#B	3.5259E-02	6.2458E+00	1.1073E+01	1.1104E+01	8.382E+01
Ce-141	#B	2.1939E-03	1.6720E-02	1.2384E+00	1.2384E+00	1.608E+00

Ce-144	#B	0.0000E+00	0.0000E+00	7.0012E-01	7.0014E-01	1.273E+00
Eu-152	#B	2.9989E-01	3.0392E-01	1.9860E-01	2.0274E-01	3.761E-01
Eu-154	#B	1.2607E-01	1.2875E-01	1.1516E-01	1.1644E-01	2.818E-01
Eu-155	#B	9.6857E-02	1.0061E-01	1.3988E-01	1.4060E-01	4.599E-01
Ir-192	#A	2.0138E-02	4.9238E-02	8.8478E-02	8.8720E-02	3.699E-01
Hg-203	#B	0.0000E+00	0.0000E+00	1.3214E-01	1.3214E-01	6.495E-01
Tl-208	#	3.5209E-01	3.8704E-01	2.0732E-01	2.1355E-01	2.087E-01
Pb-210	#A	1.9346E+00	1.9503E+00	3.7601E+00	3.7702E+00	4.916E+00
Bi-212	#	2.2038E+00	2.4225E+00	1.7734E+00	1.8023E+00	2.030E+00
Pb-212		1.1168E+00	1.2276E+00	2.8118E-01	3.2607E-01	3.020E-01
Ra-223	#A	4.8357E-01	4.8760E-01	3.3603E-01	3.4231E-01	8.137E-01
Ra-224	#B	0.0000E+00	0.0000E+00	1.4783E+00	1.4783E+00	2.703E+00
Ra-226		1.3255E+00	1.3256E+00	3.2659E-01	3.7076E-01	2.123E-01
Ac-227	#B	0.0000E+00	0.0000E+00	3.1419E-01	3.1419E-01	1.212E+00
Ac-228	#	1.2093E+00	1.2479E+00	5.3949E-01	5.6407E-01	6.451E-01
Th-228	#B	2.7051E+00	2.9736E+00	5.6478E+00	5.6633E+00	1.308E+01
Pa-231	#B	-2.4340E-01	-2.4340E-01	4.7747E+00	4.7748E+00	6.208E+00
Pa-234M	#A	0.0000E+00	0.0000E+00	4.0294E+00	4.0295E+00	2.469E+01
Th-230	#B	-9.2856E+00	-9.2856E+00	3.5228E+01	3.5251E+01	4.399E+01
Th-232	#B	1.2840E+01	1.2840E+01	5.0651E+01	5.0882E+01	6.473E+01
Th-234	#B	5.0932E-01	5.0932E-01	2.8317E+00	2.8326E+00	3.680E+00
U-235	#B	0.0000E+00	0.0000E+00	6.6544E-01	6.6546E-01	2.546E+00
U-238	#B	0.0000E+00	0.0000E+00	4.0151E+00	4.0151E+00	2.461E+01
Am-241	#B	6.3858E-02	6.3885E-02	3.0445E-01	3.0458E-01	4.045E-01
Am-243	#A	8.4527E-02	8.4529E-02	2.1546E-01	2.1578E-01	3.623E-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 (30.1 to 2035.5 keV) 2.144E+01 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 2.1588413E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854002	**Collection Date**	11/18/2016 09:55
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/21/17 15:44
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	1.070	1.083	2.974
Cesium-137	0.299	0.095	0.046
Lead-212	1.425	0.323	0.270
Potassium-40	17.073	4.240	2.589
Protactinium-234M	13.308	7.356	6.373
Radium-226	1.353	0.322	0.288
Radium-228	1.922	0.484	0.210
Thallium-208	0.551	0.177	0.136
Thorium-228	1.060	11.237	14.260
Thorium-234	3.583	3.207	5.115
Uranium-235	0.000	0.574	2.394

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Pace Analytical Spectrum name: 30204854002.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854002.An1

Acquisition information
Start time: 2/21/2017 3:44:53 PM
Live time: 900
Real time: 904
Dead time: 0.44 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.586 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.0795E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.0795E+02) =
4.8088E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/22/17

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Pace Analytical Spectrum name: 30204854002.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 9:55:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(8OZ).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.0995

***** 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. pCi/G	Nuc
63.00	26.	58.55	1.07	2.143E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	PBC<MDA	Th232
					63.81	0.267	6.314E+01	Th232
					63.29	4.800	PBC<MDA	Th234
74.88	30.	36.72	1.08	3.198E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	PBC<MDA	Pb212
77.32	74.	22.77	0.74	3.394E-02	77.11	17.500	1.953E+00	Pb212
					79.13	6.600	4.593E+00	Ag108M
83.61	28.	52.37	1.09	3.839E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	8.286E+00	Th228
87.00	42.	36.46	0.78	4.047E-02	86.54	30.700	PBC<MDA	Eu155
					87.30	7.800	2.112E+00	Pb212
					88.03	3.610	4.739E+00	Cd109
					86.54	30.700	4.991E-01	Eu155
93.02	29.	67.67	1.10	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
					92.60	2.800	3.488E+00	Th234
					92.59	5.600	PBC<MDA	U238
93.02	30.	66.28	1.10	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
236.22	21.	66.41	1.26	4.664E-02	235.97	12.300	PBC<MDA	Ac227
					235.97	12.300	PBC<MDA	Ac227
238.39	191.	10.57	1.25	4.644E-02	238.63	43.300	1.474E+00	Pb212
241.93	45.	25.21	1.26	4.615E-02	241.92	7.470	1.870E+00	Ra226
					241.00	3.900	3.931E+00	Ra224
277.45	12.	97.36	1.30	4.336E-02	276.40	7.164	PBC<MDA	Ba133
					277.36	6.310	PBC<MDA	Tl208

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Pace Analytical Spectrum name: 30204854002.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					276.40	7.164	PBC<MDA	Ba133

284.18	17.	78.57	1.31	4.285E-02	283.70	1.600	PBC<MDA	Pa231
					284.30	6.140	PBC<MDA	I131
					284.30	6.140	PBC<MDA	I131
					283.70	1.600	3.550E+00	Pa231
295.00	101.	12.35	0.57	4.207E-02	295.22	19.200	1.805E+00	Ra226
					295.96	28.670	2.959E+00	Ir192
295.09	20.	67.91	1.32	4.201E-02	295.22	19.200	PBC<MDA	Ra226
					295.96	28.670	PBC<MDA	Ir192
					295.96	28.670	PBC<MDA	Ir192
299.82	28.	34.54	1.32	4.173E-02	300.00	2.300	4.258E+00	Ac227
					300.00	2.300	4.258E+00	Ac227
338.39	52.	18.23	0.56	3.926E-02	338.32	11.300	1.755E+00	Ac228
344.51	13.	62.83	1.37	3.891E-02	344.28	26.600	PBC<MDA	Eu152
					344.28	26.600	PBC<MDA	Eu152
351.70	147.	9.89	1.75	3.846E-02	351.99	37.100	1.485E+00	Ra226
355.59	17.	52.94	1.38	3.823E-02	356.02	62.050	PBC<MDA	Ba133
					356.02	62.050	PBC<MDA	Ba133
463.15	17.	46.37	1.49	3.323E-02	463.36	10.500	7.524E-01	Sb125
					463.36	10.500	7.524E-01	Sb125
477.17	12.	70.24	1.51	3.269E-02	477.56	10.300	PBC<MDA	Be7
					477.56	10.300	1.845E+00	Be7
497.22	10.	73.17	1.53	3.199E-02	497.08	91.000	PBC<MDA	Ru103
					497.08	91.000	PBC<MDA	Ru103
582.83	84.	14.69	2.30	2.934E-02	583.19	84.500	5.383E-01	Tl208
602.25	14.	75.93	1.63	2.882E-02	602.73	97.800	PBC<MDA	Sb124
					602.73	97.800	2.148E-01	Sb124
609.32	103.	14.54	0.68	2.865E-02	609.31	44.800	1.158E+00	Ra226
636.75	15.	54.56	1.66	2.796E-02	636.99	7.170	PBC<MDA	I131
					635.95	11.300	PBC<MDA	Sb125
					636.99	7.170	PBC<MDA	I131
661.52	48.	14.43	0.62	2.738E-02	661.66	85.100	2.992E-01	Cs137
772.78	9.	92.46	1.79	2.513E-02	772.60	75.600	HL>Cutoff	I132
814.92	12.	28.87	1.83	2.438E-02	815.77	23.280	5.414E+01	La140
					815.77	23.280	5.414E+01	La140
818.50	6.	98.61	1.84	2.433E-02	818.51	99.700	PBC<MDA	Cs136
					818.51	99.700	PBC<MDA	Cs136
898.10	9.	99.03	1.91	2.308E-02	898.04	93.700	PBC<MDA	Y88
					898.04	93.700	PBC<MDA	Y88
910.72	81.	11.35	0.90	2.289E-02	911.21	26.600	1.993E+00	Ac228
1001.29	17.	26.85	2.01	2.166E-02	1001.03	0.840	1.326E+01	U238
					1001.03	0.837	1.331E+01	Pa234M
					1001.03	0.837	1.331E+01	Pa234M
					1001.03	0.840	1.326E+01	U238
1001.29	17.	26.85	2.01	2.166E-02	1001.03	0.840	1.326E+01	U238
					1001.03	0.837	1.331E+01	Pa234M
1004.52	15.	27.25	2.01	2.162E-02	1004.72	17.910	5.849E-01	Eu154
					1004.72	17.910	5.849E-01	Eu154

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
1098.69	10.	69.13	2.09	2.048E-02	1099.25	56.500	PBC<MDA	Fe59
					1099.25	56.500	PBC<MDA	Fe59
1120.68	15.	80.46	2.11	2.024E-02	1120.29	14.800	PBC<MDA	Ra226
1172.99	15.	31.33	2.16	1.967E-02	1173.24	99.974	1.168E-01	Co60
					1173.24	99.974	1.168E-01	Co60
1407.56	8.	92.85	2.35	1.747E-02	1408.01	20.870	PBC<MDA	Eu152
					1408.01	20.870	PBC<MDA	Eu152
1460.50	215.	10.53	2.40	1.704E-02	1461.00	10.670	1.707E+01	K40
					1461.00	10.670	1.707E+01	K40
1619.95	5.	50.18	2.52	1.582E-02	1620.50	1.490	PBC<MDA	Bi212

					1620.50	1.490	PBC<MDA	Bi212
1763.96	31.	18.83	2.63	1.484E-02	1764.49	15.360	1.993E+00	Ra226
1835.63	3.	57.74	2.69	1.439E-02	1836.06	99.200	PBC<MDA	Y88

No unknown peaks passed sensitivity test.

This section based on library: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Th-234	250.90	63.00	52.	26.	0.028	117.11	1.071s
Pb-212	298.12	74.81	55.	30.	0.033	73.43	1.084D
Pb-212	307.32	77.11	72.	80.	0.089	37.59	1.086D
Ra-223	333.32	83.61	48.	28.	0.031	104.74	1.093
Pb-212	346.87	87.00	55.	42.	0.047	72.92	0.780s
U-238	370.96	93.02	91.	29.	0.032	135.33	1.103s
Th-234	370.96	93.02	90.	30.	0.033	132.56	1.103s
Ac-227	943.63	236.22	39.	21.	0.023	132.82	1.256s
Pb-212	953.29	238.63	46.	180.	0.200	18.31	1.259D
Ra-226	966.44	241.92	40.	45.	0.050	50.42	1.263D
Tl-208	1108.55	277.45	31.	12.	0.014	194.72	1.300
I-131	1135.46	284.18	35.	17.	0.019	157.15	1.307s
Ra-226	1178.73	295.00	12.	101.	0.112	24.70	0.574s
Ir-192	1179.11	295.09	37.	20.	0.022	135.83	1.320s
Ac-227	1198.03	299.82	15.	28.	0.031	69.08	1.324s
Ac-228	1352.27	338.39	8.	52.	0.058	36.47	0.556s
Eu-152	1376.76	344.51	12.	13.	0.015	125.67	1.370s
Ra-226	1405.53	351.70	16.	147.	0.163	19.77	1.754s
Ba-133	1421.07	355.59	13.	17.	0.018	105.88	1.382s
Sb-125	1851.32	463.15	9.	17.	0.019	92.74	1.492s
Be-7	1907.40	477.17	12.	12.	0.014	140.48	1.506s
Ru-103	1987.56	497.22	9.	10.	0.011	146.35	1.526s
Tl-208	2330.03	582.83	16.	84.	0.093	29.39	2.296s
Sb-124	2407.72	602.25	18.	14.	0.016	151.86	1.630s
Ra-226	2436.01	609.32	24.	103.	0.114	29.08	0.684s

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Pace Analytical Spectrum name: 30204854002.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
I-131	2545.75	636.75	9.	15.	0.016	109.12	1.664s
Cs-137	2644.81	661.52	0.	48.	0.053	28.87	0.625s
I-132	3089.92	772.78	10.	9.	0.010	184.92	1.794s
La-140	3258.50	814.92	0.	12.	0.013	57.74	1.835s
Cs-136	3272.84	818.50	5.	6.	0.007	197.21	1.838s
Y-88	3591.32	898.10	11.	9.	0.010	198.05	1.912s
Ac-228	3641.80	910.72	2.	81.	0.090	22.71	0.896s
U-238	4003.14	1001.03	1.	17.	0.019	53.70	2.005D
Pa-234M	4003.14	1001.03	1.	17.	0.019	53.70	2.005D
Eu-154	4017.12	1004.52	1.	15.	0.017	54.50	2.009s
Fe-59	4393.92	1098.69	6.	10.	0.011	138.25	2.093s
Ra-226	4481.91	1120.68	23.	16.	0.018	160.92	2.111s
Co-60	4691.21	1172.99	4.	15.	0.017	62.67	2.157s
Eu-152	5629.96	1407.56	6.	8.	0.009	185.69	2.355s
K-40	5841.81	1460.50	41.	215.	0.239	21.06	2.398s
Bi-212	6480.00	1619.95	1.	5.	0.006	100.36	2.524s
Ra-226	7056.45	1763.96	2.	31.	0.035	37.66	2.633s
Y-88	7343.33	1835.63	0.	3.	0.003	115.47	2.685s

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 pCi/G	Peak Energy keV	Activity pCi/G	Code	MDA Value pCi/G		COMMENTS
Be-7	C	1.8455E+00					5.34E+01	
			477.56	1.845E+00	?(	2.833E+00	7.02E+01	1.03E+01 G K
Na-22	C	6.0857E-02					9.50E+02	
			1274.53	6.086E-02	%(	1.546E-01	1.27E+02	9.99E+01 G K
K-40	N	1.7073E+01					4.68E+11	
			1461.00	1.707E+01	(P	2.589E+00	1.05E+01	1.07E+01 G K
Cr-51	F	7.6895E-01					2.77E+01	
			320.08	7.690E-01	%(	1.164E+01	6.31E+02	1.01E+01 G K
Mn-54	C	3.4610E-02					3.12E+02	
			834.85	3.461E-02	%(	1.721E-01	2.32E+02	1.00E+02 G K
Co-56	C	2.4845E-01					7.73E+01	
			1238.28	2.484E-01	%(P	6.043E-01	1.24E+02	6.61E+01 G K
			1771.35	0.000E+00	%	3.527E+00	1.00E+03	1.55E+01 G

?

Nuclide	Ave activity		Energy	Activity	Code	Peak	MDA	Comments
Co-57	C	7.5495E-03					2.72E+02	
			122.06	7.550E-03	%(P	1.553E-01	8.39E+02	8.56E+01 G K
			136.47	3.879E-01	% P	9.991E-01	1.07E+02	1.07E+01 G
Co-58	C	-7.5393E-03					7.08E+01	
			810.78	-7.539E-03	%(	3.084E-01	1.84E+03	9.94E+01 G K
Fe-59	F	5.4838E-01					4.45E+01	
			1099.25	5.484E-01	?(P	7.788E-01	6.91E+01	5.65E+01 G K
			1291.60	1.263E-01	% P	1.523E+00	5.76E+02	4.32E+01 G
Co-60	F	5.8390E-02					1.92E+03	
			1332.50	0.000E+00	%(P	2.068E-01	1.00E+03	1.00E+02 G K
			1173.24	1.168E-01	?(P	8.805E-02	3.13E+01	1.00E+02 G
Zn-65	F	1.9120E-01					2.44E+02	
			1115.55	1.912E-01	%(P	4.583E-01	1.20E+02	5.06E+01 G K
Y-88	C	8.1753E-02					1.07E+02	
			1836.06	5.637E-02	?(	1.385E-01	5.77E+01	9.92E+01 G K
			898.04	1.086E-01	?(P	2.274E-01	9.90E+01	9.37E+01 G
Zr-95	I	-1.2187E-01					6.40E+01	
			756.73	-1.219E-01	&(	7.493E-01	2.89E+02	5.45E+01 G K
			724.20	0.000E+00	% P	1.354E+00	1.00E+03	4.42E+01 G
Ru-103	I	2.7039E-01					3.93E+01	

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                                497.08 2.704E-01 &(P 4.419E-01 7.32E+01 9.10E+01 G K

Ru-106    I  -3.3710E-01                                          3.73E+02
                                621.93-3.371E-01 &(  1.521E+00 2.07E+02 9.93E+00 G K

Cd-109    F  -3.0090E-01                                          4.64E+02
                                 88.03-3.009E-01 %(  4.819E+00 6.33E+02 3.61E+00 G K

Sb-124    F   2.1478E-01                                          6.02E+01
                                602.73 2.148E-01 ?(  3.449E-01 7.59E+01 9.78E+01 G K
                                645.85 1.161E+00 %   4.187E+00 1.62E+02 7.38E+00 G
                                722.79 0.000E+00 &   5.409E+00 1.00E+03 1.08E+01 G
                               1690.98 9.937E-03 %   8.879E-01 4.40E+03 4.73E+01 G

Sb-125    I   1.8777E-01                                          1.01E+03
                                427.88-1.252E-02 %(  4.032E-01 1.37E+03 2.96E+01 G K
                                176.31 0.000E+00 % P 1.599E+00 1.00E+03 6.82E+00 G
                                463.36 7.524E-01 &(P 7.366E-01 4.64E+01 1.05E+01 G
                                600.60 0.000E+00 % P 9.216E-01 1.00E+03 1.79E+01 G
                                635.95 3.585E-01 % P 1.002E+00 1.25E+02 1.13E+01 G
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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Te-129    I  -4.6764E-01                                          3.36E+01
                                459.60-4.676E-01 %(  1.117E+01 1.06E+03 7.70E+00 G K
                                487.39-1.944E+01 %   7.356E+01 1.73E+02 1.42E+00 G

Te-129M   I   9.8048E+00                                          3.36E+01
                                695.88 9.805E+00 %(P 2.286E+01 1.03E+02 3.00E+00 G K

I-131     I   5.2827E+02                                          8.02E+00
                                364.49 0.000E+00 %(P 5.060E+02 1.00E+03 8.17E+01 G K
                                636.99 4.020E+03 ?(P 4.549E+03 5.46E+01 7.17E+00 G
                                284.30 3.480E+03 ?(P 6.256E+03 7.86E+01 6.14E+00 G

I-132     I   6.7290E-02                                          3.20E+00
                                772.60 6.729E-02 &(P 1.334E-01 9.25E+01 7.56E+01 G K
                                522.65 9.179E-02 %   6.951E-01 3.32E+02 1.60E+01 G
                                630.19 5.791E-02 %   7.656E-01 5.80E+02 1.33E+01 G
                                954.55 0.000E+00 & P 9.736E-01 1.00E+03 1.76E+01 G

Te-132    I   1.2023E-02                                          3.20E+00
                                228.16 1.202E-02 %(P 1.197E-01 4.20E+02 8.80E+01 G K

I-133     I   4.5649E-03                                          8.67E-01
                                529.87 4.565E-03 %(P 1.053E-01 9.63E+02 8.70E+01 G K
                                875.33-2.051E-01 %   2.879E+00 5.57E+02 4.51E+00 G

Ba-133    F   1.0262E-01                                          3.84E+03
                                356.02 1.026E-01 &(P 1.225E-01 5.29E+01 6.20E+01 G K
                                 81.00-7.657E-02 %   4.554E-01 2.36E+02 3.41E+01 G
                                302.85 0.000E+00 %   7.038E-01 1.00E+03 1.83E+01 G
                                276.40-1.889E-01 %   1.668E+00 3.75E+02 7.16E+00 G
                                383.85 0.000E+00 % P 1.605E+00 1.00E+03 8.94E+00 G

Cs-136    F   5.4067E+00                                          1.32E+01
                                818.51 5.407E+00 ?(P 1.178E+01 9.86E+01 9.97E+01 G K
                                176.60 3.658E+00 % P 1.500E+02 1.65E+03 1.00E+01 G
                                273.65-4.498E+00 %   1.589E+02 1.49E+03 1.11E+01 G
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                                 340.55 0.000E+00 %   3.969E+01 1.00E+03 4.22E+01 G
                                1048.07 0.000E+00 % P 4.345E+01 1.00E+03 8.00E+01 G
                                1235.36 0.000E+00 & P 1.449E+02 1.00E+03 2.00E+01 G

Cs-137    I    2.9925E-01                                          1.10E+04
                                 661.66 2.992E-01  (  4.595E-02 1.44E+01 8.51E+01 G K

Ce-139    F    3.0890E-02                                          1.38E+02
                                 165.85 3.089E-02 %(  1.956E-01 2.59E+02 7.99E+01 G K
C
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

La-140    I    1.0620E+01                                          1.28E+01
                                1596.21 0.000E+00 %(  4.911E+01 1.00E+03 9.54E+01 G K
                                 487.02 1.207E+01 % P 4.529E+01 1.69E+02 4.55E+01 G
                                 815.77 5.414E+01 ?(  3.325E+01 2.89E+01 2.33E+01 G
                                 328.76 3.165E+01 %   7.617E+01 1.02E+02 2.03E+01 G

Ce-141    I   -7.9680E-01                                          3.25E+01
                                 145.44-7.968E-01 %(  1.956E+00 1.04E+02 4.82E+01 G K

Eu-152    F    1.5481E-01                                          4.95E+03
                                 121.78 6.321E-03 %(P 3.665E-01 2.34E+03 2.84E+01 G K
                                1408.01 3.136E-01 ?(P 5.739E-01 9.28E+01 2.09E+01 G
                                1112.12 0.000E+00 % P 1.794E+00 1.00E+03 1.36E+01 G
                                1085.91 0.000E+00 % P 1.763E+00 1.00E+03 9.92E+00 G
                                 964.13 4.301E-01 &   1.101E+00 1.25E+02 1.43E+01 G
                                 344.28 1.888E-01 &(P 2.632E-01 6.28E+01 2.66E+01 G
                                 244.70 1.702E-01 %   1.164E+00 2.85E+02 7.49E+00 G

Eu-154    I    1.9936E-01                                          3.14E+03
                                 123.07 2.929E-02 %(P 2.471E-01 3.45E+02 4.06E+01 G K
                                1274.44 1.655E-01 %   4.205E-01 1.27E+02 3.50E+01 G
                                1004.72 5.849E-01 ?(P 2.807E-01 2.72E+01 1.79E+01 G
                                 996.26 0.000E+00 %   2.039E+00 1.00E+03 1.05E+01 G
                                 873.19 0.000E+00 %   1.232E+00 1.00E+03 1.22E+01 G
                                 723.30 0.000E+00 & P 8.968E-01 1.00E+03 2.01E+01 G
                                 247.93 6.556E-02 % P 1.598E+00 1.03E+03 6.91E+00 G

Ir-192    F    1.5004E-01                                          7.38E+01
                                 316.51 0.000E+00 %(P 3.831E-01 1.00E+03 8.28E+01 G
                                 468.07 0.000E+00 % P 5.701E-01 1.00E+03 4.78E+01 G
                                 308.46 0.000E+00 % P 1.079E+00 1.00E+03 3.00E+01 G
                                 295.96 5.834E-01 ?(P 9.116E-01 6.79E+01 2.87E+01 G

Hg-203    F    1.5435E-01                                          4.66E+01
                                 279.20 1.544E-01 %(P 5.177E-01 1.43E+02 8.15E+01 G K

Tl-208    N    5.5073E-01                                          6.98E+02
                                 583.19 5.383E-01 *(P 1.364E-01 1.47E+01 8.45E+01 G K
                                 860.56 3.963E-01 &   1.291E+00 1.58E+02 1.24E+01 G
                                 277.36 7.167E-01  (P 1.654E+00 9.74E+01 6.31E+00 G

Pb-210    N    1.3251E+00                                          8.14E+03
                                  46.54 1.325E+00 %(P 2.884E+01 8.48E+02 4.25E+00 G K

Bi-212    N    1.0700E+00                                          6.98E+02
                                 727.33 5.008E-01 %(P 2.974E+00 2.83E+02 6.58E+00 G K
                                1620.50 3.583E+00 ?(P 4.962E+00 5.02E+01 1.49E+00 G
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     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:26:12 AM    Page  9
 Pace Analytical                  Spectrum name: 30204854002.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pb-212    N   1.4247E+00                                      6.98E+02
                         238.63 1.425E+00  (P 2.699E-01 9.15E+00 4.33E+01 G K
                          77.11 2.142E+00 + P 1.136E+00 1.88E+01 1.75E+01 GA
                          74.81 1.425E+00 } P 1.774E+00 3.67E+01 1.04E+01 GA
                          87.30 2.112E+00 {   1.874E+00 3.65E+01 7.80E+00 GA

Ra-223    N   3.8039E-01                                      7.98E+03
                         269.46 3.011E-01 %(P 7.373E-01 1.05E+02 1.37E+01 G K
                          83.78 4.240E-01  (  5.340E-01 5.24E+01 2.49E+01 G
                         323.87 2.300E-01 % P 2.664E+00 4.84E+02 3.93E+00 G
                         154.21 1.798E-01 % P 1.847E+00 4.19E+02 5.62E+00 G
                          94.90 0.000E+00 % P 1.458E+00 1.00E+03 1.13E+01 G
                          81.07-2.121E-01 %   1.090E+00 2.05E+02 1.50E+01 G

Ra-224    N   2.0054E-01                                      5.98E+02
                         241.00 2.005E-01 &(P 2.014E+00 4.04E+02 3.90E+00 G K

Ra-226    N   1.3533E-00                                      5.84E+05
                         609.31 1.158E+00  (P 2.880E-01 1.45E+01 4.48E+01 G K
                        1764.49 1.993E+00 + P 5.378E-01 1.88E+01 1.54E+01 G
                         295.22 1.805E+00 + P 3.377E-01 1.24E+01 1.92E+01 G
                        1120.29 7.623E-01 - P 1.212E+00 8.05E+01 1.48E+01 G
                         351.99 1.485E+00  (P 2.176E-01 9.89E+00 3.71E+01 G
                         241.92 1.870E+00  (P 1.354E+00 2.52E+01 7.47E+00 G

Ac-227    N   1.1221E+00                                      7.95E+03
                         235.97 5.356E-01 ?(P 8.065E-01 6.64E+01 1.23E+01 G K
                         256.25-3.468E-01 %   1.686E+00 2.08E+02 7.00E+00 G
                         300.00 4.258E+00 *(P 3.143E+00 3.45E+01 2.30E+00 G
                         329.85-1.288E+00 %   4.629E+00 1.54E+02 2.70E+00 G

Ac-228    N   1.9217E+00                                      2.10E+03
                         911.21 1.993E+00  (P 2.104E-01 1.14E+01 2.66E+01 G K
                         968.97 3.539E-01 % P 1.317E+00 1.81E+02 1.62E+01 G
                         338.32 1.755E+00 *(P 5.270E-01 1.82E+01 1.13E+01 G

Th-228    N   1.0602E+00                                      6.98E+02
                          84.37 1.060E+00 &(P 1.426E+01 5.30E+02 1.27E+00 G K
                         215.99 1.874E+01 &   4.414E+01 1.02E+02 2.63E-01 G
                         166.41 4.262E+00 &   9.896E+01 9.41E+02 1.08E-01 G
                         131.61-4.044E+01 &   1.081E+02 1.13E+02 1.35E-01 G

Pa-231    N   2.5866E+00                                      1.20E+07
                         283.70 2.587E+00 %(P 6.749E+00 1.12E+02 1.60E+00 G K
                         330.00-2.654E+00 %   9.537E+00 1.54E+02 1.30E+00 G
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     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:26:12 AM    Page 10
 Pace Analytical                  Spectrum name: 30204854002.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pa-234M   N   1.3308E+01                                      1.63E+12
                                                              Energy duplication
                        1001.03 1.331E+01 ?(P 6.373E+00 2.68E+01 8.37E-01 G
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Th-230    N    1.4523E+01                                          2.75E+07
                          67.67 1.452E+01 %(  5.956E+01 1.64E+02 3.80E-01 G K

Th-232    N    1.2367E+01                                          4.17E+12
                          63.81 1.237E+01 %(P 1.074E+02 3.45E+02 2.67E-01 G K

Th-234    N    3.5825E+00                                          1.63E+12
                          63.29 3.599E+00  (P 5.115E+00 5.86E+01 4.80E+00 G K
                          92.60 3.555E+00 *(P 5.610E+00 6.63E+01 2.80E+00 G

U-238     N    1.3260E+01                                          1.63E+12
                                                                 Energy duplication
                        1001.03 1.326E+01 ?(P 6.350E+00 2.68E+01 8.40E-01 G K
                          92.59 1.744E+00 - P 2.814E+00 6.77E+01 5.60E+00 GA

Am-241    T    1.8916E-01                                          1.58E+05
                          59.54 1.892E-01 %(  7.277E-01 1.52E+02 3.63E+01 G K

Am-243    T    5.2656E-02                                          2.69E+06
                                                                 Derived Ave Activity
                          74.66 5.266E-02 }(P 4.281E-01 2.39E+02 6.82E+01 G K
```

(- 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 (3263) Env32 G701W047 2/22/2017 8:26:12 AM Page 11
Pace Analytical Spectrum name: 30204854002.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 2 Sigma %	Activity

Th-234	63.00	52.	26.	0.028	117.11	3.599E+00	P
U-238	93.02	91.	29.	0.032	135.33	1.744E+00	P
Th-234	93.02	90.	30.	0.033	132.56	3.555E+00	P
Ac-227	236.22	39.	21	0.023	132.82	5.356E-01	P
I-131	284.18	35.	17.	0.019	157.15	3.480E+03	P
Ir-192	295.09	57.	20.	0.022	135.83	5.834E-01	P
Ac-227	299.82	15.	28.	0.031	69.08	4.258E+00	P
Eu-152	344.51	12.	13.	0.015	125.57	1.888E-01	P
Ba-133	355.59	13.	17.	0.018	105.88	1.026E-01	P
Sb-125	463.15	9.	17.	0.019	92.74	7.524E-01	P
Be-7	477.17	12.	12.	0.014	140.48	1.845E+00	
Ru-103	497.22	9.	10.	0.011	146.35	2.704E-01	P
Sb-124	602.25	18.	14.	0.016	151.86	2.148E-01	
I-131	636.75	9.	15.	0.016	109.12	4.020E+03	P
La-140	814.92	0.	12.	0.013	57.74	5.414E+01	
Cs-136	818.50	5.	6.	0.007	197.21	5.407E+00	P
Y-88	898.10	11.	9.	0.010	198.05	1.086E-01	P
U-238	1001.03	1.	17.	0.019	53.70	1.326E+01	P
Pa-234M	1001.03	1.	17.	0.019	53.70	1.331E+01	P
Ru-154	1004.52	1.	15.	0.017	54.50	5.849E-01	P
Fe-59	1098.69	6.	10.	0.011	138.25	5.484E-01	P
Co-60	1172.99	4.	15.	0.017	62.67	1.168E-01	P
Eu-152	1407.56	6.	8.	0.009	185.69	3.136E-01	P
K-40	1460.50	41.	215.	0.239	21.06	1.707E+01	P
Bi-212	1619.95	1.	5.	0.006	100.36	3.583E+00	P
Y-88	1835.63	0.	3.	0.003	115.47	5.637E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 sigma Total pCi/G	MDA pCi/G
Be-7	#A	5.3604E-01	1.8455E+00	2.5929E+00	2.6038E+00	2.833E+00
Na-22	#B	5.6770E-02	6.0857E-02	1.5486E-01	1.5506E-01	1.546E-01
K-40	#	1.7073E+01	1.7073E+01	3.5963E+00	4.2404E+00	2.589E+00
Sc-46	#B	0.0000E+00	0.0000E+00	2.7365E-02	2.7366E-02	3.612E-01
Cr-51	#B	7.0933E-02	7.6895E-01	9.7114E+00	9.7119E+00	1.164E+01
Mn-54	#B	2.8016E-02	3.4610E-02	1.6075E-01	1.6081E-01	1.721E-01

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Co-56	#B	1.0573E-01	2.4845E-01	6.1608E-01	6.1693E-01	6.043E-01
Co-57	#B	5.9215E-03	7.5495E-03	1.2673E-01	1.2674E-01	1.553E-01
Co-58	#B	-2.9682E-03	-7.5393E-03	2.7817E-01	2.7817E-01	3.084E-01
Fe-59	#A	1.2439E-01	5.4838E-01	7.5815E-01	7.6152E-01	7.788E-01
Co-60	#B	5.6421E-02	5.8390E-02	3.6592E-02	3.7377E-02	2.066E-01
Zn-65	#B	1.4592E-01	1.9120E-01	4.5929E-01	4.5997E-01	4.583E-01
Y-88	#A	4.4022E-02	8.1753E-02	9.3711E-02	9.4424E-02	1.385E-01
Nb-94	#B	0.0000E+00	0.0000E+00	1.7409E-02	1.7409E-02	1.791E-01
Zr-95	#B	-4.3456E-02	-1.2187E-01	7.0473E-01	7.0492E-01	7.493E-01
Nb-95	#B	0.0000E+00	0.0000E+00	1.8527E-01	1.8527E-01	1.212E+00
Ru-103	#A	5.0315E-02	2.7039E-01	3.9571E-01	3.9730E-01	4.419E-01
Ag-108M	#B	0.0000E+00	0.0000E+00	5.9779E-02	5.9781E-02	1.699E-01
Ru-106	#B	-2.8235E-01	-3.3710E-01	1.3936E+00	1.3943E+00	1.521E+00
Cd-109	#B	-2.6099E-01	-3.0090E-01	3.8102E+00	3.8105E+00	4.819E+00
Ag-110M	#B	0.0000E+00	0.0000E+00	5.4506E-02	5.4508E-02	2.007E-01
Sn-113	#B	0.0000E+00	0.0000E+00	6.2304E-02	6.2305E-02	3.348E-01
Sb-124	#A	7.1736E-02	2.1478E-01	3.2617E-01	3.2740E-01	3.449E-01
Sb-125	#B	1.7587E-01	1.8777E-01	1.7415E-01	1.7589E-01	4.032E-01

Te-129	#B	-6.5556E-02	-4.6764E-01	9.8792E+00	9.8794E+00	1.117E+01
Te-129M	#B	1.3745E+00	9.8048E+00	2.0147E+01	2.0189E+01	2.286E+01
I-131	#F	1.4058E-01	5.2827E+02	5.7644E+02	5.8063E+02	5.060E+02
I-132	#A	6.7290E-02	>12 Halflives	1.2443E-01	1.2475E-01	1.334E-01
Te-132	#B	1.2023E-02	>12 Halflives	1.0094E-01	1.0095E-01	1.197E-01
I-133	#B	4.5649E-03	>12 Halflives	8.7900E-02	8.7902E-02	1.053E-01
Ba-133	#A	1.0087E-01	1.0262E-01	1.0866E-01	1.0940E-01	1.225E-01
Cs-134	#B	0.0000E+00	0.0000E+00	3.8897E-02	3.8898E-02	2.013E-01
Cs-136	#A	3.5833E-02	5.4067E+00	1.0663E+01	1.0686E+01	1.178E+01
Cs-137		2.9745E-01	2.9925E-01	8.6385E-02	9.5007E-02	4.595E-02
Ce-139	#B	1.9121E-02	3.0890E-02	1.6021E-01	1.6026E-01	1.956E-01
Ba-140	#B	0.0000E+00	0.0000E+00	9.6791E+00	9.6793E+00	8.912E+01
La-140	#B	5.9899E-02	1.0620E+01	6.1315E+00	6.2945E+00	4.911E+01
Ce-141	#B	-1.0451E-01	-7.9680E-01	1.6524E+00	1.6558E+00	1.956E+00
Ce-144	#B	0.0000E+00	0.0000E+00	6.9407E-01	6.9408E-01	1.370E+00
Eu-152	#B	1.5276E-01	1.5481E-01	1.9454E-01	1.9564E-01	3.665E-01
Eu-154	#B	1.9521E-01	1.9936E-01	1.0865E-01	1.1187E-01	2.471E-01
Eu-155	#B	0.0000E+00	0.0000E+00	3.3992E-01	3.3993E-01	5.058E-01
Ir-192	#A	6.1356E-02	1.5004E-01	2.0379E-01	2.0475E-01	3.831E-01
Hg-203	#B	3.7445E-02	1.5435E-01	4.4022E-01	4.4071E-01	5.177E-01
Tl-208		5.0101E-01	5.5073E-01	1.6183E-01	1.7739E-01	1.364E-01
Pb-210	#B	1.3144E+00	1.3251E+00	2.2482E+01	2.2483E+01	2.884E+01
Bi-212	#B	9.7339E-01	1.0760E+00	1.0739E+00	1.0831E+00	2.974E+00
Pb-212		1.2960E+00	1.4247E+00	2.6080E-01	3.2329E-01	2.699E-01
Ra-223	B	3.7725E-01	3.8039E-01	3.9842E-01	4.0165E-01	7.373E-01
Ra-224	#B	1.8243E-01	2.0054E-01	1.6208E+00	1.6210E+00	2.014E+00
Ra-226		1.3531E+00	1.3533E+00	2.6756E-01	3.2170E-01	2.880E-01
Ac-227	#	1.1128E+00	1.1221E+00	7.7509E-01	7.8957E-01	8.065E-01
Ac-228	#	1.8622E+00	1.9217E+00	4.1276E-01	4.8406E-01	2.104E-01
Th-228	#B	9.6449E-01	1.0602E+00	1.1236E+01	1.1237E+01	1.426E+01
Pa-231	#B	2.5866E+00	2.5866E+00	5.7862E+00	5.7964E+00	6.749E+00

Pa-234M	#	1.3308E+01	1.3308E+01	7.1461E+00	7.3559E+00	6.373E+00
Th-230	#B	1.4523E+01	1.4523E+01	4.7595E+01	4.7637E+01	5.956E+01
Th-232	#B	1.2367E+01	1.2367E+01	8.5439E+01	8.5456E+01	1.074E+02
Th-234	#A	3.5825E+00	3.5825E+00	3.3683E+00	3.2068E+00	5.115E+00
U-235	#B	0.0000E+00	0.0000E+00	5.7400E-01	5.7402E-01	2.394E+00
U-238	#	1.3260E+01	1.3260E+01	7.1205E+00	7.3297E+00	6.350E+00
Am-241	#B	1.8908E-01	1.8916E-01	5.7494E-01	5.7555E-01	7.277E-01
Am-243	A	5.2655E-02	5.2656E-02	2.3071E-01	2.5182E-01	4.281E-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 (30.3 to 2035.6 keV) 5.310E+00 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 5.5496516E+00 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	Analysis SOP	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854005	Collection Date	11/18/2016 09:50
Batch ID	33843	Method	EPA 901.1
A-code	9011 SING	Analysis Date	2/21/17 15:45
Client ID	WESTON-NJ	Matrix	SL
Analyst	MAH	HBN	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	0.000	1.761	3.747
Cesium-137	0.000	0.027	0.178
Lead-212	1.605	0.358	0.264
Potassium-40	29.001	5.508	1.495
Protactinium-234M	8.501	14.801	17.230
Radium-226	1.252	0.361	0.574
Radium-228	2.567	0.629	0.382
Thallium-208	0.400	0.268	0.278
Thorium-228	4.039	7.337	9.353
Thorium-234	3.483	2.714	3.128
Uranium-235	0.510	0.605	2.217

ORTEC g V - i (3263) Env32 G701W047 2/22/2017 8:27:30 AM Page 1
Pace Analytical Spectrum name: 30204854005.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854005.An1

Acquisition information
Start time: 2/21/2017 3:45:42 PM
Live time: 900
Real time: 901
Dead time: 0.16 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.2920E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.2920E+02) =
4.3630E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:27:30 AM Page 2
Pace Analytical Spectrum name: 30204854005.Anl

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 9:50:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1301

DWS 2/22/17

***** 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. pCi/G	Nuc
46.41	17.	77.83	0.95	2.158E-02	46.54	4.250	PBC<MDA	Pb210
					46.54	4.250	PBC<MDA	Pb210
63.07	47.	38.34	0.34	3.668E-02	63.29	4.800	3.483E+00	Th234
74.68	54.	24.98	0.98	4.119E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	2.108E+00	Pb212
77.15	130.	12.83	0.98	4.197E-02	77.11	17.500	2.507E+00	Pb212
84.63	16.	90.54	0.99	4.391E-02	84.37	1.266	PBC<MDA	Th228
					83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
87.11	46.	31.55	1.33	4.456E-02	87.30	7.800	1.906E+00	Pb212
					88.03	3.610	4.305E+00	Cd109
					86.54	30.700	4.249E-01	Eu155
104.97	20.	67.90	1.01	4.704E-02	105.31	21.200	PBC<MDA	Eu155
					105.31	21.200	PBC<MDA	Eu155
143.59	23.	58.98	1.04	4.619E-02	143.76	10.960	PBC<MDA	U235
					143.76	10.960	PBC<MDA	U235
238.35	166.	10.61	1.23	3.550E-02	238.63	43.300	1.515E+00	Pb212
241.71	40.	21.74	1.13	3.514E-02	241.92	7.470	1.982E+00	Ra226
					241.00	3.900	4.162E+00	Ra224
269.37	26.	33.78	1.15	3.249E-02	269.46	13.700	7.816E-01	Ra223
					269.46	13.700	7.816E-01	Ra223
277.26	17.	64.66	1.16	3.179E-02	276.40	7.164	PBC<MDA	Ba133
					277.36	6.310	PBC<MDA	Tl208
					276.40	7.164	PBC<MDA	Ba133
295.00	65.	18.70	1.18	3.033E-02	295.22	19.200	1.453E+00	Ra226
					295.96	28.670	2.384E+00	Ir192
299.74	12.	77.69	1.18	2.995E-02	300.00	2.300	PBC<MDA	Ac227

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:27:30 AM Page 3
Pace Analytical Spectrum name: 30204854005.Anl

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					300.00	2.300	PBC<MDA	Ac227

316.47	10.	67.40	1.19	2.874E-02	316.51	82.810	PBC<MDA	Ir192
					316.51	82.810	1.413E-01	Ir192
337.94	66.	15.94	0.42	2.729E-02	338.32	11.300	2.877E+00	Ac228
351.73	96.	12.82	1.45	2.646E-02	351.99	37.100	1.280E+00	Ra226
364.31	13.	51.31	1.23	2.575E-02	364.49	81.700	PBC<MDA	I131
					364.49	81.700	3.043E+02	I131
383.60	10.	83.44	1.25	2.473E-02	383.85	8.940	PBC<MDA	Ba133
					383.85	8.940	PBC<MDA	Ba133
477.45	10.	52.89	1.33	2.089E-02	477.56	10.300	PBC<MDA	Be7
					477.56	10.300	1.992E+00	Be7
537.37	7.	90.85	1.37	1.911E-02	537.26	24.390	PBC<MDA	Ba140
					537.26	24.390	3.655E+01	Ba140
583.24	27.	48.82	1.41	1.798E-02	583.19	84.500	PBC<MDA	Tl208
609.14	89.	12.15	0.46	1.742E-02	609.31	44.800	1.440E+00	Ra226
772.65	10.	75.21	1.56	1.468E-02	772.60	75.600	HL>Cutoff	I132
					772.60	75.600	HL>Cutoff	I132
795.01	12.	60.16	1.57	1.438E-02	795.86	85.530	PBC<MDA	Cs134
					795.86	85.530	PBC<MDA	Cs134
815.75	7.	77.93	1.59	1.413E-02	815.77	23.280	PBC<MDA	La140
					815.77	23.280	4.827E+01	La140
860.45	11.	55.98	1.62	1.361E-02	860.56	12.420	PBC<MDA	Tl208
889.12	9.	64.41	1.64	1.330E-02	889.28	99.984	PBC<MDA	Sc46
					889.28	99.984	PBC<MDA	Sc46
910.82	63.	13.12	1.00	1.308E-02	911.21	26.600	2.436E+00	Ac228
969.05	18.	45.81	1.70	1.253E-02	968.97	16.200	1.211E+00	Ac228
1001.05	7.	86.81	1.72	1.225E-02	1001.03	0.840	PBC<MDA	U238
					1001.03	0.837	PBC<MDA	Pa234M
					1001.03	0.837	PBC<MDA	Pa234M
					1001.03	0.840	PBC<MDA	U238
1001.05	7.	86.81	1.72	1.225E-02	1001.03	0.840	PBC<MDA	U238
					1001.03	0.837	PBC<MDA	Pa234M
1110.96	9.	66.68	1.80	1.139E-02	1112.12	13.550	PBC<MDA	Eu152
					1112.12	13.550	7.890E-01	Eu152
1120.11	29.	18.92	0.65	1.133E-02	1120.29	14.800	2.296E+00	Ra226
1172.47	7.	84.69	1.84	1.097E-02	1173.24	99.974	PBC<MDA	Co60
					1173.24	99.974	PBC<MDA	Co60
1236.27	16.	54.85	1.88	1.058E-02	1235.36	20.000	PBC<MDA	Cs136
					1235.36	20.000	PBC<MDA	Cs136
1237.83	24.	31.31	1.88	1.056E-02	1238.28	66.070	1.052E+00	Co56
1386.02	4.	59.58	1.98	9.753E-03	1384.30	24.120	PBC<MDA	Ag110M
					1384.30	24.120	PBC<MDA	Ag110M
1460.69	222.	6.83	1.76	9.379E-03	1461.00	10.670	2.900E+01	K40
1692.99	3.	71.14	2.16	8.410E-03	1690.98	47.300	PBC<MDA	Sb124
					1690.98	47.300	PBC<MDA	Sb124
1764.09	9.	83.47	2.20	8.138E-03	1764.49	15.360	PBC<MDA	Ra226
1835.54	3.	66.16	2.23	7.888E-03	1836.06	99.200	PBC<MDA	Y88

C

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:27:30 AM Page 4
Pace Analytical Spectrum name: 30204854005.An1

No unknown peaks passed sensitivity test.

This section based on library: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-210	185.18	46.41	43.	17.	0.018	155.66	0.954s
Th-234	251.83	63.07	71.	47.	0.052	75.68	0.341s

Pb-212	298.75	74.81	102.	48.	0.053	18.77	0.980D
Pb-212	307.95	77.11	76.	128.	0.142	26.21	0.982D
Th-228	338.00	84.63	51.	16.	0.017	181.08	0.988s
Pb-212	347.93	87.11	52.	46.	0.051	63.11	1.330s
Cd-109	350.75	87.81	99.	-20.	-0.022	198.42	0.992s
Eu-155	419.34	104.97	43.	20.	0.022	135.79	1.007s
U-235	573.77	143.59	41.	23.	0.025	117.96	1.041s
Pb-212	953.83	238.63	30.	171.	0.190	17.76	1.124D
Ra-226	966.98	241.92	17.	40.	0.044	43.49	1.127D
Ra-223	1076.73	269.37	13.	26.	0.029	67.55	1.151s
Tl-208	1108.32	277.26	26.	17.	0.019	129.32	1.158s
Ra-226	1179.23	295.00	18.	65.	0.072	37.41	1.184s
Ac-227	1198.19	299.74	20.	12.	0.014	155.38	1.177s
Ir-192	1265.12	316.47	10.	10.	0.012	134.80	1.191s
Ac-228	1350.97	337.94	8.	66.	0.073	31.87	0.416s
Ra-226	1406.11	351.73	14.	96.	0.107	25.63	1.448s
I-131	1456.44	364.31	7.	13.	0.014	102.63	1.232s
Ba-133	1533.59	383.60	15.	10.	0.012	166.88	1.248s
Be-7	1908.94	477.45	4.	10.	0.011	105.79	1.325s
Ba-140	2148.37	537.37	8.	7.	0.008	181.70	1.373s
Tl-208	2332.07	583.24	33.	27.	0.031	97.64	1.410s
Ra-226	2436.03	609.23	46.	47.	0.053	67.84	1.430s
I-132	3089.73	772.65	8.	10.	0.011	152.42	1.556s
Cs-134	3179.17	795.01	9.	12.	0.014	120.31	1.573s
La-140	3262.17	815.75	4.	7.	0.008	155.87	1.588s
Tl-208	3440.96	860.45	5.	11.	0.012	111.95	1.621s
I-133	3499.72	875.13	4.	6	0.006	200.00	1.632s
Sc-46	3555.68	889.12	5.	9.	0.010	128.82	1.642s
Ac-228	3642.51	910.82	2.	63.	0.070	26.24	1.000s
Ag-110M	3746.21	936.74	4.	6.	0.006	200.00	1.677s
Ac-228	3875.45	969.05	10.	18.	0.020	91.63	1.699s
Eu-154	3982.80	995.88	4.	6.	0.006	200.00	1.719s
U-238	4003.42	1001.03	5.	7.	0.007	173.62	1.722D
Pa-234M	4003.42	1001.03	5.	7.	0.007	173.62	1.722D
Eu-152	4443.28	1110.96	5.	9.	0.010	133.36	1.799s
Ra-226	4479.90	1120.11	1.	29.	0.033	37.85	0.646s
Co-60	4689.42	1172.47	7.	7.	0.008	169.38	1.840s
Cs-136	4944.72	1236.27	11.	16.	0.018	109.70	1.881s

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:27:30 AM Page 5
Pace Analytical Spectrum name: 30204854005.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Co-56	4950.18	1237.63	5.	24.	0.026	62.63	1.883
Ag-110M	5544.00	1386.02	0.	4.	0.004	119.17	1.976s
K-40	5842.87	1460.69	3.	222.	0.246	13.65	1.757
Sb-124	6772.67	1692.99	0.	3.	0.003	142.27	2.156s
Ra-226	7057.30	1764.09	7.	9.	0.010	166.94	2.197s
Y-88	7343.33	1835.54	0.	3.	0.003	132.33	2.235s

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Peak Code	Peak MDA Value pCi/G	COMMENTS
Be-7	C	1.9915E+00					5.34E+01

```
                                 477.56 1.992E+00 ?(  2.396E+00 5.29E+01 1.03E+01 G K

Na-22     C   9.0558E-03                                          9.50E+02
                                1274.53 9.056E-03 %(  2.403E-01 1.20E+03 9.99E+01 G K

K-40      N   2.9001E+01                                          4.68E+11
                                1461.00 2.900E+01  (P 1.495E+00 6.83E+00 1.07E+01 G K

Sc-46     F   1.9808E-01                                          8.38E+01
                                 889.28 1.981E-01 ?(P 2.811E-01 6.44E+01 1.00E+02 G K

Mn-54     C  -7.7639E-03                                          3.12E+02
                                 834.85-7.764E-03 %(  2.531E-01 1.40E+03 1.00E+02 G K

Co-56     C   1.0519E+00                                          7.73E+01
                                1238.28 1.052E+00  (  5.871E-01 3.13E+01 6.61E+01 G K
                                1771.35 8.274E-02 % P 1.807E+00 3.96E+02 1.55E+01 G

Co-57     C  -6.7881E-02                                          2.72E+02
                                 122.06-6.788E-02 %(  1.788E-01 1.07E+02 8.56E+01 G K
                                 136.47-7.804E-02 &   1.140E+00 5.69E+02 1.07E+01 G

Co-58     C  -1.1792E-02                                          7.08E+01
                                 810.78-1.179E-02 %(  4.525E-01 1.61E+03 9.94E+01 G K

Co-60     F   4.5795E-02                                          1.92E+03
                                1332.50 0.000E+00 %(P 2.171E-01 1.00E+03 1.00E+02 G K
                                1173.24 9.160E-02 ?(P 1.815E-01 8.47E+01 1.00E+02 G
```



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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Y-88      C   8.6131E-02                                          1.07E+02
                                1836.06 8.613E-02 ?(P 2.292E-01 6.62E+01 9.92E+01 G K
                                 898.04 0.000E+00 % P 4.517E-01 1.00E+03 9.37E+01 G

Zr-95     I   3.3514E-02                                          6.40E+01
                                 756.73 3.351E-02 %(P 1.183E+00 1.55E+03 5.45E+01 G K
                                 724.20-9.021E-02 %   1.176E+00 5.62E+02 4.42E+01 G

Ag-108M   C   5.3156E-02                                          1.53E+05
                                 722.94 5.316E-02 %(  1.516E-01 1.23E+02 9.08E+01 G K
                                 614.28 0.000E+00 %   2.264E-01 1.00E+03 8.98E+01 G
                                 433.94 0.000E+00 %   1.660E-01 1.00E+03 9.05E+01 G
                                  79.13-8.712E-01 &   2.197E-00 1.03E+02 6.60E+00 G

Cd-109    F  -1.8875E+00                                          4.64E+02
                                  88.03-1.887E+00 ?(  4.597E+00 9.92E+01 3.61E+00 G K

Ag-110M   F   8.9314E-02                                          2.50E+02
                                 657.76 0.000E+00 %(P 2.067E-01 1.00E+03 9.40E+01 G K
                                1505.04-7.180E-02 %   1.959E+00 1.20E+03 1.29E+01 G
                                1384 30 2.603E-01 ?(P 5.347E-01 5.96E+01 2.41E+01 G
                                 937.49 2.145E-01 ?(  4.912E-01 1.00E+02 3.41E+01 G
                                 884.68 0.000E+00 & P 3.562E-01 1.00E+03 7.22E+01 G
                                 763.94 0.000E+00 %   1.132E+00 1.00E+03 2.21E+01 G
                                 744.28 0.000E+00 % P 5.259E+00 1.00E+03 4.70E+00 G
                                 706.68 0.000E+00 % P 1.863E+00 1.00E+03 1.63E+01 G

Sb-124    F   1.5420E-01                                          6.02E+01
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                          602.73 1.028E-01 %(  4.231E-01 1.72E+02 9.78E+01 G K
                          645.85 8.104E-01 % P 3.997E+00 1.87E+02 7.38E+00 G
                          722.79 1.342E+00 %   3.828E+00 1.23E+02 1.08E+01 G
                         1690.98 2.604E-01 ?(P 7.269E-01 7.11E+01 4.73E+01 G

Sb-125    I   1.0395E-02                                     1.01E+03
                          427.88 1.040E-02 %(  4.616E-01 1.78E+03 2.96E+01 G K
                          176.31 2.097E-01 & P 1.390E+00 2.57E+02 6.82E+00 G
                          463.36 4.362E-01 %   1.255E+00 1.20E+02 1.05E+01 G
                          600.60 1.840E-01 % P 9.445E-01 2.16E+02 1.79E+01 G
                          635.95 4.863E-01 % P 1.401E+00 1.21E+02 1.13E+01 G

Te-129M   I   8.5702E-01                                     3.36E+01
                          695.88 8.570E-01 %(P 3.788E+01 1.86E+03 3.00E+00 G K

I-131     I   3.0432E+02                                     8.02E+00
                          364.49 3.043E+02 &(  3.521E+02 5.13E+01 8.17E+01 G K
                          636.99 0.000E+00 %   1.226E+04 1.00E+03 7.17E+00 G
                          284.30 1.714E+02 %   6.726E+03 1.55E+03 6.14E+00 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

I-132     F   1.1293E-01                                     3.20E+00
                          772.60 1.129E-01 ?(P 1.917E-01 7.62E+01 7.56E+01 G K
                          522.65 3.422E-01 % P 8.922E-01 1.12E+02 1.60E+01 G
                          630.19 3.769E-01 %   1.073E+00 1.21E+02 1.33E+01 G
                          954.55 0.000E+00 % P 1.010E+00 1.00E+03 1.76E+01 G

I-133     I   5.8551E-02                                     8.67E-01
                          529.87 0.000E+00 %(P 1.663E-01 1.00E+03 8.70E+01 G K
                          875.33 1.188E+00 ?(  2.721E+00 1.00E+02 4.51E+00 G

Ba-133    F   1.4207E-01                                     3.84E+03
                          356.02 7.234E-02 %(  2.019E-01 1.14E+02 6.20E+01 G K
                           81.00 1.170E-02 % P 3.596E-01 1.21E+03 3.41E+01 G
                          302.85-2.201E-01 %   7.687E-01 1.44E+02 1.83E+01 G
                          276.40 0.000E+00 & P 2.102E+00 1.00E+03 7.16E+00 G
                          383.85 5.260E-01 &(P 1.237E+00 8.34E+01 8.94E+00 G

Cs-134    I   6.7735E-02                                     7.52E+02
                          604.72 0.000E+00 %(  2.641E-01 1.00E+03 9.76E+01 G K
                          801.95 0.000E+00 & P 2.514E+00 1.00E+03 8.69E+00 G
                          795.86 1.450E-01 ?(P 1.898E-01 6.02E+01 8.55E+01 G
                          569.33 2.908E-01 % P 8.588E-01 1.19E+02 1.54E+01 G

Cs-136    F   2.5617E+01                                     1.32E+01
                          818.51 0.000E+00 %(P 3.107E+01 1.00E+03 9.97E+01 G K
                          176.60 3.314E+01 & P 1.286E+02 1.52E+02 1.00E+01 G
                          273.65 3.328E+01 %   1.277E+02 1.54E+02 1.11E+01 G
                          340.55 0.000E+00 % P 5.232E+01 1.00E+03 4.22E+01 G
                         1048.07 0.000E+00 %   4.261E+01 1.00E+03 8.00E+01 G
                         1235.36 1.533E+02 &(P 1.671E+02 5.48E+01 2.00E+01 G

Ce-139    F   2.8895E-02                                     1.38E+02
                          165.85 2.890E-02 %(P 2.116E-01 2.88E+02 7.99E+01 G K

Ba-140    I   3.6552E+01                                     1.28E+01
                          537.26 3.655E+01 ?(  7.782E+01 9.09E+01 2.44E+01 G K
                          162.66 0.000E+00 % P 3.485E+02 1.00E+03 6.22E+00 G
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La-140   I   8.3540E+00                                          1.28E+01
                          1596.21-1.386E+00 %(  3.781E+01 1.20E+03 9.54E+01 G K
                           487.02 0.000E+00 %   5.509E+01 1.00E+03 4.55E+01 G
                           815.77 4.827E+01 ?(  8.633E+01 7.79E+01 2.33E+01 G
                           328.76 1.871E+01 % P 9.537E+01 2.02E+02 2.03E+01 G

Ce-141   I   1.5754E-01                                          3.25E+01
                           145.44 1.575E-01 %(  1.740E+00 4.35E+02 4.82E+01 G K
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ce-144   I  -4.1235E-01                                          2.85E+02
                           133.51-4.123E-01 &(  1.305E+00 1.27E+02 1.11E+01 G K

Eu-152   F   2.5484E-01                                          4.95E+03
                           121.78 0.000E+00 %(P 3.986E-01 1.00E+03 2.84E+01 G K
                          1408.01-2.201E-02 %   1.168E+00 2.40E+03 2.09E+01 G
                          1112.12 7.890E-01 ?(  1.115E+00 6.67E+01 1.36E+01 G
                          1085.91 0.000E+00 %   2.962E+00 1.00E+03 9.92E+00 G
                           964.13 2.132E-01 % P 1.660E+00 3.50E+02 1.43E+01 G
                           344.28 0.000E+00 % P 4.952E-01 1.00E+03 2.66E+01 G
                           244.70 2.430E-01 & P 9.998E-01 1.61E+02 7.49E+00 G

Eu-154   I   1.1711E-01                                          3.14E+03
                           123.07 0.000E+00 %(P 2.769E-01 1.00E+03 4.06E+01 G K
                          1274.44 2.463E-02 %   6.537E-01 1.20E+03 3.50E+01 G
                          1004.72 0.000E+00 % P 1.224E+00 1.00E+03 1.79E+01 G
                           996.26 5.686E-01 ?(  1.302E+00 1.00E+02 1.05E+01 G
                           873.19 0.000E+00 %   1.615E+00 1.00E+03 1.22E+01 G
                           723.30 1.081E-01 %   8.298E-01 3.28E+02 2.01E+01 G
                           247.93 8.422E-02 % P 1.472E+00 6.92E+02 6.91E+00 G

Eu-155   I   1.1161E-01                                          1.74E+03
                            86.54 0.000E+00 &(P 4.576E-01 1.00E+03 3.07E+01 G K
                           105.31 2.732E-01  (P 4.539E-01 6.79E+01 2.12E+01 G

Ir-192   F   1.4134E-01                                          7.38E+01
                           316.51 1.413E-01 ?(  2.298E-01 6.74E+01 8.28E+01 G
                           468.07 0.000E+00 % P 5.038E-01 1.00E+03 4.78E+01 G
                           308.46 1.457E-01 %   8.386E-01 2.28E+02 3.00E+01 G
                           295.96 0.000E+00 % P 7.198E-01 1.00E+03 2.87E+01 G

Tl-208   N   4.0044E-01                                          6.98E+02
                           583.19 2.603E-01 ?(P 2.777E-01 4.88E+01 8.45E+01 G K
                           860.56 9.287E-01 ?(P 1.128E+00 5.60E+01 1.24E+01 G
                           277.36 1.238E+00 ?(P 1.892E+00 6.47E+01 6.31E+00 G

Pb-210   N   2.3975E+00                                          8.14E+03
                            46.54 2.397E+00 &(P 4.810E+00 7.78E+01 4.25E+00 G K

Pb-212   N   1.6051E+00                                          6.98E+02
                           238.63 1.605E+00  (P 2.640E-01 8.88E+00 4.33E+01 G K
                            77.11 2.507E+00 + P 8.509E-01 1.31E+01 1.75E+01 GA
                            74.81 1.605E+00 } P 1.674E+00 9.38E+00 1.04E+01 GA
                            87.30 1.906E+00 *   1.505E+00 3.16E+01 7.80E+00 GA
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Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ra-223	N	7.8162E-01					7.96E+03	
			269.46	7.816E-01	(	5.727E-01	3.38E+01	1.37E+01 G K
			83.78	2.425E-02	%	4.848E-01	7.69E+02	2.49E+01 G
			323.87	1.176E-01	% P	2.805E+00	9.21E+02	3.93E+00 G
			154.21	0.000E+00	% P	1.942E+00	1.00E+03	5.62E+00 G
			94.90	0.000E+00	% P	1.200E+00	1.00E+03	1.13E+01 G
			81.07	0.000E+00	% P	8.211E-01	1.00E+03	1.50E+01 G
Ra-226	N	1.2521E+00					5.84E+05	
			609.31	7.963E-01	?(P	5.741E-01	3.39E+01	4.48E+01 G K
			1764.49	9.027E-01	?(P	1.612E+00	8.35E+01	1.54E+01 G
			295.22	1.453E+00	*(P	5.112E-01	1.87E+01	1.92E+01 G
			1120.29	2.296E+00	(P	5.761E-01	1.89E+01	1.48E+01 G
			351.99	1.280E+00	@(P	2.700E-01	1.28E+01	3.71E+01 G
			241.92	1.982E+00	(P	1.103E+00	2.17E+01	7.47E+00 G
Ac-227	N	5.5477E-01					7.95E+03	
			235.97	2.127E-01	%(P	7.062E-01	1.33E+02	1.23E+01 G K
			256.25	3.639E-01	%	1.544E+00	1.72E+02	7.00E+00 G
			300.00	2.384E+00	&(P	4.472E+00	7.77E+01	2.30E+00 G
			329.85	-6.152E-01	%	4.849E+00	3.16E+02	2.70E+00 G
Ac-228	N	2.5673E+00					2.10E+03	
			911.21	2.436E+00	(P	3.818E-01	1.31E+01	2.66E+01 G K
			968.97	1.211E+00	- P	1.153E+00	4.58E+01	1.62E+01 G
			338.32	2.877E+00	@(P	7.100E-01	1.59E+01	1.13E+01 G
Th-228	N	4.0394E+00					6.98E+02	
			84.37	4.039E+00	?(P	9.359E+00	9.05E+01	1.27E+00 G K
			215.99	9.975E+00	& P	4.541E+01	1.87E+02	2.63E-01 G
			166.41	0.000E+00	% P	1.162E+02	1.00E+03	1.08E-01 G
			131.61	0.000E+00	% P	1.036E+02	1.00E+03	1.35E-01 G
Pa-231	N	1.0043E+00					1.20E+07	
			283.70	1.004E+00	%(	6.458E+00	2.56E+02	1.60E+00 G K
			330.00	-8.451E-01	%	9.476E+00	4.45E+02	1.30E+00 G
Pa-234M	N	8.5006E+00					1.63E+12	
							Energy duplication	
			1001.03	8.501E+00	?(P	1.723E+01	8.68E+01	8.37E-01 G
Th-230	N	2.0822E+00					2.75E+07	
			67.67	2.082E+00	&(	4.201E+01	8.02E+02	3.80E-01 G K
Th-232	N	-9.7446E+00					4.17E+12	
			63.81	-9.745E+00	%(	6.080E+01	2.44E+02	2.67E-01 G K

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Th-234	N	3.4834E+00					1.63E+12	
			63.29	3.483E+00	@(P	3.128E+00	3.83E+01	4.80E+00 G K
			92.60	0.000E+00	% P	5.982E+00	1.00E+03	2.80E+00 G
U-235	N	5.0995E-01					2.57E+11	
			205.31	3.415E-01	%(P	2.217E+00	2.54E+02	5.03E+00 G K

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                    143.76 5.869E-01 @(P 8.453E-01 5.90E+01 1.10E+01 G
                     89.95 7.755E-01 %   3.900E+00 2.02E+02 3.56E+00 GA

U-238    N   8.4703E+00                                    1.63E+12
                                                          Energy duplication
                   1001.03 8.470E+00 ?(P 1.717E+01 8.68E+01 8.40E-01 G K
                     92.59 0.000E+00 % P 2.974E+00 1.00E+03 5.60E+00 GA

Am-241   T   1.5628E-02                                    1.58E+05
                     59.54 1.563E-02 %(  4.271E-01 1.03E+03 3.63E+01 G K
   ( - 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 2 Sigma %	Activity	
Pb-210	46.41	43.	17.	0.018	155.66	2.397E+00	P
Th-228	84.63	51.	16.	0.017	181.08	4.039E+00	P
Cd-109	87.81	99.	-20.	-0.022	198.42	-1.887E+00	
Eu-155	104.97	43.	20.	0.022	135.79	2.732E-01	P
U-235	143.59	41.	23.	0.025	117.96	5.869E-01	P
Ra-223	269.37	13.	26.	0.029	67.55	7.816E-01	
Ac-227	299.74	20.	12.	0.014	155.38	2.384E+00	P
Ir-192	316.47	10.	10.	0.012	134.80	1.413E-01	
I-131	364.31	7.	13.	0.014	102.63	3.043E+02	
Ba-133	383.60	15.	10.	0.012	166.88	6.260E-01	P
Be-7	477.45	4.	10.	0.011	105.79	1.992E+00	

Ba-140	537.37	8.	7.	0.008	181.70	3.655E+01	
I-132	772.65	8.	10.	0.011	152.42	0.000E+00	P
Cs-134	795.01	9.	12.	0.014	120.31	1.450E-01	P
La-140	815.75	4.	7.	0.008	155.87	4.827E+01	
Sc-46	889.12	5.	9.	0.010	128.82	1.981E-01	P
U-238	1001.03	5.	7.	0.007	173.62	8.470E+00	P
Pa-234M	1001.03	5.	7.	0.007	173.62	8.501E+00	P
Eu-152	1110.96	5.	9.	0.010	133.36	7.890E-01	
Co-60	1172.47	7.	7.	0.008	169.38	9.160E-02	P
Cs-136	1236.27	11.	16.	0.018	109.70	1.533E+02	P
Ag-110M	1386.02	0.	4.	0.004	119.17	2.603E-01	P
Sb-124	1692.99	0.	3.	0.003	142.27	2.604E-01	P
Y-88	1835.54	0.	3.	0.003	132.33	8.613E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#A	5.7843E-01	1.9915E+00	2.1068E+00	2.1231E+00	2.396E+00
Na-22	#B	8.4476E-03	9.0558E-03	2.1800E-01	2.1800E-01	2.403E-01
K-40		2.9001E-01	2.9001E+01	3.9594E+00	5.5073E+00	1.495E+00
Sc-46	#A	9.0083E-02	1.9808E-01	2.5517E-01	2.5651E-01	2.811E-01
Cr-51	#B	0.0000E+00	0.0000E+00	3.1279E+00	3.1279E+00	1.067E+01
Mn-54	#B	-6.2845E-03	-7.7639E-03	2.1697E-01	2.1698E-01	2.531E-01
Co-56		4.4761E-01	1.0519E+00	6.5874E-01	6.7292E-01	5.871E-01
Co-57	#B	-5.3242E-02	-6.7881E-02	1.4481E-01	1.4510E-01	1.788E-01
Co-58	#B	-4.6421E-03	-1.1792E-02	3.8052E-01	3.8052E-01	4.525E-01
Fe-59	#B	0.0000E+00	0.0000E+00	2.5193E-01	2.5194E-01	2.285E+00
Co-60	#B	4.4251E-02	4.5795E-02	7.7569E-02	7.7800E-02	2.171E-01
Zn-65	#B	0.0000E+00	0.0000E+00	8.4471E-02	8.4473E-02	5.347E-01

Y-88	#A	4.6379E-02	8.6131E-02	1.1398E-01	1.1463E-01	2.292E-01
Nb-94	#B	0.0000E+00	0.0000E+00	1.9437E-02	1.9438E-02	1.991E-01
Zr-95	#B	1.1950E-02	3.3514E-02	1.0357E+00	1.0357E+00	1.183E+00
Nb-95	#B	0.0000E+00	0.0000E+00	1.1733E-01	1.1733E-01	1.539E+00
Ru-103	#B	0.0000E+00	0.0000E+00	1.5273E-01	1.5274E-01	8.681E-01
Ag-108M	#B	5.3133E-02	5.3156E-02	1.3095E-01	1.3114E-01	1.516E-01
Ru-106	#B	0.0000E+00	0.0000E+00	7.7926E-01	7.7928E-01	2.794E+00
Cd-109	#A	-1.6371E+00	-1.8875E+00	3.7452E+00	3.7546E+00	4.597E+00
Ag-110M	#B	6.8570E-02	8.9314E-02	1.0643E-01	1.0709E-01	2.067E-01
Sn-113	#B	0.0000E+00	0.0000E+00	8.4417E-02	8.4418E-02	4.518E-01
Sb-124	#B	5.1498E-02	1.5420E-01	2.1938E-01	2.2033E-01	4.231E-01
Sb-125	#B	9.7361E-03	1.0395E-02	3.7016E-01	3.7016E-01	4.615E-01
Te-129	#B	0.0000E+00	0.0000E+00	5.0469E+00	5.0470E+00	1.552E-01
Te-129M	#B	1.2013E-01	8.5702E-01	3.1943E+01	3.1944E+01	3.788E+01
I-131	#A	8.0955E-02	3.0432E+02	3.1232E+02	3.1490E+02	3.521E+02
I-132	#A	1.1293E-01	>12 Halflives	1.7213E-01	1.7278E-01	1.917E-01
Te-132	#B	0.0000E+00	>12 Halflives	2.5734E-02	2.5734E-02	1.293E-01
I-133	#B	5.8551E-02	>12 Halflives	1.1710E-01	1.1736E-01	1.863E-01
Ba-133	#B	1.3965E-01	1.4207E-01	2.0057E-01	2.0135E-01	2.019E-01
Cs-134	#B	6.2045E-02	6.7735E-02	8.1495E-02	8.1987E-02	2.641E-01
Cs-136	#B	1.6974E-01	2.5617E+01	2.8101E+01	2.8305E+01	3.107E+01
Cs-137	#B	0.0000E+00	0.0000E+00	2.6715E-02	2.6715E-02	1.783E-01
Ce-139	#B	1.7886E-02	2.8895E-02	1.6652E-01	1.6656E-01	2.116E-01
Ba-140	#A	2.0612E-01	3.6552E+01	6.6418E-01	6.6593E+01	7.782E+01
La-140	#B	4.7108E-02	8.3540E+00	1.3021E+01	1.3070E+01	3.781E+01

Ce-141	#B	2.0662E-02	1.5754E-01	1.3700E+00	1.3701E+00	1.740E+00
Ce-144	#B	-3.2705E-01	-4.1235E-01	1.0494E+00	1.0509E+00	1.305E+00
Eu-152	#B	2.5146E-01	2.5484E-01	3.3986E-01	3.4158E-01	3.986E-01
Eu-154	#B	1.1467E-01	1.1711E-01	2.3421E-01	2.3474E-01	2.769E-01
Eu-155	#B	1.0745E-01	1.1161E-01	1.5155E-01	1.5236E-01	4.576E-01
Ir-192	#A	5.7797E-02	1.4134E-01	1.9052E-01	1.9145E-01	2.298E-01
Hg-203	#B	0.0000E+00	0.0000E+00	8.3833E-02	8.3835E-02	7.334E-01
Tl-208	#	3.6428E-01	4.0044E-01	2.6290E-01	2.6818E-01	2.777E-01
Pb-210	#A	2.3781E+00	2.3975E+00	3.7318E+00	3.7471E+00	4.810E+00
Bi-212	#B	0.0000E+00	0.0000E+00	1.7611E+00	1.7612E+00	3.747E+00
Pb-212		1.4602E+00	1.6051E+00	2.8509E-01	3.5760E-01	2.640E-01
Ra-223	#	7.7516E-01	7.8162E-01	5.2800E-01	5.3828E-01	5.727E-01
Ra-224	#B	0.0000E+00	0.0000E+00	1.5406E+00	1.5406E+00	2.425E+00
Ra-226		1.2519E+00	1.2521E+00	3.2091E-01	3.6120E-01	5.741E-01
Ac-227	#B	5.5018E-01	5.5477E-01	8.5330E-01	8.5655E-01	7.062E-01
Ac-228		2.4878E+00	2.5673E+00	5.2992E-01	6.2899E-01	3.818E-01
Th-228	#A	3.6746E+00	4.0394E+00	7.3146E+00	7.3367E+00	9.359E+00
Pa-231	#B	1.0043E+00	1.0043E+00	5.1390E+00	5.1408E+00	6.458E+00
Pa-234M	#A	8.5006E+00	8.5006E+00	1.4759E+01	1.4801E+01	1.723E+01
Th-230	#B	2.0822E+00	2.0822E+00	3.3384E+01	3.3385E+01	4.201E+01
Th-232	#B	-9.7446E+00	-9.7446E+00	4.7558E+01	4.7577E+01	6.080E+01
Th-234	#	3.4834E+00	3.4834E+00	2.6712E+00	2.7144E+00	3.128E+00
U-235	#B	5.0995E-01	5.0995E-01	6.0151E-01	6.0541E-01	2.217E+00
U-238	#A	8.4703E+00	8.4703E+00	1.4706E+01	1.4748E+01	1.717E+01

C

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:27:30 AM Page 13
Pace Analytical Spectrum name: 30204854005.An1

Am-241	#B	1.5621E-02	1.5628E-02	3.2129E-01	3.2129E-01	4.271E-01
Am-243	#B	0.0000E+00	0.0000E+00	2.1735E-01	2.1735E-01	3.707E-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 (30.1 to 2035.5 keV) 3.805E+01 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 3.8309093E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
NAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854006	**Collection Date**	11/18/2016 09:45
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/21/17 16:01
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	1.763	2.337	2.360
Cesium-137	-0.003	0.148	0.162
Lead-212	1.541	0.333	0.273
Potassium-40	27.280	4.720	1.255
Protactinium-234M	2.305	15.326	16.060
Radium-226	1.516	0.334	0.236
Radium-228	1.546	0.394	0.402
Thallium-208	0.728	0.162	0.098
Thorium-228	2.949	11.117	13.890
Thorium-234	2.952	1.438	5.548
Uranium-235	0.000	0.732	2.158

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Pace Analytical Spectrum name: 30204854006.Anl

Sample description
WL 33843

Spectrum Filename: C:\User\30204854006.Anl

Acquisition information
Start time: 2/21/2017 4:01:35 PM
Live time: 900
Real time: 904
Dead time: 0.44 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).Clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.3067E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.3067E+02) =
4.3352E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:32:39 AM Page 2
Pace Analytical Spectrum name: 30204854006.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 9:45:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(8OZ).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1227

***** 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. pCi/G	Nuc
63.40	18.	88.58	1.07	2.195E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	PBC<MDA	Th232
74.97	68.	21.28	1.08	3.198E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	2.909E+00	Pb212
					74.66	68.200	PBC<MDA	Am243
75.04	44.	45.81	1.08	3.186E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	1.892E+00	Pb212
77.32	91.	18.60	0.89	3.394E-02	77.11	17.500	2.181E+00	Pb212
83.68	29.	60.19	1.09	3.839E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
					83.78	24.900	4.029E-01	Ra223
					84.37	1.266	7.908E+00	Th228
87.18	54.	29.07	0.40	4.047E-02	87.30	7.800	2.448E+00	Pb212
93.00	33.	58.53	1.10	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
					92.59	5.600	PBC<MDA	U238
93.09	66.	23.36	0.50	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	7.117E+00	Th234
121.98	14.	99.14	1.13	5.126E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	PBC<MDA	Co57
					122.06	85.600	PBC<MDA	Co57
					121.78	28.400	1.297E-01	Eu152
					123.07	40.600	PBC<MDA	Eu154
236.46	20.	79.39	1.26	4.664E-02	235.97	12.300	PBC<MDA	Ac227
					235.97	12.300	PBC<MDA	Ac227
238.47	228.	10.00	1.08	4.644E-02	238.63	43.300	1.590E+00	Pb212
241.90	37.	33.79	1.26	4.615E-02	241.92	7.470	PBC<MDA	Ra226

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Pace Analytical Spectrum name: 30204854006.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					241.00	3.900	2.903E+00	Ra224

277.05	15.	93.87	1.30	4.336E-02	277.36	6.310	PBC<MDA	Tl208
					276.40	7.164	PBC<MDA	Ba133
295.03	101.	15.48	1.81	4.207E-02	295.22	19.200	1.627E+00	Ra226
					295.96	28.670	2.668E+00	Ir192
300.07	18.	72.50	1.32	4.173E-02	300.00	2.300	PBC<MDA	Ac227
					300.00	2.300	PBC<MDA	Ac227
338.24	69.	18.95	1.26	3.926E-02	338.32	11.300	1.976E+00	Ac228
351.76	149.	10.74	1.35	3.846E-02	351.99	37.100	1.357E+00	Ra226
462.75	19.	63.43	1.49	3.323E-02	463.36	10.500	PBC<MDA	Sb125
					463.36	10.500	PBC<MDA	Sb125
582.78	122.	10.59	1.28	2.934E-02	583.19	84.500	7.018E-01	Tl208
609.12	147.	11.11	1.14	2.865E-02	609.31	44.800	1.487E+00	Ra226
621.79	10.	77.14	1.65	2.833E-02	621.93	9.930	PBC<MDA	Ru106
					621.93	9.930	5.526E-01	Ru106
702.75	14.	67.42	1.73	2.649E-02	702.62	97.900	PBC<MDA	Nb94
					702.62	97.900	PBC<MDA	Nb94
727.30	21.	65.97	1.75	2.599E-02	727.33	6.580	PBC<MDA	Bi212
					727.33	6.580	PBC<MDA	Bi212
756.94	11.	72.61	1.78	2.543E-02	756.73	54.460	PBC<MDA	Zr95
					756.73	54.460	2.989E-01	Zr95
795.47	20.	50.00	1.82	2.472E-02	795.86	85.530	1.378E-01	Cs134
					795.86	85.530	1.378E-01	Cs134
815.58	11.	72.61	1.83	2.438E-02	815.77	23.280	PBC<MDA	La140
					815.77	23.280	4.614E+01	La140
860.50	18.	73.33	1.88	2.365E-02	860.56	12.420	PBC<MDA	Tl208
875.54	13.	52.09	1.89	2.342E-02	875.33	4.510	ML>Cutoff	I133
					875.33	4.510	ML>Cutoff	I133
883.65	12.	55.86	1.90	2.328E-02	884.68	72.200	PBC<MDA	Ag110M
					884.68	72.200	1.194E-01	Ag110M
911.33	61.	16.78	0.44	2.289E-02	911.21	26.600	1.344E+00	Ac228
969.28	42.	20.79	0.47	2.208E-02	968.97	16.200	1.577E+00	Ac228
1099.46	15.	48.40	2.09	2.048E-02	1099.25	56.500	7.426E-01	Fe59
					1099.25	56.500	7.426E-01	Fe59
1120.35	23.	71.34	2.11	2.024E-02	1120.29	14.800	PBC<MDA	Ra226
1460.44	381.	5.62	2.97	1.704E-02	1461.00	10.670	2.728E+01	K40
1691.81	8.	35.36	2.58	1.533E-02	1690.98	47.300	4.301E-01	Sb124
					1690.98	47.300	4.301E-01	Sb124
1764.23	33.	18.20	2.63	1.484E-02	1764.49	15.360	1.911E+00	Ra226

No unknown peaks passed sensitivity test.

This section based on library: Pace Master w Ra-226 Rev.4 09281

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Pace Analytical Spectrum name: 30204854006.An1

********** 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 2 Sigma %	FWHM keV
Th-232	252.51	63.40	63.	18.	0.020	177.16	1.071
Am-243	299.03	75.04	95.	44.	0.049	91.62	1.083
Pb-212	298.12	74.81	69.	58.	0.075	42.55	1.084D
Pb-212	307.32	77.11	84.	129.	0.144	26.64	1.086D
Ra-223	333.58	83.68	74.	29.	0.033	120.38	1.093s
Pb-212	347.58	87.18	55.	54.	0.060	58.15	0.400s
Cd-109	348.63	87.44	130.	-29.	-0.033	156.81	1.098s
U-238	370.87	93.00	88.	33.	0.037	117.06	1.103s
Th-234	371.23	93.09	47.	66.	0.073	46.73	0.495s
Co-57	486.77	121.98	45.	14.	0.016	198.28	1.135s

Ac-227	944.61	236.46	49.	20.	0.022	158.77	1.258s
Pb-212	953.29	238.63	59.	216.	0.241	16.90	1.259D
Ra-226	966.44	241.92	57.	37.	0.041	67.58	1.263D
Tl-208	1106.96	277.05	41.	15.	0.017	187.74	1.300s
Ra-226	1178.85	295.03	29.	101.	0.112	30.96	1.813s
Ac-227	1199.03	300.07	32.	18.	0.020	144.99	1.324s
Ac-228	1351.69	338.24	17.	65.	0.072	37.89	1.264
Ra-226	1405.74	351.76	23.	149.	0.165	21.48	1.354s
Sb-125	1849.70	462.75	26.	19.	0.022	126.85	1.492s
Tl-208	2329.82	582.78	9.	122.	0.135	21.19	1.282s
Ra-226	2435.22	609.12	19.	147.	0.163	22.22	1.144s
Ru-106	2485.89	621.79	9.	10.	0.011	154.27	1.649s
Nb-94	2809.76	702.75	14.	14.	0.016	134.83	1.728s
Bi-212	2907.96	727.30	30.	21.	0.023	131.93	1.751s
Zr-95	3026.55	756.94	10.	11.	0.013	145.22	1.779s
Cs-134	3180.71	795.47	14.	20.	0.023	100.01	1.816s
La-140	3261.16	815.58	10.	11.	0.013	145.22	1.835s
Tl-208	3440.87	860.50	26.	18.	0.020	146.66	1.877s
I-133	3501.03	875.54	5.	13.	0.014	104.19	1.891s
Ag-110M	3533.49	883.65	5.	12.	0.013	111.72	1.899s
Ac-228	3644.24	911.33	11.	61.	0.068	33.57	0.437s
Ac-228	3876.09	969.28	9.	42.	0.047	41.57	0.474s
Fe-59	4397.00	1099.46	6.	15.	0.017	96.80	2.093s
Ra-226	4480.59	1120.35	40.	23.	0.026	142.68	2.111s
K-40	5841.58	1460.44	10.	381.	0.423	11.23	2.972s
Sb-124	6767.62	1691.81	0.	8.	0.009	70.71	2.578s
Ra-226	7057.54	1764.23	2.	33.	0.037	36.41	2.633s

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

D

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Pace Analytical Spectrum name: 30204854006.Am1

***** 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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Code	MDA Value pCi/G		COMMENTS
Be-7	C	-1.1316E+00					5.34E+01	
			477.56	-1.132E+00	%(	4.160E-00	1.67E+02	1.03E+01 G K
Na-22	C	6.2345E-02					9.50E+02	
			1274.53	6.235E-02	%(	1.394E-01	1.13E+02	9.99E+01 G K
K-40	N	2.7280E+01					4.68E+11	
			1461.00	2.728E+01	@(P	1.255E+00	5.62E+00	1.07E+01 G K
Sc-46	F	5.5515E-02					8.38E+01	
			889.28	5.552E-02	%(	2.598E-01	2.22E+02	1.00E+02 G K
Cr-51	F	2.0806E+00					2.77E+01	
			320.08	2.081E+00	%(	1.141E+01	2.33E+02	1.01E+01 G K
Mn-54	C	3.3432E-02					3.12E+02	
			834.85	3.343E-02	%(	1.859E-01	2.64E+02	1.00E+02 G K
Co-56	C	2.5649E-01					7.73E+01	

```
                                 1238.28 2.565E-01 &(P 6.821E-01 1.38E+02 6.61E+01 G K
                                 1771.35 0.000E+00 %   4.000E+00 1.00E+03 1.55E+01 G

Co-57     C   5.4094E-02                                          2.72E+02
                                  122.06 5.409E-02 ?(P 1.281E-01 9.91E+01 8.56E+01 G K
                                  136.47 3.943E-01 % P 1.184E+00 1.26E+02 1.07E+01 G

Fe-59     F   7.4257E-01                                          4.45E+01
                                 1099.25 7.426E-01 ?(P 7.023E-01 4.84E+01 5.65E+01 G K
                                 1291.60 2.575E-01 % P 1.374E+00 2.58E+02 4.32E+01 G

Co-60     F   3.0913E-02                                          1.32E+03
                                 1332.50 3.091E-02 %(P 1.623E-01 2.43E+02 1.00E+02 G K
                                 1173.24 4.135E-02 % P 1.843E-01 2.18E+02 1.00E+02 G

Zn-65     F   1.0593E-01                                          2.44E+02
                                 1115.55 1.059E-01 %(P 4.132E-01 1.93E+02 5.06E+01 G K

Nb-94     I   3.4842E-02                                          7.41E+06
                                  871.09 0.000E+00 %(P 1.492E-01 1.00E+03 9.99E+01 G K
                                  702.62 7.040E-02 ?(P 1.010E-01 6.74E+01 9.79E+01 G
E
```



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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Zr-95     I   2.9889E-01                                          6.40E+01
                                  756.73 2.989E-01 ?(  4.536E-01 7.26E+01 5.45E+01 G K
                                  724.20 0.000E+00 % P 1.221E+00 1.00E+03 4.42E+01 G

Ag-108M   C   1.1477E-02                                          1.53E+05
                                  722.94 1.148E-02 %(P 1.642E-01 6.79E+02 9.08E+01 G K
                                  614.28 0.000E+00 %   1.143E-01 1.00E+03 8.98E+01 G
                                  433.94-7.665E-03 &   1.123E-01 6.26E+02 9.05E+01 G
                                   79.13 0.000E+00 &   2.346E+00 1.00E+03 6.60E+00 G

Ru-106    I   5.5255E-01                                          3.73E+02
                                  621.93 5.526E-01 ?(  9.222E-01 7.71E+01 9.93E+00 G K

Cd-109    F  -2.9840E+00                                          4.64E+02
                                   88.03-2.984E+00 &(  5.688E+00 7.84E+01 3.61E+00 G K

Ag-110M   F   5.1865E-02                                          2.50E+02
                                  657.76 0.000E+00 %(P 1.934E-01 1.00E+03 9.40E+01 G K
                                 1505.04 0.000E+00 %   2.077E+00 1.00E+03 1.29E+01 G
                                 1384.30 0.000E+00 %   7.588E-01 1.00E+03 2.41E+01 G
                                  937.49 0.000E+00 % P 5.399E-01 1.00E+03 3.41E+01 G
                                  884.68 1.194E-01 ?(  1.342E-01 5.59E+01 7.22E+01 G
                                  763.94-1.715E-01 %   9.596E-01 2.68E+02 2.21E+01 G
                                  744.28 1.575E+00 % P 3.297E+00 1.00E+02 4.70E+00 G
                                  706.68 0.000E+00 % P 9.892E-01 1.00E+03 1.63E+01 G

Sb-124    F   1.7750E-01                                          6.02E+01
                                  602.73 5.533E-02 &(  3.725E-01 3.09E+02 9.78E+01 G K
                                  645.85 1.237E+00 %   3.776E+00 1.38E+02 7.38E+00 G
                                  722.79-6.483E-01 %   4.402E+00 3.25E+02 1.08E+01 G
                                 1690.98 4.301E-01 ?(  3.962E-01 3.54E+01 4.73E+01 G

Sb-125    I   1.3699E-01                                          1.01E+03
                                  427.88-8.801E-02 &(  4.073E-01 2.02E+02 2.96E+01 G K
                                  176.31 5.446E-02 % P 1.558E+00 1.17E+03 6.82E+00 G
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                                463.36 7.713E-01 ?(P 1.048E+00 6.34E+01 1.05E+01 G
                                600.60 6.535E-02 % P 7.310E-01 5.10E+02 1.79E+01 G
                                635.95 1.254E-01 % P 1.015E+00 3.59E+02 1.13E+01 G

Te-129    I   9.0374E-01                                        3.36E+01
                                459.60 9.037E-01 %(  1.130E+01 5.60E+02 7.70E+00 G K
                                487.39 1.012E+01 &   5.262E+01 2.32E+02 1.42E+00 G

I-132     I   3.6681E-02                                        3.20E+00
                                772.60 3.668E-02 %(P 1.771E-01 2.27E+02 7.56E+01 G K
                                522.65-5.662E-02 %   7.284E-01 5.71E+02 1.60E+01 G
                                630.19 5.221E-02 %   8.636E-01 7.46E+02 1.33E+01 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                                954.55 0.000E+00 % P 7.008E-01 1.00E+03 1.76E+01 G

I-133     I   1.2252E-01                                        8.67E-01
                                529.87 4.688E-02 &(P 1.070E-01 1.02E+02 8.70E+01 G K
                                875.33 1.582E+00 &(  1.639E+00 5.21E+01 4.51E+00 G

Cs-134    I   6.4359E-02                                        7.52E+02
                                604.72 0.000E+00 %(P 1.573E-01 1.00E+03 9.76E+01 G K
                                801.95 1.715E-01 % P 1.314E+00 3.18E+02 8.69E+00 G
                                795.86 1.378E-01 ?(  1.375E-01 5.00E+01 8.55E+01 G
                                569.33 0.000E+00 % P 7.819E-01 1.00E+03 1.54E+01 G

Cs-136    F   1.2314E+00                                        1.32E+01
                                818.51 1.231E+00 %(P 1.887E+01 7.07E+02 9.97E+01 G K
                                176.60 0.000E+00 % P 1.610E+02 1.00E+03 1.00E+01 G
                                273.65 1.827E+01 %   1.481E+02 3.45E+02 1.11E+01 G
                                340.55 0.000E+00 &   2.496E+01 1.00E+03 4.22E+01 G
                               1048.07 4.046E+00 % P 2.525E+01 3.05E+02 8.00E+01 G
                               1235.36 5.475E+01 % P 1.444E+02 1.37E+02 2.00E+01 G

Cs-137    I  -2.8101E-03                                        1.10E+04
                                661.66-2.810E-03 &(  1.622E-01 2.64E+03 8.51E+01 G K

Ce-139    F  -3.9666E-02                                        1.38E+02
                                165.85-3.967E-02 &(  2.151E-01 2.25E+02 7.99E+01 G K

La-140    I   9.0513E+00                                        1.28E+01
                               1596.21 0.000E+00 %(  2.954E+01 1.00E+03 9.54E+01 G K
                                487.02 0.000E+00 & P 5.151E+01 1.00E+03 4.55E+01 G
                                815.77 4.614E+01 ?(  7.002E+01 7.26E+01 2.33E+01 G
                                328.76-1.428E+01 %   1.134E+02 3.40E+02 2.03E+01 G

Ce-141    I   2.2211E-01                                        3.25E+01
                                145.44 2.221E-01 %(  1.560E+00 2.90E+02 4.82E+01 G K

Eu-152    F   4.3488E-02                                        4.95E+03
                                121.78 4.349E-02 %(P 3.210E-01 3.00E+02 2.84E+01 G K
                               1408.01 0.000E+00 % P 6.906E-01 1.00E+03 2.09E+01 G
                               1112.12 0.000E+00 % P 1.420E+00 1.00E+03 1.36E+01 G
                               1085.91 2.775E-01 % P 1.402E+00 2.47E+02 9.92E+00 G
                                964.13 1.523E-01 %   1.357E+00 4.39E+02 1.43E+01 G
                                344.28 2.996E-02 % P 3.842E-01 5.56E+02 2.66E+01 G
                                244.70 0.000E+00 %   1.562E+00 1.00E+03 7.49E+00 G

Tl-208    N   7.2844E-01                                        6.98E+02
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                          583.19 7.018E-01 *(P 9.823E-02 1.06E+01 8.45E+01 G K
                          860.56 8.851E-01 ?(  1.286E+00 7.33E+01 1.24E+01 G
                          277.36 7.768E-01 ?(P 1.705E+00 9.39E+01 6.31E+00 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pb-210    N   5.3840E+00                                     8.14E+03
                           46.54 5.384E+00 %(P 2.286E+01 1.67E+02 4.25E+00 G K

Bi-212    N   1.7625E+00                                     6.98E+02
                          727.33 1.763E+00 &(P 2.360E+00 6.60E+01 6.58E+00 G K
                         1620.50 3.332E+00 % P 9.397E+00 1.42E+02 1.49E+00 G

Pb-212    N   1.5413E+00                                     6.98E+02
                          238.63 1.541E+00  (P 2.731E-01 8.45E+00 4.33E+01 G K
                           77.11 3.132E+00 + P 1.097E+00 1.33E+01 1.75E+01 GA
                           74.81 2.909E+00 + P 1.786E+00 2.13E+01 1.04E+01 GA
                           87.30 2.448E+00 +   1.690E-00 2.91E+01 7.80E+00 GA

Ra-223    N   2.6725E-03                                     7.96E+03
                          269.46 2.076E-02 &(P 8.462E-01 1.73E+03 1.37E+01 G K
                           83.78 4.029E-01 *(  5.865E-01 6.02E+01 2.49E+01 G
                          323.87 0.000E+00 % P 2.519E+00 1.00E+03 3.93E+00 G
                          154.21 2.586E-01 & P 2.092E+00 3.36E+02 5.62E+00 G
                           94.90 3.127E-01 % P 9.025E-01 1.19E+02 1.13E+01 G
                           81.07-1.354E-01 &   1.021E+00 3.00E+02 1.50E+01 G

Ra-224    N   8.5553E-01                                     6.98E+02
                          241.00 8.555E-01 &(P 2.215E+00 1.10E+02 3.90E+00 G K

Ra-226    N   1.5160E+00                                     5.84E+05
                          609.31 1.487E+00  (P 2.359E-01 1.11E+01 4.48E+01 G K
                         1764.49 1.911E+00 ?(P 4.848E-01 1.82E+01 1.54E+01 G
                          295.22 1.627E+00 *(P 4.486E-01 1.55E+01 1.92E+01 G
                         1120.29 1.013E+00 - P 1.393E+00 7.13E+01 1.48E+01 G
                          351.99 1.357E+00  (P 2.298E-01 1.07E+01 3.71E+01 G
                          241.92 1.381E+00  (P 1.436E+00 3.38E+01 7.47E+00 G

Ac-227    N   7.5642E-01                                     7.95E+03
                          235.97 4.485E-01 ?(P 8.114E-01 7.94E+01 1.23E+01 G K
                          256.25-6.044E-01 %   1.611E+00 1.16E+02 7.00E+00 G
                          300.00 2.403E+00  (P 4.000E+00 7.25E+01 2.30E+00 G
                          329.85 6.111E-01 %   4.593E+00 3.21E+02 2.70E+00 G

Ac-228    N   1.5457E+00                                     2.10E+03
                          911.21 1.344E+00  (P 4.023E-01 1.68E+01 2.66E+01 G K
                          968.97 1.577E+00  (P 6.269E-01 2.08E+01 1.62E+01 G
                          338.32 1.976E+00  (P 6.597E-01 1.89E+01 1.13E+01 G

Th-228    N   2.9491E+00                                     6.98E+02
                           84.37 2.949E+00 &(P 1.389E+01 1.88E+02 1.27E+00 G K
                          215.99-2.253E+00 &   4.233E+01 7.97E+02 2.63E-01 G
                          166.41-3.330E+01 &   1.110E+02 1.40E+02 1.08E-01 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
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                                 131.61 6.752E-01 %   9.437E+01 5.77E+03 1.35E-01 G

Pa-234M   N   2.3046E+00                                          1.63E+12
                                                                 Energy duplication
                                1001.03 2.305E+00 %(P 1.606E+01 3.32E+02 8.37E-01 G

Th-230    N   6.8790E+00                                          2.75E+07
                                  67.67 6.879E+00 %(  5.583E+01 3.22E+02 3.80E-01 G K

Th-232    N   4.0392E+01                                          4.17E+12
                                  63.81 4.039E+01  (P 8.805E+01 8.86E+01 2.67E-01 G K

Th-234    N   2.9521E+00                                          1.63E+12
                                  53.29 5.228E-01 %(P 5.548E+00 4.20E+02 4.80E+00 G K
                                  92.60 7.117E+00  (P 3.728E+00 2.34E+01 2.80E+00 G

U-238     N   2.2964E+00                                          1.63E+12
                                                                 Energy duplication
                                1001.03 2.298E+00 %(P 1.600E+01 3.32E+02 8.40E-01 G K
                                  92.59 1.797E+00   P 2.495E+00 5.85E+01 5.60E+00 GA

Am-241    T   1.3301E-01                                          1.58E+05
                                  59.54 1.330E-01 &(  7.910E-01 2.36E+02 3.63E+01 G K

Am-243    T   2.6346E-01                                          2.69E+06
                                  74.66 2.635E-01  (P 2.884E-01 4.58E+01 6.82E+01 G K
   ( - 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
E

      ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:32:39 AM    Page 10
 Pace Analytical                  Spectrum name: 30204854006.Am1

   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 2 Sigma %	Activity	
Am-243	75.04	95.	44.	0.049	91.62	2.635E-01	P
Ra-223	83.68	74.	29.	0.033	120.38	4.029E-01	
Cd-109	87.44	130.	-29.	-0.033	156.81	-2.984E+00	
U-238	93.00	88.	33.	0.037	117.06	1.797E+00	P
Co-57	121.98	45.	14.	0.016	198.28	5.409E-02	P
Ac-227	236.46	49.	20.	0.022	158.77	4.485E-01	P
Ac-227	300.07	32.	18.	0.020	144.99	2.403E+00	P
Sb-125	462.75	26.	19.	0.022	126.85	7.713E-01	P
Ru-106	621.79	9.	10.	0.011	154.27	5.526E-01	
Nb-94	702.75	14.	14.	0.016	134.83	7.040E-02	P
Bi-212	727.30	30.	21.	0.023	131.93	1.763E+00	P
Zr-95	756.94	10.	11.	0.013	145.22	2.989E-01	
Cs-134	795.47	14.	20.	0.023	100.01	1.378E-01	
La-140	815.58	10.	11.	0.013	145.22	4.614E+01	
I-133	875.54	5.	13.	0.014	104.19	0.000E+00	
Ag-110M	883.65	5.	12.	0.013	111.72	1.194E-01	
Fe-59	1099.46	6.	15.	0.017	96.80	7.426E-01	P
Sb-124	1691.81	0.	8.	0.009	70.71	4.301E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-3.2861E-01	-1.1316E+00	3.7866E+00	3.7895E+00	4.160E+00
Na-22	#B	5.8157E-02	5.2345E-02	1.4041E-01	1.4064E-01	1.394E-01
K-40	#	2.7280E+01	2.7280E+01	3.0647E+00	4.7203E+00	1.255E+00
Sc-46	#B	2.6245E-02	5.5515E-02	2.4684E-01	2.4695E-01	2.598E-01
Cr-51	#B	1.9184E-01	2.0806E+00	9.6847E+00	9.6886E+00	1.141E+01
Mn-54	#B	2.7060E-02	3.3432E-02	1.7648E-01	1.7654E-01	1.859E-01
Co-56	#B	1.0913E-01	2.5649E-01	7.0774E-01	7.0853E-01	6.821E-01
Co-57	#A	4.2426E-02	5.4094E-02	1.0726E-01	1.0750E-01	1.281E-01
Co-58	#B	0.0000E+00	0.0000E+00	1.2754E-01	1.2754E-01	4.308E-01
Fe-59	#	1.6839E-01	7.4257E-01	7.1877E-01	7.2528E-01	7.023E-01
Co-60	#B	2.9870E-02	3.0913E-02	1.5036E-01	1.5042E-01	1.623E-01
Zn-65	#B	8.0840E-02	1.0593E-01	4.0871E-01	4.0895E-01	4.132E-01
Y-88	#B	0.0000E+00	0.0000E+00	3.3884E-02	3.3885E-02	3.448E-01
Nb-94	#B	3.4842E-02	3.4842E-02	4.6978E-02	4.7202E-02	1.492E-01

Zr-95	#A	1.0656E-01	2.9889E-01	4.3406E-01	4.3586E-01	4.536E-01
Nb-95	#B	0.0000E+00	0.0000E+00	4.2047E-01	4.2048E-01	1.208E+00
Ru-103	#B	0.0000E+00	0.0000E+00	9.6147E-02	9.6149E-02	8.278E-01
Ag-108M	#B	1.1472E-02	1.1477E-02	1.5579E-01	1.5580E-01	1.642E-01
Ru-106	#A	4.6281E-01	5.5255E-01	8.5244E-01	8.5555E-01	9.222E-01
Cd-109	#A	-2.5881E+00	-2.9840E+00	4.6792E+00	4.6979E+00	5.688E+00
Ag-110M	#B	3.9818E-02	5.1865E-02	5.7945E-02	5.8349E-02	1.934E-01
Sn-113	#B	0.0000E+00	0.0000E+00	4.8647E-02	4.8648E-02	3.303E-01
Sb-124	#B	5.9271E-02	1.7750E-01	1.2551E-01	1.2768E-01	3.725E-01
Sb-125	#B	1.2830E-01	1.3699E-01	1.7377E-01	1.7470E-01	4.073E-01
Te-129	#B	1.2664E-01	9.0374E-01	1.0128E+01	1.0129E+01	1.130E+01
Te-129M	#B	0.0000E+00	0.0000E+00	2.3254E+00	2.3255E+00	3.202E+01
I-131	#B	0.0000E+00	0.0000E+00	7.7799E+01	7.7801E+01	5.483E+02

X-132	#B	3.6681E-02	>12 Halflives	1.6677E-01	1.6684E-01	1.771E-01
Te-132	#B	0.0000E+00	>12 Halflives	1.5324E-02	1.5325E-02	1.483E-01
I-133	#F	1.2252E-01	>12 Halflives	1.2765E-01	1.2867E-01	1.070E-01
Ba-133	#B	0.0000E+00	0.0000E+00	6.6991E-02	6.6992E-02	2.157E-01
Cs-134	#B	5.8952E-02	6.4359E-02	6.4366E-02	6.4924E-02	1.573E-01
Cs-136	#B	8.1530E-03	1.2314E+00	1.7408E+01	1.7409E+01	1.887E+01
Cs-137	#B	-2.7933E-03	-2.8101E-03	1.4817E-01	1.4817E-01	1.522E-01
Ce-139	#B	-2.4551E-02	-3.9666E-02	1.7869E-01	1.7876E-01	2.151E-01
Ba-140	#B	0.0000E+00	0.0000E+00	6.1763E+00	6.1764E+00	7.416E+01
La-140	#B	5.1000E-02	9.0513E+00	1.3145E+01	1.3200E+01	2.954E+01
Ce-141	#B	2.9122E-02	2.2211E-01	1.2871E+00	1.2874E+00	1.560E+00
Ce-144	#B	0.0000E+00	0.0000E+00	2.6572E-01	2.6572E-01	1.327E+00
Eu-152	#B	4.2911E-02	4.3488E-02	2.6113E-01	2.6120E-01	3.210E-01
Eu-154	#B	0.0000E+00	0.0000E+00	1.3964E-01	1.3964E-01	2.714E-01
Eu-155	#B	0.0000E+00	0.0000E+00	3.2485E-01	3.2485E-01	5.358E-01
Ir-192	#A	0.0000E+00	0.0000E+00	3.7858E-02	3.7859E-02	3.559E-01
Hg-203	#B	0.0000E+00	0.0000E+00	6.0981E-02	6.0982E-02	5.603E-01
Tl-208	#	6.6265E-01	7.2844E-01	1.5432E-01	1.8178E-01	9.823E-02
Pb-210	#B	5.3405E+00	5.3840E+00	1.7941E+01	1.7957E+01	2.286E+01
Bi-212	#A	1.6033E+00	1.7625E+00	2.3253E+00	2.3370E+00	2.360E+00
Pb-212		1.4021E+00	1.5413E+00	2.6044E-01	3.3250E-01	2.731E-01
Ra-223	#B	2.6504E-01	2.6725E-01	3.2171E-01	3.2368E-01	8.462E-01
Ra-224	#B	7.7826E-01	8.5553E-01	1.8816E+00	1.8850E+00	2.215E+00
Ra-226		1.5158E+00	1.5160E+00	2.6789E-01	3.3438E-01	2.359E-01
Ac-227	#A	7.5016E-01	7.5642E-01	8.1320E-01	8.1950E-01	8.114E-01
Ac-228		1.4979E+00	1.5457E+00	3.3751E-01	3.9406E-01	4.023E-01
Th-228	#B	2.6828E+00	2.9491E+00	1.1109E+01	1.1117E+01	1.389E+01
Pa-231	#B	0.0000E+00	0.0000E+00	7.5880E-01	7.5881E-01	6.556E+00
Pa-234M	#A	2.3046E+00	2.3046E+00	1.5323E+01	1.5326E+01	1.606E+01
Th-230	#B	6.8790E+00	6.8790E+00	4.4294E+01	4.4304E+01	5.583E+01
Th-232	A	4.0392E+01	4.0392E+01	7.1560E-01	7.1777E+01	8.805E+01
Th-234	#B	2.9521E+00	2.9521E+00	1.3794E+00	1.4384E+00	5.548E+00
U-235	#B	0.0000E+00	0.0000E+00	7.3181E-01	7.3182E-01	2.158E+00
U-238	#B	2.2964E+00	2.2964E+00	1.5268E+01	1.5271E+01	1.600E+01
Am-241	B	1.3296E-01	1.3301E-01	6.2683E-01	6.2711E-01	7.910E-01
Am-243	#A	2.6345E-01	2.6346E-01	2.4138E-01	2.4414E-01	2.884E-01

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:32:39 AM Page 12
Pace Analytical Spectrum name: 30204854006.Anl

- 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 (30.3 to 2035.6 keV) 3.236E+01 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 3.2611362E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	Analysis SOP	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854007	Collection Date	11/18/2016 10:40
Batch ID	33843	Method	EPA 901.1
A-code	9011 SING	Analysis Date	2/21/17 16:02
Client ID	WESTON-NJ	Matrix	SL
Analyst	MAH	HBN	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	3.645	1.611	1.304
Cesium-137	0.083	0.164	0.188
Lead-212	3.243	0.572	0.325
Potassium-40	6.619	2.015	1.271
Protactinium-234M	0.166	15.598	18.820
Radium-226	1.670	0.404	0.222
Radium-228	3.547	0.673	0.506
Thallium-208	1.133	0.265	0.148
Thorium-228	0.000	3.938	12.120
Thorium-234	1.484	2.819	3.538
Uranium-235	0.460	1.491	1.884

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:33:42 AM Page 1
Pace Analytical Spectrum name: 30204854007.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854007.An1

Acquisition information
Start time: 2/21/2017 4:02:28 PM
Live time: 900
Real time: 902
Dead time: 0.17 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.6976E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.6976E+02) =
3.7070E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

JM 2/22/17

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:33:42 AM Page 2
Pace Analytical Spectrum name: 30204854007.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 10:40:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1355

***** 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. pCi/G	Nuc
46.34	26.	47.01	0.95	2.158E-02	46.54	4.250	PBC<MDA	Pb210
					46.54	4.250	PBC<MDA	Pb210
63.21	23.	94.72	0.97	3.668E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	2.650E+01	Th232
					63.29	4.800	PBC<MDA	Th234
74.71	120.	15.51	0.98	4.125E-02	74.66	68.200	4.738E-01	Am243
					74.81	10.400	3.391E+00	Pb212
77.07	228.	9.16	0.98	4.198E-02	77.11	17.500	3.764E+00	Pb212
87.29	72.	23.76	0.99	4.456E-02	87.30	7.800	2.525E+00	Pb212
					88.03	3.610	5.703E+00	Cd109
90.00	74.	19.47	0.66	4.509E-02	89.95	3.560	5.156E+00	U235
					89.95	3.560	5.156E+00	U235
92.81	24.	97.96	1.00	4.555E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
					92.60	2.800	PBC<MDA	Th234
					92.59	5.600	PBC<MDA	U238
105.26	30.	64.02	1.01	4.704E-02	105.31	21.200	PBC<MDA	Eu155
121.37	30.	53.52	1.02	4.744E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	PBC<MDA	Co57
					123.07	40.600	PBC<MDA	Eu154
121.40	20.	84.69	1.02	4.744E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	7.049E-02	Co57
					123.07	40.600	PBC<MDA	Eu154
					123.07	40.600	1.124E-01	Eu154
236.21	16.	74.73	1.12	3.575E-02	235.97	12.300	PBC<MDA	Ac227
					235.97	12.300	PBC<MDA	Ac227
238.35	417.	6.53	0.98	3.551E-02	238.63	43.300	3.287E+00	Pb212

J

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:33:42 AM Page 3
Pace Analytical Spectrum name: 30204854007.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
241.59	46.	27.98	1.13	3.514E-02	241.92	7.470	1.965E+00	Ra226

					241.00	3.900	4.125E+00	Ra224
269.91	42.	30.50	1.15	3.249E-02	269.46	13.700	1.047E+00	Ra223
277.16	29.	40.81	0.32	3.179E-02	277.36	6.310	1.773E+00	Tl208
284.16	14.	79.89	1.16	3.121E-02	283.70	1.600	3.042E+00	Pa231
					284.30	6.140	2.979E+03	I131
					284.30	6.140	2.979E+03	I131
					283.70	1.600	3.042E+00	Pa231
294.89	79.	15.34	1.33	3.033E-02	295.22	19.200	1.515E+00	Ra226
					295.96	28.670	2.485E+00	Ir192
300.03	27.	57.83	1.18	2.995E-02	300.00	2.300	PBC<MDA	Ac227
					300.00	2.300	PBC<MDA	Ac227
328.11	35.	37.17	1.20	2.791E-02	328.76	20.300	1.214E+02	La140
					329.85	2.700	5.212E+00	Ac227
					328.76	20.300	1.214E+02	La140
					329.85	2.700	5.212E+00	Ac227
338.09	100.	10.76	1.47	2.729E-02	338.32	11.300	3.742E+00	Ac228
344.13	11.	73.34	1.21	2.692E-02	344.28	26.600	PBC<MDA	Eu152
351.68	167.	9.83	1.04	2.648E-02	351.99	37.100	1.853E+00	Ra226
462.81	29.	33.07	1.31	2.138E-02	463.36	10.500	1.535E+00	Sb125
					463.36	10.500	1.535E+00	Sb125
477.47	13.	51.31	1.33	2.089E-02	477.56	10.300	PBC<MDA	Be7
					477.56	10.300	2.315E+00	Be7
582.90	141.	9.65	1.29	1.798E-02	583.19	84.300	1.133E+00	Tl208
604.13	11.	61.38	1.43	1.751E-02	602.73	97.800	PBC<MDA	Sb124
					604.72	97.620	8.058E-02	Cs134
					604.72	97.620	8.058E-02	Cs134
609.34	114.	10.46	0.95	1.741E-02	609.31	44.800	1.633E+00	Ra226
662.03	10.	99.17	1.47	1.640E-02	661.66	85.100	PBC<MDA	Cs137
					661.66	85.100	PBC<MDA	Cs137
727.37	30.	21.08	1.14	1.532E-02	727.33	6.580	3.645E+00	Bi212
763.09	10.	31.62	1.55	1.480E-02	763.94	22.140	4.425E-01	Ag110M
					763.94	22.140	4.425E-01	Ag110M
772.53	13.	46.32	1.56	1.468E-02	772.60	75.600	HL>Cutoff	I132
					772.60	75.600	HL>Cutoff	I132
809.94	7.	77.93	1.58	1.419E-02	810.78	99.448	PBC<MDA	Co58
					810.78	99.448	1.369E-01	Co58
816.34	4.	50.00	1.59	1.413E-02	815.77	23.280	PBC<MDA	La140
					815.77	23.280	2.398E+01	La140
860.49	11.	92.82	1.62	1.361E-02	860.56	12.420	PBC<MDA	Tl208
871.68	10.	35.36	1.63	1.350E-02	871.09	99.900	8.210E-02	Nb94
					871.09	99.900	8.210E-02	Nb94
911.12	101.	11.57	0.85	1.308E-02	911.21	26.600	3.324E+00	Ac228
955.87	3.	65.73	1.69	1.266E-02	954.55	17.600	HL>Cutoff	I132
					954.55	17.600	HL>Cutoff	I132
964.20	13.	35.39	1.70	1.257E-02	964.13	14.340	7.863E-01	Eu152
969.04	67.	13.01	1.70	1.253E-02	968.97	16.200	3.776E+00	Ac228
1119.85	15.	57.95	1.80	1.133E-02	1120.29	14.800	PBC<MDA	Ra226

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:33:42 AM Page 4
Pace Analytical Spectrum name: 30204854007.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
1333.01	4.	80.77	1.94	1.002E-02	1332.50	99.986	PBC<MDA	Co60
					1332.50	99.986	PBC<MDA	Co60
1383.73	6.	45.87	1.98	9.753E-03	1384.30	24.120	PBC<MDA	Ag110M
					1384.30	24.120	PBC<MDA	Ag110M
1460.57	60.	13.72	1.64	9.379E-03	1461.00	10.670	6.619E+00	K40
1693.82	2.	96.93	2.16	8.410E-03	1690.98	47.300	PBC<MDA	Sb124
					1690.98	47.300	PBC<MDA	Sb124
1764.43	16.	49.06	2.20	8.138E-03	1764.49	15.360	1.390E+00	Ra226

********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
359.44	90.00	58.	70.	1.562E-03	38.69	0.994	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-210	184.90	46.34	36.	26.	0.029	94.02	0.954s
Th-234	252.39	63.21	131.	23.	0.026	189.44	0.970s
Pb-212	298.75	74.81	113.	112.	0.124	23.42	0.980D
Pb-212	307.95	77.11	125.	226.	0.251	19.32	0.982D
Pb-212	348.70	87.30	109.	72.	0.080	47.51	0.991D
U-235	359.49	90.00	122.	33.	0.037	134.86	0.993s
U-238	370.74	92.81	137.	24.	0.026	195.91	0.996s
Eu-155	420.52	105.26	85.	30.	0.033	128.04	1.007s
Eu-152	484.94	121.37	60.	30.	0.033	107.05	1.022s
Co-57	485.05	121.40	71.	20.	0.022	169.38	1.022
Ac-227	944.15	236.21	33.	16.	0.018	149.46	1.122s
Pb-212	953.83	238.63	67.	407.	0.452	11.43	1.124D
Ra-226	966.98	241.92	61.	46.	0.051	55.96	1.127D
Ra-223	1078.90	269.91	28.	42.	0.046	61.01	1.151
Tl-208	1107.88	277.16	25.	29.	0.032	81.63	0.323s
I-131	1135.90	284.16	25.	14.	0.015	159.79	1.164s
Ra-226	1178.80	294.89	17.	79.	0.088	30.68	1.329s
Ac-227	1199.37	300.03	51.	27.	0.030	115.66	1.177s
La-140	1311.67	328.11	32.	35.	0.039	74.34	1.202s

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Pace Analytical Spectrum name: 30204854007.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Ac-228	1351.55	338.09	4.	100.	0.112	21.52	1.472s
Eu-152	1375.71	344.13	14.	11.	0.012	146.68	1.215s
Ra-226	1405.91	351.68	26.	163.	0.182	20.26	1.045
Sb-125	1850.39	462.81	14.	29.	0.032	66.15	1.313s
Be-7	1909.00	477.47	7.	13.	0.014	102.63	1.325s
Tl-208	2330.71	582.90	11.	141.	0.156	19.30	1.291
Cs-134	2415.60	604.13	8.	11.	0.013	122.76	1.427s
Ra-226	2436.45	609.34	8.	114.	0.127	20.93	0.946s
Cs-137	2647.21	662.03	20.	10.	0.011	198.35	1.471s
Bi-212	2908.60	727.37	3.	30.	0.033	42.16	1.135s
Ag-110M	3051.50	763.09	0.	10.	0.011	63.25	1.549s
I-132	3089.23	772.53	4.	13.	0.014	92.65	1.556s
Co-58	3238.90	809.94	4.	7.	0.008	155.87	1.584s
La-140	3264.50	816.34	0.	4.	0.004	100.00	1.588s
Tl-208	3441.15	860.49	19.	11.	0.013	185.65	1.621s
Nb-94	3485.91	871.68	1.	10.	0.011	70.71	1.629s
Ac-228	3643.72	911.12	7.	101.	0.112	23.14	0.852s
I-132	3822.75	955.87	1.	3.	0.004	131.46	1.689s
Eu-152	3855.79	964.13	3.	13.	0.014	70.78	1.696D

Ac-228	3875.15	968.97	4.	67.	0.074	26.02	1.699D
Ra-226	4478.86	1119.85	10.	15.	0.016	115.90	1.804s
Co-60	5331.86	1333.01	3.	4.	0.004	161.53	1.943s
Ag-110M	5534.83	1383.73	0.	6.	0.006	91.74	1.976s
K-40	5842.37	1460.57	3.	60.	0.066	27.44	1.645
Sb-124	6776.00	1693.82	0.	2.	0.002	193.85	2.156s
Ra-226	7058.66	1764.43	7.	16.	0.017	98.13	2.197s

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Code	MDA Value pCi/G		COMMENTS
Be-7	C	2.3148E+00					5.34E+01	
			477.58	2.315E+00	?(	2.678E+00	5.13E+01	1.03E+01 G K
Na-22	C	2.1159E-02					9.50E+02	
			1274.53	2.116E-02	%(	1.535E-01	3.17E+02	9.99E+01 G K
K-40	N	6.6194E+00					4.68E+11	
			1461.00	6.619E+00	(P	1.271E+00	1.37E+01	1.07E+01 G K
Sc-46	F	9.4658E-02					8.38E+01	
			889.28	9.466E-02	%(P	2.388E-01	1.08E+02	1.00E+02 G K

C

Nuclide	Ave activity		Energy	Activity	Code	Peak	MDA	Comments
Mn-54	C	1.1543E-02					3.12E+02	
			834.85	1.154E-02	%(	2.373E-01	8.94E+02	1.00E+02 G K
Co-56	C	1.7496E-01					7.73E+01	
			1238.28	1.750E-01	&(	6.632E-01	1.77E+02	6.61E+01 G K
			1771.35	0.000E+00	% P	3.038E+00	1.00E+03	1.55E+01 G
Co-57	C	7.0487E-02					2.72E+02	
			122.06	7.049E-02	(	1.466E-01	8.47E+01	8.56E+01 G K
			136.47	-2.320E-01	%	1.277E+00	2.20E+02	1.07E+01 G
Co-58	C	1.3689E-01					7.08E+01	
			810.78	1.369E-01	?(	2.448E-01	7.79E+01	9.94E+01 G K
Fe-59	F	7.8805E-03					4.45E+01	
			1099.25	7.880E-03	%(P	9.851E-01	5.14E+03	5.65E+01 G K
			1291.60	0.000E+00	% P	2.015E+00	1.00E+03	4.32E+01 G
Co-60	F	4.5723E-02					1.92E+03	
			1332.50	4.572E-02	&(P	1.243E-01	8.08E+01	1.00E+02 G K
			1173.24	2.529E-02	% P	1.542E-01	2.44E+02	1.00E+02 G
Nb-94	I	8.2099E-02					7.41E+06	
			871.09	8.210E-02	?(P	6.195E-02	3.54E+01	9.99E+01 G K
			702.62	9.653E-03	%	1.574E-01	7.01E+02	9.79E+01 G

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Ag-108M  C   2.7895E-02                                          1.53E+05
                          722.94 2.790E-02 %(  1.529E-01 2.36E+02 9.08E+01 G K
                          614.28 4.777E-03 %   1.502E-01 1.30E+03 8.98E-01 G
                          433.94-2.736E-02 &   1.317E-01 1.99E+02 9.05E+01 G
                           79.13 6.675E-01 %   1.948E+00 1.18E+02 6.60E+00 G

Cd-109   F   7.5542E-01                                          4.64E+02
                           88.03 7.554E-01 %(  3.799E+00 1.48E+02 3.61E+00 G K

Ag-110M  F   1.2908E-01                                          2.50E+02
                          657.76 0.000E+00 %(P 2.363E-01 1.00E+03 9.40E+01 G K
                         1505.04 1.830E-01 %   1.664E+00 4.07E+02 1.29E+01 G
                         1384.30 3.444E-01 ?(P 4.543E-01 4.59E+01 2.41E+01 G
                          937.49 0.000E+00 %   6.571E-01 1.00E+03 3.41E+01 G
                          884.68 0.000E+00 % P 3.026E-01 1.00E+03 7.22E+01 G
                          763.94 4.425E-01 ?(  3.261E-01 3.18E+01 2.21E+01 G
                          744.28 0.000E+00 & P 5.339E+00 1.00E+03 4.70E+00 G
                          706.68 1.307E-01 % P 1.235E+00 4.09E+02 1.63E+01 G
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ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:33:42 AM    Page  7
Pace Analytical                  Spectrum name: 30204854007.Anl

Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Sn-113   F   4.4371E-02                                          1.15E+02
                          391.69 4.437E-02 &(  2.815E-01 2.59E+02 6.40E+01 G K

Sb-124   F   1.0803E-01                                          6.02E+01
                          602.73 9.383E-02 &(  4.487E-01 2.04E+02 9.78E+01 G K
                          645.85 0.000E+00 & P 6.861E+00 1.00E+03 7.38E+00 G
                          722.79 7.042E-01 %   3.860E+00 2.36E+02 1.08E+01 G
                         1690.98 1.374E-01 ?(P 6.174E-01 9.69E+01 4.73E+01 G

Sb-125   I   4.0204E-01                                          1.01E+03
                          427.88 0.000E+00 %(  5.099E-01 1.00E+03 2.96E+01 G K
                          176.31 0.000E+00 % P 1.811E+00 1.00E+03 6.82E+00 G
                          463.36 1.535E+00 ?(  1.067E+00 3.31E+01 1.05E+01 G
                          600.60 0.000E+00 & P 8.825E-01 1.00E+03 1.79E+01 G
                          635.95 4.965E-02 % P 1.338E+00 1.10E+03 1.13E+01 G

I-131    I   1.7129E+02                                          8.02E+00
                          364.49-3.970E+01 %(  5.433E+02 5.66E+02 8.17E+01 G K
                          636.99 1.267E+03 %   7.242E+03 2.41E+02 7.17E+00 G
                          284.30 2.979E+03 &(  5.703E+03 7.99E+01 6.14E+00 G

I-132    I   1.3539E-01                                          3.20E+00
                          772.60 1.277E-01 ?(P 1.237E-01 4.63E+01 7.56E+01 G K
                          522.65 0.000E+00 & P 9.024E-01 1.00E+03 1.60E+01 G
                          630.19 3.285E-02 &   1.033E+00 1.30E+03 1.33E+01 G
                          954.55 1.683E-01 ?(P 3.682E-01 6.57E+01 1.76E+01 G

Y-133    I   2.3533E-02                                          8.67E-01
                          529.87 2.353E-02 %(P 8.308E-02 1.37E+02 8.70E+01 G K
                          875.33 0.000E+00 %   3.063E+00 1.00E+03 4.51E+00 G

Ba-133   F  -2.8994E-02                                          3.84E+03
                          356.02-2.899E-02 %(  1.715E-01 2.36E+02 5.20E+01 G K
                           81.00 0.000E+00 % P 4.041E-01 1.00E+03 3.41E+01 G
                          302.85 1.697E-01 %   6.277E-01 1.52E+02 1.83E+01 G
                          276.40 3.843E-03 % P 1.377E+00 1.42E+04 7.16E+00 G
                          383.85 0.000E+00 % P 1.878E+00 1.00E+03 8.94E+00 G
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Cs-134    I    8.0583E-02                                                  7.52E+02
                          604.72 8.058E-02 ?(  1.110E-01 6.14E+01 9.76E+01 G K
                          801.95 1.286E-01 % P 1.888E+00 6.21E+02 8.69E+00 G
                          795.86 8.864E-02 % P 2.380E-01 1.21E+02 8.55E+01 G
                          569.33 0.000E+00 % P 1.190E+00 1.00E+03 1.54E+01 G

Cs-137    I    8.2573E-02                                                  1.10E+04
                          661.66 8.257E-02 ?(P 1.878E-01 9.92E+01 8.51E+01 G K
```

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ce-139    F    5.6161E-02                                                  1.38E+02
                          165.85 5.616E-02 %(P 1.846E-01 1.31E+02 7.99E+01 G K

La-140    I    2.1754E+01                                                  1.28E+01
                         1596.21 0.000E+00 %(  4.274E+01 1.00E+03 9.54E+01 G K
                          487.02 1.158E+01 %   3.750E+01 1.32E+02 4.55E+01 G
                          815.77 2.398E+01 ?(  4.418E+01 5.00E+01 2.33E+01 G
                          328.76 1.214E+02 ?(P 1.013E+02 3.72E+01 2.03E+01 G

Ce-141    I    5.7338E-02                                                  3.25E+01
                          145.44 5.734E-02 %(  1.662E+00 1.14E+03 4.82E+01 G K

Ce-144    I   -2.7847E-01                                                  2.85E+02
                          133.51-2.785E-01 %(  1.306E+00 1.89E+02 1.11E+01 G K

Eu-152    F    4.3120E-01                                                  4.95E+03
                          121.78 2.519E-01 &(P 3.247E-01 5.35E+01 2.84E+01 G K
                         1408.01 4.676E-02 %   7.464E-01 6.86E+02 2.09E+01 G
                         1112.12 2.438E-02 %   1.258E+00 2.26E+03 1.36E+01 G
                         1085.91-1.637E-01 %   1.690E+00 4.57E+02 9.92E+00 G
                          964.13 7.863E-01  (P 7.098E-01 3.54E+01 1.43E+01 G
                          344.28 1.755E-01 - P 3.160E-01 7.33E+01 2.66E+01 G
                          244.70 0.000E+00 % P 1.466E+00 1.00E+03 7.49E+00 G

Eu-155    I    1.8941E-01                                                  1.74E+03
                           86.54 8.384E-02 %(P 4.705E-01 2.25E+02 3.07E+01 G K
                          105.31 3.423E-01 ?(P 5.309E-01 6.40E+01 2.12E+01 G

Ir-192    F   -1.3340E-02                                                  7.38E+01
                          316.51-1.334E-02 %(  2.819E-01 8.29E+02 8.28E+01 G
                          468.07 1.320E-01 & P 7.467E-01 2.35E+02 4.78E+01 G
                          308.46-2.217E-01 %   1.009E+00 1.87E+02 3.00E+01 G
                          295.96 0.000E+00 % P 9.514E-01 1.00E+03 2.87E+01 G

Hg-203    F    1.9581E-01                                                  4.66E+01
                          279.20 1.958E-01 %(P 4.950E-01 1.04E+02 8.15E+01 G K

Tl-208    N    1.1325E+00                                                  6.98E+02
                          583.19 1.133E+00  (P 1.484E-01 9.65E+00 8.45E+01 G K
                          860.56 8.253E-01 - P 1.651E+00 9.28E+01 1.24E+01 G
                          277.36 1.773E+00 - P 1.584E+00 4.08E+01 6.31E+00 G

Pb-210    N    3.1996E+00                                                  8.14E+03
                           46.54 3.200E+00 *(P 3.746E+00 4.70E+01 4.25E+00 G K
```

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Bi-212	N	3.6446E+00					6.98E+02	
			727.33	3.645E+00	(P	1.304E+00	2.11E+01	6.98E+00 G K
			1620.50	5.200E+00	%	1.290E+01	1.17E+02	1.49E+00 G
Pb-212	N	3.2430E+00					6.98E+02	
			238.63	3.243E+00	(P	3.252E-01	5.71E+00	4.33E+01 G K
			77.11	3.765E+00	P	9.135E-01	9.96E+00	1.75E+01 GA
			74.81	3.195E+00 }	P	1.493E+00	1.17E+01	1.04E+01 GA
			87.30	2.525E+00 -		1.811E+00	2.38E+01	7.80E+00 GA
Ra-223	N	1.0466E+00					7.96E+03	
			269.46	1.047E+00	(	6.957E-01	3.05E+01	1.37E+01 G K
			83.78	-1.751E-01	%	5.877E-01	1.34E+02	2.49E+01 G
			323.87	0.000E+00	% P	3.218E+00	1.00E+03	3.93E+00 G
			154.21	0.000E+00	% P	2.034E+00	1.00E+03	5.62E+00 G
			94.90	0.000E+00	% P	1.363E+00	1.00E+03	1.13E+01 G
			81.07	1.575E-01	% P	8.315E-01	2.07E+02	1.50E+01 G
Ra-224	N	4.5651E-01					6.98E+02	
			241.00	4.565E-01	&(P	3.202E+00	2.88E+02	3.90E+00 G K
Ra-226	N	1.6704E+00					5.84E+05	
			609.31	1.633E+00	(P	2.220E-01	1.05E+01	4.48E+01 G K
			1764.49	1.390E+00	&(P	1.370E+00	4.91E+01	1.54E+01 G
			295.22	1.515E+00	@(P	4.166E-01	1.53E+01	1.92E+01 G
			1120.29	9.766E-01	- P	1.173E+00	5.79E+01	1.48E+01 G
			351.99	1.853E+00	(P	2.983E-01	1.01E+01	3.71E+01 G
			241.92	1.965E+00	(P	1.655E+00	2.80E-01	7.47E+00 G
Ac-227	N	1.0399E+00					7.95E+03	
			235.97	4.190E-01	?(P	7.481E-01	7.47E+01	1.23E+01 G K
			256.25	4.281E-01	%	1.495E+00	1.44E+02	7.00E+00 G
			300.00	4.361E+00	?(P	5.876E+00	5.78E+01	2.30E+00 G
			329.85	0.000E+00	%	7.188E+00	1.00E+03	2.70E+00 G
Ac-228	N	3.5468E+00					2.10E+03	
			911.21	3.324E+00	(P	5.061E-01	1.16E+01	2.66E+01 G K
			968.97	3.776E+00	(P	6.983E-01	1.30E+01	1.62E+01 G
			338.32	3.742E+00	*(P	4.276E-01	1.08E+01	1.13E+01 G
Pa-231	N	1.8178E+00					1.20E+07	
			283.70	1.818E+00	%(	6.725E+00	1.52E+02	1.60E+00 G K
			330.00	-3.949E+00	%	1.307E+01	1.39E+02	1.30E+00 G
Pa-234M	N	1.6557E-01					1.63E+12	
							Energy duplication	
			1001.03	1.656E-01	%(P	1.882E+01	4.71E+03	8.37E-01 G

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Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Th-230	N	-9.8564E+00					2.75E+07	
			67.67	-9.856E+00	%(	4.326E+01	1.78E+02	3.80E-01 G K
Th-232	N	1.2043E+01					4.17E+12	
			63.81	1.204E+01	&(	6.561E+01	2.16E+02	2.67E-01 G K

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Th-234    N    1.4842E+00                                          1.63E+12
                              63.29 1.484E+00 &(P 3.538E+00 9.47E+01 4.80E+00 G K
                              92.60 1.908E+00 % P 5.034E+00 1.06E+02 2.80E+00 G

U-235     N    4.6025E-01                                          2.57E+11
                             205.31 4.602E-01 &(P 1.884E+00 1.62E+02 5.01E+00 G K
                             143.76 0.000E+00 % P 9.654E-01 1.00E+03 1.10E+01 G
                              89.95 2.300E+00     3.755E+00 6.74E+01 3.56E+00 GA

U-238     N    1.6498E-01                                          1.63E+12
                                                                  Energy duplication
                            1001.03 1.650E-01 %(P 1.875E+01 4.71E+03 8.40E-01 G K
                              92.59 1.029E+00 * P 2.502E+00 9.80E+01 5.60E+00 GA

Am-241    T    1.2393E-01                                          1.58E+05
                              59.54 1.239E-01 &(  4.043E-01 1.26E+02 3.63E+01 G K
```

(- 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

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M - No MDA Calculation
R - Coincidence Corrected
H - Halflife limit exceeded
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 2 Sigma %	Activity	
Pb-210	46.34	36.	26.	0.029	94.02	3.200E+00	P
Th-234	63.21	131.	23.	0.026	189.44	1.484E+00	P
U-235	90.00	122.	33.	0.037	134.86	2.300E+00	
U-238	92.81	137.	24.	0.026	195.91	1.029E+00	P
Ac-227	236.21	33.	16.	0.018	149.46	4.190E-01	P

I-131	284.16	25.	14.	0.015	159.79	2.979E+03	
Ac-227	300.03	51.	27.	0.030	115.66	4.361E+00	P
La-140	328.11	32.	35.	0.039	74.34	1.214E+02	P
Sb-125	462.81	14.	29.	0.032	66.15	1.535E+00	
Be-7	477.47	7.	13.	0.014	102.63	2.315E+00	
Cs-134	604.13	8.	11.	0.013	122.76	8.058E-02	
Cs-137	662.03	20.	10.	0.011	198.35	8.257E-02	P
Ag-110M	763.09	0.	10.	0.011	63.25	4.425E-01	
I-132	772.53	4.	13.	0.014	92.65	0.000E+00	P
Co-58	809.94	4.	7.	0.008	155.87	1.369E-01	
La-140	816.34	0.	4.	0.004	100.00	2.398E+01	
Nb-94	871.68	1.	10.	0.011	70.71	8.210E-02	P
I-132	955.87	1.	3.	0.004	131.46	0.000E+00	P
Co-60	1333.01	3.	4.	0.004	161.53	4.572E-02	P
Ag-110M	1383.73	0.	6.	0.006	91.74	3.444E-01	P
Sb-124	1693.82	0.	2.	0.002	193.85	1.374E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#A	6.7252E-01	2.3148E+00	2.3756E+00	2.3951E+00	2.678E+00
Na-22	#B	1.9738E-02	2.1159E-02	1.3399E-01	1.3401E-01	1.535E-01
K-40		6.6194E+00	6.6194E+00	1.8161E+00	2.0154E+00	1.271E+00
Sc-46	#B	4.3057E-02	9.4658E-02	2.0388E-01	2.0426E-01	2.388E-01
Cr-51	#B	0.0000E+00	0.0000E+00	3.7562E+00	3.7563E+00	1.278E+01
Mn-54	#B	9.3443E-03	1.1543E-02	2.0642E-01	2.0642E-01	2.373E-01
Co-56	#B	7.4466E-02	1.7496E-01	6.2008E-01	6.2051E-01	6.632E-01
Co-57	A	5.5289E-02	7.0487E-02	1.1939E-01	1.1976E-01	1.466E-01
Co-58	#A	5.3904E-02	1.3689E-01	2.1337E-01	2.1414E-01	2.448E-01
Fe-59	#B	1.7881E-03	7.8805E-03	8.1054E-01	8.1054E-01	9.851E-01
Co-60	#A	4.4181E-02	4.5723E-02	7.3857E-02	7.4099E-02	1.243E-01
Zn-65	#B	0.0000E+00	0.0000E+00	5.0746E-02	5.0747E-02	4.543E-01
Y-88	#B	0.0000E+00	0.0000E+00	5.2830E-02	5.2832E-02	4.962E-01

Nb-94	#	8.2098E-02	8.2099E-02	5.8054E-02	5.9060E-02	6.195E-02
Zr-95	#B	0.0000E+00	0.0000E+00	2.7220E-01	2.7220E-01	1.143E+00
Nb-95	#B	0.0000E+00	0.0000E+00	9.9643E-02	9.9645E-02	1.207E+00
Ru-103	#B	0.0000E+00	0.0000E+00	9.1723E-02	9.1725E-02	9.012E-01
Ag-108M	#B	2.7883E-02	2.7895E-02	1.3153E-01	1.3158E-01	1.529E-01
Ru-106	#B	0.0000E+00	0.0000E+00	3.1210E-01	3.1211E-01	1.839E+00
Cd-109	B	6.5523E-01	7.5542E-01	2.2293E+00	2.2319E+00	3.799E+00
Ag-110M	#B	9.9104E-02	1.2908E-01	8.1635E-02	8.3409E-02	2.363E-01
Sn-113	#B	2.5005E-02	4.4371E-02	2.2995E-01	2.3002E-01	2.815E-01
Sb-124	#B	3.6089E-02	1.0803E-01	2.0942E-01	2.0991E-01	4.487E-01
Sb-125	#B	3.7656E-01	4.0204E-01	2.6595E-01	2.7118E-01	5.099E-01
Te-129	#B	0.0000E+00	0.0000E+00	5.4215E+00	5.4216E+00	1.242E+01
Te-129M	#B	0.0000E+00	0.0000E+00	1.0582E+01	1.0582E+01	4.959E+01
I-131	#B	4.5658E-02	1.7129E+02	2.7371E+02	2.7464E+02	5.433E+02
I-132	#	1.3539E-01	>12 Halflives	1.0887E-01	1.1034E-01	1.237E-01
Te-132	#B	0.0000E+00	>12 Halflives	4.2622E-02	4.2623E-02	1.320E-01
I-133	#B	2.3533E-02	>12 Halflives	6.4538E-02	6.4613E-02	8.308E-02
Ba-133	#B	-2.8499E-02	-2.8994E-02	1.3673E-01	1.3678E-01	1.715E-01
Cs-134	#A	7.3815E-02	8.0583E-02	9.8921E-02	9.9494E-02	1.110E-01
Cs-136	#B	0.0000E+00	0.0000E+00	2.3879E+00	2.3880E+00	2.339E+01
Cs-137	#A	8.2078E-02	8.2573E-02	1.6378E-01	1.6415E-01	1.878E-01

Ce-139	#B	3.4768E-02	5.6161E-02	1.4766E-01	1.4785E-01	1.846E-01
Ba-140	#B	0.0000E+00	0.0000E+00	8.4594E+00	8.4595E+00	1.136E+02
La-140	#B	1.2283E-01	2.1754E+01	1.6172E+01	1.6434E-01	4.274E+01
Ce-141	#B	7.5237E-03	5.7338E-02	1.3125E+00	1.3125E+00	1.662E+00
Ce-144	#B	-2.2088E-01	-2.7847E-01	1.0501E+00	1.0508E+00	1.306E+00
Eu-152		4.2548E-01	4.3120E-01	2.7668E-01	2.8266E-01	3.247E-01
Eu-154	#B	0.0000E+00	0.0000E+00	1.1452E-01	1.1452E-01	2.955E-01
Eu-155	B	1.8235E-01	1.8941E-01	2.4252E-01	2.4398E-01	4.705E-01
Ir-192	#A	-5.4563E-03	-1.3340E-02	2.2116E-01	2.2117E-01	2.819E-01
Hg-203	#B	4.7515E-02	1.9581E-01	4.0804E-01	4.0888E-01	4.950E-01
Tl-208		1.0303E+00	1.1325E+00	2.1867E-01	2.6502E-01	1.484E-01
Pb-210	#A	3.1738E+00	3.1996E+00	3.0083E+00	3.0419E+00	3.746E+00
Bi-212		3.3156E+00	3.6446E+00	1.5364E+00	1.6106E+00	1.304E+00
Pb-212		2.9502E+00	3.2430E+00	3.7066E-01	5.7237E-01	3.252E-01
Ra-223		1.0379E+00	1.0466E+00	6.3849E-01	6.5369E-01	6.957E-01
Ra-224	#B	4.1530E-01	4.5651E-01	2.6258E+00	2.6266E+00	3.202E+00
Ra-226		1.6702E+00	1.6704E+00	3.3840E-01	4.0425E-01	2.220E-01
Ac-227	#	1.0313E+00	1.0399E+00	9.8266E-01	9.9256E-01	7.481E-01
Ac-228		3.4371E+00	3.5468E+00	4.8393E-01	6.7330E-01	5.061E-01
Th-228	#B	0.0000E+00	0.0000E+00	3.9380E+00	3.9381E+00	1.212E+01
Pa-231	#B	1.8178E+00	1.8178E+00	5.5121E+00	5.5175E+00	6.725E+00
Pa-234M	#A	1.6557E-01	1.6557E-01	1.5598E+01	1.5598E+01	1.882E-01
Th-230	#B	-9.8564E+00	-9.8564E+00	3.5052E+01	3.5078E+01	4.326E+01
Th-232	#B	1.2043E+01	1.2043E+01	5.1929E+01	5.1956E+01	6.561E+01
Th-234	#A	1.4842E+00	1.4842E+00	2.8116E+00	2.8191E+00	3.538E+00
U-235	#B	4.6025E-01	4.6025E-01	1.4896E+00	1.4909E+00	1.884E+00
U-238	#B	1.6498E-01	1.6498E-01	1.5542E+01	1.5542E+01	1.875E+01
Am-241	#B	1.2388E-01	1.2393E-01	3.1246E-01	3.1295E-01	4.043E-01

Am-243	#B	0.0000E+00	0.0000E+00	2.4850E-01	2.4850E-01	4.202E-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 (30.1 to 2035.5 keV) 1.945E+01 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 2.0287888E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854008	**Collection Date**	11/18/2016 10:36
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/21/17 16:36
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248250

Test	Activity	Uncertainty	MDC
Bismuth-212	1.655	1.402	1.579
Cesium-137	0.040	0.105	0.114
Lead-212	1.069	0.270	0.277
Potassium-40	10.112	2.253	1.009
Protactinium-234M	4.326	11.663	12.280
Radium-226	2.334	0.432	0.174
Radium-228	1.645	0.410	0.170
Thallium-208	0.370	0.122	0.096
Thorium-228	10.586	5.458	11.070
Thorium-234	2.722	2.422	4.809
Uranium-235	0.000	0.848	1.895

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:34:46 AM Page 1
Pace Analytical Spectrum name: 30204854008.Anl

Sample description
WL 33843

Spectrum Filename: C:\User\30204854008.Anl

Acquisition information
Start time: 2/21/2017 4:36:25 PM
Live time: 900
Real time: 903
Dead time: 0.38 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).Clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.5688E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.5688E+02) =
3.8929E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:34:46 AM Page 2
Pace Analytical Spectrum name: 30204854008.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 10:38:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_bkg_021717PaceRa226(80Z).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1266

***** 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. pCi/G	Nuc
59.42	31.	54.33	1.07	1.753E-02	59.54	36.300	PBC<MDA	Am241
					59.54	36.300	5.666E-01	Am241
74.66	75.	20.60	1.08	3.183E-02	74.66	68.200	3.956E-01	Am243
					74.81	10.400	2.885E+00	Pb212
77.25	96.	16.46	1.09	3.386E-02	77.11	17.500	2.068E+00	Pb212
84.15	34.	39.33	1.09	3.875E-02	84.37	1.266	PBC<MDA	Th228
					83.78	24.900	PBC<MDA	Ra223
87.08	53.	25.94	1.10	4.047E-02	86.54	30.700	PBC<MDA	Eu155
					87.30	7.800	2.148E+00	Pb212
92.72	46.	44.54	1.10	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
					92.60	2.800	4.451E+00	Th234
					92.59	5.600	PBC<MDA	U238
92.72	47.	43.94	1.10	4.318E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
121.97	27.	62.72	1.13	5.126E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	PBC<MDA	Co57
					122.06	85.600	PBC<MDA	Co57
					121.78	28.400	2.223E-01	Eu152
					123.07	40.600	1.562E-01	Eu154
185.92	80.	16.52	0.81	5.073E-02				
215.97	18.	74.85	1.24	4.831E-02	215.99	0.263	PBC<MDA	Th228
238.57	167.	10.70	1.26	4.642E-02	238.63	43.300	1.069E+00	Pb212
240.10	16.	85.39	1.26	4.623E-02	241.00	3.900	PBC<MDA	Ra224
					241.00	3.900	PBC<MDA	Ra224
241.86	64.	20.95	1.26	4.615E-02	241.92	7.470	2.168E+00	Ra226
244.81	15.	95.22	1.27	4.592E-02	244.70	7.490	PBC<MDA	Eu152

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:34:46 AM Page 3
Pace Analytical Spectrum name: 30204854008.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					244.70	7.490	5.167E-01	Eu152

278.62	30.	51.99	1.30	4.322E-02	279.20	81.460	PBC<MDA	Hg203
					279.20	81.460	PBC<MDA	Hg203
283.43	19.	59.78	1.31	4.289E-02	283.70	1.600	PBC<MDA	Pa231
					284.30	6.140	PBC<MDA	I131
					283.70	1.600	PBC<MDA	Pa231
294.80	145.	11.42	1.34	4.207E-02	295.22	19.200	2.098E+00	Ra226
					295.96	28.670	3.440E+00	Ir192
338.06	74.	17.59	1.95	3.926E-02	338.32	11.300	2.001E+00	Ac228
351.78	318.	7.10	1.55	3.847E-02	351.99	37.100	2.595E+00	Ra226
487.19	14.	78.54	1.52	3.235E-02	487.02	45.500	PBC<MDA	La140
					487.39	1.420	2.562E+01	Te129
					487.39	1.420	2.562E+01	Te129
					487.02	45.500	PBC<MDA	La140
582.90	71.	15.15	1.03	2.934E-02	583.19	84.500	3.701E-01	Tl208
602.27	21.	52.16	1.63	2.882E-02	602.73	97.800	PBC<MDA	Sb124
					602.73	97.800	2.608E-01	Sb124
609.19	237.	7.51	1.20	2.865E-02	609.31	44.800	2.137E+00	Ra226
637.11	11.	53.88	1.66	2.796E-02	635.95	11.300	PBC<MDA	Sb125
					636.99	7.170	PBC<MDA	I131
					635.95	11.300	PBC<MDA	Sb125
					636.99	7.170	PBC<MDA	I131
695.68	13.	49.34	1.72	2.663E-02	695.88	3.000	PBC<MDA	Te129M
					695.88	3.000	PBC<MDA	Te129M
702.55	10.	81.42	1.73	2.649E-02	702.62	97.900	PBC<MDA	Nb94
					702.62	97.900	PBC<MDA	Nb94
727.26	22.	48.41	1.75	2.599E-02	727.33	6.580	1.620E+00	Bi212
					727.33	6.580	1.620E+00	Bi212
801.85	18.	28.29	1.82	2.461E-02	801.95	8.690	1.089E+00	Cs134
					801.95	8.690	1.089E+00	Cs134
885.00	9.	72.22	1.90	2.328E-02	884.68	72.200	PBC<MDA	Ag110M
					884.68	72.200	8.003E-02	Ag110M
889.54	9.	98.17	1.90	2.321E-02	889.28	99.984	PBC<MDA	Sc46
					889.28	99.984	9.600E-02	Sc46
911.01	75.	11.82	1.30	2.289E-02	911.21	26.600	1.494E+00	Ac228
963.61	14.	72.36	1.97	2.215E-02	964.13	14.340	PBC<MDA	Eu152
					964.13	14.340	5.409E-01	Eu152
1048.20	15.	26.66	2.05	2.108E-02	1048.07	80.000	1.566E+01	Cs136
					1048.07	80.000	1.566E+01	Cs136
1120.51	40.	34.25	2.11	2.024E-02	1120.29	14.800	1.554E+00	Ra226
1238.12	43.	15.53	0.62	1.901E-02	1238.28	66.070	9.337E-01	Co56
1460.68	157.	8.99	2.52	1.704E-02	1461.00	10.670	1.011E+01	K40
1596.11	7.	37.80	2.50	1.600E-02	1596.21	95.400	PBC<MDA	La140
					1596.21	95.400	9.508E+00	La140
1621.57	3.	68.19	2.52	1.582E-02	1620.50	1.490	PBC<MDA	Bi212
					1620.50	1.490	PBC<MDA	Bi212
1764.56	65.	17.08	2.63	1.484E-02	1764.49	15.360	3.315E+00	Ra226

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:34:46 AM Page 4
Pace Analytical Spectrum name: 30204854008.An1

********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
742.46	185.92	28.	80.	1.587E+03	33.03	0.805	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Am-241	236.57	59.42	65.	31.	0.034	108.66	1.067s
Am-243	297.52	74.66	210.	35.	0.039	121.80	0.939D
Pb-212	298.12	74.81	80.	28.	0.031	76.63	1.083D
Pb-212	307.32	77.11	94.	90.	0.100	37.28	1.086D
Th-228	336.36	84.37	72.	34.	0.038	78.66	1.094D
Pb-212	348.07	87.30	67.	53.	0.059	51.87	1.097D
U-235	356.50	89.41	162.	-36.	-0.041	145.94	1.100s
U-238	369.74	92.72	94.	46.	0.051	89.09	1.103s
Th-234	369.74	92.72	93.	47.	0.052	87.88	1.103s
Co-57	486.71	121.97	64.	27.	0.030	125.43	1.135s
Th-228	862.65	215.97	38.	18.	0.021	149.70	1.235
Pb-212	953.29	238.63	76.	167.	0.186	21.40	1.259D
Ra-224	959.17	240.10	40.	16.	0.018	170.79	1.262s
Ra-226	966.44	241.92	57.	64.	0.071	41.91	1.263D
Eu-152	978.00	244.81	42.	15.	0.017	190.44	1.266s
Hg-203	1113.21	278.62	46.	30.	0.033	103.97	1.302s
Pa-231	1132.48	283.43	26.	19.	0.021	119.57	1.307s
Ra-226	1177.92	294.80	29.	145.	0.161	22.85	1.343
Ac-228	1350.96	338.06	17.	74.	0.082	35.18	1.950s
Ra-226	1405.84	351.78	32.	317.	0.352	14.28	1.545s
La-140	1947.46	487.19	21.	14.	0.016	157.09	1.515s
Tl-208	2330.34	582.90	12.	71.	0.079	30.29	1.028s
Sb-124	2407.80	602.27	18.	21.	0.023	104.33	1.630s
Ra-226	2435.27	609.14	12.	247.	0.274	14.33	1.206s
I-131	2547.18	637.11	5.	11.	0.013	107.75	1.664s
Te-129M	2781.49	695.68	6.	13.	0.015	98.67	1.721s
Nb-94	2808.95	702.55	9.	10.	0.011	162.84	1.728s
Bi-212	2907.82	727.26	15.	22.	0.024	96.82	1.751s

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:34:46 AM Page 5
Pace Analytical Spectrum name: 30204854008.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Cs-134	3206.23	801.85	4.	18.	0.020	56.58	1.822s
Ag-110M	3538.91	885.00	5.	9.	0.010	144.44	1.899s
Sc-46	3557.08	889.54	10.	9.	0.010	196.34	1.903s
Ac-228	3642.95	911.01	2.	75.	0.084	23.64	1.300s
Eu-152	3853.41	963.61	16.	14.	0.016	144.72	1.972s
Cs-136	4191.87	1048.20	0.	15.	0.017	53.33	2.047s
Ra-226	4481.24	1120.51	23.	40.	0.044	68.48	2.111s
Co-56	4951.86	1238.12	0.	43.	0.047	31.06	0.625s
K-40	5842.53	1460.68	8.	157.	0.175	17.98	2.518s
La-140	6384.57	1596.11	0.	7.	0.008	75.59	2.505s
Bi-212	6486.50	1621.57	1.	3.	0.004	136.38	2.523s
Ra-226	7058.85	1764.56	8.	65.	0.072	34.15	2.633s

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Code	Peak MDA Value pCi/G		COMMENTS
Be-7	C	3.7850E-01					5.34E+01	
			477.56	3.785E-01	%(	2.865E+00	3.32E+02	1.03E+01 G K
K-40	N	1.0112E+01					4.68E+11	
			1461.00	1.011E+01	*(P	1.009E+00	8.99E+00	1.07E+01 G K
Sc-46	F	9.5999E-02					8.38E+01	
			889.28	9.600E-02	?(	1.959E-01	9.82E+01	1.00E+02 G K
Cr-51	F	-3.1129E-01					2.77E+01	
			320.08	-3.113E-01	%(	8.519E+00	1.13E+03	1.01E+01 G K
Mn-54	C	-1.9012E-02					3.12E+02	
			834.85	-1.901E-02	&(	1.538E-01	3.79E+02	1.00E+02 G K
Co-56	C	9.3372E-01					7.73E+01	
			1238.28	9.337E-01	(P	1.612E-01	1.55E+01	6.61E+01 G K
			1771.35	0.000E+00	%	4.457E+00	1.00E+03	1.55E+01 G
Co-57	C	9.2732E-02					2.72E+02	
			122.06	9.273E-02	?(P	1.355E-01	6.27E+01	8.56E+01 G K
			136.47	0.000E+00	& P	1.179E+00	1.00E+03	1.07E+01 G
Co-58	C	1.8311E-02					7.08E+01	
			810.78	1.831E-02	%(	2.497E-01	6.19E+02	9.94E+01 G K

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ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:34:46 AM Page 6
Pace Analytical Spectrum name: 30204854008.Anl

Nuclide	Ave activity		Energy	Activity	Code	Peak	MDA	Comments
Y-88	C	-2.5354E-03					1.07E+02	
			1836.06	-2.535E-03	%(	2.310E-01	4.60E+03	9.92E+01 G K
			898.04	2.603E-02	% P	2.167E-01	3.88E+02	9.37E+01 G
Nb-94	I	2.1248E-02					7.41E+06	
			871.09	0.000E+00	%(P	1.218E-01	1.00E+03	9.99E+01 G K
			702.62	4.293E-02	?(P	7.687E-02	8.14E+01	9.79E+01 G
Zr-95	I	-3.5518E-02					6.40E+01	
			756.73	-3.552E-02	%(	4.843E-01	6.19E+02	5.45E+01 G K
			724.20	0.000E+00	% P	1.096E+00	1.00E+03	4.42E+01 G
Ru-103	I	1.2539E-01					3.93E+01	
			497.08	1.254E-01	%(P	4.754E-01	1.67E+02	9.10E+01 G K
Ag-108M	C	4.5439E-03					1.53E+05	
			722.94	4.544E-03	%(P	1.375E-01	1.42E+03	9.08E+01 G K
			614.28	-4.567E-03	%	1.229E-01	1.22E+03	8.98E+01 G
			433.94	1.251E-02	%	1.071E-01	3.69E+02	9.05E+01 G
			79.13	-2.261E-01	%	2.400E+00	4.23E+02	6.60E+00 G
Ru-106	I	-1.9847E-01					3.73E+02	
			621.93	-1.985E-01	%(	1.522E+00	3.55E+02	9.93E+00 G K
Cd-109	F	-1.0962E+00					4.64E+02	
			88.03	-1.096E+00	%(	4.172E+00	1.12E+02	3.61E+00 G K

```
Ag-110M   F   4.5020E-02                                          2.50E+02
                          657.76 1.813E-02 %(P 1.221E-01 2.92E+02 9.40E+01 G K
                         1505.04 7.046E-02 %   1.375E+00 9.92E+02 1.29E+01 G
                         1384.30-5.358E-02 %   8.127E-01 7.72E+02 2.41E+01 G
                          937.49 0.000E+00 % P 6.554E-01 1.00E+03 3.41E+01 G
                          884.68 8.003E-02 ?(  1.205E-01 7.22E+01 7.22E+01 G
                          763.94 0.000E+00 %   9.977E-01 1.00E+03 2.21E+01 G
                          744.28 2.777E-01 % P 2.950E+00 4.91E+02 4.70E+00 G
                          706.68 0.000E+00 & P 1.152E+00 1.00E+03 1.63E+01 G

Sn-113    F   6.7102E-02                                          1.15E+02
                          391.69 6.710E-02 &(P 2.573E-01 1.67E+02 6.40E+01 G K

Sb-124    F   2.6082E-01                                          6.02E+01
                          602.73 2.608E-01 ?(  2.792E-01 5.22E+01 9.78E+01 G K
                          645.85-2.564E-01 %   4.934E+00 8.81E+02 7.38E+00 G
                          722.79 1.081E+00 %   2.894E+00 1.27E+02 1.08E+01 G
                         1690.98 1.529E-01 %   7.188E-01 2.38E+02 4.73E+01 G
```



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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Sb-125   I  -4.4578E-02                                          1.01E+03
                          427.88-4.458E-02 &(  3.467E-01 3.36E+02 2.96E+01 G K
                          176.31 0.000E+00 % P 1.672E+00 1.00E+03 6.82E+00 G
                          463.36 1.381E-01 % P 1.126E+00 3.66E+02 1.05E+01 G
                          600.60 0.000E+00 % P 8.618E-01 1.00E+03 1.79E+01 G
                          635.95 1.391E-02 & P 8.109E-01 2.50E+03 1.13E+01 G

Te-129   I   4.3270E-01                                          3.36E+01
                          459.60 4.327E-01 &(  1.064E+01 1.10E+03 7.70E+00 G K
                          487.39 4.844E+00 %   5.379E+01 4.96E+02 1.42E+00 G

Te-129M  I   1.3679E+01                                          3.36E+01
                          695.88 1.368E+01 ?(P 1.464E-01 4.93E+01 3.00E+00 G K

I-131    I   2.0077E+02                                          8.02E+00
                          364.49 0.000E+00 %(P 4.319E+02 1.00E+03 8.17E+01 G K
                          636.99 2.488E+03 &(P 2.797E+03 5.39E+01 7.17E+00 G
                          284.30 0.000E+00 % P 6.100E+03 1.00E+03 6.14E+00 G

Te-132   I   2.2373E-02                                          3.20E+00
                          228.16 2.237E-02 %(P 1.232E-01 2.37E+02 8.80E+01 G K

Cs-134   I   8.9004E-02                                          7.52E+02
                          604.72 0.000E+00 %(P 2.289E-01 1.00E+03 9.76E+01 G K
                          801.95 1.089E+00 ?(P 7.004E-01 2.83E+01 8.69E+00 G
                          795.86-2.918E-02 %   1.800E-01 2.94E+02 8.55E+01 G
                          569.33 1.947E-01 % P 6.430E-01 1.42E+02 1.54E+01 G

Cs-136   F   8.5931E+00                                          1.32E+01
                          818.51 2.560E+00 %(P 1.693E+01 3.08E+02 9.97E-01 G K
                          176.60 0.000E+00 % P 1.666E+02 1.00E+03 1.00E+01 G
                          273.65-4.553E+01 %   1.483E+02 1.41E+02 1.11E+01 G
                          340.55 5.165E+00 &   2.470E+01 2.04E+02 4.22E+01 G
                         1048.07 1.566E+01 ?(P 7.711E+00 2.67E+01 8.00E+01 G
                         1235.36 0.000E+00 % P 1.407E+02 1.00E+03 2.00E+01 G

Cs-137   I   4.0375E-02                                          1.10E+04
```

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                                661.66 4.037E-02 &(  1.135E-01 1.29E+02 8.51E+01 G K

Ce-139    F  -5.5319E-02                                          1.38E+02
                                165.85-5.532E-02 %(  2.008E-01 1.52E+02 7.99E+01 G K

Ba-140    I   2.5841E+00                                          1.28E+01
                                537.26 2.584E+00 %(P 7.216E+01 1.23E+03 2.44E+01 G K
                                162.66 6.892E+01 % P 2.739E+02 1.65E+02 6.22E+00 G
```

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Pace Analytical Spectrum name: 30204854008.Anl

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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

La-140    I   1.2855E+01                                          1.28E+01
                               1596.21 9.508E+00 ?(  1.001E+01 3.78E+01 9.54E+01 G K
                                487.02 1.987E+01 ?(P 3.382E+01 7.85E+01 4.55E+01 G
                                815.77 0.000E+00 %   1.089E+02 1.00E+03 2.33E+01 G
                                328.76 1.410E+01 %   8.752E+01 2.64E+02 2.03E+01 G

Ce-141    I   5.8646E-01                                          3.25E+01
                                145.44 5.865E-01 %(  1.400E+00 1.00E+02 4.82E+01 G K

Ce-144    I   2.8402E-02                                          2.85E+02
                                133.51 2.840E-02 %(P 1.088E+00 1.57E+03 1.11E+01 G K

Eu-152    F   2.5814E-01                                          4.95E+03
                                121.78 4.719E-02 %(P 3.765E-01 3.30E+02 2.84E+01 G K
                               1408.01 0.000E+00 % P 6.202E-01 1.00E+03 2.09E+01 G
                               1112.12 0.000E+00 % P 9.412E-01 1.00E+03 1.36E+01 G
                               1085.91 0.000E+00 % P 1.428E+00 1.00E+03 9.92E+00 G
                                964.13 5.409E-01 ?(  7.854E-01 7.24E+01 1.43E+01 G
                                344.28 0.000E-00 % P 3.619E-01 1.00E+03 2.56E+01 G
                                244.70 5.167E-01 ?(  1.134E+00 9.52E+01 7.49E+00 G

Hg-203    F   4.0555E-01                                          4.68E+01
                                279.20 4.056E-01 &(P 4.714E-01 5.20E+01 8.15E+01 G K

Tl-208    N   3.7014E-01                                          6.98E+02
                                583.19 3.701E-01 @(P 9.629E-02 1.51E+01 8.45E+01 G K
                                850.56 3.208E-01 %   1.045E+00 1.58E+02 1.24E+01 G
                                277.36 7.680E-01 % P 1.803E+00 1.01E+02 6.31E+00 G

Pb-210    N   3.7162E+00                                          8.14E+03
                                 46.54 3.716E+00 &(P 2.438E+01 2.59E+02 4.25E+00 G K

Bi-212    N   1.6554E+00                                          6.98E+02
                                727.33 1.620E+00  (P 1.579E+00 4.84E+01 6.58E+00 G K
                               1620.50 1.811E+00 ?(P 4.017E+00 6.82E+01 1.49E+00 G

Pb-212    N   1.0687E+00                                          6.98E+02
                                238.63 1.069E+00  (P 2.768E-01 1.07E+01 4.33E+01 G K
                                 77.11 1.948E+00 + P 1.043E+00 1.86E+01 1.75E+01 GA
                                 74.81 1.069E+00 } P 1.718E+00 3.83E+01 1.04E+01 GA
                                 87.30 2.148E+00 +   1.666E+00 2.59E+01 7.80E+00 GA

Ra-223    N   1.2629E-01                                          7.96E+03
                                269.46 1.263E-01 %(P 7.801E-01 2.65E+02 1.37E+01 G K
                                 83.78-1.398E-01 %   5.453E-01 1.57E+02 2.49E+01 G
                                323.87 4.850E-01 % P 2.156E+00 1.88E+02 3.93E+00 G
                                154.21 6.788E-01 & P 1.546E+00 1.02E+02 5.62E+00 G
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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                         94.90 0.000E+00 % P 1.455E+00 1.00E+03 1.13E+01 G
                         81.07-9.656E-02 %   1.109E+00 4.50E+02 1.50E+01 G

Ra-224   N   1.1603E+00                                     6.98E+02
                        241.00 1.160E+00 &(P 2.287E+00 8.54E+01 3.90E+00 G K

Ra-226   N   2.3338E+00                                     5.84E+05
                        609.31 2.246E+00 @(P 1.744E-01 7.16E+00 4.48E+01 G K
                       1764.49 3.315E+00 + P 8.304E-01 1.71E+01 1.54E+01 G
                        295.22 2.098E+00  (P 4.028E-01 1.14E+01 1.92E+01 G
                       1120.29 1.554E+00 - P 9.813E-01 3.42E+01 1.48E+01 G
                        351.99 2.595E+00 @(P 2.391E-01 7.14E+00 3.71E+01 G
                        241.92 2.168E+00  (P 1.286E+00 2.10E+01 7.47E+00 G

Ac-228   N   1.6452E+00                                     2.10E+03
                        911.21 1.494E+00  (P 1.703E-01 1.18E+01 2.66E+01 G K
                        968.97 2.528E-01 % P 1.066E-00 2.05E+02 1.62E+01 G
                        338.32 2.001E+00  (P 6.026E-01 1.76E+01 1.13E+01 G

Th-228   N   1.0586E+01                                     6.98E+02
                         84.37 8.898E+00  (P 1.107E+01 3.93E+01 1.27E+00 G K
                        215.99 1.871E+01  (  3.198E+01 7.49E+01 2.63E-01 G
                        166.41-1.150E+00 %   9.365E+01 3.33E+03 1.08E-01 G
                        131.61 2.637E-01 %   7.405E+01 1.18E+02 1.35E-01 G

Pa-231   N   3.2864E+00                                     1.20E+07
                        283.70 3.286E+00 &(P 4.486E+00 5.98E+01 1.60E+00 G K
                        330.00-4.070E+00 &   9.429E+00 1.01E+02 1.30E+00 G

Pa-234M  N   4.3259E+00                                     1.63E+12
                                                           Energy duplication
                       1001.03 4.326E+00 %(P 1.228E+01 1.35E+02 8.37E-01 G

Th-230   N   3.9853E-01                                     2.75E+07
                         67.67 3.985E-01 %(  5.105E+01 6.10E+03 3.80E-01 G K

Th-234   N   2.7221E+00                                     1.63E+12
                         63.29 1.682E+00 %(P 4.809E+00 1.15E+02 4.80E+00 G K
                         92.60 4.505E+00  (P 4.616E+00 4.39E+01 2.80E+00 G

U-238    N   4.3104E+00                                     1.63E+12
                                                           Energy duplication
                       1001.03 4.310E+00 %(P 1.224E+01 1.35E+02 8.40E-01 G K
                         92.59 2.226E+00   P 2.315E+00 4.45E+01 5.60E+00 GA

Am-241   T   5.6657E-01                                     1.58E+05
                         59.54 5.666E-01 ?(  7.410E-01 5.43E+01 3.63E+01 G K
```



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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Am-243   T   1.8853E-01                                     2.69E+06
                                                           Derived Ave Activity
                         74.66 1.885E-01 }(P 3.781E-01 6.09E+01 6.82E+01 G K
```

(- 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 2 Sigma %	Activity	
Am-241	59.42	65.	31.	0.034	108.66	5.666E-01	
U-235	89.41	162.	-36.	-0.041	145.94	-2.861E+00	
U-238	92.72	94.	46.	0.051	89.09	2.226E+00	P
Th-234	92.72	93.	47.	0.052	87.88	4.505E+00	P
Co-57	121.97	64.	27.	0.030	125.43	9.273E-02	P
Ra-224	240.10	40.	16.	0.018	170.79	1.160E+00	P
Eu-152	244.81	42.	15.	0.017	190.44	5.167E-01	
Hg-203	278.62	46.	30.	0.033	103.97	4.056E-01	P
Pa-231	283.43	26.	19.	0.021	119.57	3.286E+00	P
La-140	487.19	21.	14.	0.016	157.09	1.987E+01	P
Sb-124	602.27	18.	21.	0.023	104.33	2.608E-01	

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Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
I-131	637.11	5.	11.	0.013	107.75	2.488E+03		P
Te-129M	695.68	6.	13.	0.015	98.67	1.368E+01		P
Nb-94	702.55	9.	10.	0.011	162.84	4.293E-02		P
Bi-212	727.26	15.	22.	0.024	96.82	1.620E+00		P
Cs-134	801.85	4.	18.	0.020	56.58	1.089E+00		P
Ag-110M	885.00	5.	9.	0.010	144.44	8.003E-02		
Sc-46	889.54	10.	9.	0.010	196.34	9.600E-02		
Eu-152	963.61	16.	14.	0.016	144.72	5.409E-01		
Cs-136	1048.20	0.	15.	0.017	53.33	1.566E+01		P
La-140	1596.11	0.	7.	0.008	75.59	9.508E+00		

Bi-212	1621.57	1.	3.	0.004	136.38	1.811E+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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	1.0993E-01	3.7850E-01	2.5154E+00	2.5169E+00	2.866E+00
Na-22	#B	0.0000E+00	0.0000E+00	1.3436E-02	1.3438E-02	1.873E-01
K-40	#	1.0112E+01	1.0112E+01	1.8186E+00	2.2534E+00	1.009E+00
Sc-46	#A	4.3659E-02	9.5999E-02	1.8849E-01	1.8891E-01	1.959E-01
Cr-51	#B	-2.8711E-02	-3.1129E-01	7.0161E+00	7.0162E+00	8.519E+00
Mn-54	#B	-1.5390E-02	-1.9012E-02	1.4416E-01	1.4419E-01	1.538E-01
Co-56		3.9732E-01	9.3372E-01	2.8999E-01	3.1445E-01	1.612E-01
Co-57	#A	7.2734E-02	9.2732E-02	1.1632E-01	1.1698E-01	1.355E-01
Co-58	#B	7.2084E-03	1.8311E-02	2.2652E-01	2.2653E-01	2.497E-01
Fe-59	#B	0.0000E+00	0.0000E+00	8.9083E-02	8.9085E-02	1.417E+00
Co-60	#B	0.0000E+00	0.0000E+00	3.7754E-02	3.7755E-02	2.030E-01
Zn-65	#B	0.0000E+00	0.0000E+00	5.9660E-02	5.9661E-02	4.434E-01
Y-88	#B	-1.3652E-03	-2.5354E-03	2.3309E-01	2.3309E-01	2.310E-01
Nb-94	#B	2.1248E-02	2.1248E-02	3.4602E-02	3.4715E-02	1.218E-01
Zr-95	#B	-1.2664E-02	-3.5518E-02	4.3939E-01	4.3941E-01	4.843E-01
Nb-95	#B	0.0000E+00	0.0000E+00	1.9364E-01	1.9365E-01	1.085E+00
Ru-103	#B	2.3332E-02	1.2539E-01	4.1805E-01	4.1837E-01	4.754E-01
Ag-108M	#B	4.5420E-03	4.5439E-03	1.2925E-01	1.2925E-01	1.375E-01
Ru-106	#B	-1.6623E-01	-1.9847E-01	1.4104E+00	1.4106E+00	1.522E+00
Cd-109	#B	-9.5073E-01	-1.0962E+00	2.4647E+00	2.4694E+00	4.172E+00
Ag-110M	#B	3.4563E-02	4.5020E-02	6.5024E-02	6.5296E-02	1.221E-01
Sn-113	#B	3.7810E-02	6.7102E-02	2.2440E-01	2.2457E-01	2.573E-01
Sb-124	#A	8.7108E-02	2.6082E-01	2.7211E-01	2.7428E-01	2.792E-01
Sb-125	#B	-4.1752E-02	-4.4578E-02	2.9967E-01	2.9973E-01	3.467E-01
Te-129	#B	6.0550E-02	4.3270E-01	9.5526E+00	9.5528E+00	1.064E+01
Te-129M	#A	1.9174E+00	1.3679E+01	1.3497E-01	1.3618E+01	1.464E+01
I-131	#B	5.3399E-02	2.0077E+02	2.1633E-02	2.1794E+02	4.319E+02
I-132	#B	0.0000E+00	>12 Halflives	3.0142E-02	3.0143E-02	2.068E-01
Te-132	#B	2.2373E-02	>12 Halflives	1.0627E-01	1.0631E-01	1.232E-01

I-133	#B	0.0000E+00	>12 Halflives	1.2297E-02	1.2297E-02	1.057E-01
Ba-133	#B	0.0000E+00	0.0000E+00	2.4558E-02	2.4559E-02	1.470E-01
Cs-134	#B	8.1527E-02	8.9004E-02	5.0362E-02	5.1714E-02	2.289E-01
Cs-136	#B	5.5608E-02	8.3931E+00	4.4756E+00	4.6107E+00	1.693E+01
Cs-137	#B	4.0133E-02	4.0375E-02	1.0441E-01	1.0455E-01	1.135E-01
Ce-139	#B	-3.4242E-02	-5.5319E-02	1.6818E-01	1.6834E-01	2.008E-01
Ba-140	#B	1.4570E-02	2.5841E+00	6.3464E+01	6.3465E+01	7.216E+01
La-140	#	7.2480E-02	1.2855E+01	9.7172E+00	9.8687E+00	1.001E+01
Ce-141	#B	7.6913E-02	5.8646E-01	1.1788E+00	1.1813E+00	1.400E+00
Ce-144	#B	2.2527E-02	2.8402E-02	8.9258E-01	8.9259E-01	1.088E+00
Eu-152	#B	2.5471E-01	2.5814E-01	3.7357E-01	3.7516E-01	3.765E-01
Eu-154	#B	0.0000E+00	0.0000E+00	1.0738E-01	1.0738E-01	3.007E-01
Eu-155	#B	0.0000E+00	0.0000E+00	1.7207E-01	1.7207E-01	3.766E-01
Ir-192	#A	0.0000E+00	0.0000E+00	3.3991E-02	3.3992E-02	2.575E-01
Hg-203	#A	9.8374E-02	4.0555E-01	4.2165E-01	4.2511E-01	4.714E-01
Tl-208	#	3.3672E-01	3.7014E-01	1.1213E-01	1.2229E-01	9.629E-02
Pb-210	#B	3.6862E+00	3.7162E+00	1.9236E+01	1.9243E+01	2.438E+01
Bi-212	#	1.5059E+00	1.6554E+00	1.3844E+00	1.4016E+00	1.579E+00
Pb-212		9.7220E-01	1.0687E+00	2.2868E-01	2.6988E-01	2.768E-01
Ra-223	#B	1.2525E-01	1.2629E-01	6.6917E-01	6.6938E-01	7.801E-01

Ra-224 #A	1.0555E+00	1.1603E+00	1.9816E+00	1.9877E+00	2.287E+00
Ra-226	2.3336E+00	2.3338E+00	3.0248E-01	4.3173E-01	1.744E-01
Ac-227 #B	0.0000E+00	0.0000E+00	1.6438E-01	1.6438E-01	9.169E-01
Ac-228	1.5943E+00	1.6452E+00	3.4861E-01	4.1036E-01	1.703E-01
Th-228 A	9.6301E+00	1.0586E+01	8.3265E+00	8.4579E+00	1.107E+01
Pa-231 #A	3.2863E+00	3.2864E+00	3.9294E+00	3.9537E+00	4.486E+00
Pa-234M#A	4.3259E+00	4.3259E+00	1.1649E+01	1.1663E+01	1.228E+01
Th-230 #B	3.9853E-01	3.9853E-01	4.8597E+01	4.8597E+01	6.105E+01
Th-232 #B	0.0000E+00	0.0000E+00	2.9311E+01	2.9312E+01	1.008E+02
Th-234 #B	2.7221E+00	2.7221E+00	2.3921E+00	2.4215E+00	4.809E+00
U-235 #B	0.0000E+00	0.0000E+00	8.4836E-01	8.4838E-01	1.895E+00
U-238 #B	4.3104E+00	4.3104E+00	1.1608E+01	1.1622E+01	1.224E+01
Am-241 #A	5.6633E-01	5.6657E-01	6.1566E-01	6.2077E-01	7.410E-01
Am-243 #A	1.8853E-01	1.8853E-01	2.2963E-01	2.3112E-01	3.781E-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 (30.3 to 2035.6 keV) 2.556E+01 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 2.7238152E+01 pCi/G

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Pace Analytical Spectrum name: 30204854008.An1

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854009	**Collection Date**	11/18/2016 10:35
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/21/17 16:37
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	246280

Test	Activity	Uncertainty	MDC
Bismuth-212	2.626	2.788	2.931
Cesium-137	0.024	0.124	0.151
Lead-212	2.933	0.529	0.312
Potassium-40	12.813	2.983	1.267
Protactinium-234M	14.239	8.620	7.979
Radium-226	2.400	0.501	0.291
Radium-228	2.799	0.572	0.324
Thallium-208	1.000	0.245	0.137
Thorium-228	6.496	9.029	11.200
Thorium-234	2.174	2.682	3.315
Uranium-235	0.000	0.480	2.547

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:35:52 AM Page 1
Pace Analytical Spectrum name: 30204854009.An1

Sample description
WI 33843

Spectrum Filename: C:\User\30204854009.An1

Acquisition information
Start time: 2/21/2017 4:37:16 PM
Live time: 900
Real time: 902
Dead time: 0.21 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can), RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.7052E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.7052E+02) =
3.6966E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

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Pace Analytical Spectrum name: 30204854009.Anl

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 10:35:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_skg_021717PaceRa226(8oz).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1670

***** 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. pCi/G	Nuc
63.07	50.	36.99	0.70	3.657E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	5.592E+01	Th232
74.71	173.	12.03	0.98	4.120E-02	74.66	68.200	6.809E-01	Am243
					74.81	10.400	4.882E+00	Pb212
77.04	279.	8.19	0.98	4.194E-02	77.11	17.500	4.605E+00	Pb212
79.56	33.	56.80	0.98	4.255E-02	79.13	6.600	PBC<MDA	Ag108M
					79.13	6.600	1.298E+00	Ag108M
84.33	30.	69.14	0.99	4.391E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
					83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
87.35	52.	50.28	0.99	4.456E-02	87.30	7.800	PBC<MDA	Pb212
					88.03	3.610	4.084E+00	Cd109
87.47	31.	91.71	0.99	4.471E-02	87.30	7.800	PBC<MDA	Pb212
					88.03	3.610	2.432E+00	Cd109
133.22	17.	98.02	1.03	4.696E-02	133.51	11.090	PBC<MDA	Ce144
					133.51	11.090	4.569E-01	Ce144
185.38	62.	30.63	0.90	4.158E-02				
238.37	374.	5.92	1.12	3.551E-02	238.63	43.300	2.934E+00	Pb212
241.60	100.	14.62	1.13	3.517E-02	241.00	3.900	8.836E+00	Ra224
					241.92	7.470	4.156E+00	Ra226
269.71	39.	33.27	1.15	3.249E-02	269.46	13.700	9.892E-01	Ra223
					269.45	13.700	9.892E-01	Ra223
273.21	13.	79.92	1.15	3.212E-02	273.65	11.100	PBC<MDA	Cs136
					273.65	11.100	6.032E+01	Cs136
277.05	33.	27.58	0.39	3.179E-02	277.36	6.310	1.981E+00	Tl208
294.77	164.	9.78	1.04	3.036E-02	295.22	19.200	3.106E+00	Ra226

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pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					295.96	28.670	5.116E+00	Ir192

299.81	31.	37.82	1.18	2.995E-02	300.00	2.300	5.053E+00	Ac227
					300.00	2.300	5.053E+00	Ac227
328.31	16.	83.92	1.20	2.791E-02	328.76	20.300	PBC<MDA	La140
					329.85	2.700	2.442E+00	Ac227
					328.76	20.300	PBC<MDA	La140
					329.85	2.700	2.442E+00	Ac227
338.00	85.	12.13	0.62	2.731E-02	338.32	11.300	3.168E+00	Ac228
351.77	238.	7.89	1.10	2.648E-02	351.99	37.100	2.654E+00	Ra226
355.85	10.	73.75	1.22	2.623E-02	356.02	62.050	PBC<MDA	Ba133
					356.02	62.050	6.592E-02	Ba133
463.11	14.	77.03	1.31	2.138E-02	463.36	10.500	PBC<MDA	Sb125
					463.36	10.500	7.656E-01	Sb125
529.94	14.	60.73	1.37	1.931E-02	529.87	87.000	HL>Cutoff	I133
					529.87	87.000	HL>Cutoff	I133
583.01	126.	10.12	1.10	1.799E-02	583.19	84.500	9.995E-01	Tl208
600.39	11.	75.24	1.42	1.760E-02	600.60	17.900	PBC<MDA	Sb125
					600.60	17.900	PBC<MDA	Sb125
609.11	168.	8.82	0.72	1.742E-02	609.31	44.800	2.342E+00	Ra226
645.35	15.	40.47	1.46	1.669E-02	645.85	7.380	3.925E+00	Sb124
					645.85	7.380	3.925E+00	Sb124
727.30	22.	52.68	1.52	1.532E-02	727.33	6.580	PBC<MDA	Bi212
					727.33	6.580	PBC<MDA	Bi212
795.44	15.	49.77	1.57	1.438E-02	795.86	85.530	PBC<MDA	Cs134
					795.86	85.530	PBC<MDA	Cs134
859.92	28.	19.28	0.42	1.361E-02	860.56	12.420	2.050E+00	Tl208
911.05	73.	12.12	1.72	1.308E-02	911.21	26.600	2.393E+00	Ac228
964.20	15.	61.69	1.70	1.257E-02	964.13	14.340	PBC<MDA	Eu152
					964.13	14.340	PBC<MDA	Eu152
968.94	57.	15.90	0.61	1.253E-02	968.97	16.200	3.208E+00	Ac228
1000.50	13.	29.54	1.72	1.225E-02	1001.03	0.837	1.424E+01	Pa234M
					1001.03	0.840	1.419E+01	U238
					1001.03	0.837	1.424E+01	Pa234M
					1001.03	0.840	1.419E+01	U238
1000.50	13.	29.54	1.72	1.225E-02	1001.03	0.837	1.424E+01	Pa234M
					1001.03	0.840	1.419E+01	U238
1099.06	9.	34.19	1.79	1.148E-02	1099.25	56.500	6.745E-01	Fe59
					1099.25	56.500	6.745E-01	Fe59
1120.20	35.	17.17	0.37	1.133E-02	1120.29	14.800	2.343E+00	Ra226
1238.33	17.	41.45	1.88	1.056E-02	1238.28	66.070	6.295E-01	Co56
					1238.28	66.070	6.295E-01	Co56
1385.06	6.	45.87	1.98	9.753E-03	1384.30	24.120	PBC<MDA	Ag110M
					1384.30	24.120	PBC<MDA	Ag110M
1407.97	7.	37.80	1.99	9.634E-03	1408.01	20.870	PBC<MDA	Eu152
					1408.01	20.870	3.917E-01	Eu152
1460.65	116.	9.59	0.50	9.379E-03	1461.00	10.670	1.281E+01	K40
1689.90	3.	71.14	2.16	8.410E-03	1690.98	47.300	PBC<MDA	Sb124
					1690.98	47.300	PBC<MDA	Sb124

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pk energy	area	uncert	fwhm	curr	nuclide	brnch.	act.	nuc
1764.39	23.	35.84	2.20	8.138E-03	1764.49	15.360	2.008E+00	Ra226
1833.58	4.	55.38	2.23	7.888E-03	1836.06	99.200	PBC<MDA	Y88

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

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 2 Sigma %	FWHM keV	Suspected Nuclide
740.89	185.38	76.	62.	1.479E+03	61.25	0.901	-

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

This section based on library: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Th-234	252.19	63.16	115.	34.	0.038	122.61	0.970s
Th-230	270.50	67.74	190.	-33.	-0.036	167.99	0.973s
Am-243	298.15	74.66	599.	43.	0.048	163.56	0.823D
Pb-212	298.75	74.81	135.	103.	0.115	31.93	0.980D
Pb-212	307.95	77.11	128.	273.	0.303	16.85	0.982D
Ag-108M	317.77	79.56	82.	33.	0.036	113.60	0.984s
Th-228	336.84	84.33	107.	30.	0.033	138.28	0.988
Pb-212	348.91	87.35	162.	52.	0.057	100.57	0.991
Cd-109	349.39	87.47	198.	31.	0.034	183.42	0.992
Ce-144	532.32	133.22	68.	17.	0.019	196.04	1.032s
Pb-212	953.83	238.63	62.	369.	0.410	12.03	1.124D
Ra-224	963.30	241.00	161.	34.	0.038	109.42	1.126D
Ra-226	966.98	241.92	59.	83.	0.092	34.09	1.127D
Ra-223	1078.09	269.71	32.	39.	0.044	66.55	1.151s
Cs-136	1092.09	273.21	22.	13.	0.014	159.84	1.155s
Tl-208	1107.45	277.05	14.	33.	0.036	55.17	0.386s
Ra-226	1178.32	294.77	20.	163.	0.181	19.72	1.042
Ac-227	1198.49	299.81	26.	31.	0.035	75.64	1.177s
La-140	1312.47	328.31	42.	16.	0.018	167.84	1.202s
Ac-228	1351.21	338.00	6.	85.	0.095	24.33	0.615s
Ra-226	1406.29	351.77	25.	235.	0.261	16.13	1.105
Ba-133	1422.58	355.85	10.	10.	0.011	147.49	1.224s
Sb-125	1851.58	463.11	24.	14.	0.016	154.06	1.313s
I-133	2118.88	529.94	12.	14.	0.015	121.46	1.367s
Tl-208	2331.13	583.01	10.	124.	0.138	20.68	1.104

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Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Sb-125	2400.64	600.39	12.	11.	0.012	150.47	1.424s
Ra-226	2435.53	609.11	14.	165.	0.183	18.16	0.725s
Sb-124	2580.49	645.35	4.	15.	0.016	80.93	1.459s
Bi-212	2908.32	727.30	21.	22.	0.024	105.35	1.522s
Cs-134	3180.89	795.44	9.	15.	0.017	99.53	1.573s
Tl-208	3438.85	859.92	1.	28.	0.032	38.56	0.417s
Ac-228	3643.43	911.05	2.	73.	0.081	24.25	1.721
Eu-152	3856.08	964.20	14.	15.	0.017	123.38	1.696s
Ac-228	3875.03	968.94	5.	57.	0.063	31.79	0.614s
Pa-234M	4003.42	1001.03	1.	13.	0.015	59.09	1.722D
U-238	4003.42	1001.03	1.	13.	0.015	59.09	1.722D
Fe-59	4395.67	1099.06	0.	9.	0.010	68.38	1.790s
Ra-226	4480.24	1120.20	1.	35.	0.039	34.34	0.375s
Co-56	4952.97	1238.33	5.	17.	0.019	82.91	1.883s
Ag-110M	5540.17	1385.06	0.	6.	0.006	91.74	1.976s
Eu-152	5631.86	1407.97	0.	7.	0.008	75.59	1.990s
K-40	5842.69	1460.65	3.	115.	0.128	19.17	0.500s
Sb-124	6760.33	1689.90	0.	3.	0.003	142.27	2.156s
Ra-226	7058.51	1764.39	7.	23.	0.025	71.68	2.197s

```
Y-88     7335.50  1833.58          0.          4.      0.004    110.76    2.235s

  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
              pCi/G         keV      pCi/G         pCi/G          COMMENTS
-----------------------------------------------------------------------------

Be-7      C  -8.8812E-02                                        5.34E+01
                          477.56-8.881E-02 %(  4.578E+00 2.10E+03 1.03E+01 G K

K-40      N   1.2813E+01                                        4.68E+11
                         1461.00 1.281E+01  (P 1.267E+00 9.59E+00 1.07E+01 G K

Mn-54     C   3.2891E-02                                        3.12E+02
                          834.85 3.289E-02 %(  2.145E-01 2.84E+02 1.00E+02 G K

Co-56     C   6.2948E-01                                        7.73E+01
                         1238.28 6.295E-01 ?(  4.974E-01 4.15E+01 5.61E+01 G K
                         1771.35 0.000E+00 % P 3.030E+00 1.00E+03 1.55E+01 G

Co-57     C  -5.6351E-02                                        2.72E+02
                          122.06-5.635E-02 %(  1.712E-01 1.23E+02 8.56E+01 G K
                          136.47-2.692E-01 %   1.465E+00 2.19E+02 1.07E+01 G
C
```

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Fe-59     F   6.7453E-01                                        4.45E+01
                         1099.25 6.745E-01 ?(P 5.562E-01 3.42E+01 5.65E+01 G K
                         1291.60 0.000E+00 % P 2.010E+00 1.00E+03 4.32E+01 G

Y-88      C   9.9323E-02                                        1.07E+02
                         1836.06 9.932E-02 ?(P 1.942E-01 5.54E+01 9.92E+01 G K
                          898.04 0.000E+00 % P 3.399E-01 1.00E+03 9.37E+01 G

Nb-94     I   7.7607E-03                                        7.41E+06
                          871.09 7.761E-03 %(P 1.440E-01 7.71E+02 9.99E+01 G K
                          702.62 6.738E-02 %   1.569E-01 1.05E+02 9.79E+01 G

Ag-108M   C   8.7977E-02                                        1.53E+05
                          722.94 0.000E+00 %(  2.354E-01 1.00E+03 9.08E+01 G K
                          614.28-2.024E-02 %   1.918E-01 4.06E+02 8.98E+01 G
                          433.94 0.000E+00 %   1.313E-01 1.00E+03 9.05E+01 G
                           79.13 1.298E+00 &(  1.778E+00 5.68E+01 6.60E+00 G

Ru-106    I   2.6870E-01                                        3.73E+02
                          621.93 2.687E-01 &(P 1.271E+00 1.89E+02 9.93E+00 G K

Cd-109    F   2.4318E+00                                        4.64E+02
                           88.03 2.432E+00  (  5.419E+00 9.17E+01 3.61E+00 G K

Ag-110M   F   7.0131E-02                                        2.50E+02
                          657.76 0.000E+00 %(P 2.176E-01 1.00E+03 9.40E+01 G K
                         1505.04 0.000E+00 %   3.303E+00 1.00E+03 1.29E+01 G
```

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                    1384.30 3.434E-01 ?(P 4.530E-01 4.59E+01 2.41E+01 G
                     937.49 0.000E+00 %   8.199E-01 1.00E+03 3.41E+01 G
                     884.68 0.000E+00 % P 3.410E-01 1.00E+03 7.22E+01 G
                     763.94 0.000E+00 %   1.148E+00 1.00E+03 2.21E+01 G
                     744.28 4.750E-01 % P 3.939E+00 3.53E+02 4.70E+00 G
                     706.68 5.267E-01 % P 1.231E+00 1.05E+02 1.63E+01 G

Sn-113    F  -8.8507E-02                                   1.15E+02
                     391.69-8.851E-02 &(  4.467E-01 2.15E+02 6.40E+01 G K

Sb-124    F   3.6607E-01                                   6.02E+01
                     602.73 1.678E-01 %(  4.058E-01 1.05E+02 9.78E+01 G K
                     645.85 3.925E+00 ?(P 3.386E+00 4.05E+01 7.38E+00 G
                     722.79 0.000E+00 &   5.944E+00 1.00E+03 1.08E+01 G
                    1690.98 2.206E-01 ?(P 6.159E-01 7.11E+01 4.73E+01 G

Sb-125    I   2.8405E-01                                   1.01E+03
                     427.88 3.523E-02 &(  3.549E-01 4.03E+02 2.96E+01 G K
                     176.31 0.000E+00 % P 1.855E+00 1.00E+03 6.82E+00 G
                     463.36 7.658E-01  (  1.361E+00 7.70E+01 1.05E+01 G
L

     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:35:52 AM    Page  7
 Pace Analytical                  Spectrum name: 30204854009.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                     600.60 4.131E-01 ?(P 7.100E-01 7.52E+01 1.79E+01 G
                     635.95 0.000E+00 % P 1.583E+00 1.00E+03 1.13E+01 G

Te-129    I   5.7374E-01                                   3.36E+01
                     459.60 5.737E-01 &(P 1.386E+01 1.00E+03 7.70E+00 G K
                     487.39 2.305E+01 &   6.023E+01 1.10E+02 1.42E+00 G

I-131     I  -1.6865E+02                                   8.02E+00
                     364.49-1.687E+02 %(  6.275E+02 1.59E+02 8.17E+01 G K
                     636.99 5.757E+02 %   7.239E+03 5.22E+02 7.17E+00 G
                     284.30-4.357E+02 %   6.849E+03 6.33E+02 6.14E+00 G

Te-132    I   2.5583E-02                                   3.20E+00
                     228.16 2.558E-02 %(P 1.247E-01 2.00E+02 8.80E+01 G K

I-133     I   9.1741E-02                                   8.67E-01
                     529.87 9.174E-02 &(P 1.251E-01 6.07E+01 8.70E+01 G K
                     875.33-3.660E-01 %   4.114E+00 5.02E+02 4.51E+00 G

Ba-133    F   6.5920E-02                                   3.84E+03
                     356.02 6.592E-02 ?(  1.185E-01 7.37E+01 6.20E+01 G K
                      81.00 1.073E-01 % P 3.934E-01 1.48E+02 3.41E+01 G
                     302.85-1.312E-01 %   6.990E-01 2.18E+02 1.83E+01 G
                     276.40 0.000E+00 % P 1.373E+00 1.00E+03 7.16E+00 G
                     383.85 1.966E-02 & P 1.815E+00 3.88E+03 8.94E+00 G

Cs-134    I   8.1904E-02                                   7.52E+02
                     604.72 2.009E-02 %(  1.639E-01 3.45E+02 9.76E+01 G K
                     801.95 0.000E+00 % P 2.348E+00 1.00E+03 8.69E+00 G
                     795.86 1.525E-01  (P 1.608E-01 4.98E+01 8.55E+01 G
                     569.33 0.000E+00 % P 1.384E+00 1.00E+03 1.54E+01 G

Cs-136    F   9.3173E+00                                   1.32E+01
                     818.51 3.639E+00 %(P 1.985E+01 2.26E+02 9.97E+01 G K
                     176.60 0.000E+00 % P 1.714E+02 1.00E+03 1.00E+01 G
                     273.65 6.032E+01 ?(  1.159E+02 7.99E+01 1.11E+01 G
                     340.53 0.000E+00 % P 4.612E+01 1.00E+03 4.22E+01 G
```

```
                                1048.07 0.000E+00 %   4.096E+01 1.00E+03 8.00E+01 G
                                1235.36 1.771E+01 % P 1.680E+02 4.44E+02 2.00E+01 G

Cs-137    I   2.3657E-02                                          1.10E+04
                                 661.66 2.366E-02 %(P 1.511E-01 2.61E+02 8.51E+01 G K

Ba-140    I   2.8865E+01                                          1.28E+01
                                 537.26 2.885E+01 %(  9.763E+01 1.46E+02 2.44E+01 G K
                                 162.66 3.867E+01 % P 3.277E+02 3.38E+02 6.22E+00 G
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      ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:35:52 AM    Page  8
 Pace Analytical                    Spectrum name: 30204854009.Am1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

La-140    I   9.9982E+00                                          1.28E+01
                               1596.21 0.000E+00 %(  4.268E+01 1.00E+03 9.54E+01 G K
                                487.02 1.577E+01 %   4.669E+01 1.24E+02 4.55E+01 G
                                815.77 2.095E+01 %   1.149E+02 2.35E+02 2.33E+01 G
                                328.76 5.698E+01 ?(P 1.139E+02 8.39E+01 2.03E+01 G

Ce-141    I  -1.3985E-01                                          3.25E+01
                                145.44-1.398E-01 %(  1.796E+00 5.11E+02 4.82E+01 G K

Ce-144    I   4.5687E-01                                          2.85E+02
                                133.51 4.569E-01 &(  1.106E+00 9.80E+01 1.11E+01 G K

Eu-152    F   3.4504E-01                                          4.95E+03
                                121.78 0.000E+00 %(P 3.940E-01 1.00E+03 2.84E+01 G K
                               1408.01 3.917E-01 ?(  4.124E-01 3.78E+01 2.09E+01 G
                               1112.12 0.000E+00 %   2.028E+00 1.00E+03 1.36E+01 G
                               1085.91-6.531E-02 %   1.685E+00 1.13E+03 9.92E+00 G
                                964.13 9.605E-01 ?(P 1.241E+00 6.17E+01 1.43E+01 G
                                344.28 1.017E-01 % P 4.196E-01 1.66E+02 2.66E+01 G
                                244.70 3.998E-01 % P 1.414E+00 1.45E+02 7.49E+00 G

Eu-154    I   2.1643E-03                                          3.14E+03
                                123.07 2.164E-03 %(P 2.578E-01 4.68E+03 4.06E+01 G K
                               1274.44 0.000E+00 %   5.538E-01 1.00E+03 3.50E+01 G
                               1004.72 0.000E+00 % P 1.173E+00 1.00E+03 1.79E+01 G
                                996.26 0.000E+00 %   1.969E+00 1.00E+03 1.05E+01 G
                                873.19 2.759E-01 &   1.151E+00 1.83E+02 1.22E+01 G
                                723.30 2.015E-01 %   7.031E-01 1.52E+02 2.01E+01 G
                                247.93 0.000E+00 % P 1.497E+00 1.00E+03 6.91E+00 G

Ir-192    F   2.2811E-02                                          7.38E+01
                                316.51 2.281E-02 %(  3.585E-01 5.33E+02 8.28E+01 G
                                468.07 7.812E-02 % P 6.583E-01 3.42E+02 4.78E+01 G
                                308.46-2.315E-01 %   1.075E+00 1.91E+02 3.00E+01 G
                                295.96 5.816E-02 % P 9.490E-01 6.55E+02 2.87E+01 G

Hg-203    F   7.3993E-02                                          4.66E+01
                                279.20 7.399E-02 %(P 4.687E-01 2.53E+02 8.15E+01 G K

Tl-208    N   9.9952E-01                                          6.98E+02
                                583.19 9.995E-01  (P 1.374E-01 1.03E+01 8.45E+01 G K
                                860.56 2.050E+00 + P 5.320E-01 1.93E+01 1.24E+01 G
                                277.36 1.981E+00 + P 1.241E+00 2.76E+01 6.31E+00 G

Bi-212    N   2.6259E+00                                          6.98E+02
                                727.33 2.626E+00  (P 2.931E+00 5.27E+01 6.58E+00 G K
                               1620.50 0.000E+00 %   1.713E+01 1.00E+03 1.49E+00 G
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 Pace Analytical                  Spectrum name: 30204854009.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pb-212    N   2.9334E+00                                        6.98E+02
                         238.63 2.933E+00  (P 3.124E-01 6.01E+00 4.33E+01 G K
                          77.11 4.538E+00 + P 9.208E-01 8.42E+00 1.75E+01 GA
                          74.81 2.933E+00 } P 1.620E+00 1.60E+01 1.04E+01 GA
                          87.30 1.808E+00 -   2.174E+00 5.03E+01 7.80E+00 GA

Ra-223    N   9.8916E-01                                        7.96E+03
                         269.46 9.892E-01  (  7.276E-01 3.33E+01 1.37E+01 G K
                          83.78 8.217E-02 &   5.693E-01 2.73E+02 2.49E+01 G
                         323.87 0.000E+00 & P 3.439E+00 1.00E+03 3.93E+00 G
                         154.21 2.773E-01 & P 2.150E+00 3.09E+02 5.62E+00 G
                          94.90 0.000E+00 % P 1.524E+00 1.00E+03 1.13E+01 G
                          81.07 3.014E-01 % P 8.402E-01 1.11E+02 1.50E+01 G

Ra-224    N   3.0637E+00                                        6.98E+02
                         241.00 3.064E+00  (P 5.484E+00 5.47E+01 3.90E+00 G K

Ra-226    N   2.3997E+00                                        5.84E+05
                         609.31 2.342E+00  (P 2.905E-01 9.08E+00 4.48E+01 G K
                        1764.49 2.008E+00 ?(P 1.366E+00 3.58E+01 1.54E+01 G
                         295.22 3.106E+00 + P 4.500E-01 9.86E+00 1.92E+01 G
                        1120.29 2.343E+00  (P 4.881E-01 1.72E+01 1.48E+01 G
                         351.99 2.654E+00  (P 2.957E-01 8.06E+00 3.71E+01 G
                         241.92 3.519E+00 + P 1.626E+00 1.70E+01 7.47E+00 G

Ac-227    N   7.9596E-01                                        7.95E+03
                         235.97 0.000E+00 %(P 1.088E+00 1.00E+03 1.23E+01 G K
                         256.25-1.581E-01 %   1.600E+00 4.11E+02 7.00E+00 G
                         300.00 5.053E+00 *(P 4.293E+00 3.78E+01 2.30E+00 G
                         329.85-1.713E+00 %   6.063E+00 1.48E+02 2.70E+00 G

Ac-228    N   2.7990E+00                                        2.10E+03
                         911.21 2.393E+00  (P 3.235E-01 1.21E+01 2.66E+01 G K
                         968.97 3.208E+00  (P 7.497E-01 1.59E+01 1.62E+01 G
                         338.32 3.168E+00  (P 5.142E-01 1.22E+01 1.13E+01 G

Th-228    N   6.4958E+00                                        6.98E+02
                          84.37 6.496E+00  (P 1.120E+01 6.91E+01 1.27E+00 G K
                         215.99 0.000E+00 & P 4.980E+01 1.00E+03 2.63E-01 G
                         166.41 0.000E+00 & P 1.206E+02 1.00E+03 1.08E-01 G
                         131.61 0.000E+00 % P 9.561E+01 1.00E+03 1.35E-01 G

Pa-231    N  -4.8093E-01                                        1.20E+07
                         283.70-4.809E-01 %(  7.238E+00 6.08E+02 1.60E+00 G K
                         330.00 0.000E+00 %   1.330E+01 1.00E+03 1.30E+00 G
]

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 Pace Analytical                  Spectrum name: 30204854009.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pa-234M   N   1.4239E+01                                        1.63E+12
                                                              Energy duplication
                        1001.03 1.424E+01 ?(P 7.979E+00 2.95E+01 8.37E-01 G
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Th-230    N  -2.4824E+01                                        2.75E+07
                                67.67-2.482E+01 7(  5.059E+01 8.40E+01 3.80E-01 G K

Th-232    N   7.8809E+00                                        4.17E+12
                                63.81 7.881E+00 %(  6.603E+01 3.30E+02 2.67E-01 G K

Th-234    N   2.1736E+00                                        1.63E+12
                                63.29 2.174E+00 ?(P 3.315E+00 6.13E+01 4.80E+00 G K
                                92.60 1.192E+00 & P 5.787E+00 1.95E+02 2.80E+00 G

U-238     N   1.4188E+01                                        1.63E+12
                                                               Energy duplication
                             1001.03 1.419E+01 ?(P 7.951E+00 2.95E+01 8.40E-01 G K
                                92.59 6.706E-01 % P 2.881E+00 1.73E+02 5.60E+00 GA

Am-241    T  -9.7098E-02                                        1.58E+05
                                59.54-9.710E-02 %(  4.929E-01 1.96E+02 3.63E+01 G K

Am-243    T   1.7021E-01                                        2.69E+06
                                                               Derived Ave Activity
                                74.66 1.702E-01 }(P 4.613E-01 8.18E+01 6.82E+01 G K
```

(- 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 2 Sigma %	Activity

Th-230	67.74	190.	-33.	-0.036	167.99	-2.482E+01	
Ag-108M	79.56	82.	33.	0.036	113.60	1.298E+00	
Th-228	84.33	107.	30.	0.033	138.28	6.496E+00	F
Ce-144	133.22	68.	17.	0.019	196.04	4.569E-01	
Ra-223	269.71	32.	39.	0.044	66.55	9.892E-01	
Cs-136	273.21	22.	13.	0.014	159.84	6.032E+01	
Ac-227	299.81	26.	31.	0.035	75.64	5.053E+00	P
La-140	328.31	42.	16.	0.018	167.84	5.698E+01	P
Ba-133	355.85	10.	10.	0.011	147.49	6.592E-02	
Sb-125	463.11	24.	14.	0.016	154.06	7.656E-01	
I-133	529.94	12.	14.	0.015	121.46	0.000E+00	P
Sb-125	600.39	12.	11.	0.012	150.47	4.131E-01	F
Sb-124	645.35	4.	15.	0.016	80.93	3.925E+00	P
Bi-212	727.30	21.	22.	0.024	105.35	2.626E+00	P
Cs-134	795.44	9.	15.	0.017	99.53	1.525E-01	P
Eu-152	964.20	14.	15.	0.017	123.38	9.605E-01	P
Pa-234M	1001.03	1.	13.	0.015	59.09	1.424E+01	P
U-238	1001.03	1.	13.	0.015	59.09	1.419E+01	P
Fe-59	1099.06	0.	9.	0.010	68.38	6.745E-01	P
Co-56	1238.33	5.	17.	0.019	82.91	6.295E-01	
Ag-110M	1385.06	0.	6.	0.006	91.74	3.434E-01	P
Eu-152	1407.97	0.	7.	0.008	75.59	3.917E-01	
Sb-124	1689.90	0.	3.	0.003	142.27	2.206E-01	P
Y-88	1833.58	0.	4.	0.004	110.76	9.932E-02	P

F - 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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-2.5794E-02	-8.8812E-02	3.7385E+00	3.7386E+00	4.578E+00
Na-22	#B	0.0000E+00	0.0000E+00	3.2552E-02	3.2553E-02	2.036E-01
K-40		1.2813E+01	1.2813E+01	2.4568E+00	2.9827E+00	1.267E+00
Sc-46	#B	0.0000E+00	0.0000E+00	3.6707E-02	3.6708E-02	4.586E-01
Cr-51	#B	0.0000E+00	0.0000E+00	3.1360E+00	3.1361E+00	1.222E+01
Mn-54	#B	2.6623E-02	3.2891E-02	1.8664E-01	1.8669E-01	2.145E-01
Co-56	#	2.6786E-01	6.2948E-01	5.2190E-01	5.2833E-01	4.974E-01
Co-57	#B	-4.4198E-02	-5.6351E-02	1.3878E-01	1.3899E-01	1.712E-01

Co-58	#B	0.0000E+00	0.0000E+00	5.6518E-02	5.6519E-02	5.197E-01
Fe-59	#	1.5299E-01	6.7453E-01	4.6122E-01	4.6960E-01	5.562E-01
Co-60	#B	0.0000E+00	0.0000E+00	4.5853E-02	4.5854E-02	2.610E-01
Zn-65	#B	0.0000E+00	0.0000E+00	1.6003E-01	1.6004E-01	7.140E-01
Y-88	#A	5.3480E-02	9.9323E-02	1.1001E-01	1.1091E-01	1.942E-01
Nb-94	#B	7.7606E-03	7.7607E-03	1.1973E-01	1.1973E-01	1.440E-01
Zr-95	#B	0.0000E+00	0.0000E+00	1.8799E-01	1.8800E-01	1.074E+00
Nb-95	#B	0.0000E+00	0.0000E+00	1.4060E-01	1.4060E-01	1.638E+00
Ru-103	#B	0.0000E+00	0.0000E+00	9.1510E-02	9.1512E-02	8.991E-01
Ag-108M	#B	8.7939E-02	8.7977E-02	9.9943E-02	1.0062E-01	2.354E-01
Ru-106	#B	2.2506E-01	2.6870E-01	1.0163E+00	1.0169E+00	1.271E+00
Cd-109	A	2.1092E+00	2.4318E+00	4.4603E+00	4.4734E+00	5.419E+00
Ag-110M	#B	5.3842E-02	7.0131E-02	6.4340E-02	6.5008E-02	2.176E-01
Sn-113	#B	-4.9870E-02	-8.8507E-02	3.8142E-01	3.8160E-01	4.467E-01
Sb-124	#B	1.2225E-01	3.6607E-01	2.9627E-01	3.0020E-01	4.058E-01
Sb-125	#B	2.6605E-01	2.8405E-01	4.2742E-01	4.2905E-01	3.549E-01
Te-129	#B	8.0415E-02	5.7374E-01	1.1472E+01	1.1472E+01	1.386E+01
Te-129M	#B	0.0000E+00	0.0000E+00	1.4165E+01	1.4166E+01	3.634E+01

I-131	#B	-4.4847E-02	-1.6865E+02	5.3499E+02	5.3545E+02	6.275E+02
I-132	#B	0.0000E+00	>12 Halflives	7.4847E-02	7.4849E-02	2.606E-01
Te-132	#B	2.5583E-02	>12 Halflives	1.0252E-01	1.0258E-01	1.247E-01
I-133	#A	9.1741E-02	>12 Halflives	1.1143E-01	1.1209E-01	1.251E-01
Ba-133	#A	6.4796E-02	6.5920E-02	9.7228E-02	9.7571E-02	1.185E-01
Cs-134	#B	7.5024E-02	8.1904E-02	8.1522E-02	8.2240E-02	1.639E-01
Cs-136	#B	6.1723E-02	9.3173E+00	1.4893E+01	1.4944E+01	1.985E+01
Cs-137	#B	2.3515E-02	2.3657E-02	1.2370E-01	1.2374E-01	1.511E-01
Ce-139	#B	0.0000E+00	0.0000E+00	7.7877E-02	7.7879E-02	2.478E-01
Ba-140	#B	1.6273E-01	2.8865E+01	8.4260E+01	8.4346E+01	9.763E+01
La-140	#B	5.6365E-02	9.9982E+00	1.6781E+01	1.6835E+01	4.268E+01
Ce-141	#B	-1.8340E-02	-1.3985E-01	1.4295E+00	1.4297E+00	1.796E+00
Ce-144	#A	3.6236E-01	4.5687E-01	8.9564E-01	8.9770E-01	1.106E+00
Eu-152	#B	3.4046E-01	3.4504E-01	2.6082E-01	2.6490E-01	3.940E-01
Eu-154	#B	2.1193E-03	2.1643E-03	2.0276E-01	2.0276E-01	2.578E-01
Eu-155	#B	0.0000E+00	0.0000E+00	4.0098E-01	4.0099E-01	5.160E-01
Ir-192	#A	9.3275E-03	2.2811E-02	2.8883E-01	2.8885E-01	3.585E-01
Hg-203	#B	1.7948E-02	7.3993E-02	3.7474E-01	3.7487E-01	4.687E-01
Tl-208		9.0926E-01	9.9952E-01	2.0665E-01	2.4533E-01	1.374E-01
Pb-210	#B	0.0000E+00	0.0000E+00	2.4650E+00	2.4651E+00	5.898E+00
Bi-212	#A	2.3888E+00	2.6259E+00	2.7665E+00	2.7883E+00	2.931E+00
Pb-212		2.6685E+00	2.9334E+00	3.5280E-01	5.2924E-01	3.124E-01
Ra-223	#	9.8099E-01	9.8916E-01	6.5824E-01	6.7143E-01	7.276E-01
Ra-224	A	2.7870E+00	3.0637E+00	3.3523E+00	3.3775E+00	5.484E+00
Ra-226		2.3995E+00	2.3997E+00	3.8696E-01	5.0068E-01	2.905E-01
Ac-227	#B	7.8938E-01	7.9596E-01	6.0210E-01	6.1155E-01	1.088E+00
Ac-228		2.7123E+00	2.7990E+00	4.3670E-01	5.7199E-01	3.235E-01
Th-228	#A	5.9092E+00	6.4958E+00	8.9826E+00	9.0291E+00	1.120E+01
Pa-231	#B	-4.8093E-01	-4.8093E-01	5.8508E+00	5.8511E+00	7.238E+00
Pa-234M	#	1.4239E+01	1.4239E+01	8.4139E+00	8.6196E+00	7.979E+00
Th-230	#A	-2.4824E+01	-2.4824E+01	4.1701E+01	4.1841E+01	5.059E+01

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Th-232	B	7.8809E+00	7.8809E+00	5.2082E+01	5.2093E+01	6.601E+01
Th-234	#A	2.1736E+00	2.1736E+00	2.6651E+00	2.6821E+00	3.315E+00
U-235	#B	0.0000E+00	0.0000E+00	4.7975E-01	4.7976E-01	2.547E+00
U-238	#	1.4188E+01	1.4188E+01	8.3838E+00	8.5888E+00	7.951E+00
Am-241	#B	-9.7058E-02	-9.7098E-02	3.8110E-01	3.8135E-01	4.929E-01
Am-243	A	1.7021E-01	1.7021E-01	2.7839E-01	2.7940E-01	4.613E-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 (30.1 to 2035.5 keV) 2.646E+01 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 2.7181667E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____

Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854010	**Collection Date**	11/18/2016 10:30
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/22/17 7:35
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	1.664	2.179	2.224
Cesium-137	-0.054	0.192	0.204
Lead-212	1.763	0.372	0.288
Potassium-40	28.213	4.922	1.315
Protactinium-234M	5.400	14.560	15.330
Radium-226	1.423	0.350	0.261
Radium-228	2.010	0.622	0.398
Thallium-208	0.665	0.198	0.135
Thorium-228	0.000	7.404	12.590
Thorium-234	0.000	1.268	6.530
Uranium-235	0.000	0.335	2.365

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Pace Analytical Spectrum name: 30204854010.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854010.An1

Acquisition information
Start time: 2/22/2017 7:35:54 AM
Live time: 900
Real time: 903
Dead time: 0.38 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.0577E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.0577E+02) =
4.8598E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

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2/24/17

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Pace Analytical Spectrum name: 30204854010.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 10:30:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(802).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1389

***** 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. pCi/G	Nuc
74.84	37.	8.70	1.08	3.198E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	1.762E+00	Pb212
77.16	86.	21.95	0.87	3.382E-02	77.11	17.500	2.306E+00	Pb212
81.11	9.	91.42	1.09	3.662E-02	81.07	15.000	PBC<MDA	Ra223
					81.00	34.100	1.066E-01	Ba133
83.82	22	51.06	1.09	3.839E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	6.466E+00	Th228
87.34	59.	22.24	1.10	4.047E-02	87.30	7.800	2.977E+00	Pb212
					88.03	3.610	6.682E+00	Cd109
					88.03	3.610	6.682E+00	Cd109
					86.54	30.700	7.085E-01	Eu155
93.17	47.	32.89	0.56	4.345E-02	92.59	5.600	PBC<MDA	U238
					92.60	2.800	PBC<MDA	Th234
105.29	15.	92.28	1.12	4.792E-02	105.31	21.200	PBC<MDA	Eu155
					105.31	21.200	PBC<MDA	Eu155
153.86	23.	51.77	0.30	5.245E-02	154.21	5.620	PBC<MDA	Ra223
236.25	25.	55.16	1.26	4.664E-02	235.97	12.300	PBC<MDA	Ac227
					235.97	12.300	PBC<MDA	Ac227
238.56	211.	9.91	0.91	4.643E-02	238.63	43.300	1.648E+00	Pb212
241.95	45.	28.60	1.26	4.615E-02	241.92	7.470	1.899E+00	Ra226
					241.00	3.900	3.993E+00	Ra224
269.52	24.	55.51	1.29	4.396E-02	269.46	13.700	PBC<MDA	Ra223
277.72	40.	24.98	0.60	4.336E-02	277.36	6.310	2.358E+00	Tl208
283.89	12.	90.01	1.31	4.285E-02	283.70	1.600	PBC<MDA	Pa231
					284.30	6.140	PBC<MDA	I131
					284.30	6.140	PBC<MDA	I131
					283.70	1.600	2.631E+00	Pa231

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Pace Analytical Spectrum name: 30204854010.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
295.13	92.	13.87	1.15	4.207E-02	295.22	19.200	1.668E+00	Ra226

					295.96	28.670	2.750E+00	Ir192
328.06	16.	80.90	1.35	3.985E-02	328.76	20.300	PBC<MDA	La140
					329.85	2.700	2.124E+00	Ac227
					330.00	1.300	4.375E+00	Pa231
					328.76	20.300	5.133E+01	La140
					329.85	2.700	2.124E+00	Ac227
					330.00	1.300	4.375E+00	Pa231
338.75	86.	14.73	1.01	3.926E-02	338.32	11.300	2.934E+00	Ac228
351.70	146.	10.38	1.41	3.846E-02	351.99	37.100	1.491E+00	Ra226
433.77	22.	52.45	1.46	3.442E-02	433.94	90.500	PBC<MDA	Ag108M
					433.94	90.500	1.031E-01	Ag108M
463.19	14.	97.88	1.49	3.323E-02	463.36	10.500	PBC<MDA	Sb125
					463.36	10.500	PBC<MDA	Sb125
537.59	10.	76.32	1.57	3.068E-02	537.26	24.390	PBC<MDA	Ba140
					537.26	24.390	PBC<MDA	Ba140
583.39	103.	13.30	1.60	2.934E-02	583.19	84.500	6.653E-01	Tl208
602.78	10.	53.36	1.63	2.882E-02	602.73	97.800	PBC<MDA	Sb124
604.77	11.	69.86	1.63	2.877E-02	604.72	97.620	PBC<MDA	Cs134
609.37	112.	10.93	1.64	2.865E-02	609.31	44.800	1.275E+00	Ra226
629.91	20.	34.11	1.66	2.812E-02	630.19	13.300	HL>Cutoff	I132
					630.19	13.300	HL>Cutoff	I132
727.49	18.	65.13	1.75	2.599E-02	727.33	6.580	PBC<MDA	Bi212
					727.33	6.580	PBC<MDA	Bi212
794.36	12.	78.82	1.82	2.472E-02	795.86	85.530	PBC<MDA	Cs134
859.90	21.	44.45	1.88	2.365E-02	860.56	12.420	1.129E+00	Tl208
889.29	10.	65.67	1.90	2.321E-02	889.28	99.984	PBC<MDA	Sc46
					889.28	99.984	1.367E-01	Sc46
898.29	12.	31.86	1.91	2.308E-02	898.04	93.700	1.522E-01	Y88
					898.04	93.700	1.522E-01	Y88
911.35	81.	14.01	1.98	2.289E-02	911.21	25.600	2.010E+00	Ac228
968.70	28.	49.85	1.98	2.208E-02	968.97	16.200	1.172E+00	Ac228
1119.90	41.	26.32	2.11	2.024E-02	1120.29	14.800	1.988E+00	Ra226
1384.20	11.	30.15	2.34	1.767E-02	1384.30	24.120	4.913E-01	Ag110M
					1384.30	24.120	4.913E-01	Ag110M
1407.62	10.	32.62	2.35	1.747E-02	1408.01	20.870	4.048E-01	Eu152
					1408.01	20.870	4.048E-01	Eu152
1460.52	351.	5.73	2.31	1.704E-02	1461.00	10.670	2.821E+01	K40
1594.90	4.	50.00	2.50	1.600E-02	1596.21	95.400	PBC<MDA	La140
					1596.21	95.400	7.019E+00	La140
1763.94	27.	41.04	2.63	1.484E-02	1764.49	15.360	1.385E+00	Ra226

C

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Pace Analytical Spectrum name: 30204854010.An1

********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
370.80	93.17	42.	40.	9.253E+02	55.36	1.103	-	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: Pace Master w Ra-226 Rev.4 09281

********** I D E N T I F I E D P E A K S U M M A R Y **********
Page 3

Nuclide	Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 2 Sigma %	FWHM keV
Pb-212	298.12	74.81	47.	37.	0.041	17.40	1.083D
Pb-212	307.32	77.11	72.	99.	0.110	31.62	1.086D
Ra-223	323.15	81.07	29.	9.	0.010	182.83	1.090D
Ra-223	333.99	83.78	52.	22.	0.024	102.11	1.093D
Pb-212	348.07	87.30	55.	59.	0.065	44.47	1.097D
Eu-155	420.00	105.29	52.	16.	0.018	184.56	1.117
Ra-223	614.25	153.86	32.	23.	0.026	103.54	0.300s
Ac-227	943.78	236.25	35.	25.	0.027	110.32	1.256s
Pb-212	953.29	238.63	51.	221.	0.245	16.32	1.259D
Ra-226	966.44	241.92	59.	45.	0.050	57.19	1.263D
Ra-223	1076.84	269.52	36.	24.	0.027	111.01	1.292s
Tl-208	1109.64	277.72	17.	40.	0.045	49.96	0.604s
I-131	1134.29	283.89	25.	12.	0.014	180.01	1.307s
Ra-226	1179.26	295.13	20.	92.	0.103	27.75	1.150s
La-140	1310.95	328.06	32.	16.	0.017	161.81	1.354s
Ac-228	1353.74	338.75	14.	86.	0.096	29.47	1.013s
Ra-226	1405.51	351.70	15.	146.	0.162	20.76	1.412s
Ag-108M	1733.79	433.77	23.	22.	0.024	104.91	1.462s
Sb-125	1851.47	463.19	34.	14.	0.016	195.77	1.492s
Ba-140	2149.47	537.69	8.	10.	0.011	152.65	1.566s
Tl-208	2332.27	583.39	15.	103.	0.114	26.61	1.603s
Sb-124	2409.64	602.73	8.	10.	0.011	106.73	1.630D
Cs-134	2417.61	604.72	21.	11.	0.012	139.71	1.632D
Ra-226	2435.97	609.31	19.	112.	0.125	21.87	1.637D
I-132	2518.37	629.91	4.	20.	0.022	68.23	1.657s
Bi-212	2908.73	727.49	20.	18.	0.020	130.26	1.751s
Cs-134	3178.65	794.96	14.	12.	0.014	157.65	1.816s
Tl-208	3438.48	859.90	10.	21.	0.023	88.90	1.877s
Sc-46	3556.07	889.29	5.	10.	0.011	131.33	1.903s

C

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:37:12 AM Page 5
Pace Analytical Spectrum name: 30204854010.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Y-88	3592.08	898.29	1.	12.	0.013	63.73	1.911s
Ac-228	3644.31	911.35	8.	81.	0.090	28.01	1.978
Ac-228	3873.78	968.70	28.	28.	0.031	99.70	1.976s
Ra-226	4478.78	1119.90	12.	41.	0.045	52.64	2.111s
Ag-110M	5536.45	1384.20	0.	11.	0.012	60.30	2.335s
Eu-152	5630.20	1407.62	0.	10.	0.011	65.24	2.355s
K-40	5841.92	1460.52	9.	351.	0.390	11.45	2.309s
La-140	6379.75	1594.90	0.	4.	0.004	100.00	2.505s
Ra-226	7056.36	1763.94	8.	22.	0.024	82.08	2.633s

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Peak Code	MDA Value pCi/G	COMMENTS
Be-7	C	-4.7639E-01					5.34E+01
			477.56	-4.764E-01	%(	4.194E+00	3.92E+02 1.03E+01 G K
K-40	N	2.8213E+01					4.68E+11

```
                                1461.00 2.821E+01  (P 1.315E+00 5.73E+00 1.07E+01 G K

Sc-46     F   1.3669E-01                                          8.38E+01
                                 889.28 1.367E-01 ?(  1.849E-01 6.57E+01 1.00E+02 G K

Cr-51     F  -4.7374E+00                                          2.77E+01
                                 320.08-4.737E+00 %(  1.395E+01 1.27E+02 1.01E+01 G K

Mn-54     C   6.6300E-02                                          3.12E+02
                                 834.85 6.630E-02 %(  1.923E-01 1.39E+02 1.00E+02 G K

Co-58     C   1.4567E-01                                          7.08E+01
                                 810.78 1.457E-01 %(  3.136E-01 1.02E+02 9.94E+01 G K

Co-60     F   3.4661E-02                                          1.92E+03
                                1332.50 3.466E-02 %(P 1.820E-01 2.43E+02 1.00E+02 G K
                                1173.24 0.000E+00 % P 2.258E-01 1.00E+03 1.00E+02 G

Y-88      C   7.2284E-02                                          1.07E+02
                                1836.06-3.178E-03 %(  2.896E-01 4.60E+03 9.92E+01 G K
                                 898.04 1.522E-01 &(P 9.275E-02 3.19E+01 9.37E+01 G

Zr-95     I  -1.1905E-01                                          6.40E+01
                                 756.73-1.191E-01 %(  8.275E-01 3.29E+02 5.45E+01 G K
                                 724.20 0.000E+00 & P 1.209E+00 1.00E+03 4.42E+01 G
```

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Pace Analytical Spectrum name: 30204854010.An1

```
 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ag-108M   C   5.1468E-02                                          1.53E+05
                                 722.94 0.000E+00 %(P 1.840E-01 1.00E+03 9.08E+01 G K
                                 614.28 1.710E-02 %   1.282E-01 3.37E+02 8.98E+01 G
                                 433.94 1.031E-01 &(  1.174E-01 5.25E+01 9.05E+01 G
                                  79.13-3.032E-01 %   2.314E+00 3.01E+02 6.60E+00 G

Ru-106    I  -4.0308E-01                                          3.73E+02
                                 621.93-4.031E-01 %(  1.790E+00 2.06E+02 9.93E+00 G K

Cd-109    F  -1.9024E+00                                          4.64E+02
                                  88.03-1.902E+00 %(  4.875E+00 1.04E+02 3.61E+00 G K

Ag-110M   F   1.2131E-01                                          2.50E+02
                                 657.76 2.636E-02 %(P 1.714E-01 2.88E+02 9.40E+01 G K
                                1505.04 3.084E-01 %   1.286E+00 2.07E+02 1.29E+01 G
                                1384.30 4.913E-01 ?(  3.292E-01 3.02E+01 2.41E+01 G
                                 937.49 0.000E+00 % P 6.668E-01 1.00E+03 3.41E+01 G
                                 884.68 5.098E-02 &   2.386E-01 2.22E+02 7.22E+01 G
                                 763.94 2.891E-01 &   6.956E-01 1.14E+02 2.21E+01 G
                                 744.28 1.268E+00 % P 3.274E+00 1.21E+02 4.70E+00 G
                                 706.68 0.000E+00 % P 1.366E+00 1.00E+03 1.63E+01 G

Sb-124    F   1.5031E-01                                          6.02E+01
                                 602.73 1.503E-01  (  2.530E-01 5.34E+01 9.78E+01 G K
                                 645.85 6.448E-01 %   4.832E+00 3.37E+02 7.38E+00 G
                                 722.79 0.000E+00 %   5.246E+00 1.00E+03 1.08E+01 G
                                1690.98 0.000E+00 %   9.039E-01 1.00E+03 4.73E+01 G

Sb-125    I   1.4354E-01                                          1.01E+03
                                 427.88-2.784E-02 %(  4.077E-01 6.26E+02 2.96E+01 G K
                                 176.31 0.000E+00 % P 1.789E+00 1.00E+03 6.82E+00 G
```

```
                                463.36 6.267E-01 ?(P 1.335E+00 9.79E+01 1.05E+01 G
                                600.60 1.035E-01 % P 6.874E-01 2.99E+02 1.79E+01 G
                                635.95 0.000E+00 % P 1.251E+00 1.00E+03 1.13E+01 G

I-131     I   3.7194E+02                                        8.02E+00
                                364.49 1.951E+02 %(P 4.761E+02 1.07E+02 8.17E+01 G K
                                636.99 0.000E+00 % P 7.801E+03 1.00E+03 7.17E+00 G
                                284.30 2.725E+03 &(P 5.690E+03 9.00E+01 6.14E+00 G

I-132     I   1.2048E-01                                        3.20E+00
                                772.60 7.835E-03 %(P 1.594E-01 9.16E+02 7.56E+01 G K
                                522.65 0.000E+00 %   8.675E-01 1.00E+03 1.60E+01 G
                                630.19 7.608E-01 ?(  4.914E-01 3.41E+01 1.33E+01 G
                                954.55 0.000E+00 % P 9.839E-01 1.00E+03 1.76E+01 G
]

      ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:37:12 AM    Page  7
 Pace Analytical                    Spectrum name: 30204854010.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

I-133     I   2.9037E-02                                        8.67E-01
                                529.87 2.904E-02 %(P 1.428E-01 2.18E+02 8.70E+01 G K
                                875.33 0.000E+00 &   3.647E+00 1.00E+03 4.51E+00 G

Cs-134    I   7.6179E-02                                        7.52E+02
                                604.72 6.034E-02  (P 1.377E-01 6.99E+01 9.76E+01 G K
                                801.95 4.781E-01 % P 1.220E+00 1.02E+02 8.69E+00 G
                                795.86 9.426E-02 ?(  1.542E-01 7.88E+01 8.55E+01 G
                                569.33 0.000E+00 % P 1.173E+00 1.00E+03 1.54E+01 G

Cs-137    I  -5.3555E-02                                        1.10E+04
                                661.66-5.356E-02 %(  2.039E-01 1.79E+02 8.51E+01 G K

Ce-139    F   5.6941E-03                                        1.38E+02
                                165.85 5.694E-03 &(  2.158E-01 1.54E+03 7.99E+01 G K

Ba-140    I   3.4365E+01                                        1.28E+01
                                537.26 3.437E+01 &(P 5.806E+01 7.63E+01 2.44E+01 G K
                                162.66 1.609E+01 % P 3.468E+02 8.83E+02 6.22E+00 G

La-140    I   1.4793E+01                                        1.28E+01
                               1596.21 7.019E+00 ?(  1.293E+01 5.00E+01 9.54E+01 G K
                                487.02 1.991E+01 % P 4.738E+01 1.09E+02 4.55E+01 G
                                815.77-1.101E+01 %   1.095E+02 4.60E+02 2.33E+01 G
                                328.76 5.133E+01 ?(  9.558E+01 8.09E+01 2.03E+01 G

Ce-141    I  -5.7137E-01                                        3.25E+01
                                145.44-5.714E-01 %(  2.109E+00 1.55E+02 4.82E+01 G K

Ce-144    I   2.5282E-01                                        2.85E+02
                                133.51 2.528E-01 &(P 1.215E+00 1.98E+02 1.11E+01 G K

Eu-152    F   1.7147E-01                                        4.95E+03
                                121.78 0.000E+00 %(P 4.452E-01 1.00E+03 2.84E+01 G K
                               1408.01 4.048E-01 ?(P 2.989E-01 3.26E+01 2.09E+01 G
                               1112.12 2.715E-01 % P 1.175E+00 2.11E+02 1.36E+01 G
                               1085.91 2.027E-01 % P 1.323E+00 3.10E+02 9.92E+00 G
                                964.13 2.329E-01 &   1.335E+00 2.80E+02 1.43E+01 G
                                344.28 0.000E+00 % P 5.444E-01 1.00E+03 2.66E+01 G
                                244.70 0.000E+00 %   1.707E+00 1.00E+03 7.49E+00 G

Eu-154    I   5.4611E-02                                        3.14E+03
```

```
                    123.07 5.461E-02 %(P 2.716E-01 2.06E+02 4.06E+01 G K
                   1274.44 0.000E+00 %   6.909E-01 1.00E+03 3.50E+01 G
                   1004.72 0.000E+00 % P 9.581E-01 1.00E+03 1.79E+01 G
                    996.26 9.774E-02 %   1.410E+00 6.95E+02 1.05E+01 G
                    873.19 3.473E-02 %   9.216E-01 1.20E+03 1.22E+01 G
```

E

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:37:12 AM Page 8
Pace Analytical Spectrum name: 30204854010.An1

```
Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                         723.30 0.000E+00 % P 8.535E-01 1.00E+03 2.01E+01 G
                         247.93 5.860E-01 & P 1.496E+00 1.10E+02 6.91E+00 G

Eu-155   I   1.0030E-01                                     1.74E+03
                          86.54 0.000E+00 &(P 5.304E-01 1.00E+03 3.07E+01 G K
                         105.31 2.456E-01 &(P 5.399E-01 9.23E+01 2.12E+01 G

Tl-208   N   6.6526E-01                                     6.98E+02
                         583.19 6.653E-01 *(P 1.354E-01 1.33E+01 8.45E+01 G K
                         860.56 1.129E+00 +   9.668E-01 4.45E+01 1.24E+01 G
                         277.36 2.358E+00 + P 1.280E+00 2.50E+01 6.31E+00 G

Bi-212   N   1.6641E+00                                     6.98E+02
                         727.33 1.664E+00 ?(P 2.224E+00 6.51E+01 6.58E+00 G K
                        1620.50 3.056E+00 % P 1.054E+01 1.72E+02 1.49E+00 G

Pb-212   N   1.7625E+00                                     6.98E+02
                         238.63 1.762E+00  (P 2.882E-01 8.16E+00 4.33E+01 G K
                          77.11 2.682E+00 + P 1.149E+00 1.58E+01 1.75E+01 GA
                          74.81 1.762E+00 } P 1.674E+00 8.70E+00 1.04E+01 GA
                          87.30 2.977E+00 +   1.903E+00 2.22E+01 7.80E+00 GA

Ra-223   N   5.2469E-01                                     7.96E+03
                         269.46 5.975E-01 &(P 7.451E-01 5.55E+01 1.37E+01 G K
                          83.78 3.385E-01  (  5.592E-01 5.11E+01 2.49E+01 G
                         323.87 2.791E-01 % P 2.553E+00 3.81E+02 3.93E+00 G
                         154.21 1.172E+00  (P 1.442E+00 5.18E+01 5.62E+00 G
                          94.90 0.000E+00 % P 1.214E+00 1.00E+03 1.13E+01 G
                          81.07 2.400E-01 -   7.454E-01 9.14E+01 1.50E+01 G

Ra-224   N   4.6992E-01                                     6.98E+02
                         241.00 4.699E-01 &(P 2.615E+00 2.33E+02 3.90E+00 G K

Ra-226   N   1.4230E+00                                     5.84E+05
                         609.31 1.275E+00  (P 2.611E-01 1.09E+01 4.48E+01 G K
                        1764.49 1.385E+00 ?(P 1.037E+00 4.10E+01 1.54E+01 G
                         295.22 1.668E+00  (P 4.229E-01 1.39E+01 1.92E+01 G
                        1120.29 1.988E+00 & P 9.244E-01 2.63E+01 1.48E+01 G
                         351.99 1.491E+00 *(P 2.139E-01 1.04E+01 3.71E+01 G
                         241.92 1.899E+00 + P 1.632E+00 2.86E+01 7.47E+00 G

Ac-227   N   6.3110E-01                                     7.95E+03
                         235.97 6.311E-01 ?(P 7.807E-01 5.52E+01 1.23E+01 G K
                         256.25 5.607E-01 &   1.415E+00 1.08E+02 7.00E+00 G
                         300.00 0.000E+00 % P 5.638E+00 1.00E+03 2.30E+00 G
                         329.85 0.000E+00 %   6.344E+00 1.00E+03 2.70E+00 G
```

D

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:37:12 AM Page 9
Pace Analytical Spectrum name: 30204854010.An1

```
Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
```

```
Ac-228    N   2.0100E+00                                          2.10E+03
                          911.21 2.010E+00  (P 3.883E-01 1.40E+01 2.66E+01 G K
                          968.97 1.172E+00 - P 1.155E+00 4.98E+01 1.62E+01 G
                          338.32 2.934E+00 + P 6.753E-01 1.47E+01 1.13E+01 G

Pa-234M   N   5.4003E+00                                          1.63E+12
                                                                 Energy duplication
                         1001.03 5.400E+00 %(P 1.533E+01 1.35E+02 8.37E-01 G

Th-232    N   5.4442E+00                                          4.17E+12
                           63.81 5.444E+00 &(P 1.304E+02 8.04E+02 2.67E-01 G K

U-238     N   5.3810E+00                                          1.63E+12
                                                                 Energy duplication
                         1001.03 5.381E+00 %(P 1.527E+01 1.35E+02 8.40E-01 G K
                           92.59 0.000E+00 % P 2.796E+00 1.00E+03 5.60E+00 GA

Am-241    T  -1.9881E-01                                          1.58E+05
                           59.54-1.988E-01 %(  9.797E-01 1.97E+02 3.63E+01 G K

Am-243    T   1.2532E-01                                          2.69E+06
                                                                 Derived Ave Activity
                           74.66 1.253E-01 }(P 4.333E-01 1.03E+02 6.82E+01 G K
   ( - This peak used in the nuclide activity average.

   * - Peak is too wide, but only one peak in library.
   i - 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 **********
Page 8

Nuclide	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 2 Sigma %	Activity	
Eu-155	105.29	52.	16.	0.018	184.56	2.456E-01	P
Ac-227	236.25	35.	25.	0.027	110.32	6.311E-01	P
I-131	283.89	25.	12.	0.014	180.01	2.725E+03	P
La-140	328.06	32.	16.	0.017	161.81	5.133E+01	
Ag-108M	433.77	23.	22.	0.024	104.91	1.031E-01	
Sb-125	463.19	34.	14.	0.016	195.77	6.267E-01	P
Ba-140	537.69	8.	10.	0.011	152.65	3.437E+01	P
I-132	629.91	4.	20.	0.022	68.23	0.000E+00	
Bi-212	727.49	20.	18.	0.020	130.26	1.664E+00	P
Sc-46	889.29	5.	10.	0.011	131.33	1.367E-01	
Y-88	898.29	1.	12.	0.013	63.73	1.522E-01	P
Ag-110M	1384.20	0.	11.	0.012	60.30	4.913E-01	
Eu-152	1407.62	0.	10.	0.011	65.24	4.048E-01	P
La-140	1594.90	0.	4.	0.004	100.00	7.019E+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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-1.3724E-01	-4.7639E-01	3.7321E+00	3.7327E+00	4.194E+00
Na-22	#B	0.0000E+00	0.0000E+00	2.3732E-02	2.3732E-02	2.541E-01
K-40	#	2.8213E+01	2.8213E+01	3.2316E+00	4.9222E+00	1.315E+00
Sc-46	#A	6.1840E-02	1.3669E-01	1.7951E-01	1.8041E-01	1.849E-01
Cr-51	#B	-4.3010E-01	-4.7374E+00	1.2039E+01	1.2056E+01	1.395E+01
Mn-54	#B	5.3591E-02	6.6300E-02	1.8373E-01	1.8394E-01	1.923E-01
Co-56	#B	0.0000E+00	0.0000E+00	3.3848E-01	3.3849E-01	7.589E-01
Co-57	#B	0.0000E+00	0.0000E+00	2.6863E-02	2.6864E-02	1.915E-01
Co-58	#B	5.6993E-02	1.4567E-01	2.9746E-01	2.9808E-01	3.136E-01
Fe-59	#B	0.0000E+00	0.0000E+00	1.1231E-01	1.1231E-01	1.667E+00
Co-60	#B	3.3485E-02	3.4861E-02	1.6859E-01	1.6865E-01	1.820E-01
Zn-65	#B	0.0000E+00	0.0000E+00	7.4612E-02	7.4613E-02	7.600E-01
Y-88	#B	3.8763E-02	7.2284E-02	4.6064E-02	4.7189E-02	2.896E-01
Nb-94	#B	0.0000E+00	0.0000E+00	1.2440E-02	1.2441E-02	1.520E-01
Zr-95	#B	-4.2159E-02	-1.1905E-01	7.8331E-01	7.8346E-01	8.275E-01
Nb-95	#B	0.0000E+00	0.0000E+00	7.7405E-02	7.7407E-02	1.009E+00
Ru-103	#B	0.0000E+00	0.0000E+00	3.8524E-01	3.8525E-01	8.124E-01
Ag-108M	#B	5.1446E-02	5.1468E-02	5.3994E-02	5.4421E-02	1.840E-01
Ru-106	#B	-3.3723E-01	-4.0308E-01	1.6628E+00	1.6637E+00	1.790E+00
Cd-109	#B	-1.6484E+00	-1.9024E+00	3.9478E+00	3.9568E+00	4.875E+00

Ag-110M	#B	9.2972E-02	1.2131E-01	7.3153E-02	7.4889E-02	1.714E-01
Sn-113	#B	0.0000E+00	0.0000E+00	1.9481E-01	1.9482E-01	3.716E-01
Sb-124	A	4.9836E-02	1.5031E-01	1.6042E-01	1.6164E-01	2.530E-01
Sb-125	#B	1.3438E-01	1.4354E-01	2.8101E-01	2.8164E-01	4.077E-01
Te-129	#B	0.0000E+00	0.0000E+00	3.6710E+00	3.6711E+00	1.519E+01
Te-129M	#B	0.0000E+00	0.0000E+00	1.2384E+01	1.2384E+01	4.340E+01
I-131	#B	9.3682E-02	3.7194E+02	5.2036E+02	5.2267E+02	4.761E+02
I-132	#B	1.2048E-01	>12 Halflives	8.2202E-02	8.3729E-02	1.594E-01
Te-132	#B	0.0000E+00	>12 Halflives	2.2178E-02	2.2178E-02	1.539E-01
I-133	#B	2.9037E-02	>12 Halflives	1.2661E-01	1.2667E-01	1.428E-01
Ba-133	#B	0.0000E+00	0.0000E+00	4.3362E-02	4.3363E-02	1.835E-01
Cs-134	A	6.9739E-02	7.6179E-02	8.0236E-02	8.0863E-02	1.377E-01
Cs-136	#B	0.0000E+00	0.0000E+00	2.6550E+00	2.6551E+00	2.185E+01

Cs-137	#B	-5.3232E-02	-5.3555E-02	1.9163E-01	1.9176E-01	2.039E-01
Ce-139	#B	3.5134E-03	5.6941E-03	1.7587E-01	1.7588E-01	2.158E-01
Ba-140	#A	1.8724E-01	3.4365E+01	5.2458E+01	5.2653E+01	5.806E+01
La-140	#	8.0602E-02	1.4793E+01	1.4069E+01	1.4208E+01	1.293E+01
Ce-141	#B	-7.3933E-02	-5.7137E-01	1.7708E+00	1.7724E+00	2.109E+00
Ce-144	#B	2.0021E-01	2.5282E-01	1.0031E+00	1.0037E+00	1.215E+00
Eu-152	#B	1.6918E-01	1.7147E-01	1.1186E-01	1.1419E-01	4.452E-01
Eu-154	#B	5.3466E-02	5.4611E-02	2.2463E-01	2.2475E-01	2.716E-01
Eu-155	#B	9.6542E-02	1.0030E-01	1.8512E-01	1.8566E-01	5.304E-01
Ir-192	#A	0.0000E+00	0.0000E+00	6.7492E-02	6.7494E-02	3.894E-01
Hg-203	#B	0.0000E+00	0.0000E+00	1.0908E-01	1.0909E-01	7.718E-01
Tl-208	#	6.0481E-01	6.6526E-01	1.7700E-01	1.9755E-01	1.354E-01
Pb-210	#B	0.0000E+00	0.0000E+00	1.1399E+01	1.1399E+01	2.780E+01
Bi-212	#A	1.5129E+00	1.6641E+00	2.1676E+00	2.1788E+00	2.224E+00
Pb-212		1.6023E+00	1.7625E+00	2.8765E-01	3.7230E-01	2.882E-01
Ra-223	A	5.2033E-01	5.2469E-01	3.1998E-01	3.2756E-01	7.451E-01
Ra-224	#B	4.2721E-01	4.6992E-01	2.1862E+00	2.1871E+00	2.615E+00
Ra-226		1.4228E+00	1.4230E+00	2.9535E-01	3.5002E-01	2.611E-01
Ac-227	#A	6.2585E-01	6.3110E-01	6.9622E-01	7.0135E-01	7.807E-01
Ac-228		1.9474E+00	2.0100E+00	5.6302E-01	6.2205E-01	3.883E-01
Th-228	#B	0.0000E+00	0.0000E+00	7.4036E+00	7.4038E+00	1.259E+01
Pa-231	#B	0.0000E+00	0.0000E+00	3.6089E+00	3.6089E+00	7.839E+00
Pa-234M	#A	5.4003E+00	5.4003E+00	1.4543E+01	1.4560E+01	1.533E+01
Th-230	#B	0.0000E+00	0.0000E+00	1.8879E+01	1.8880E+01	7.231E+01
Th-232	#B	5.4442E+00	5.4442E+00	8.7489E+01	8.7492E+01	1.104E+02
Th-234	#B	0.0000E+00	0.0000E+00	1.2691E+00	1.2692E+00	6.530E+00
U-235	#B	0.0000E+00	0.0000E+00	3.3491E-01	3.3492E-01	2.365E+00
U-238	#B	5.3810E+00	5.3810E+00	1.4491E+01	1.4508E+01	1.527E+01
Am-241	#B	-1.9873E-01	-1.9881E-01	7.8271E-01	7.8321E-01	9.797E-01
Am-243	A	1.2532E-01	1.2532E-01	2.5857E-01	2.5915E-01	4.333E-01

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.

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Pace Analytical Spectrum name: 30204854010.Anl

< - 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 (30.3 to 2035.6 keV) 3.436E+01 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 3.4748310E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854011	**Collection Date**	11/18/2016 11:25
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/22/17 7:36
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	11.672	3.213	2.315
Cesium-137	0.000	0.094	0.275
Lead-212	8.852	1.305	0.433
Potassium-40	6.414	2.096	1.615
Protactinium-234M	0.000	2.409	29.180
Radium-226	7.824	1.160	0.347
Radium-228	7.394	1.411	0.666
Thallium-208	3.216	0.535	0.198
Thorium-228	15.992	12.500	15.720
Thorium-234	8.803	4.205	4.772
Uranium-235	0.535	0.782	3.000

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Pace Analytical Spectrum name: 30204854011.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854011.An1

Acquisition information
Start time: 2/22/2017 7:36:50 AM
Live time: 900
Real time: 904
Dead time: 0.41 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 kev
Gain: 0.250 kev/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 3.4389E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00+ 3.4389E+02) =
2.9079E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/22/17

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Pace Analytical Spectrum name: 30204854011.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 11:25:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:13:45 AM
Absorption (internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1610

DMA 2/22/17

***** 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. pCi/G	Nuc
46.73	68.	36.76	0.39	2.190E-02	46.54	4.250	6.478E+00	Pb210
62.90	177.	22.86	1.10	3.668E-02	63.29	4.800	8.803E+00	Th234
74.80	573.	7.02	0.98	4.124E-02	74.66	68.200	1.780E+00	Am243
					74.81	10.400	1.281E+01	Pb212
77.15	898.	4.76	0.98	4.198E-02	77.11	17.500	1.172E+01	Pb212
78.88	53.	75.85	0.98	4.255E-02	79.13	6.600	PBC<MDA	Ag108M
					79.13	6.600	1.643E+00	Ag108M
83.93	137.	20.37	0.99	4.382E-02	83.78	24.900	1.106E+00	Ra223
					84.37	1.266	2.305E+01	Th228
87.18	346.	9.27	0.99	4.455E-02	86.54	30.700	2.282E+00	Eu155
					87.30	7.800	9.572E+00	Pb212
					88.03	3.610	2.162E+01	Cd109
89.90	238.	11.98	0.99	4.509E-02	89.95	3.550	1.293E+01	U235
					89.95	3.560	1.293E+01	U235
92.96	291.	10.79	1.00	4.562E-02	92.59	5.600	9.619E+00	U238
					92.60	2.800	1.912E+01	Th234
					92.59	5.600	9.619E+00	U238
105.20	72.	43.74	0.34	4.704E-02	105.31	21.200	PBC<MDA	Eu155
121.84	36.	92.46	1.02	4.744E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	PBC<MDA	Co57
					122.06	85.600	PBC<MDA	Co57
					121.78	28.400	PBC<MDA	Eu152
121.87	66.	47.54	1.02	4.744E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	1.817E-01	Co57
					123.07	40.600	3.013E-01	Eu154
129.22	114.	24.69	0.78	4.719E-02				
131.48	33.	66.00	1.03	4.707E-02	131.61	0.135	PBC<MDA	Th228

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pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
143.48	45.	72.78	1.04	4.619E-02	143.76	10.960	PBC<MDA	U235

					143.76	10.960	PBC<MDA	U235
154.17	46.	68.07	0.34	4.519E-02	154.21	5.620	PBC<MDA	Ra223
162.79	45.	67.94	1.06	4.427E-02	162.66	6.220	PBC<MDA	Ba140
					162.66	6.220	PBC<MDA	Ba140
204.00	50.	41.09	0.48	3.934E-02				
209.14	160.	24.92	0.98	3.874E-02				
238.32	1423.	2.98	1.12	3.551E-02	238.63	43.300	8.873E+00	Pb212
241.49	291.	9.38	1.13	3.518E-02	241.00	3.900	2.035E+01	Ra224
					241.92	7.470	9.646E+00	Ra226
270.03	94.	30.79	1.15	3.249E-02	269.46	13.700	1.870E+00	Ra223
273.88	32.	80.61	1.15	3.212E-02	273.65	11.100	PBC<MDA	Cs136
					273.65	11.100	1.221E+02	Cs136
276.96	65.	24.29	0.75	3.179E-02	277.36	6.310	3.092E+00	Tl208
279.28	29.	66.29	1.16	3.164E-02	279.20	81.460	PBC<MDA	Hg203
					279.20	81.460	PBC<MDA	Hg203
294.95	534.	5.91	1.31	3.035E-02	295.22	19.200	7.996E+00	Ra226
					295.96	28.670	1.321E+01	Ir192
					295.96	28.670	1.321E+01	Ir192
299.75	90.	27.72	1.18	2.995E-02	300.00	2.300	1.147E+01	Ac227
					300.00	2.300	1.147E+01	Ac227
308.22	27.	70.38	1.18	2.932E-02	308.46	30.000	PBC<MDA	Ir192
					308.46	30.000	6.551E+01	Ir192
327.80	102.	22.63	1.18	2.797E-02	329.85	2.700	1.201E+01	Ac227
					328.76	20.300	2.881E+02	La140
329.57	22.	75.73	1.20	2.783E-02	330.00	1.300	PBC<MDA	Pa231
					329.85	2.700	2.597E+00	Ac227
338.15	356.	8.89	1.19	2.730E-02	338.32	11.300	1.040E+01	Ac228
351.72	966.	4.10	1.28	2.648E-02	351.99	37.100	8.564E+00	Ra226
356.39	20.	88.32	1.22	2.623E-02	356.02	62.050	PBC<MDA	Ba133
					356.02	62.050	1.069E-01	Ba133
463.08	128.	15.78	0.75	2.139E-02	463.36	10.500	5.318E+00	Sb125
					463.36	10.500	5.318E+00	Sb125
537.79	26.	60.61	1.37	1.911E-02	537.26	24.390	PBC<MDA	Ba140
					537.26	24.390	8.921E+01	Ba140
583.05	512.	5.00	1.55	1.799E-02	583.19	84.500	3.225E+00	Tl208
609.15	647.	4.43	1.40	1.742E-02	609.31	44.800	7.202E+00	Ra226
723.87	16.	75.30	1.52	1.537E-02	724.20	44.170	PBC<MDA	Zr95
					724.20	44.170	5.809E-01	Zr95
					722.94	90.800	1.000E-01	Ag108M
					722.79	10.750	2.543E+00	Sb124
					723.30	20.110	4.613E-01	Eu154
726.98	123.	12.06	1.60	1.532E-02	727.33	6.580	1.167E+01	Bi212
794.89	72.	18.66	1.57	1.438E-02	795.86	85.530	5.583E-01	Cs134
					795.86	85.530	5.583E-01	Cs134
835.34	21.	83.23	1.60	1.390E-02	834.85	99.976	PBC<MDA	Mn54
					834.85	99.976	1.619E-01	Mn54
860.80	57.	19.84	1.22	1.361E-02	860.56	12.420	3.224E+00	Tl208

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pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
870.88	14.	77.03	1.63	1.350E-02	871.09	99.900	PBC<MDA	Nb94
					871.09	99.900	PBC<MDA	Nb94
911.05	291.	6.82	1.35	1.308E-02	911.21	26.600	7.479E+00	Ac228
953.74	12.	98.66	1.69	1.265E-02	954.55	17.600	HL>Cutoff	I132
					954.55	17.600	HL>Cutoff	I132
964.94	46.	35.40	1.70	1.257E-02	964.13	14.340	2.277E+00	Eu152
					964.13	14.340	2.277E+00	Eu152
968.79	164.	12.20	0.87	1.253E-02	968.97	16.200	7.253E+00	Ac228
996.23	23.	37.02	1.72	1.229E-02	996.26	10.530	1.585E+00	Eu154
					996.26	10.530	1.585E+00	Eu154

1047.89	11.	72.61	1.75	1.187E-02	1048.07	80.000	PBC<MDA	Cs136
					1048.07	80.000	1.624E+01	Cs136
1086.74	12.	88.42	1.78	1.158E-02	1085.91	9.920	PBC<MDA	Eu152
					1085.91	9.920	9.762E-01	Eu152
1111.06	12.	78.82	1.80	1.139E-02	1112.12	13.550	PBC<MDA	Eu152
					1112.12	13.550	7.171E-01	Eu152
1120.08	156.	8.04	2.25	1.133E-02	1120.29	14.800	8.146E+00	Ra226
1237.54	64.	19.62	0.56	1.056E-02	1238.28	66.070	1.907E+00	Co56
1384.92	16.	42.74	1.98	9.753E-03	1384.30	24.120	7.953E-01	Ag110M
					1384.30	24.120	7.953E-01	Ag110M
1407.37	36.	16.67	1.99	9.634E-03	1408.01	20.870	1.585E+00	Eu152
					1408.01	20.870	1.585E+00	Eu152
1460.86	74.	14.94	1.23	9.379E-03	1461.00	10.670	6.414E+00	K40
1620.87	22.	33.92	2.12	8.686E-03	1620.50	1.490	1.970E+01	Bi212
1764.40	104.	11.34	2.20	8.138E-03	1764.49	15.360	7.286E+00	Ra226
1771.26	2.	90.47	2.20	8.114E-03	1771.35	15.480	PBC<MDA	Co56

********** 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 2 Sigma %	FWHM kev	Suspected Nuclide	
359.53	89.98	292.	232.	5.150E+03	24.60	0.994	-	D
515.76	129.22	238.	102.	2.159E+03	47.20	1.028	-	D
815.32	204.00	124.	50.	1.271E+03	82.17	0.480	-	s
835.91	209.14	295.	160.	4.126E+03	49.84	0.979	-	s
1310.53	327.80	99.	84.	3.004E+03	39.97	1.201	-	D
1851.45	463.08	56.	128.	5.984E+03	31.56	0.751	-	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: Pace Master w Ra-226 Rev.4 09281
n

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Pace Analytical Spectrum name: 30204854011.Anl

********** 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 2 Sigma %	FWHM keV
Pb-210	186.49	46.73	179.	67.	0.075	74.54	0.386s
Th-234	251.14	62.90	403.	177.	0.197	45.72	1.105s
Th-232	254.69	63.79	456.	-63.	-0.070	132.23	0.970
Am-243	298.15	74.66	2019.	95.	0.106	135.29	0.953D
Pb-212	298.75	74.81	546.	395.	0.439	15.76	0.980D
Pb-212	307.95	77.11	459.	880.	0.978	9.63	0.982D
Ag-108M	315.02	78.88	405.	53.	0.059	151.70	0.984s
Ra-223	334.62	83.78	371.	81.	0.090	71.20	0.988D
Th-228	336.99	84.37	359.	71.	0.079	78.87	0.989D
Eu-155	345.68	86.54	547.	104.	0.116	66.37	0.990D
Pb-212	348.70	87.30	422.	267.	0.296	24.99	0.991D
Cd-109	351.63	88.03	660.	52.	0.058	142.99	0.992D
U-235	359.23	89.93	371.	184.	0.204	43.61	0.993
U-238	370.88	92.85	415.	261.	0.290	32.84	0.996s
Th-234	369.89	92.60	366.	262.	0.291	24.07	0.996D

Eu-155	420.26	105.20	263.	72.	0.080	87.49	0.335s
Eu-152	486.79	121.84	284.	36.	0.040	184.93	1.022s
Co-57	486.92	121.87	241.	66.	0.074	95.08	1.022s
Th-228	525.88	131.61	227.	33.	0.037	131.99	1.031D
U-235	573.32	143.48	271.	45.	0.050	145.55	1.041s
Ce-141	581.52	145.53	371.	-43.	-0.048	177.40	1.043s
Ra-223	616.07	154.17	269.	46.	0.051	136.15	0.341s
Ba-140	650.54	162.79	233.	45.	0.050	135.87	1.058s
Pb-212	953.83	238.63	204.	1416.	1.573	6.03	1.124D
Ra-224	963.30	241.00	508.	121.	0.134	55.98	1.126D
Ra-226	966.98	241.92	265.	238.	0.264	23.31	1.127D
Ra-223	1079.39	270.03	180.	94.	0.105	61.58	1.151s
Cs-136	1094.77	273.88	152.	32.	0.036	161.21	1.155s
Tl-208	1107.11	276.96	60.	65.	0.072	48.58	0.752s
Hg-203	1116.37	279.28	83.	29.	0.032	132.58	1.159s
Ra-226	1179.05	294.95	100.	533.	0.592	11.85	1.307
Ir-192	1183.44	296.05	60.	26.	0.028	130.53	1.174s
Ac-227	1198.23	299.75	127.	90.	0.100	55.44	1.177
Ir-192	1232.10	308.22	79.	27.	0.030	140.77	1.184s
Ac-227	1312.00	328.20	234.	-42.	-0.047	150.79	1.202s
Pa-231	1319.21	330.00	130.	22.	0.025	151.47	1.203D
Ac-228	1351.81	338.15	125.	356.	0.396	17.79	1.190
Ra-226	1406.09	351.72	120.	963.	1.070	8.24	1.280
Ba-133	1424.75	356.39	66.	20.	0.022	176.63	1.224s
Sb-125	1851.20	463.02	77.	97.	0.108	43.42	1.313s
Ba-140	2150.28	537.79	46.	26.	0.029	121.22	1.373s
Tl-208	2331.30	583.05	38.	510.	0.567	10.06	1.553
Ra-226	2435.68	609.15	37.	643.	0.715	8.92	1.404
Zr-95	2894.60	723.87	25.	16.	0.018	150.61	1.519s

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Pace Analytical Spectrum name: 30204854011.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Bi-212	2907.02	726.98	21.	123.	0.136	24.12	1.604s
Cs-134	3178.68	794.89	21.	72.	0.080	37.32	1.573s
Mn-54	3340.53	835.34	54.	21.	0.023	166.47	1.602
Tl-208	3442.37	860.80	15.	57.	0.063	39.69	1.219s
Nb-94	3482.70	870.88	19.	14.	0.015	154.07	1.629s
Ac-228	3643.41	911.05	24.	289.	0.321	13.79	1.345
I-132	3814.20	953.74	23.	12.	0.013	197.33	1.689s
Eu-152	3859.01	964.94	41.	46.	0.052	70.79	1.696s
Ac-228	3874.42	968.79	47.	163.	0.182	24.54	0.869s
Eu-154	3984.20	996.23	9.	23.	0.026	74.04	1.719s
Cs-136	4190.93	1047.89	10.	11.	0.013	145.22	1.755s
Eu-152	4346.38	1086.74	19.	13.	0.014	176.85	1.781s
Eu-152	4443.69	1111.06	14.	12.	0.014	157.65	1.799s
Ra-226	4479.78	1120.08	1.	156.	0.174	16.07	2.249s
Co-56	4949.79	1237.34	16.	64.	0.072	39.23	0.562s
Ag-110M	5539.61	1384.92	6.	16.	0.018	85.49	1.976s
Eu-152	5629.47	1407.37	0.	36.	0.040	33.33	1.990s
K-40	5843.52	1460.88	11.	74.	0.082	29.88	1.232s
Bi-212	6484.01	1620.87	6.	22.	0.025	67.84	2.117s
Ra-226	7058.93	1764.49	18.	104.	0.116	22.68	2.195D
Co-56	7086.38	1771.35	1.	2.	0.002	180.93	2.200D

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 *****
Page 5

- Nuclide - Name	Code	Average Activity pCi/G	Peak Energy keV	Peak Activity pCi/G	Code	MDA Value pCi/G		COMMENTS
Na-22	C	1.2076E-02					9.50E+02	
			1274.53	1.208E-02	%(	2.164E-01	8.51E+02	9.99E+01 G K
K-40	N	6.4141E+00					4.68E+11	
			1461.00	6.414E+00	(P	1.615E+00	1.49E+01	1.07E+01 G K
Cr-51	F	2.6606E+00					2.77E+01	
			320.08	2.661E+00	%(P	1.689E+01	2.65E+02	1.01E-01 G K
Mn-54	C	1.6192E-01					3.12E+02	
			834.85	1.619E-01	(	2.876E-01	8.32E+01	1.00E+02 G K
Co-56	C	1.9074E+00					7.73E+01	
			1238.28	1.907E+00	@(	6.227E-01	1.96E+01	6.61E+01 G K
			1771.35	3.601E-01	- P	1.211E+00	9.05E+01	1.55E+01 G

Nuclide	Ave activity		Energy	Activity	Code	Peak	MDA	Comments
Co-57	C	1.8170E-01					2.72E+02	
			122.06	1.817E-01	*(	2.060E-01	4.75E+01	8.56E+01 G K
			136.47	1.823E-01	%	1.987E+00	4.45E+02	1.07E+01 G
Co-58	C	1.8445E-02					7.08E+01	
			810.78	1.844E-02	%(	3.791E-01	8.94E+02	9.94E+01 G K
Co-60	F	7.6462E-02					1.92E+03	
			1332.50	7.646E-02	&(P	2.053E-01	1.24E+02	1.00E+02 G K
			1173.24	5.694E-02	% P	1.988E-01	1.61E+02	1.00E+02 G
Nb-94	I	9.0311E-02					7.41E+06	
			871.09	9.031E-02	&(P	1.493E-01	7.70E+01	9.99E+01 G K
			702.62	5.679E-03	&	2.446E-01	1.97E+03	9.79E+01 G
Zr-95	I	3.2009E-01					6.40E+01	
			756.73	1.086E-01	%(P	1.127E+00	4.72E+02	5.45E+01 G K
			724.20	5.809E-01	?(	9.443E-01	7.53E+01	4.42E+01 G
Ru-103	I	2.4515E-01					3.93E+01	
			497.08	2.452E-01	&(P	1.002E+00	1.75E+02	9.10E+01 G K
Ag-108M	C	1.1136E-01					1.53E+05	
			722.94	0.000E+00	%(	3.022E-01	1.00E+03	9.08E+01 G K
			614.28	6.651E-02	%	1.853E-01	1.24E+02	8.98E+01 G
			433.94	0.000E+00	&	2.599E-01	1.00E+03	9.05E+01 G
			79.13	1.643E+00	?(	3.002E+00	7.59E+01	6.60E+00 G
Cd-109	F	3.2349E+00					4.64E+02	
			88.03	3.235E+00	(	7.645E+00	7.15E+01	3.61E+00 G K
Ag-110M	F	1.6240E-01					2.50E+02	
			657.76	0.000E+00	&(P	3.133E-01	1.00E+03	9.40E+01 G K
			1505.04	5.273E-01	%	2.074E+00	1.93E+02	1.29E+01 G
			1384.30	7.953E-01	?(P	6.643E-01	4.27E+01	2.41E+01 G
			937.49	0.000E+00	%	1.132E+00	1.00E+03	3.41E+01 G

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                    884.68 0.000E+00 % P 4.550E-01 1.00E+03 7.22E+01 G
                    763.94 1.623E-01 %   1.332E+00 3.75E+02 2.21E+01 G
                    744.28 1.286E+00 & P 5.519E+00 1.96E+02 4.70E+00 G
                    706.68 0.000E+00 % P 1.971E+00 1.00E+03 1.63E+01 G

Sn-113    F  -1.1978E-01                                   1.15E+02
                    391.69-1.198E-01 %(  5.345E-01 1.95E+02 6.40E+01 G K

Sb-124    F  -4.6012E-02                                   6.02E+01
                    602.73-4.601E-02 %(  6.353E-01 6.11E+02 9.78E+01 G K
                    645.85 0.000E+00 % P 7.919E+00 1.00E+03 7.38E+00 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                    727.79 0.000E+00 %   7.682E+00 1.00E+03 1.08E+01 G
                   1690.98 0.000E+00 % P 1.681E+00 1.00E+03 4.73E+01 G

Sb-125    I   9.3766E-01                                   1.01E+03
                    427.88-1.594E-01 %(  7.104E-01 1.94E+02 2.96E+01 G K
                    176.31 0.000E+00 % P 2.500E+00 1.00E+03 6.82E+00 G
                    463.36 4.030E+00 ?(  1.812E+00 2.17E+01 1.05E+01 G
                    600.60 3.646E-01 % P 9.819E-01 1.20E+02 1.79E+01 G
                    635.95 0.000E+00 & P 2.283E+00 1.00E+03 1.13E+01 G

Te-129M   I   1.6087E+01                                   3.36E+01
                    695.88 1.609E+01 %(P 4.557E+01 1.31E+02 3.00E+00 G K

I-131     I   2.6280E+02                                   8.02E+00
                    364.49 2.628E+02 &(  7.460E+02 1.24E+02 8.17E+01 G K
                    636.99-3.812E+02 %   1.121E+04 1.29E+03 7.17E+00 G
                    284.30 3.006E+02 %   1.041E+04 1.45E+03 6.14E+00 G

I-132     I   8.7836E-02                                   3.20E+00
                    772.60 0.000E+00 %(P 3.391E-01 1.00E+03 7.56E+01 G K
                    522.65 0.000E+00 % P 1.221E+00 1.00E+03 1.60E+01 G
                    630.19 1.031E-01 &   1.515E+00 6.49E+02 1.33E+01 G
                    954.55 4.651E-01 ?(P 9.844E-01 9.87E+01 1.76E+01 G

Ba-133    F   1.0645E-01                                   3.84E+03
                    356.02 1.065E-01 ?(  2.222E-01 8.83E+01 6.20E+01 G K
                     81.00 0.000E+00 % P 6.056E-01 1.00E+03 3.41E+01 G
                    302.85-2.010E-01 %   9.999E-01 2.10E+02 1.83E+01 G
                    276.40 0.000E+00 % P 2.273E+00 1.00E+03 7.16E+00 G
                    383.85 1.963E-01 % P 1.867E+00 4.10E+02 8.94E+00 G

Cs-134    I   2.8847E-01                                   7.52E+02
                    604.72 5.209E-02 &(  2.056E-01 1.76E+02 9.76E+01 G K
                    801.95 0.000E+00 % P 2.522E+00 1.00E+03 8.69E+00 G
                    795.86 5.583E-01 ?(P 1.868E-01 1.87E+01 8.55E+01 G
                    569.33 0.000E+00 % P 1.382E+00 1.00E+03 1.54E+01 G

Cs-136    F   1.3908E+01                                   1.32E+01
                    818.51 0.000E+00 %(P 3.194E+01 1.00E+03 9.97E+01 G K
                    176.60 3.657E+00 & P 2.435E+02 2.70E+03 1.00E+01 G
                    273.65 1.221E+02 &(  2.295E+02 8.06E+01 1.11E+01 G
                    340.55 1.787E+01 % P 5.537E+01 1.30E+02 4.22E+01 G
                   1048.07 1.624E+01 ?(  2.464E+01 7.26E+01 8.00E+01 G
                   1235.36 0.000E+00 & P 2.634E+02 1.00E+03 2.00E+01 G

Ba-140    I   1.2428E+02                                   1.28E+01
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                          537.26 8.921E+01 ?(  1.177E+02 6.06E+01 2.44E+01 G K
                          162.66 2.618E+02  (P 4.288E+02 6.79E+01 6.22E+00 G
```



```
Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

La-140   I   3.8170E+00                                    1.28E+01
                          1596.21 3.817E+00 %(  4.689E+01 6.02E+02 9.54E+01 G K
                           487.02 2.647E+01 %   6.953E+01 1.14E+02 4.55E+01 G
                           815.77 2.999E+01 %   1.166E+02 1.73E+02 2.33E+01 G
                           328.76 0.000E+00 & P 1.701E+02 1.00E+03 2.03E+01 G

Ce-141   I  -1.3115E+00                                    3.25E+01
                           145.44-1.312E+00 ?(  2.810E+00 8.87E+01 4.82E+01 G K

Ce-144   I   6.7042E-01                                    2.85E+02
                           133.51 6.704E-01 %(  1.718E+00 1.06E+02 1.11E+01 G K

Eu-152   F   1.0553E+00                                    4.95E+03
                           121.78 2.381E-01 *(P 5.335E-01 9.25E+01 2.84E+01 G K
                          1408.01 1.585E+00 ?(  3.244E-01 1.67E+01 2.09E+01 G
                          1112.12 7.171E-01 ?(  1.173E+00 7.88E+01 1.36E+01 G
                          1085.91 9.762E-01 &(  1.788E+00 8.84E+01 9.92E+00 G
                           964.13 2.277E+00  (P 1.591E+00 3.54E+01 1.43E+01 G
                           344.28 0.000E+00 % P 6.683E-01 1.00E+03 2.66E+01 G
                           244.70 0.000E+00 & P 2.464E+00 1.00E+03 7.49E+00 G

Eu-154   I   3.2643E-01                                    3.14E+03
                           123.07 0.000E+00 %(P 4.260E-01 1.00E+03 4.06E+01 G K
                          1274.44 3.284E-02 %   5.885E-01 8.51E+02 3.50E+01 G
                          1004.72 8.966E-02 % P 1.181E+00 6.04E+02 1.79E+01 G
                           996.26 1.585E+00 ?(  1.150E+00 3.70E+01 1.05E+01 G
                           873.19 2.171E-01 %   1.664E+00 3.55E+02 1.22E+01 G
                           723.30 0.000E+00 %   1.477E+00 1.00E+03 2.01E+01 G
                           247.93 4.175E-01 & P 2.463E+00 2.50E+02 6.91E+00 G

Eu-155   I   6.7840E-01                                    1.74E+03
                            86.54 6.944E-01  (P 7.433E-01 3.32E+01 3.07E+01 G K
                           105.31 6.552E-01  (P 7.121E-01 4.37E+01 2.12E+01 G

Ir-192   F   2.2114E-01                                    7.38E+01
                           316.51-7.819E-02 %(  4.976E-01 2.67E+02 8.28E+01 G
                           468.07 1.782E-01 % P 8.249E-01 1.98E+02 4.78E+01 G
                           308.46 6.551E-01 ?(  1.078E+00 7.04E+01 3.00E+01 G
                           295.96 6.317E-01 ?(P 9.638E-01 6.53E+01 2.87E+01 G

Hg-203   F   4.1103E-01                                    4.66E+01
                           279.20 4.110E-01 ?(P 6.359E-01 6.63E+01 8.15E+01 G K

Tl-208   N   3.2164E+00                                    6.98E+02
                           583.19 3.225E+00  (P 1.984E-01 5.03E+00 8.45E+01 G K
                           860.56 3.224E+00  (P 1.189E+00 1.98E+01 1.24E+01 G
                           277.36 3.092E+00  (P 1.864E+00 2.43E+01 6.31E+00 G
```



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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
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Pb-210    N    6.4782E+00                                                  8.14E+03
                                 46.54 6.478E+00  (P 6.238E+00 3.73E+01 4.25E+00 G K

Bi-212    N    1.1672E+01                                                  6.98E+02
                                727.33 1.167E+01  (P 2.315E+00 1.21E+01 6.58E+00 G K
                               1620.50 1.670E+01 +   1.012E+01 3.39E+01 1.49E+00 G

Pb-212    N    8.8524E+00                                                  6.98E+02
                                238.63 8.852E+00  (P 4.334E-01 3.02E+00 4.33E+01 G K
                                 77.11 1.152E+01 + P 1.341E+00 4.82E+00 1.75E+01 GA
                                 74.81 8.852E+00 } P 2.500E+00 7.88E+00 1.04E+01 GA
                                 87.30 7.374E+00 -   2.721E+00 1.25E+01 7.80E+00 GA

Ra-223    N    1.7909E+00                                                  7.96E+03
                                269.46 1.870E+00 &(  1.292E+00 3.08E+01 1.37E+01 G K
                                 83.78 6.512E-01 -   7.475E-01 3.56E+01 2.49E+01 G
                                323.87 6.514E-02 % P 3.898E+00 2.47E+03 3.93E+00 G
                                154.21 1.599E+00  (P 2.743E+00 6.81E+01 5.62E+00 G
                                 94.90 3.737E-01 % P 1.398E+00 1.12E+02 1.13E+01 G
                                 81.07 0.000E+00 % P 1.329E+00 1.00E+03 1.50E+01 G

Ra-224    N    8.4264E+00                                                  6.98E+02
                                241.00 8.426E-00  (P 7.535E+00 2.80E+01 3.90E+00 G K

Ra-226    N    7.8243E+00                                                  5.84E+05
                                609.31 7.202E+00  (P 3.467E-01 4.46E+00 4.48E+01 G K
                               1764.49 7.286E+00  (P 1.560E+00 1.13E+01 1.54E+01 G
                                295.22 7.996E+00  (P 7.394E-01 5.93E+00 1.92E+01 G
                               1120.29 8.146E+00 *(P 3.839E-01 8.04E+00 1.48E+01 G
                                351.99 8.564E+00  (P 4.788E-01 4.12E+00 3.71E+01 G
                                241.92 7.915E+00  (P 2.615E+00 1.17E+01 7.47E+00 G

Ac-227    N    1.8074E+00                                                  7.95E+03
                                235.97 0.000E+00 %(P 1.675E+00 1.00E+03 1.23E+01 G K
                                256.25-7.587E-01 %   2.537E+00 1.42E+02 7.00E+00 G
                                300.00 1.147E+01  (P 7.065E+00 2.77E+01 2.30E+00 G
                                329.85-4.960E+00 +   8.675E+00 7.54E+01 2.70E+00 G

Ac-228    N    7.3935E+00                                                  2.10E+03
                                911.21 7.479E+00  (P 6.657E-01 6.90E+00 2.66E+01 G K
                                968.97 7.253E+00  (P 1.533E+00 1.23E+01 1.62E+01 G
                                338.32 1.040E+01 + P 1.602E+00 8.89E+00 1.13E+01 G

Th-228    N    1.5992E+01                                                  6.98E+02
                                 84.37 1.231E+01  (P 1.572E+01 3.94E+01 1.27E+00 G K
                                215.99 1.660E+01 & P 7.488E+01 1.92E+02 2.63E-01 G
                                166.41 3.244E+01 % P 1.557E+02 1.96E+02 1.08E-01 G
```

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Pace Analytical Spectrum name: 30204854011.Anl

```
Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                                131.61 5.038E+01  (P 1.097E+02 6.60E+01 1.35E-01 G

Pa-231    N    3.8919E+00                                                  1.20E+07
                                283.70 2.706E+00 &(  9.516E+00 1.49E+02 1.60E+00 G K
                                330.00 5.351E+00  (  1.347E+01 7.57E+01 1.30E+00 G

Th-230    N    1.4076E+01                                                  2.75E+07
                                 67.67 1.408E+01 %(  6.385E+01 1.87E+02 3.80E-01 G K

Th-232    N   -5.5796E+01                                                  4.17E+12
```

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                                63.81-5.580E+01  (  9.053E+01 6.51E+01 2.67E-01 G K

Th-234    N    8.8030E+00                                          1.63E+12
                                63.29 8.803E+00 *(P 4.772E+00 2.29E+01 4.80E+00 G K
                                92.60 1.794E+01 + P 6.289E+00 1.20E+01 2.80E+00 G

U-235     N    5.3480E-01                                          2.57E+11
                               205.31 0.000E+00 &(P 3.000E+00 1.00E+03 5.01E+00 G K
                               143.76 7.793E-01 7(P 1.369E+00 7.28E+01 1.10E+01 G
                                89.95 1.000E+01     5.032E+00 2.18E+01 3.56E+00 GA

Am-241    T    2.1179E-01                                          1.58E+05
                                59.54 2.118E-01 %(  6.177E-01 1.15E+02 3.63E-01 G K

Am-243    T    2.9541E-01                                          2.69E+06
                                                                   Derived Ave Activity
                                74.66 2.954E-01 }(P 6.593E-01 6.76E+01 6.82E+01 G K
   ( - 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.
   7 - 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
]
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Pace Analytical   Spectrum name: 30204854011.An1

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   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  2 Sigma %
 ------------------------------------------------------------------------------
 Th-232     63.79     456.       -63.     -0.070    132.23   -5.580E+01
 Ag-108M    78.88     405.        53.      0.059    151.70    1.643E+00
 U-235      89.93     371.       184.      0.204     43.61    1.000E+01
 U-238      92.85     415.       261.      0.290     32.84    8.932E+00   P
```

Eu-152	121.84	284.	36.	0.040	184.93	2.381E-01	P
Co-57	121.87	241.	66.	0.074	95.08	1.817E-01	
U-235	143.48	271.	45.	0.050	145.55	7.793E-01	P
Ce-141	145.53	371.	-43.	-0.048	177.40	-1.312E+00	
Ba-140	162.79	233.	45.	0.050	135.87	2.618E+02	P
Cs-136	273.88	152.	32.	0.036	161.21	1.221E+02	
Hg-203	279.28	83.	29.	0.032	132.58	4.110E-01	P
Ir-192	296.05	60.	26.	0.028	130.53	6.317E-01	P
Ac-227	299.75	127.	90.	0.100	55.44	1.147E+01	P
Ir-192	308.22	79.	27.	0.030	140.77	6.551E-01	
Ac-227	328.20	234.	-42.	-0.047	150.79	-4.960E+00	
Ba-133	356.39	66.	20.	0.022	176.63	1.065E-01	
Sb-125	463.02	77.	97.	0.108	43.42	4.030E+00	
Ba-140	537.79	46.	26.	0.029	121.22	8.921E+01	
Zr-95	723.87	25.	16.	0.018	150.61	5.809E-01	
Cs-134	794.89	21.	72.	0.080	37.32	5.583E-01	P
Mn-54	835.34	54.	21.	0.023	166.47	1.619E-01	
Nb-94	870.88	19.	14.	0.015	154.07	9.031E-02	P
I-132	953.74	23.	12.	0.013	197.33	0.000E+00	P
Eu-152	964.94	41.	46.	0.052	70.79	2.277E+00	P
Eu-154	996.23	9.	23.	0.026	74.04	1.585E+00	
Cs-136	1047.89	10.	11.	0.013	145.22	1.624E+01	
Eu-152	1086.74	19.	13.	0.014	176.85	9.762E-01	
Eu-152	1111.06	14.	12.	0.014	157.55	7.171E-01	
Ag-110M	1384.92	6.	15.	0.018	85.49	7.953E-01	P
Eu-152	1407.37	0.	36.	0.040	33.33	1.585E+00	

P - Peakbackground subtraction

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Pace Analytical Spectrum name: 30204854011.Anl

***** 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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	0.0000E+00	0.0000E+00	1.1499E+00	1.1500E+00	6.139E+00
Na-22	#B	1.1261E-02	1.2076E-02	2.0557E-01	2.0557E-01	2.164E-01
K-40		6.4141E+00	6.4141E+00	1.9168E+00	2.0955E+00	1.615E+00
Sc-46	#B	0.0000E+00	0.0000E+00	2.1323E-01	2.1323E-01	4.946E-01
Cr-51	#B	2.4178E-01	2.6606E+00	1.4115E+01	1.4119E+01	1.689E+01
Mn-54	#A	1.3089E-01	1.6192E-01	2.6955E-01	2.7040E-01	2.876E-01
Co-56		8.0737E-01	1.9074E+00	7.4833E-01	7.8873E-01	6.227E-01
Co-57	#A	1.4230E-01	1.8170E-01	1.7275E-01	1.7446E-01	2.060E-01
Co-58	#B	7.2192E-03	1.8445E-02	3.2983E-01	3.2984E-01	3.791E-01
Fe-59	#B	0.0000E+00	0.0000E+00	3.3895E-01	3.3896E-01	1.900E+00
Co-60	#B	7.3868E-02	7.6462E-02	1.8954E-01	1.8980E-01	2.053E-01
Zn-65	#B	0.0000E+00	0.0000E+00	9.7678E-02	9.7680E-02	6.390E-01
Y-88	#B	0.0000E+00	0.0000E+00	5.8844E-02	5.8845E-02	2.951E-01
Nb-94	#A	9.0310E-02	9.0311E-02	1.3914E-01	1.3965E-01	1.493E-01
Zr-95	#B	1.1340E-01	3.2009E-01	4.8208E-01	4.8394E-01	1.127E+00
Nb-95	#B	0.0000E+00	0.0000E+00	6.8067E-01	6.8068E-01	2.273E+00
Ru-103	#B	4.5140E-02	2.4515E-01	8.5997E-01	8.6058E-01	1.002E+00
Ag-108M	#B	1.1132E-01	1.1136E-01	1.6894E-01	1.6959E-01	3.022E-01
Ru-106	#B	0.0000E+00	0.0000E+00	1.1755E+00	1.1755E+00	2.681E+00
Cd-109	A	2.8033E+00	3.2349E+00	4.6255E+00	4.6479E+00	7.645E+00
Ag-110M	#B	1.2447E-01	1.5240E-01	1.3883E-01	1.4049E-01	3.133E-01
Sn-113	#B	-6.7251E-02	-1.1978E-01	4.6712E-01	4.6738E-01	5.345E-01
Sb-124	#B	-1.5262E-02	-4.6012E-02	5.6269E-01	5.6272E-01	6.353E-01
Sb-125	#F	8.7786E-01	9.3766E-01	4.0715E-01	4.2548E-01	7.104E-01

Te-129 #B	0.0000E+00	0.0000E+00	6.2789E+00	6.2791E+00	1.766E+01
Te-129M B	2.2274E+00	1.6087E+01	4.2003E+01	4.2057E+01	4.557E+01
I-131 #B	6.6407E-02	2.6280E+02	6.5205E+02	6.5297E+02	7.460E+02
I-132 #B	8.7836E-02	>12 Halflives	1.7332E-01	1.7371E-01	3.391E-01
Te-132 #B	0.0000E+00	>12 Halflives	6.9458E-02	6.9460E-02	1.959E-01
I-133 #B	0.0000E+00	>12 Halflives	1.6528E+00	1.6528E+00	2.322E-01
Ba-133 #A	1.0463E-01	1.0645E-01	1.8803E-01	1.8849E-01	2.222E-01
Cs-134 #F	2.6409E-01	2.8847E-01	1.0766E-01	1.1423E-01	2.056E-01
Cs-136 #B	8.9315E-02	1.3908E+01	2.0198E+01	2.0282E+01	3.194E+01
Cs-137 #B	0.0000E+00	0.0000E+00	9.4220E-02	9.4222E-02	2.748E-01
Ce-139 #B	0.0000E+00	0.0000E+00	1.2289E-01	1.2289E-01	3.321E-01
Ba-140 #	6.7854E-01	1.2428E+02	1.1315E+02	1.1434E+02	1.177E+02
La-140 #B	2.0839E-02	3.8170E+00	4.5963E+01	4.5966E+01	4.589E+01
Ce-141 #A	-1.6984E-01	-1.3115E+00	2.3266E+00	2.3331E+00	2.810E+00
Ce-144 #B	5.3097E-01	6.7042E-01	1.4156E+00	1.4184E+00	1.718E+00
Eu-152 #C	1.0412E+00	1.0553E+00	3.5175E-01	3.7916E-01	5.335E-01
Eu-154 #B	3.1959E-01	3.2643E-01	2.4169E-01	2.4562E-01	4.260E-01
Eu-155 A	6.5297E-01	6.7840E-01	3.7249E-01	3.8453E-01	7.433E-01
Ir-192 #A	8.9928E-02	2.2114E-01	2.8865E-01	2.9014E-01	4.976E-01

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Hg-203 #A	9.8829E-02	4.1103E-01	5.4495E-01	5.4771E-01	6.359E-01
Tl-208	2.9242E+00	3.2164E+00	3.2350E-01	5.3450E-01	1.984E-01
Pb-210	6.4255E+00	6.4782E+00	4.8289E+00	4.9145E+00	6.238E+00
Bi-212 #	1.0612E+01	1.1672E+01	2.8151E+00	3.2125E+00	2.315E+00
Pb-212	8.0483E+00	8.8524E+00	5.3418E-01	1.3049E+00	4.334E-01
Ra-223	1.7760E+00	1.7909E+00	1.1028E+00	1.1286E+00	1.292E+00
Ra-224	7.6610E+00	8.4264E+00	4.7167E+00	4.8509E+00	7.535E+00
Ra-226	7.8234E+00	7.8243E+00	5.2221E-01	1.1601E+00	3.467E-01
Ac-227 #F	1.7924E+00	1.8074E+00	1.0021E+00	1.0312E+00	1.675E+00
Ac-228	7.1633E+00	7.3935E+00	1.0197E+00	1.4114E+00	6.657E-01
Th-228	1.4540E+01	1.5992E+01	1.2295E+01	1.2500E+01	1.572E+01
Pa-231 B	3.8918E+00	3.8919E+00	5.8950E+00	5.9179E+00	9.516E+00
Pa-234M#A	0.0000E+00	0.0000E+00	2.4088E+00	2.4089E+00	2.918E+01
Th-230 #B	1.4076E+01	1.4076E+01	5.2620E+01	5.2656E+01	6.385E+01
Th-232 #A	-5.5796E+01	-5.5796E+01	7.3780E+01	7.4183E+01	9.053E+01
Th-234	8.8030E+00	8.8030E+00	4.0243E+00	4.2050E+00	4.772E+00
U-235 #B	5.3480E-01	5.3480E-01	7.7843E-01	7.8175E-01	3.000E+00
U-238 #B	0.0000E+00	0.0000E+00	2.4002E+00	2.4003E+00	2.908E+01
Am-241 #B	2.1170E-01	2.1179E-01	4.8691E-01	4.8782E-01	6.177E-01
Am-243 A	2.9540E-01	2.9541E-01	3.9965E-01	4.0176E-01	6.593E-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 (30.1 to 2035.5 keV) 8.365E+01 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 8.9449722E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854012	**Collection Date**	11/18/2016 11:22
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/22/17 7:52
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	10.126	2.446	1.146
Cesium-137	0.017	0.138	0.151
Lead-212	7.021	1.073	0.439
Potassium-40	28.246	4.688	0.675
Protactinium-234M	8.376	18.021	18.020
Radium-226	2.386	0.551	0.357
Radium-228	7.125	1.291	0.585
Thallium-208	2.273	0.405	0.167
Thorium-228	0.953	12.964	16.220
Thorium-234	2.013	6.952	8.527
Uranium-235	0.000	1.473	3.139

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Pace Analytical Spectrum name: 30204854012.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854012.An1

Acquisition information
Start time: 2/22/2017 7:52:40 AM
Live time: 900
Real time: 905
Dead time: 0.54 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_CZ_CAN(121613).clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.3155E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.3155E+02) =
4.3187E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/22/17

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:39:34 AM Page 2
Pace Analytical Spectrum name: 30204854012.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 11:22:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1627

***** 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. pCi/G	Nuc
63.35	29.	92.18	1.07	2.195E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	PBC<MDA	Th232
					63.81	0.267	PBC<MDA	Th232
					63.29	4.800	PBC<MDA	Th234
75.01	198.	13.02	1.08	3.211E-02	74.66	68.200	1.174E+00	Am243
					74.81	10.400	8.482E+00	Pb212
77.09	328.	8.46	1.09	3.373E-02	77.11	17.500	7.886E+00	Pb212
78.76	26.	89.29	1.09	3.527E-02	79.13	6.600	PBC<MDA	Ag108M
					79.13	6.600	1.431E+00	Ag108M
83.77	37.	45.81	1.09	3.839E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	1.014E+01	Th228
87.16	133.	16.17	1.10	4.040E-02	86.54	30.700	1.441E+00	Eu155
					87.30	7.800	5.991E+00	Pb212
					88.03	3.610	1.345E+01	Cd109
89.90	115.	17.39	1.10	4.187E-02	89.95	3.560	9.967E+00	U235
					89.95	3.560	9.967E+00	U235
93.19	138.	14.19	1.10	4.346E-02	92.59	5.600	6.952E+00	U238
					92.60	2.800	1.396E+01	Th234
					92.60	2.800	1.396E+01	Th234
					92.59	5.600	6.952E+00	U238
95.13	62.	15.54	1.11	4.422E-02	94.90	11.300	1.612E+00	Ra223
105.76	35.	68.46	0.55	4.792E-02	105.31	21.200	PBC<MDA	Eu155
153.80	69.	28.19	0.88	5.245E-02	154.21	5.620	3.053E+00	Ra223
185.94	137.	15.36	0.77	5.072E-02				
236.44	97.	24.05	1.26	4.664E-02	235.97	12.300	2.202E+00	Ac227
					235.97	12.300	2.202E+00	Ac227
238.72	1089.	4.78	1.28	4.641E-02	238.63	43.300	7.698E+00	Pb212

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:39:34 AM Page 3
Pace Analytical Spectrum name: 30204854012.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
240.69	99.	19.39	1.26	4.623E-02	241.00	3.900	7.855E+00	Ra224

					241.00	3.900	7.855E+00	Ra224
241.91	90.	22.70	1.26	4.615E-02	241.92	7.470	3.386E+00	Ra226
269.90	95.	23.62	1.36	4.396E-02	269.46	13.700	2.073E+00	Ra223
277.47	60.	25.38	0.58	4.336E-02	277.36	6.310	3.147E+00	Tl208
295.07	120.	20.64	0.63	4.208E-02	295.22	19.200	1.913E+00	Ra226
					295.96	28.670	3.126E+00	Ir192
300.04	61.	34.07	1.32	4.173E-02	300.00	2.300	8.253E+00	Ac227
					300.00	2.300	8.253E+00	Ac227
327.74	36.	60.47	1.35	3.985E-02	328.76	20.300	PBC<MDA	La140
					329.85	2.700	4.323E+00	Ac227
					330.00	1.300	8.905E+00	Pa231
					328.76	20.300	1.043E+02	La140
					329.85	2.700	4.323E+00	Ac227
					330.00	1.300	8.905E+00	Pa231
338.27	247.	10.27	1.21	3.927E-02	338.32	11.300	7.450E+00	Ac228
340.40	28.	42.13	1.37	3.913E-02	340.55	42.200	3.427E+01	Cs136
					340.55	42.200	3.427E+01	Cs136
351.78	195.	11.27	1.56	3.847E-02	351.99	37.100	1.764E+00	Ra226
356.39	23.	66.43	1.38	3.823E-02	356.02	62.050	PBC<MDA	Ba133
					356.02	62.050	PBC<MDA	Ba133
364.16	22.	65.64	1.39	3.777E-02	364.49	81.700	PBC<MDA	I131
					364.49	81.700	PBC<MDA	I131
391.35	27.	60.15	1.42	3.636E-02	391.69	64.000	PBC<MDA	Sn113
					391.69	64.000	PBC<MDA	Sn113
463.02	39.	54.15	1.49	3.323E-02	463.36	10.500	PBC<MDA	Sb125
					463.36	10.500	PBC<MDA	Sb125
467.45	17.	82.85	1.50	3.305E-02	468.07	47.830	PBC<MDA	Ir192
					468.07	47.830	PBC<MDA	Ir192
510.62	215.	7.98	1.25	3.153E-02				
530.00	15.	85.22	1.56	3.091E-02	529.87	87.000	HL>Cutoff	I133
					529.87	87.000	HL>Cutoff	I133
536.66	13.	92.51	1.57	3.068E-02	537.26	24.390	PBC<MDA	Ba140
					537.26	24.390	PBC<MDA	Ba140
583.06	399.	5.92	1.54	2.934E-02	583.19	84.500	2.273E+00	Tl208
609.14	244.	9.49	1.41	2.865E-02	609.31	44.800	2.467E+00	Ra226
621.80	18.	78.92	1.63	2.833E-02	621.93	9.930	PBC<MDA	Ru106
					621.93	9.930	9.644E-01	Ru106
695.97	14.	98.06	1.72	2.663E-02	695.88	3.000	PBC<MDA	Te129M
					695.88	3.000	PBC<MDA	Te129M
723.52	14.	87.58	1.75	2.607E-02	723.30	20.110	PBC<MDA	Eu154
					724.20	44.170	PBC<MDA	Zr95
					724.20	44.170	PBC<MDA	Zr95
					722.94	90.800	PBC<MDA	Ag108M
					722.79	10.760	1.995E+00	Sb124
					723.30	20.110	PBC<MDA	Eu154
723.58	22.	40.20	1.75	2.605E-02	723.30	20.110	PBC<MDA	Eu154
					724.20	44.170	7.146E-01	Zr95

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:39:34 AM Page 4
Pace Analytical Spectrum name: 30204854012.An1

pk energy	area	uncert	fwhm	corr	nuclide	branch.	act.	nuc
727.07	121.	10.11	1.15	2.599E-02	727.33	6.580	1.013E+01	Bi212
772.20	16.	93.43	1.79	2.513E-02	772.60	75.600	HL>Cutoff	I132
					772.60	75.600	HL>Cutoff	I132
795.23	41.	35.36	1.82	2.472E-02	795.86	85.530	2.747E-01	Cs134
					795.86	85.530	2.747E-01	Cs134
860.76	58.	23.37	1.88	2.365E-02	860.56	12.420	2.833E+00	Tl208
873.31	18.	60.77	1.89	2.345E-02	873.19	12.200	PBC<MDA	Eu154
					873.19	12.200	8.102E-01	Eu154
888.38	12.	83.17	1.90	2.321E-02	889.28	99.984	PBC<MDA	Sc46
					889.28	99.984	1.544E-01	Sc46

911.08	318.	7.03	1.48	2.289E-02	911.21	26.500	6.986E+00	Ac228
965.10	28.	72.35	1.97	2.215E-02	964.13	14.340	PBC<MDA	Eu152
					964.13	14.340	1.159E+00	Eu152
968.12	203.	9.89	1.56	2.210E-02	968.97	16.200	7.502E+00	Ac228
1085.94	12.	89.26	2.08	2.063E-02	1085.91	9.920	PBC<MDA	Eu152
					1085.91	9.920	PBC<MDA	Eu152
1111.52	15.	86.65	2.10	2.034E-02	1112.12	13.550	PBC<MDA	Eu152
					1112.12	13.550	PBC<MDA	Eu152
1120.02	33.	50.82	2.11	2.024E-02	1120.29	14.800	1.442E+00	Ra226
1238.53	25.	41.14	2.21	1.901E-02	1238.28	66.070	6.106E-01	Co56
					1238.28	66.070	6.106E-01	Co56
1274.82	15.	48.91	2.24	1.867E-02	1274.44	35.000	3.075E-01	Eu154
					1274.53	99.944	1.131E-01	Na22
					1274.53	99.944	1.131E-01	Na22
					1274.44	35.000	3.075E-01	Eu154
1274.82	15.	48.91	2.24	1.866E-02	1274.44	35.000	3.075E-01	Eu154
					1274.53	99.944	1.131E-01	Na22
1407.57	12.	63.70	2.35	1.747E-02	1408.01	20.870	PBC<MDA	Eu152
					1408.01	20.870	PBC<MDA	Eu152
1460.41	398.	5.01	1.68	1.704E-02	1461.00	10.670	2.825E+01	K40
1764.10	38.	32.24	2.63	1.484E-02	1764.49	15.360	2.150E+00	Ra226

********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
358.50	89.92	130.	126.	3.006E+03	31.23	1.100	-	D
371.62	93.20	120.	141.	3.247E+03	27.66	1.103	-	D
742.57	185.94	79.	137.	2.694E+03	30.72	0.773	-	s
2041.20	510.62	14.	215.	6.818E+03	15.96	1.248	-	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: Pace Master w Ra-226 Rev.4 09281
]

********** 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 2 Sigma %	FWHM keV
Th-232	252.30	63.35	179.	29.	0.032	184.37	1.071s
Pb-212	298.12	74.81	182.	164.	0.182	20.16	1.083D
Pb-212	307.32	77.11	221.	328.	0.364	16.94	1.086D
Ag-108M	313.90	78.76	130.	26.	0.029	178.59	1.088s
Ra-223	333.99	83.78	126.	37.	0.041	91.62	1.093D
Eu-155	345.05	86.54	247.	43.	0.048	108.37	1.096D
Pb-212	348.07	87.30	161.	127.	0.141	33.32	1.097D
U-235	358.12	89.81	165.	82.	0.091	67.34	1.100
Ra-223	378.46	94.90	14.	62.	0.068	31.08	1.105D
Eu-155	421.89	105.76	136.	35.	0.039	136.92	0.547s
Ce-141	580.58	145.44	187.	-36.	-0.040	159.27	1.160s
Ra-223	614.01	153.80	84.	69.	0.076	56.37	0.883s
Ac-227	944.52	236.44	98.	97.	0.107	48.10	1.256s

Pb-212	953.29	238.63	161.	989.	1.099	7.32	1.259D
Ra-224	961.52	240.69	61.	99.	0.110	38.79	1.262
Ra-226	966.44	241.92	163.	90.	0.100	45.40	1.263D
Ra-223	1078.34	269.90	89.	95.	0.106	47.24	1.356
Tl-208	1108.63	277.47	45.	60.	0.067	50.76	0.581s
Ra-226	1179.03	295.07	100.	122.	0.135	42.44	0.636s
Ac-227	1198.91	300.04	81.	61.	0.067	68.13	1.324
La-140	1309.68	327.74	94.	36.	0.039	120.93	1.354s
Ac-227	1311.00	328.07	178.	-48.	-0.054	120.35	1.355s
Pa-231	1311.00	328.07	178.	-48.	-0.054	120.35	1.355s
Ac-228	1351.82	338.27	72.	247.	0.274	20.56	1.205s
Cs-136	1360.33	340.40	23.	28.	0.031	84.26	1.366s
Ra-226	1405.85	351.78	68.	194.	0.216	22.73	1.564
Ba-133	1424.27	356.39	44.	23.	0.025	132.86	1.382s
I-131	1455.35	364.16	39.	22.	0.025	131.29	1.391s
Sn-113	1564.11	391.35	31.	27.	0.030	120.30	1.419s
Sb-125	1850.80	463.02	80.	39.	0.044	108.31	1.492
Ir-192	1868.51	467.45	34.	17.	0.019	165.71	1.496s
I-133	2118.69	530.00	30.	15.	0.017	170.44	1.558s
Ba-140	2145.35	536.66	25.	13.	0.014	185.01	1.566s
Tl-208	2330.96	583.06	32.	395.	0.439	12.00	1.544s
Ra-226	2435.28	609.14	49.	244.	0.271	18.97	1.411s
Ru-106	2485.91	621.80	32.	18.	0.019	157.84	1.649s
Te-129M	2782.64	695.97	33.	14.	0.016	196.12	1.721s
Eu-154	2892.86	723.52	25.	14.	0.016	175.16	1.747s
Zr-95	2893.08	723.58	11.	22.	0.025	80.40	1.748s
Bi-212	2907.06	727.07	6.	121.	0.135	20.22	1.147s
I-132	3087.60	772.20	34.	16.	0.017	186.87	1.794s
Cs-134	3179.73	795.23	29.	41.	0.046	70.72	1.816s
Tl-208	3441.91	860.76	21.	58.	0.065	46.73	1.877s
Eu-154	3492.12	873.31	16.	18.	0.019	121.53	1.888s

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Pace Analytical Spectrum name: 30204854012.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Sc-46	3552.44	888.38	16.	12.	0.014	166.34	1.903s
Ac-228	3643.24	911.08	26.	318.	0.353	14.05	1.478s
Eu-152	3859.38	965.10	62.	28.	0.031	144.69	1.972s
Ac-228	3875.04	969.01	42.	141.	0.156	26.45	1.531
Eu-152	4342.91	1085.94	17.	12.	0.014	178.52	2.081s
Eu-152	4445.25	1111.52	22.	15.	0.016	173.30	2.104s
Ra-226	4479.24	1120.02	40.	33.	0.037	101.64	2.111s
Co-56	4953.49	1238.53	12.	25.	0.028	82.27	2.213s
Eu-154	5098.73	1274.82	6.	15.	0.017	97.82	2.244s
Na-22	5098.73	1274.82	6.	15.	0.017	97.82	2.244s
Eu-152	5629.98	1407.57	6.	12.	0.013	127.40	2.355s
K-40	5841.47	1460.41	2.	396.	0.440	10.11	1.676s
Ra-226	7057.02	1764.10	15.	38.	0.042	64.48	2.633s

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Peak Code	Peak MDA Value pCi/G	COMMENTS
Be-7	C	1.4256E+00				5.34E+01	

```
                                477.56 1.426E+00 %(  3.958E+00 1.27E+02 1.03E+01 G K

Na-22     C   1.1309E-01                                          9.50E+02
                               1274.53 1.131E-01 ?(  1.041E-01 4.89E+01 9.99E+01 G K

K-40      N   2.8246E+01                                          4.68E+11
                               1461.00 2.825E+01 *(P 6.752E-01 5.06E+00 1.07E+01 G K

Sc-46     F   1.5438E-01                                          8.38E+01
                                889.28 1.544E-01 ?(  2.601E-01 8.32E+01 1.00E+02 G K

Cr-51     F  -3.6815E+00                                          2.77E+01
                                320.08-3.681E+00 %(  1.683E+01 1.99E+02 1.01E+01 G K

Mn-54     C  -1.0004E-02                                          3.12E+02
                                834.85-1.000E-02 %(  2.231E-01 1.07E+03 1.00E+02 G K

Co-56     C   6.1057E-01                                          7.73E+01
                               1238.28 6.106E-01 ?(P 4.594E-01 4.11E+01 6.61E+01 G K
                               1771.35 0.000E+00 %   4.007E+00 1.00E+03 1.55E+01 G

Co-58     C   1.0671E-01                                          7.08E+01
                                810.78 1.067E-01 %(  3.490E-01 1.56E+02 9.94E+01 G K
1
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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Zr-95     I   5.2688E-01                                          6.40E+01
                                756.73 3.746E-01 %(  7.884E-01 1.03E+02 5.45E+01 G K
                                724.20 7.146E-01 ?(P 5.675E-01 4.02E+01 4.42E+01 G

Ag-108M   C   1.4846E-01                                          1.53E+05
                                722.94 5.527E-02 %(P 1.635E-01 1.43E+02 9.08E+01 G K
                                614.28 5.319E-02 &   1.640E-01 1.45E+02 8.98E+01 G
                                433.94-3.124E-02 &   1.585E-01 2.25E+02 9.05E+01 G
                                 79.13 1.431E+00 ?(  3.116E+00 8.93E+01 6.60E+00 G

Ru-106    I   9.6436E-01                                          3.73E+02
                                621.93 9.644E-01 &(  1.591E+00 7.89E+01 9.93E+00 G K

Cd-109    F   1.0312E+00                                          4.64E+02
                                 88.03 1.031E+00 %(  4.253E+00 1.21E+02 3.61E+00 G K

Ag-110M   F   3.7677E-03                                          2.50E+02
                                657.76 3.768E-03 %(P 1.806E-01 2.15E+03 9.40E+01 G K
                               1505.04-1.958E-01 %   1.824E+00 4.88E+02 1.29E+01 G
                               1384.30-9.923E-02 %   9.031E-01 4.65E+02 2.41E+01 G
                                937.49 0.000E+00 % P 6.854E-01 1.00E+03 3.41E+01 G
                                884.68 8.390E-02 %   2.406E-01 1.40E+02 7.22E+01 G
                                763.94-9.569E-02 %   1.109E+00 5.59E+02 2.21E+01 G
                                744.28 1.916E-01 % P 3.625E+00 8.79E+02 4.70E+00 G
                                706.68 1.294E-01 % P 1.459E+00 5.27E+02 1.63E+01 G

Sn-113    F   2.7162E-01                                          1.15E+02
                                391.69 2.716E-01 ?(P 3.561E-01 6.02E+01 6.40E+01 G K

Sb-124    F  -1.5957E-01                                          6.02E+01
                                602.73-1.596E-01 %(  5.321E-01 1.59E+02 9.78E+01 G K
                                645.85 2.005E+00 %   6.180E+00 1.45E+02 7.38E+00 G
                                722.79 2.090E-01 %   4.660E+00 1.07E+03 1.08E+01 G
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                                1690.98 0.000E+00 %   1.075E+00 1.00E+03 4.73E+01 G

Sb-125    I   4.8713E-01                                          1.01E+03
                                427.88 1.079E-01 %(  4.630E-01 1.90E+02 2.96E+01 G K
                                176.31 0.000E+00 & P 2.389E+00 1.00E+03 6.82E+00 G
                                463.36 1.555E+00  (P 1.760E+00 5.42E+01 1.05E+01 G
                                600.60 0.000E+00 % P 1.033E+00 1.00E+03 1.79E+01 G
                                635.95 0.000E+00 % P 1.436E+00 1.00E+03 1.13E+01 G

Te-129M   I   1.6539E+01                                          3.36E+01
                                695.88 1.654E+01 &(P 3.452E+01 9.81E+01 3.00E+00 G K
1
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Pace Analytical Spectrum name: 30204854012.Anl

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

I-131     I   3.6730E+02                                          8.02E+00
                                364.49 3.673E+02 &(P 5.294E+02 6.56E+01 8.17E+01 G K
                                636.99 0.000E+00 & P 9.110E+03 1.00E+03 7.17E+00 G
                                284.30 1.049E+03 & P 8.701E+03 3.58E+02 6.14E+00 G

I-132     I   1.0707E-01                                          3.20E+00
                                772.60 1.071E-01 ?(P 2.048E-01 9.34E+01 7.56E+01 G K
                                522.65 1.345E-01 %   8.918E-01 3.01E+02 1.60E+01 G
                                630.19 3.120E-01 &   1.178E+00 1.78E+02 1.33E+01 G
                                954.55 2.728E-01 % P 7.918E-01 1.42E+02 1.76E+01 G

Te-132    I   3.0071E-03                                          3.20E+00
                                228.16 3.007E-03 %(P 1.851E-01 2.67E+03 8.80E+01 G K

I-133     I   7.3231E-02                                          8.67E-01
                                529.87 7.323E-02 ?(P 1.358E-01 8.52E+01 8.70E+01 G K
                                875.33 3.888E-01 %   3.241E+00 4.03E+02 4.51E+00 G

Ba-133    F   1.2740E-01                                          3.84E+03
                                356.02 1.274E-01 &(P 1.872E-01 6.64E+01 6.20E+01 G K
                                 81.00 2.116E-02 %   6.386E-01 1.21E+03 3.41E+01 G
                                302.85 0.000E+00 %   1.061E+00 1.00E+03 1.83E+01 G
                                276.40 2.120E-01 %   1.926E+00 3.91E+02 7.16E+00 G
                                383.85 1.931E-02 % P 1.491E+00 3.37E+03 8.94E+00 G

Cs-134    I   1.2830E-01                                          7.52E+02
                                604.72 0.000E+00 %(P 2.267E-01 1.00E+03 9.76E+01 G K
                                801.95 3.365E-01 % P 1.810E+00 2.45E+02 8.69E+00 G
                                795.86 2.747E-01 ?(  1.863E-01 3.54E+01 8.55E+01 G
                                569.33 0.000E+00 & P 1.354E+00 1.00E+03 1.54E+01 G

Cs-136    F   1.0983E+01                                          1.32E+01
                                818.51 1.127E+00 %(P 1.712E+01 6.89E+02 9.97E+01 G K
                                176.60 6.109E+01 & P 2.209E+02 1.53E+02 1.00E+01 G
                                273.65 2.086E+01 &   1.968E+02 4.07E+02 1.11E+01 G
                                340.55 3.427E+01 ?(  3.067E+01 4.21E+01 4.22E+01 G
                               1048.07 0.000E+00 % P 4.255E+01 1.00E+03 8.00E+01 G
                               1235.36 0.000E+00 & P 2.036E+02 1.00E+03 2.00E+01 G

Cs-137    I   1.6797E-02                                          1.10E+04
                                661.66 1.680E-02 %(  1.508E-01 4.10E+02 8.51E+01 G K

Ce-139    F  -6.9147E-02                                          1.38E+02
                                165.85-6.915E-02 &(  3.163E-01 1.94E+02 7.99E+01 G K
1
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Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ba-140	T	4.1089E+01					1.28E+01	
			537.26	4.109E+01	?(P	8.274E+01	9.25E+01	2.44E+01 G K
			162.66	0.000E+00	% P	4.724E+02	1.00E+03	5.22E+00 G
La-140	T	2.4084E+01					1.28E+01	
			1596.21	7.008E+00	%(	2.272E+01	1.62E+02	9.54E+01 G K
			487.02	1.309E+01	% P	5.536E+01	1.93E+02	4.55E+01 G
			815.77	0.000E+00	%	1.165E+02	1.00E+03	2.33E+01 G
			328.76	1.043E+02	?(	1.411E+02	6.05E+01	2.03E+01 G
Ce-141	I	-1.4170E+00					3.25E+01	
			145.44	-1.417E+00	(	2.626E+00	7.96E+01	4.82E+01 G K
Ce-144	I	6.7209E-01					2.85E+02	
			133.51	6.721E-01	%(P	1.619E+00	1.03E+02	1.11E+01 G K
Eu-152	F	4.9096E-01					4.95E+03	
			121.78	0.000E+00	%(P	5.356E-01	1.00E+03	2.84E+01 G K
			1408.01	4.258E-01	?(P	5.155E-01	6.37E+01	2.09E+01 G
			1112.12	6.944E-01	?(P	1.182E+00	8.67E+01	1.36E+01 G
			1085.91	7.902E-01	?(P	1.397E+00	8.93E+01	9.92E+00 G
			964.13	1.159E+00	?(	1.631E+00	7.23E+01	1.43E+01 G
			344.28	0.000E+00	& P	5.127E-01	1.00E+03	2.66E+01 G
			244.70	7.643E-02	%	1.666E+00	9.33E+02	7.49E+00 G
Eu-154	I	2.5876E-01					3.14E+03	
			123.07	0.000E+00	%(P	3.862E-01	1.00E+03	4.06E+01 G K
			1274.44	3.075E-01	?(	2.832E-01	4.89E+01	3.50E+01 G
			1004.72	2.925E-02	% P	9.386E-01	1.58E+03	1.79E+01 G
			996.26	-1.448E-01	%	1.572E+00	5.39E+02	1.05E+01 G
			873.19	8.102E-01	?(	9.748E-01	6.08E+01	1.22E+01 G
			723.30	3.618E-01	?(P	6.534E-01	8.76E+01	2.01E+01 G
			247.93	1.848E-01	% P	2.017E+00	4.72E+02	6.91E+00 G
Eu-155	I	4.6789E-01					1.74E+03	
			86.54	4.693E-01	(P	8.328E-01	5.42E+01	3.07E+01 G K
			105.31	4.658E-01	(P	7.565E-01	6.85E+01	2.12E+01 G
Ir-192	F	1.3814E-01					7.38E+01	
			316.51	2.313E-02	%(P	4.046E-01	7.49E+02	8.28E+01 G
			468.07	3.373E-01	?(P	6.053E-01	8.29E+01	4.78E+01 G
			308.46	6.491E-02	% P	1.081E+00	7.11E+02	3.00E+01 G
			295.96	4.475E-01	% P	1.262E+00	1.23E+02	2.87E+01 G
Tl-208	N	2.2733E+00					6.98E+02	
			583.19	2.273E+00	*(P	1.671E-01	6.00E+00	8.45E+01 G K
			860.56	2.833E+00	+	1.160E+00	2.34E+01	1.24E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
			277.36	3.147E+00	+ P	1.765E+00	2.54E+01	6.31E+00 G
Bi-212	N	1.0126E+01					6.98E+02	
			727.33	1.013E+01	*(P	1.146E+00	1.01E+01	6.58E+00 G K

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                    1620.50 0.000E+00 % P 1.828E+01 1.00E+03 1.49E+00 G

Pb-212    N   7.0209E+00                                   6.98E+02
                     238.63 7.021E+00  (P 4.385E-01 3.66E+00 4.33E+01 G K
                      77.11 7.909E+00   P 1.738E+00 8.47E+00 1.75E+01 GA
                      74.81 7.021E+00 } P 2.814E+00 1.01E+01 1.04E+01 GA
                      87.30 5.747E+00 -   2.793E+00 1.67E+01 7.80E+00 GA

Ra-223    N   2.0825E+00                                   7.96E+03
                     269.46 2.073E+00  (P 1.011E+00 2.36E+01 1.37E+01 G K
                      83.78 5.077E-01 -   7.525E-01 4.58E+01 2.49E+01 G
                     323.87 0.000E+00 % P 3.837E+00 1.00E+03 3.93E+00 G
                     154.21 3.053E+00 *(P 2.017E+00 2.82E+01 5.62E+00 G
                      94.90 1.612E+00  (P 5.343E-01 1.55E+01 1.13E+01 G
                      81.07 3.293E-01 %   1.345E+00 1.66E+02 1.50E+01 G

Ra-224    N   7.8554E+00                                   6.98E+02
                     241.00 7.855E+00 ?(P 3.088E+00 1.94E+01 3.90E+00 G K

Ra-226    N   2.3859E+00                                   5.84E+05
                     609.31 2.467E+00 @(P 3.569E-01 9.49E+00 4.48E+01 G K
                    1764.49 2.150E+00 ?(P 1.188E+00 3.22E+01 1.54E+01 G
                     295.22 1.958E+00 - P 7.921E-01 2.12E+01 1.92E+01 G
                    1120.29 1.442E+00 & P 1.388E+00 5.08E+01 1.48E+01 G
                     351.99 1.764E+00 - P 3.737E-01 1.14E+01 3.71E+01 G
                     241.92 3.386E+00 + P 2.340E+00 2.27E+01 7.47E+00 G

Ac-227    N   2.2021E+00                                   7.95E+03
                     235.97 2.202E+00 &(P 1.116E+00 2.40E+01 1.23E+01 G K
                     256.25 3.945E-01 %   1.923E+00 2.11E+02 7.00E+00 G
                     300.00 8.253E+00 + P 6.099E+00 3.41E+01 2.30E+00 G
                     329.85-5.906E+00 -   7.911E+00 6.02E+01 2.70E+00 G

Ac-228    N   7.1245E+00                                   2.10E+03
                     911.21 6.985E+00 *(P 5.847E-01 7.03E+00 2.66E+01 G K
                     968.97 5.263E+00 - P 1.236E+00 1.32E+01 1.62E+01 G
                     338.32 7.450E+00 *(P 1.276E+00 1.03E+01 1.13E+01 G

Th-228    N   9.5274E-01                                   6.98E+02
                      84.37 9.527E-01 %(P 1.622E+01 6.80E+02 1.27E+00 G K
                     215.99 1.347E+01 %   6.337E+01 2.06E+02 2.63E-01 G
                     156.41-3.405E+00 &   1.566E+02 1.93E+03 1.08E-01 G
                     131.61-1.582E+01 &   1.405E+02 3.76E+02 1.35E-01 G
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Pace Analytical                  Spectrum name: 30204854012.An1

Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pa-231    N   4.3323E-01                                   1.20E+07
                     283.70 4.332E-01 %(P 8.806E+00 8.72E+02 1.60E+00 G K
                     330.00-1.217E+01 -   1.830E+01 5.02E+01 1.30E+00 G

Pa-234M   N   8.3751E+00                                   1.63E+12
                                                          Energy duplication
                    1001.03 8.375E+00 &(P 1.802E+01 1.07E+02 8.37E-01 G

Th-230    N   1.7685E+01                                   2.75E+07
                      67.67 1.768E+01 %(  8.939E+01 2.06E+02 3.80E-01 G K

Th-232    N   5.4208E+01                                   4.17E+12
                      63.81 6.421E+01  (P 1.439E+02 9.22E+01 2.67E-01 G K
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Th-234    N   2.0129E+00                                          1.63E+12
                              63.29 2.013E+00 %(P 8.527E+00 1.73E+02 4.80E+00 G K
                              92.60 1.762E+00 % P 5.664E+00 1.34E+02 2.80E+00 G

U-238     N   8.3452E+00                                          1.63E+12
                                                                 Energy duplication
                            1001.03 8.345E+00 &(P 1.796E+01 1.07E+02 8.40E-01 G K
                              92.59 8.512E-01 % P 2.839E+00 1.38E+02 5.60E+00 GA

Am-241    T  -4.8585E-01                                          1.58E+05
                              59.54-4.859E-01 %(  1.364E+00 1.15E+02 3.63E+01 G K

Am-243    T   9.9396E-02                                          2.69E+06
                                                                 Derived Ave Activity
                              74.66 9.940E-02 }(P 7.970E-01 2.40E+02 6.82E+01 G K
```

(- 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:

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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 2 Sigma %	Activity	
Th-232	63.35	179.	29.	0.032	184.37	6.421E+01	P
Ag-108M	78.76	130.	28.	0.029	178.59	1.431E+00	
U-235	89.81	165.	82.	0.091	67.34	7.161E+00	
Ce-141	145.44	187.	-36.	-0.040	159.27	-1.417E+00	
Ac-227	236.44	98.	97.	0.107	48.10	2.202E+00	P

Ra-224	240.69	61.	99.	0.110	38.79	7.855E+00	P
Ac-227	300.04	81.	61.	0.067	68.13	8.253E+00	P
La-140	327.74	94.	36.	0.039	120.93	1.043E+02	
Ac-227	328.07	178.	-48.	-0.054	120.35	-5.906E+00	
Pa-231	328.07	178.	-48.	-0.054	120.35	-1.217E+01	
Cs-136	340.40	23.	28.	0.031	84.26	3.427E+01	
Ba-133	356.39	44.	23.	0.025	132.86	1.274E-01	P
I-131	364.18	39.	22.	0.025	131.29	3.673E-02	P
Sn-113	391.35	51.	27.	0.030	120.30	2.716E-01	P
Sb-125	463.02	80.	39.	0.044	108.31	1.556E+00	P
Ir-192	467.45	34.	17.	0.019	165.71	3.373E-01	P
I-133	530.00	30.	15.	0.017	170.44	0.000E+00	P
Ba-140	536.66	25.	13.	0.014	185.01	4.109E+01	P
Ru-106	621.80	32.	18.	0.019	157.84	9.644E-01	
Te-129M	695.97	33.	14.	0.016	196.12	1.654E+01	P
Eu-154	723.52	25.	14.	0.016	175.16	3.618E-01	P
Zr-95	723.58	11.	22.	0.025	80.40	7.146E-01	P
I-132	772.20	34.	16.	0.017	186.87	0.000E+00	P
Cs-134	795.23	29.	41.	0.046	70.72	2.747E-01	
Eu-154	873.31	16.	18.	0.019	121.53	8.102E-01	
Sc-46	888.38	16.	12.	0.014	166.34	1.544E-01	
Eu-152	965.10	62.	28.	0.031	144.69	1.159E+00	
Eu-152	1085.94	17.	12.	0.014	178.52	7.902E-01	P
Eu-152	1111.52	22.	15.	0.016	173.30	6.944E-01	P
Co-56	1238.53	12.	25.	0.028	82.27	6.106E-01	P
Eu-154	1274.82	6.	15.	0.017	97.82	3.075E-01	
Na-22	1274.82	6.	15.	0.017	97.82	1.131E-01	
Eu-152	1407.57	6.	12.	0.013	127.40	4.258E-01	P

P - Peakbackground subtraction

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Pace Analytical Spectrum name: 30204854012.Anl

***** 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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	4.1080E-01	1.4256E+00	3.6148E+00	3.6197E+00	3.958E+00
Na-22	#	1.0544E-01	1.1309E-01	1.1062E-01	1.1160E-01	1.041E-01
K-40	#	2.8246E+01	2.8246E+01	2.8567E+00	4.6881E+00	6.752E-01
Sc-46	#A	6.9858E-02	1.5438E-01	2.5680E-01	2.5760E-01	2.601E-01
Cr-51	#B	-3.3444E-01	-3.6815E+00	1.4638E+01	1.4646E+01	1.683E+01
Mn-54	#B	-8.0872E-03	-1.0004E-02	2.1312E-01	2.1312E-01	2.231E-01
Co-56	#	2.5841E-01	6.1057E-01	5.0232E-01	5.0857E-01	4.594E-01
Co-57	#B	0.0000E+00	0.0000E+00	1.1196E-01	1.1197E-01	2.181E-01
Co-58	#B	4.1762E-02	1.0671E-01	3.3237E-01	3.3266E-01	3.490E-01
Fe-59	#B	0.0000E+00	0.0000E+00	1.4109E-01	1.4109E-01	1.686E+00
Co-60	#B	0.0000E+00	0.0000E+00	2.0947E-02	2.0947E-02	2.252E-01
Zn-65	#B	0.0000E+00	0.0000E+00	1.6903E-01	1.6904E-01	7.009E-01
Y-88	#B	0.0000E+00	0.0000E+00	4.7922E-02	4.7923E-02	3.448E-01
Nb-94	#B	0.0000E+00	0.0000E+00	1.5634E-02	1.5635E-02	1.609E-01
Zr-95	#B	1.8663E-01	5.2686E-01	4.2360E-01	4.2928E-01	7.884E-01
Nb-95	#B	0.0000E+00	0.0000E+00	5.5856E-01	5.5857E-01	1.420E+00
Ru-103	#B	0.0000E+00	0.0000E+00	5.2123E-01	5.2124E-01	9.306E-01
Ag-108M	#B	1.4840E-01	1.4846E-01	2.5052E-01	2.5129E-01	1.535E-01
Ru-106	#A	8.0683E-01	9.6436E-01	1.5222E+00	1.5275E+00	1.591E+00
Cd-109	B	8.9360E-01	1.0312E+00	2.4997E+00	2.5038E+00	4.253E+00
Ag-110M	#B	2.8877E-03	3.7677E-03	1.6180E-01	1.6180E-01	1.806E-01
Sn-113	#A	1.5249E-01	2.7162E-01	3.2675E-01	3.2870E-01	3.561E-01

Sb-124	#B	-5.2920E-02	-1.5957E-01	5.0659E-01	5.0703E-01	5.321E-01
Sb-125	#F	4.5606E-01	4.8713E-01	5.2759E-01	5.3146E-01	4.630E-01
Te-129	#B	0.0000E+00	0.0000E+00	6.2720E+00	6.2722E+00	1.901E+01
Te-129M	#A	2.2894E+00	1.6539E+01	3.2436E+01	3.2509E+01	3.452E+01
I-131	#A	9.2709E-02	3.6730E+02	4.8221E+02	4.8463E+02	5.294E+02
I-132	#A	1.0707E-01	>12 Halflives	2.0009E-01	2.0059E-01	2.048E-01
Te-132	#B	3.0071E-03	>12 Halflives	1.6082E-01	1.6082E-01	1.851E-01
I-133	#A	7.3231E-02	>12 Halflives	1.2481E-01	1.2518E-01	1.358E-01
Ba-133	#A	1.2521E-01	1.2740E-01	1.6926E-01	1.6999E-01	1.872E-01
Cs-134	#B	1.1746E-01	1.2830E-01	9.0730E-02	9.2297E-02	2.267E-01
Cs-136	#B	7.0482E-02	1.0983E+01	9.2545E+00	9.3674E+00	1.712E+01
Cs-137	#B	1.6696E-02	1.6797E-02	1.3783E-01	1.3785E-01	1.508E-01
Ce-139	#B	-4.2671E-02	-6.9147E-02	2.6768E-01	2.6784E-01	3.163E-01
Ba-140	#A	2.2417E-01	4.1089E+01	7.6020E+01	7.6212E+01	8.274E+01
La-140	#F	1.3139E-01	2.4084E+01	2.9124E+01	2.9303E+01	2.272E+01
Ce-141	#A	-1.8345E-01	-1.4170E+00	2.2569E+00	2.2647E+00	2.626E+00
Ce-144	#B	5.3228E-01	6.7209E-01	1.3780E+00	1.3808E+00	1.619E+00
Eu-152	#B	4.8441E-01	4.9096E-01	6.2547E-01	6.2891E-01	5.356E-01
Eu-154	#B	2.5334E-01	2.5876E-01	2.5312E-01	2.5547E-01	3.862E-01
Eu-155	A	4.5034E-01	4.6789E-01	4.0851E-01	4.1375E-01	8.328E-01
Ir-192	#A	5.6168E-02	1.3814E-01	2.2891E-01	2.2964E-01	4.046E-01

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:39:34 AM Page 14
Pace Analytical Spectrum name: 30204854012.Anl

Hg-203	#B	0.0000E+00	0.0000E+00	1.6784E-01	1.6785E-01	8.568E-01
Tl-208	#	2.0667E+00	2.2733E+00	2.7288E-01	4.0540E-01	1.671E-01
Pb-210	#B	0.0000E+00	0.0000E+00	1.2836E+01	1.2836E+01	3.767E+01
Bi-212	#	9.2059E+00	1.0126E+01	2.0476E+00	2.4464E+00	1.146E+00
Pb-212		6.3831E+00	7.0209E+00	5.1405E-03	1.0727E+00	4.385E-01
Ra-223		2.0651E+00	2.0825E+00	5.5427E-01	6.2011E-01	1.011E+00
Ra-224	#	7.1418E+00	7.8554E+00	3.0469E+00	3.2238E+00	3.088E+00
Ra-226		2.3856E+00	2.3859E+00	4.5272E-01	5.5148E-01	3.569E-01
Ac-227	#	2.1838E+00	2.2021E+00	1.0591E+00	1.0995E+00	1.116E+00
Ac-228		6.9026E+00	7.1245E+00	8.8719E-01	1.2907E+00	5.847E-01
Th-228	#B	8.6619E-01	9.5274E-01	1.2964E+01	1.2964E+01	1.622E+01
Pa-231	#B	4.3323E-01	4.3323E-01	7.5547E+00	7.5549E+00	8.806E+00
Pa-234M	#A	8.3751E+00	8.3751E+00	1.7988E+01	1.8021E+01	1.802E+01
Th-230	B	1.7685E+01	1.7685E+01	7.2739E+01	7.2780E+01	8.939E+01
Th-232	#A	6.4208E+01	6.4208E+01	1.1838E+02	1.1871E+02	1.439E+02
Th-234	#B	2.0129E+00	2.0129E+00	6.9461E+00	6.9517E+00	8.527E+00
U-235	#B	0.0000E+00	0.0000E+00	1.4732E+00	1.4732E+00	3.139E+00
U-238	#B	8.3452E+00	8.3452E+00	1.7923E+01	1.7957E+01	1.796E+01
Am-241	#B	-4.8565E-01	-4.8585E-01	1.1177E+00	1.1198E+00	1.364E+00
Am-243	A	9.9394E-02	9.9396E-02	4.7645E-01	4.7665E-01	7.970E-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 (30.3 to 2035.6 keV) 5.771E+01 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 5.9727013E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____ _____
Supervisor

Laboratory: Pace Analytical

Sample Solid Preparation Logbook

Balance ID: [illegible] Oven ID: [illegible] Logbook ID: 8-R026-2 SOP ID: PGH-R-024

Sample ID			Oven Drying Prep Analyst	Sample Wet Weight (g)	Begin Drying Date	End Drying Date	Dried Sample Weight Analyst	Final Dry Weight (g)	Sample Process Analyst	Sample Process Date	Geom Prep Analyst	Geometry/ Canned Prep Date	Gamma Geometry	Geometry Prep Volume/ Mass (L,g)
30	207 597	004	CB	602.67	1-13-17	1-23-17	CB	506.87	CB	1-30-17	CB	1-30-17	8oz	208.69
30	207 597	005	CB	820.57	1-13-17	1-23-17	CB	668.88	CB	1-30-17	CB	1-30-17	8oz	229.51
30	207 597	006	CB	571.57	1-13-17	1-23-17	CB	480.94	CB	1-31-17	CB	1-31-17	8oz	237.14
30	207 597	007	CB	740.55	1-13-17	1-23-17	CB	614.53	CB	1-31-17	CB	1-31-17	8oz	238.19
30	207 597	008	CB	681.99	1-13-17	1-23-17	CB	559.09	CB	1-31-17	CB	1-31-17	8oz	239.37
30	207 597	009	CB	526.30	1-13-17	1-23-17	CB	443.50	CB	1-31-17	CB	1-31-17	8oz	220.94
30	207 597	010	CB	606.93	1-13-17	1-23-17	CB	578.30	CB	1-31-17	CB	1-31-17	8oz	240.63
30	206858	001	—	—	—	—	—	—	—	—	MA	1/16/17	2L	2250.55g
30	206859	001	—	—	—	—	—	—	—	—	MA	1/16/17	2L	2285.65g
30	206861	001	—	—	—	—	—	—	—	—	MA	1/16/17	2L	2255.93g
30	206862	001	—	—	—	—	—	—	—	—	MA	1/16/17	2L	2235.57g
10	375 730	001	CB	831.17	1-16-17	1-23-17	CB	773.17	CB	1-23-17	CB	1-23-17	8oz	363.07
10	375 730	002	CB	830.81	1-16-17	1-23-17	CB	712.34	CB	1-23-17	CB	1-23-17	8oz	361.56
10	375 730	003	CB	649.93	1-16-17	1-23-17	CB	488.97	CB	1-23-17	CB	1-23-17	8oz	194.48
10	375 730	004	CB	866.15	1-16-17	1-23-17	CB	733.47	CB	1-23-17	CB	1-23-17	8oz	301.32
10	375 730	005	CB	681.30	1-16-17	1-23-17	CB	531.96	CB	1-23-17	CB	1-23-17	8oz	256.57
10	375 730	006	CB	836.33	1-16-17	1-23-17	CB	623.79	CB	1-23-17	CB	1-23-17	8oz	220.39
10	375 730	007	CB	900.55	1-16-17	1-23-17	CB	709.98	CB	1-24-17	CB	1-24-17	8oz	248.17
10	375 730	008	CB	792.56	1-16-17	1-23-17	CB	641.11	CB	1-27-17	CB	1-24-17	8oz	261.75
30	206615	001	—	—	—	—	—	—	—	—	MA	1/16/17	2L	095L

Peer Review: [illegible] 2/28/17

Sample Solid Preparation Logbook

Balance ID: 9299 Oven ID: #7 Logbook ID: 8-R026-2 SOP ID: PGH-R-074

Sample ID			Oven Drying Prep Analyst	Sample Wet Weight (g)	Begin Drying Date	End Drying Date	Dried Sample Weight Analyst	Final Dry Weight (g)	Sample Process Analyst	Sample Process Date	Geom Prep Analyst	Geometry/ Canned Prep Date	Gamma Geometry	Geometry Prep Volume/ Mass (L,g)
30	208 396	005		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	58.52
30	208 396	006		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	54.42
30	208 396	007		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	57.58
30	208 396	008		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	54.99
30	208 396	009		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	49.46
30	208 396	010		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	55.56
30	208 396	011		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	52.99
30	208 396	012		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	53.15
30	208 396	013		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	56.75
30	208 396	014		AS RECEIVED					CB	1-26-17	CB	1-26-17	2 oz	51.67
30	208 396	001		AS RECEIVED					CB	1-26-17	CB	1-26-17	8 oz	165.46
30	204 854	001	CB	485.85	1-26-17	1-28-17	CB	369.72	CB	1-31-17	CB	1-31-17	8 oz	205.58
30	204 854	002	CB	484.76	1-26-17	1-28-17	CB	395.64	CB	1-31-17	CB	1-31-17	8 oz	207.95
30	204 854	003	CB	512.01	1-26-17	1-28-17	CB	416.90	CB	1-31-17	CB	1-31-17	8 oz	203.53
30	204 854	004	CB	449.11	1-26-17	1-28-17	CB	365.03	CB	1-31-17	CB	1-31-17	8 oz	235.23
30	204 854	005	CB	573.45	1-26-17	1-28-17	CB	469.19	CB	1-31-17	CB	1-31-17	8 oz	229.20
30	204 854	006	CB	539.26	1-26-17	1-28-17	CB	448.63	CB	1-31-17	CB	1-31-17	8 oz	230.67
30	204 854	007	CB	718.26	1-26-17	1-28-17	CB	674.07	CB	1-31-17	CB	1-31-17	8 oz	269.72
30	204 854	008	CB	749.76	1-26-17	1-28-17	CB	680.26	CB	1-31-17	CB	1-31-17	8 oz	266.88
30	204 854	009	CB	554.20	1-26-17	1-28-17	CB	488.30	CB	1-31-17	CB	1-31-17	8 oz	270.52

JMA 2/28/17

Peer Review: _____

Sample Solid Preparation Logbook

Balance ID: 9299 Oven ID: #7 Logbook ID: 8-R026-2 SOP ID: PGH-R-024

Sample ID			Oven Drying Prep Analyst	Sample Wet Weight (g)	Begin Drying Date	End Drying Date	Dried Sample Weight Analyst	Final Dry Weight (g)	Sample Process Analyst	Sample Process Date	Geom Prep Analyst	Geometry/ Canned Prep Date	Gamma Geometry	Geometry Prep Volume/ Mass (L,g)
30	204 854	001	CB	380.46	1-26-17	1-28-17	CB	311.21	CB	1-31-17	CB	1-31-17	802	209.77
30	204 854	002	CB	843.19	1-26-17	1-28-17	CB	798.86	CB	1-31-17	CB	1-31-17	802	343.89
30	204 854	003	CB	527.09	1-26-17	1-28-17	CB	469.03	CB	1-31-17	CB	1-31-17	802	231.55
30	204 854	013	CB	594.26	1-26-17	1-28-17	CB	437.66	CB	1-31-17	CB	1-31-17	802	268.23
30	204 854	014	CB	491.01	1-26-17	1-28-17	CB	403.82	CB	1-31-17	CB	1-31-17	802	219.68
30	204 854	015	CB	606.06	1-26-17	1-28-17	CB	778.36	CB	1-31-17	CB	1-31-17	802	311.15
30	204 854	016	CB	710.95	1-26-17	1-28-17	CB	675.15	CB	2-1-17	CB	2-1-17	802	304.71
30	204 854	017	CB	482.47	1-26-17	1-28-17	CB	398.34	CB	2-1-17	CB	2-1-17	802	212.90
30	204 854	018	CB	592.71	1-26-17	1-28-17	CB	521.26	CB	2-1-17	CB	2-1-17	802	272.87
30	317 250	001		44	8-26-91	CB			CB	1-26-17	CB	1-26-17	802	46.34
30	105343	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.40L
30	206183	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.0L-8
30	206184	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.0L
30	206185	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.0L
30	207969	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.0L
30	206710	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.0L
30	206722	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.0L
30	206729	001	—	—	—	—	—	—	—	—	JMA	1/26/17	2L	2.0L
30	208961	001	CB	252.20	1-27-17	2-1-17	CB	230.52	CB	2-1-17	CB	2-1-17	402	185.01
30	208 961	002	CB	220.16	1-27-17	2-1-17	CB	189.86	CB	2-1-17	CB	2-1-17	402	156.57

*2274.11g +2156.49g

JMA 2/8/17

Peer Review: _____

Sample Solid Preparation Logbook

Balance ID: 9249 Oven ID: #7 Logbook ID: 8-R026-2 SOP ID: FGH-R-024

Sample ID			Oven Drying Prep Analyst	Sample Wet Weight (g)	Begin Drying Date	End Drying Date	Dried Sample Weight Analyst	Final Dry Weight (g)	Sample Process Analyst	Sample Process Date	Geom Prep Analyst	Geometry/ Canned Prep Date	Gamma Geometry	Geometry Prep Volume/ Mass (L,g)
30	208 961	003	CB	245.51	1-27-17	2-1-17	CB	218.24	CB	2-1-17	CB	2-1-17	402	170.57
30	208 961	004	CB	207.12	1-27-17	2-1-17	CB	173.86	CB	2-1-17	CB	2-1-17	402	151.68
30	208 962	001	CB	191.41	1-27-17	2-1-17	CB	163.24	CB	2-1-17	CB	2-1-17	402	134.50
30	208 963	002	CB	233.97	1-27-17	2-1-17	CB	184.72	CB	2-1-17	CB	2-1-17	402	152.76
30	209 082	001	CB	1657.23	1-27-17	2-1-17	CB	76.65	CB	2-2-17	CB	2-2-17	802	73.72
30	209 082	002	CB	1636.12	1-27-17	2-1-17	CB	83.32	CB	2-2-17	CB	2-2-17	402	81.03
30	209 082	003	CB	860.31	1-27-17	2-1-17	CB	173.76	CB	2-2-17	CB	2-2-17	802	177.16
10	377 287	001	CB	706.87	1-27-17	2-1-17	CB	709.11	CB	2-3-17	CB	2-3-17	802	360.31
10	377 287	002	CB	782.62	1-27-17	2-1-17	CB	437.05	CB	2-3-17	CB	2-3-17	802	172.18
10	377 287	003	CB	812.15	1-27-17	2-1-17	CB	693.41	CB	2-3-17	CB	2-3-17	802	302.99
10	377 287	004	CB	833.96	1-27-17	2-1-17	CB	677.78	CB	2-3-17	CB	2-3-17	802	310.58
10	377 287	005	CB	846.87	1-27-17	2-1-17	CB	720.52	CB	2-3-17	CB	2-3-17	802	306.90
10	377 287	006	CB	867.81	1-27-17	2-1-17	CB	712.88	CB	2-3-17	CB	2-3-17	802	285.26
30	209 072	001	CB	570.01	1-27-17	1-30-17	CB	311.00	CB	1-30-17	CB	1-30-17	802	170.96
30	209 072	002	CB	475.78	1-27-17	1-30-17	CB	323.05	CB	1-30-17	CB	1-30-17	802	192.61
30	208 162	001	CB	734.50	1-30-17	1-31-17	CB	235.50	CB	1-31-17	CB	1-31-17	802	178.62
10	37 5126	001	—	—	—	—	—	—	—	—	JMA	1/30/17	2L	2.0
10	37 5126	002	—	—	—	—	—	—	—	—	JMA	1/30/17	2L	2.0
10	377 176	001		AS RECEIVED					CB	1-30-17	CB	1-30-17	[illegible]	1172.23
30	209 176	001	CB	206.76	1-30-17	2-3-17	CB	82.00	CB	2-3-17	CB	2-3-17	802	60.49

JMA 2/28/17

Peer Review:

Sample Solid Preparation Logbook

Balance ID: 9299 Oven ID: #7 Logbook ID: 8-R028-2 SOP ID: PGH-R-024

Sample ID			Oven Drying Prep Analyst	Sample Wet Weight (g)	Begin Drying Date	End Drying Date	Dried Sample Weight Analyst	Final Dry Weight (g)	Sample Process Analyst	Sample Process Date	Geom Prep Analyst	Geometry/ Canned Prep Date	Gamma Geometry	Geometry Prep Volume/ Mass (L,g)
30	209186	001	CB	213.16	1-31-17	2-3-17	CB	207.96	CB	2-3-17	CB	2-3-17	8oz	114.29
30	209187	001	CB	213.16	1-31-17	2-3-17	CB	207.96	CB	2-3-17	CB	2-3-17	8oz	114.29
30	207961	002	—	—	—	—	—	—	—	—	LMA	2/1/17	2L	1.68L
30	207961	005	—	—	—	—	—	—	—	—	LMA	2/1/17	2L	2.0L
30	207961	007	—	—	—	—	—	—	—	—	LMA	2/1/17	2L	2.0L
30	208763	001	—	—	—	—	—	—	—	—	LMA	2/1/17	2L	2.0L
30	207663	001	CB	485.42	1-25-17	1-26-17	CB	484.46	CB	2-1-17	CB	2-1-17	8oz	478.07
30	208150	001	—	CB 2-1-17	—	—	—	—	—	—	LMA	2/1/17	2L	2.0L
30	209195	001	—	—	—	—	—	—	—	—	LMA	2/1/17	2L	2.0L
30	209273	001	CB	872.40	2-1-17	2-3-17	CB	57.20	CB	2-3-17	CB	2-3-17	2oz	49.44
30	209275	001	CB	423.64	2-1-17	2-3-17	CB	6.24	CB	2-6-17	CB	2-6-17	0.5oz	5.99
30	209354	001	CB	423.50	2-1-17	2-3-17	CB	351.43	CB	2-6-17	CB	2-6-17	8oz	350.92
10	377617	001	CB	998.78	2-1-17	2-3-17	CB	743.41	CB	2-3-17	CB	2-3-17	8oz	274.13
10	377617	002	CB	1162.02	2-1-17	2-3-17	CB	925.73	CB	2-3-17	CB	2-3-17	8oz	270.73
10	316449	001	CB	192.57	2-1-17	2-3-17	CB	186.00	CB	2-3-17	CB	2-3-17	8oz	2-3-17 95.43
30	208765	001	CB	136.98	2-1-17	2-3-17	CB	114.05	CB	2-3-17	CB	2-3-17	2oz	202.11
30	209034	001	CB	587.19	2-1-17	2-3-17	CB	446.59	CB	2-3-17	CB	2-3-17	8oz	340.48
30	207961	004	—	—	—	—	—	—	—	—	LMA	2/2/17	2L	1.59L
30	208522	001	—	—	—	—	—	—	—	—	LMA	2/2/17	2L	2.0L
30	208522	002	—	—	—	—	—	—	—	—	LMA	2/2/17	2L	2.0L

Peer Review: LMA 2/28/17

Pace Analytical Services, Inc.-Pittsburgh

Logbook ID: 8-R061-2

Gamma Spectrometry Run Log

SOP ID: PGH-R-023

REMINDER: Perform and Log Daily Checks!

Detector #	Sample No.	Batch ID	Aliquots (g, L, S, F)	Geometry	Count Time (min)	Count Start date/ time	Count Analyst
2	30207596010	33842	232.30g	8 oz	15	2/20/17 1115	[illegible]
5	30207596011	33842	216.92g	8 oz	15	2/20/17 1116	[illegible]
2	30207596012	33842	222.35g	8 oz	15	2/20/17 1135	[illegible]
5	30207596013	33842	255.62g	8 oz	15	2/20/17 1136	[illegible]
2	30207596014	33842	231.38g	8 oz	15	2/20/17 1152	[illegible]
5	30207596015	33842	272.02g	8 oz	15	2/20/17 1153	[illegible]
2	30207597001	33842	215.22g	8 oz	15	2/20/17 1209	[illegible]
5	30207597002	33842	225.06g	8 oz	15	2/20/17 1210	[illegible]
2	30207597003	33842	200.90g	8 oz	15	2/20/17 1227	[illegible]
5	30207597004	33842	228.69g	8 oz	15	2/20/17 1228	[illegible]
2	30207597005	33842	239.51g	8 oz	15	2/20/17 1245	[illegible]
2	LCS34107	34107	53.544g	1 oz	30	2/20/17 1309	[illegible]
5	LCS034107	34107	53.544g	1 oz	30	2/20/17 1358	[illegible]
2	30208718001 [illegible] 2/20/17	34107	26.03g	1 oz	120	2/20/17 1502	[illegible]
5	1228264	34107	46.47g	1 oz	120	2/20/17 1502	[illegible]
2	DBD2022117	DBKG	—	—	5	2/21/17 [illegible]	[illegible]
5	DBD5022117	DBKG	—	—	5	2/21/17 [illegible]	[illegible]
2	30207597006	33842	239.14g	8 oz	15	2/21/17 709	[illegible]
5	30207597007	33842	238.19g	8 oz	15	2/21/17 710	[illegible]
2	30207597008	33842	238.37g	8 oz	15	2/21/17 730	[illegible]
5	30207597009	33842	220.99g	8 oz	15	2/21/17 731	[illegible]
2	30208716001	33842	178.68g	8 oz	15	2/21/17 750	[illegible]
2	1221147	33842	318.71g	8 oz	15	2/21/17 830	[illegible]
5	LCS33843	33843	369.59g	8 oz	15	2/21/17 830	[illegible]

Comments:

Peer Review: [illegible] 2/28/17

Pace Analytical Services, Inc.-Pittsburgh

Logbook ID: 8-R061-2

Gamma Spectrometry Run Log

SOP ID: PGH-R-023

REMINDER: Perform and Log Daily Checks!

Detector #	Sample No.	Batch ID	Aliquots (g, L,S, P)	Geometry	Count Time (min)	Count Start date/ time	Count Analyst
2	3LCSD33843 MA 2/21/17	33843	369.5g	8 OZ	15	2/21/17 855	MAK
5	30204597010	33843	240.63g	8 OZ	15	2/21/17 855	MAK
2	1228261 (#13)	34106	2.0L	2 LITER	60	2/21/17 931	MAK
5	LCS34106	34106	2.0L	2 LITER	30	2/21/17 932	MAK
5	30209373001 (#33)	34106	2.0L	2 LITER	60	2/21/17 1003	MAK
2	LCSD34106	34106	2.0L	2 LITER	30	2/21/17 1032	MAK
2	1229645	34137	318.71g	8 OZ	15	2/21/17 1133	MAK
5	LCS34137	34137	369.5g	8 OZ	15	2/21/17 1134	MAK
2	LCSD34137	34137	369.5g	8 OZ	15	2/21/17 1156	MAK
5	30209586001	34137	373.72g	8 OZ	15	2/21/17 1157	MAK
2	30209586002	34137	342.76g	8 OZ	15	2/21/17 1344	MAK
5	30210937001	34137	172.56g	8 OZ	60	2/21/17 1344	MAK
2	30210804001	34137	313.95g	8 OZ	15	2/21/17 1401	MAK
2	30210805001	34137	64.63g	8 OZ	60	2/21/17 1417	MAK
5	30210239001	34137	107.21g	8 OZ	30	2/21/17 1447	MAK
2	30210353001	34137	256.11g	8 OZ	15	2/21/17 1522	MAK
5	30204854001	33843	206.58g	8 OZ	15	2/21/17 1523	MAK
2	30204854002	33843	207.95g	8 OZ	15	2/21/17 1544	MAK
5	30204854003 S MA 2/21/17	33843	229.28g	8 OZ	15	2/21/17 1545	MAK
2	30204854006	33843	230.67g	8 OZ	15	2/21/17 1601	MAK
5	30204854007	33843	269.76g	8 OZ	15	2/21/17 1602	MAK
2	1229645R	34137	318.71g	8 OZ	15	2/21/17 1619	MAK
2	30204854008	33843	256.88g	8 OZ	15	2/21/17 1636	MAK
5	30204854009	33843	270.58g	8 OZ	15	2/21/17 1637	MAK

Comments:

Peer Review: JMA 2/28/17

Pace Analytical Services, Inc.-Pittsburgh

Logbook ID: 8-R061-2

Gamma Spectrometry Run Log

SOP ID: PGH-R-023

REMINDER: Perform and Log Daily Checks!

Detector #	Sample No.	Batch ID	Aliquots (g, L,S, F)	Geometry	Count Time (min)	Count Start date/ time	Count Analyst
2	10379320001	33628	1.0 S	2 OZ	480	2/21/17 1701	MAK
5	3040238001	34137	26.58g	8 OZ	180	2/21/17 1702	MAK
2	DBD2022217	DBKG	—	—	5	2/22/17 706	MAK
5	DBD5022217	DBKG	—	—	5	2/22/17 707	MAK
2	30204854010	33843	205.77g	8 OZ	15	2/22/17 735	MAK
5	30204854011	33843	343.89g	8 OZ	15	2/22/17 736	MAK
2	30204854012	33843	231.56g	8 OZ	15	2/22/17 752	MAK
5	30204854013	33843	208.22g	8 OZ	15	2/22/17 752	MAK
2	30204854014	33843	219.68g	8 OZ	15	2/22/17 813	MAK
5	30204854015	33843	311.75g	8 OZ	15	2/22/17 814	MAK
2	30204854016	33843	304.71g	8 OZ	15	2/22/17 830	MAK
5	30204854017	33843	212.99g	8 OZ	15	2/22/17 831	MAK
2	30204854018	33843	272.28g	8 OZ	15	2/22/17 846	MAK
2	30204854896 1001 MAK 2/22/17	34036	185.53g	4 OZ	30	2/22/17 924	MAK
5	30208961002	34036	148.57g	4 OZ	30	2/22/17 924	MAK
2	30208961003	34036	170.59g	4 OZ	30	2/22/17 956	MAK
5	30208961004	34036	151.63g	4 OZ	30	2/22/17 956	MAK
2	30208962001	34036	134.58g	4 OZ	30	2/22/17 1032	MAK
5	30208963001	34036	152.76g	4 OZ	30	2/22/17 1033	MAK
2	30209465001 (29)	34106	2.0L	2 LOTBR	60	2/22/17 1109	MAK
5	30209466001 (30)	34106	2.0L	2 LOTBR	60	2/22/17 1110	MAK
2	30209470001 (28)	34106	2.0L	2 LOTBR	60	2/22/17 1229	MAK
5	30209471001 (27)	34106	2.0L	2 LOTBR	60	2/22/17 1230	MAK
2	30209539001 (31)	34106	2.0L	2 LOTBR	60	2/22/17 1340	MAK

Comments:

Peer Review: MAK 2/28/17

Pace Analytical Services, Inc.-Pittsburgh

Logbook ID: 8-R061-2

Gamma Spectrometry Run Log

SOP ID: PGH-R-023

REMINDER: Perform and Log Daily Checks!

Detector #	Sample No.	Batch ID	Aliquots (g, L,S, F)	Geometry	Count Time (min)	Count Start date/ time	Count Analyst
5	3020924001 (32)	34106	2.0L	2LGER	60	2/22/17 1341	[illegible]
2	3021024001 (33)	34106	2.0L	2LGER	60	2/22/17 1541	[illegible]
5	3021025001 (34)	34106	2.0L	2LGER	60	2/22/17 1542	[illegible]
2	3600 00034	38116	—	—	5	2/23/17 711	[illegible]
5	3605 00032	38116	—	—	5	2/23/17 712	[illegible]
2	3020908003	35843	172.16g	8 OZ	15	2/23/17 803	[illegible]
2	3020908001	35843	73.72g	8 OZ	30	2/23/17 841	[illegible]
5	3020908002	34106	81.02g	4 OZ	30	2/23/17 842	[illegible]
2	3020925001	34106	1.94L	2LGER	60	2/22/17 922	[illegible]
5	1030660	34198	2000.0g	2LGER	60	2/22/17 923	[illegible]
2	3014301M1001 [illegible]	34198	2014.0g	2LGER	60	2/22/17 1040	[illegible]
5	1034198	34198	2.0L	2LGER	30	2/23/17 1041	[illegible]
2	1030 34198	34198	2.0L	2LGER	30	2/23/17 1145	[illegible]
5	1037-937-001	34137	152.32g	8 OZ	30	2/22/17 1146	[illegible]
2	1037-946-001 [illegible] 1/23/17	35789	31.79g	2 OZ	120	2/23/17 1219	[illegible]
5	1037-937-002	34137	96.54g	8 OZ	60	2/23/17 1219	[illegible]
5	3020947001 [illegible]	—	1.06L	2LGER	30	2/23/17 1320	[illegible]
2	1037-949-001	35789	36.96g	2 OZ	120	2/23/17 1321	[illegible]
5	3020947001R	—	2.0L	2LGER	60	2/23/17 1321	[illegible]
5	3021147001	34137	168.71g	8 OZ	15	2/23/17 1555	[illegible]
2	1037-949-001	35789	25.32g	2 OZ	120	2/23/17 1619	[illegible]
5	1037-946-001	34137	34.04g	8 OZ	120	2/23/17 1620	[illegible]
2	3600 02017	38116	—	—	5	2/24/17 729	[illegible]
5	3605 02017	38116	—	—	5	2/24/17 730	[illegible]

Comments:

Peer Review: _____

Logbook ID: 9-R061-2

Gamma Spectrometry Run Log

SOP ID: PGH-R-023

REMINDER: Perform and Log Daily Checks!

Detector #	Sample No.	Batch ID	Aliquots (g, L,S, F)	Geometry	Count Time (min)	Count Start date/ time	Count Analyst
2	3020927300l	33849	49.44g	2oz	30	2/24/17 756	[illegible]
5	3020928700l	33842	114.28g	8oz	30	2/24/17 757	[illegible]
2	102406	34057	318.7g	8oz	15	2/24/17 838	[illegible]
5	LCS34057	34057	360.5g	8oz	15	2/24/17 839	[illegible]
2	LCS34057	34057	362.8g	8oz	15	2/24/17 855	[illegible]
5	1037883001	34057	360.0g	8oz	15	2/24/17 856	[illegible]
2	1037897001	34057	272.8g	8oz	15	2/24/17 913	[illegible]
5	1037887003	34057	301.9g	8oz	15	2/24/17 912	[illegible]
2	1037708768A	34057	340.5g	8oz	15	2/24/17 931	[illegible]
5	1037782605	34057	306.3g	8oz	15	2/24/17 932	[illegible]
5	1037782606	34057	255.2g	8oz	15	2/24/17 950	[illegible]
2	4014493001	33915	3.31g	0.5oz	120	2/24/17 950	[illegible]
5	3720969001 (28)	34106	2.0L	2LITER	60	2/24/17 1015	[illegible]
2	1037830019 (33)	34106	1.87L	2LITER	60	2/24/17 1026	[illegible]
5	1037962018 (26)	34106	1.95L	2LITER	60	2/24/17 1037	[illegible]
2	1037830021 (32)	34106	1.88L	2LITER	60	2/24/17 1304	[illegible]
5	1037830020 (29)	34106	1.97L	2LITER	60	2/24/17 1304	[illegible]
5	3020947100RL (20)	—	2.0L	2LITER	60	2/24/17 1315	[illegible]
2	LB0509247	LCS3486	1.0	EMPTY	1000	2/24/17 1556	[illegible]
5	LB0509247	LCS3486	1.0	EMPTY	1000	2/24/17 1557	[illegible]
2	3BD0509247	DBK16	—	—	5	2/24/17 749	[illegible]
5	3BD0509247	DBK16	—	—	5	2/24/17 750	[illegible]
2	3020922001	33985	5.79g	0.5oz	120	2/24/17 846	[illegible]
5	LCS33986	33986	2.0L	2LITER	30	2/24/17 907	[illegible]

Comments:

Peer Review: [illegible] 2/28/17

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854013	**Collection Date**	11/18/2016 11:18
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/22/17 7:53
Client ID	WESTON NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	3.923	1.740	1.159
Cesium-137	0.039	0.135	0.167
Lead-212	2.544	0.497	0.290
Potassium-40	29.895	5.779	1.646
Protactinium-234M	0.000	12.577	35.470
Radium-226	1.544	0.416	0.274
Radium-228	2.689	0.676	0.420
Thallium-208	1.048	0.257	0.095
Thorium-228	0.000	5.649	13.670
Thorium-234	1.731	3.010	3.799
Uranium-235	0.000	0.974	2.583

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:40:39 AM Page 1
Pace Analytical Spectrum name: 30204854013.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854013.An1

Acquisition information
Start time: 2/22/2017 7:53:28 AM
Live time: 900
Real time: 901
Dead time: 0.16 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.0829E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.0829E+02) =
4.8010E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:40:39 AM Page 2
Pace Analytical Spectrum name: 30204854013.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 11:18:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(8OZ).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

OK 2/22/17

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1554

***** 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. pCi/G	Nuc
47.01	29.	45.81	0.91	2.158E-02	46.54	4.250	PBC<MDA	Pb210
63.43	21.	86.55	0.97	3.668E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	3.091E+01	Th232
					63.81	0.267	3.091E+01	Th232
					63.29	4.800	PBC<MDA	Th234
63.51	33.	52.57	0.97	3.693E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	4.874E+01	Th232
74.69	91.	18.86	0.98	4.120E-02	74.66	58.200	4.669E-01	Am243
					74.81	10.400	3.338E+00	Pb212
77.01	151.	12.63	0.98	4.193E-02	77.11	17.500	3.213E+00	Pb212
87.40	31.	65.21	0.99	4.456E-02	87.30	7.800	PBC<MDA	Pb212
					88.03	3.610	3.161E+00	Cd109
					88.03	3.610	3.161E+00	Cd109
					86.54	30.700	2.991E-01	Eu155
105.44	25.	47.77	1.01	4.704E-02	105.31	21.200	PBC<MDA	Eu155
					105.31	21.200	PBC<MDA	Eu155
121.61	18.	73.00	1.02	4.744E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	PBC<MDA	Co57
					122.06	85.600	PBC<MDA	Co57
					121.78	28.400	PBC<MDA	Eu152
121.74	20.	61.31	1.02	4.744E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	9.068E-02	Co57
					123.07	40.600	1.443E-01	Eu154
238.33	241.	8.43	0.98	3.551E-02	238.63	43.300	2.440E+00	Pb212
241.62	20.	49.98	1.13	3.514E-02	241.92	7.470	PBC<MDA	Ra226
					241.00	3.900	2.354E+00	Ra224
247.99	12.	87.85	1.13	3.453E-02	247.93	6.910	PBC<MDA	Eu154

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ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:40:39 AM Page 3
Pace Analytical Spectrum name: 30204854013.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					247.93	6.910	PBC<MDA	Eu154

269.72	28.	39.39	1.15	3.249E-02	269.46	13.700	9.091E-01	Ra223
					269.46	13.700	9.091E-01	Ra223
295.05	64.	14.54	1.19	3.033E-02	295.22	19.200	1.578E+00	Ra226
					295.96	28.670	2.604E+00	Ir192
319.55	16.	47.40	1.19	2.849E-02	320.08	10.080	PBC<MDA	Cr51
					320.08	10.080	PBC<MDA	Cr51
338.07	52.	20.91	0.37	2.729E-02	338.32	11.300	2.515E+00	Ac228
351.55	100.	12.30	1.42	2.646E-02	351.99	37.100	1.469E+00	Ra226
427.66	17.	40.97	1.28	2.273E-02	427.88	29.600	3.891E-01	Sb125
					427.88	29.600	3.891E-01	Sb125
462.77	24.	31.04	1.31	2.138E-02	463.36	10.500	1.646E+00	Sb125
					463.36	10.500	1.646E+00	Sb125
467.83	10.	35.59	1.32	2.121E-02	468.07	47.830	3.467E-01	Ir192
					468.07	47.830	3.467E-01	Ir192
496.96	7.	90.83	1.34	2.026E-02	497.08	91.000	PBC<MDA	Ru103
					497.08	91.000	PBC<MDA	Ru103
522.79	11.	64.90	1.36	1.951E-02	522.65	16.000	HL>Cutoff	I132
					522.65	16.000	HL>Cutoff	I132
529.27	9.	91.51	1.37	1.931E-02	529.87	87.000	HL>Cutoff	I133
					529.87	87.000	HL>Cutoff	I133
537.21	10.	84.92	1.37	1.911E-02	537.26	24.390	PBC<MDA	Ba140
					537.26	24.390	5.387E+01	Ba140
583.29	98.	10.30	1.08	1.798E-02	583.19	84.500	1.024E+00	Tl208
602.68	9.	72.97	1.43	1.755E-02	602.73	97.800	PBC<MDA	Sb124
					602.73	97.800	2.364E-01	Sb124
609.27	90.	11.73	1.49	1.741E-02	609.31	44.800	1.668E+00	Ra226
614.27	14.	50.01	1.43	1.731E-02	614.28	89.800	PBC<MDA	Ag108M
					614.28	89.800	1.330E-01	Ag108M
702.55	21.	31.24	1.50	1.571E-02	702.62	97.900	1.953E-01	Nb94
					702.62	97.900	1.953E-01	Nb94
727.15	24.	21.17	1.52	1.532E-02	727.33	6.580	3.701E+00	Bi212
744.65	11.	53.83	1.53	1.507E-02	744.28	4.700	PBC<MDA	Ag110M
					744.28	4.700	PBC<MDA	Ag110M
860.21	13.	48.55	1.62	1.361E-02	860.56	12.420	PBC<MDA	Tl208
911.34	67.	12.69	0.42	1.308E-02	911.21	26.600	2.852E+00	Ac228
968.78	35.	20.82	1.07	1.253E-02	968.97	16.200	2.543E+00	Ac228
1119.93	18.	49.11	1.80	1.133E-02	1120.29	14.800	1.523E+00	Ra226
1172.68	7.	84.69	1.84	1.097E-02	1173.24	99.974	PBC<MDA	Co60
					1173.24	99.974	PBC<MDA	Co60
1235.25	10.	67.92	1.88	1.058E-02	1235.36	20.000	PBC<MDA	Cs136
					1235.36	20.000	PBC<MDA	Cs136
1273.47	9.	72.22	1.91	1.035E-02	1274.44	35.000	PBC<MDA	Eu154
					1274.53	99.944	1.321E-01	Na22
					1274.53	99.944	1.321E-01	Na22
					1274.44	35.000	3.592E-01	Eu154
1273.47	9.	72.22	1.91	1.035E-02	1274.44	35.000	3.592E-01	Eu154
					1274.53	99.944	1.321E-01	Na22

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pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
1332.55	7.	52.31	1.94	1.002E-02	1332.50	99.986	PBC<MDA	Co60
					1332.50	99.986	PBC<MDA	Co60
1460.74	208.	7.06	1.85	9.379E-03	1461.00	10.670	2.990E+01	K40
1594.89	3.	57.74	2.10	8.785E-03	1596.21	95.400	PBC<MDA	La140
					1596.21	95.400	9.461E+00	La140
1619.50	4.	50.00	2.12	8.685E-03	1620.50	1.490	PBC<MDA	Bi212
1690.70	2.	96.93	2.16	8.410E-03	1690.98	47.300	PBC<MDA	Sb124
					1690.98	47.300	PBC<MDA	Sb124
1764.13	12.	63.68	2.20	8.138E-03	1764.49	15.360	PBC<MDA	Ra226
1838.45	3.	66.16	2.23	7.888E-03	1836.06	99.200	PBC<MDA	Y88

No unknown peaks passed sensitivity test.

This section based on library: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-210	187.59	47.01	41.	29.	0.032	91.61	0.911s
Th-234	253.23	63.43	88.	21.	0.023	173.30	0.970s
Th-232	253.59	63.51	75.	33.	0.037	105.15	0.970s
Pb-212	298.75	74.81	119.	68.	0.076	41.37	0.980D
Pb-212	307.95	77.11	91.	149.	0.165	24.53	0.982D
Pb-212	349.10	87.40	96.	31.	0.034	130.43	0.991s
Eu-155	421.21	105.44	32.	25.	0.028	95.54	1.007
Eu-152	485.89	121.61	40.	18.	0.020	146.00	1.022s
Co-57	486.40	121.74	34.	20.	0.022	122.61	1.022s
Pb-212	953.83	238.63	30.	246.	0.274	14.19	1.124D
Ra-226	966.98	241.92	42.	20.	0.023	99.95	1.127D
Eu-154	991.24	247.99	22.	12.	0.013	175.70	1.132s
Ra-223	1078.15	269.72	22.	28.	0.031	78.78	1.151
Ra-226	1179.45	295.05	6.	64.	0.071	29.07	1.188
Cr-51	1277.43	319.55	10.	16.	0.018	94.79	1.194s
Ac-228	1351.47	338.07	16.	52.	0.058	41.82	0.370s
Ra-226	1405.41	351.55	15.	100.	0.111	24.59	1.423
Sb-125	1709.80	427.66	7.	17.	0.019	81.93	1.284s
Sb-125	1850.23	462.77	7.	24.	0.027	62.08	1.313
Ir-192	1870.45	467.83	1.	10.	0.011	71.18	1.317s
Ru-103	1986.97	496.96	8.	7.	0.008	181.65	1.341s
I-132	2090.29	522.79	8.	11.	0.012	129.79	1.362s
I-133	2116.21	529.27	12.	9.	0.010	183.02	1.367s
Ba-140	2147.96	537.21	12.	10.	0.011	169.84	1.373s
Tl-208	2332.26	583.29	2.	98.	0.109	20.60	1.079
Sb-124	2409.81	602.68	8.	9.	0.010	145.95	1.425s
Ra-226	2436.17	609.27	7.	90.	0.100	23.46	1.491
Ag-108M	2456.18	614.27	8.	14.	0.016	100.03	1.434s

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Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Nb-94	2809.29	702.55	4.	21.	0.023	62.48	1.503s
Bi-212	2907.71	727.15	0.	24.	0.026	42.34	1.522s
Ag-110M	2977.71	744.65	4.	11.	0.012	107.65	1.534s
Tl-208	3440.02	860.21	5.	13.	0.014	97.10	1.621s
Ac-228	3644.60	911.34	2.	67.	0.074	25.39	0.417s
Ac-228	3874.40	968.78	4.	35.	0.039	41.64	1.065s
Ra-226	4479.16	1119.93	10.	18.	0.020	98.23	1.804s
Co-60	4690.25	1172.68	7.	7.	0.008	169.38	1.840s
Cs-136	4940.64	1235.25	5.	10.	0.011	135.84	1.881s
Eu-154	5093.57	1273.47	5.	9.	0.010	144.44	1.906s
Na-22	5093.57	1273.47	5.	9.	0.010	144.44	1.906s
Co-60	5330.00	1332.55	3.	7.	0.008	104.61	1.943s
K-40	5843.04	1460.74	3.	208.	0.231	14.12	1.853s
La-140	6380.00	1594.89	0.	3.	0.003	115.47	2.103s
Bi-212	6478.50	1619.50	0.	4.	0.004	100.00	2.117s
Sb-124	6763.50	1690.70	0.	2.	0.002	193.85	2.156s
Ra-226	7057.46	1764.13	7.	12.	0.013	127.35	2.197s
Y-88	7355.00	1838.45	0.	3.	0.003	132.33	2.235s

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

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*****   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
              pCi/G          keV      pCi/G          pCi/G          COMMENTS
-----------------------------------------------------------------------------------

Be-7      C  -4.6503E-01                                          5.34E+01
                            477.56-4.650E-01 %(  4.684E+00 4.03E+02 1.03E+01 G K

Na-22     C   1.3209E-01                                          9.50E+02
                           1274.53 1.321E-01 ?(  1.989E-01 7.22E+01 9.99E+01 G K

K-40      N   2.9895E+01                                          4.68E+11
                           1461.00 2.990E+01  (P 1.646E+00 7.06E+00 1.07E+01 G K

Cr-51     F   8.8152E+00                                          2.77E+01
                            320.08 8.815E+00 &(P 9.660E+00 4.74E+01 1.01E+01 G K

Co-56     C  -2.2788E-01                                          7.73E+01
                           1238.28-2.279E-01 &(  1.167E+00 2.46E+02 6.61E+01 G K
                           1771.35 3.628E-01 % P 1.999E+00 1.25E+02 1.55E+01 G

Co-57     C   9.0681E-02                                          2.72E+02
                            122.06 9.068E-02  (  1.355E-01 6.13E+01 8.56E+01 G K
                            136.47-9.215E-02 %   1.425E+00 6.07E+02 1.07E+01 G
C
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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Co-60     F   1.0236E-01                                          1.92E+03
                           1332.50 1.039E-01 ?(P 1.610E-01 5.23E+01 1.00E+02 G K
                           1173.24 1.008E-01 ?(P 1.998E-01 8.47E+01 1.00E+02 G

Y-88      C   9.5155E-02                                          1.07E+02
                           1836.06 9.516E-02 ?(P 2.532E-01 6.62E+01 9.92E+01 G K
                            898.04 0.000E+00 % P 4.990E-01 1.00E+03 9.37E+01 G

Nb-94     I   1.0988E-01                                          7.41E+06
                            871.09 2.612E-02 %(P 1.465E-01 2.23E+02 9.99E+01 G K
                            702.62 1.953E-01 ?(  1.146E-01 3.12E+01 9.79E+01 G

Ru-103    I   2.9868E-01                                          3.93E+01
                            497.08 2.987E-01 &(P 6.738E-01 9.08E+01 9.10E+01 G K

Ag-108M   C   4.6243E-02                                          1.53E+05
                            722.94-3.957E-02 %(  2.475E-01 2.75E+02 9.08E+01 G K
                            614.28 1.330E-01 ?(  1.449E-01 5.00E+01 8.98E+01 G
                            433.94 4.961E-02 %   1.428E-01 1.20E+02 9.05E+01 G
                             79.13-5.906E-01 %   2.453E+00 1.67E+02 6.60E+00 G

Ru-106    I   6.6975E-01                                          3.73E+02
                            621.93 6.698E-01 &(P 1.933E+00 1.21E+02 9.93E+00 G K

Cd-109    F   1.6665E+00                                          4.64E+02
                             88.03 1.667E+00 %(  5.582E+00 1.36E+02 3.61E+00 G K
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Ag-110M   F   1.7895E-01                                          2.50E+02
                          657.76 4.637E-02 %(P 1.488E-01 1.26E+02 9.40E+01 G K
                         1505.04 2.374E-01 %   2.159E+00 4.07E+02 1.29E+01 G
                         1384.30 1.269E-01 % P 5.893E-01 1.01E+02 2.41E+01 G
                          937.49 0.000E+00 %   1.318E+00 1.00E+03 3.41E+01 G
                          884.68 8.865E-02 % P 3.326E-01 1.64E+02 7.22E+01 G
                          763.94 1.435E-01 %   1.102E+00 3.28E+02 2.21E+01 G
                          744.28 2.831E+00 &(P 3.297E+00 5.38E+01 4.70E+00 G
                          706.68 0.000E+00 % P 2.054E+00 1.00E+03 1.63E+01 G

Sn-113    F  -5.7685E-02                                          1.15E+02
                          391.69-5.769E-02 %(  4.248E-01 3.05E+02 6.40E+01 G K

Sb-124    F   2.1776E-01                                          6.02E+01
                          602.73 2.364E-01 ?(  3.954E-01 7.30E+01 9.78E+01 G K
                          645.85 6.039E-01 & P 5.692E+00 3.71E+02 7.38E+00 G
                          722.79-1.006E+00 %   6.295E+00 2.75E+02 1.08E+01 G
                         1690.98 1.792E-01 ?(P 8.055E-01 9.69E+01 4.73E+01 G
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L


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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Sb-125   I   7.1831E-01                                          1.01E+03
                          427.88 3.891E-01 &(  3.442E-01 4.10E+01 2.96E+01 G K
                          176.31 2.926E-01 % P 1.912E+00 2.58E+02 6.82E+00 G
                          463.36 1.646E+00  (  1.032E+00 3.10E+01 1.05E+01 G
                          600.60 0.000E+00 % P 1.143E+00 1.00E+03 1.79E+01 G
                          635.95 1.316E-01 % P 1.542E+00 4.72E+02 1.13E+01 G

Te-129M  I   1.0103E+01                                          3.36E+01
                          695.88 1.010E+01 %(P 3.560E-01 1.51E+02 3.00E+00 G K

I-131    I  -1.3578E+01                                          8.02E+00
                          364.49-1.358E+01 %(  6.030E+02 1.78E+03 8.17E+01 G K
                          636.99 0.000E+00 %   1.093E+04 1.00E+03 7.17E+00 G
                          284.30 0.000E+00 %   8.628E+03 1.00E+03 6.14E+00 G

I-132    I   1.0051E-01                                          3.20E+00
                          772.60 1.602E-02 %(P 2.831E-01 7.60E+02 7.56E+01 G K
                          522.65 4.997E-01 ?(P 7.406E-01 6.49E+01 1.60E+01 G
                          630.19 4.041E-01 &   9.962E-01 1.04E+02 1.33E+01 G
                          954.55 0.000E+00 % P 1.760E+00 1.00E+03 1.76E+01 G

I-133    I   7.6244E-02                                          8.67E-01
                          529.87 7.624E-02 &(P 1.624E-01 9.15E+01 8.70E+01 G K
                          875.33 8.319E-01 %   2.994E+00 1.52E+02 4.51E+00 G

Ba-133   F  -3.0043E-03                                          3.84E+03
                          356.02-3.004E-03 %(  2.358E-01 3.09E+03 6.20E+01 G K
                           81.00 0.000E+00 % P 4.915E-01 1.00E+03 3.41E+01 G
                          302.85-2.063E-01 %   9.656E-01 1.93E+02 1.83E+01 G
                          276.40 1.442E-01 % P 1.693E+00 4.66E+02 7.16E+00 G
                          383.85 4.899E-01 % P 1.362E+00 1.15E+02 8.94E+00 G

Cs-134   I  -2.9178E-02                                          7.52E+02
                          604.72-2.918E-02 %(  2.129E-01 3.09E+02 9.76E+01 G K
                          801.95 3.992E-02 % P 2.447E+00 2.57E+03 8.69E+00 G
                          795.86 1.170E-01 % P 2.798E-01 1.07E+02 8.55E+01 G
                          569.33 0.000E+00 % P 1.340E+00 1.00E+03 1.54E+01 G
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Cs-136    F    2.2378E+01                                                  1.32E+01
                                818.51 6.478E+00 %(P 2.662E+01 1.72E+02 9.97E+01 G K
                                176.60 2.800E+01 & P 1.856E+02 2.61E+02 1.00E+01 G
                                273.65-3.782E+01 %   1.981E+02 2.14E+02 1.11E+01 G
                                340.55 0.000E+00 % P 7.998E+01 1.00E+03 4.22E+01 G
                               1048.07-8.285E+00 %   4.842E+01 2.68E+02 8.00E+01 G
                               1235.36 1.016E+02 ?(P 1.442E+02 6.79E+01 2.00E+01 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Cs-137    I    3.9387E-02                                                  1.10E+04
                                661.66 3.939E-02 %(P 1.670E-01 1.71E+02 8.51E+01 G K

Ba-140    I    5.3865E+01                                                  1.28E+01
                                537.26 5.387E+01 ?(  1.050E+02 8.49E+01 2.44E+01 G K
                                162.66 9.509E+01 % P 3.196E+02 1.33E+02 6.22E-00 G

La-140    I    9.4613E+00                                                  1.28E+01
                               1596.21 9.461E+00 ?(  2.324E+01 5.77E+01 9.54E+01 G K
                                487.02-2.822E+00 %   5.686E+01 8.00E+02 4.55E+01 G
                                815.77 0.000E+00 %   2.090E+02 1.00E+03 2.33E+01 G
                                328.76 0.000E+00 % P 1.529E+02 1.00E+03 2.03E+01 G

Ce-144    I    1.1652E-02                                                  2.85E+02
                                133.51 1.165E-02 %(  1.321E+00 4.42E+03 1.11E+01 G K

Eu-152    F    1.9432E-01                                                  4.95E+03
                                121.78 1.943E-01  (P 3.494E-01 7.30E+01 2.84E+01 G K
                               1408.01-8.479E-02 %   9.668E-01 4.93E+02 2.09E+01 G
                               1112.12 2.210E-01 %   1.629E+00 3.28E+02 1.36E+01 G
                               1085.91-2.121E-01 %   2.188E+00 4.57E+02 9.92E+00 G
                                964.13 2.751E-01 % P 1.613E+00 2.60E+02 1.43E+01 G
                                344.28 0.000E+00 & P 5.450E-01 1.00E+03 2.66E+01 G
                                244.70 9.951E-02 % P 1.632E+00 6.54E+02 7.49E+00 G

Eu-154    I    2.1269E-01                                                  3.14E+03
                                123.07 0.000E+00 %(P 3.231E-01 1.00E+03 4.06E+01 G K
                               1274.44 3.592E-01 ?(  5.410E-01 7.22E+01 3.50E+01 G
                               1004.72 0.000E+00 % P 1.821E+00 1.00E+03 1.79E+01 G
                                996.26 0.000E+00 %   2.558E+00 1.00E+03 1.05E+01 G
                                873.19-2.240E-01 %   1.777E+00 3.50E+02 1.22E+01 G
                                723.30 0.000E+00 %   1.238E+00 1.00E+03 2.01E+01 G
                                247.93 7.202E-01  (P 1.526E+00 8.78E+01 6.91E+00 G

Eu-155    I    1.5556E-01                                                  1.74E+03
                                 86.54 0.000E+00 &(P 5.557E-01 1.00E+03 3.07E+01 G K
                                105.31 3.808E-01  (P 4.344E-01 4.78E+01 2.12E+01 G

Ir-192    F    1.2692E-01                                                  7.38E+01
                                316.51 0.000E+00 %(  4.501E-01 1.00E+03 8.28E+01 G
                                468.07 3.467E-01 &(P 2.639E-01 3.56E+01 4.78E+01 G
                                308.46-2.016E-02 %   1.112E+00 2.18E+03 3.00E+01 G
                                295.96 0.000E+00 % P 1.187E+00 1.00E+03 2.87E+01 G

Tl-208    N    1.0479E+00                                                  6.98E+02
                                583.19 1.024E+00  (P 9.488E-02 1.03E+01 8.45E+01 G K
                                860.56 1.210E+00 ?(P 1.242E+00 4.86E+01 1.24E+01 G
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     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:40:39 AM    Page  9
 Pace Analytical                    Spectrum name: 30204854013.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                          277.36 0.000E+00 % P 2.847E+00 1.00E+03 6.31E+00 G

Pb-210    N   4.6196E+00                                   8.14E+03
                           46.54 4.620E+00  (P 5.151E+00 4.58E+01 4.25E+00 G K

Bi-212    N   3.9225E+00                                   6.98E+02
                          727.33 3.701E+00 ?(P 1.159E+00 2.12E+01 6.58E+00 G K
                         1620.50 4.901E+00 ?(  9.031E+00 5.00E+01 1.49E+00 G

Pb-212    N   2.5443E+00                                   6.98E+02
                          238.63 2.544E+00  (P 2.895E-01 7.10E+00 4.33E+01 G K
                           77.11 3.208E+00 + P 1.021E+00 1.23E+01 1.75E+01 GA
                           74.81 2.526E+00 } P 1.980E+00 2.07E+01 1.04E+01 GA
                           87.30 1.399E+00 -   2.211E+00 6.52E+01 7.80E+00 GA

Ra-223    N   9.0912E-01                                   7.96E+03
                          269.46 9.091E-01  (  8.051E-01 3.94E+01 1.37E+01 G K
                           83.78 0.000E+00 &   6.193E-01 1.00E+03 2.49E+01 G
                          323.87 6.971E-01 % P 2.613E+00 1.46E+02 3.93E+00 G
                          154.21 0.000E+00 % P 2.236E+00 1.00E+03 5.62E+00 G
                           94.90 0.000E+00 % P 1.432E+00 1.00E+03 1.13E+01 G
                           81.07 0.000E+00 % P 1.077E+00 1.00E+03 1.50E+01 G

Ra-226    N   1.5439E+00                                   5.84E+05
                          609.31 1.668E+00  (P 2.741E-01 1.17E+01 4.48E+01 G K
                         1764.49 1.339E+00 &(P 1.774E+00 6.37E+01 1.54E+01 G
                          295.22 1.578E+00  (P 3.559E-01 1.45E+01 1.92E+01 G
                         1120.29 1.523E+00 ?(P 1.519E+00 4.91E+01 1.48E+01 G
                          351.99 1.469E+00  (P 3.045E-01 1.23E+01 3.71E+01 G
                          241.92 1.120E+00 - P 1.800E+00 5.00E+01 7.47E+00 G

Ac-228    N   2.6889E+00                                   2.10E+03
                          911.21 2.852E+00  (P 4.202E-01 1.27E+01 2.66E+01 G K
                          968.97 2.543E+00  (P 9.083E-01 2.08E+01 1.62E+01 G
                          338.32 2.515E+00  (P 1.027E+00 2.09E+01 1.13E+01 G

Th-230    N  -2.9458E+00                                   2.75E+07
                           67.67-2.946E+00 %(  4.485E+01 6.04E+02 3.80E-01 G K

Th-232    N   4.8740E+01                                   4.17E+12
                           63.81 4.874E+01  (  6.284E+01 5.26E+01 2.67E-01 G K

Th-234    N   1.7311E+00                                   1.53E+12
                           63.29 1.731E+00  (P 3.799E+00 8.67E+01 4.80E+00 G K
                           92.60 0.000E+00 % P 6.583E+00 1.00E+03 2.80E+00 G
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     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:40:39 AM    Page 10
 Pace Analytical                    Spectrum name: 30204854013.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Am-241    T   2.2929E-02                                   1.58E+05
                           59.54 2.293E-02 %(  4.937E-01 8.13E+02 3.63E+01 G K

Am-243    T   2.3903E-02                                   2.69E+06
                                                          Derived Ave Activity
                           74.66 2.390E-02 }(P 4.448E-01 5.49E+02 6.82E+01 G K
```

(- 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 2 Sigma %	Activity	
Th-234	63.43	88.	21.	0.023	173.30	1.731E+00	P
Th-232	63.51	75.	33.	0.037	105.15	4.874E+01	
Eu-155	105.44	32.	25.	0.028	95.54	3.808E-01	P
Eu-152	121.61	40.	18.	0.020	146.00	1.943E-01	P
Co-57	121.74	34.	20.	0.022	122.61	9.068E-02	
Eu-154	247.99	22.	12.	0.013	175.70	7.202E-01	P
Ra-223	269.72	22.	28.	0.031	78.78	9.091E-01	
Cr-51	319.55	10.	16.	0.018	94.79	8.815E+00	P

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Pace Analytical Spectrum name: 30204854013.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Sb-125	427.66	7.	17.	0.019	81.93	3.891E-01	
Sb-125	462.77	7.	24.	0.027	62.08	1.646E+00	
Ir-192	467.83	1.	10.	0.011	71.18	3.467E-01	P
Ru-103	496.96	8.	7.	0.008	181.65	2.987E-01	P
I-132	522.79	8.	11.	0.012	129.79	0.000E+00	P
I-133	529.27	12.	9.	0.010	183.02	0.000E+00	P
Ba-140	537.21	12.	10.	0.011	169.84	5.387E+01	
Sb-124	602.68	8.	9.	0.010	145.95	2.364E-01	
Ag-108M	614.27	8.	14.	0.016	100.03	1.330E-01	
Nb-94	702.55	4.	21.	0.023	62.48	1.953E-01	
Ag-110M	744.65	4.	11.	0.012	107.65	2.831E+00	P
Co-60	1172.68	7.	7.	0.008	169.38	1.008E-01	P

Cs-136	1235.25	5.	10.	0.011	135.84	1.016E+02	P
Eu-154	1273.47	5.	9.	0.010	144.44	3.592E-01	
Na-22	1273.47	5.	9.	0.010	144.44	1.321E-01	
Co-60	1332.55	3.	7.	0.008	104.61	1.039E-01	P
La-140	1594.89	0.	3.	0.003	115.47	9.461E+00	
Sb-124	1690.70	0.	2.	0.002	193.85	1.792E-01	P
Y-88	1838.45	0.	3.	0.003	132.33	9.516E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-1.3400E-01	-4.6503E-01	3.7492E+00	3.7497E+00	4.684E+00
Na-22	#A	1.2317E-01	1.3209E-01	1.9079E-01	1.9157E-01	1.989E-01
K-40	#	2.9895E+01	2.9895E+01	4.2214E+00	5.7787E+00	1.646E+00
Sc-46	#B	0.0000E+00	0.0000E+00	1.7928E-01	1.7928E-01	4.805E-01
Cr-51	#A	8.0075E-01	8.8152E-00	8.3560E-00	8.4376E+00	9.660E+00
Mn-54	#B	0.0000E+00	0.0000E+00	2.5665E-02	2.5665E-02	2.789E-01
Co-56	#B	-9.6443E-02	-2.2788E-01	1.1226E+00	1.1229E+00	1.187E+00
Co-57	#A	7.1014E-02	9.0681E-02	1.1118E-01	1.1185E-01	1.355E-01
Co-58	#B	0.0000E+00	0.0000E+00	5.2213E-02	5.2214E-02	4.219E-01
Fe-59	#B	0.0000E+00	0.0000E+00	1.9790E-01	1.9791E-01	2.299E+00
Co-60	#A	9.8885E-02	1.0236E-01	1.0189E-01	1.0277E-01	1.610E-01
Zn-65	#B	0.0000E+00	0.0000E+00	9.3112E-02	9.3114E-02	7.804E-01
Y-88	#A	5.1034E-02	9.5155E-02	1.2592E-01	1.2664E-01	2.532E-01
Nb-94	#B	1.0988E-01	1.0988E-01	6.8654E-02	7.0174E-02	1.465E-01
Zr-95	#B	0.0000E+00	0.0000E+00	1.0033E-01	1.0034E-01	6.278E-01
Nb-95	#B	0.0000E+00	0.0000E+00	1.8481E-01	1.8481E-01	1.438E+00
Ru-103	#A	5.4981E-02	2.9868E-01	5.4256E-01	5.4399E-01	6.738E-01
Ag-108M	#B	4.6223E-02	4.6243E-02	4.6255E-02	4.6660E-02	2.475E-01
Ru-106	#B	5.6035E-01	6.6975E-01	1.6231E+00	1.6255E+00	1.933E+00
Cd-109	#B	1.4441E+00	1.6665E+00	4.5319E+00	4.5379E+00	5.582E+00
Ag-110M	#F	1.3715E-01	1.7895E-01	1.9264E-01	1.9410E-01	1.488E-01

Sn-113	#B	-3.2385E-02	-5.7685E-02	3.5156E-01	3.5163E-01	4.248E-01
Sb-124	#A	7.2216E-02	2.1776E-01	2.6420E-01	2.6576E-01	3.954E-01
Sb-125	#	6.7249E-01	7.1831E-01	3.6919E-01	3.8113E-01	3.442E-01
Te-129	#B	0.0000E+00	0.0000E+00	1.7785E+00	1.7785E+00	1.911E+01
Te-129M	#B	1.3984E+00	1.0103E+01	3.0535E+01	3.0564E+01	3.960E+01
I-131	#B	-3.4262E-03	-1.3578E+01	4.8350E+02	4.8350E+02	6.030E+02
I-132	#B	1.0051E-01	>12 Halflives	1.3046E-01	1.3113E-01	2.831E-01
Te-132	#B	0.0000E+00	>12 Halflives	2.8317E-02	2.8318E-02	1.794E-01
I-133	#A	7.6244E-02	>12 Halflives	1.3954E-01	1.3990E-01	1.624E-01
Ba-133	#B	-2.9528E-03	-3.0043E-03	1.8549E-01	1.8549E-01	2.358E-01
Cs-134	#B	-2.6711E-02	-2.9378E-02	1.8037E-01	1.8041E-01	2.129E-01
Cs-136	#B	1.4358E-01	2.2378E+01	3.0399E+01	3.0543E+01	2.662E+01
Cs-137	#B	3.9149E-02	3.9387E-02	1.3479E-01	1.3489E-01	1.670E-01
Ce-139	#B	0.0000E+00	0.0000E+00	8.6333E-02	8.6335E-02	2.459E-01
Ba-140	#A	2.9382E-01	5.3865E+01	9.1485E+01	9.1761E+01	1.050E+02
La-140	#A	5.1609E-02	9.4613E+00	1.0925E+01	1.0999E+01	2.324E+01
Ce-141	#B	0.0000E+00	0.0000E+00	4.2579E-01	4.2580E-01	2.256E+00
Ce-144	#B	9.2279E-03	1.1652E-02	1.0312E+00	1.0312E+00	1.321E+00
Eu-152	#A	1.9173E-01	1.9432E-01	2.8371E-01	2.8491E-01	3.494E-01
Eu-154	#B	2.0824E-01	2.1269E-01	3.0720E-01	3.0852E-01	3.231E-01
Eu-155	#B	1.4973E-01	1.5556E-01	1.4861E-01	1.5022E-01	5.557E-01
Ir-192	#A	5.1605E-02	1.2692E-01	9.0343E-02	9.1904E-02	4.501E-01

Hg-203 #B	0.0000E+00	0.0000E+00	2.3734E-01	2.3734E-01	8.144E-01
Tl-208	9.5273E-01	1.0479E+00	2.1587E-01	2.5655E-01	9.488E-02
Pb-210 #A	4.5820E+00	4.6196E+00	4.2322E+00	4.2820E+00	5.151E+00
Bi-212 #	3.5661E+00	3.9225E+00	1.6609E+00	1.7404E+00	1.159E+00
Pb-212	2.3132E+00	2.5443E+00	3.6110E-01	4.9748E-01	2.895E-01
Ra-223 #	9.0157E-01	9.0912E-01	7.1619E-01	7.2647E-01	8.051E-01
Ra-224 #B	0.0000E+00	0.0000E+00	1.6323E+00	1.6323E+00	3.902E+00
Ra-226	1.5437E+00	1.5439E+00	3.6217E-01	4.1587E-01	2.741E-01
Ac-227 #B	0.0000E+00	0.0000E+00	2.2904E-01	2.2904E-01	1.089E+00
Ac-228	2.6052E+00	2.6889E+00	5.7581E-01	6.7639E-01	4.202E-01
Th-228 #B	0.0000E+00	0.0000E+00	5.6484E+00	5.6485E+00	1.367E+01
Pa-231 #B	0.0000E+00	0.0000E+00	1.1531E+00	1.1532E+00	7.953E+00
Pa-234M#A	0.0000E+00	0.0000E+00	1.2576E+01	1.2577E+01	3.547E+01
Th-230 #B	-2.9458E+00	-2.9458E+00	3.5613E+01	3.5615E+01	4.485E+01
Th-232 #A	4.8740E+01	4.8740E+01	5.1249E+01	5.1691E+01	6.284E+01
Th-234 #A	1.7311E+00	1.7311E+00	3.0001E+00	3.0096E+00	3.799E+00
U-235 #B	0.0000E+00	0.0000E+00	9.7417E-01	9.7419E-01	2.583E+00
U-238 #B	0.0000E+00	0.0000E+00	1.2532E+01	1.2532E+01	3.534E+01
Am-241 #B	2.2919E-02	2.2929E-02	3.7290E-01	3.7292E-01	4.937E-01
Am-243 #A	2.3903E-02	2.3903E-02	2.6245E-01	2.6247E-01	4.448E-01

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.

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Pace Analytical Spectrum name: 30204854013.Anl

< - 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 (30.1 to 2035.5 keV) 4.546E+01 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 4.6262386E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854014	**Collection Date**	11/18/2016 11:15
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/22/17 8:13
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	3.698	1.596	1.237
Cesium-137	0.000	0.029	0.170
Lead-212	2.103	0.408	0.276
Potassium-40	26.288	4.629	1.439
Protactinium-234M	11.843	6.775	6.033
Radium-226	1.522	0.310	0.227
Radium-228	2.135	0.486	0.347
Thallium-208	0.753	0.210	0.147
Thorium-228	7.101	8.728	14.600
Thorium-234	0.662	4.624	5.826
Uranium-235	0.000	0.608	2.457

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Pace Analytical Spectrum name: 30204854014.Anl

Sample description
WL 33843

Spectrum filename: C:\user\30204854014.Anl

Acquisition information
Start time: 2/22/2017 8:13:27 AM
Live time: 900
Real time: 905
Dead time: 0.51 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.1968E+02
Activity scaling factor: 1.0000E+05/(1.0000E+00* 2.1968E+02) =
4.5521E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/22/17

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:41:52 AM Page 2
Pace Analytical Spectrum name: 30204854014.Anl

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 11:15:00 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1529

***** 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. pCi/G	Nuc
66.55	15.	55.06	0.36	2.466E-02				
74.96	47.	27.48	1.08	3.198E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	PBC<MDA	Pb212
77.26	99.	17.16	1.09	3.378E-02	77.11	17.500	2.522E+00	Pb212
105.30	22.	73.26	1.12	4.792E-02	105.31	21.200	PBC<MDA	Eu155
132.92	24.	70.08	1.15	5.225E-02	133.51	11.090	PBC<MDA	Ce144
					133.51	11.090	PBC<MDA	Ce144
166.36	23.	61.06	1.18	5.197E-02	165.85	79.886	PBC<MDA	Ce139
					166.41	0.108	6.146E+01	Th228
					165.85	79.886	1.218E-01	Ce139
					166.41	0.108	6.146E+01	Th228
176.14	18.	91.78	1.19	5.139E-02	176.31	6.820	PBC<MDA	Sb125
					176.60	10.000	PBC<MDA	Cs136
					176.31	6.820	PBC<MDA	Sb125
					176.60	10.000	PBC<MDA	Cs136
236.24	22.	63.57	1.26	4.664E-02	235.97	12.300	PBC<MDA	Ac227
					235.97	12.300	PBC<MDA	Ac227
238.46	276.	9.17	0.94	4.644E-02	238.63	43.300	2.028E+00	Pb212
241.86	47.	25.94	1.26	4.615E-02	241.92	7.470	1.862E+00	Ra226
					241.00	3.900	3.916E+00	Ra224
248.10	16.	69.01	1.27	4.566E-02	247.93	6.910	PBC<MDA	Eu154
					247.93	6.910	PBC<MDA	Eu154
270.21	17.	94.45	1.29	4.396E-02	269.46	13.700	PBC<MDA	Ra223
					269.46	13.700	PBC<MDA	Ra223
283.56	20.	57.05	1.31	4.289E-02	283.70	1.600	PBC<MDA	Pa231
					284.30	6.140	PBC<MDA	I131
					284.30	6.140	PBC<MDA	I131

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Pace Analytical Spectrum name: 30204854014.Anl

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					283.70	1.600	PBC<MDA	Pa231

295.20	96.	12.93	0.43	4.207E-02	295.22	19.200	1.621E+00	Ra226
					295.96	28.670	2.674E+00	Ir192
295.34	19.	72.51	1.32	4.201E-02	295.22	19.200	PBC<MDA	Ra226
					295.96	28.670	PBC<MDA	Ir192
					295.96	28.670	PBC<MDA	Ir192
300.01	24.	39.17	0.51	4.173E-02	300.00	2.300	PBC<MDA	Ac227
					300.00	2.300	3.241E+00	Ac227
328.04	15.	87.56	1.35	3.985E-02	328.76	20.300	PBC<MDA	La140
					328.76	20.300	4.651E+01	La140
					329.85	2.700	1.925E+00	Ac227
					330.00	1.300	3.966E+00	Pa231
338.02	78.	16.40	0.94	3.926E-02	338.32	11.300	2.478E+00	Ac228
340.51	28.	28.54	1.37	3.913E-02	340.55	42.200	3.659E+01	Cs136
					340.55	42.200	3.659E+01	Cs136
351.76	155.	11.71	1.33	3.846E-02	351.99	37.100	1.489E+00	Ra226
462.87	25.	59.78	1.49	3.323E-02	463.36	10.500	PBC<MDA	Sb125
					463.36	10.500	PBC<MDA	Sb125
487.19	19.	42.55	1.52	3.235E-02	487.02	45.500	3.171E+01	La140
					487.39	1.420	4.003E+01	Te129
					487.39	1.420	4.003E+01	Te129
					487.02	45.500	3.171E+01	La140
487.29	12.	80.45	1.52	3.234E-02	487.02	45.500	PBC<MDA	La140
					487.39	1.420	2.654E+01	Te129
529.79	13.	58.31	1.56	3.091E-02	529.87	87.000	HL>Cutoff	I133
					529.87	87.000	HL>Cutoff	I133
582.92	124.	12.11	0.37	2.934E-02	583.19	84.500	7.505E-01	Tl208
609.17	132.	11.02	1.28	2.865E-02	609.31	44.800	1.407E+00	Ra226
724.11	18.	25.16	1.75	2.605E-02	722.94	90.800	PBC<MDA	Ag108M
					723.30	20.110	PBC<MDA	Eu154
					724.20	44.170	6.080E-01	Zr95
					724.20	44.170	6.080E-01	Zr95
					722.94	90.800	1.047E-01	Ag108M
					722.79	10.760	2.663E+00	Sb124
					723.30	20.110	4.828E-01	Eu154
727.14	42.	20.57	0.49	2.599E-02	727.33	6.580	3.698E+00	Bi212
860.18	16.	64.16	1.88	2.365E-02	860.56	12.420	PBC<MDA	Tl208
875.44	10.	65.67	1.89	2.342E-02	875.33	4.510	HL>Cutoff	I133
					875.33	4.510	HL>Cutoff	I133
889.05	15.	60.37	1.90	2.321E-02	889.28	99.984	PBC<MDA	Sc46
					889.28	99.984	1.910E-01	Sc46
910.84	94.	12.21	1.02	2.289E-02	911.21	26.600	2.180E+00	Ac228
969.45	46.	18.91	1.14	2.208E-02	968.97	16.200	1.821E+00	Ac228
996.05	8.	78.26	2.00	2.173E-02	996.26	10.530	PBC<MDA	Eu154
					996.26	10.530	5.188E-01	Eu154
1001.13	16.	27.84	2.01	2.166E-02	1001.03	0.840	1.180E+01	U238
					1001.03	0.837	1.184E+01	Pa234M
					1001.03	0.837	1.184E+01	Pa234M

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Pace Analytical Spectrum name: 30204854014.Anl

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					1001.03	0.840	1.180E+01	U238
1001.13	16.	27.84	2.01	2.166E-02	1001.03	0.840	1.180E+01	U238
					1001.03	0.837	1.184E+01	Pa234M
1098.68	12.	58.77	2.09	2.048E-02	1099.25	56.500	PBC<MDA	Fe59
					1099.25	56.500	PBC<MDA	Fe59
1112.29	12.	79.59	2.10	2.034E-02	1112.12	13.550	PBC<MDA	Eu152
					1112.12	13.550	PBC<MDA	Eu152
1120.35	26.	44.42	2.11	2.024E-02	1120.29	14.800	1.201E+00	Ra226
1236.37	12.	93.96	2.21	1.904E-02	1235.36	20.000	PBC<MDA	Cs136
					1235.36	20.000	PBC<MDA	Cs136

1460.63	350.	5.85	2.83	1.704E-02	1461.00	10.670	2.629E+01	K40
1595.80	3.	57.74	2.50	1.600E-02	1596.21	95.400	PBC<MDA	La140
					1596.21	95.400	4.930E+00	La140
1693.18	7.	37.80	2.58	1.533E-02	1690.98	47.300	PBC<MDA	Sb124
					1690.98	47.300	3.980E-01	Sb124
1764.05	27.	20.31	2.63	1.484E-02	1764.49	15.360	1.647E+00	Ra226
1837.04	5.	44.72	2.69	1.439E-02	1836.06	99.200	PBC<MDA	Y88

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

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 2 Sigma %	FWHM keV	Suspected Nuclide	
265.08	66.55	23.	15.	5.948E+02	110.13	0.358	-	s
1198.77	300.01	18.	24.	5.631E+02	78.35	0.510	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-212	298.12	74.81	90.	47.	0.052	54.97	1.084D
Pb-212	307.32	77.11	95.	99.	0.110	34.31	1.086D
Eu-155	420.04	105.30	58.	22.	0.025	146.51	1.117
Ce-144	530.51	132.92	61.	24.	0.026	140.15	1.147s
Th-228	664.24	166.36	41.	23.	0.025	122.11	1.182s
Sb-125	703.35	176.14	58.	18.	0.019	183.56	1.193s
Ac-227	943.73	236.24	39.	22.	0.025	127.14	1.256s
Pb-212	953.29	238.63	54.	281.	0.312	14.05	1.259D

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Ra-226	966.44	241.92	50.	47.	0.052	51.88	1.263D
Eu-154	991.14	248.10	25.	16.	0.018	138.02	1.269s
Ra-223	1079.59	270.21	57.	17.	0.019	188.90	1.292s
Pa-231	1133.00	283.56	26.	20.	0.023	114.10	1.307s
Ra-226	1179.54	295.20	15.	96.	0.106	25.85	0.429s
Ir-192	1180.10	295.34	41.	19.	0.022	145.03	1.320s
La-140	1310.88	328.04	35.	15.	0.017	175.12	1.354s
Ac-228	1350.81	338.02	21.	78.	0.087	32.81	0.939s
Cs-136	1360.77	340.51	8.	28.	0.031	57.08	1.366s
Ra-226	1405.78	351.76	35.	155.	0.173	23.42	1.349
Sb-125	1850.18	462.87	38.	25.	0.028	119.56	1.492s
La-140	1947.44	487.19	8.	15.	0.021	85.10	1.515s
Te-129	1947.88	487.29	17.	12.	0.014	160.90	1.516s
I-133	2117.85	529.79	9.	13.	0.014	116.62	1.558s
Tl-208	2330.39	582.92	21.	124.	0.137	24.23	0.369s
Ra-226	2435.41	609.17	16.	132.	0.147	22.03	1.284s
Zr-95	2895.21	724.11	1.	18.	0.020	50.32	1.748s
Bi-212	2907.33	727.14	6.	42.	0.047	41.15	0.487s
Tl-208	3439.58	860.18	16.	16.	0.018	128.33	1.877s

I-133	3500.64	875.44	5.	10.	0.011	131.33	1.891s
Sc-46	3555.12	889.05	10.	15.	0.016	120.73	1.903s
Ac-228	3642.29	910.84	7.	94.	0.105	24.41	1.018s
Ac-228	3876.78	969.45	7.	46.	0.051	37.83	1.143s
Eu-154	3983.21	996.05	6.	8.	0.009	156.52	2.001s
U-238	4003.14	1001.03	1.	16.	0.017	55.68	2.005D
Pa-234M	4003.14	1001.03	1.	16.	0.017	55.68	2.005D
Fe-59	4393.88	1098.68	6.	12.	0.013	117.55	2.093s
Eu-152	4448.34	1112.29	11.	12.	0.013	159.18	2.104s
Ra-226	4480.57	1120.35	18.	26.	0.029	88.85	2.111s
Cs-136	4944.87	1236.37	18.	12.	0.014	187.92	2.210s
K-40	5842.33	1460.63	12.	350.	0.388	11.70	2.830s
La-140	6383.33	1595.80	0.	3.	0.003	115.47	2.505s
Sb-124	6773.14	1693.18	0.	7.	0.008	75.59	2.578s
Ra-226	7056.83	1764.05	2.	27.	0.031	40.62	2.633s
Y-88	7349.00	1837.04	0.	5.	0.006	89.44	2.685s

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 pCi/G	Peak Energy keV	Activity pCi/G	Code	MDA Value pCi/G	COMMENTS
Be-7	C	-2.8181E-01					5.34E+01
			477.56	-2.818E-01	%(	3.665E+00	5.73E+02 1.03E+01 G K

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Pace Analytical Spectrum name: 30204854014.An1

Nuclide	Ave activity		Energy	Activity	Code	Peak	MDA	Comments
K-40	N	2.6288E+01						4.68E+11
			1461.00	2.629E+01	*(P	1.439E+00	5.85E+00	1.07E+01 G K
Sc-46	F	1.9096E-01						8.38E+01
			889.28	1.910E-01	?(	2.303E-01	6.04E+01	1.00E+02 G K
Cr-51	F	-1.2941E+00						2.77E+01
			320.08	-1.294E+00	%(	1.349E+01	4.42E+02	1.01E+01 G K
Mn-54	C	-5.3899E-02						3.12E+02
			834.85	-5.390E-02	%(	2.228E-01	1.99E+02	1.00E+02 G K
Co-56	C	9.5082E-02						7.73E+01
			1238.28	9.508E-02	%(P	7.817E-01	4.23E+02	6.61E+01 G K
			1771.35	0.000E+00	%	3.358E+00	1.00E+03	1.55E+01 G
Co-57	C	2.1082E-02						2.72E+02
			122.06	2.108E-02	%(P	1.588E-01	3.11E+02	8.56E+01 G K
			136.47	0.000E+00	& P	1.504E+00	1.00E+03	1.07E+01 G
Co-58	C	-4.7873E-03						7.08E+01
			810.78	-4.787E-03	%(	3.332E-01	3.19E+03	9.94E+01 G K
Fe-59	F	6.2941E-01						4.45E+01
			1099.25	6.294E-01	?(P	7.445E-01	5.88E+01	5.65E+01 G K
			1291.60	0.000E+00	% P	1.456E+00	1.00E+03	4.32E+01 G

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Y-88      C   8.9304E-02                                          1.07E+02
                          1836.06 8.930E-02 ?(  1.316E-01 4.47E+01 9.92E+01 G K
                           898.04 1.013E-01 % P 2.544E-01 1.20E+02 9.37E+01 G

Zr-95     I   2.4151E-01                                          6.40E+01
                           756.73-5.575E-02 %(  7.751E-01 6.54E+02 5.45E+01 G K
                           724.20 6.080E-01 &(P 2.472E-01 2.52E+01 4.42E+01 G

Ru-106    I   5.5181E-01                                          3.73E+02
                           621.93 5.518E-01 &(  1.441E+00 1.22E+02 9.93E+00 G K

Cd-109    F  -7.1276E-02                                          4.64E+02
                            88.03-7.128E-02 %(  5.459E+00 3.05E+03 3.61E+00 G K

Sb-124    F   1.6424E-01                                          6.02E+01
                           602.73 5.120E-02 %(  4.222E-01 3.80E+02 9.78E+01 G K
                           645.85 5.033E-01 %   4.996E+00 4.49E+02 7.38E+00 G
                           722.79 0.000E+00 &   4.655E+00 1.00E+03 1.08E+01 G
                          1690.98 3.980E-01 ?(  4.190E-01 3.78E+01 4.73E+01 G
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Pace Analytical Spectrum name: 30204854014.An1

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Sb-125    I   3.4202E-01                                          1.01E+03
                           427.88 4.741E-03 %(  4.056E-01 3.66E+03 2.96E+01 G K
                           176.31 7.307E-01 ?(P 1.597E+00 9.18E+01 6.82E+00 G
                           463.36 1.040E+00 ?(P 1.318E+00 5.98E+01 1.05E+01 G
                           600.60 2.382E-01 % P 8.727E-01 1.72E+02 1.79E+01 G
                           635.95 1.086E-01 % P 1.171E+00 4.83E+02 1.13E+01 G

Te-129    I   4.1316E+00                                          3.36E+01
                           459.60 0.000E+00 %(  1.567E+01 1.00E+03 7.70E+00 G K
                           487.39 2.654E+01 ?(  4.676E+01 8.04E+01 1.42E+00 G

I-131     I   9.7870E+00                                          8.02E+00
                           364.49 9.787E+00 %(P 6.295E+02 2.80E+03 8.17E+01 G K
                           636.99 0.000E+00 % P 8.315E+03 1.00E+03 7.17E+00 G
                           284.30 2.551E+03 % P 5.963E+03 1.01E+02 6.14E+00 G

Te-132    I   2.9446E-02                                          3.20E+00
                           228.16 2.945E-02 %(P 1.245E-01 1.81E+02 8.80E+01 G K

I-133     I   1.2563E-01                                          8.67E-01
                           529.87 6.617E-02 &(P 8.478E-02 5.83E+01 8.70E+01 G K
                           875.33 1.273E+00 ?(  1.722E+00 6.57E+01 4.51E+00 G

Cs-136    F   1.9929E+01                                          1.32E+01
                           818.51 3.093E+00 %(P 2.046E+01 3.08E+02 9.97E+01 G K
                           176.60 2.364E+01 % P 1.746E+02 3.04E+02 1.00E+01 G
                           273.65 0.000E+00 %   1.878E+02 1.00E+03 1.11E+01 G
                           340.55 3.659E+01 ?(  2.016E+01 2.85E+01 4.22E+01 G
                          1048.07 0.000E+00 % P 2.738E+01 1.00E+03 8.00E+01 G
                          1235.36 6.871E+01 ?(P 1.250E+02 9.40E+01 2.00E+01 G

Ce-139    F   3.5556E-02                                          1.38E+02
                           165.85 3.556E-02 %(  2.122E-01 2.47E+02 7.99E+01 G K

Ba-140    I   3.6848E+00                                          1.28E+01
                           537.26 3.685E+00 %(P 8.051E+01 9.53E+02 2.44E+01 G K
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                                162.66 9.755E+01 & P 2.963E+02 1.26E+02 6.22E+00 G

La-140    I    1.7724E+01                                                1.28E+01
                               1596.21 4.930E+00 ?(  1.211E+01 5.77E+01 9.54E+01 G K
                                487.02 3.171E+01 ?(P 2.762E+01 4.26E+01 4.55E+01 G
                                815.77 2.873E+01 %   9.041E+01 1.47E+02 2.33E+01 G
                                328.76 4.651E+01 ?(  9.389E+01 8.76E+01 2.03E+01 G

Ce-141    T    5.5598E-01                                                3.25E+01
                                145.44 5.560E-01 &(  1.735E+00 1.31E+02 4.82E+01 G K
E
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ce-144    I    7.0843E-01                                                2.85E+02
                                133.51 7.084E-01 &(P 1.167E+00 7.01E+01 1.11E+01 G K

Eu-152    F    1.9928E-01                                                4.95E+03
                                121.78 1.710E-02 %(P 3.923E-01 9.38E+02 2.84E+01 G K
                               1408.01 6.256E-02 % P 7.253E-01 5.78E+02 2.09E+01 G
                               1112.12 5.811E-01 ?(P 9.289E-01 7.96E+01 1.36E+01 G
                               1085.91 2.065E-02 % P 1.472E+00 3.42E+03 9.92E+00 G
                                964.13 5.307E-01 %   1.151E+00 1.08E+02 1.43E+01 G
                                344.28 0.000E+00 % P 4.939E-01 1.00E+03 2.66E+01 G
                                244.70-4.028E-02 %   1.102E+00 1.13E+03 7.49E+00 G

Eu-154    I    1.8054E-01                                                3.14E+03
                                123.07 0.000E+00 %(P 3.018E-01 1.00E+03 4.06E+01 G K
                               1274.44 0.000E+00 %   5.943E-01 1.00E+03 3.50E+01 G
                               1004.72 0.000E+00 % P 1.221E+00 1.00E+03 1.79E+01 G
                                996.26 5.188E-01 ?(  8.324E-01 7.83E+01 1.05E+01 G
                                873.19 1.789E-01 %   8.632E-01 2.24E+02 1.22E+01 G
                                723.30 0.000E+00 % P 6.887E-01 1.00E+03 2.01E+01 G
                                247.93 7.259E-01 ?(P 1.143E+00 6.90E+01 6.91E+00 G

Eu-155    I    1.4955E-01                                                1.74E+03
                                 86.54 3.928E-02 %(P 5.056E-01 5.09E+02 3.07E+01 G K
                                105.31 3.092E-01  (P 5.336E-01 7.33E+01 2.12E+01 G

Ir-192    F    1.9452E-01                                                7.38E+01
                                316.51 7.436E-02 %(P 3.163E-01 1.81E+02 8.28E+01 G
                                468.07 0.000E+00 & P 6.381E-01 1.00E+03 4.78E+01 G
                                308.46 0.000E+00 % P 9.010E-01 1.00E+03 3.00E+01 G
                                295.96 5.416E-01 ?(P 9.045E-01 7.25E+01 2.87E+01 G

Tl-208    N    7.6256E-01                                                6.98E+02
                                583.19 7.505E-01 @(P 1.467E-01 1.21E+01 8.45E+01 G K
                                860.56 8.446E-01 ?(  1.078E+00 6.42E+01 1.24E+01 G
                                277.36 0.000E+00 & P 2.278E+00 1.00E+03 6.31E+00 G

Bi-212    N    3.6981E+00                                                6.98E+02
                                727.33 3.698E+00  (P 1.237E+00 2.06E+01 6.58E+00 G K
                               1620.50 4.138E+00 % P 9.873E+00 1.21E+02 1.49E+00 G

Pb-212    N    2.1029E+00                                                6.98E+02
                                238.63 2.103E+00  (P 2.761E-01 7.02E+00 4.33E+01 G K
                                 77.11 2.522E+00   P 1.223E+00 1.72E+01 1.75E+01 GA
                                 74.81 2.103E+00 } P 2.121E+00 2.75E+01 1.04E+01 GA
                                 87.30 6.351E-01 &   2.243E+00 1.42E+02 7.80E+00 GA
P
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 Pace Analytical                  Spectrum name: 30204854014.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ra-223    N   3.9946E-01                                      7.96E+03
                          269.46 3.995E-01 ?(P 8.641E-01 9.44E+01 1.37E+01 G K
                           83.78 1.106E-01 %   6.987E-01 2.53E+02 2.49E+01 G
                          323.87 1.304E-01 % P 2.522E+00 8.05E+02 3.93E+00 G
                          154.21 0.000E+00 % P 2.006E+00 1.00E+03 5.62E+00 G
                           94.90 0.000E+00 % P 1.567E+00 1.00E+03 1.13E+01 G
                           81.07 2.928E-01 %   1.110E+00 1.52E+02 1.50E+01 G

Ra-224    N   4.4016E-01                                      6.98E+02
                          241.00 4.402E-01 &(P 2.449E+00 2.33E+02 3.90E+00 G K

Ra-226    N   1.5218E+00                                      5.84E+05
                          609.31 1.407E+00  (P 2.271E-01 1.10E+01 4.48E+01 G K
                         1764.49 1.647E+00 ?(P 5.090E-01 2.03E+01 1.54E+01 G
                          295.22 1.621E+00  (P 3.536E-01 1.29E+01 1.92E+01 G
                         1120.29 1.201E+00 - P 1.018E+00 4.44E+01 1.48E+01 G
                          351.99 1.489E+00  (P 2.886E-01 1.17E+01 3.71E+01 G
                          241.92 1.862E+00  (P 1.415E+00 2.59E+01 7.47E+00 G

Ac-227    N   5.3107E-01                                      7.95E+03
                          235.97 5.311E-01 ?(P 7.634E-01 6.36E+01 1.23E+01 G K
                          256.25-5.690E-01 %   1.825E+00 1.39E+02 7.00E+00 G
                                                            Energy duplication
                          300.00 1.303E+00 % P 5.118E+00 1.68E+02 2.30E+00 G
                          329.85-1.412E+00 %   5.095E+00 1.56E+02 2.70E+00 G

Ac-228    N   2.1346E+00                                      2.10E+03
                          911.21 2.180E+00 @(P 3.471E-01 1.22E+01 2.66E+01 G K
                          968.97 1.821E+00  (P 5.874E-01 1.89E+01 1.62E+01 G
                          338.32 2.478E+00 @(P 7.668E-01 1.64E+01 1.13E+01 G

Th-228    N   7.1010E+00                                      6.98E+02
                           84.37 2.488E+00 %(P 1.460E+01 2.34E+02 1.27E+00 G K
                          215.99-7.692E+00 %   5.048E+01 2.83E+02 2.63E-01 G
                          166.41 6.146E+01 *(  8.777E+01 6.11E+01 1.08E-01 G
                          131.61 2.057E+01 %   8.469E+01 1.71E+02 1.35E-01 G

Pa-231    N   4.0420E+00                                      1.20E+07
                          283.70 4.042E+00 ?(P 5.246E+00 5.71E+01 1.60E+00 G K
                          330.00-2.909E+00 %   1.050E+01 1.56E+02 1.30E+00 G

Pa-234M   N   1.1843E+01                                      1.63E+12
                                                            Energy duplication
                         1001.03 1.184E+01 ?(P 6.033E+00 2.78E+01 8.37E-01 G

Th-230    N  -5.8251E+00                                      2.75E+07
                           67.67-5.825E+00 %(  5.638E+01 3.82E+02 3.80E-01 G K
]

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 Pace Analytical                  Spectrum name: 30204854014.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Th-232    N   3.5417E+01                                      4.17E+12
                           63.81 3.542E+01 %(P 9.245E+01 1.05E+02 2.67E-01 G K
```

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Th-234    N   6.8183E-01                                          1.63E+12
                          63.29 6.818E-01 %(P 5.826E+00 3.39E+02 4.80E+00 G K
                          92.60 0.000E+00 % P 6.272E+00 1.00E+03 2.80E+00 G

U-238     N   1.1801E+01                                          1.63E+12
                                                                 Energy duplication
                        1001.03 1.180E+01 ?(P 6.011E+00 2.78E+01 8.40E-01 G K
                          92.59 0.000E+00 % P 3.143E+00 1.00E+03 5.60E+00 GA

Am-241    T  -8.2367E-02                                          1.58E+05
                          59.54-8.237E-02 %(  9.966E-01 4.81E+02 3.63E+01 G K

Am-243    T   3.3926E-02                                          2.69E+06
                                                                 Derived Ave Activity
                          74.66 3.393E-02 }(P 4.703E-01 4.08E+02 6.82E+01 G K
```

(- 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	

]

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:41:52 AM Page 11
Pace Analytical Spectrum name: 30204854014.An1

********** 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 2 Sigma %	Activity	
Ce-144	132.92	61.	24.	0.026	140.15	7.084E-01	P
Th-228	166.36	41.	23.	0.025	122.11	6.146E+01	
Sb-125	176.14	58.	18.	0.019	183.56	7.307E-01	P
Ac-227	236.24	39.	22.	0.025	127.14	5.311E-01	P
Eu-154	248.10	25.	16.	0.018	138.02	7.259E-01	P
Ra-223	270.21	57.	17.	0.019	188.90	3.995E-01	P

Pa-231	283.56	26.	20.	0.023	114.10	4.042E+00	P
Ir-192	295.34	41.	19.	0.022	145.03	5.416E-01	P
La-140	328.04	35.	15.	0.017	175.12	4.651E+01	
Cs-136	340.51	8.	28.	0.031	57.08	3.659E+01	
Sb-125	462.87	38.	25.	0.028	119.56	1.040E+00	P
La-140	487.19	8.	19.	0.021	85.10	3.171E+01	P
Te-129	487.29	17.	12.	0.014	160.90	2.654E+01	
I-133	529.79	9.	13.	0.014	116.62	0.000E+00	P
Zr-95	724.11	1.	18.	0.020	50.32	6.080E-01	P
I-133	875.44	5.	10.	0.011	131.33	0.000E+00	
Sc-46	889.05	10.	15.	0.016	120.73	1.910E-01	
Eu-154	996.05	6.	8.	0.009	156.52	5.188E-01	
U-238	1001.03	1.	16.	0.017	55.68	1.180E+01	P
Pa-234M	1001.03	1.	16.	0.017	55.68	1.184E+01	P
Fe-59	1098.68	6.	12.	0.013	117.55	6.294E-01	P
Eu-152	1112.29	11.	12.	0.013	159.18	5.811E-01	P
Cs-136	1236.37	18.	12.	0.014	187.92	6.871E+01	P
La-140	1595.80	0.	3.	0.003	115.47	4.930E+00	
Sb-124	1693.18	0.	7.	0.008	75.59	3.980E-01	
Y-88	1837.04	0.	5.	0.006	89.44	8.930E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-8.1187E-02	-2.8181E-01	3.2275E+00	3.2277E+00	3.665E+00
Na-22	#B	0.0000E+00	0.0000E+00	1.5718E-02	1.5719E-02	2.553E-01
K-40	#	2.6288E+01	2.6288E+01	3.0757E+00	4.6291E+00	1.439E+00
Sc-46	#A	8.6395E-02	1.9096E-01	2.3055E-01	2.3191E-01	2.303E-01
Cr-51	#B	-1.1750E-01	-1.2941E+00	1.1450E+01	1.1451E+01	1.349E+01
Mn-54	#B	-4.3568E-02	-5.3899E-02	2.1473E-01	2.1485E-01	2.228E-01
Co-56	#B	4.0234E-02	9.5082E-02	8.0358E-01	8.0367E-01	7.817E-01
Co-57	#B	1.6509E-02	2.1082E-02	1.3102E-01	1.3105E-01	1.588E-01
Co-58	#B	-1.8731E-03	-4.7873E-03	3.0549E-01	3.0549E-01	3.332E-01
Fe-59	#A	1.4138E-01	6.2941E-01	7.3986E-01	7.4441E-01	7.445E-01

Co-60	#B	0.0000E+00	0.0000E+00	5.8415E-02	5.8416E-02	2.176E-01
Zn-65	#B	0.0000E+00	0.0000E+00	4.9417E-02	4.9418E-02	5.912E-01
Y-88	#A	4.7891E-02	8.9304E-02	7.9876E-02	8.0872E-02	1.316E-01
Nb-94	#B	0.0000E+00	0.0000E+00	1.6479E-02	1.6480E-02	1.566E-01
Zr-95	#B	8.5532E-02	2.4151E-01	1.2154E-01	1.2566E-01	7.751E-01
Nb-95	#B	0.0000E+00	0.0000E+00	7.2496E-02	7.2498E-02	1.395E+00
Ru-103	#B	0.0000E+00	0.0000E+00	7.2164E-02	7.2165E-02	7.170E-01
Ag-108M	#B	0.0000E+00	0.0000E+00	4.3220E-02	4.3220E-02	1.832E-01
Ru-106	#B	4.6166E-01	5.5181E-01	1.3410E+00	1.3430E+00	1.441E+00
Cd-109	#B	-6.1762E-02	-7.1276E-02	4.3476E+00	4.3476E+00	5.459E+00
Ag-110M	#B	0.0000E+00	0.0000E+00	2.7628E-02	2.7628E-02	1.903E-01
Sn-113	#B	0.0000E+00	0.0000E+00	6.6189E-02	6.6191E-02	3.481E-01
Sb-124	#B	5.4457E-02	1.6424E-01	1.2415E-01	1.2603E-01	4.222E-01
Sb-125	#B	3.2020E-01	3.4202E-01	4.0892E-01	4.1138E-01	4.056E-01
Te-129	#B	5.7169E-01	4.1316E+00	6.6475E+00	6.6696E+00	1.567E+01
Te-129M	#B	0.0000E+00	0.0000E+00	1.3085E+01	1.3085E+01	4.064E+01
I-131	#B	2.4662E-03	9.7870E+00	5.4894E+02	5.4894E+02	6.295E+02
I-132	#B	0.0000E+00	>12 Halflives	3.5247E-02	3.5247E-02	2.418E-01
Te-132	#B	2.9446E-02	>12 Halflives	1.0680E-01	1.0687E-01	1.245E-01
I-133	#	1.2563E-01	>12 Halflives	1.1033E-01	1.1156E-01	8.478E-02

Ba-133	#B	0.0000E+00	0.0000E+00	3.3163E-02	3.3164E-02	2.124E-01
Cs-134	#B	0.0000E+00	0.0000E+00	2.6051E-02	2.6051E-02	1.983E-01
Cs-136	#B	1.2777E-01	1.9929E+01	1.1376E+01	1.1676E+01	2.046E+01
Cs-137	#B	0.0000E+00	0.0000E+00	2.8912E-02	2.8913E-02	1.703E-01
Ce-139	#B	2.1940E-02	3.5556E-02	1.7546E-01	1.7552E-01	2.122E-01
Ba-140	#B	2.0082E-02	3.6848E+00	7.0244E+01	7.0245E+01	8.051E+01
La-140	#	9.6599E-02	1.7724E+01	1.3374E+01	1.3583E+01	1.211E+01
Ce-141	#B	7.1950E-02	5.5598E-01	1.4531E+00	1.4550E+00	1.735E+00
Ce-144	#A	5.6104E-01	7.0843E-01	9.9288E-01	9.9733E-01	1.167E+00
Eu-152	#B	1.9662E-01	1.9928E-01	3.1722E-01	3.1833E-01	3.923E-01
Eu-154	#B	1.7676E-01	1.8054E-01	2.4919E-01	2.5035E-01	3.018E-01
Eu-155	B	1.4394E-01	1.4955E-01	2.1911E-01	2.2011E-01	5.056E-01
Ir-192	#A	7.9077E-02	1.9452E-01	2.8210E-01	2.8328E-01	3.163E-01
Hg-203	#B	0.0000E+00	0.0000E+00	2.7793E-01	2.7794E-01	5.115E-01
Tl-208	#	6.9327E-01	7.6256E-01	1.8475E-01	2.1035E-01	1.467E-01
Pb-210	#B	0.0000E+00	0.0000E+00	9.8851E+00	9.8853E+00	3.577E+01
Bi-212		3.3621E+00	3.6981E+00	1.5216E+00	1.5982E+00	1.237E+00
Pb-212		1.9118E+00	2.1029E+00	2.9542E-01	4.0841E-01	2.761E-01
Ra-223	#A	3.9614E-01	3.9946E-01	7.5458E-01	7.5646E-01	8.641E-01
Ra-224	#B	4.0016E-01	4.4016E-01	2.0477E+00	2.0486E+00	2.449E+00
Ra-226		1.5216E+00	1.5218E+00	2.3662E-01	3.1038E-01	2.271E-01
Ac-227	#A	5.2665E-01	5.3107E-01	6.7519E-01	6.7894E-01	7.634E-01
Ac-228		2.0682E+00	2.1348E+00	3.9639E-01	4.8583E-01	3.471E-01
Th-228	#B	6.4558E+00	7.1010E+00	8.6713E+00	8.7283E+00	1.460E+01
Pa-231	#A	4.0420E+00	4.0420E+00	4.6120E+00	4.6434E+00	5.246E+00
Pa-234M	#	1.1843E+01	1.1843E+01	6.5944E+00	6.7747E+00	6.033E+00
Th-230	#B	-5.8251E+00	-5.8251E+00	4.4559E+01	4.4567E+01	5.638E+01
Th-232	#B	3.5417E+01	3.5417E+01	7.4705E+01	7.4864E+01	9.245E+01
Th-234	#B	6.8183E-01	6.8183E-01	4.6230E+00	4.6240E+00	5.826E-00

U-235	#B	0.0000E+00	0.0000E+00	6.0749E-01	6.0750E-01	2.457E+00
U-238	#	1.1801E+01	1.1801E+01	6.5708E+00	6.7505E+00	6.011E+00
Am-241	#B	-8.2332E-02	-8.2367E-02	7.9301E-01	7.9310E-01	9.966E-01
Am-243	A	3.3925E-02	3.3926E-02	2.7664E-01	2.7668E-01	4.703E-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 (30.3 to 2035.6 keV) 3.585E+01 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 3.6508316E+01 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854015	**Collection Date**	11/18/2016 12:30
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/22/17 8:14
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	133.840	20.082	9.870
Cesium-137	0.037	0.689	0.728
Lead-212	125.400	16.994	1.611
Potassium-40	8.952	6.183	5.587
Protactinium-234M	17.053	58.277	59.940
Radium-226	20.387	2.950	1.312
Radium-228	121.200	16.267	2.033
Thallium-208	44.850	6.096	0.830
Thorium-228	169.250	37.384	45.130
Thorium-234	13.509	8.427	13.390
Uranium-235	0.000	6.356	10.420

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:43:00 AM Page 1
Pace Analytical Spectrum name: 30204854015.An1

Sample description
WL 33843

Spectrum Filename: C:\user\30204854015.An1

Acquisition information
Start time: 2/22/2017 8:14:20 AM
Live time: 900
Real time: 917
Dead time: 1.83 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 3.1175E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 3.1175E+02) =
3.2077E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/22/17

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:43:00 AM Page 2
Pace Analytical Spectrum name: 30204854015.Anl

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 12:30:00 PM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(8OZ).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1083

***** 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. pCi/G	Nuc
46.51	206.	36.09	0.41	2.156E-02	46.54	4.250	2.178E+01	Pb210
63.45	426.	25.67	0.86	3.676E-02	63.29	4.800	2.302E+01	Th234
					63.81	0.267	4.162E+02	Th232
74.82	4844.	2.36	0.98	4.124E-02	74.66	68.200	1.661E+01	Am243
					74.81	10.400	1.196E+02	Pb212
77.15	7776.	1.57	0.98	4.197E-02	77.11	17.500	1.122E+02	Pb212
80.91	1147.	5.48	0.99	4.308E-02	81.00	34.100	7.656E+00	Ba133
					81.07	15.000	1.724E+01	Ra223
84.24	959.	8.22	0.99	4.387E-02	83.78	24.900	8.547E+00	Ra223
					84.37	1.266	1.821E+02	Th228
87.22	2773.	3.34	0.99	4.454E-02	86.54	30.700	2.033E+01	Eu155
					87.30	7.800	8.452E+01	Pb212
					88.03	3.610	1.910E+02	Cd109
90.00	2098.	4.06	0.99	4.509E-02	89.95	3.560	1.259E+02	U235
					89.95	3.560	1.259E+02	U235
93.32	2049.	4.31	1.00	4.567E-02	92.59	5.600	7.700E+01	U238
					92.60	2.800	1.539E+02	Th234
					92.59	5.600	7.700E+01	U238
94.92	212.	37.78	1.00	4.591E-02	94.90	11.300	PBC<MDA	Ra223
99.43	669.	14.23	1.20	4.650E-02				
105.36	722.	14.05	1.51	4.705E-02	105.31	21.200	7.239E+00	Eu155
128.99	1036.	10.92	1.13	4.720E-02				
131.65	96.	67.49	1.03	4.707E-02	131.61	0.135	PBC<MDA	Th228
149.70	147.	56.16	0.55	4.565E-02				
154.01	512.	16.37	1.13	4.521E-02	154.21	5.620	1.951E+01	Ra223
165.55	104.	85.28	1.06	4.391E-02	165.85	79.886	PBC<MDA	Ce139
					166.41	0.108	PBC<MDA	Th228

E

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:43:00 AM Page 3
Pace Analytical Spectrum name: 30204854015.Anl

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					165.85	79.886	PBC<MDA	Ce139

176.42	115.	75.66	1.07	4.264E-02	176.31	6.820	PBC<MDA	Sb125
					176.60	10.000	PBC<MDA	Cs136
					176.31	6.820	PBC<MDA	Sb125
					176.60	10.000	PBC<MDA	Cs136
185.72	690.	12.65	1.48	4.154E-02				
209.08	1745.	5.90	1.17	3.875E-02				
215.73	127.	70.32	1.10	3.795E-02	215.99	0.263	PBC<MDA	Th228
220.62	62.	95.09	0.44	3.743E-02				
238.39	18172.	0.83	1.12	3.550E-02	235.97	12.300	4.014E+02	Ac227
					238.63	43.300	1.253E+02	Pb212
241.05	1811.	5.32	1.13	3.522E-02	241.00	3.900	1.396E+02	Ra224
					241.92	7.470	6.642E+01	Ra226
270.04	1375.	6.31	1.22	3.244E-02	269.46	13.700	3.001E+01	Ra223
277.26	857.	9.90	1.27	3.180E-02	277.36	6.310	4.524E+01	Tl208
295.02	1298.	6.76	1.19	3.034E-02	295.22	19.200	2.145E+01	Ra226
					295.96	28.670	3.540E+01	Ir192
300.00	1137.	6.54	0.92	2.995E-02	300.00	2.300	1.602E+02	Ac227
					300.00	2.300	1.602E+02	Ac227
320.02	58.	65.48	1.19	2.849E-02	320.08	10.080	PBC<MDA	Cr51
323.80	44.	89.94	1.20	2.824E-02	323.87	3.930	PBC<MDA	Ra223
327.96	1075.	6.48	1.29	2.796E-02	328.76	20.300	3.344E+03	La140
338.18	3655.	2.04	1.21	2.730E-02	338.32	11.300	1.178E+02	Ac228
341.03	182.	23.93	1.21	2.713E-02	340.55	42.200	2.371E+02	Cs136
					340.55	42.200	2.371E+02	Cs136
351.77	2207.	4.24	1.38	2.648E-02	351.99	37.100	2.162E+01	Ra226
355.79	38.	94.85	1.22	2.623E-02	356.02	62.050	PBC<MDA	Ba133
402.23	31.	74.43	0.62	2.385E-02				
409.26	704.	9.41	1.25	2.353E-02				
427.41	70.	75.83	1.28	2.273E-02	427.88	29.600	PBC<MDA	Sb125
					427.88	29.600	1.078E+00	Sb125
462.89	1193.	6.19	1.32	2.140E-02	463.36	10.500	5.469E+01	Sb125
					463.36	10.500	5.469E+01	Sb125
510.61	2319.	4.07	1.76	1.986E-02				
522.90	71.	47.14	0.39	1.951E-02	522.65	16.000	HL>Cutoff	I132
562.07	283.	16.95	1.48	1.848E-02				
583.08	6365.	1.56	1.56	1.798E-02	583.19	84.500	4.437E+01	Tl208
604.53	86.	51.97	1.43	1.751E-02	604.72	97.620	PBC<MDA	Cs134
					604.72	97.620	5.315E-01	Cs134
609.08	1662.	4.01	1.48	1.742E-02	609.31	44.800	2.048E+01	Ra226
702.59	87.	58.30	1.50	1.571E-02	702.62	97.900	PBC<MDA	Nb94
					702.62	97.900	5.440E-01	Nb94
722.63	30.	80.73	1.52	1.539E-02	722.79	10.760	PBC<MDA	Sb124
					723.30	20.110	9.408E-01	Eu154
					724.20	44.170	1.185E+00	Zr95
					722.94	90.800	2.040E-01	Ag108M
					723.30	20.110	9.408E-01	Eu154
724.51	68.	66.93	1.52	1.537E-02	724.20	44.170	PBC<MDA	Zr95

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:43:00 AM Page 4
Pace Analytical Spectrum name: 30204854015.Anl

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
727.21	1382.	4.03	1.71	1.532E-02	727.33	6.580	1.452E+02	Bi212
755.54	101.	50.28	1.54	1.490E-02	756.73	54.460	PBC<MDA	Zr95
					756.73	54.460	PBC<MDA	Zr95
763.19	96.	49.23	1.55	1.480E-02	763.94	22.140	PBC<MDA	Ag110M
					763.94	22.140	3.695E+00	Ag110M
772.28	249.	16.56	1.41	1.468E-02	772.60	75.600	HL>Cutoff	I132
785.59	181.	17.29	1.26	1.451E-02				
794.46	707.	5.53	1.97	1.439E-02	795.86	85.530	6.045E+00	Cs134
					795.86	85.530	6.045E+00	Cs134
835.42	303.	10.64	1.35	1.390E-02	834.85	99.976	2.598E+00	Mn54

860.45	765.	5.97	1.89	1.361E-02	860.56	12.420	4.791E+01	Tl208
897.89	36.	86.79	1.65	1.321E-02	898.04	93.700	PBC<MDA	Y88
					898.04	93.700	PBC<MDA	Y88
911.17	4377.	1.73	1.79	1.308E-02	911.21	26.600	1.250E+02	Ac228
964.76	658.	7.77	1.70	1.257E-02	964.13	14.340	3.565E+01	Eu152
					964.13	14.340	3.565E+01	Eu152
968.94	2398.	2.51	1.77	1.253E-02	968.97	16.200	1.174E+02	Ac228
996.80	25.	91.21	1.72	1.229E-02	996.26	10.530	PBC<MDA	Eu154
					996.26	10.530	1.900E+00	Eu154
1110.99	43.	68.48	1.80	1.139E-02	1112.12	13.550	PBC<MDA	Eu152
					1112.12	13.550	2.711E+00	Eu152
1120.43	422.	7.24	1.90	1.133E-02	1120.29	14.800	2.427E+01	Ra226
1227.88	33.	53.61	0.64	1.062E-02				
1238.11	144.	19.86	1.88	1.056E-02	1235.36	20.000	1.015E+03	Cs136
					1238.28	66.070	4.680E+00	Co56
					1238.28	66.070	4.680E+00	Co56
1332.39	32.	81.92	1.94	1.002E-02	1332.50	99.986	PBC<MDA	Co60
1365.60	26.	35.26	0.71	9.849E-03				
1408.06	68.	40.59	1.99	9.634E-03	1408.01	20.870	3.318E+00	Eu152
					1408.01	20.870	3.318E+00	Eu152
1459.62	93.	33.90	2.02	9.379E-03	1461.00	10.670	8.952E+00	K40
1620.46	153.	15.93	1.59	8.686E-03	1620.50	1.490	1.250E+02	Bi212
1630.84	165.	11.66	0.62	8.644E-03				
1690.47	26.	40.36	0.32	8.410E-03	1690.98	47.300	1.920E+00	Sb124
1764.48	361.	7.89	1.71	8.138E-03	1764.49	15.360	2.782E+01	Ra226

********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
359.53	89.99	2505.	2179.	4.832E+04	7.78	0.994	-	D
372.80	93.31	2696.	1880.	4.117E+04	9.07	0.997	-	D
397.20	99.43	2288.	669.	1.439E+04	28.45	1.197	-	s
515.52	128.99	2086.	1070.	2.268E+04	13.53	1.028	-	D
598.22	149.70	1905.	147.	3.220E+03	112.31	0.549	-	s
742.26	185.72	1891.	690.	1.662E+04	25.29	1.484	-	s

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Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
835.66	209.08	2043.	1745.	4.503E+04	11.80	1.170	-	s
881.81	220.62	1138.	52.	1.657E+03	190.19	0.438	-	sc
1198.99	300.00	813.	1085.	3.623E+04	9.60	1.177	-	D
1330.78	327.96	813.	999.	3.574E+04	10.25	1.201	-	D
1362.71	341.02	851.	184.	6.792E+03	47.14	1.212	-	D
1608.07	402.23	226.	31.	1.286E+03	148.87	0.625	-	c
1636.21	409.26	712.	704.	2.990E+04	18.83	1.255	-	s
1850.68	462.89	730.	1193.	5.577E+04	12.38	1.321	-	s
2041.54	510.61	792.	2319.	1.168E+05	8.14	1.762	-	s
2247.40	562.07	418.	283.	1.532E+04	33.89	1.482	-	s
3141.50	785.59	219.	181.	1.250E+04	34.58	1.256	-	
3176.97	794.46	196.	707.	4.909E+04	11.05	1.974	-	s
4911.13	1227.88	56.	33.	3.107E+03	107.22	0.641	-	s
5462.28	1365.60	20.	26.	2.623E+03	70.52	0.715	-	s
6523.92	1630.84	44.	165.	1.909E+04	23.33	0.618	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-210	185.59	46.51	1528.	206.	0.228	72.48	0.413s
Th-234	252.69	63.29	2695.	247.	0.274	60.82	0.969D
Th-232	254.77	63.81	2907.	119.	0.133	129.14	0.970D
Pb-212	298.75	74.81	4298.	4408.	4.898	3.73	0.980D
Pb-212	307.95	77.11	3737.	7571.	8.413	3.24	0.982D
Ra-223	323.78	81.07	3134.	1147.	1.275	10.95	0.985D
Ra-223	334.62	83.78	3299.	241.	0.268	68.60	0.988D
Th-228	336.99	84.37	2523.	894.	0.993	17.25	0.988D
Eu-155	345.68	86.54	4872.	773.	0.858	26.55	0.990D
Pb-212	348.70	87.30	3375.	2308.	2.565	8.25	0.991D
Cd-109	351.63	88.03	5460.	411.	0.456	51.86	0.992D
U-235	359.31	89.96	2743.	2386.	2.651	9.52	0.993
U-238	369.30	92.45	3209.	132.	0.147	168.52	0.996s
Th-234	369.89	92.60	4032.	480.	0.533	38.54	0.996D
Ra-223	379.08	94.90	3094.	212.	0.235	75.56	0.998D
Eu-155	420.90	105.36	2497.	721.	0.802	28.13	1.511s
Th-228	525.88	131.61	2034.	96.	0.106	134.99	1.031D
Ra-223	615.43	154.01	1859.	510.	0.567	32.84	1.134s
Ce-139	661.57	165.55	2023.	104.	0.116	170.56	1.061s
Cs-136	705.06	176.42	1950.	115.	0.128	151.32	1.070s

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Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Th-228	862.24	215.73	1881.	127.	0.141	140.65	1.105s
Pb-212	953.83	238.63	2455.	18181.	20.201	1.67	1.124D
Ra-224	963.30	241.00	3814.	1741.	1.934	11.12	1.126D
Ra-226	966.98	241.92	2744.	501.	0.557	30.90	1.127D
Ra-223	1079.19	269.98	1305.	1114.	1.238	14.53	1.151s
Tl-208	1108.29	277.26	1311.	857.	0.952	19.80	1.268
I-131	1141.53	285.57	1172.	-80.	-0.089	176.83	1.164s
Ra-226	1179.32	295.02	1238.	1297.	1.441	13.53	1.194s
Ac-227	1199.24	300.00	1042.	1072.	1.191	13.73	1.177D
Cr-51	1279.56	320.08	680.	58.	0.064	130.96	1.194D
Ra-223	1294.70	323.87	745.	44.	0.048	179.89	1.197D
Ac-228	1352.50	338.32	890.	3649.	4.055	4.04	1.209D
Cs-136	1359.96	340.19	634.	404.	0.449	27.29	1.211s
Ra-226	1407.16	351.99	767.	2050.	2.278	5.84	1.221D
Ba-133	1423.26	356.02	646.	38.	0.043	189.71	1.224D
Sb-125	1708.79	427.41	620.	70.	0.078	151.67	1.284s
Sb-125	1850.74	462.90	665.	1053.	1.170	12.08	1.313s
I-132	2090.73	522.90	313.	71.	0.079	94.28	0.391s
Tl-208	2331.42	583.08	623.	6363.	7.071	3.12	1.557
Cs-134	2417.22	604.53	399.	86.	0.096	103.94	1.427s
Ra-226	2435.40	609.08	493.	1659.	1.843	8.04	1.484s
Nb-94	2809.47	702.59	479.	87.	0.096	116.59	1.503s
Sb-124	2890.26	722.79	270.	30.	0.033	161.47	1.518D
Zr-95	2897.17	724.51	392.	68.	0.076	133.87	1.519s
Bi-212	2908.43	727.33	383.	1293.	1.436	7.02	1.522D
Zr-95	3021.27	755.54	484.	101.	0.113	100.56	1.544s
Ag-110M	3051.87	763.19	417.	96.	0.107	98.46	1.549
I-132	3088.25	772.28	312.	249.	0.277	33.13	1.410

Cs-134	3182.43	795.82	167.	170.	0.189	37.76	1.573s
Mn-54	3340.84	835.42	170.	303.	0.337	21.28	1.353
Tl-208	3440.99	860.45	221.	764.	0.849	11.95	1.891
Y-88	3590.76	897.89	167.	36.	0.040	173.58	1.648s
Ac-228	3643.88	911.17	216.	4374.	4.860	3.46	1.789
Eu-152	3858.29	964.76	356.	658.	0.732	15.53	1.696
Ac-228	3875.05	968.94	274.	2397.	2.664	5.02	1.770
Eu-154	3986.49	996.80	90.	25.	0.028	182.43	1.719s
Eu-152	4443.38	1110.99	140.	43.	0.048	136.97	1.799s
Ra-226	4481.17	1120.43	86.	422.	0.469	14.47	1.900s
Co-56	4952.08	1238.11	108.	144.	0.159	39.73	1.883s
Co-60	5329.36	1332.39	112.	32.	0.036	163.85	1.943s
Eu-152	5632.23	1408.06	114.	68.	0.076	81.18	1.990s
K-40	5838.59	1459.62	141.	93.	0.103	67.79	2.023s
Bi-212	6482.34	1620.46	69.	153.	0.170	31.87	1.591s
Sb-124	6762.59	1690.47	19.	26.	0.029	80.73	0.320s
Ra-226	7058.88	1764.48	54.	361.	0.401	15.77	1.713s

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

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***** 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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Peak Code	MDA Value pCi/G		COMMENTS
Be-7	C	2.0963E+00					5.34E+01	
			477.56	2.096E+00	&(	1.791E+01	3.81E+02	1.03E+01 G K
Na-22	C	-1.4320E-01					9.50E+02	
			1274.53	-1.432E-01	&(	5.667E-01	2.03E+02	9.99E+01 G K
K-40	N	8.9524E+00					4.68E+11	
			1461.00	8.952E+00	?(P	5.587E+00	3.39E+01	1.07E+01 G K
Cr-51	F	2.1220E+01					2.77E+01	
			320.08	2.122E+01	(P	4.584E+01	6.55E+01	1.01E+01 G K
Mn-54	C	2.5976E+00					3.12E+02	
			834.85	2.598E+00	(	5.441E-01	1.06E+01	1.00E+02 G K
Co-56	C	4.6804E+00					7.73E+01	
			1238.28	4.680E+00	@(	1.672E+00	1.99E+01	6.61E+01 G K
			1771.35	0.000E+00	% P	8.151E+00	1.00E+03	1.55E+01 G
Co-57	C	2.3728E-02					2.72E+02	
			122.06	2.373E-02	%(	7.062E-01	1.24E+03	8.56E+01 G K
			136.47	-8.619E-02	&	5.890E+00	2.84E+03	1.07E+01 G
Co-58	C	4.7660E-01					7.08E+01	
			810.78	4.766E-01	%(	1.243E+00	1.24E+02	9.94E+01 G K
Co-60	F	3.2312E-01					1.92E+03	
			1332.50	3.231E-01	&(P	5.166E-01	8.19E+01	1.00E+02 G K
			1173.24	0.000E+00	& P	4.750E-01	1.00E+03	1.00E+02 G

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Y-88      C   4.3677E-01                                                1.07E+02
                          1836.06 3.619E-01 &(P 9.583E-01 1.41E+02 9.92E+01 G K
                           898.04 5.161E-01  (P 9.139E-01 8.68E+01 9.37E+01 G

Nb-94     I   2.9430E-01                                                7.41E+06
                           871.09 4.961E-02 %(P 5.299E-01 5.19E+02 9.99E+01 G K
                           702.62 5.440E-01  (  6.560E-01 5.83E+01 9.79E+01 G

Zr-95     I   3.1014E+00                                                6.40E+01
                           756.73 3.398E+00 ?(P 3.524E+00 5.03E+01 5.45E+01 G K
                           724.20 2.736E+00 &(  3.801E+00 6.69E+01 4.42E+01 G
C
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ru-106    I   1.6416E+00                                                3.73E+02
                           621.93 1.642E+00 &(P 7.139E+00 2.01E+02 9.93E+00 G K

Cd-109    F   2.8272E+01                                                4.64E+02
                            88.03 2.827E+01  (  2.390E+01 2.59E+01 3.61E+00 G K

Ag-110M   F   8.8386E-01                                                2.50E+02
                           657.76 2.217E-01 &(P 8.470E-01 1.77E+02 9.40E+01 G K
                          1505.04 0.000E+00 %   7.952E+00 1.00E+03 1.29E+01 G
                          1384.30 1.073E+00 % P 2.743E+00 1.31E+02 2.41E+01 G
                           937.49 0.000E+00 %   2.258E+00 1.00E+03 3.41E+01 G
                           884.68 0.000E+00 % P 9.104E-01 1.00E+03 7.22E+01 G
                           763.94 3.695E+00 &(  3.752E+00 4.92E+01 2.21E+01 G
                           744.28 0.000E+00 & P 1.727E+01 1.00E+03 4.70E+00 G
                           706.68 2.319E+00 % P 5.490E+00 1.14E+02 1.63E+01 G

Sn-113    F  -1.9267E-01                                                1.15E+02
                           391.69-1.927E-01 %(  1.526E+00 3.54E+02 6.40E+01 G K

Sb-124    F   7.9041E-01                                                6.02E+01
                           602.73-2.396E-01 %(  1.812E+00 3.49E+02 9.78E+01 G K
                           645.85 3.640E-01 % P 2.372E+01 2.99E+03 7.38E+00 G
                           722.79 5.186E+00  (  1.391E+01 8.07E+01 1.08E+01 G
                          1690.98 1.920E+00  (P 1.668E+00 4.04E+01 4.73E+01 G

Sb-125    I   1.3433E+01                                                1.01E+03
                           427.88 1.078E+00 ?(  1.815E+00 7.58E+01 2.96E+01 G K
                           176.31 2.682E+00 % P 7.454E+00 1.16E+02 6.82E+00 G
                           463.36 4.826E+01 @(  5.632E+00 6.04E+00 1.05E+01 G
                           600.60 7.995E-01 % P 3.100E+00 1.79E+02 1.79E+01 G
                           635.95 0.000E+00 % P 5.720E+00 1.00E+03 1.13E+01 G

I-131     I  -1.0762E+03                                                8.02E+00
                           364.49-1.076E+03 %(  2.597E+03 1.09E+02 8.17E+01 G K
                           636.99 1.889E+03 %   3.310E+04 8.06E+02 7.17E+00 G
                           284.30-1.582E+04 +   3.222E+04 8.84E+01 6.14E+00 G

I-132     I   2.1670E+00                                                3.20E+00
                           772.60 2.163E+00  (P 7.376E-01 1.66E+01 7.56E+01 G K
                           522.65 2.185E+00  (P 2.628E+00 4.71E+01 1.60E+01 G
                           630.19-2.913E-01 &   4.499E+00 7.11E+02 1.33E+01 G
                           954.55 0.000E+00 % P 3.458E+00 1.00E+03 1.76E+01 G

Ba-133    F   3.7951E-01                                                3.84E+03
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                          356.02 2.315E-01  (  7.293E-01 9.49E+01 6.20E+01 G K
                           81.00 0.000E+00 ) P 1.359E+00 5.25E+03 3.41E+01 G
                          302.85-2.697E-01 %   2.733E+00 3.03E+02 1.83E+01 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                          276.40 1.298E+00 % P 6.484E+00 2.16E+02 7.16E+00 G
                          383.85 0.000E+00 & P 6.171E+00 1.00E+03 8.94E+00 G

Cs-134   I   9.6312E-01                                     7.52E+02
                          604.72 5.315E-01 &(  5.895E-01 5.20E+01 9.76E+01 G K
                          801.95 2.948E-01 % P 6.873E+00 1.10E+03 8.69E+00 G
                          795.86 1.456E+00 ?(P 5.383E-01 1.89E+01 8.55E+01 G
                          569.33 0.000E+00 & P 4.393E+00 1.00E+03 1.54E+01 G

Cs-136   F   1.8992E+02                                     1.32E+01
                          818.51 2.493E+01 %(P 7.752E+01 1.47E+02 9.97E+01 G K
                          176.60 4.046E+02  (P 7.326E+02 7.57E+01 1.00E+01 G
                          273.65 0.000E+00 %   7.342E+02 1.00E+03 1.11E+01 G
                          340.55 5.288E+02 ?(P 1.569E+02 1.36E+01 4.22E+01 G
                         1048.07-1.026E+01 %   8.831E+01 4.26E+02 8.00E+01 G
                         1235.36 2.410E+01 % P 5.172E+02 1.10E+03 2.00E+01 G

Cs-137   I   3.6732E-02                                     1.10E+04
                          661.66 3.673E-02 %(P 7.276E-01 9.11E+02 8.51E+01 G K

Ce-139   F   4.6254E-01                                     1.38E+02
                          165.85 4.625E-01  (P 9.447E-01 8.53E+01 7.99E+01 G K

Ba-140   I  -1.3297E+02                                     1.28E+01
                          537.26-1.330E+02 &(  4.313E+02 1.50E+02 2.44E+01 G K
                          162.66 0.000E+00 % P 1.403E+03 1.00E+03 6.22E+00 G

Ce-141   I   1.7867E-01                                     3.25E+01
                          145.44 1.787E-01 %(  7.797E+00 1.81E+03 4.82E+01 G K

Ce-144   I  -1.0236E+00                                     2.85E+02
                          133.51-1.024E+00 %(  5.525E+00 2.25E+02 1.11E+01 G K

Eu-152   F   7.9986E+00                                     4.95E+03
                          121.78 0.000E+00 &(P 1.691E+00 1.00E+03 2.84E+01 G K
                         1408.01 3.318E+00 @(  2.544E+00 4.06E+01 2.09E+01 G
                         1112.12 2.711E+00 &(  3.663E+00 6.85E+01 1.36E+01 G
                         1085.91-1.984E-01 %   4.839E+00 1.21E+03 9.92E+00 G
                          964.13 3.565E+01  (P 4.905E+00 7.77E+00 1.43E+01 G
                          344.28 0.000E+00 & P 1.960E+00 1.00E+03 2.66E+01 G
                          244.70 0.000E+00 & P 6.733E+00 1.00E+03 7.49E+00 G

Eu-154   I   3.9140E-01                                     3.14E+03
                          123.07 0.000E+00 %(P 1.205E+00 1.00E+03 4.06E+01 G K
                         1274.44-3.894E-01 &   1.541E+00 2.03E+02 3.50E+01 G
                         1004.72 0.000E+00 % P 3.105E+00 1.00E+03 1.79E+01 G
                          996.26 1.900E+00 ?(  3.567E+00 9.12E+01 1.05E+01 G
                          873.19 6.285E-01 &   4.388E+00 3.40E+02 1.22E+01 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
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```
                                723.30 0.000E+00 &   4.926E+00 1.00E+03 2.01E+01 G
                                247.93 0.000E+00 % P 7.003E+00 1.00E+03 6.91E+00 G

Eu-155    I    6.3126E+00                                      1.74E+03
                                 86.54 5.673E+00  (P 2.408E+00 1.33E+01 3.07E+01 G K
                                105.31 7.239E+00 *(P 2.364E+00 1.41E+01 2.12E+01 G

Ir-192    F    2.0895E-01                                      7.38E+01
                                316.51 2.090E-01 &(  1.398E+00 2.88E+02 8.28E+01 G
                                468.07 0.000E+00 % P 2.583E+00 1.00E+03 4.78E+01 G
                                308.46 8.032E-01 %   3.972E+00 2.13E+02 3.00E+01 G
                                295.96 0.000E+00 % P 4.174E+00 1.00E+03 2.87E+01 G

Hg-203    F    9.0656E-01                                      4.66E+01
                                279.20 9.066E-01 %(P 2.279E+00 1.09E+02 8.15E+01 G K

Tl-208    N    4.4850E+01                                      6.98E+02
                                583.19 4.437E+01  (P 8.296E-01 1.55E+00 8.45E+01 G K
                                860.56 4.791E+01  (P 4.508E+00 5.97E+00 1.24E+01 G
                                277.36 4.524E+01  (P 9.055E+00 9.90E+00 6.31E+00 G

Pb-210    N    2.1778E+01                                      8.14E+03
                                 46.54 2.178E+01  (P 1.958E+01 3.62E+01 4.25E+00 G K

Bi-212    N    1.3384E+02                                      6.98E+02
                                727.33 1.359E+02  (P 9.870E+00 3.51E+00 6.58E+00 G K
                               1620.50 1.250E+02  (  3.398E+01 1.59E+01 1.49E+00 G

Pb-212    N    1.2540E+02                                      6.98E+02
                                238.63 1.254E+02  (P 1.611E+00 8.36E-01 4.33E+01 G K
                                 77.11 1.092E+02 - P 4.149E+00 1.62E+00 1.75E+01 GA
                                 74.81 1.089E+02 } P 7.613E+00 1.86E+00 1.04E+01 GA
                                 87.30 7.036E+01 -   8.335E+00 4.12E+00 7.80E+00 GA

Ra-223    N    2.4318E+01                                      7.96E+03
                                269.46 2.432E-01 &(  3.732E+00 7.26E+00 1.37E+01 G K
                                 83.78 2.149E+00 -   2.410E+00 3.43E+01 2.49E+01 G
                                323.87 3.813E+00 - P 1.137E+01 8.99E+01 3.93E+00 G
                                154.21 1.951E+01 - P 7.788E+00 1.64E+01 5.62E+00 G
                                 94.90 3.965E+00 - P 4.904E+00 3.78E+01 1.13E+01 G
                                 81.07 1.724E+01 } P 3.962E+00 5.48E+00 1.50E+01 G

Ra-224    N    1.3422E+02                                      6.98E+02
                                241.00 1.342E+02  (P 2.240E+01 5.56E+00 3.90E+00 G K

Ra-226    N    2.0387E+01                                      5.84E+05
                                609.31 2.048E+01 *(P 1.312E+00 4.02E+00 4.48E+01 G K
                               1764.49 2.782E+01 + P 2.849E+00 7.89E+00 1.54E+01 G
```



```
Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                                295.22 2.145E+01 @(P 2.758E+00 6.76E+00 1.92E+01 G
                               1120.29 2.427E+01 + P 2.634E+00 7.24E+00 1.48E+01 G
                                351.99 2.012E+01  (P 1.293E+00 2.92E+00 3.71E+01 G
                                241.92 1.839E+01  (P 9.060E+00 1.54E+01 7.47E+00 G

Ac-227    N    2.3801E+01                                      7.95E+03
                                235.97 0.000E+00 %(P 5.286E+00 1.00E+03 1.23E+01 G K
                                256.25 7.546E-02 %   6.861E+00 3.92E+03 7.00E+00 G
                                                                Energy duplication
```

```
                                 300.00 1.511E+02  (P 2.159E+01 6.87E+00 2.30E+00 G
                                 329.85 7.539E-01 &   1.931E+01 1.10E+03 2.70E+00 G

Ac-228    N   1.2120E+02                                          2.10E+03
                                 911.21 1.250E+02  (P 2.033E+00 1.73E+00 2.66E+01 G K
                                 968.97 1.174E+02  (P 3.909E+00 2.51E+00 1.62E+01 G
                                 338.32 1.176E+02  (P 4.568E+00 2.02E+00 1.13E+01 G

Th-228    N   1.6925E+02                                          6.98E+02
                                  84.37 1.704E+02  (P 4.513E+01 8.62E+00 1.27E+00 G K
                                 215.99 1.347E+02 & P 2.174E+02 7.03E+01 2.63E-01 G
                                 166.41 1.780E+01 % P 4.865E+02 1.13E+03 1.08E-01 G
                                 131.61 1.588E+02  (P 3.536E+02 6.75E+01 1.35E-01 G

Pa-231    N  -1.3483E+01                                          1.20E+07
                                 283.70-1.348E+01 &(  3.133E+01 1.01E+02 1.60E+00 G K
                                 330.00 1.415E+01 %   3.928E+01 1.20E+02 1.30E-00 G

Pa-234M   N   1.7053E+01                                          1.63E+12
                                                                 Energy duplication
                                1001.03 1.705E+01 %(P 5.994E+01 1.71E+02 8.37E-01 G

Th-230    N   6.7466E+01                                          2.75E+07
                                  67.67 6.747E+01 %(  1.899E+02 1.18E+02 3.80E-01 G K

Th-232    N   1.1653E+02                                          4.17E+12
                                  63.81 1.165E+02  (  2.481E+02 6.46E+01 2.67E-01 G K

Th-234    N   1.3509E+01                                          1.63E+12
                                  63.29 1.351E+01  (P 1.339E+01 3.04E+01 4.80E+00 G K
                                  92.60 3.623E+01 + P 2.255E+01 1.93E+01 2.80E+00 G

U-238     N   1.6993E+01                                          1.63E+12
                                                                 Energy duplication
                                1001.03 1.699E+01 %(P 5.972E+01 1.71E+02 8.40E-01 G K
                                  92.59 4.994E+00 & P 1.007E+01 8.43E+01 5.60E+00 GA

Am-241    T  -2.5660E-01                                          1.58E+05
                                  59.54-2.566E-01 %(  1.833E+00 2.84E+02 3.63E+01 G K
   ( - 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 2 Sigma %	Activity	
U-235	89.96	2743.	2386.	2.651	9.52	1.432E+02	
U-238	92.45	3209.	132.	0.147	168.52	4.994E+00	P
Ce-139	165.55	2023.	104.	0.116	170.56	4.625E-01	P
Cs-136	176.42	1950.	115.	0.128	151.32	4.046E+02	P
I-131	285.57	1172.	-80.	-0.089	176.83	-1.582E+04	
Ac-227	300.00	1042.	1072.	1.191	13.73	1.511E+02	P
Cs-136	340.19	634.	404.	0.449	27.29	5.288E+02	P
Sb-125	427.41	620.	70.	0.078	151.67	1.078E+00	
Sb-125	462.90	665.	1053.	1.170	12.08	4.826E-01	
Cs-134	604.53	399.	86.	0.096	103.94	5.315E-01	
Nb-94	702.59	479.	87.	0.096	116.59	5.440E-01	
Zr-95	724.51	392.	68.	0.076	133.87	2.736E+00	
Zr-95	756.54	484.	101.	0.113	100.56	3.398E+00	P
Ag-110M	763.19	417.	96.	0.107	98.46	3.695E+00	
Cs-134	795.82	167.	170.	0.189	37.76	1.456E+00	P
Y-88	897.89	167.	36.	0.040	173.58	5.161E-01	P
Eu-152	964.76	356.	658.	0.732	15.53	3.565E+01	P
Eu-154	996.80	90.	25.	0.028	182.43	1.900E+00	
Eu-152	1110.99	140.	43.	0.048	136.97	2.711E+00	

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Pace Analytical Spectrum name: 30204854015.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Co-56	1238.11	108.	144.	0.159	39.73	4.680E+00	
Eu-152	1408.06	114.	68.	0.076	81.18	3.318E+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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	6.0432E-01	2.0963E+00	1.5968E+01	1.5970E+01	1.791E+01
Na-22	#B	-1.3353E-01	-1.4320E-01	5.8007E-01	5.8037E-01	5.667E-01
K-40	#	8.9524E+00	8.9524E+00	6.0692E+00	6.1832E+00	5.587E+00
Sc-46	#B	0.0000E+00	0.0000E+00	4.2457E-01	4.2458E-01	1.105E+00
Cr-51	A	1.9293E+00	2.1220E+01	2.7791E+01	2.7933E+01	4.584E+01
Mn-54		2.1000E+00	2.5976E+00	5.5286E-01	6.5103E-01	5.441E-01
Co-56	#	1.9814E+00	4.6804E+00	1.8595E+00	1.9574E+00	1.672E+00
Co-57	#B	1.8584E-02	2.3728E-02	5.8676E-01	5.8677E-01	7.062E-01
Co-58	#B	1.8657E-01	4.7660E-01	1.1810E+00	1.1826E+00	1.243E+00
Fe-59	#B	0.0000E+00	0.0000E+00	5.2861E-01	5.2862E-01	3.949E+00

Co-60	#A	3.1216E-01	3.2312E-01	5.2942E-01	5.3111E-01	5.166E-01
Zn-65	#B	0.0000E+00	0.0000E+00	1.8661E-01	1.8662E-01	1.591E+00
Y-88	#B	2.3431E-01	4.3677E-01	7.2331E-01	7.2596E-01	9.583E-01
Nb-94	#B	2.9430E-01	2.9430E-01	3.4314E-01	3.4534E-01	5.299E-01
Zr-95	#A	1.0990E+00	3.1014E+00	2.5953E+00	2.6287E+00	3.524E+00
Nb-95	#B	0.0000E+00	0.0000E+00	8.8119E-01	8.8121E-01	5.625E+00
Ru-103	#B	0.0000E+00	0.0000E+00	1.2909E+00	1.2909E+00	3.341E+00
Ag-108M	#B	0.0000E+00	0.0000E+00	2.6817E-01	2.6817E-01	8.537E-01
Ru-106	#B	1.3735E+00	1.6416E+00	6.5941E+00	6.5977E+00	7.139E+00
Cd-109		2.4500E+01	2.8272E+01	1.4662E+01	1.5192E+01	2.390E+01
Ag-110M	#F	6.7749E-01	8.8386E-01	8.7025E-01	8.7810E-01	8.470E-01
Sn-113	#B	-1.0819E-01	-1.9267E-01	1.3653E+00	1.3655E+00	1.526E+00
Sb-124	B	2.6224E-01	7.9041E-01	6.3808E-01	6.4660E-01	1.812E+00
Sb-125	#	1.2576E+01	1.3433E+01	1.6228E+00	2.4013E+00	1.815E+00
Te-125	#B	0.0000E+00	0.0000E+00	1.3590E+01	1.3590E+01	5.226E+01
Te-129M	#B	0.0000E+00	0.0000E+00	6.8875E+01	6.8877E+01	1.623E+02
I-131	#B	-2.7241E-01	-1.0762E+03	2.3362E+03	2.3405E+03	2.597E+03
I-132		2.1670E+00	>12 Halflives	7.1786E-01	7.7318E-01	7.376E-01
Te-132	#B	0.0000E+00	>12 Halflives	1.3135E-01	1.3136E-01	5.906E-01
I-133	#B	0.0000E+00	>12 Halflives	3.8159E-01	3.8160E-01	6.650E-01
Ba-133	A	3.7300E-01	3.7951E-01	4.3324E-01	4.3579E-01	7.293E-01
Cs-134	#	8.8174E-01	9.6312E-01	3.6371E-01	3.8541E-01	5.895E-01
Cs-136	#F	1.2209E+00	1.8992E+02	5.1825E+01	5.7603E+01	7.752E+01
Cs-137	#B	3.6511E-02	3.6732E-02	6.6932E-01	6.6934E-01	7.276E-01
Ce-139	#A	2.8548E-01	4.6254E-01	7.8893E-01	7.9135E-01	9.447E-01
Ba-140	#B	-7.2670E-01	-1.3297E+02	3.9985E+02	4.0023E+02	4.313E+02
La-140	#B	0.0000E+00	0.0000E+00	3.5191E+01	3.5192E+01	1.910E+02
Ce-141	#B	2.3148E-02	1.7867E-01	6.4774E+00	6.4775E+00	7.797E+00

Ce-144	#B	-8.1075E-01	-1.0236E+00	4.5998E+00	4.6018E+00	5.525E+00
Eu-152	#F	7.8919E+00	7.9986E+00	1.2423E+00	1.6414E+00	1.691E+00
Eu-154	#B	3.8320E-01	3.9140E-01	7.1402E-01	7.1594E-01	1.205E+00
Eu-155		6.0760E+00	6.3126E+00	1.2208E+00	1.5099E+00	2.408E+00
Ir-192	#A	8.4986E-02	2.0895E-01	1.2044E+00	1.2047E+00	1.398E+00
Hg-203	#B	2.1804E-01	9.0656E-01	1.9735E+00	1.9772E+00	2.279E+00
Tl-208		4.0777E+01	4.4850E+01	1.4014E+00	6.0964E+00	8.295E-01
Pb-210		2.1601E+01	2.1778E+01	1.5785E+01	1.6081E+01	1.958E+01
Bi-212		1.2169E+02	1.3384E+02	9.3967E+00	2.0082E+01	9.870E+00
Pb-212		1.1401E+02	1.2540E+02	2.0962E+00	1.6994E+01	1.611E+00
Ra-223		2.4116E+01	2.4318E+01	3.5325E+00	4.8044E+00	3.732E+00
Ra-224		1.2203E+02	1.3422E+02	1.4929E+01	2.3421E+01	2.240E+01
Ra-226		2.0384E-01	2.0387E+01	1.1905E+00	2.9500E+00	1.312E+00
Ac-227	#F	2.3603E+01	2.3801E+01	3.2686E+00	4.5754E+00	5.286E+00
Ac-228		1.1743E+02	1.2120E+02	2.9559E+00	1.6267E+01	2.033E+00
Th-228		1.5387E+02	1.6925E+02	2.9190E+01	3.7684E+01	4.513E+01
Pa-231	#B	-1.3483E+01	-1.3483E+01	2.7180E+01	2.7240E+01	3.133E+01
Pa-234M	#A	1.7053E+01	1.7053E+01	5.8234E+01	5.8277E+01	5.994E+01
Th-230	#B	6.7465E+01	6.7466E+01	1.5868E+02	1.5895E+02	1.899E+02
Th-232	A	1.1653E+02	1.1653E+02	1.5050E+02	1.5136E+02	2.481E+02
Th-234		1.3509E+01	1.3509E+01	8.2168E+00	8.4272E+00	1.339E+01
U-235	#B	0.0000E+00	0.0000E+00	6.3561E+00	6.3562E+00	1.042E+01
U-238	#B	1.6993E+01	1.6993E+01	5.8026E+01	5.8069E+01	5.972E+01
Am-241	#B	-2.5649E-01	-2.5660E-01	1.4577E+00	1.4582E+00	1.833E+00
Am-243	#B	0.0000E+00	0.0000E+00	1.2925E+00	1.2925E+00	2.139E+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 (30.1 to 2035.5 keV) 7.914E+02 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 8.5521063E+02 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	Analysis SOP	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854016	Collection Date	11/18/2016 12:25
Batch ID	33843	Method	EPA 901.1
A-code	9011 SING	Analysis Date	2/22/17 8:30
Client ID	WESTON-NJ	Matrix	SL
Analyst	MAH	HBN	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	104.270	15.317	7.192
Cesium-137	0.115	0.481	0.487
Lead-212	107.010	14.455	1.382
Potassium-40	12.193	3.949	2.904
Protactinium-234M	32.995	40.188	37.230
Radium-226	17.171	2.590	0.913
Radium-228	101.250	13.553	1.711
Thallium-208	35.772	4.826	0.607
Thorium-228	153.110	39.461	49.450
Thorium-234	22.436	13.181	22.990
Uranium-235	2.401	3.048	8.999

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:48:06 AM Page 1
Pace Analytical Spectrum name: 30204854016.An1

Sample description
WL 33843

Spectrum Filename: C:\User\30204854016.An1

Acquisition information
Start time: 2/22/2017 8:30:20 AM
Live time: 900
Real time: 917
Dead time: 1.88 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 3.0471E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 3.0471E+02) =
3.2818E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:48:06 AM Page 2
Pace Analytical Spectrum name: 30204854016.Anl

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 12:25.00 PM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1305

***** 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. pCi/G	Nuc
50.36	89.	59.83	0.58	7.982E-03				
63.56	246.	41.01	1.07	2.143E-02	63.29	4.800	2.357E+01	Th234
					63.81	0.267	4.135E+02	Th232
					63.81	0.267	4.135E+02	Th232
					63.29	4.800	2.357E+01	Th234
63.77	217.	46.90	1.07	2.185E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	PBC<MDA	Th232
74.86	3338.	3.00	1.08	3.198E-02	74.66	68.200	1.513E+01	Am243
					74.81	10.400	1.087E+02	Pb212
77.19	5318.	2.09	1.09	3.380E-02	77.11	17.500	9.748E+01	Pb212
81.06	67.	78.27	1.09	3.662E-02	81.00	34.100	PBC<MDA	Ba133
					81.07	15.000	1.210E+00	Ra223
					81.00	34.100	5.378E-01	Ba133
84.26	768.	9.00	1.09	3.867E-02	83.78	24.900	7.984E+00	Ra223
					84.37	1.266	1.692E+02	Th228
87.23	2264.	3.71	1.10	4.042E-02	86.54	30.700	1.885E+01	Eu155
					87.30	7.800	7.776E+01	Pb212
					88.03	3.610	1.745E+02	Cd109
89.98	1645.	4.70	1.10	4.189E-02	89.95	3.560	1.087E+02	U235
					89.95	3.560	1.087E+02	U235
93.32	1701.	4.57	1.10	4.351E-02	92.59	5.600	6.898E+01	U238
					92.60	2.800	1.380E+02	Th234
					92.60	2.800	1.380E+02	Th234
					92.59	5.600	6.898E+01	U238
94.89	196.	41.77	1.11	4.422E-02	94.90	11.300	PBC<MDA	Ra223
99.29	475.	17.42	1.30	4.596E-02				
105.31	673.	15.20	1.50	4.792E-02	105.31	21.200	6.775E+00	Eu155

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pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
109.59	150.	56.16	0.43	4.904E-02				

115.20	289.	25.64	1.01	5.021E-02				
129.03	1043.	8.40	1.25	5.196E-02				
143.79	163.	63.15	1.16	5.255E-02	143.76	10.960	PBC<MDA	U235
					143.76	10.960	PBC<MDA	U235
153.93	393.	24.99	0.94	5.245E-02	154.21	5.620	1.320E+01	Ra223
165.78	125.	78.49	1.18	5.200E-02	165.85	79.886	PBC<MDA	Ce139
					166.41	0.108	2.425E+02	Th228
					165.85	79.886	4.806E-01	Ce139
169.88	120.	60.86	0.68	5.178E-02				
185.99	648.	13.56	1.38	5.072E-02				
209.16	1731.	6.25	1.30	4.888E-02				
215.71	214.	32.26	0.43	4.834E-02	215.99	0.263	1.828E+02	Th228
228.16	159.	61.88	1.25	4.729E-02	228.16	88.000	MLD>Cutoff	Te132
238.61	19858.	0.81	1.26	4.643E-02	238.63	43.300	1.071E+02	Pb212
241.28	2224.	5.74	1.26	4.621E-02	241.00	3.900	1.336E+02	Ra224
					241.92	7.470	6.357E+01	Ra226
270.09	1446.	5.96	1.43	4.391E-02	269.46	13.700	2.384E+01	Ra223
277.33	875.	9.07	1.30	4.336E-02	277.36	6.310	3.456E+01	Tl208
					276.40	7.164	2.820E+01	Ba133
295.07	1504.	5.40	1.45	4.208E-02	295.22	19.200	1.835E+01	Ra226
					295.96	28.670	3.023E+01	Ir192
300.07	1388.	6.46	1.39	4.173E-02	300.00	2.300	1.437E+02	Ac227
					300.00	2.300	1.437E+02	Ac227
327.71	1186.	7.20	1.67	3.991E-02	328.76	20.300	2.646E+03	La140
					329.85	2.700	1.097E+02	Ac227
					330.00	1.300	2.261E+02	Pa231
					328.76	20.300	2.646E+03	La140
338.22	4254.	1.88	1.36	3.926E-02	338.32	11.300	9.754E+01	Ac228
340.93	173.	33.04	1.37	3.910E-02	340.55	42.200	1.606E+02	Cs136
					340.55	42.200	1.606E+02	Cs136
344.40	92.	74.24	1.37	3.891E-02	344.28	26.600	PBC<MDA	Eu152
					344.28	26.600	PBC<MDA	Eu152
351.68	2524.	3.53	1.48	3.848E-02	351.99	37.100	1.743E+01	Ra226
355.74	85.	76.19	1.38	3.823E-02	356.02	62.050	PBC<MDA	Ba133
					356.02	62.050	PBC<MDA	Ba133
384.12	72.	93.15	1.41	3.675E-02	383.85	8.940	PBC<MDA	Ba133
					383.85	8.940	PBC<MDA	Ba133
409.32	714.	10.55	1.61	3.552E-02				
463.03	1335.	3.82	1.49	3.325E-02	463.36	10.500	4.025E+01	Sb125
					463.36	10.500	4.025E+01	Sb125
467.00	105.	31.85	1.50	3.310E-02	468.07	47.830	PBC<MDA	Ir192
510.59	2629.	4.07	1.84	3.153E-02				
537.29	68.	82.38	1.57	3.068E-02	537.26	24.390	PBC<MDA	Ba140
					537.26	24.390	PBC<MDA	Ba140
562.39	270.	20.77	0.53	2.992E-02				
583.05	8206.	1.42	1.83	2.934E-02	583.19	84.500	3.586E+01	Tl208
609.17	2170.	3.60	1.62	2.865E-02	609.31	44.800	1.665E+01	Ra226

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
635.54	61.	91.25	1.66	2.798E-02	635.95	11.300	PBC<MDA	Sb125
					635.95	11.300	PBC<MDA	Sb125
					636.99	7.170	PBC<MDA	I131
722.82	31.	88.50	1.75	2.608E-02	722.79	10.760	PBC<MDA	Sb124
					722.94	90.800	1.279E-01	Ag108M
					723.30	20.110	5.816E-01	Eu154
724.47	149.	21.28	1.75	2.605E-02	722.94	90.800	PBC<MDA	Ag108M
					723.30	20.110	2.857E+00	Eu154
					724.20	44.170	3.597E+00	Zr95
724.69	102.	62.63	1.75	2.607E-02	722.94	90.800	PBC<MDA	Ag108M

					723.30	20.110	PBC<MDA	Eu154
					724.20	44.170	PBC<MDA	Zr95
727.17	1904.	4.02	1.95	2.599E-02	727.33	6.580	1.206E+02	Bi212
755.46	168.	36.82	1.78	2.543E-02	756.73	54.460	3.365E+00	Zr95
762.75	163.	30.80	0.52	2.531E-02	763.94	22.140	3.743E+00	Ag110M
772.44	364.	15.50	2.02	2.513E-02	772.60	75.600	HL>Cutoff	I132
794.83	1036.	5.92	1.96	2.474E-02	795.86	85.530	5.275E+00	Cs134
					795.86	85.530	5.275E+00	Cs134
815.12	59.	70.15	1.83	2.438E-02	815.77	23.280	PBC<MDA	La140
					815.77	23.280	1.866E+02	La140
835.75	371.	9.87	1.35	2.405E-02	834.85	99.976	1.879E+00	Mn54
860.47	1025.	5.74	2.11	2.365E-02	860.56	12.420	3.782E+01	Tl208
874.75	58.	67.81	1.89	2.342E-02	875.33	4.510	HL>Cutoff	I133
					875.33	4.510	HL>Cutoff	I133
911.04	6156.	1.58	2.19	2.289E-02	911.21	26.600	1.028E+02	Ac228
965.08	1172.	4.57	1.97	2.214E-02	964.13	14.340	3.686E+01	Eu152
					964.13	14.340	3.686E+01	Eu152
969.08	3255.	2.06	1.98	2.208E-02	968.97	16.200	9.247E+01	Ac228
1001.42	61.	60.55	2.01	2.166E-02	1001.03	0.840	PBC<MDA	U238
					1001.03	0.837	PBC<MDA	Pa234M
					1001.03	0.837	PBC<MDA	Pa234M
					1001.03	0.840	PBC<MDA	U238
1001.42	61.	60.55	2.01	2.166E-02	1001.03	0.840	PBC<MDA	U238
					1001.03	0.837	PBC<MDA	Pa234M
1003.39	44.	82.13	2.01	2.162E-02	1004.72	17.910	PBC<MDA	Eu154
					1004.72	17.910	PBC<MDA	Eu154
1047.10	37.	87.51	2.05	2.108E-02	1048.07	80.000	PBC<MDA	Cs136
					1048.07	80.000	PBC<MDA	Cs136
1110.11	150.	21.82	0.80	2.036E-02	1112.12	13.550	5.440E+00	Eu152
1119.93	613.	6.78	2.48	2.024E-02	1120.29	14.800	2.015E+01	Ra226
1237.94	197.	15.95	0.64	1.901E-02	1238.28	66.070	3.645E+00	Co56
1408.02	66.	49.76	2.35	1.747E-02	1408.01	20.870	1.812E+00	Eu152
					1408.01	20.870	1.812E+00	Eu152
1459.94	225.	14.80	2.40	1.704E-02	1461.00	10.670	1.219E+01	K40
1620.27	307.	11.03	3.70	1.582E-02	1620.50	1.490	1.412E+02	Bi212
1764.68	381.	6.62	2.63	1.484E-02	1764.49	15.360	1.646E+01	Ra226
1771.54	31.	36.96	2.64	1.480E-02	1771.35	15.480	PBC<MDA	Co56

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********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
200.36	50.36	1030.	89.	1.115E+04	119.67	0.578	-	S
358.69	89.96	2096.	1710.	4.082E+04	8.98	1.100	-	D
372.04	93.30	2084.	1783.	4.098E+04	8.65	1.104	-	D
396.00	99.29	1820.	475.	1.034E+04	34.84	1.305	-	M
437.22	109.59	1985.	150.	3.059E+03	112.33	0.428	-	SM
459.65	115.20	1647.	289.	5.762E+03	51.28	1.007	-	M
514.95	129.03	1990.	1043.	2.007E+04	16.81	1.252	-	M
678.34	169.88	1573.	120.	2.324E+03	121.71	0.678	-	SM
742.76	185.99	1928.	648.	1.278E+04	27.11	1.379	-	S
835.41	209.16	2307.	1731.	3.542E+04	12.51	1.295	-	
1199.02	300.07	1288.	1388.	3.328E+04	12.92	1.385	-	SM
1310.21	327.71	1015.	1023.	2.564E+04	10.80	1.353	-	D
1362.39	341.02	1545.	173.	4.419E+03	66.12	1.366	-	D
1635.97	409.32	932.	714.	2.011E+04	21.11	1.611	-	SM
1850.82	462.90	634.	1335.	4.015E+04	7.64	1.491	-	D

1866.69	466.87	501.	105.	3.158E+03	63.69	1.495	-	D
2041.05	510.59	1099.	2529.	8.337E+04	8.13	1.842	-	s
2248.29	562.39	594.	270.	9.017E+03	41.54	0.526	-	s
3049.82	762.76	442.	87.	3.445E+03	71.46	1.785	-	D
3178.15	794.83	390.	1036.	4.188E+04	11.85	1.956	-	s
3342.28	835.75	279.	315.	1.310E+04	18.75	1.854	-	D
3859.43	965.01	849.	1170.	5.287E+04	9.15	1.973	-	D
4439.63	1110.11	130.	150.	7.393E+03	43.64	0.796	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Th-234	253.14	63.56	2591.	246.	0.273	82.03	1.071s
Th-232	253.95	63.77	2641.	217.	0.241	93.79	1.071s
Pb-212	298.12	74.81	3520.	3088.	3.431	4.85	1.084D
Pb-212	307.32	77.11	3081.	5187.	5.763	4.11	1.086D
Ra-223	323.15	81.07	1337.	67.	0.074	156.55	1.090D
Ra-223	333.99	83.78	2738.	139.	0.154	108.08	1.093D

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Th-228	336.36	84.37	2251.	665.	0.739	21.62	1.094D
Eu-155	345.05	86.54	4171.	542.	0.603	34.75	1.096D
Pb-212	348.07	87.30	2876.	1785.	1.983	9.73	1.097D
Cd-109	351.00	88.03	4539.	437.	0.486	44.65	1.098D
U-235	358.68	89.95	2894.	1386.	1.540	16.74	1.100D
U-238	368.18	92.33	2339.	251.	0.279	79.64	1.103s
Th-234	368.18	92.33	2339.	251.	0.279	79.46	1.103s
Ra-223	378.46	94.90	3237.	196.	0.217	83.53	1.105D
Eu-155	420.07	105.31	2449.	672.	0.747	30.44	1.501D
U-235	573.99	143.79	2508.	163.	0.181	126.26	1.158s
Ra-223	614.54	153.93	2315.	391.	0.435	50.18	0.936
Ce-139	661.91	165.78	2280.	125.	0.139	156.97	1.182s
Th-228	861.60	215.71	1370.	214.	0.238	64.51	0.426s
Te-132	911.42	228.16	2115.	159.	0.177	123.75	1.248s
Pb-212	953.29	238.63	2961.	19843.	22.048	1.62	1.259D
Ra-224	962.76	241.00	7254.	1920.	2.133	13.35	1.262D
Ra-226	966.44	241.92	3455.	611.	0.679	28.40	1.263D
Ra-223	1079.09	270.09	1327.	1445.	1.606	11.92	1.431s
Ba-133	1101.21	275.62	1340.	-106.	-0.117	148.52	1.299s
Tl-208	1108.05	277.33	1207.	872.	0.969	18.19	1.305
Ra-226	1179.03	295.07	1132.	1503.	1.670	10.80	1.451s
Ac-227	1198.84	300.03	1187.	1275.	1.416	12.76	1.324
La-140	1311.01	328.07	1362.	-128.	-0.143	123.10	1.354s
Ac-228	1352.01	338.32	1076.	4254.	4.727	3.76	1.363D
Cs-136	1360.50	340.44	797.	304.	0.337	42.47	1.366s
Eu-152	1376.33	344.40	939.	92.	0.102	148.47	1.370s
Ra-226	1405.45	351.68	1051.	2523.	2.803	7.07	1.480
Ba-133	1421.69	355.74	849.	85.	0.094	152.37	1.382s

Ba-133	1535.20	384.12	929.	72.	0.081	186.31	1.411s
Sb-125	1850.47	462.94	817.	1311.	1.456	11.35	1.492
Ba-140	2147.85	537.29	596.	68.	0.076	164.77	1.566s
Tl-208	2330.93	583.05	852.	8202.	9.113	2.84	1.825s
Ra-226	2435.42	609.17	621.	2168.	2.409	7.20	1.619s
Sb-125	2540.89	635.54	550.	61.	0.068	182.51	1.663s
Sb-124	2889.92	722.79	356.	31.	0.034	176.99	1.747D
Eu-154	2897.53	724.69	682.	102.	0.113	125.25	1.747s
Zr-95	2896.66	724.47	426.	149.	0.165	42.55	1.748
Bi-212	2908.10	727.33	565.	1645.	1.828	6.41	1.751D
Zr-95	3020.64	755.46	624.	168.	0.186	73.65	1.779
Ag-110M	3054.58	763.94	416.	46.	0.052	127.55	1.786D
I-132	3088.57	772.44	484.	364.	0.405	30.99	2.016
Cs-134	3181.40	795.64	382.	-59.	-0.065	162.54	1.816s
La-140	3259.33	815.12	280.	59.	0.065	140.31	1.835s
Mn-54	3338.25	834.85	524.	41.	0.046	160.85	1.853D
Tl-208	3439.95	860.27	315.	1120.	1.244	10.86	2.127s
I-133	3497.89	874.75	243.	58.	0.065	135.62	1.891s
Ac-228	3643.07	911.04	458.	6154.	6.838	3.16	2.194s
Eu-152	3859.34	965.09	982.	864.	0.960	19.25	1.972

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Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Ac-228	3874.87	968.97	622.	3252.	3.613	4.12	1.976D
Eu-154	3979.11	995.02	242.	-47.	-0.052	171.27	2.001s
U-238	4003.14	1001.03	199.	61.	0.067	121.09	2.005D
Pa-234M	4003.14	1001.03	199.	61.	0.067	121.09	2.005D
Eu-154	4012.59	1003.39	193.	44.	0.049	164.26	2.009s
Cs-136	4187.48	1047.10	160.	37.	0.042	175.02	2.047s
Ra-226	4478.91	1119.93	137.	613.	0.681	13.57	2.480s
Co-56	4951.13	1237.94	121.	197.	0.219	31.90	0.643s
Eu-152	5631.79	1408.02	142.	66.	0.073	99.51	2.355s
K-40	5839.58	1459.94	119.	225.	0.250	29.59	2.397
La-140	6372.56	1593.10	228.	-60.	-0.066	141.25	2.505s
Bi-212	6481.28	1620.27	118.	307.	0.341	22.07	3.704s
Ra-226	7058.59	1764.49	127.	381.	0.423	13.24	2.633D
Co-56	7086.03	1771.35	52.	31.	0.035	73.93	2.638D

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Peak Code	MDA Value pCi/G	COMMENTS
Be-7	C	1.6923E-01				5.34E+01	
			477.56	1.692E-01	&(	1.352E+01 3.82E+03 1.03E+01	G K
Na-22	C	1.1143E-01				9.50E+02	
			1274.53	1.114E-01	%(	3.528E-01 1.71E+02 9.99E+01	G K
K-40	N	1.2193E+01				4.68E+11	
			1461.00	1.219E+01	(P	2.904E+00 1.48E+01 1.07E+01	G K
Cr-51	F	1.4514E+01				2.77E+01	
			320.08	1.451E+01	%(	4.180E+01 1.30E+02 1.01E+01	G K

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Mn-54     C   2.0795E-01                                          3.12E+02
                          834.85 2.080E-01  (  5.543E-01 8.04E+01 1.00E+02 G K

Co-56     C   3.5591E+00                                          7.73E+01
                         1238.28 3.645E+00  (P 1.001E+00 1.60E+01 6.61E+01 G K
                         1771.35 3.190E+00  (  3.678E+00 3.70E+01 1.55E+01 G

Co-58     C  -3.4329E-01                                          7.08E+01
                          810.78-3.433E-01 %(  9.585E-01 1.42E+02 9.94E+01 G K
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 Pace Analytical                  Spectrum name: 30204854016.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Co-60     F   8.3435E-02                                          1.92E+03
                         1332.50 8.343E-02 %(P 3.257E-01 2.13E+02 1.00E+02 G K
                         1173.24 0.000E+00 & P 3.575E-01 1.00E+03 1.00E+02 G

Zn-65     F   1.1052E-02                                          2.44E+02
                         1115.55 1.105E-02 %(P 8.262E-01 3.92E+03 5.06E+01 G K

Y-88      C  -3.0038E-02                                          1.07E+02
                         1836.06-3.004E-02 &(  7.531E-01 1.47E+03 9.92E+01 G K
                          898.04 0.000E+00 % P 7.876E-01 1.00E+03 9.37E+01 G

Nb-94     I   1.5090E-01                                          7.41E+06
                          871.09 1.509E-01 %(P 3.203E-01 1.10E+02 9.99E+01 G K
                          702.62 1.730E-01 % P 4.643E-01 1.33E+02 9.79E+01 G

Zr-95     I   3.4687E+00                                          6.40E+01
                          756.73 3.365E+00  (  2.392E+00 3.68E+01 5.45E+01 G K
                          724.20 3.597E+00  (P 2.391E+00 2.13E+01 4.42E+01 G

Ru-106    I   9.2123E-01                                          3.73E+02
                          621.93 9.212E-01 &(  4.869E+00 2.61E+02 9.93E+00 G K

Cd-109    F   3.3680E+01                                          4.64E+02
                           88.03 3.368E+01  (  2.441E+01 2.23E+01 3.61E+00 G K

Ag-110M   F   2.0334E-01                                          2.50E+02
                          657.76 0.000E+00 %(P 6.149E-01 1.00E+03 9.40E+01 G K
                         1505.04 4.165E-01 %   4.632E+00 6.32E+02 1.29E+01 G
                         1384.30-1.136E+00 %   2.117E+00 1.04E+02 2.41E+01 G
                          937.49 0.000E+00 % P 1.623E+00 1.00E+03 3.41E+01 G
                          884.68-2.219E-01 &   6.162E-01 1.44E+02 7.22E+01 G
                          763.94 1.067E+00  (  2.244E+00 6.38E+01 2.21E+01 G
                          744.28 7.320E-01 % P 1.175E+01 8.12E+02 4.70E+00 G
                          706.68 0.000E+00 % P 3.668E+00 1.00E+03 1.63E+01 G

Sn-113    F   6.1799E-02                                          1.15E+02
                          391.69 6.180E-02 &(P 1.113E+00 8.35E+02 6.40E+01 G K

Sb-124    F   1.8553E-01                                          6.02E+01
                          602.73-1.529E-01 %(  1.266E+00 4.08E+02 9.78E+01 G K
                          645.85-4.062E+00 %   1.736E+01 2.11E+02 7.38E+00 G
                          722.79 3.261E+00  (  9.598E+00 8.85E+01 1.08E+01 G
                         1690.98 0.000E+00 %   2.978E+00 1.00E+03 4.73E+01 G

Sb-125    I   8.4661E+00                                          1.01E+03
                          427.88-9.912E-02 %(  1.331E+00 6.21E+02 2.96E+01 G K
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                    176.31 2.965E-01 & P 6.813E+00 9.95E+02 6.82E+00 G
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     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:48:06 AM    Page  9
 Pace Analytical                  Spectrum name: 30204854016.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
                         463.36 3.954E+01  (P 4.101E+00 5.67E+00 1.05E+01 G
                         600.60 0.000E+00 % P 2.378E+00 1.00E+03 1.79E+01 G
                         635.95 2.026E+00 &(P 3.729E+00 9.13E+01 1.13E+01 G

Te-129   I   1.6246E+01                                      3.36E+01
                         459.60 1.625E+01 &(  3.744E+01 1.11E+02 7.70E+00 G K
                         487.39-2.583E+00 %   1.942E+02 3.59E+03 1.42E+00 G

I-131    I   7.6303E+02                                      8.02E+00
                         364.49 7.630E+02 %(P 1.776E+03 1.08E+02 8.17E+01 G K
                         636.99 0.000E+00 % P 2.477E+04 1.00E+03 7.17E+00 G
                         284.30 2.500E+03 % P 2.464E+04 4.42E+02 6.14E+00 G

I-132    I   1.8890E+00                                      3.20E+00
                         772.60 1.889E+00  (P 5.457E-01 1.55E+01 7.56E+01 G K
                         522.65 7.781E-01 &   2.521E+00 1.56E+02 1.60E+01 G
                         630.19 8.695E-01 &   3.064E+00 1.74E+02 1.33E+01 G
                         954.55 0.000E+00 % P 2.148E+00 1.00E+03 1.76E+01 G

Te-132   I   3.7643E-01                                      3.20E+00
                         228.16 3.764E-01 ?(P 5.139E-01 6.19E+01 8.80E+01 G K

I-133    I   2.6746E-01                                      8.67E-01
                         529.87 0.000E+00 %(P 4.713E-01 1.00E+03 8.70E+01 G K
                         875.33 5.427E+00 @(  7.028E+00 6.78E+01 4.51E+00 G

Ba-133   F   5.9225E-01                                      3.84E+03
                         356.02 3.589E-01 ?(P 5.854E-01 7.62E+01 6.20E+01 G K
                          81.00-8.041E-03 &   1.964E+00 1.01E+04 3.41E+01 G
                         302.85 6.124E-01 %   2.021E+00 1.48E+02 1.83E+01 G
                         276.40-3.400E+00 +   5.586E+00 7.43E+01 7.16E+00 G
                         383.85 2.212E+00 &(P 4.417E+00 9.32E+01 8.94E+00 G

Cs-136   F   6.5949E+01                                      1.32E+01
                         818.51 0.000E+00 %(P 6.076E+01 1.00E+03 9.97E+01 G K
                         176.60 1.116E+02 & P 6.729E+02 2.61E+02 1.00E+01 G
                         273.65-1.599E+02 %   5.725E+02 1.61E+02 1.11E+01 G
                         340.55 2.822E+02 ?(  1.248E+02 2.12E+01 4.22E+01 G
                        1048.07 3.409E+01 &(P 5.601E+01 8.75E+01 8.00E+01 G
                        1235.36 0.000E+00 % P 3.503E+02 1.00E+03 2.00E+01 G

Cs-137   I   1.1488E-01                                      1.10E+04
                         661.66 1.149E-01 &(  4.874E-01 2.09E+02 8.51E+01 G K

Ce-139   F   4.8055E-01                                      1.38E+02
                         165.85 4.806E-01  (  8.658E-01 7.85E+01 7.99E+01 G K
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     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:48:06 AM    Page 10
 Pace Analytical                  Spectrum name: 30204854016.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ba-140   I   1.6426E+02                                      1.28E+01
                         537.26 1.643E+02 ?(P 2.809E+02 8.24E+01 2.44E+01 G K
                         162.66 0.000E+00 % P 1.279E+03 1.00E+03 6.22E+00 G
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La-140    I   -1.9953E+01                                          1.28E+01
                          1596.21-7.035E+01 ?(  8.631E+01 7.06E+01 9.54E+01 G K
                           487.02 5.796E+01 % P 1.481E+02 1.23E+02 4.55E+01 G
                           815.77 1.866E+02 ?(  2.567E+02 7.02E+01 2.33E+01 G
                           328.76-2.867E+02 +   3.897E+02 6.15E+01 2.03E+01 G

Ce-141    I    1.3718E+00                                          3.25E+01
                           145.44 1.372E+00 %(  7.258E+00 2.30E+02 4.82E+01 G K

Eu-152    F    7.0314E+00                                          4.95E+03
                           121.78 6.921E-01 &(P 1.625E+00 1.02E+02 2.84E+01 G K
                          1408.01 1.812E+00 @(P 1.595E+00 4.98E+01 2.09E+01 G
                          1112.12 0.000E+00 % P 2.606E+00 1.00E+03 1.36E+01 G
                          1085.91 0.000E+00 % P 3.378E+00 1.00E+03 9.92E+00 G
                           964.13 2.718E+01 ?(  4.677E+00 9.62E+00 1.43E+01 G
                           344.28 8.848E-01 - P 1.405E+00 7.42E+01 2.66E+01 G
                           244.70 2.251E+00 %   5.085E+00 1.02E+02 7.49E+00 G

Eu-154    I    7.6059E-01                                          3.14E+03
                           123.07 0.000E+00 &(P 1.191E+00 1.00E+03 4.06E+01 G K
                          1274.44 3.030E-01 %   9.594E-01 1.71E+02 3.50E+01 G
                          1004.72 1.140E+00 &(P 1.754E+00 8.21E+01 1.79E+01 G
                           996.26-2.068E+00 +   3.309E+00 8.56E+01 1.05E+01 G
                           873.19-1.636E+00 &   3.191E+00 1.02E+02 1.22E+01 G
                           723.30 1.958E+00 ?(P 2.389E+00 6.26E+01 2.01E+01 G
                           247.93 0.000E+00 % P 5.780E+00 1.00E+03 6.91E+00 G

Eu-155    I    5.4400E+00                                          1.74E+03
                            86.54 4.518E+00  (P 2.529E+00 1.74E+01 3.07E+01 G K
                                                                Energy duplication
                           105.31 6.775E+00 *(P 2.352E+00 1.52E+01 2.12E+01 G

Tl-208    N    3.5772E+01                                          6.98E+02
                           583.19 3.586E+01 *(P 6.066E-01 1.42E+00 8.45E+01 G K
                           860.56 4.132E+01 +   3.154E+00 5.43E+00 1.24E+01 G
                           277.36 3.456E+01  (P 6.520E+00 9.10E+00 6.31E+00 G

Pb-210    N    5.7903E+00                                          8.14E+03
                            46.54 5.790E+00 %(P 1.092E+02 7.82E+02 4.25E+00 G K

Bi-212    N    1.0427E+02                                          6.98E+02
                           727.33 1.043E+02  (P 7.192E+00 3.20E+00 6.58E+00 G K
                          1620.50 1.412E+02 + P 2.450E+01 1.10E+01 1.49E+00 G
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Pace Analytical Spectrum name: 30204854016.An1

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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Pb-212    N    1.0701E+02                                          6.98E+02
                           238.63 1.070E+02  (P 1.382E+00 8.09E-01 4.33E+01 G K
                            77.11 9.511E+01 - P 4.793E+00 2.05E+00 1.75E+01 GA
                            74.81 1.006E+02 } P 9.098E+00 2.42E+00 1.04E+01 GA
                            87.30 6.128E+01 -   8.676E+00 4.87E+00 7.80E+00 GA

Ra-223    N    2.3844E+01                                          7.96E+03
                           269.46 2.384E+01 *(P 2.846E+00 5.96E+00 1.37E+01 G K
                            83.78 1.442E+00 -   2.564E+00 5.40E+01 2.49E+01 G
                           323.87 0.000E+00 % P 1.111E+01 1.00E+03 3.93E+00 G
                           154.21 1.320E+01 - P 7.650E+00 2.51E+01 5.62E+00 G
                            94.90 3.890E+00 - P 5.328E+00 4.18E+01 1.13E+01 G
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                                 81.07 1.210E+00 -   3.132E+00 7.83E+01 1.50E+01 G

Ra-224    N   1.1544E+02                                        6.98E+02
                                241.00 1.154E-02  (P 2.403E+01 6.68E+00 3.90E+00 G K

Ra-226    N   1.7171E+01                                        5.84E+05
                                609.31 1.665E+01 *(P 9.127E-01 3.60E+00 4.48E+01 G K
                               1764.49 1.646E+01  (P 2.389E+00 6.62E+00 1.54E+01 G
                                295.22 1.835E+01 *(P 1.946E+00 5.40E+00 1.92E+01 G
                               1120.29 2.015E+01 + P 1.886E+00 6.78E+00 1.48E+01 G
                                351.99 1.743E+01  (P 1.062E+00 3.53E+00 3.71E+01 G
                                241.92 1.746E+01  (P 7.909E+00 1.42E+01 7.47E+00 G

Ac-227    N   2.0789E+01                                        7.95E+03
                                235.97 0.000E+00 %(P 2.285E+00 1.00E+03 1.23E+01 G K
                                256.25 1.783E+00 %   5.581E+00 1.41E+02 7.00E+00 G
                                300.00 1.320E+02  (P 1.691E+01 6.38E+00 2.30E+00 G
                                329.85 0.000E+00 %   2.253E+01 1.00E+03 2.70E+00 G

Ac-228    N   1.0125E+02                                        2.10E+03
                                911.21 1.028E+02 *(P 1.711E+00 1.58E+00 2.66E+01 G K
                                968.97 9.246E+01 - P 3.382E+00 2.06E+00 1.62E+01 G
                                338.32 9.754E+01  (P 3.566E+00 1.88E+00 1.13E+01 G

Th-228    N   1.5311E+02                                        6.98E+02
                                 84.37 1.469E+02  (P 4.945E-01 1.08E+01 1.27E+00 G K
                                215.99 1.828E+02  (  1.494E+02 3.23E+01 2.53E-01 G
                                166.41 1.520E+02 %   4.382E+02 1.25E+02 1.08E-01 G
                                131.61 1.514E+02 %   3.680E+02 1.06E+02 1.35E-01 G

Pa-234M   N   3.2995E+01                                        1.63E+12
                                                                Energy duplication
                               1001.03 3.300E+01  (P 3.723E+01 6.05E+01 8.37E-01 G
C

      ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:48:06 AM    Page 12
 Pace Analytical                    Spectrum name: 30204854016.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Th-230    N  -3.6957E+01                                        2.75E+07
                                 67.67-3.696E+01 &(  2.621E+02 2.95E+02 3.80E-01 G K

Th-232    N   3.6460E+02                                        4.17E+12
                                 63.81 3.646E+02 *(P 4.072E+02 4.69E+01 2.67E-01 G K

Th-234    N   2.2436E+01                                        1.63E+12
                                 63.29 2.357E+01 *(P 2.299E+01 4.10E+01 4.80E+00 G K
                                 92.60 2.049E+01 &(P 1.859E+01 3.97E+01 2.80E+00 G

U-235     N   2.4005E+00                                        2.57E+11
                                205.31 1.545E+00 &(P 8.999E+00 2.53E+02 5.01E+00 G K
                                143.76 2.792E+00 &(P 4.040E+00 6.31E+01 1.10E+01 G
                                                                Energy duplication
                                 89.95 9.158E+01     1.675E+01 8.37E+00 3.56E+00 GA

U-238     N   3.2878E+01                                        1.63E+12
                                                                Energy duplication
                               1001.03 3.288E+01  (P 3.709E+01 6.05E+01 8.40E-01 G K
                                 92.59 1.022E+01 & P 9.296E+00 3.98E+01 5.60E+00 GA

Am-241    T   6.4546E-02                                        1.58E+05
                                 59.54 6.455E-02 &(  3.553E+00 2.29E+03 3.63E+01 G K
```

(- 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
R - Coincidence Corrected
H - Halflife limit exceeded
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 2 Sigma %	Activity	
Th-234	63.56	2591.	246.	0.273	82.03	2.357E+01	P
Th-232	63.77	2641.	217.	0.241	93.79	3.646E+02	P
U-235	89.95	2894.	1386.	1.540	16.74	9.158E+01	
U-238	92.33	2339.	251.	0.279	79.64	1.022E+01	P
Th-234	92.33	2339.	251.	0.279	79.46	2.049E+01	P
U-235	143.79	2508.	163.	0.181	126.26	2.792E+00	P
Ce-139	165.78	2280.	125.	0.139	156.97	4.806E-01	
Ba-133	275.62	1340.	-106.	-0.117	148.52	-3.400E+00	
Ac-227	300.03	1187.	1275.	1.416	12.76	1.320E+02	P
La-140	328.07	1362.	-128.	-0.143	123.10	-2.867E+02	
Cs-136	340.44	797.	304.	0.337	42.47	2.822E+02	
Eu-152	344.40	939.	92.	0.102	148.47	8.848E-01	P
Ba-133	355.74	849.	85.	0.094	152.37	3.589E-01	P
Ba-133	384.12	929.	72.	0.081	186.31	2.212E+00	P
Sb-125	462.94	817.	1311.	1.456	11.35	3.954E+01	P
Ba-140	537.29	596.	68.	0.076	164.77	1.643E+02	P
Sb-125	635.54	550.	61.	0.068	182.51	2.026E+00	P
Eu-154	724.69	682.	102.	0.113	125.25	1.958E+00	P
Cs-134	795.64	382.	-59.	-0.065	162.54	-2.996E-01	
La-140	815.12	280.	59.	0.065	140.31	1.866E+02	
I-133	874.75	243.	58.	0.065	135.62	0.000E+00	

Eu-152	965.09	982.	864.	0.960	19.25	2.718E+01	
Eu-154	995.02	242.	-47.	-0.052	171.27	-2.068E+00	
U-238	1001.03	199.	63.	0.067	121.09	3.288E+01	P
Pa-234M	1001.03	199.	61.	0.067	121.09	3.300E+01	P
Eu-154	1003.39	193.	44.	0.049	164.26	1.140E+00	P
Cs-136	1047.10	160.	37.	0.042	175.02	3.409E+01	P
Eu-152	1408.02	142.	66.	0.073	99.51	1.812E+00	P
La-140	1593.10	228.	-60.	-0.066	141.25	-7.035E+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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	4.8777E-02	1.6923E-01	1.2922E+01	1.2922E+01	1.352E+01
Na-22	#B	1.0390E-01	1.1143E-01	3.8190E-01	3.8217E-01	3.528E-01
K-40		1.2193E+01	1.2193E+01	3.6082E+00	3.9490E+00	2.904E+00
Sc-46	#B	0.0000E+00	0.0000E+00	3.2614E-01	3.2615E-01	9.033E-01
Cr-51	B	1.3191E+00	1.4514E+01	3.7603E+01	3.7653E+01	4.180E+01

Mn-54	A	1.6811E-01	2.0795E-01	3.3449E-01	3.3561E-01	5.543E-01
Co-56		1.5065E+00	3.5591E+00	1.1354E+00	1.2264E+00	1.001E+00
Co-57	#B	0.0000E+00	0.0000E+00	3.2981E-01	3.2981E-01	6.992E-01
Co-58	#B	-1.3437E-01	-3.4329E-01	9.7187E-01	9.7293E-01	9.585E-01
Fe-59	#B	0.0000E+00	0.0000E+00	1.2637E+00	1.2637E+00	2.945E+00
Co-60	#B	8.0604E-02	8.3435E-02	3.5537E-01	3.5553E-01	3.257E-01
Zn-65	#B	8.4203E-03	1.1052E-02	8.6625E-01	8.6625E-01	8.262E-01
Y-88	#B	-1.6113E-02	-3.0038E-02	8.8178E-01	8.8179E-01	7.531E-01
Nb-94	#B	1.5090E-01	1.5090E-01	3.3268E-01	3.3327E-01	3.203E-01
Zr-95		1.2290E+00	3.4687E+00	1.4752E+00	1.5448E+00	2.392E+00
Nb-95	#B	0.0000E+00	0.0000E+00	1.3053E+00	1.3053E+00	3.170E+00
Ru-103	#B	0.0000E+00	0.0000E+00	1.1127E+00	1.1127E+00	2.542E+00
Ag-108M	#B	0.0000E+00	0.0000E+00	1.1235E-01	1.1235E-01	5.756E-01
Ru-106	#B	7.7077E-01	9.2123E-01	4.8029E+00	4.8045E+00	4.869E+00
Cd-109		2.9186E+01	3.3680E+01	1.5037E+01	1.5760E+01	2.441E+01
Ag-110M	B	1.5585E-01	2.0334E-01	2.5935E-01	2.6074E-01	6.149E-01
Sn-113	#B	3.4698E-02	6.1799E-02	1.0321E+00	1.0321E+00	1.113E+00
Sb-124	B	6.1544E-02	1.8553E-01	3.2838E-01	3.2929E-01	1.266E+00
Sb-125	#F	7.9261E+00	8.4661E+00	9.6087E-01	1.4698E+00	1.331E+00
Te-129	#B	2.2497E+00	1.6246E+01	3.6043E+01	3.6106E+01	3.744E+01
Te-129M	#B	0.0000E+00	0.0000E+00	8.7851E+01	8.7853E+01	1.063E+02
I-131	#B	1.9289E-01	7.6303E+02	1.6546E+03	1.6576E+03	1.776E+03
I-132		1.8890E+00	>12 Halflives	5.8550E-01	6.3649E-01	5.457E-01
Te-132	#A	3.7643E-01	>12 Halflives	4.6585E-01	4.6858E-01	5.139E-01
I-133	#B	2.6746E-01	>12 Halflives	3.6272E-01	3.6443E-01	4.713E-01
Ba-133	#	5.8209E-01	5.9225E-01	7.1272E-01	7.1647E-01	5.854E-01
Cs-134	#B	0.0000E+00	0.0000E+00	8.3990E-02	8.3992E-02	5.385E-01
Cs-136	#F	4.2362E-01	6.5949E+01	2.8006E+01	2.9328E+01	6.076E+01
Cs-137	#B	1.1419E-01	1.1488E-01	4.8100E-01	4.8124E-01	4.874E-01
Ce-139	#A	2.9658E-01	4.8055E-01	7.5433E-01	7.5704E-01	8.658E-01
Ba-140	#A	8.9701E-01	1.6426E+02	2.7065E+02	2.7151E+02	2.809E+02
La-140	#A	-1.0896E-01	-1.9953E+01	1.9863E+01	2.0042E+01	8.631E+01
Ce-141	B	1.7766E-01	1.3718E+00	6.3001E+00	6.3028E+00	7.258E+00
Ce-144	#B	0.0000E+00	0.0000E+00	2.6896E+00	2.6896E+00	5.448E+00
Eu-152	#F	6.9375E+00	7.0314E+00	1.3532E+00	1.6480E+00	1.625E+00
Eu-154	#B	7.4456E-01	7.6059E-01	9.5267E-01	9.5808E-01	1.191E+00
Eu-155		5.2361E+00	5.4400E+00	1.2567E+00	1.4702E+00	2.529E+00

Ir-192 #A	0.0000E+00	0.0000E+00	7.2607E-01	7.2609E-01	1.164E+00
Hg-203 #B	0.0000E+00	0.0000E+00	9.1949E-01	9.1951E-01	1.928E+00
Tl-208	3.2523E+01	3.5772E+01	1.0165E+00	4.8262E+00	6.066E-01
Pb-210 #B	5.7433E+00	5.7903E+00	9.0606E+01	9.0610E+01	1.092E+02
Bi-212	9.4799E+01	1.0427E+02	6.6789E+00	1.5317E+01	7.192E+00
Pb-212	9.7290E+01	1.0701E+02	1.7313E+00	1.4455E+01	1.382E+00
Ra-223	2.3646E+01	2.3844E+01	2.8422E+00	4.2678E+00	2.846E+00
Ra-224	1.0495E+02	1.1544E+02	1.5414E+01	2.1843E+01	2.403E+01
Ra-226	1.7169E+01	1.7171E+01	1.1898E+00	2.5598E+00	9.127E-01
Ac-227 #F	2.0616E+01	2.0789E+01	2.6535E+00	3.8493E+00	2.285E+00
Ac-228	9.8096E+01	1.0125E+02	2.4862E+00	1.3553E+01	1.711E+00
Th-228	1.3920E+02	1.5311E+02	3.3101E+01	3.9461E+01	4.945E+01

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Pace Analytical Spectrum name: 30204854016.An1

Pa-231 #B	0.0000E+00	0.0000E+00	6.8930E+00	6.8932E+00	2.425E+01
Pa-234M#A	3.2995E+01	3.2995E+01	3.9955E+01	4.0188E+01	3.723E+01
Th-230 #B	-3.6957E+01	-3.6957E+01	2.1826E+02	2.1832E+02	2.621E+02
Th-232 #A	3.6460E+02	3.6460E+02	3.4196E+02	3.4564E+02	4.072E+02
Th-234 #A	2.2436E+01	2.2436E+01	1.2811E+01	1.3181E+01	2.299E+01
U-235 #B	2.4005E+00	2.4005E+00	3.0308E+00	3.0479E+00	8.999E+00
U-238 #A	3.2878E+01	3.2878E+01	3.9812E+01	4.0045E+01	3.709E+01
Am-241 #B	6.4519E-02	6.4546E-02	2.9511E+00	2.9511E+00	3.553E+00
Am-243 #B	0.0000E+00	0.0000E+00	1.4551E+00	1.4551E+00	2.410E+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 (30.3 to 2035.6 keV) 6.436E+02 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 7.0054004E+02 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	Analysis SOP	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854017	Collection Date	11/18/2016 12:22
Batch ID	33643	Method	EPA 901.1
A-code	9011 SING	Analysis Date	2/22/17 8:31
Client ID	WESTON-NJ	Matrix	SL
Analyst	MAH	HBN	246280

Test	Activity	Uncertainty	MDC
Bismuth-212	58.144	10.790	5.005
Cesium-137	0.000	0.091	0.520
Lead-212	43.400	6.013	0.986
Potassium-40	29.517	6.155	3.048
Protactinium-234M	0.897	41.284	44.930
Radium-226	7.840	1.448	0.837
Radium-228	41.051	5.833	1.222
Thallium-208	14.038	2.065	0.514
Thorium-228	60.470	22.484	30.590
Thorium-234	8.073	8.388	10.160
Uranium-235	0.000	2.656	6.571

ORTEC g v - i (3263) Env32 G703W047 2/22/2017 8:49:09 AM Page 1
Pace Analytical Spectrum name: 30204854017.An1

Sample description
WL 33843

Spectrum Filename: C:\user\30204854017.An1

Acquisition information
Start time: 2/22/2017 8:31:09 AM
Live time: 900
Real time: 906
Dead time: 0.62 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can), RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G703W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.1299E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.1299E+02) =
4.6951E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/22/17

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:49:09 AM Page 2
Pace Analytical Spectrum name: 30204854017.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 12:22:00 PM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(BOZ).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1538

***** 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. pCi/G	Nuc
46.58	76.	38.75	0.58	2.158E-02	46.54	4.250	PBC<MDA	Pb210
63.37	101.	51.48	0.97	3.668E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	1.441E+02	Th232
					63.81	0.267	1.441E+02	Th232
					63.29	4.800	PBC<MDA	Th234
63.51	92.	57.52	0.97	3.693E-02	63.29	4.800	PBC<MDA	Th234
					63.81	0.267	1.311E+02	Th232
74.77	1292.	4.35	0.98	4.123E-02	74.66	68.200	6.480E+00	Am243
					74.81	10.400	4.565E+01	Pb212
77.13	2142.	2.84	0.98	4.197E-02	77.11	17.500	4.518E+01	Pb212
					79.13	6.600	1.076E+02	Ag108M
84.19	220.	16.72	0.99	4.387E-02	83.78	24.900	2.875E+00	Ra223
					84.37	1.266	6.054E+01	Th228
87.18	658.	6.44	0.99	4.454E-02	86.54	30.700	7.038E+00	Eu155
					87.30	7.800	2.937E+01	Pb212
					88.03	3.610	6.636E+01	Cd109
89.99	510.	7.65	0.99	4.509E-02	89.95	3.560	4.479E+01	U235
					89.95	3.560	4.479E+01	U235
93.26	508.	7.80	1.00	4.566E-02	92.60	2.800	5.483E+01	Th234
					92.60	2.800	5.483E+01	Th234
					92.59	5.600	2.751E+01	U238
94.87	68.	54.17	1.00	4.591E-02	94.90	11.300	PBC<MDA	Ra223
99.45	152.	26.79	0.99	4.650E-02				
105.15	228.	18.10	1.39	4.704E-02	105.31	21.200	3.342E+00	Eu155
114.89	76.	45.01	0.74	4.745E-02				
129.05	275.	13.09	1.10	4.720E-02				
131.57	69.	59.62	1.03	4.707E-02	131.61	0.135	PBC<MDA	Th228

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ORTEC g v - i (3263) Env32 G701W047 2/22/2017 8:49:09 AM Page 3
Pace Analytical Spectrum name: 30204854017.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
135.08	60.	47.35	0.39	4.686E-02	136.47	10.680	2.157E+00	Co57

153.94	176.	22.63	1.27	4.519E-02	154.21	5.620	9.869E+00	Ra223
208.93	446.	10.69	1.22	3.876E-02				
215.50	48.	55.10	0.39	3.795E-02	215.99	0.263	PBC<MDA	Th228
238.36	4308.	1.66	1.12	3.551E-02	238.63	43.300	4.344E+01	Pb212
241.03	474.	8.75	1.13	3.523E-02	241.00	3.900	5.348E+01	Ra224
					241.92	7.470	2.539E+01	Ra226
270.02	383.	9.25	1.00	3.244E-02	269.46	13.700	1.223E+01	Ra223
275.97	242.	13.21	1.45	3.183E-02	276.40	7.164	1.518E+01	Ba133
					277.36	6.310	1.867E+01	Tl208
					276.40	7.164	1.518E+01	Ba133
295.03	314.	10.66	1.16	3.034E-02	295.22	19.200	7.590E+00	Ra226
					295.96	28.670	1.255E+01	Ir192
					295.96	28.670	1.255E+01	Ir192
299.94	293.	11.82	1.02	2.996E-02	300.00	2.300	6.038E+01	Ac227
					300.00	2.300	6.038E+01	Ac227
327.72	287.	12.69	1.38	2.798E-02	329.85	2.700	5.429E+01	Ac227
					330.00	1.300	1.119E+02	Pa231
					328.76	20.300	1.306E+03	La140
338.15	964.	4.56	0.96	2.730E-02	338.32	11.300	4.546E+01	Ac228
340.35	37.	64.83	1.21	2.715E-02	340.55	42.200	PBC<MDA	Cs136
343.92	48.	50.71	1.21	2.692E-02	344.28	26.600	PBC<MDA	Eu152
					344.28	26.600	PBC<MDA	Eu152
351.77	596.	6.39	1.28	2.648E-02	351.99	37.100	8.503E+00	Ra226
356.17	34.	70.19	1.22	2.623E-02	356.02	62.050	PBC<MDA	Ba133
					356.02	62.050	3.011E-01	Ba133
427.41	26.	82.95	1.28	2.273E-02	427.88	29.600	PBC<MDA	Sb125
					427.88	29.600	5.931E-01	Sb125
462.84	261.	10.66	1.54	2.140E-02	463.36	10.500	1.751E+01	Sb125
					463.36	10.500	1.751E+01	Sb125
510.52	546.	9.66	1.04	1.986E-02				
530.01	36.	58.53	1.37	1.931E-02	529.87	87.000	HL>Cutoff	I133
					529.87	87.000	HL>Cutoff	I133
583.01	1377.	3.21	1.63	1.799E-02	583.19	84.500	1.404E+01	Tl208
604.16	39.	50.50	1.43	1.751E-02	604.72	97.620	PBC<MDA	Cs134
					604.72	97.620	3.529E-01	Cs134
609.22	416.	6.95	1.66	1.741E-02	609.31	44.800	7.458E+00	Ra226
645.75	31	67.59	1.46	1.669E-02	645.85	7.380	PBC<MDA	Sb124
695.55	38.	57.66	1.50	1.581E-02	695.88	3.000	PBC<MDA	Te129M
					695.88	3.000	PBC<MDA	Te129M
702.52	40.	56.13	1.50	1.571E-02	702.62	97.900	PBC<MDA	Nb94
					702.62	97.900	3.622E-01	Nb94
706.93	27.	86.49	1.51	1.564E-02	706.68	16.330	PBC<MDA	Ag110M
					706.68	16.330	PBC<MDA	Ag110M
727.04	378.	6.48	1.63	1.533E-02	727.33	6.580	5.814E+01	Bi212
755.68	25.	89.14	1.54	1.490E-02	756.73	54.460	PBC<MDA	Zr95
					756.73	54.460	PBC<MDA	Zr95
772.36	58.	32.71	1.09	1.468E-02	772.60	75.600	HL>Cutoff	I132

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
795.13	192.	10.73	1.39	1.439E-02	795.86	85.530	2.398E+00	Cs134
					795.86	85.530	2.398E+00	Cs134
801.30	18.	84.33	1.58	1.430E-02	801.95	8.690	PBC<MDA	Cs134
					801.95	8.690	PBC<MDA	Cs134
819.03	33.	29.96	0.45	1.410E-02	818.51	99.700	5.215E+01	Cs136
835.48	74.	25.47	1.60	1.390E-02	834.85	99.976	9.265E-01	Mn54
860.30	240.	7.15	1.54	1.361E-02	860.56	12.420	2.202E+01	Tl208
873.48	21.	62.00	1.63	1.347E-02	871.09	99.900	PBC<MDA	Nb94
					873.19	12.200	1.840E+00	Eu154
					873.19	12.200	1.840E+00	Eu154

875.05	28.	43.29	1.63	1.345E-02	875.33	4.510	HL>Cutoff	I133
					875.33	4.510	HL>Cutoff	I133
898.54	16.	80.31	1.65	1.321E-02	898.04	93.700	PBC<MDA	Y88
					898.04	93.700	PBC<MDA	Y88
911.13	985.	3.47	1.78	1.308E-02	911.21	26.600	4.111E+01	Ac228
964.58	193.	10.26	1.70	1.257E-02	964.13	14.340	1.529E+01	Eu152
					964.13	14.340	1.529E+01	Eu152
969.03	503.	5.82	2.20	1.253E-02	968.97	16.200	3.608E+01	Ac228
1110.78	21.	65.67	1.80	1.139E-02	1112.12	13.550	PBC<MDA	Eu152
					1112.12	13.550	1.945E+00	Eu152
1120.26	92.	15.88	1.59	1.133E-02	1120.29	14.800	7.728E+00	Ra226
1173.01	13.	78.91	1.84	1.097E-02	1173.24	99.974	PBC<MDA	Co60
					1173.24	99.974	PBC<MDA	Co60
1236.52	28.	57.51	1.88	1.058E-02	1235.36	20.000	PBC<MDA	Cs136
					1238.28	66.070	PBC<MDA	Co56
1274.20	15.	77.93	1.91	1.035E-02	1274.44	35.000	PBC<MDA	Eu154
					1274.53	99.944	2.242E-01	Na22
					1274.53	99.944	2.242E-01	Na22
					1274.44	35.000	6.098E-01	Eu154
1274.20	15.	77.93	1.91	1.035E-02	1274.44	35.000	6.098E-01	Eu154
					1274.53	99.944	2.242E-01	Na22
1408.11	14.	83.07	1.99	9.634E-03	1408.01	20.870	PBC<MDA	Eu152
					1408.01	20.870	1.019E+00	Eu152
1460.55	210.	8.07	1.62	9.379E-03	1461.00	10.670	2.952E+01	K40
1764.51	81.	11.30	0.54	8.138E-03	1764.49	15.360	9.187E+00	Ra226
1835.76	17.	44.73	2.23	7.888E-03	1836.06	99.200	5.689E-01	Y88

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

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 2 Sigma %	FWHM keV	Suspected Nuclide	
359.39	90.00	490.	526.	1.166E+04	14.76	0.994	-	D
372.46	93.27	516.	522.	1.143E+04	15.11	0.996	-	D
397.28	99.45	428.	152.	3.258E+03	53.59	0.990	-	
459.00	114.89	342.	76.	1.595E+03	90.01	0.736	-	sM
515.64	129.05	340.	275.	5.826E+03	26.17	1.097	-	M

C

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Pace Analytical Spectrum name: 30204854017.An1

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
539.74	135.08	262.	60.	1.277E+03	94.70	0.385	-	sM
835.07	208.93	406.	446.	1.151E+04	21.38	1.219	-	s
1199.02	299.94	188.	293.	9.786E+03	23.64	1.022	-	s
1310.51	327.72	154.	225.	8.043E+03	20.52	1.201	-	D
1850.49	462.84	110.	261.	1.220E+04	21.32	1.538	-	sM
2041.18	510.52	220.	546.	2.749E+04	19.32	1.040	-	sM
3179.65	795.13	43.	192.	1.332E+04	21.46	1.394	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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	2 Sigma %	kev
Pb-210	185.88	46.58	265.	76.	0.085	77.50	0.583s
Am-241	237.00	59.37	688.	-66.	-0.073	151.81	0.966
Th-234	253.00	63.37	709.	101.	0.112	102.97	0.970s
Th-232	253.56	63.51	733.	92.	0.102	115.05	0.970s
Pb-212	298.75	74.81	971.	1164.	1.294	6.92	0.980D
Pb-212	307.95	77.13	805.	2121.	2.357	5.76	0.982D
Ra-223	334.62	83.78	713.	54.	0.060	143.41	0.988D
Th-228	336.99	84.37	527.	206.	0.229	34.41	0.988D
Eu-155	345.68	86.54	1071.	153.	0.170	62.81	0.990D
Pb-212	348.70	87.30	669.	558.	0.619	15.62	0.991D
Cd-109	351.63	88.03	1177.	94.	0.104	105.53	0.992D
U-235	359.31	89.95	592.	504.	0.560	20.91	0.993
Ra-223	379.08	94.90	638.	68.	0.075	108.33	0.998D
Eu-155	420.06	105.15	400.	228.	0.253	36.20	1.388s
Th-228	525.70	131.57	423.	69.	0.077	119.23	1.031
Ra-223	615.15	153.94	370.	176.	0.196	45.26	1.267s
Th-228	861.32	215.50	216.	48.	0.053	110.20	0.394s
Pb-212	953.83	238.63	415.	4299.	4.776	3.53	1.124D
Ra-224	963.30	241.00	674.	424.	0.472	19.84	1.126D
Ra-226	966.98	241.92	562.	143.	0.159	49.61	1.127D
Ra-223	1079.09	269.95	223.	333.	0.370	21.68	0.962
Cs-136	1093.56	273.57	256.	-44.	-0.048	153.34	1.155
Tl-208	1107.13	276.97	180.	242.	0.268	26.48	1.451s
Ra-226	1179.35	295.03	188.	313.	0.348	21.40	1.155
Ac-227	1199.00	299.94	225.	221.	0.245	30.87	1.177s
Ir-192	1266.17	316.74	244.	-38.	-0.042	171.61	1.191s
Ac-228	1352.50	338.32	154.	867.	0.964	7.91	1.209D

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Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Cs-136	1361.39	340.55	262.	37.	0.041	129.67	1.211D
Eu-152	1374.90	343.92	131.	48.	0.053	101.42	1.215s
Ra-226	1406.26	351.77	180.	592.	0.658	12.87	1.285s
Ba-133	1423.86	356.17	130.	34.	0.038	140.38	1.224
Sb-125	1708.80	427.41	102.	26.	0.029	165.91	1.284s
Ag-108M	1733.00	433.46	168.	-31.	-0.034	180.99	1.289s
Sb-125	1850.68	462.89	126.	244.	0.271	23.34	1.313s
I-133	2119.14	530.01	85.	36.	0.040	117.07	1.367s
Tl-208	2331.13	583.01	105.	1375.	1.528	6.44	1.628
Cs-134	2415.73	604.16	73.	39.	0.044	101.00	1.427s
Ra-226	2435.97	609.22	87.	413.	0.458	14.05	1.661
Sb-124	2582.08	645.75	85.	31.	0.034	135.17	1.459s
Te-129M	2781.31	695.55	88.	38.	0.043	115.33	1.498s
Nb-94	2809.20	702.52	88.	40.	0.044	112.26	1.503s
Ag-110M	2826.84	706.93	100.	27.	0.030	172.99	1.506s
Bi-212	2907.26	727.04	41.	378.	0.420	12.98	1.632
Zr-95	3021.85	755.68	92.	25.	0.028	178.28	1.544s
I-132	3088.59	772.36	61.	58.	0.064	65.42	1.092s
Cs-134	3179.34	795.05	71.	164.	0.182	28.10	1.573s
Cs-134	3204.35	801.30	42.	18.	0.020	168.67	1.578s
Cs-136	3275.26	819.03	18.	33.	0.037	59.92	0.452s
Mn-54	3341.09	835.48	54.	74.	0.082	50.94	1.602
Tl-208	3440.39	860.30	10.	240.	0.267	14.30	1.544
Eu-154	3493.12	873.48	27.	21.	0.023	123.99	1.630s
I-133	3499.38	875.05	22.	28.	0.032	86.59	1.632s
Y-88	3593.38	898.54	28.	16.	0.018	160.63	1.648s
Ac-228	3643.73	911.13	32.	983.	1.092	6.95	1.782
Eu-152	3857.59	964.58	36.	193.	0.214	20.51	1.696s

Ac-228	3875.37	969.03	74.	503.	0.559	11.63	2.203s
Eu-152	4442.56	1110.78	29.	21.	0.023	131.33	1.799s
Ra-226	4480.50	1120.26	18.	92.	0.102	31.77	1.594
Co-60	4691.58	1173.01	16.	13.	0.014	157.82	1.840s
Cs-136	4945.72	1236.52	36.	28.	0.031	115.03	1.881s
Eu-154	5098.52	1274.20	21.	15.	0.017	155.86	1.906s
Na-22	5096.52	1274.20	21.	15.	0.017	155.86	1.906s
Eu-152	5632.42	1408.11	21.	14.	0.016	166.14	1.990s
K-40	5842.28	1460.55	16.	210.	0.233	16.14	1.624s
Ra-226	7058.99	1764.51	2.	81.	0.090	22.59	0.535s
Y-88	7344.22	1835.76	6.	17.	0.019	89.46	2.235s

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

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***** 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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Code	MDA Value pCi/G	COMMENTS
Be-7	C	4.6603E+00					5.34E+01
			477.56	4.660E+00	&(	1.200E+01	1.13E+02 1.03E+01 G K
Na-22	C	2.2423E-01					9.50E+02
			1274.53	2.242E-01	?(	3.494E-01	7.79E+01 9.99E+01 G K
K-40	N	2.9517E+01					4.68E+11
			1461.00	2.952E+01	@(P	3.048E+00	8.07E+00 1.07E+01 G K
Mn-54	C	9.2651E-01					3.12E+02
			834.85	9.265E-01	(	4.644E-01	2.55E+01 1.00E+02 G K
Co-56	C	5.4113E-01					7.73E+01
			1238.28	5.411E-01	%(	1.729E+00	1.60E+02 6.61E+01 G K
			1771.35	0.000E+00	& P	6.773E+00	1.00E+03 1.55E+01 G
Co-57	C	-9.5326E-02					2.72E+02
			122.06	-9.533E-02	%(	4.825E-01	2.08E+02 8.56E+01 G K
			136.47	-1.135E+00	&	3.663E+00	1.33E+02 1.07E+01 G
Co-58	C	-3.2758E-01					7.08E+01
			810.78	-3.276E-01	%(	1.070E+00	1.52E+02 9.94E+01 G K
Co-60	F	8.4784E-02					1.92E+03
			1332.50	0.000E+00	%(P	4.914E-01	1.00E+03 1.00E+02 G K
			1173.24	1.696E-01	?(P	2.862E-01	7.89E+01 1.00E+02 G
Y-88	C	4.5839E-01					1.07E+02
			1836.06	5.689E-01	&(P	4.765E-01	4.47E+01 9.92E+01 G K
			898.04	3.434E-01	?(P	5.804E-01	8.03E+01 9.37E+01 G
Nb-94	I	1.7927E-01					7.41E+06
			871.09	0.000E+00	%(P	4.698E-01	1.00E+03 9.99E+01 G K
			702.62	3.622E-01	?(	4.246E-01	5.61E+01 9.79E+01 G

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Zr-95     I   1.2299E+00                                                  6.40E+01
                          756.73 1.230E+00 &(P 2.324E+00 8.91E+01 5.45E+01 G K
                          724.20-5.471E-01 %   2.652E+00 2.25E+02 4.42E+01 G

Ru-103    I   6.2417E-01                                                  3.93E+01
                          497.08 6.242E-01 &(P 1.896E+00 1.32E+02 9.10E+01 G K
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Pace Analytical Spectrum name: 30204854017.An1

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Cd-109    F   9.4528E+00                                                  4.64E+02
                           88.03 9.453E+00  (  1.639E+01 5.28E+01 3.51E+00 G K

Ag-110M   F   2.8748E-01                                                  2.50E+02
                          657.76 0.000E+00 %(P 6.463E-01 1.00E+03 9.40E+01 G K
                         1505.04-1.935E+00 %   5.494E+00 1.46E+02 1.29E+01 G
                         1384.30 2.805E-01 % P 2.254E+00 3.90E+02 2.41E+01 G
                          937.49-5.465E-01 %   1.553E+00 1.35E+02 3.41E+01 G
                          884.68 2.775E-01 & P 5.887E-01 1.01E+02 7.22E+01 G
                          763.94-7.486E-02 %   3.173E+00 1.97E+03 2.21E+01 G
                          744.28 0.000E+00 % P 1.355E+01 1.00E+03 4.70E+00 G
                          706.68 1.942E+00 ?(P 3.552E+00 8.65E+01 1.63E+01 G

Sn-113    F  -3.7873E-01                                                  1.15E+02
                          391.69-3.787E-01 %(  1.159E+00 1.36E+02 6.40E+01 G K

Sb-124    F   6.8652E-01                                                  6.02E+01
                          602.73-7.016E-02 %(  1.325E+00 8.48E+02 9.78E+01 G K
                          645.85 1.071E+01 ?(P 1.576E+01 6.76E+01 7.38E+00 G
                          722.79 0.000E+00 %   1.652E+01 1.00E+03 1.08E+01 G
                         1690.98 3.277E-02 % P 2.713E+00 4.13E+03 4.73E+01 G

Sb-125    I   4.7240E+00                                                  1.01E+03
                          427.88 5.931E-01 *(  1.111E+00 8.30E+01 2.96E+01 G K
                          176.31 1.468E+00 % P 4.789E+00 1.34E+02 6.82E+00 G
                          463.36 1.637E+01 @(  3.691E+00 1.17E+01 1.05E+01 G
                          600.60 0.000E+00 % P 2.317E+00 1.00E+03 1.79E+01 G
                          635.95 8.789E-01 % P 3.760E+00 1.92E+02 1.13E+01 G

Te-129    I   1.2294E-01                                                  3.36E+01
                          459.60 1.229E-01 %(P 3.057E+01 1.07E+04 7.70E+00 G K
                          487.39-1.220E+01 &   1.787E+02 6.34E+02 1.42E+00 G

Te-129M   I   8.2488E+01                                                  3.36E+01
                          695.88 8.249E+01  (P 9.940E+01 5.77E+01 3.00E+00 G K

J-131     I  -8.3522E+02                                                  8.02E+00
                          364.49-8.352E+02 &(  1.936E+03 1.03E+02 8.17E+01 G K
                          636.99 4.539E+03 %   2.145E+04 2.12E+02 7.17E+00 G
                          284.30-6.648E+03 &   2.278E+04 1.46E+02 6.14E+00 G

I-132     I   7.3130E-01                                                  3.20E+00
                          772.60 7.313E-01  (P 4.984E-01 3.27E+01 7.56E+01 G K
                          522.65 0.000E+00 % P 2.458E+00 1.00E+03 1.60E+01 G
                          630.19-6.032E-01 %   3.072E+00 2.29E+02 1.33E+01 G
                          954.55 6.877E-01 % P 1.843E+00 1.25E+02 1.76E+01 G
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Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Te-132	I	1.5801E-01					3.20E+00	
			228.16	1.580E-01	%(P	3.791E-01	1.03E+02	8.80E+01 G K
I-133	I	6.1412E-01					8.67E-01	
			529.87	3.025E-01	?(P	3.832E-01	5.85E+01	8.70E+01 G K
			875.33	6.625E+00	?(	5.768E+00	4.33E+01	4.51E+00 G
Ba-133	F	3.0115E-01					3.84E+03	
			356.02	3.011E-01	&(	4.919E-01	7.02E+01	6.20E+01 G K
			81.00	0.000E+00	% P	1.258E+00	1.00E+03	3.41E+01 G
			302.85	4.211E-01	&	1.675E+00	1.69E+02	1.83E+01 G
			276.40	0.000E+00	% P	4.108E+00	1.00E+03	7.16E+00 G
			383.85	0.000E+00	% P	4.527E+00	1.00E+03	8.94E+00 G
Cs-134	I	1.1970E+00					7.32E+02	
			604.72	3.529E-01	?(	3.828E-01	5.05E+01	9.76E+01 G K
			801.95	2.249E+00	?(P	4.072E+00	8.43E+01	8.69E+00 G
			795.86	2.054E+00	?(P	5.258E-01	1.40E+01	8.55E+01 G
			569.33	7.963E-01	% P	2.946E+00	1.67E+02	1.54E+01 G
Cs-136	F	5.7472E+01					1.32E+01	
			818.51	5.215E+01	(P	3.478E+01	3.00E+01	9.97E+01 G K
			176.60	1.827E+02	% P	4.676E+02	1.06E+02	3.00E+01 G
			273.65	-2.679E+02	-	4.763E+02	7.67E+01	1.11E+01 G
			340.55	7.005E+01	(P	1.498E+02	6.48E+01	4.22E+01 G
			1048.07	0.000E+00	%	8.119E+01	1.00E+03	8.00E+01 G
			1235.36	2.861E+02	+ P	3.200E+02	5.75E+01	2.00E+01 G
Ba-140	I	6.4626E+00					1.28E+01	
			537.26	6.463E+00	%(	2.964E+02	2.06E+03	2.44E+01 G K
			162.66	0.000E+00	& P	9.593E+02	1.00E+03	6.22E+00 G
La-140	I	3.2352E+01					1.28E+01	
			1596.21	3.235E+01	%(	8.364E+01	1.31E+02	9.54E+01 G K
			487.02	-6.893E-00	%	1.413E+02	8.86E+02	4.55E+01 G
			815.77	-3.402E+01	%	3.007E+02	4.03E+02	2.33E+01 G
			328.76	0.000E+00	% P	3.054E+02	1.00E+03	2.03E+01 G
Ce-141	I	9.1567E-01					3.25E+01	
			145.44	9.157E-01	%(	5.090E+00	2.29E+02	4.82E+01 G K
Ce-144	I	1.3103E+00					2.85E+02	
			133.51	1.310E+00	%(	3.265E+00	1.03E+02	1.11E+01 G K
Eu-152	F	2.8216E+00					4.95E+03	
			121.78	1.680E-02	%(P	1.127E+00	2.75E+03	2.84E+01 G K
			1408.01	1.019E+00	?(	1.698E+00	8.31E+01	2.09E+01 G

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
			1112.12	1.945E+00	?(	2.576E+00	6.57E+01	1.36E+01 G
			1085.91	0.000E+00	%	4.753E+00	1.00E+03	9.92E+00 G
			964.13	1.529E+01	(P	2.434E+00	1.03E+01	1.43E+01 G
			344.28	9.572E-01	?(P	1.118E+00	5.07E+01	2.66E+01 G
			244.70	1.493E+00	% P	3.859E+00	1.11E+02	7.49E+00 G
Eu-154	I	4.9875E-01					3.14E+03	

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                                 123.07 0.000E+00 &(P 8.041E-01 1.00E+03 4.06E+01 G K
                                1274.44 6.098E-01 ?(  9.503E-01 7.79E+01 3.50E+01 G
                                1004.72 0.000E+00 % P 2.342E+00 1.00E+03 1.79E+01 G
                                 996.26 1.669E-01 %   3.212E+00 8.81E+02 1.05E+01 G
                                 873.19 1.840E+00 ?(  2.359E+00 6.20E+01 1.22E+01 G
                                 723.30 0.000E+00 %   3.804E+00 1.00E+03 2.01E+01 G
                                 247.93 1.409E-01 % P 4.500E+00 1.35E+03 6.91E+00 G

Eu-155    I   2.3351E+00                                          1.74E+03
                                  86.54 1.640E+00  (P 1.668E+00 3.14E+01 3.07E+01 G K
                                 105.31 3.342E+00 *(P 1.410E+00 1.81E+01 2.12E+01 G

Ir-192    F  -5.5109E-01                                          7.38E+01
                                 316.51-5.511E-01 ?(  1.099E+00 8.58E+01 8.28E+01 G
                                 468.07 1.681E-01 & P 1.837E+00 4.74E+02 4.78E+01 G
                                 308.46-1.222E+00 %   2.880E+00 1.01E+02 3.00E+01 G
                                 295.96 0.000E+00 % P 2.698E+00 1.00E+03 2.87E+01 G

Hg-203    F   4.7402E-01                                          4.66E+01
                                 279.20 4.740E-01 %(P 1.501E+00 1.35E+02 8.15E+01 G K

Tl-208    N   1.4038E+01                                          6.98E+02
                                 583.19 1.404E+01  (P 5.139E-01 3.22E+00 8.45E+01 G K
                                 860.56 2.202E+01 + P 1.596E+00 7.15E+00 1.24E+01 G
                                 277.36 1.867E+01 + P 5.048E+00 1.32E+01 6.31E+00 G

Pb-210    N   1.1803E+01                                          8.14E+03
                                  46.54 1.180E+01  (P 1.218E+01 3.87E+01 4.25E+00 G K

Bi-212    N   5.8144E+01                                          6.98E+02
                                 727.33 5.814E+01  (P 5.005E+00 6.49E+00 6.58E+00 G K
                                1620.50 5.392E+00 %   4.253E+01 4.01E+02 1.49E+00 G

Pb-212    N   4.3400E+01                                          6.98E+02
                                 238.63 4.340E+01  (P 9.860E-01 1.67E+00 4.33E+01 G K
                                  77.11 4.480E+01   P 2.849E+00 2.88E+00 1.75E+01 GA
                                  74.81 4.209E+01 } P 5.347E+00 3.46E+00 1.04E+01 GA
                                  87.30 2.488E+01 -   5.501E+00 7.81E+00 7.80E+00 GA
C

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 Pace Analytical                  Spectrum name: 30204854017.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ra-223    N   1.0406E+01                                          7.96E+03
                                 269.46 1.063E+01  (  2.311E+00 1.08E+01 1.37E+01 G K
                                  83.78 7.000E-01 -   1.659E+00 7.17E+01 2.49E+01 G
                                 323.87 0.000E+00 % P 9.568E+00 1.00E+03 3.93E+00 G
                                 154.21 9.869E+00 *(P 5.168E+00 2.26E+01 5.62E+00 G
                                  94.90 1.855E+00 - P 3.301E+00 5.42E+01 1.13E+01 G
                                  81.07 0.000E+00 % P 2.776E+00 1.00E+03 1.50E+01 G

Ra-224    N   4.7904E+01                                          6.98E+02
                                 241.00 4.790E+01  (P 1.396E+01 9.92E+00 3.90E+00 G K

Ra-226    N   7.8404E+00                                          5.84E+05
                                 609.31 7.458E+00  (P 8.366E-01 7.02E+00 4.48E+01 G K
                                1764.49 9.187E+00 + P 9.612E-01 1.13E+01 1.54E+01 G
                                 295.22 7.590E+00  (P 1.611E+00 1.07E+01 1.92E+01 G
                                1120.29 7.728E+00  (P 1.897E+00 1.59E+01 1.48E+01 G
                                 351.99 8.503E+00 @(P 9.368E-01 6.44E+00 3.71E+01 G
                                 241.92 7.710E+00  (P 6.078E+00 2.48E+01 7.47E+00 G
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Ac-227    N    7.3644E+00                                          7.95E+03
                          235.97 2.289E-01 %(P 3.308E+00 6.17E+02 1.23E+01 G K
                          256.25-1.647E+00 %   4.632E+00 1.20E+02 7.00E+00 G
                          300.00 4.552E+01 @(P 1.500E+01 1.54E+01 2.30E+00 G
                          329.85 0.000E+00 %   2.120E+01 1.00E+03 2.70E+00 G

Ac-228    N    4.1051E+01                                          2.10E+03
                          911.21 4.111E+01  (P 1.222E+00 3.48E+00 2.66E+01 G K
                          968.97 3.608E+01 - P 3.061E+00 5.82E+00 1.62E+01 G
                          338.32 4.092E+01  (P 2.855E+00 3.95E+00 1.13E+01 G

Th-228    N    6.0470E+01                                          6.98E+02
                           84.37 5.757E+01  (P 3.059E+01 1.72E+01 1.27E+00 G K
                          215.99 7.444E+01  (P 1.106E+02 5.51E+01 2.63E-01 G
                          166.41 1.673E+01 % P 3.113E+02 7.60E+02 1.08E-01 G
                          131.61 1.677E+02 + P 2.396E+02 5.96E+01 1.35E-01 G

Pa-231    N   -7.1420E+00                                          1.20E+07
                          283.70-7.142E+00 %(  2.244E+01 1.34E+02 1.60E+00 G K
                          330.00 0.000E+00 %   4.320E+01 1.00E+03 1.30E+00 G

Pa-234M   N    8.9723E-01                                          1.63E+12
                                                                  Energy duplication
                         1001.03 8.972E-01 &(P 4.493E+01 2.30E+03 8.37E-01 G

Th-230    N    1.9366E+01                                          2.75E+07
                           67.67 1.937E+01 %(  1.346E+02 2.87E+02 3.80E-01 G K
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     ORTEC g v - i (3263) Env32  G701W047  2/22/2017 8:49:09 AM    Page 12
 Pace Analytical                  Spectrum name: 30204854017.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Th-232    N    1.3108E+02                                          4.17E+12
                           63.81 1.311E+02 *(  1.843E+02 5.75E+01 2.67E-01 G K

Th-234    N    8.0731E+00                                          1.63E+12
                           63.29 8.073E+00 *(P 1.016E+01 5.15E+01 4.80E+00 G K
                           92.60 0.000E+00 & P 1.691E+01 1.00E+03 2.80E+00 G

U-238     N    8.9402E-01                                          1.63E+12
                                                                  Energy duplication
                         1001.03 8.940E-01 &(P 4.477E+01 2.30E+03 8.40E-01 G K
                           92.59 0.000E+00 & P 6.817E+00 1.00E+03 5.60E+00 GA

Am-241    T   -7.3435E-01                                          1.58E+05
                           59.54-7.343E-01 &(  1.400E+00 7.59E+01 3.63E+01 G K
   ( - 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 2 Sigma %	Activity	
Am-241	59.37	688.	-66.	-0.073	151.81	-7.343E-01	
Th-234	63.37	709.	101.	0.112	102.97	8.073E+00	P
Th-232	63.51	733.	92.	0.102	115.05	1.311E+02	
U-235	89.95	592.	504.	0.560	20.91	4.426E+01	
Ac-227	299.94	225.	221.	0.245	30.87	4.552E+01	P
Ir-192	316.74	244.	-38.	-0.042	171.61	-5.511E-01	
Eu-152	343.92	131.	48.	0.053	101.42	9.572E-01	P
Ba-133	356.17	130.	34.	0.038	140.38	3.011E-01	
Sb-125	427.41	102.	26.	0.029	165.91	5.931E-01	
Ag-108M	433.46	168.	-31.	-0.034	180.99	-2.149E-01	
Sb-125	462.89	126.	244.	0.271	23.34	1.637E+01	
I-133	530.01	85.	36.	0.040	117.07	0.000E+00	P
Cs-134	604.16	73.	39.	0.044	101.00	3.529E-01	
Te-129M	695.55	88.	38.	0.043	115.33	8.249E+01	P
Nb-94	702.52	88.	40.	0.044	112.26	3.622E-01	
Ag-110M	706.93	100.	27.	0.030	172.99	1.942E+00	P
Zr-95	755.68	92.	25.	0.028	178.28	1.230E+00	P
Cs-134	795.05	71.	164.	0.182	28.10	2.054E+00	P
Cs-134	801.30	42.	18.	0.020	168.67	2.249E+00	P
Eu-154	873.48	27.	21.	0.023	123.99	1.840E+00	
I-133	875.05	22.	28.	0.032	86.59	0.000E+00	
Y-88	898.54	28.	16.	0.018	160.63	3.414E-01	P
Eu-152	964.58	36.	193.	0.214	20.51	1.529E+01	P
Eu-152	1110.78	29.	21.	0.023	131.33	1.945E+00	
Co-60	1173.01	16.	13.	0.014	157.82	1.696E-01	P
Eu-154	1274.20	21.	15.	0.017	155.86	6.098E-01	
Na-22	1274.20	21.	15.	0.017	155.86	2.242E-01	
Eu-152	1408.11	21.	14.	0.016	166.14	1.019E+00	
Y-88	1835.75	6.	17.	0.019	89.46	5.689E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G

Be-7	#B	1.3432E+00	4.6603E+00	1.0568E+01	1.0586E+01	1.200E+01
Na-22	#A	2.0908E-01	2.2423E-01	3.4948E-01	3.5071E-01	3.494E-01
K-40	#	2.9517E+01	2.9517E+01	4.7651E+00	6.1554E+00	3.048E+00
Sc-46	#B	0.0000E+00	0.0000E+00	1.4815E-01	1.4815E-01	9.323E-01
Cr-51	#B	0.0000E+00	0.0000E+00	7.9385E+00	7.9387E+00	4.030E+01
Mn-54		7.4898E-01	9.2651E-01	4.7200E-01	4.8767E-01	4.644E-01
Co-56	#B	2.2905E-01	5.4113E-01	1.7346E+00	1.7360E+00	1.729E+00

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Pace Analytical Spectrum name: 30204854017.Anl

Co-57	#B	-7.4655E-02	-9.5326E-02	3.9747E-01	3.9767E-01	4.825E-01
Co-58	#B	-1.2822E-01	-3.2738E-01	9.9362E-01	9.9457E-01	1.070E+00
Fe-59	#B	0.0000E+00	0.0000E+00	1.9348E-01	1.9348E-01	3.697E+00
Co-60	#B	8.1908E-02	8.4784E-02	1.3381E-01	1.3427E-01	4.914E-01
Zn-65	#B	0.0000E+00	0.0000E+00	9.1053E-02	9.1055E-02	9.722E-01
Y-88	#A	2.4588E-01	4.5839E-01	4.1005E-01	4.1519E-01	4.765E-01
Nb-94	#B	1.7927E-01	1.7927E-01	2.0125E-01	2.0264E-01	4.698E-01
Zr-95	#A	4.3572E-01	1.2299E+00	2.1925E+00	2.1986E+00	2.324E+00
Nb-95	#B	0.0000E+00	0.0000E+00	1.0220E+00	1.0220E+00	4.254E+00
Ru-103	#B	1.1493E-01	6.2417E-01	1.6511E+00	1.6531E+00	1.896E+00
Ag-108M	#B	0.0000E+00	0.0000E+00	7.5539E-02	7.5541E-02	6.496E-01
Ru-106	#B	0.0000E+00	0.0000E+00	1.1193E+00	1.1193E+00	5.231E+00
Cd-109	A	8.1915E+00	9.4528E+00	9.9756E+00	1.0064E+01	1.639E+01
Ag-110M	#B	2.2035E-01	2.8748E-01	4.9731E-01	4.9877E-01	6.463E-01
Sn-113	#B	-2.1264E-01	-3.7873E-01	1.0273E+00	1.0285E+00	1.159E+00
Sb-124	#B	2.2772E-01	6.8652E-01	9.2798E-01	9.3242E-01	1.325E+00
Sb-125	#	4.4227E+00	4.7240E+00	1.1027E+00	1.2663E+00	1.111E+00
Te-129	#B	1.7023E-02	1.2294E-01	2.6307E+01	2.6307E+01	3.057E+01
Te-129M	#A	1.1422E+01	8.2488E+01	9.5134E+01	9.5760E+01	9.940E+01
I-131	#B	-2.1109E-01	-8.3522E+02	1.7227E+03	1.7262E+03	1.936E+03
I-132		7.3130E-01	>12 Halflives	4.7839E-01	4.8811E-01	4.984E-01
Te-132	#B	1.5801E-01	>12 Halflives	3.2584E-01	3.2653E-01	3.791E-01
I-133	#	6.1412E-01	>12 Halflives	4.4711E-01	4.5440E-01	3.832E-01
Ba-133	#A	2.9598E-01	3.0115E-01	4.2276E-01	4.2441E-01	4.919E-01
Cs-134	#	1.0959E+00	1.1970E+00	3.3635E-01	3.7181E-01	3.828E-01
Cs-136		3.6911E-01	5.7472E+01	3.4439E+01	3.5270E+01	3.478E+01
Cs-137	#B	0.0000E+00	0.0000E+00	9.0913E-02	9.0915E-02	5.195E-01
Ce-139	#B	0.0000E+00	0.0000E+00	2.9533E-01	2.9533E-01	6.307E-01
Ba-140	#B	3.5287E-02	6.4626E+00	2.6578E+02	2.6578E+02	2.964E+02
La-140	#B	1.7665E-01	3.2352E+01	8.4773E+01	8.4884E+01	8.364E+01
Ce-141	#B	1.1858E-01	9.1567E-01	4.1872E+00	4.1890E+00	5.090E+00
Ce-144	#B	1.0378E+00	1.3103E+00	2.6992E+00	2.7049E+00	3.265E+00
Eu-152	#F	2.7840E+00	2.8216E+00	5.7882E-01	6.9155E-01	1.127E+00
Eu-154	#B	4.8830E-01	4.9875E-01	6.1841E-01	6.2201E-01	8.041E-01
Eu-155		2.2475E+00	2.3351E+00	8.4532E-01	9.0698E-01	1.568E+00
Ir-192	#A	-2.2410E-01	-5.5109E-01	9.4570E-01	9.4853E-01	1.099E+00
Hg-203	#B	1.1398E-01	4.7402E-01	1.2772E+00	1.2788E+00	1.501E+00
Tl-208		1.2763E+01	1.4038E+01	9.0398E-01	2.0654E+00	5.139E-01
Pb-210	A	1.1707E+01	1.1803E+01	9.1470E+00	9.2971E+00	1.218E+01
Bi-212		5.2863E+01	5.8144E+01	7.5480E+00	1.0790E+01	5.005E+00
Pb-212		3.9458E+01	4.3400E+01	1.4461E+00	6.0132E+00	9.860E-01
Ra-223		1.0319E+01	1.0406E+01	2.2560E+00	2.6516E+00	2.311E+00
Ra-224		4.3553E+01	4.7904E+01	9.5031E+00	1.1480E+01	1.396E+01
Ra-226		7.8395E+00	7.8404E+00	1.0093E+00	1.4478E+00	8.366E-01
Ac-227	#F	7.3031E+00	7.3644E+00	2.2731E+00	2.4796E+00	3.308E+00
Ac-228		3.9773E+01	4.1051E+01	2.1613E+00	5.8332E+00	1.222E+00
Th-228		5.4977E+01	6.0470E+01	2.0809E+01	2.2484E+01	3.059E+01
Pa-231	#B	-7.1420E+00	-7.1420E+00	1.9204E+01	1.9228E+01	2.244E+01
Pa-234M	#A	8.9723E-01	8.9723E-01	4.1284E+01	4.1284E+01	4.493E+01

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Pace Analytical Spectrum name: 30204854017.An1

Th-230	#B	1.9366E+01	1.9366E+01	1.1123E+02	1.1127E+02	1.346E+02
Th-232	#A	1.3108E+02	1.3108E+02	1.5080E+02	1.5189E+02	1.843E+02
Th-234	#A	8.0731E+00	8.0731E+00	8.3127E+00	8.3875E+00	1.016E+01
U-235	#B	0.0000E+00	0.0000E+00	2.6560E+00	2.6561E+00	6.571E+00
U-238	#B	8.9402E-01	8.9402E-01	4.1136E+01	4.1137E+01	4.477E+01
Am-241	#A	-7.3404E-01	-7.3435E-01	1.1148E+00	1.1196E+00	1.400E+00
Am-243	#B	0.0000E+00	0.0000E+00	9.6317E-01	9.6317E-01	1.600E+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 (30.1 to 2035.5 keV) 3.136E+02 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 3.9383289E+02 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Sample Lims Upload

Prep SOP	PGH-R-024-0	**Analysis SOP**	PGH-R-023-4/ PGH-R-040-0
Sample ID	30204854018	**Collection Date**	11/18/2016 12:20
Batch ID	33843	**Method**	EPA 901.1
A-code	9011 SING	**Analysis Date**	2/22/17 8:46
Client ID	WESTON-NJ	**Matrix**	SL
Analyst	MAH	**HBN**	248280

Test	Activity	Uncertainty	MDC
Bismuth-212	244.510	34.048	11.130
Cesium-137	0.021	0.772	0.779
Lead-212	232.950	31.355	2.085
Potassium-40	21.018	7.619	5.901
Protactinium-234M	22.633	65.987	61.550
Radium-226	36.575	5.021	1.573
Radium-228	221.460	28.416	2.833
Thallium-208	78.922	10.525	0.877
Thorium-228	323.850	66.646	75.390
Thorium-234	15.308	23.142	31.350
Uranium-235	0.000	4.514	13.890

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Pace Analytical Spectrum name: 30204854018.An1

Sample description
WI 33843

Spectrum Filename: C:\User\30204854018.An1

Acquisition information
Start time: 2/22/2017 8:46:48 AM
Live time: 900
Real time: 928
Dead time: 3.03 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).Clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: 1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 2.7227E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 2.7227E+02) =
3.6728E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/22/17

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Pace Analytical Spectrum name: 30204854018.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	11/18/2016 12:20:00 PM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(8OZ).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1373

***** 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. pCi/G	Nuc
53.20	153.	44.76	0.36	1.083E-02				
63.67	312.	36.04	0.63	2.181E-02	63.29	4.800	3.328E+01	Th234
					63.81	0.267	5.855E+02	Th232
74.90	5908.	2.25	1.08	3.202E-02	74.66	58.200	2.998E+01	Am243
					74.81	10.400	2.154E+02	Pb212
77.19	9108.	1.62	1.09	3.381E-02	77.11	17.500	1.869E+02	Pb212
					79.13	6.600	4.317E+02	Ag108M
84.38	1329.	7.41	1.09	3.876E-02	83.78	24.900	1.547E+01	Ra223
					84.37	1.266	3.281E+02	Th228
87.24	3923.	2.88	1.10	4.044E-02	86.54	30.700	3.656E+01	Eu155
					87.30	7.800	1.508E+02	Pb212
					88.03	3.610	3.384E+02	Cd109
89.99	2969.	3.56	1.10	4.191E-02	89.95	3.560	2.196E+02	U235
					89.95	3.560	2.196E+02	U235
93.30	2882.	3.63	1.10	4.351E-02	92.59	5.600	1.311E+02	U238
					92.60	2.800	2.622E+02	Th234
					92.59	5.600	1.311E+02	U238
94.89	250.	42.97	1.11	4.422E-02	94.90	11.300	PBC<MDA	Ra223
99.42	808.	15.03	1.27	4.601E-02				
105.37	1017.	9.14	1.12	4.793E-02	105.31	21.200	1.146E+01	Eu155
109.01	378.	22.60	1.12	4.890E-02				
115.14	561.	18.97	1.37	5.020E-02				
129.00	1868.	6.74	1.15	5.196E-02				
131.66	139.	64.75	1.15	5.214E-02	131.61	0.135	PBC<MDA	Th228
154.08	706.	17.79	1.25	5.245E-02	154.21	5.620	2.660E+01	Ra223
166.13	149.	7.86	1.18	5.197E-02	165.85	79.886	PBC<MDA	Ce139
					166.41	0.108	3.238E+02	Th228

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Pace Analytical Spectrum name: 30204854018.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
176.46	90.	90.03	1.19	5.139E-02	176.31	6.820	PBC<MDA	Sb125

					176.60	10.000	PBC<MDA	Cs136
178.86	291.	36.89	0.81	5.122E-02				
185.95	1129.	11.69	1.26	5.072E-02				
196.21	140.	67.62	0.49	4.994E-02				
209.14	3725.	4.50	1.33	4.889E-02				
215.99	221.	52.77	0.42	4.831E-02	215.99	0.263	2.107E+02	Th228
224.89	76.	64.81	0.35	4.757E-02				
238.61	38558.	0.58	1.26	4.642E-02	238.63	43.300	2.327E+02	Pb212
241.06	4084.	4.32	1.25	4.622E-02	241.00	3.900	2.747E+02	Ra224
					241.92	7.470	1.305E+02	Ra226
247.65	117.	49.62	0.68	4.568E-02	247.93	6.910	PBC<MDA	Eu154
270.06	2791.	4.38	1.46	4.391E-02	269.46	13.700	5.153E+01	Ra223
277.34	1546.	7.91	1.22	4.335E-02	276.40	7.164	5.574E+01	Ba133
					277.36	6.310	6.841E+01	Tl208
287.82	424.	22.75	0.80	4.259E-02				
295.03	2780.	4.28	1.37	4.208E-02	295.22	19.200	3.796E+01	Ra226
					295.96	28.670	6.256E+01	Ir192
					295.96	28.670	6.256E+01	Ir192
299.95	2595.	4.09	1.36	4.174E-02	300.00	2.300	3.006E+02	Ac227
					300.00	2.300	3.006E+02	Ac227
320.16	55.	86.61	1.34	4.039E-02	320.08	10.080	PBC<MDA	Cr51
323.94	85.	68.98	1.35	4.015E-02	323.87	3.930	PBC<MDA	Ra223
327.85	2378.	5.45	1.51	3.990E-02	328.76	20.300	5.944E+03	La140
					329.85	2.700	2.463E+02	Ac227
					330.00	1.300	5.074E+02	Pa231
					328.76	20.300	5.944E+03	La140
338.23	8187.	1.37	1.36	3.927E-02	338.32	11.300	2.101E+02	Ac228
341.20	314.	25.43	1.37	3.910E-02	340.55	42.200	3.264E+02	Cs136
351.72	5109.	2.59	1.38	3.848E-02	351.99	37.100	3.949E+01	Ra226
367.75	88.	50.75	0.52	3.759E-02				
387.53	184.	37.70	0.52	3.656E-02				
409.29	1274.	8.63	1.34	3.552E-02				
453.04	321.	24.37	0.78	3.364E-02				
459.39	119.	34.19	1.49	3.339E-02	459.60	7.700	3.695E+01	Te129
					459.60	7.700	3.695E+01	Te129
463.01	2564.	2.73	1.49	3.325E-02	463.36	10.500	8.655E+01	Sb125
510.53	5438.	3.78	1.73	3.154E-02				
541.36	63.	69.03	0.51	3.055E-02				
562.17	582.	13.93	1.16	2.993E-02				
583.05	16132.	0.99	1.80	2.934E-02	583.19	84.500	7.892E+01	Tl208
609.23	3968.	3.03	1.77	2.865E-02	609.31	44.800	3.408E+01	Ra226
635.95	53.	75.60	1.66	2.798E-02	635.95	11.300	PBC<MDA	Sb125
					636.99	7.170	PBC<MDA	I131
691.74	49.	54.20	0.53	2.672E-02				
695.95	113.	69.39	1.72	2.663E-02	695.88	3.000	PBC<MDA	Te129M
					695.88	3.000	PBC<MDA	Te129M
724.22	296.	21.58	1.75	2.605E-02	724.20	44.170	8.017E+00	Zr95

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					722.94	90.800	PBC<MDA	Ag108M
					722.79	10.760	3.511E+01	Sb124
727.35	3413.	2.21	1.75	2.599E-02	727.33	6.580	2.420E+02	Bi212
732.16	58.	56.04	1.76	2.590E-02				
755.46	333.	24.15	1.78	2.543E-02	756.73	54.460	7.496E+00	Zr95
763.08	318.	18.77	0.91	2.531E-02	763.94	22.140	8.181E+00	Ag110M
					763.94	22.140	8.181E+00	Ag110M
772.65	514.	13.57	2.08	2.513E-02	772.60	75.600	HL>Cutoff	I132
785.74	400.	15.95	1.48	2.490E-02				
794.76	1979.	3.97	2.11	2.474E-02	795.86	85.530	1.128E+01	Cs134

					795.86	85.530	1.128E+01	Cs134
830.24	290.	20.67	1.42	2.414E-02				
834.85	462.	9.71	1.85	2.406E-02	834.85	99.976	2.621E+00	Mn54
860.35	2210.	3.65	2.05	2.365E-02	860.56	12.420	9.127E+01	Tl208
874.76	68.	82.83	1.89	2.342E-02	875.33	4.510	HL>Cutoff	I133
					875.33	4.510	HL>Cutoff	Tl33
904.59	321.	11.78	1.92	2.299E-02				
911.28	10925.	1.09	1.92	2.289E-02	911.21	26.600	2.043E+02	Ac228
965.27	2319.	3.46	1.97	2.214E-02	964.13	14.340	8.160E+01	Eu152
					964.13	14.340	8.160E+01	Eu152
969.03	6183.	1.56	1.98	2.209E-02	968.97	16.200	1.967E+02	Ac228
1110.68	177.	28.93	2.10	2.034E-02	1112.12	13.550	7.163E+00	Eu152
					1112.12	13.550	7.163E+00	Eu152
1120.19	1101.	6.22	2.60	2.024E-02	1120.29	14.800	4.053E+01	Ra226
1237.65	439.	10.06	2.06	1.902E-02	1235.36	20.000	1.981E+03	Cs136
					1238.28	66.070	9.107E+00	Co56
1246.90	321.	17.52	0.85	1.893E-02				
1258.87	20.	46.94	0.25	1.881E-02				
1384.46	59.	73.11	2.34	1.767E-02	1384.30	24.120	PBC<MDA	Ag110M
					1384.30	24.120	1.997E+00	Ag110M
1407.89	140.	32.85	2.35	1.747E-02	1408.01	20.870	4.306E+00	Eu152
					1408.01	20.870	4.306E+00	Eu152
1459.79	346.	16.89	2.40	1.704E-02	1461.00	10.670	2.102E+01	K40
1620.23	486.	11.06	2.18	1.582E-02	1620.50	1.490	2.501E+02	Bi212
1764.30	834.	5.59	2.44	1.484E-02	1764.49	15.360	4.029E+01	Ra226
1771.44	45.	35.80	2.64	1.480E-02	1771.35	15.480	PBC<MDA	Co56
1836.72	44.	90.61	2.69	1.439E-02	1836.06	99.200	PBC<MDA	Y88

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

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Efficiency * Area	Uncert 2 Sigma %	FWHM keV	Suspected Nuclide	
211.71	53.20	1815.	153.	1.412E+04	89.53	0.364	-	s
358.82	90.00	4038.	3034.	7.240E+04	6.95	1.100	-	D
372.06	93.31	3978.	2939.	6.755E+04	7.10	1.104	-	D
396.52	99.42	3797.	808.	1.756E+04	30.06	1.272	-	s

Channel	Energy	Background	Net area	Eff*Area	Uncert	FWHM	Suspected	
435.12	109.01	3468.	370.	7.557E+03	46.26	1.121	-	D
459.39	115.14	3232.	561.	1.118E+04	37.93	1.367	-	s
515.02	129.00	4025.	1843.	3.547E+04	10.79	1.142	-	D
714.57	178.86	3285.	176.	3.430E+03	93.50	1.196	-	D
742.61	185.95	4074.	1129.	2.226E+04	23.38	1.256	-	s
783.63	196.21	2793.	140.	2.807E+03	135.25	0.490	-	s
835.34	209.14	4884.	3725.	7.620E+04	9.01	1.327	-	s
898.34	224.89	1175.	76.	1.598E+03	129.62	0.349	-	sc
989.37	247.65	1220.	117.	2.561E+03	99.24	0.683	-	sM
1150.02	287.82	2050.	424.	9.955E+03	45.51	0.799	-	s
1198.52	299.95	2007.	2595.	6.218E+04	8.19	1.362	-	M
1310.43	327.85	1839.	2137.	5.354E+04	7.14	1.353	-	D
1469.71	367.75	715.	88.	2.341E+03	101.50	0.521	-	sM
1548.83	387.53	1210.	184.	5.037E+03	75.41	0.517	-	sM
1635.87	409.29	1966.	1274.	3.588E+04	17.25	1.343	-	
1810.86	453.04	1243.	321.	9.543E+03	48.75	0.783	-	sM
1836.26	459.26	771.	119.	3.569E+03	68.39	1.488	-	D
1850.72	462.88	1172.	2564.	7.711E+04	5.47	1.491	-	D
2040.83	510.53	3147.	5438.	1.724E+05	7.55	1.726	-	s
2164.17	541.36	574.	63.	2.037E+03	138.05	0.507	-	s

2247.39	562.17	1158.	582.	1.943E+04	27.86	1.156	-	S
2765.72	691.74	277.	49.	1.821E+03	108.40	0.528	-	SM
2926.73	731.97	494.	61.	2.372E+03	105.42	1.756	-	D
3051.14	763.08	697.	318.	1.258E+04	37.54	0.912	-	SM
3141.79	785.74	759.	400.	1.607E+04	31.89	1.480	-	
3177.84	794.76	700.	1979.	8.000E+04	7.94	2.106	-	S
3319.79	830.24	596.	204.	8.435E+03	36.71	1.849	-	D
3616.39	904.37	625.	82.	3.575E+03	135.57	0.787	-	SM
3859.66	965.10	2050.	2326.	1.051E+05	6.89	1.973	-	D
4986.98	1246.90	321.	321.	1.695E+04	35.03	0.848	-	SM
5034.91	1258.87	33.	20.	1.081E+03	93.89	0.251	-	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: Pace Master w Ra-226 Rev.4 09281

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Pace Analytical Spectrum name: 30204854018.Anl

********** 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 2 Sigma %	FWHM keV
Th-234	252.05	63.29	3864.	118.	0.131	150.54	0.626D
Th-232	254.13	63.81	3818.	172.	0.191	102.69	0.626D
Pb-212	298.12	74.81	5992.	5542.	6.158	3.60	1.084D
Pb-212	307.32	77.11	5440.	9054.	10.060	3.12	1.086D
Ra-223	333.99	83.78	5215.	121.	0.134	169.81	1.093D
Th-228	336.36	84.37	4204.	1310.	1.455	15.05	1.094D
Eu-155	345.05	86.54	7734.	840.	0.933	30.41	1.096D
Pb-212	348.07	87.30	5075.	3268.	3.631	7.09	1.097D
Cd-109	351.00	88.03	8343.	524.	0.582	50.07	1.098D
U-235	358.75	89.97	5292.	2824.	3.138	11.17	1.100
U-238	368.80	92.48	4907.	257.	0.285	112.06	1.103s
Ra-223	378.46	94.90	5665.	250.	0.278	85.94	1.105D
Eu-155	420.07	105.31	3545.	1015.	1.128	17.73	1.117D
Th-228	525.28	131.61	3960.	139.	0.154	129.51	1.145D
Ra-223	615.12	154.08	3934.	705.	0.783	35.65	1.252
Th-228	664.45	166.41	4478.	149.	0.166	15.72	1.182D
Sb-125	704.05	176.31	4048.	90.	0.100	180.07	1.193D
Th-228	862.74	215.99	3479.	221.	0.245	105.53	0.424s
Pb-212	953.29	238.63	5409.	38597.	42.886	1.15	1.259D
Ra-224	962.76	241.00	13926.	3673.	4.081	9.67	1.262D
Ra-226	966.44	241.92	6901.	952.	1.058	25.52	1.263D
Ac-227	1017.99	254.81	2810.	-128.	-0.143	175.92	1.278s
Ra-223	1076.58	269.46	2976.	1798.	1.997	9.80	1.292D
Tl-208	1108.18	277.36	1992.	1435.	1.594	10.26	1.300D
Ra-226	1178.87	295.03	2351.	2779.	3.088	8.55	1.373s
Ac-227	1198.60	299.97	2223.	2494.	2.771	8.97	1.324
Cr-51	1279.06	320.08	1122.	55.	0.062	173.21	1.345D
Ra-223	1294.21	323.87	1677.	85.	0.094	137.96	1.349D
La-140	1310.57	327.96	2370.	-154.	-0.172	134.64	1.354s
Ac-228	1352.01	338.32	2234.	8175.	9.083	2.75	1.364D
Cs-136	1360.91	340.55	5918.	286.	0.318	76.95	1.366D
Ra-226	1405.60	351.72	2128.	5108.	5.676	5.18	1.379s

Sb-125	1709.04	427.58	1552.	-104.	-0.115	168.54	1.456s
Te-129	1840.93	460.56	1304.	305.	0.339	55.06	1.488s
Sb-125	1850.60	462.97	1051.	2804.	3.116	5.00	1.492
Tl-208	2330.91	583.05	1434.	16128.	17.920	1.98	1.802s
Ra-226	2435.65	609.23	1496.	3966.	4.406	6.06	1.770s
Sb-125	2542.55	635.95	785.	53.	0.059	151.20	1.663D
Te-129M	2782.54	695.95	1090.	113.	0.125	138.79	1.721s
Zr-95	2895.57	724.20	1895.	296.	0.329	43.15	1.748D
Bi-212	2908.10	727.33	1098.	3429.	3.810	4.37	1.751D
Zr-95	3020.64	755.46	1054.	333.	0.370	48.30	1.779s
Ag-110M	3051.86	763.27	1121.	179.	0.199	91.76	1.786s
I-132	3089.40	772.65	868.	514.	0.571	27.14	2.080

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Pace Analytical Spectrum name: 30204854018.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Mn-54	3338.25	834.85	776.	462.	0.513	19.43	1.853D
Tl-208	3440.27	860.35	598.	2210.	2.455	7.29	2.052s
I-133	3497.92	874.76	501.	68.	0.075	165.70	1.891s
Sc-46	3566.91	892.00	703.	-106.	-0.117	126.10	1.903s
Ac-228	3643.13	911.05	1019.	12109.	13.454	2.36	2.111s
Eu-152	3859.52	965.13	1824.	1800.	2.000	12.69	1.972
Ac-228	3874.87	968.97	1359.	6185.	6.872	3.05	1.976D
Eu-152	4441.91	1110.68	374.	177.	0.196	57.86	2.104s
Ra-226	4479.94	1120.19	415.	1101.	1.223	12.44	2.604s
Cs-136	4940.82	1235.36	387.	102.	0.113	58.29	2.211D
Co-56	4952.50	1238.28	234.	323.	0.359	17.41	2.213D
Ag-110M	5537.49	1384.46	253.	59.	0.066	146.22	2.335s
Eu-152	5631.26	1407.89	278.	140.	0.156	65.70	2.355s
K-40	5838.98	1459.79	412.	346.	0.385	33.78	2.398s
Ag-110M	6011.49	1502.89	546.	-79.	-0.088	163.56	2.433s
La-140	6372.68	1593.13	429.	-76.	-0.084	151.02	2.505s
Bi-212	6481.12	1620.23	314.	486.	0.540	22.12	2.180
Ra-226	7058.59	1764.49	232.	725.	0.806	9.51	2.633D
Co-56	7086.03	1771.35	109.	45.	0.050	71.59	2.638D
Y-88	7347.70	1836.72	186.	44.	0.049	181.21	2.685s

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Peak Code	MDA Value pCi/G	COMMENTS
Be-7	C	-4.3758E+00				5.34E+01	
			477.56	-4.376E+00	%(	2.124E+01 2.34E+02 1.03E+01 G K	
Na-22	C	-2.6421E-02				9.50E+02	
			1274.53	-2.642E-02	&(	5.654E-01 1.16E+03 9.99E+01 G K	
K-40	N	2.1018E+01				4.68E+11	
			1461.00	2.102E+01	&(P	5.901E+00 1.69E+01 1.07E+01 G K	
Sc-46	F	-1.1098E+00				8.38E+01	
			889.28	-1.110E+00	?(	1.326E+00 6.31E+01 1.00E+02 G K	
Cr-51	F	1.6505E+01				2.77E+01	

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                                320.08 1.651E+01  (  4.734E+01 8.66E+01 1.01E+01 G K

Mn-54     C   2.6208E+00                                          3.12E+02
                                834.85 2.621E+00  (  7.517E-01 9.71E+00 1.00E+02 G K
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Co-56     C   6.7044E+00                                          7.73E+01
                               1238.28 6.704E+00  (P 1.534E+00 8.70E+00 6.61E+01 G K
                               1771.35 5.168E+00 -   5.856E+00 3.58E+01 1.55E+01 G

Co-58     C  -5.7541E-01                                          7.08E+01
                                810.78-5.754E-01 &(  1.436E+00 1.27E+02 9.94E+01 G K

Y-88      C   6.2919E-01                                          1.07E+02
                               1836.06 6.292E-01 ?(  9.556E-01 9.06E+01 9.92E+01 G K
                                898.04 0.000E+00 % P 1.214E+00 1.00E+03 9.37E+01 G

Nb-94     I   1.4534E-02                                          7.41E+06
                                871.09 1.453E-02 %(P 5.425E-01 1.94E+03 9.99E+01 G K
                                702.62 2.000E-01 % P 7.113E-01 1.77E+02 9.79E+01 G

Zr-95     I   7.7290E+00                                          6.40E+01
                                756.73 7.496E+00 ?(  3.462E+00 2.41E+01 5.45E+01 G K
                                724.20 8.017E+00  (P 5.562E+00 2.16E+01 4.42E+01 G

Ru-103    I   7.2318E-01                                          3.93E+01
                                497.08 7.232E-01 &(P 3.424E+00 2.28E+02 9.10E+01 G K

Ru-106    I   1.6403E+00                                          3.73E+02
                                621.93 1.640E+00 &(  7.626E+00 2.31E+02 9.93E+00 G K

Cd-109    F   4.5203E+01                                          4.64E+02
                                 88.03 4.520E+01  (  3.695E+01 2.50E+01 3.61E+00 G K

Ag-110M   F   1.0682E+00                                          2.50E+02
                                657.76 0.000E+00 &(P 9.157E-01 1.00E+03 9.40E+01 G K
                               1505.04-5.261E+00 +   7.432E+00 8.18E+01 1.29E+01 G
                               1384.30 1.997E+00  (  2.593E+00 7.31E+01 2.41E+01 G
                                937.49 0.000E+00 % P 2.408E+00 1.00E+03 3.41E+01 G
                                884.68-9.133E-02 %   9.569E-01 5.46E+02 7.22E+01 G
                                763.94 4.592E+00  (  4.080E+00 4.59E+01 2.21E+01 G
                                744.28 0.000E+00 & P 1.850E+01 1.00E+03 4.70E+00 G
                                706.68 2.446E+00 % P 5.452E-00 1.11E+02 1.63E+01 G

Sn-113    F   3.9985E-01                                          1.15E+02
                                391.69 3.998E-01 &(P 1.702E+00 1.99E+02 6.40E+01 G K

Sb-124    F  -4.3069E-01                                          6.02E+01
                                602.73-4.307E-01 %(  1.952E+00 2.25E+02 9.78E+01 G K
                                645.85 1.056E+00 %   2.567E+01 1.20E+03 7.38E+00 G
                                722.79 0.000E+00 %   2.448E+01 1.00E+03 1.08E+01 G
                               1690.98-1.689E+00 %   3.522E+00 1.22E+02 4.73E+01 G
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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments
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Sb-125    I    2.3917E+01                                          1.01E+03
                          427.88-1.188E+00 ?(  2.138E+00 8.43E+01 2.96E+01 G K
                          176.31 3.011E+00 } P 1.006E+01 9.00E+01 6.82E+00 G
                          463.36 9.469E+01  (P 5.192E+00 2.50E+00 1.05E+01 G
                          600.60 0.000E+00 & P 3.675E+00 1.00E+03 1.79E+01 G
                          635.95 1.986E+00 - P 4.964E+00 7.56E+01 1.13E+01 G

Te-129    I    9.4503E+01                                          3.36E+01
                          459.60 9.450E+01 ?(  5.301E+01 2.75E+01 7.70E+00 G K
                          487.39 2.314E+01 %   3.144E+02 6.53E+02 1.42E+00 G

Te-129M   I    1.1228E+02                                          3.36E+01
                          695.88 1.123E+02 &(P 1.561E+02 6.94E+01 3.00E+00 G K

I-132     I    2.9810E+00                                          3.20E+00
                          772.60 2.981E+00  (P 8.129E-01 1.36E+01 7.56E+01 G K
                          522.65 1.199E+00 %   3.845E+00 1.55E+02 1.60E+01 G
                          630.19-7.666E-01 %   4.762E+00 3.08E+02 1.33E+01 G
                          954.55 0.000E+00 % P 3.434E+00 1.00E+03 1.76E+01 G

I-133     I    3.4908E-01                                          8.67E-01
                          529.87 0.000E+00 %(P 7.179E-01 1.00E+03 8.70E+01 G K
                          875.33 7.083E+00  (  1.118E+01 8.28E+01 4.51E+00 G

Cs-136    F    1.4511E+02                                          1.32E+01
                          818.51 4.618E+00 &(P 8.657E+01 9.51E+02 9.97E+01 G K
                          176.60 1.456E+01 } P 8.328E+02 1.29E+03 1.00E+01 G
                          273.65 0.000E+00 %   9.694E+02 1.00E+03 1.11E+01 G
                          340.55 2.978E+02  (  3.759E+02 3.85E+01 4.22E+01 G
                         1048.07 0.000E+00 & P 9.392E+01 1.00E+03 8.00E+01 G
                         1235.36 4.585E+02  (P 4.261E+02 2.91E+01 2.00E+01 G

Cs-137    I    2.1428E-02                                          1.10E+04
                          661.66 2.143E-02 %(  7.792E-01 1.80E+03 8.51E+01 G K

La-140    I   -1.0065E+02                                          1.28E+01
                         1596.21-1.006E+02 ?(  1.314E+02 7.55E+01 9.54E+01 G K
                          487.02 7.928E+00 % P 2.498E+02 1.51E+03 4.55E+01 G
                          815.77 1.692E+02 %   4.144E+02 1.25E+02 2.33E+01 G
                          328.76-3.861E+02 +   5.736E+02 6.73E+01 2.03E+01 G

Ce-141    I    3.9345E+00                                          3.25E+01
                          145.44 3.935E+00 &(  1.085E+01 1.20E+02 4.82E+01 G K

Ce-144    I    1.5609E+00                                          2.85E+02
                          133.51 1.561E+00 &(P 7.738E+00 2.16E+02 1.11E+01 G K
[
```

ORTEC g v - i (3263) Env32 G701W047 2/22/2017 9:05:59 AM Page 10
Pace Analytical Spectrum name: 30204854018.An1

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Eu-152    F    1.4198E+01                                          4.95E+03
                          121.78 0.000E+00 &(P 2.459E+00 1.00E+03 2.84E+01 G K
                         1408.01 4.306E+00  (P 2.463E+00 3.29E+01 2.09E+01 G
                         1112.12 7.163E+00 ?(P 3.768E+00 2.89E+01 1.36E+01 G
                         1085.91 0.000E+00 & P 4.998E+00 1.00E+03 9.92E+00 G
                          964.13 6.336E+01  (  7.100E+00 6.35E+00 1.43E+01 G
                          344.28 0.000E+00 % P 2.330E+00 1.00E+03 2.66E+01 G
                          244.70 5.850E-01 &   8.132E+00 6.26E+02 7.49E+00 G
```

```
Eu-155    I    9.3102E+00                                          1.74E+03
                                 86.54 7.829E+00  (P 3.846E+00 1.52E+01 3.07E+01 G K
                                105.31 1.146E+01  (P 3.160E+00 8.87E+00 2.12E+01 G

Hg-203    F    2.9487E-01                                          4.66E+01
                                279.20 2.949E-01 %(P 3.073E+00 4.69E+02 8.15E+01 G K

Tl-208    N    7.8922E+01                                          6.98E+02
                                583.19 7.892E+01 *(P 8.768E-01 9.89E-01 8.45E+01 G K
                                860.56 9.127E+01 +   4.819E+00 3.65E+00 1.24E+01 G
                                277.36 6.361E+01 - P 9.343E+00 5.13E+00 6.31E+00 G

Pb-210    N    2.1158E+01                                          8.14E+03
                                 46.54 2.116E+01 &(P 1.608E+02 3.17E+02 4.25E+00 G K

Bi-212    N    2.4451E+02                                          6.98E+02
                                727.33 2.433E+02  (P 1.113E+01 2.19E+00 6.58E+00 G K
                               1620.50 2.501E+02  (P 4.388E+01 1.11E+01 1.49E+00 G

Pb-212    N    2.3295E+02                                          6.98E+02
                                238.63 2.330E+02  (P 2.085E+00 5.76E-01 4.33E+01 G K
                                 77.11 1.858E+02 - P 7.109E+00 1.56E+00 1.75E+01 GA
                                 74.81 2.021E+02 } P 1.325E+01 1.80E+00 1.04E+01 GA
                                 87.30 1.256E+02 -   1.286E+01 3.54E+00 7.80E+00 GA

Ra-223    N    3.3196E+01                                          7.96E+03
                                269.46 3.320E+01  (P 4.745E+00 4.90E+00 1.37E+01 G K
                                 83.78 1.408E+00 -   3.947E+00 8.49E+01 2.49E+01 G
                                323.87 5.993E+00 - P 1.364E+01 6.90E+01 3.93E+00 G
                                154.21 2.660E+01 - P 1.113E+01 1.78E+01 5.62E+00 G
                                 94.90 5.575E+00 - P 7.867E+00 4.30E+01 1.13E+01 G
                                 81.07-1.853E+00 %   6.662E+00 1.50E+02 1.50E+01 G

Ra-224    N    2.4718E+02                                          6.98E+02
                                241.00 2.472E+02  (P 3.719E+01 4.83E+00 3.90E+00 G K
```

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Pace Analytical Spectrum name: 30204854018.An1

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Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ra-226    N    3.6575E+01                                          5.84E+05
                                609.31 3.408E+01 @(P 1.573E+00 3.03E+00 4.48E+01 G K
                               1764.49 3.508E+01  (P 3.565E+00 4.76E+00 1.54E+01 G
                                295.22 3.796E+01 @(P 3.123E+00 4.28E+00 1.92E+01 G
                               1120.29 4.053E+01 + P 3.596E+00 6.22E+00 1.48E+01 G
                                351.99 3.949E+01 *(P 1.683E+00 2.59E+00 3.71E+01 G
                                241.92 3.046E+01 - P 1.247E+01 1.28E+01 7.47E+00 G

Ac-227    N    4.5517E+01                                          7.95E+03
                                235.97 0.000E+00 %(P 4.385E+00 1.00E+03 1.23E+01 G K
                                256.25-4.538E+00 +   8.820E+00 8.80E+01 7.00E+00 G
                                300.00 2.889E+02  (P 2.578E+01 4.48E+00 2.30E+00 G
                                329.85 0.000E+00 %   3.548E+01 1.00E+03 2.70E+00 G

Ac-228    N    2.2146E+02                                          2.10E+03
                                911.21 2.264E+02 *(P 2.833E+00 1.18E+00 2.66E+01 G K
                                968.97 1.968E+02 - P 5.553E+00 1.53E+00 1.62E+01 G
                                338.32 2.098E+02  (P 5.721E+00 1.38E+00 1.13E+01 G

Th-228    N    3.2385E+02                                          6.98E+02
                                 84.37 3.238E+02  (P 7.539E+01 7.53E+00 1.27E+00 G K
```

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                          215.99 2.107E+02 -   2.650E+02 5.28E+01 2.63E-01 G
                          166.41 3.238E+02 }   6.830E+02 7.86E+00 1.08E-01 G
                          131.61 2.381E+02 -   5.082E+02 6.48E+01 1.35E-01 G

Pa-234M   N   2.2633E+01                                   1.63E+12
                                                          Energy duplication
                         1001.03 2.263E+01 %(P 6.156E+01 1.46E+02 8.37E-01 G

Th-230    N  -5.9031E+01                                   2.75E+07
                           67.67-5.903E+01 %(  3.826E+02 2.70E-02 3.80E-01 G K

Th-232    N   3.2381E+02                                   4.37E+12
                                                          Derived Ave Activity
                           63.81 3.238E+02 }(P 5.469E+02 5.13E+01 2.67E-01 G K

Th-234    N   1.5308E+01                                   1.63E+12
                                                          Derived Ave Activity
                           63.29 1.262E+01 }(P 3.135E+01 7.53E+01 4.80E+00 G K
                           92.60 1.992E+01 }(P 3.936E+01 8.10E+02 2.80E+00 G

U-238     N   2.2552E+01                                   1.63E+12
                                                          Energy duplication
                         1001.03 2.255E+01 %(P 6.134E+01 1.46E+02 8.40E-01 G K
                           92.59 1.171E+01 & P 1.501E+01 5.60E+01 5.60E+00 GA

Am-241    T  -4.5364E-01                                   1.58E+05
                           59.54-4.536E-01 %(  5.323E+00 4.89E+02 3.63E+01 G K
```



```
  ( - 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 2 Sigma %	Activity	
U-235	89.97	5292.	2824.	3.138	11.17	2.089E+02	
U-238	92.48	4907.	257.	0.285	112.06	1.171E+01	P
Ac-227	254.81	2810.	-128.	-0.143	175.92	-4.538E+00	
Ac-227	299.97	2223.	2494.	2.771	8.97	2.889E+02	P
La-140	327.96	2370.	-154.	-0.172	134.64	-3.861E+02	
Te-129	460.56	1304.	305.	0.339	55.06	9.450E+01	
Te-129M	695.95	1090.	113.	0.125	138.79	1.123E+02	P
Ag-110M	763.27	1121.	179.	0.199	91.76	4.592E+00	
I-133	874.76	501.	68.	0.075	165.70	0.000E+00	
Sc-46	892.00	703.	-106.	-0.117	126.10	-1.110E+00	
Eu-152	965.13	1824.	1800.	2.000	12.69	6.336E+01	
Eu-152	1110.68	374.	177.	0.196	57.86	7.163E+00	P
Ag-110M	1384.46	253.	59.	0.066	146.22	1.997E+00	
Eu-152	1407.89	278.	140.	0.156	65.70	4.306E+00	P
Ag-110M	1502.89	546.	-79.	-0.088	163.56	-5.261E+00	
La-140	1593.13	429.	-76.	-0.084	151.02	-1.006E+02	
Y-88	1836.72	186.	44.	0.049	181.21	6.292E-01	

P - Peakbackground subtraction

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***** 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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-1.2610E+00	-4.3758E+00	2.0472E+01	2.0481E+01	2.124E+01
Na-22	#B	-2.4636E-02	-2.6421E-02	6.1557E-01	6.1558E-01	5.654E-01
K-40	#	2.1018E+01	2.1018E+01	7.0995E+00	7.6193E+00	5.901E+00
Sc-46	#A	-5.0221E-01	-1.1098E+00	1.3995E+00	1.4071E+00	1.326E+00
Cr-51	A	1.4995E+00	1.6505E+01	2.8590E+01	2.8673E+01	4.734E+01
Mn-54		2.1186E+00	2.6208E+00	5.0910E-01	6.1544E-01	7.517E-01
Co-56		2.8375E+00	6.7044E+00	1.1672E+00	1.4576E+00	1.534E+00
Co-57	#B	0.0000E+00	0.0000E+00	3.4139E-01	3.4140E-01	1.044E+00
Co-58	#B	-2.2519E-01	-5.7541E-01	1.4649E+00	1.4668E+00	1.436E+00
Fe-59	#B	0.0000E+00	0.0000E+00	2.6532E+00	2.6533E+00	4.341E+00
Co-60	#B	0.0000E+00	0.0000E+00	2.2743E-01	2.2744E-01	5.708E-01
Zn-65	#B	0.0000E+00	0.0000E+00	4.3493E-01	4.3493E-01	1.319E+00
Y-88	#A	3.3746E-01	6.2919E-01	1.1402E+00	1.1437E+00	9.556E-01
Nb-94	#B	1.4534E-02	1.4534E-02	5.6461E-01	5.6461E-01	5.425E-01
Zr-95		2.7379E+00	7.7290E+00	2.5029E+00	2.7033E+00	3.462E+00
Nb-95	#B	0.0000E+00	0.0000E+00	8.2272E-01	8.2274E-01	4.984E+00
Ru-103	#B	1.3314E-01	7.2318E-01	3.2948E+00	3.2962E+00	3.424E+00
Ag-108M	#B	0.0000E+00	0.0000E+00	2.7678E-01	2.7679E-01	9.297E-01
Ru-106	#B	1.3723E+00	1.6403E+00	7.5680E+00	7.5711E+00	7.626E+00
Cd-109		3.9170E+01	4.5203E+01	2.2633E+01	2.3503E+01	3.695E+01
Ag-110M	#F	8.1876E-01	1.0682E+00	9.8025E-01	9.9036E-01	9.157E-01
Sn-113	#B	2.2448E-01	3.9985E-01	1.5886E+00	1.5894E+00	1.702E+00
Sb-124	#B	-1.4284E-01	-4.3069E-01	1.9380E+00	1.9388E+00	1.952E+00
Sb-125	C	2.2391E+01	2.3917E+01	1.1948E+00	3.3614E+00	2.138E+00
Te-129	#	1.3082E+01	9.4503E+01	5.2035E+01	5.3496E+01	5.301E+01
Te-129M	#A	1.5544E+01	1.1228E+02	1.5584E+02	1.5654E+02	1.561E+02
I-131	#B	0.0000E+00	0.0000E+00	1.4079E+03	1.4079E+03	2.815E+03

I-132	2.9810E+00	>12 Halflives	8.0898E-01	8.0979E-01	8.129E-01
Te-132 #B	0.0000E+00	>12 Halflives	2.5771E-01	2.5771E-01	8.163E-01
I-133 #B	3.4908E-01	>12 Halflives	5.7841E-01	5.8024E-01	7.179E-01
Ba-133 #B	0.0000E+00	0.0000E+00	1.7519E+00	1.7519E+00	1.010E+00
Cs-134 #B	0.0000E+00	0.0000E+00	2.9276E-01	2.9276E-01	7.928E-01
Cs-136 F	9.3139E-01	1.4511E+02	8.4586E+01	8.6728E+01	8.657E+01
Cs-137 #B	2.1299E-02	2.1428E-02	7.7153E-01	7.7154E-01	7.792E-01
Ce-139 #B	0.0000E+00	0.0000E+00	5.3655E-01	5.3655E-01	8.957E-01
Ba-140 #B	0.0000E+00	0.0000E+00	2.0674E+02	2.0675E+02	4.539E+02
La-140 #A	-5.4918E-01	-1.0065E+02	1.5200E+02	1.5260E+02	1.314E+02
Ce-141 #B	5.0941E-01	3.9345E+00	9.4520E+00	9.4664E+00	1.085E+01
Ce-144 #B	1.2362E+00	1.5609E+00	6.7329E+00	6.7361E+00	7.738E+00
Eu-152 #B	1.4008E+01	1.4198E+01	1.8017E+00	2.6179E+00	2.459E+00
Eu-154 #B	0.0000E+00	0.0000E+00	7.5860E-01	7.5862E-01	1.762E+00
Eu-155	8.9611E+00	9.3102E+00	1.6388E+00	2.0935E+00	3.346E+00
Ir-192 #A	0.0000E+00	0.0000E+00	9.6217E-01	9.6219E-01	1.749E+00

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Hg-203 #B	7.0887E-02	2.9487E-01	2.7686E+00	2.7688E+00	3.073E+00
Tl-208	7.1752E+01	7.8922E+01	1.5607E+00	1.0525E+01	8.768E-01
Pb-210 #B	2.0986E+01	2.1158E+01	1.3401E+02	1.3404E+02	1.608E+02
Bi-212	2.2230E+02	2.4451E+02	1.0692E+01	3.4048E+01	1.113E+01
Pb-212	2.1179E+02	2.3295E+02	2.6833E+00	3.1355E+01	2.085E+00
Ra-223	3.2920E+01	3.3196E+01	3.2519E+00	5.4974E+00	4.745E+00
Ra-224	2.2473E+02	2.4718E+02	2.3896E+01	4.0857E+01	3.719E+01
Ra-226	3.6571E+01	3.6575E+01	1.3786E+00	5.0207E+00	1.573E+00
Ac-227 #B	4.5138E+01	4.5517E+01	4.0813E+00	7.3441E+00	4.385E+00
Ac-228	2.1456E+02	2.2146E+02	4.0138E+00	2.9416E+01	2.833E+00
Th-228	2.9443E+02	3.2385E+02	4.8755E+01	6.6646E+01	7.539E+01
Pa-231 #B	0.0000E+00	0.0000E+00	1.8470E+01	1.8471E+01	3.652E+01
Pa-234M#A	2.2633E+01	2.2633E+01	6.5920E+01	6.5987E+01	6.156E+01
Th-230 #B	-5.9031E+01	-5.9031E+01	3.1934E+02	3.1944E+02	3.826E+02
Th-232 A	3.2381E+02	3.2381E+02	3.3253E+02	3.3552E+02	5.469E+02
Th-234 A	1.5308E+01	1.5308E+01	2.3046E+01	2.3142E+01	3.135E+01
U-235 #B	0.0000E+00	0.0000E+00	4.5136E+00	4.5137E+00	1.389E+01
U-238 #B	2.2552E+01	2.2552E+01	6.5684E+01	6.5751E+01	6.134E+01
Am-241 #B	-4.5345E-01	-4.5364E-01	4.4366E+00	4.4370E+00	5.323E+00
Am-243 #B	0.0000E+00	0.0000E+00	2.1668E+00	2.1668E+00	3.584E+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 (30.3 to 2035.6 keV) 1.710E+03 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 1.8350404E+03 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Spec Quality Control Sample Performance Assessment

Face Analytical

Analyst: MAH
Date: 2/21/2017
Batch ID: 33543
Matrix: SOLID

Method: EPA 901.1

Geometry: 6 OZ CANS
Activity Units: pCi
Aliquot Units: GRAM

Method Blank Assessment Method Blank ID: 132/1147

Analytes of Interest	MB Result	2 Sigma CSU	MD MDC	Numerical Indicator	MB Evaluation
Bi-212	0.000	0.166	1.835	0.000	Pass
Cs-137	0.004	0.067	0.067	0.138	Pass
Pb-212	0.000	0.038	0.116	0.000	Pass
K-40	0.000	0.254	0.849	0.000	Pass
Pa-234M	0.109	6.522	7.718	0.033	Pass
Ra-226	0.065	0.046	0.181	1.264	Pass
Ra-228	0.085	0.107	0.230	1.554	Pass
Th-208	0.011	0.057	0.072	0.493	Pass
Th-228	0.222	0.090	0.144	1.713	Pass
Th-234	0.424	0.439	2.887	1.591	Pass
U-235	0.000	0.153	0.891	0.000	Pass

Duplicate Sample Precision Assessment

Sample ID: Duplicate Sample ID:

Analytes of Interest	Sample Results	Sample 2 Sigma CSU	Duplicate Results	Duplicate 2 Sigma CSU	Numerical Indicator	% RPD	Evaluation
Bi-212					#DIV/0!	#DIV/0!	#DIV/0!
Cs-137					#DIV/0!	#DIV/0!	#DIV/0!
Pb-212					#DIV/0!	#DIV/0!	#DIV/0!
K-40					#DIV/0!	#DIV/0!	#DIV/0!
Pa-234M					#DIV/0!	#DIV/0!	#DIV/0!
Ra-226					#DIV/0!	#DIV/0!	#DIV/0!
Ra-228					#DIV/0!	#DIV/0!	#DIV/0!
Th-208					#DIV/0!	#DIV/0!	#DIV/0!
Th-228					#DIV/0!	#DIV/0!	#DIV/0!
Th-234					#DIV/0!	#DIV/0!	#DIV/0!
U-235					#DIV/0!	#DIV/0!	#DIV/0!

Duplicate LCS Precision Assessment

Analyte	LCS Concentration	LCS 2 Sigma CSU	LCSD Concentration	LCSD 2 Sigma CSU	Numerical Indicator	Percent RPD	Precision Evaluation
Lead-210	1880.100	267.260	1858.800	277.200	0.103	1.1%	Pass
Cobalt-60	40.251	6.335	37.575	4.948	0.721	6.9%	Pass
Cesium-137	63.725	8.548	58.828	7.842	0.878	8.0%	Pass

Laboratory Control Sample Assessment

	Analyte	Lead-210	Cobalt-60	Cesium-137
	Count Date	2/21/2017	2/21/2017	2/21/2017
	Reference ID	13-051Pb	13-051Co	13-051Cs
Volume or Mass of Reference Geometry	Reference Concentration	1579.391	37.401	54.594
	Reference Uncertainty	0.059	0.059	0.059
	LCS Concentration	1880.1	40.251	63.725
	LCS 2 Sigma CSU	267.260	6.335	8.548
	Numerical Indicator	-2.21	-1.05	-2.03
	Percent Recovery	119.0%	107.6%	116.7%
	LCS Evaluation	Pass	Pass	Pass

Laboratory Control Sample Duplicate Assessment

Analyte	Lead-210	Cobalt-60	Cesium-137
Count Date	2/21/2017	2/21/2017	2/21/2017
Reference ID	13-051Pb	13-051Co	13-051Cs
Reference Concentration	1579.391	37.401	54.594
Reference Uncertainty	0.059	0.059	0.059
LCSD Concentration	1858.8	37.575	58.828
LCSD 2 Sigma CSU	277.200	4.948	7.842
Numerical Indicator	-1.98	-0.07	-1.06
Percent Recovery	117.6%	100.5%	107.6%
LCSD Evaluation	Pass	Pass	Pass

Evaluation: If an sample or Duplicate sample activity is below the associated MDC, the %RPD evaluation is not applicable and the sample duplicate precision criteria is acceptable.

2/21/17

ORTEC g v - i (3263) Env32 G701W047 2/21/2017 11:01:06 AM Page 1
Pace Analytical Spectrum name: LCS33843.Anl

Sample description
WL 33843

Spectrum Filename: C:\User\LCS33843.Anl

Acquisition information
Start time: 2/21/2017 8:30:58 AM
Live time: 900
Real time: 912
Dead time: 1.35 %
Detector ID: 5

Detector system
DET 5

Calibration
Filename: DET_5_8_OZ_CAN(121613).Clb
Pace Std TD 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration
Created: 1/31/2014 3:17:29 PM
Zero offset: 0.091 keV
Gain: 0.250 keV/channel
Quadratic: -2.204E-08 keV/channel^2

Efficiency Calibration
Created: 1/31/2014 3:24:20 PM
Type: Polynomial
Uncertainty: 0.798 %
Coefficients: -0.299196 -4.550221 0.502791
-0.057551 0.002743 -0.000050

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.10keV)
Stop channel: 8144 (2035.52keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 3.6950E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 3.6950E+02) =
2.7064E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 5.0000000E+00
Systematic error: 4.9600000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

2/21/18

ORTEC g v - i (3263) Env32 G701W047 2/21/2017 11:01:06 AM Page 2
Pace Analytical Spectrum name: LCS33843.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	2/21/2017 8:30:58 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_021717PaceRa226(8CZ).P 2/20/2017 9:13:45 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.1722

***** 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. pCi/G	Nuc
31.84	295.	18.96	1.27	6.928E-03				
36.54	383.	17.54	1.33	1.161E-02				
46.48	21215.	0.92	0.98	2.153E-02	46.54	4.250	1.880E+03	Pb210
53.46	73.	48.41	0.28	3.020E-02				
84.32	98.	56.59	0.99	4.391E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
					84.37	1.266	PBC<MDA	Th228
88.05	875.	8.84	0.96	4.472E-02	87.30	7.800	2.046E+01	Pb212
					88.03	3.610	4.406E+01	Cd109
89.60	87.	76.19	0.99	4.508E-02	89.95	3.560	PBC<MDA	U235
					89.95	3.560	4.397E+00	U235
122.04	49.	72.64	1.02	4.744E-02	121.78	28.400	PBC<MDA	Eu152
					122.06	85.600	9.726E-02	Co57
					123.07	40.600	2.004E-01	Eu154
136.63	41.	66.88	0.48	4.675E-02	136.47	10.680	6.726E-01	Co57
238.63	96.	35.84	1.12	3.548E-02	238.63	43.300	PBC<MDA	Pb212
240.74	100.	48.84	1.13	3.523E-02	241.00	3.900	PBC<MDA	Ra224
					241.00	3.900	PBC<MDA	Ra224
241.92	34.	95.85	1.13	3.514E-02	241.92	7.470	PBC<MDA	Ra226
244.82	37.	99.42	1.13	3.485E-02	244.70	7.490	PBC<MDA	Eu152
269.32	82.	61.13	1.15	3.249E-02	269.46	13.700	PBC<MDA	Ra223
277.36	42.	69.80	1.16	3.179E-02	277.36	6.310	PBC<MDA	Tl208
					276.40	7.164	PBC<MDA	Ba133
279.09	63.	74.23	1.16	3.164E-02	279.20	81.460	PBC<MDA	Hg203
					279.20	81.460	PBC<MDA	Hg203
283.64	76.	63.32	1.16	3.126E-02	283.70	1.600	PBC<MDA	Pa231
					284.30	6.140	3.216E+00	I131

ORTEC g v - i (3263) Env32 G701W047 2/21/2017 11:01:06 AM Page 3
Pace Analytical Spectrum name: LCS33843.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					284.30	6.140	3.216E+00	I131

					283.70	1.600	1.232E+01	Pa231
295.14	113.	31.86	0.72	3.033E-02	295.22	19.200	1.574E+00	Ra226
320.17	33.	79.58	1.19	2.849E-02	320.08	10.080	PBC<MDA	Cr51
323.96	37.	77.46	1.20	2.824E-02	323.87	3.930	PBC<MDA	Ra223
337.84	51.	91.75	1.21	2.729E-02	338.32	11.300	PBC<MDA	Ac228
352.13	124.	28.78	0.86	2.646E-02	351.99	37.100	1.024E+00	Ra226
364.15	48.	95.45	1.23	2.575E-02	364.49	81.700	PBC<MDA	Tl31
					364.49	81.700	1.873E-01	I131
427.55	52.	92.68	1.28	2.273E-02	427.88	29.600	PBC<MDA	Sb125
					427.88	29.600	6.341E-01	Sb125
496.65	87.	45.52	1.34	2.026E-02	497.08	91.000	PBC<MDA	Ru103
					497.08	91.000	PBC<MDA	Ru103
602.65	52.	64.95	1.43	1.755E-02	602.73	97.800	PBC<MDA	Sb124
					602.73	97.800	2.446E-01	Sb124
635.62	36.	94.18	1.45	1.688E-02	635.95	11.300	PBC<MDA	Sb125
					635.95	11.300	PBC<MDA	Sb125
					636.99	7.170	PBC<MDA	I131
657.77	131.	22.29	1.47	1.647E-02	657.76	94.000	6.885E-01	Ag110M
					657.76	94.000	6.885E-01	Ag110M
661.45	10943.	1.02	1.65	1.640E-02	661.66	85.100	6.373E+01	Cs137
803.82	90.	34.61	0.73	1.428E-02				
811.04	43.	77.35	1.58	1.419E-02	810.78	99.448	PBC<MDA	Co58
					810.78	99.448	2.467E-01	Co58
835.06	52.	69.71	1.60	1.390E-02	834.85	99.975	PBC<MDA	Mn54
					834.85	99.976	3.050E-01	Mn54
875.55	42.	97.89	1.63	1.345E-02	875.33	4.510	PBC<MDA	I133
					875.33	4.510	5.560E+00	I133
910.96	72.	57.72	1.66	1.308E-02	911.21	26.600	PBC<MDA	Ac228
968.90	56.	73.20	1.70	1.253E-02	968.97	16.200	PBC<MDA	Ac228
996.46	40.	89.36	1.72	1.229E-02	996.26	10.530	PBC<MDA	Eu154
					996.26	10.530	2.512E+00	Eu154
1057.99	28.	50.68	0.34	1.179E-02				
1111.79	71.	45.91	1.80	1.139E-02	1112.12	13.550	3.732E+00	Eu152
1115.55	49.	41.25	1.80	1.136E-02	1115.55	50.600	PBC<MDA	Zn65
1120.07	60.	52.60	1.80	1.133E-02	1120.29	14.800	PBC<MDA	Ra226
1173.12	5395.	1.51	2.06	1.097E-02	1173.24	99.974	3.998E+01	Co60
1332.42	4964.	1.46	2.16	1.002E-02	1332.50	99.986	4.023E+01	Co60
1408.25	20.	36.25	1.99	9.634E-03	1408.01	20.870	8.017E-01	Eu152
1460.52	62.	13.47	0.70	9.379E-03	1461.00	10.670	4.995E+00	K40
1763.96	18.	66.11	2.20	8.138E-03	1764.49	15.360	PBC<MDA	Ra226

L

********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
126.95	31.84	810.	295.	4.258E+04	37.93	1.270	-	s
145.73	36.54	1239.	383.	5.298E+04	35.08	1.331	-	s
213.38	53.46	504.	73.	2.417E+03	96.83	0.283	-	s
3214.42	803.82	176.	90.	6.304E+03	69.21	0.728	-	s
4231.35	1057.99	65.	28.	2.375E+03	101.35	0.343	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-210	185.46	46.48	3801.	21214.	23.571	1.83	0.976
Th-230	268.00	67.12	1541.	-113.	-0.126	136.94	0.973s
Th-228	336.79	84.32	1134.	98.	0.109	133.17	0.988s
Cd-109	351.63	88.03	983.	789.	0.876	13.31	0.992D
U-235	357.88	89.60	1119.	87.	0.096	152.38	0.993s
Co-57	487.69	122.06	523.	49.	0.054	145.28	1.022D
Pb-212	953.83	238.63	544.	96.	0.107	71.67	1.124D
Ra-224	962.26	240.74	548.	100.	0.111	97.59	1.126s
Ra-226	966.98	241.92	508.	34.	0.038	191.70	1.127D
Eu-152	978.09	244.70	656.	37.	0.041	198.85	1.130D
Ra-223	1076.54	269.32	586.	82.	0.091	122.27	1.151s
Tl-208	1108.69	277.36	406.	42.	0.047	139.60	1.158D
Hg-203	1115.61	279.09	507.	63.	0.070	148.47	1.159s
Pa-231	1133.80	283.64	535.	76.	0.084	126.64	1.163s
Ra-226	1179.79	295.14	353.	113.	0.125	63.71	0.722s
Cr-51	1279.56	320.08	330.	33.	0.037	159.16	1.194D
Ra-223	1294.70	323.87	387.	37.	0.041	154.93	1.197D
Ac-228	1352.50	338.32	523.	51.	0.057	183.51	1.210D
Ra-226	1407.71	352.13	344.	124.	0.137	57.55	0.865s
I-131	1455.80	364.15	466.	48.	0.054	190.91	1.232s
Sb-125	1709.36	427.55	514.	52.	0.058	185.37	1.284s
Ru-103	1985.73	496.65	330.	87.	0.097	91.05	1.341s
Sb-124	2409.70	602.65	222.	52.	0.057	129.91	1.425s
Sb-125	2541.59	635.62	235.	36.	0.040	188.36	1.451s
Ag-110M	2630.20	657.77	150.	131.	0.146	44.58	1.468s

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Pace Analytical Spectrum name: LCS33843.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Cs-137	2644.89	561.45	262.	10942.	12.158	2.03	1.652
Co-58	3243.31	811.04	204.	43.	0.048	154.70	1.585s
Mn-54	3339.38	835.06	246.	52.	0.058	139.41	1.602s
I-133	3501.39	875.55	292.	42.	0.046	195.77	1.632s
Ac-228	3643.04	910.96	304.	72.	0.080	115.44	1.658s
Ac-228	3874.87	968.90	298.	56.	0.062	146.40	1.699s
Eu-154	3985.12	996.46	225.	40.	0.044	178.71	1.719s
Eu-152	4346.56	1086.79	334.	-66.	-0.074	134.90	1.781s
Eu-152	4447.90	1112.12	169.	71.	0.079	91.83	1.799D
Zn-65	4461.63	1115.55	183.	49.	0.055	82.50	1.801D
Ra-226	4479.73	1120.07	160.	60.	0.067	105.20	1.804
Co-60	4691.97	1173.11	148.	5420.	6.022	2.99	2.057
Co-60	5329.49	1332.42	40.	4973.	5.526	2.92	2.165
Eu-152	5632.97	1408.25	5.	20.	0.022	72.50	1.990s
K-40	5842.17	1460.52	3.	62.	0.068	26.94	0.700s
Ra-226	7056.78	1763.96	19.	18.	0.020	132.21	2.197s

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	Peak Energy	Activity	Code	MDA Value

Page 4

		pCi/G	keV	pCi/G		pCi/G	COMMENTS
Be-7	C	9.6309E-01					5.34E+01
			477.56	9.631E-01	%(	4.306E+00	2.00E+02 1.03E+01 G K
Na-22	C	-5.1090E-02					9.50E+02
			1274.53	-5.109E-02	%(	2.711E-01	2.63E+02 9.99E+01 G K
K-40	N	4.9950E+00					4.68E+11
			1461.00	4.995E+00	(P	9.276E-01	1.35E+01 1.07E+01 G K
Sc-46	F	3.4490E-02					8.38E+01
			889.28	3.449E-02	%(P	5.150E-01	7.28E+02 1.00E+02 G K
Cr-51	F	9.3632E-01					2.77E+01
			320.08	9.363E-01	(P	2.472E+00	7.96E+01 1.01E+01 G K
Mn-54	C	3.0504E-01					3.12E+02
			834.85	3.050E-01	(	4.431E-01	6.97E+01 1.00E+02 G K
Co-56	C	1.3397E-01					7.73E+01
			1238.28	1.340E-01	%(	4.018E-01	1.50E+02 6.61E+01 G K
			1771.35	0.000E+00	% P	1.822E+00	1.00E+03 1.55E+01 G

Nuclide	Ave activity		Energy	Activity	Code	Peak	MDA	Comments
Co-57	C	9.7258E-02						2.72E+02
			122.06	9.726E-02	)	2.188E-01	7.26E+01	8.56E+01 G K
			136.47	1.464E-01	%(	2.277E+00	6.41E+02	1.07E+01 G
Co-58	C	2.4668E-01						7.08E+01
			810.78	2.467E-01	&(	3.991E-01	7.73E+01	9.94E+01 G K
Co-60	F	4.0251E+01						1.92E+03
			1332.50	4.033E+01	(P	2.601E-01	1.46E+00	1.00E+02 G K
			1173.24	4.017E+01	(P	4.409E-01	1.49E+00	1.00E+02 G
Zn-65	F	6.9809E-01						2.44E+02
			1115.55	6.981E-01	(P	9.286E-01	4.13E+01	5.06E+01 G K
Nb-95	I	8.2831E-02						3.50E+01
			765.81	8.283E-02	&(P	4.315E-01	2.47E+02	9.98E+01 G K
Ru-103	I	3.8356E-01						3.93E+01
			497.08	3.836E-01	&(P	3.850E-01	4.55E+01	9.10E+01 G K
Ag-108M	C	2.8111E-02						1.53E+05
			722.94	2.811E-02	%(	4.261E-01	7.13E+02	9.08E+01 G K
			614.28	3.922E-02	%	3.928E-01	4.57E+02	8.98E+01 G
			433.94	-2.396E-02	%	4.540E-01	8.43E+02	9.05E+01 G
			79.13	-1.785E-01	%	5.077E+00	1.18E+03	6.60E+00 G
Cd-109	F	3.9710E+01						4.64E+02
			88.03	3.971E+01	(	7.495E+00	6.66E+00	3.61E+00 G K
Ag-110M	F	6.8851E-01						2.50E+02
			657.76	6.885E-01	&(P	3.137E-01	2.23E+01	9.40E+01 G K
			1505.04	0.000E+00	%	1.857E+00	1.00E+03	1.29E+01 G

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                                1384.30 0.000E+00 % P 8.328E-01 1.00E+03 2.41E+01 G
                                 937.49 7.429E-01 %   1.651E+00 1.10E+02 3.41E+01 G
                                 884.68 8.889E-02 % P 7.404E-01 4.07E+02 7.22E+01 G
                                 763.94 9.922E-02 %   1.895E+00 9.00E+02 2.21E+01 G
                                 744.28 0.000E+00 % P 8.258E+00 1.00E+03 4.70E+00 G
                                 706.68 8.263E-01 & P 2.183E+00 1.25E+02 1.63E+01 G

Sn-113    F    4.4335E-02                                          1.15E+02
                                 391.69 4.433E-02 %(  5.803E-01 5.82E+02 6.40E+01 G K

Sb-124    F    2.4463E-01                                          6.02E+01
                                 602.73 2.446E-01  (  3.418E-01 6.50E+01 9.78E+01 G K
                                 645.85 1.048E+00 & P 4.964E+00 2.17E+02 7.38E+00 G
                                 722.79 2.372E-01 %   3.595E+00 7.13E+02 1.08E+01 G
                                1690.98 0.000E+00 % P 5.188E-01 1.00E+03 4.73E+01 G
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      ORTEC g v - i (3263) Env32  G701W047  2/21/2017 11:01:05 AM   Page  7
 Pace Analytical                    Spectrum name: LCS33843.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Sb-125    I    8.8629E-01                                          1.01E+03
                                 427.88 6.341E-01 &(  1.309E+00 9.27E+01 2.96E+01 G K
                                 176.31 8.758E-01 & P 3.547E+00 1.67E+02 6.82E+00 G
                                 463.36-1.376E+00 %   4.562E+00 1.49E+02 1.05E+01 G
                                 600.60 0.000E+00 % P 2.111E+00 1.00E+03 1.79E+01 G
                                 635.95 1.547E+00 &(P 3.158E+00 9.42E+01 1.13E+01 G

Te-129M   I    1.5877E+00                                          3.36E+01
                                 695.88 1.588E+00 &(P 1.222E+01 3.63E+02 3.00E+00 G K

I-131     I    1.8735E-01                                          8.02E+00
                                 364.49 1.873E-01 ?(  3.988E-01 9.55E+01 8.17E+01 G K
                                 636.99 3.923E-01 %   5.129E+00 5.96E+02 7.17E+00 G
                                 284.30 8.130E-01 &   4.976E+00 2.63E+02 6.14E+00 G

I-132     I    1.7574E-02                                          3.20E+00
                                 772.60 1.757E-02 %(P 5.458E-01 1.46E+03 7.56E+01 G K
                                 522.65 0.000E+00 % P 2.411E+00 1.00E+03 1.60E+01 G
                                 630.19 3.297E-01 &   2.901E+00 4.03E+02 1.33E+01 G
                                 954.55 0.000E+00 & P 3.688E+00 1.00E+03 1.76E+01 G

Te-132    I    2.3241E-03                                          3.20E+00
                                 228.16 2.324E-03 %(P 3.439E-01 6.35E+03 8.80E+01 G K

I-133     I    2.7404E-01                                          8.67E-01
                                 529.87 0.000E+00 %(P 4.459E-01 1.00E+03 8.70E+01 G K
                                 875.33 5.560E+00 &(  1.104E+01 9.79E+01 4.51E+00 G

Ba-133    F    3.6619E-02                                          3.84E+03
                                 356.02 3.662E-02 &(  5.173E-01 6.04E+02 6.20E+01 G K
                                  81.00 4.311E-02 % P 9.432E-01 9.05E+02 3.41E+01 G
                                 302.85 5.964E-02 &   1.671E+00 1.20E+03 1.83E+01 G
                                 276.40 0.000E+00 % P 4.144E+00 1.00E+03 7.16E+00 G
                                 383.85 0.000E+00 % P 4.230E+00 1.00E+03 8.94E+00 G

Cs-134    I    1.4265E-02                                          7.52E+02
                                 604.72 1.426E-02 %(  3.810E-01 1.22E+03 9.76E+01 G K
                                 801.95 0.000E+00 % P 4.751E+00 1.00E+03 8.69E+00 G
                                 795.86 0.000E+00 % P 5.327E-01 1.00E+03 8.55E+01 G
                                 569.33 1.636E-03 & P 2.469E+00 6.89E+04 1.54E+01 G
```

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Cs-137    I    6.3725E+01                                          1.10E+04
                          661.66 6.373E+01  (P 4.547E-01 1.02E+00 8.51E+01 G K

Ba-140    I   -2.4409E-01                                          1.28E+01
                          537.26-2.441E-01 %(  1.556E+00 2.93E+02 2.44E+01 G K
                          162.66 0.000E+00 % P 4.064E+00 1.00E+03 6.22E+00 G
]
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Pace Analytical Spectrum name: LCS33843.An1

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

La-140    I   -6.7883E-02                                          1.28E+01
                         1596.21-6.788E-02 %(  2.859E-01 2.13E+02 9.54E+01 G K
                          487.02 2.604E-02 %   8.928E-01 1.52E+03 4.55E+01 G
                          815.77 8.236E-03 %   1.762E+00 1.00E+04 2.33E+01 G
                          328.76 1.730E-01 % P 1.568E+00 3.88E+02 2.03E+01 G

Ce-141    I    8.6054E-02                                          3.25E+01
                          145.44 8.605E-02 &(  5.099E-01 2.45E+02 4.82E+01 G K

Ce-144    I    7.8808E-01                                          2.85E+02
                          133.51 7.881E-01 %(  2.152E+00 1.13E+02 1.11E+01 G K

Eu-152    F    8.9374E-01                                          4.95E+03
                          121.78 0.000E+00 } P 8.800E-01 3.83E+03 2.84E+01 G K
                         1408.01 8.017E-01 ?(  5.377E-01 3.63E+01 2.09E+01 G
                         1112.12 3.732E+00 +   3.336E+00 4.59E+01 1.36E+01 G
                         1085.91-4.706E+00 &   6.215E+00 6.75E+01 9.92E+00 G
                          964.13 0.000E+00 % P 4.488E+00 1.00E+03 1.43E+01 G
                          344.28 1.453E-01 % P 1.230E+00 2.52E+02 2.66E+01 G
                          244.70 1.150E+00  (P 3.800E+00 9.94E+01 7.49E+00 G

Eu-154    I    5.2188E-01                                          3.14E+03
                          123.07 5.774E-03 &(P 6.107E-01 4.36E+03 4.06E+01 G K
                         1274.44-1.459E-01 %   7.740E-01 2.63E+02 3.50E+01 G
                         1004.72 0.000E+00 % P 3.217E+00 1.00E+03 1.79E+01 G
                          996.26 2.512E+00 &(  4.560E+00 8.94E+01 1.05E+01 G
                          873.19-8.653E-01 &   4.310E+00 2.44E+02 1.22E+01 G
                          723.30-1.314E-02 %   1.958E+00 7.01E+03 2.01E+01 G
                          247.93 0.000E+00 % P 4.460E+00 1.00E+03 6.91E+00 G

Ir-192    F   -1.1381E-02                                          7.38E+01
                          316.51-1.138E-02 &(  3.912E-01 1.47E+03 8.28E+01 G
                          468.07 0.000E+00 & P 9.489E-01 1.00E+03 4.78E+01 G
                          308.46-8.007E-02 %   1.081E+00 5.79E+02 3.00E+01 G
                          295.96 0.000E+00 & P 1.093E+00 1.00E+03 2.87E+01 G

Hg-203    F    1.9815E-01                                          4.66E+01
                          279.20 1.981E-01 ?(P 3.395E-01 7.42E+01 8.15E+01 G K

Tl-208    N    1.1790E-01                                          6.98E+02
                          583.19 0.000E+00 %(P 4.550E-01 1.00E+03 8.45E+01 G K
                          860.56 0.000E+00 & P 4.053E+00 1.00E+03 1.24E+01 G
                          277.36 1.697E+00  (P 3.914E+00 6.98E+01 6.31E+00 G

Pb-210    N    1.8801E+03                                          8.14E+03
                           46.54 1.880E+03  (P 2.570E+01 9.15E-01 4.25E+00 G K
[
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Pace Analytical Spectrum name: LCS33843.An1
Page 7

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Bi-212	N	2.1519E+00					6.98E+02	
			727.33	2.152E+00	&(P	5.481E+00	1.21E+02	6.58E+00 G K
			1620.50	0.000E+00	%	1.851E+01	1.00E+03	1.49E+00 G
Pb-212	N	5.0809E-01					6.98E+02	
			238.63	5.081E-01	(P	5.894E-01	3.58E+01	4.33E+01 G K
			77.11	7.105E-01	% P	1.907E+00	1.09E+02	1.75E+01 GA
			74.81	0.000E+00	& P	3.385E+00	1.00E+03	1.04E+01 GA
			87.30	-1.239E+00	%	4.031E+00	1.35E+02	7.80E+00 GA
Ra-223	N	1.7663E+00					7.96E+03	
			269.46	1.500E+00	?(	2.109E+00	6.11E+01	1.37E+01 G K
			83.78	2.983E-01	%	1.220E+00	1.23E+02	2.49E+01 G
			323.87	2.694E+00	(P	6.915E+00	7.75E+01	3.93E+00 G
			154.21	0.000E+00	% P	4.343E+00	1.00E+03	5.62E+00 G
			94.90	0.000E+00	& P	2.460E+00	1.00E+03	1.13E+01 G
			81.07	8.049E-02	% P	2.085E+00	1.05E+03	1.50E+01 G
Ra-224	N	5.9127E+00					6.98E+02	
			241.00	5.913E+00	?(P	6.613E+00	4.88E+01	3.90E+00 G K
Ra-226	N	1.1082E+00					5.84E+05	
			609.31	3.758E-01	%(P	8.229E-01	1.01E+02	4.48E+01 G K
			1764.49	1.167E+00	?(P	1.499E+00	6.61E+01	1.54E+01 G
			295.22	1.574E+00	(P	1.260E+00	3.19E+01	1.92E+01 G
			1120.29	2.903E+00	(P	2.990E+00	5.26E+01	1.48E+01 G
			351.99	1.024E+00	(P	7.382E-01	2.88E+01	3.71E+01 G
			241.92	1.047E+00	(P	3.336E+00	9.59E+01	7.47E+00 G
Ac-228	N	1.7858E+00					2.10E+03	
			911.21	1.686E+00	?(P	1.961E+00	5.77E+01	2.66E+01 G K
			968.97	2.249E+00	&(P	3.328E+00	7.32E+01	1.62E+01 G
			338.32	1.356E+00	(P	2.878E+00	9.18E+01	1.13E+01 G
Th-228	N	1.4317E+01					6.98E+02	
			84.37	1.432E+01	(P	2.334E+01	6.68E+01	1.27E+00 G K
			215.99	3.046E+01	& P	1.162E+02	1.65E+02	2.63E-01 G
			166.41	0.000E+00	& P	2.303E+02	1.00E+03	1.08E-01 G
			131.61	0.000E+00	% P	1.905E+02	1.00E+03	1.35E-01 G
Pa-231	N	1.2323E+01					1.20E+07	
			283.70	1.232E+01	@(	1.796E+01	6.33E+01	1.60E+00 G K
			330.00	1.273E+00	%	2.490E+01	8.37E+02	1.30E+00 G
Th-230	N	-6.2733E+01					2.75E+07	
			67.67	-6.273E+01	(	1.028E+02	6.85E+01	3.80E-01 G K

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Th-232	N	-2.3354E+01					4.17E-12	
			63.81	-2.335E+01	%(	1.391E+02	2.42E+02	2.67E-01 G K
Am-241	T	8.7208E-02					1.58E+05	
			59.54	8.721E-02	&(	1.044E+00	4.73E+02	3.63E+01 G K

(- 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 2 Sigma %	Activity	
Th-230	67.12	1541.	-113.	-0.126	136.94	-6.273E+01	
Th-228	84.32	1134.	98.	0.109	133.17	1.432E+01	P
U-235	89.60	1119.	87.	0.096	152.38	4.397E+00	
Ra-224	240.74	548.	100.	0.111	97.69	5.913E+00	P
Hg-203	279.09	507.	63.	0.070	148.47	1.981E-01	P
Pa-231	283.64	535.	76.	0.084	126.64	1.232E+01	
I-131	364.15	466.	48.	0.054	190.91	1.873E-01	
Sb-125	427.55	514.	52.	0.058	185.37	6.341E-01	
Ru-103	496.65	330.	87.	0.097	91.05	3.836E-01	P

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Pace Analytical Spectrum name: LCS33843.Anl

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM	
Sb-124	602.65	222.	52.	0.057	129.91	2.446E-01		
Sb-125	635.62	235.	36.	0.040	188.36	1.547E+00		P
Ag-110M	657.77	150.	131.	0.146	44.58	6.885E-01		P
Co-58	811.04	204.	43.	0.048	154.70	2.467E-01		
Mn-54	835.06	246.	52.	0.058	139.41	3.050E-01		
I-133	875.55	292.	42.	0.046	195.77	5.560E+00		
Eu-154	996.46	225.	40.	0.044	178.71	2.512E+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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G

Be-7	#B	9.6309E-01	9.6309E-01	3.8463E+00	3.8483E+00	4.306E+00
Na-22	#B	-5.1090E-02	-5.1090E-02	2.6920E-01	2.6928E-01	2.711E-01
K-40		4.9950E+00	4.9950E+00	1.3456E+00	1.4985E+00	9.276E-01
Sc-46	#B	3.4490E-02	3.4490E-02	5.0234E-01	5.0236E-01	5.150E-01
Cr-51	A	9.3632E-01	9.3632E-01	1.4902E+00	1.4954E+00	2.472E+00
Mn-54	#A	3.0504E-01	3.0504E-01	4.2526E-01	4.2718E-01	4.431E-01
Co-56	#B	1.3397E-01	1.3397E-01	4.0238E-01	4.0276E-01	4.018E-01
Co-57	A	9.7258E-02	9.7258E-02	1.4122E-01	1.4182E-01	2.277E+00
Co-58	#A	2.4668E-01	2.4668E-01	3.8161E-01	3.8300E-01	3.991E-01
Fe-59	#B	0.0000E+00	0.0000E+00	1.6243E-01	1.6244E-01	1.061E+00
Co-60		4.0251E+01	4.0251E+01	8.4106E-01	5.3346E+00	2.601E-01
Zn-65	A	6.9809E-01	6.9809E-01	5.7593E-01	5.8313E-01	9.286E-01
Y-88	#B	0.0000E+00	0.0000E+00	2.0771E-02	2.0772E-02	2.631E-01
Nb-94	#B	0.0000E+00	0.0000E+00	1.7231E-01	1.7231E-01	5.401E-01
Zr-95	#B	0.0000E+00	0.0000E+00	2.8190E-01	2.8191E-01	7.469E-01
Nb-95	#B	8.2831E-02	8.2831E-02	4.0841E-01	4.0856E-01	4.315E-01
Ru-103	#A	3.8356E-01	3.8356E-01	3.4923E-01	3.5287E-01	3.850E-01
Ag-108M	#B	2.8111E-02	2.8111E-02	4.0108E-01	4.0110E-01	4.261E-01
Ru-106	#B	0.0000E+00	0.0000E+00	2.0378E+00	2.0379E+00	4.101E+00
Cd-109		3.9710E+01	3.9710E+01	5.2863E+00	7.6902E+00	7.495E+00
Ag-110M	#	6.8851E-01	6.8851E-01	3.0693E-01	3.2021E-01	3.137E-01
Sn-113	B	4.4335E-02	4.4335E-02	5.1632E-01	5.1635E-01	5.803E-01
Sb-124	#A	2.4463E-01	2.4463E-01	3.1780E-01	3.1944E-01	3.418E-01
Sb-125	#A	8.8629E-01	8.8629E-01	1.1711E+00	1.1769E+00	1.309E+00
Te-129	#B	0.0000E+00	0.0000E+00	3.3856E+00	3.3857E+00	6.030E+00
Te-129M	#B	1.5877E+00	1.5877E+00	1.1514E+01	1.1516E+01	1.222E+01
I-131	#A	1.8735E-01	1.8735E-01	3.5766E-01	3.5851E-01	3.988E-01
I-132	#B	1.7574E-02	1.7574E-02	5.1363E-01	5.1364E-01	5.458E-01
Te-132	#B	2.3241E-03	2.3241E-03	2.9524E-01	2.9524E-01	3.439E-01
I-133	#B	2.7404E-01	2.7404E-01	5.3651E-01	5.3772E-01	4.459E-01
Ba-133	#B	3.6619E-02	3.6619E-02	4.4216E-01	4.4218E-01	5.173E-01
Cs-134	#B	1.4265E-02	1.4265E-02	3.4773E-01	3.4774E-01	3.810E-01
Cs-136	#B	0.0000E+00	0.0000E+00	1.4961E-01	1.4961E-01	4.829E-01

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Pace Analytical Spectrum name: LCS33843.An1

Cs-137		6.3725E+01	6.3725E+01	1.2959E+00	8.5456E+00	4.547E-01
Ce-139	#B	0.0000E+00	0.0000E+00	7.0583E-02	7.0585E-02	3.126E-01
Ba-140	#B	-2.4409E-01	-2.4409E-01	1.4299E+00	1.4302E+00	1.556E+00
La-140	#B	-6.7883E-02	-6.7883E-02	2.8865E-01	2.8880E-01	2.859E-01
Ce-141	#B	8.6054E-02	8.6054E-02	4.2164E-01	4.2179E-01	5.099E-01
Ce-144	#B	7.8808E-01	7.8808E-01	1.7865E+00	1.7895E+00	2.152E+00
Eu-152	C	8.9374E-01	8.9374E-01	6.4799E-01	6.5855E-01	5.377E-01
Eu-154	#B	5.2188E-01	5.2188E-01	9.3265E-01	9.3527E-01	6.107E-01
Eu-155	#B	0.0000E+00	0.0000E+00	2.9309E-01	2.9309E-01	1.028E+00
Ir-192	#A	-1.1381E-02	-1.1381E-02	3.3487E-01	3.3488E-01	3.912E-01
Hg-203	#A	1.9815E-01	1.9815E-01	2.9418E-01	2.9537E-01	3.395E-01
Tl-208	B	1.1790E-01	1.1790E-01	1.6459E-01	1.6533E-01	4.550E-01
Pb-210		1.8801E+03	1.8801E+03	3.4408E+01	2.6726E+02	2.570E+01
Bi-212	#B	2.1519E+00	2.1519E+00	5.1984E+00	5.2062E+00	5.481E+00
Pb-212	A	5.0809E-01	5.0809E-01	3.6415E-01	3.7051E-01	5.894E-01
Ra-223	A	1.7663E+00	1.7663E+00	1.7430E+00	1.7590E+00	2.109E+00
Ra-224	#A	5.9127E+00	5.9127E+00	5.7759E+00	5.8303E+00	6.613E+00
Ra-226	F	1.1082E+00	1.1082E+00	6.2170E-01	6.3878E-01	8.229E-01
Ac-227	#B	0.0000E+00	0.0000E+00	9.1585E-01	9.1587E-01	2.527E+00
Ac-228	A	1.7858E+00	1.7858E+00	1.5572E+00	1.5750E+00	1.961E+00
Th-228	#A	1.4317E+01	1.4317E+01	1.9066E+01	1.9172E+01	2.334E+01
Pa-231	#A	1.2323E+01	1.2323E+01	1.5606E+01	1.5693E+01	1.796E+01
Pa-234M	#A	0.0000E+00	0.0000E+00	3.6564E+01	3.6565E+01	6.589E+01

Th-230	#A	-6.2733E+01	-6.2733E+01	8.5908E+01	8.6343E+01	1.028E+02
Th-232	#B	-2.3354E+01	-2.3354E+01	1.1281E+02	1.1285E+02	1.391E+02
Th-234	#B	0.0000E+00	0.0000E+00	2.7852E+00	2.7853E+00	8.105E+00
U-235	#B	0.0000E+00	0.0000E+00	2.4475E+00	2.4475E+00	5.547E+00
U-238	#B	0.0000E+00	0.0000E+00	3.6433E+01	3.6434E+01	6.566E+01
Am-241	#B	8.7208E-02	8.7208E-02	8.2547E-01	8.2556E-01	1.044E+00
Am-243	#B	0.0000E+00	0.0000E+00	2.1832E-01	2.1833E-01	5.362E-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 (30.1 to 2035.5 keV) 2.034E+03 pCi/G
Total Decayed Activity (30.1 to 2035.5 keV) 2.0344086E+03 pCi/G

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

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Pace Analytical Spectrum name: LCSD33843.An1

Sample description
WL 33843

Spectrum Filename: C:\User\LCSD33843.An1

Acquisition information
Start time: 2/21/2017 8:55:08 AM
Live time: 900
Real time: 910
Dead time: 1.13 %
Detector ID: 2

Detector system
DET 2

Calibration
Filename: DET_2_8_OZ_CAN(121613).clb
Pace Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration
Created: 1/10/2014 12:30:55 PM
Zero offset: 0.262 keV
Gain: 0.250 keV/channel
Quadratic: -1.773E-08 keV/channel^2

Efficiency Calibration
Created: 1/6/2014 12:06:06 PM
Type: Polynomial
Uncertainty: 1.566 %
Coefficients: -0.352903 -3.748292 0.302295
-0.033892 0.001351 -0.000028

Library Files
Main analysis library: Pace Master w Ra-226 Rev.4 09281
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G701W047
Start channel: 120 (30.27keV)
Stop channel: 8144 (2035.63keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 3.6950E+02
Activity scaling factor: 1.0000E+06/(1.0000E+00* 3.6950E+02) =
2.7064E+03
Detection limit method: Reg. Guide 4.16 Method

Random error: 4.9600000E+00
Systematic error: 5.0000000E+00
Fraction Limit: 0.000%
Background width: average of three points.

Half lives decay limit: 12.000

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Pace Analytical Spectrum name: LCSD33843.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	2/21/2017 8:55:08 AM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_2_Bkg_021717PaceRa226(80Z).P 2/20/2017 9:06:04 AM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 0 cutoff: 0.00E+00 %
Energy Calibration
Normalized diff: 0.2436

***** 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. pCi/G	Nuc
30.87	56.	70.92	0.62	0.000E+00				
46.46	4422.	2.47	1.01	4.454E-03	46.54	4.250	1.860E+03	Pb210
74.80	149.	43.56	1.08	3.198E-02	74.66	68.200	PBC<MDA	Am243
					74.81	10.400	PBC<MDA	Pb212
					74.66	68.200	PBC<MDA	Am243
76.80	133.	38.42	0.34	3.355E-02	77.11	17.500	PBC<MDA	Pb212
83.49	109.	61.80	1.09	3.839E-02	83.78	24.900	PBC<MDA	Ra223
					84.37	1.266	PBC<MDA	Th228
					83.78	24.900	9.282E-01	Ra223
					84.37	1.266	1.772E+01	Th228
87.96	791.	10.79	1.28	4.083E-02	86.54	30.700	5.222E+00	Eu155
					87.30	7.800	2.037E+01	Pb212
					88.03	3.610	4.357E+01	Cd109
89.30	123.	56.44	1.10	4.189E-02	89.95	3.560	PBC<MDA	U235
					89.95	3.560	6.694E+00	U235
215.76	134.	53.02	1.24	4.831E-02	215.99	0.263	PBC<MDA	Th228
					215.99	0.263	8.571E+01	Th228
238.49	169.	24.68	1.26	4.642E-02	238.63	43.300	6.842E-01	Pb212
240.86	59.	69.92	1.26	4.623E-02	241.00	3.900	PBC<MDA	Ra224
					241.92	7.470	PBC<MDA	Ra226
256.10	64.	97.89	1.28	4.499E-02	256.25	7.000	PBC<MDA	Ac227
					256.25	7.000	1.664E+00	Ac227
269.28	68.	89.24	1.29	4.396E-02	269.46	13.700	PBC<MDA	Ra223
					269.46	13.700	PBC<MDA	Ra223
295.18	122.	49.56	1.32	4.207E-02	295.22	19.200	PBC<MDA	Ra226
					295.96	28.670	PBC<MDA	Ir192
					295.96	28.670	PBC<MDA	Ir192

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Pace Analytical Spectrum name: LCSD33843.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
					295.22	19.200	PBC<MDA	Ra226

328.56	88.	64.87	1.35	3.985E-02	328.76	20.300	PBC<MDA	La140
					328.76	20.300	8.792E-01	La140
					329.85	2.700	6.621E+00	Ac227
					330.00	1.300	1.375E+01	Pa231
340.32	95.	63.67	1.37	3.913E-02	340.55	42.200	PBC<MDA	Cs136
					340.55	42.200	4.684E-01	Cs136
351.90	118.	52.50	1.38	3.846E-02	351.99	37.100	PBC<MDA	Ra226
					351.99	37.100	PBC<MDA	Ra226
583.18	52.	88.57	1.61	2.934E-02	583.19	84.500	PBC<MDA	Tl208
					583.19	84.500	PBC<MDA	Tl208
621.84	70.	57.63	1.65	2.833E-02	621.93	9.930	PBC<MDA	Ru106
					621.93	9.930	2.037E+00	Ru106
658.71	1113.	4.54	1.68	2.747E-02	657.76	94.000	3.501E+00	Ag110M
					657.76	94.000	3.501E+00	Ag110M
661.51	16868.	0.87	1.82	2.739E-02	661.66	85.100	5.883E+01	Cs137
722.79	30.	57.77	1.75	2.608E-02	722.79	10.760	PBC<MDA	Sb124
					722.94	90.800	PBC<MDA	Ag108M
					723.30	20.110	PBC<MDA	Eu154
					724.20	44.170	2.036E-01	Zr95
					722.94	90.800	1.016E-01	Ag108M
					723.30	20.110	4.523E-01	Eu154
727.33	32.	70.37	1.75	2.599E-02	727.33	6.580	PBC<MDA	Bi212
772.61	57.	72.37	1.79	2.513E-02	772.60	75.600	PBC<MDA	I132
					772.60	75.600	PBC<MDA	I132
815.54	104.	40.49	1.83	2.438E-02	815.77	23.280	1.487E+00	La140
					815.77	23.280	1.487E+00	La140
853.95	80.	36.20	0.66	2.375E-02				
897.83	65.	76.05	1.91	2.308E-02	898.04	93.700	PBC<MDA	Y88
					898.04	93.700	PBC<MDA	Y88
910.64	74.	70.54	1.92	2.289E-02	911.21	26.600	PBC<MDA	Ac228
					911.21	26.600	PBC<MDA	Ac228
1000.96	66.	76.06	2.01	2.166E-02	1001.03	0.837	PBC<MDA	Pa234M
					1001.03	0.840	PBC<MDA	U238
					1001.03	0.837	PBC<MDA	Pa234M
					1001.03	0.840	PBC<MDA	U238
1000.96	66.	76.06	2.01	2.166E-02	1001.03	0.837	PBC<MDA	Pa234M
					1001.03	0.840	PBC<MDA	U238
1005.50	39.	50.05	0.74	2.161E-02	1004.72	17.910	PBC<MDA	Eu154
1120.29	56.	78.50	2.11	2.024E-02	1120.29	14.800	PBC<MDA	Ra226
					1120.29	14.800	PBC<MDA	Ra226
1172.98	9229.	1.21	2.40	1.968E-02	1173.24	99.974	3.812E+01	Co60
1332.08	8356.	1.24	2.62	1.813E-02	1332.50	99.986	3.745E+01	Co60
1383.74	28.	50.55	2.34	1.767E-02	1384.30	24.120	5.401E-01	Ag110M
					1384.30	24.120	5.401E-01	Ag110M
1407.68	20.	77.17	2.35	1.747E-02	1408.01	20.870	PBC<MDA	Eu152
					1408.01	20.870	PBC<MDA	Eu152
1460.51	98.	11.87	0.53	1.704E-02	1461.00	10.670	4.370E+00	K40

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Pace Analytical Spectrum name: LCSD33843.An1

pk energy	area	uncert	fwhm	corr	nuclide	brnch.	act.	nuc
1619.64	14.	57.67	2.52	1.582E-02	1620.50	1.490	PBC<MDA	Bi212

********** 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 2 Sigma %	FWHM keV	Suspected Nuclide	
122.39	30.87	690.	56.	0.000E+00	141.85	0.622	-	c
306.08	76.80	826.	133.	3.965E+03	76.84	0.343	-	sM
3414.66	853.95	184.	80.	3.382E+03	72.40	0.664	-	s

4023.04	1005.50	114.	39.	1.805E+03	100.10	0.741	-	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: Pace Master w Ra-226 Rev.4 09281

********** 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 2 Sigma %	FWHM keV
Pb-210	184.73	46.46	1738.	4421.	4.912	4.95	1.014s
Pb-212	298.09	74.80	1057.	149.	0.165	87.12	1.083
Ra-223	328.00	82.28	1420.	-124.	-0.137	120.81	1.090s
Ra-223	332.84	83.49	1159.	109.	0.121	123.60	1.093s
Cd-109	350.70	87.96	1442.	791.	0.879	21.57	1.276s
U-235	356.07	89.30	1124.	123.	0.136	112.89	1.100s
Ce-139	666.08	166.82	1108.	-89.	-0.099	153.61	1.182s
Th-228	861.80	215.76	1092.	134.	0.149	106.04	1.235s
Pb-212	953.29	238.63	787.	169.	0.188	49.36	1.259D
Ra-224	962.76	241.00	816.	59.	0.065	139.85	1.262D
Eu-152	982.63	245.97	1099.	-74.	-0.082	191.48	1.266s
Ac-227	1023.15	256.10	872.	64.	0.072	195.77	1.278s
Ra-223	1075.87	269.28	802.	68.	0.076	178.47	1.292s
Ra-226	1179.45	295.18	785.	122.	0.135	99.12	1.319s
La-140	1312.96	328.56	696.	88.	0.097	129.74	1.354s
Cs-136	1359.98	340.32	740.	95.	0.106	127.33	1.366s
Ra-226	1406.30	351.90	776.	118.	0.132	105.01	1.378
Tl-208	2331.43	583.18	404.	52.	0.058	177.14	1.611s
Ru-106	2486.10	621.84	400.	70.	0.078	135.26	1.649s
Ag-110M	2633.57	658.71	262.	1113.	1.236	9.08	1.684s
Cs-137	2644.78	661.51	696.	16858.	18.742	1.75	1.819s
Sb-124	2889.92	722.79	132.	30.	0.033	115.54	1.747D

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Bi-212	2908.10	727.33	233.	32.	0.035	140.74	1.751D
I-132	3089.25	772.61	286.	57.	0.064	144.73	1.794s
La-140	3260.99	815.54	285.	104.	0.115	80.97	1.835s
Y-88	3590.24	897.83	383.	65.	0.072	152.09	1.912s
Ac-228	3641.48	910.64	436.	74.	0.083	141.08	1.924s
Pa-234M	4003.14	1001.03	381.	66.	0.074	152.13	2.005D
U-238	4003.14	1001.03	381.	66.	0.074	152.13	2.005D
Ra-226	4480.33	1120.29	293.	56.	0.063	157.00	2.111s
Co-60	4691.18	1172.98	427.	9226.	10.251	2.43	2.400s
Co-60	5328.47	1332.23	377.	8259.	9.176	2.64	2.613s
Ag-110M	5534.61	1383.74	25.	28.	0.031	101.09	2.335s
Eu-152	5630.42	1407.68	31.	20.	0.022	154.35	2.355s
K-40	5841.87	1460.51	7.	98.	0.109	23.73	0.531s
Bi-212	6478.75	1619.64	8.	14.	0.016	115.35	2.523s

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

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*****   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
              pCi/G         keV      pCi/G         pCi/G          COMMENTS
-----------------------------------------------------------------------------

Be-7      C  -7.4816E-01                                      5.34E+01
                          477.56-7.482E-01 %(  3.246E+00 2.08E+02 1.03E+01 G K

Na-22     C  -4.7924E-02                                      9.50E+02
                         1274.53-4.792E-02 %(  2.198E-01 2.45E+02 9.99E+01 G K

K-40      N   4.3697E+00                                      4.68E+11
                         1461.00 4.370E+00  (P 6.828E-01 1.19E+01 1.07E+01 G K

Sc-46     F   1.8678E-02                                      8.38E+01
                          889.28 1.868E-02 %(  3.454E-01 9.59E+02 1.00E+02 G K

Cr-51     F   3.9920E-01                                      2.77E+01
                          320.08 3.992E-01 &(  2.564E+00 2.87E+02 1.01E+01 G K

Mn-54     C   1.2163E-01                                      3.12E+02
                          834.85 1.216E-01 %(  3.029E-01 1.26E+02 1.00E+02 G K

Co-56     C   4.8719E-02                                      7.73E+01
                         1238.28 4.872E-02 %(P 3.182E-01 3.48E+02 6.61E+01 G K
                         1771.35 8.870E-02 %   8.448E-01 5.11E+02 1.55E+01 G
L

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 Pace Analytical                  Spectrum name: LCSD33843.An1

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Co-58     C  -8.7420E-02                                      7.08E+01
                          810.78-8.742E-02 &(  3.094E-01 1.79E+02 9.94E+01 G K

Co-60     F   3.7575E+01                                      1.92E+03
                         1332.50 3.703E+01 *(P 4.179E-01 1.32E+00 1.00E+02 G K
                         1173.24 3.812E+01 *(P 4.092E-01 1.21E+00 1.00E+02 G

Zn-65     F   1.6125E-01                                      2.44E+02
                         1115.55 1.613E-01 %(P 7.246E-01 2.40E+02 5.06E+01 G K

Y-88      C   1.3139E-01                                      1.07E+02
                         1836.06 2.563E-02 %(  1.385E-01 2.98E+02 9.92E+01 G K
                          898.04 2.434E-01  (P 3.530E-01 7.60E+01 9.37E+01 G

Nb-94     I   1.2213E-01                                      7.41E+06
                          871.09 1.221E-01 %(P 3.297E-01 1.41E+02 9.99E+01 G K
                          702.62 0.000E+00 & P 2.678E-01 1.00E+03 9.79E+01 G

Zr-95     I  -6.4565E-02                                      6.40E+01
                          756.73-6.456E-02 %(  5.044E-01 3.93E+02 5.45E+01 G K
                          724.20 8.447E-02 % P 5.757E-01 3.42E+02 4.42E+01 G

Nb-95     I   1.1410E-01                                      3.50E+01
                          765.81 1.141E-01 %(P 2.932E-01 1.30E+02 9.98E+01 G K

Ru-106    I   2.0369E+00                                      3.73E+02
                          621.93 2.037E+00 &(  2.773E+00 6.76E+01 9.93E+00 G K
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Cd-109    F   4.3568E+01                                                  4.64E+02
                                 88.03 4.357E+01  (  9.896E+00 1.08E+01 3.61E+00 G K

Ag-110M   F   3.5014E+00                                                  2.50E+02
                                657.76 3.501E+00 ?(P 2.461E-01 4.54E+00 9.40E+01 G K
                               1505.04 0.000E+00 %   1.284E+00 1.00E+03 1.29E+01 G
                               1384.30 5.401E-01 -   4.929E-01 5.05E+01 2.41E+01 G
                                937.49 2.203E-03 % P 1.150E+00 2.71E+04 3.41E+01 G
                                884.68 4.674E-02 %   4.881E-01 5.42E+02 7.22E+01 G
                                763.94-4.814E-01 %   1.442E+00 1.52E+02 2.21E+01 G
                                744.28 1.033E-01 % P 6.045E+00 2.94E+03 4.70E+00 G
                                706.68 0.000E+00 % P 1.634E+00 1.00E+03 1.63E+01 G

Sb-124    F  -1.3482E-02                                                  6.02E+01
                                602.73-1.096E-01 &(  3.013E-01 1.36E+02 9.78E+01 G K
                                645.85-1.984E-02 %   4.050E+00 1.00E+04 7.38E+00 G
                                722.79 8.600E-01  (  1.631E+00 5.78E+01 1.08E+01 G
                               1690.98 3.923E-02 &   2.668E-01 3.66E+02 4.73E+01 G
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Pace Analytical Spectrum name: LCSD33843.An1

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 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Sb-125    I   1.1347E-01                                                  1.01E+03
                                427.88 1.135E-01 &(  1.027E+00 4.19E+02 2.96E+01 G K
                                176.31 7.391E-01 & P 3.385E+00 1.98E+02 6.82E+00 G
                                463.36 0.000E+00 % P 3.432E+00 1.00E+03 1.05E+01 G
                                600.60 0.000E+00 % P 1.606E+00 1.00E+03 1.79E+01 G
                                635.95 0.000E+00 % P 2.664E+00 1.00E+03 1.13E+01 G

Te-129    I   3.9529E-01                                                  3.36E+01
                                459.60 3.953E-01 %(  4.476E+00 5.42E+02 7.70E+00 G K
                                487.39 5.310E+00 %   2.191E+01 1.98E+02 1.42E+00 G

Te-129M   I   2.1467E+00                                                  3.36E+01
                                695.88 2.147E+00 &(P 8.647E+00 1.97E+02 3.00E+00 G K

I-132     I   2.4533E-01                                                  3.20E+00
                                772.60 2.453E-01 ?(P 3.485E-01 7.24E+01 7.56E+01 G K
                                522.65-1.414E-01 &   1.813E+00 6.11E+02 1.60E+01 G
                                630.19-4.128E-01 %   2.207E+00 2.63E+02 1.33E+01 G
                                954.55 6.546E-01 % P 2.359E+00 1.88E+02 1.76E+01 G

Te-132    I   1.8844E-03                                                  3.20E+00
                                228.16 1.884E-03 %(P 3.175E-01 7.54E+03 8.80E+01 G K

Cs-136    F   1.6210E-01                                                  1.32E+01
                                818.51 3.245E-02 %(P 3.218E-01 5.01E+02 9.97E+01 G K
                                176.60 1.217E-01 % P 2.332E+00 8.24E+02 1.00E+01 G
                                273.65 7.214E-01 %   2.283E+00 1.42E+02 1.11E+01 G
                                340.55 4.684E-01  (  6.372E-01 6.37E+01 4.22E+01 G
                               1048.07 0.000E+00 % P 4.782E-01 1.00E+03 8.00E+01 G
                               1235.36 2.868E-01 % P 1.020E+00 1.90E+02 2.00E+01 G

Cs-137    I   5.8828E+01                                                  1.10E+04
                                661.66 5.883E+01 *(  4.382E-01 8.74E-01 8.51E+01 G K

Ce-139    F  -1.7479E-01                                                  1.38E+02
                                165.85-1.748E-01 ?(  3.088E-01 7.68E+01 7.99E+01 G K

Ba-140    I   4.8989E-01                                                  1.28E+01
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                                537.26 4.899E-01 &(P 1.098E+00 1.07E+02 2.44E+01 G K
                                162.66 3.787E-01 % P 3.758E+00 4.27E+02 6.22E+00 G

La-140    I    3.6471E-01                                          1.28E+01
                               1596.21-1.864E-02 %(  1.559E-01 4.49E+02 9.54E+01 G K
                                487.02 0.000E+00 % P 7.428E-01 1.00E+03 4.55E+01 G
                                815.77 1.487E+00 &(  1.166E+00 4.05E+01 2.33E+01 G
                                328.76 8.792E-01 ?(  1.263E+00 6.49E+01 2.03E+01 G
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      ORTEC g v - i (3263) Env32  G701W047  2/21/2017 11:02:04 AM   Page  8
 Pace Analytical                    Spectrum name: LCSD33843.Anl

 Nuclide  Ave activity   Energy    Activity  Code Peak MDA  Comments

Ce-141    I    1.8608E-01                                          3.25E+01
                                145.44 1.861E-01 &(  4.831E-01 1.12E+02 4.82E+01 G K

Eu-152    F    2.5018E-01                                          4.95E+03
                                121.78 1.041E-01 %(P 8.924E-01 3.70E+02 2.84E+01 G K
                               1408.01 4.490E-01 ?(P 6.373E-01 7.72E+01 2.09E+01 G
                               1112.12 0.000E+00 % P 3.000E+00 1.00E+03 1.36E+01 G
                               1085.91 0.000E+00 % P 3.891E+00 1.00E+03 9.92E+00 G
                                964.13-2.729E-01 &   2.860E+00 5.46E+02 1.43E+01 G
                                344.28 0.000E+00 % P 1.089E+00 1.00E+03 2.66E+01 G
                                244.70-1.748E+00 +   3.714E+00 9.57E+01 7.49E+00 G

Ir-192    F    1.1340E-01                                          7.38E+01
                                316.51 1.134E-01 %(P 3.103E-01 1.23E+02 8.28E+01 G
                                468.07 0.000E+00 % P 7.479E-01 1.00E+03 4.78E+01 G
                                308.46 0.000E+00 & P 8.865E-01 1.00E+03 3.00E+01 G
                                295.96 4.075E-01 % P 9.401E-01 1.04E+02 2.87E+01 G

Hg-203    F    1.0687E-02                                          4.66E+01
                                279.20 1.069E-02 &(P 3.265E-01 1.36E+03 8.15E+01 G K

Tl-208    N    1.7071E-01                                          6.98E+02
                                583.19 1.707E-01 ?(P 3.159E-01 8.86E+01 8.45E+01 G K
                                860.56 4.842E-01 &   2.613E+00 2.80E+02 1.24E+01 G
                                277.36 0.000E+00 % P 4.140E+00 1.00E+03 6.31E+00 G

Pb-210    N    1.8598E+03                                          8.14E+03
                                 46.54 1.860E+03 @(P 8.287E+01 2.47E+00 4.25E+00 G K

Bi-212    N    2.1523E+00                                          6.98E+02
                                727.33 1.509E+00  (P 3.511E+00 7.04E+01 6.58E+00 G K
                               1620.50 4.994E+00 ?(P 5.336E+00 5.77E+01 1.49E+00 G

Pb-212    N    6.8418E-01                                          6.98E+02
                                238.63 6.842E-01  (P 5.395E-01 2.47E+01 4.33E+01 G K
                                 77.11 8.305E-01 % P 2.321E+00 1.16E+02 1.75E+01 GA
                                 74.81 3.635E+00 + P 3.768E+00 4.36E+01 1.04E+01 GA
                                 87.30-5.278E-01 %   4.194E+00 3.29E+02 7.80E+00 GA

Ra-223    N    9.2426E-01                                          7.96E+03
                                269.46 9.170E-01 &(P 1.818E+00 8.92E+01 1.37E+01 G K
                                 83.78 9.282E-01 &(  1.372E+00 6.18E+01 2.49E+01 G
                                323.87 0.000E+00 % P 6.708E+00 1.00E+03 3.93E+00 G
                                154.21 0.000E+00 % P 4.355E+00 1.00E+03 5.62E+00 G
                                 94.90 3.047E-01 % P 2.616E+00 3.70E+02 1.13E+01 G
                                 81.07-1.827E-00 &   2.638E+00 6.04E+01 1.50E+01 G
```

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Ra-224	N	2.6522E+00					6.98E+02	
			241.00	2.652E+00	(P	6.124E+00	6.99E+01	3.90E+00 G K
Ra-226	N	6.8779E-01					5.84E+05	
			609.31	1.904E-01	%(P	6.959E-01	1.80E+02	4.48E+01 G K
			1764.49	3.017E-01	% P	1.180E+00	2.16E+02	1.54E+01 G
			295.22	1.227E+00	*(P	1.341E+00	4.96E+01	1.92E+01 G
			1120.29	1.528E+00	&(P	2.236E+00	7.85E+01	1.48E+01 G
			351.99	6.744E-01	(P	7.546E-01	5.25E+01	3.71E+01 G
			241.92	0.000E+00	% P	3.577E+00	1.00E+03	7.47E+00 G
Ac-227	N	6.9039E-01					7.95E+03	
			235.97	1.360E-01	%(P	2.185E+00	7.19E+02	1.23E+01 G K
			256.25	1.664E+00	?(	3.620E+00	9.79E+01	7.00E+00 G
			300.00	1.234E+00	& P	1.165E+01	4.22E+02	2.30E+00 G
			329.85	-2.346E+00	&	1.008E+01	1.92E+02	2.70E+00 G
Ac-228	N	9.9328E-01					2.10E+03	
			911.21	9.933E-01	?(P	1.335E+00	7.05E+01	2.66E+01 G K
			968.97	0.000E+00	% P	2.473E+00	1.00E+03	1.62E+01 G
			338.32	1.968E-01	% P	2.500E+00	5.88E+02	1.13E+01 G
Th-228	N	1.4742E+01					6.98E+02	
			84.37	0.000E+00	&(P	2.909E+01	1.00E+03	1.27E+00 G K
			215.99	8.571E+01	(	1.002E+02	5.30E+01	2.63E-01 G
			166.41	-1.140E+01	&	2.208E+02	8.34E+02	1.08E-01 G
			131.61	-1.495E+01	&	1.856E+02	5.35E+02	1.35E-01 G
Pa-231	N	4.0018E+00					1.20E+07	
			283.70	4.002E+00	&(P	1.653E+01	1.85E+02	1.60E+00 G K
			330.00	-4.873E+00	&	2.094E+01	1.92E+02	1.30E+00 G
Pa-234M	N	2.9675E+01					1.63E+12	
							Energy duplication	
			1001.03	2.967E+01	&(P	4.197E+01	7.61E+01	8.37E-01 G
Th-230	N	-4.5715E+00					2.75E+07	
			67.67	-4.571E+00	%(	1.373E+02	1.24E+03	3.80E-01 G K
U-238	N	2.9569E+01					1.63E+12	
							Energy duplication	
			1001.03	2.957E+01	&(P	4.182E+01	7.61E+01	8.40E-01 G K
			92.59	1.245E+00	& P	5.551E+00	1.92E+02	5.60E+00 GA
Am-241	T	-6.5124E-01					1.58E+05	
			59.54	-6.512E-01	%(	2.102E+00	1.34E+02	3.63E+01 G K

Nuclide		Ave activity	Energy	Activity	Code	Peak	MDA	Comments
Am-243	T	1.0525E-01					2.69E+06	
			74.66	1.053E-01	%(P	6.231E-01	2.45E+02	6.82E+01 G K

(- 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 2 Sigma %	Activity	
Ra-223	82.28	1420.	-124.	-0.137	120.81	-1.827E+00	
Ra-223	83.49	1159.	109.	0.121	123.60	9.282E-01	
U-235	89.30	1124.	123.	0.136	112.89	6.694E+00	
Ce-139	166.82	1108.	-89.	-0.099	153.61	-1.748E-01	
Th-228	215.76	1092.	134.	0.149	106.04	8.571E+01	
Eu-152	245.97	1099.	-74.	-0.082	191.48	-1.748E+00	
Ac-227	256.10	872.	64.	0.072	195.77	1.664E+00	
Ra-223	269.28	802.	68.	0.076	178.47	9.170E-01	P
Ra-226	295.18	785.	122.	0.135	99.12	1.227E+00	P
La-140	328.56	696.	88.	0.097	129.74	8.792E-01	
Cs-136	340.32	740.	95.	0.106	127.33	4.684E-01	
Ra-226	351.90	776.	118.	0.132	105.01	6.744E-01	P

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Pace Analytical Spectrum name: LCSD33843.An1

Nuclide	Channel	Energy	Background	Net area	Cnts/sec	Uncert	FWHM
Tl-208	583.18	404.	52.	0.058	177.14	1.707E-01	P
Ru-106	621.84	400.	70.	0.078	135.26	2.037E+00	
Ag-110M	658.71	262.	1113.	1.236	9.08	3.501E+00	P
I-132	772.61	286.	57.	0.064	144.73	2.453E-01	P
La-140	815.54	285.	104.	0.115	80.97	1.487E+00	
Y-88	897.83	383.	65.	0.072	152.09	2.434E-01	P
Ac-228	910.64	436.	74.	0.083	141.08	9.933E-01	P
Pa-234M	1001.03	381.	66.	0.074	152.13	2.967E+01	P
U-238	1001.03	381.	66.	0.074	152.13	2.957E+01	P
Ra-226	1120.29	293.	56.	0.063	157.00	1.528E+00	P
Ag-110M	1383.74	25.	28.	0.031	101.09	5.401E-01	

Eu-152 1407.68 31. 20. 0.022 154.35 4.490E-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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
Be-7	#B	-7.4816E-01	-7.4816E-01	3.1149E+00	3.1164E+00	3.246E+00
Na-22	#B	-4.7924E-02	-4.7924E-02	2.3518E-01	2.3527E-01	2.198E-01
K-40		4.3697E+00	4.3697E+00	1.0370E+00	1.1858E+00	6.828E-01
Sc-46	#B	1.8678E-02	1.8678E-02	3.5838E-01	3.5839E-01	3.454E-01
Cr-51	#B	3.9920E-01	3.9920E-01	2.2918E+00	2.2924E+00	2.564E+00
Mn-54	#B	1.2163E-01	1.2163E-01	3.0714E-01	3.0756E-01	3.029E-01
Co-56	#B	4.8719E-02	4.8719E-02	3.3899E-01	3.3905E-01	3.182E-01
Co-57	#B	0.0000E+00	0.0000E+00	1.4145E-01	1.4146E-01	3.088E-01
Co-58	#B	-8.7420E-02	-8.7420E-02	3.1320E-01	3.1341E-01	3.094E-01
Fe-59	#B	0.0000E+00	0.0000E+00	3.4976E-01	3.4977E-01	6.973E-01
Co-60	#	3.7575E+01	3.7575E+01	6.7375E-01	4.9484E+00	4.179E-01
Zn-65	#B	1.6125E-01	1.6125E-01	7.7240E-01	7.7268E-01	7.246E-01
Y-88	#B	1.3139E-01	1.3139E-01	1.9984E-01	2.0071E-01	1.385E-01
Nb-94	#B	1.2213E-01	1.2213E-01	3.4358E-01	3.4396E-01	3.297E-01
Zr-95	#B	-6.4565E-02	-6.4565E-02	5.0789E-01	5.0796E-01	5.044E-01
Nb-95	#B	1.1410E-01	1.1410E-01	2.9721E-01	2.9759E-01	2.932E-01
Ru-103	#B	0.0000E+00	0.0000E+00	1.5022E-01	1.5022E-01	3.467E-01
Ag-108M	#B	0.0000E+00	0.0000E+00	1.0854E-01	1.0854E-01	3.118E-01
Ru-106	#A	2.0369E+00	2.0369E+00	2.7551E+00	2.7681E+00	2.773E+00
Cd-109	#	4.3568E+01	4.3568E+01	9.3991E+00	1.1209E+01	9.896E+00
Ag-110M	#	3.5014E+00	3.5014E+00	3.1794E-01	5.6139E-01	2.461E-01
Sn-113	#B	0.0000E+00	0.0000E+00	1.6794E-01	1.6795E-01	4.770E-01
Sb-124	B	-1.3482E-02	-1.3482E-02	1.5577E-02	1.5678E-02	3.013E-01
Sb-125	#B	1.1347E-01	1.1347E-01	9.5111E-01	9.5123E-01	1.027E+00
Te-129	#B	3.9529E-01	3.9529E-01	4.2887E+00	4.2890E+00	4.476E+00
Te-129M	#B	2.1467E+00	2.1467E+00	8.4681E+00	8.4728E+00	8.647E+00
I-131	#B	0.0000E+00	0.0000E+00	1.3306E-01	1.3306E-01	3.637E-01
I-132	#A	2.4533E-01	2.4533E-01	3.5507E-01	3.5654E-01	3.485E-01

Te-132	#B	1.8844E-03	1.8844E-03	2.8423E-01	2.8423E-01	3.175E-01
I-133	#B	0.0000E+00	0.0000E+00	1.9058E-01	1.9059E-01	3.374E-01
Ba-133	#B	0.0000E+00	0.0000E+00	2.5303E-01	2.5304E-01	4.627E-01
Cs-134	#B	0.0000E+00	0.0000E+00	1.3123E-01	1.3124E-01	3.136E-01
Cs-136	#B	1.6210E-01	1.6210E-01	2.0640E-01	2.0751E-01	3.218E-01
Cs-137	#	5.8828E+01	5.8828E+01	1.0284E+00	7.8419E+00	4.382E-01
Ce-139	#A	-1.7479E-01	-1.7479E-01	2.6848E-01	2.6949E-01	3.088E-01
Ba-140	#B	4.8989E-01	4.8989E-01	1.0531E+00	1.0550E+00	1.098E+00
La-140	#F	3.6471E-01	3.6471E-01	2.9532E-01	2.9934E-01	1.559E-01
Ce-141	#B	1.8608E-01	1.8608E-01	4.1849E-01	4.1922E-01	4.831E-01
Ce-144	#B	0.0000E+00	0.0000E+00	7.8439E-01	7.8440E-01	2.249E+00
Eu-152	#B	2.5018E-01	2.5018E-01	3.8615E-01	3.8760E-01	8.924E-01
Eu-154	#B	0.0000E+00	0.0000E+00	2.9752E-01	2.9753E-01	6.487E-01
Eu-155	#B	0.0000E+00	0.0000E+00	4.6974E-01	4.6975E-01	1.498E+00
Ir-192	#A	1.1340E-01	1.1340E-01	2.7856E-01	2.7897E-01	3.103E-01
Hg-203	#B	1.0687E-02	1.0687E-02	2.9168E-01	2.9168E-01	3.265E-01
Tl-208	#A	1.7071E-01	1.7071E-01	3.0240E-01	3.0323E-01	3.159E-01
Pb-210	#	1.8598E+03	1.8598E+03	9.1975E+01	2.7720E+02	8.287E+01
Bi-212	A	2.1523E+00	2.1523E+00	1.9583E+00	1.9789E+00	3.511E+00
Pb-212		6.8418E-01	6.8418E-01	3.3768E-01	3.4993E-01	5.395E-01
Ra-223	#A	9.2426E-01	9.2426E-01	1.0032E+00	1.0108E+00	1.818E+00

Ra-224	A	2.6522E+00	2.6522E+00	3.7091E+00	3.7261E+00	6.124E+00
Ra-226	#B	6.8779E-01	6.8779E-01	6.8177E-01	6.8779E-01	5.959E-01
Ac-227	#B	6.9039E-01	6.9039E-01	1.3516E+00	1.3548E+00	2.185E+00
Ac-228	#A	9.9328E-01	9.9328E-01	1.4013E+00	1.4074E+00	1.335E+00
Th-228	#B	1.4742E+01	1.4742E+01	1.5633E+01	1.5769E+01	2.909E+01
Pa-231	#B	4.0018E+00	4.0018E+00	1.4813E+01	1.4823E+01	1.653E+01
Pa-234M	#A	2.9675E+01	2.9675E+01	4.5144E+01	4.5312E+01	4.197E+01
Th-230	#B	-4.5715E+00	-4.5715E+00	1.1354E+02	1.1354E+02	1.373E+02
Th-232	#B	0.0000E+00	0.0000E+00	7.7247E+01	7.7249E+01	2.298E+02
Th-234	#B	0.0000E+00	0.0000E+00	4.4307E+00	4.4308E+00	1.294E+01
U-235	#B	0.0000E+00	0.0000E+00	1.5266E+00	1.5267E+00	5.335E+00
U-238	#A	2.9569E+01	2.9569E+01	4.4983E+01	4.5150E+01	4.182E+01
Am-241	#B	-6.5124E-01	-6.5124E-01	1.7467E+00	1.7491E+00	2.102E+00
Am-243	#B	1.0525E-01	1.0525E-01	5.1643E-01	5.1664E-01	6.231E-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 (30.3 to 2035.6 keV) 2.005E+03 pCi/G
Total Decayed Activity (30.3 to 2035.6 keV) 2.0047893E+03 pCi/G

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Pace Analytical Spectrum name: LCSD33843.An1

The library has energies which are not separable.

Analyzed by: _____
HAMLEY

Reviewed by: _____
Supervisor

Laboratory: Pace Analytical

Gamma Spectroscopy

Calibration Data

Detector D2

Geometry (8-ounce can)

Date: 12/16/13

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

95232

Sieved Macon Soil in 1.5 Liter Wide Mouth PE "K" Bottle

Customer: Pace Analytical Services, Inc.
P.O. No.: PI-15443, Item 1 Product Code: 8403-EG-SOI
Reference Date: 01-Oct-2013 12:00 PM EST **Grams of Master Source:** 0.032362

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	———	6.301E+03	0.1	1.6	3.2	4π LS
Am-241	59.5	1.580E+05	———	3.966E+03	0.1	1.6	3.2	4π LS
Cd-109	88.0	4.614E+02	1.716E+05	5.553E+03	0.5	2.0	4.1	HPGe
Co-57	122.1	2.717E+02	9.779E+04	3.165E+03	0.4	1.7	3.5	HPGe
Ce-139	165.9	1.376E+02	1.385E+05	4.482E+03	0.4	1.7	3.5	HPGe
Hg-203	279.2	4.689E+01	3.025E+05	9.791E+03	0.3	1.7	3.5	HPGe
Sn-113	391.7	1.151E+02	1.821E+05	5.893E+03	0.4	1.9	3.9	HPGe
Cs-137	661.7	1.099E+04	1.169E+05	3.782E+03	0.7	1.9	4.0	HPGe
Y-88	898.0	1.066E+02	4.396E+05	1.423E+04	0.5	1.7	3.5	HPGe
Co-60	1173.2	1.923E+03	2.171E+05	7.027E+03	0.6	1.8	3.8	HPGe
Co-60	1332.5	1.925E+03	2.172E+05	7.029E+03	0.7	1.8	3.9	HPGe
Y-88	1836.1	1.066E+02	4.654E+05	1.506E+04	0.7	1.7	3.7	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
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Comments:
~ 2000 grams soil

This standard will expire one year after the reference date.

Source Prepared by: _____
K. Eardley, Radiochemist

QA Approved. _____ Date: 5 Dec 13
J.D. McCorvey, Counting Room Manager

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 3-R056-0

Standard ID: 13-056
Parent Source: 95232
Parent Conc: Varies (See Calc.)
Reference Date: 10/1/13 1200

Nuclide: Mixed γ

Std Conc.: See below
Prepared By: WTF
Prep Date:
Expiration Date:

Balance ID: GX-814 14900804
Diluent: NA
Diluent IDs: NA

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

Transferred 371.44g of 95232 to an 8-oz can and sealed.

Dilution Calculations:

Pb-210 Conc (46.5 keV) = $\frac{371.44g}{2.000g}$ (630 gps) = 1170.2 gps

Cs-137 Conc (661.6 keV) = $\frac{371.44g}{2.000g}$ (3782 gps) = 702.39 gps

Y-88 Conc (1836 keV) = $\frac{371.44g}{2000g}$ (15060 gps) = 2796.94 gps

Container Tare Weight:
Container + Standard Final Weight:

Balance ID:

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst Initials: Date:

Mixed Gamma Soil Source 13-056

Isotope	Half-Life (Days)	Reference Date	Energy	Abundance	Primary Source GPS
Pb-210	8109.0	10/1/2013	46.5	0.0425	6301
Am-241	157864.7	10/1/2013	59.5	0.359	3966
Cd-109	463.9	10/1/2013	88	0.0361	5553
Co-57	271.79	10/1/2013	122	0.856	3185
Ce-139	137.6	10/1/2013	166	0.79888	4482
Hg-203	46.61	10/1/2013	279	0.8146	9791
Sn-113	115.1	10/1/2013	392	0.64	5893
Cs-137	10983.1	10/1/2013	662	0.851	3782
Y-88	106.6	10/1/2013	898	0.937	14230
Co-60	1924.9	10/1/2013	1173	0.999736	7027
Co-60	1924.9	10/1/2013	1332	0.9998561	7029
Y-88	106.6	10/1/2013	1836	0.992	15060

Isotope	Primary Mass	Peak pCi	Analyte uCi	Mass (g)	uCi/g
Pb-210	2000	4006995.7	4.007	2.000	2.00E-03
Am-241	2000	298577.1	0.298	2.000	1.49E-04
Cd-109	2000	4157370.7	4.157	2.000	2.08E-03
Co-57	2000	99930.5	0.100	2.000	5.00E-05
Ce-139	2000	151635.0	0.152	2.000	7.58E-05
Hg-203	2000	324848.5	0.325	2.000	1.62E-04
Sn-113	2000	248858.8	0.249	2.000	1.24E-04
Cs-137	2000	120113.1	0.120	2.000	6.01E-05
Y-88	2000	410453.1	0.410	2.000	2.05E-04
Co-60	2000	189939.1	0.190	2.000	9.50E-05
Co-60	2000	190000.3		2.000	
Y-88	2000	410309.5		2.000	
		Total =	10.009		

Isotope	Energy	Source Mass	Source GPS	Uncertainty from Certificate (%)
Pb-210	46.5	371.44	1170.22	3.2
Am-241	59.5	371.44	736.57	3.2
Cd-109	88	371.44	1031.30	4.1
Co-57	122	371.44	587.80	3.5
Ce-139	166	371.44	832.40	3.5
Hg-203	279	371.44	1818.38	3.5
Sn-113	392	371.44	1094.45	3.9
Cs-137	662	371.44	702.39	4.0
Y-88	898	371.44	2642.80	3.5
Co-60	1173	371.44	1305.05	3.8
Co-60	1332	371.44	1305.43	3.9
Y-88	1836	371.44	2796.94	3.7

Calibration Data from file: DET_2_8_OZ_CAN(121613).Clb
Energy Calibration Date: 1/10/2014 Time: 12:30:55 PM
Efficiency Calibration Date: 1/6/2014 Time: 12:06:06 PM

Calibration Description:
Face Source 13-056 (371.44g of SRM 95232 in a sealed 8-ounce can
)

Energy Calibration Fit
Energy = 0.2622 +0.250066*Channel -1.77271e-008*Channel**2
FWHM (ch) = 4.0053 +0.001106*Channel -2.55938e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
185.24	46.54	46.58	-0.09%	1.02	1.05	-2.89%
237.23	59.54	59.58	-0.07%	1.04	1.07	-2.48%
351.15	88.03	88.07	-0.04%	1.10	1.10	-0.16%
487.00	122.06	122.04	0.02%	1.14	1.13	0.37%
544.69	136.47	136.47	0.01%	1.18	1.15	2.70%
662.17	165.85	165.84	0.00%	1.21	1.18	2.67%
1115.22	279.20	279.12	0.03%	1.30	1.30	-0.24%
1565.14	391.69	391.61	0.02%	1.42	1.42	0.24%
2645.50	661.66	661.69	-0.00%	1.69	1.69	0.05%
3591.13	898.04	898.06	-0.00%	1.89	1.91	-1.07%
4692.32	1173.24	1173.26	-0.00%	2.17	2.16	0.78%
5329.67	1332.50	1332.53	-0.00%	2.28	2.29	-0.59%
7344.97	1836.06	1836.04	0.00%	2.69	2.69	0.16%

Efficiency Calibration Fit
Polynomial Uncertainty = 1.5664 %
Coefficients:
-0.352903 -3.748292 0.302295 -0.033892 0.001351 -0.000028

Efficiency Table

Energy	Efficiency	Fit	Delta
46.77	4.7789E-003	4.7734E-003	0.11%
59.78	1.7688E-002	1.7783E-002	-0.54%
88.03	4.1806E-002	4.0873E-002	2.23%
122.04	5.0792E-002	5.1256E-002	-0.91%
166.05	5.1443E-002	5.1986E-002	-1.06%
279.31	4.2781E-002	4.3216E-002	-1.02%
391.62	3.7281E-002	3.6351E-002	2.49%
661.81	2.8830E-002	2.7380E-002	5.03%
898.27	2.2609E-002	2.3076E-002	-2.07%
1173.68	1.9334E-002	1.9669E-002	-1.73%
1332.86	1.7347E-002	1.8127E-002	-4.49%
1836.29	1.4858E-002	1.4385E-002	3.18%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Am-241	59.54	36.30	1.58E+003	2029.12	736.57	3.20%	10/1/2013 12:00:00 PM
Cd-109	88.03	3.61	4.64E+002	28567.87	1031.30	4.10%	10/1/2013 12:00:00 PM
Co-57	122.06	85.60	2.72E+002	686.68	587.80	3.50%	10/1/2013 12:00:00 PM
Ce-139	165.85	79.89	1.38E+002	1041.98	832.40	3.50%	10/1/2013 12:00:00 PM
Sn-113	391.70	64.00	1.15E+002	1710.08	1094.45	3.90%	10/1/2013 12:00:00 PM
Cs-137	661.66	85.10	1.10E+004	825.37	702.39	4.00%	10/1/2013 12:00:00 PM
Y-88	898.07	93.70	1.07E+002	2820.49	2642.80	3.50%	10/1/2013 12:00:00 PM
Co-60	1173.24	99.97	1.92E+003	1305.39	1305.05	3.80%	10/1/2013 12:00:00 PM
Co-60	1332.50	99.99	1.92E+003	1305.61	1305.43	3.90%	10/1/2013 12:00:00 PM
Y-88	1836.08	99.20	1.07E+002	2819.50	2796.94	3.70%	10/1/2013 12:00:00 PM
Pb-210	46.77	4.25	8.15E+003	27534.59	1170.22	3.20%	10/1/2013 12:00:00 PM
Hg-203	279.31	81.46	4.66E+001	2232.24	1818.38	3.50%	10/1/2013 12:00:00 PM

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

80581-493

2000 Grams of Sieved Griffin Soil in 1500 mL Wide Mouth <K> Bottle

Customer: Face Analytical Services, Inc.
P.O. No.: PI-11862, Item 1
Calibration Date: 01-Jul-2009 12:00 EST **Grams of Master Source:** 0.035871

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	8119.5	--------	6.299E+03	0.1	2.1	4.1	4π LS
Cd-109	88.0	462.6	1.668E+05	6.044E+03	0.6	2.3	4.6	HPGe
Co-57	122.1	271.8	8.978E+04	3.230E+03	0.6	2.0	4.2	HPGe
Ce-139	165.9	137.6	1.262E+05	4.527E+03	0.5	1.9	3.9	HPGe
Hg-203	279.2	46.61	2.772E+05	9.943E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	115.1	1.763E+05	6.324E+03	0.4	1.9	3.9	HPGe
Cs-137	661.7	10983	1.143E+05	4.100E+03	0.6	1.9	4.0	HPGe
Y-88	898.0	106.6	4.264E+05	1.530E+04	0.4	1.9	3.9	HPGe
Co-60	1173.2	1925.2	2.107E+05	7.558E+03	0.5	1.9	3.9	HPGe
Co-60	1332.5	1925.2	2.110E+05	7.568E+03	0.5	1.9	3.9	HPGe
Y-88	1836.1	106.6	4.509E+05	1.617E+04	0.4	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)

Mass measurement upon receipt of this standard indicated a total mass of 2003.1 g. 10/6/09

Corporate Office
24951 Avenue Tibbitts Valencia California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 3-R056-0

Standard ID: 13-051
Parent Source: 80581-493
Parent Conc: See certificate
Reference Date: 7/1/2009 1200

Nuclide: Mixed X

Std Conc.: see below
Prepared By: WTF
Prep Date: 8/27/13
Expiration Date: 8/27/18

Balance ID: NA
Diluent: NA Mixed Soil
Diluent IDs: NA

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

369.5 grams of 80581-493 canned in 8 oz can and sealed on 8/27/2013.

Dilution Calculations:

NA

Container Tare Weight: _____
Container + Standard Final Weight: _____

Balance ID: _____

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst Initials: _____ Date: _____

ORTEC g v - i (3135) Env32 G53W4.24 1/10/2014 12:34:47 PM Page 1
Spectrum name: 13-051CVD2-8OZCAN.An1

Sample description
CALIBRATION

Spectrum Filename: C:\User\13-051CVD2-8OZCAN.An1

Acquisition information

Start time:	1/3/2014 3:36:38 PM
Live time:	900
Real time:	912
Dead time:	1.32 %
Detector ID:	2

Detector system
DET 2

Calibration

Filename:	DET_2_8_OZ_CAN(121613).Clb

Energy Calibration

Created:	1/10/2014 12:30:55 PM
Zero offset:	0.262 keV
Gain:	0.250 keV/channel
Quadratic:	-1.773E-08 keV/channel^2

Efficiency Calibration

Created:	1/6/2014 12:06:06 PM
Type:	Polynomial
Uncertainty:	1.566 %
Coefficients:	-0.352903 -3.748292 0.302295
	-0.033892 0.001351 -0.000028

Library Files

Main analysis library:	Calib(wPbandAm).Lib
Library Match Width:	0.500
Peak stripping:	Library based

Analysis parameters

Analysis engine:	Env32 G53W4.24
Start channel:	120 (30.27keV)
Stop channel:	8144 (2035.63keV)
Peak rejection level:	100.000%
Peak search sensitivity:	3
Sample Size:	3.6950E+02
Activity scaling factor:	1.0000E+06/(1.0000E+00* 3.6950E+02) = 2.7064E+03
Detection limit method:	Reg. Guide 4.16 Method
Random error:	4.9600000E+00
Systematic error:	5.0000000E+00
Fraction Limit:	0.000%
Background width:	average of three points.
Half lives decay limit:	100.000

ORTEC g v - i (3135) Env32 G53W4.24 1/10/2014 12:34:47 PM Page 2
Spectrum name: 13-051CVD2-8OZCAN.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	1/1/2013 12:00:00 PM
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. 9 cutoff 20.00000 %
Energy Calibration
Normalized diff: 0.0216

***** 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. pCi/G	Nuc
46.58	4561.	2.67	0.99	4.586E-03	46.54	4.250	1.980E+03	PB210
63.35	84.	64.88	0.65	2.149E-02				
82.24	116.	43.90	0.74	3.740E-02				
88.03	3752.	3.33	1.15	4.087E-02	88.03	3.610	3.577E+02	CD109
107.75	103.	43.45	0.59	4.858E-02				
122.02	566.	11.80	1.01	5.125E-02	122.06	85.600	2.672E+00	CO57
185.77	67.	59.02	1.20	5.074E-02				
250.57	82.	46.53	1.27	4.543E-02				
252.64	68.	55.36	1.27	4.527E-02				
263.07	115.	52.48	0.55	4.445E-02				
287.04	92.	39.30	0.33	4.265E-02				
661.56	18012.	0.82	1.70	2.739E-02	661.66	85.100	6.429E+01	CS137
755.92	31.	45.37	0.39	2.544E-02				
834.81	44.	49.53	0.68	2.406E-02				
897.46	45.	53.28	0.39	2.309E-02				
1160.85	26.	47.36	0.59	1.980E-02				
1173.03	13796.	0.98	2.10	1.968E-02	1173.24	99.974	6.506E+01	CO60
1332.23	12588.	0.98	2.22	1.813E-02	1332.50	99.986	6.441E+01	CO60

********** 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	Intensity Cts/Sec	Uncert 2 Sigma %	FWHM keV	Suspected Nuclide	
252.29	63.35	962.	84.	0.093	129.76	0.646	-	s
327.82	82.24	923.	116.	0.129	87.79	0.740	-	s
429.84	107.75	673.	103.	0.115	86.90	0.593	-	s
741.87	185.75	759.	67.	0.075	118.03	1.203	-	D
1001.05	250.73	682.	82.	0.091	93.06	1.272	-	D
1009.30	252.79	681.	68.	0.076	110.71	1.274	-	D
1051.03	263.07	882.	115.	0.128	104.97	0.551	-	s
1146.89	287.04	429.	92.	0.102	78.61	0.333	-	s
3022.49	755.92	77.	31.	0.034	90.74	0.386	-	s
3338.09	834.81	148.	44.	0.048	99.06	0.582	-	s
3588.75	897.46	174.	58.	0.064	59.87	0.395	-	s
4642.64	1160.85	57.	26.	0.029	94.72	0.593	-	s

C

ORTEC g v - i (3135) Env32 G53W4.24 1/10/2014 12:34:47 PM Page 3
Spectrum name: 13-051CVD2-8OZCAN.An1

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

This section based on library: Calib(wPbandAm).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 2 Sigma %	FWHM keV
PB-210	185.22	46.58	2200.	4561.	5.068	5.34	0.990
CD-109	350.98	88.03	2300.	3752.	4.169	6.67	1.154
CO-57	486.91	122.02	1061.	566.	0.629	23.60	1.014s
CS-137	2645.00	661.56	578.	18012.	20.013	1.65	1.698s
CO-60	4691.37	1173.03	512.	13796.	15.329	1.97	2.103s
CO-60	5328.48	1332.23	270.	12588.	13.987	1.96	2.224s

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 pCi/G	Peak Energy keV	Peak Activity pCi/G	Peak Code	MDA Value pCi/G	COMMENTS
PB-210	N	1.9797E+03					
			46.54	1.980E+03	(	9.605E+01 2.67E+00	G K
AM-241		1.0870E-02					
			59.54	1.087E-02	&(	2.450E+00 6.74E+03	G
CD-109	F	3.5771E+02					
			88.03	3.577E+02	(	2.156E+01 3.33E+00	G K
CO-57	C	2.6725E+00					
			122.06	2.672E+00	(	7.300E-01 1.18E+01	G K
			136.47	1.095E+00	%	6.909E+00 1.90E+02	G
CE-139	F	-8.4294E-03					
			165.85	-8.429E-03	%(	2.246E+00 7.96E+03	G K
HG-203	F	2.0463E+00					
			279.20	2.046E+00	&(	9.451E+01 1.38E+03	G K

C

ORTEC g v - i (3135) Env32 G53W4.24 1/10/2014 12:34:47 PM Page 4
Spectrum name: 13-051CVD2-8OZCAN.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments
SN-113	F 1.6903E-02					

```
                                 391.69 1.690E-02 %(  4.672E+00 8.24E+03 G K

CS-137    I    6.4289E+01
                                 661.66 6.429E+01 @(  4.094E-01 8.23E-01 G K

CO-60     F    6.4740E+01
                                1332.50 6.441E+01 @(  4.057E-01 9.82E-01 G
                                1173.24 6.506E+01 @(  5.101E-01 9.83E-01 G

Y-88      C    2.2685E-01
                                1836.06 2.269E-01 %(  2.026E+00 2.54E+02 G K
                                 898.04-6.245E-01 %   5.626E+00 2.69E+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        G - Gamma Ray
   F - Fast Neutron Activation           X - X-Ray
   I - Fission Product                   F - 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

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

ORTEC g v - i (3135) Env32 G53W4.24 1/10/2014 12:34:47 PM Page 5
Spectrum name: 13-051CVD2-8OZCAN.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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
PB-210	1.9188E+03	1.9797E+03	1.0571E+02	2.9775E+02	9.605E+01
AM-241 #A	1.0853E-02	1.0870E-02	1.4663E+00	1.4663E+00	2.450E+00
CD-109	2.0666E+02	3.5771E+02	2.3842E+01	5.6000E+01	2.156E+01
CO-57 #	1.0478E+00	2.6725E+00	6.3083E-01	7.2504E-01	7.300E-01
CE-139 #B	-1.3268E-03	-8.4294E-03	1.3428E+00	1.3428E+00	2.246E+00
HG-203 #B	8.7044E-03	2.0463E+00	5.6510E+01	5.6511E+01	9.451E+01
SN-113 #B	1.8520E-03	1.6903E-02	2.7839E+00	2.7839E+00	4.672E+00
CS-137 #	6.2816E+01	6.4289E+01	1.0578E+00	8.5614E+00	4.094E-01

CO-60	#	5.6722E+01	6.4740E+01	8.9980E-01	8.4943E+00	4.057E-01
Y-88	#B	2.0865E-02	2.2685E-01	1.1527E+00	1.1531E+00	2.025E+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 (263.1 to 2035.6 keV) 2.246E+03 pCi/G
Total Decayed Activity (263.1 to 2035.6 keV) 2.4690686E+03 pCi/G

Analyzed by: _____
HAMLEY

Reviewed by: _____ 5/2/14
Supervisor

Laboratory:

Isotope	Half-Life (Days)	Reference Date	Count Date	Decay Days	DF	Energy	Abundance
Pb-210	8145.1	7/1/2009	01/01/13	1280.50	0.8963	46.5	0.0425
Cd-109	463.8	7/1/2009	01/01/13	1280.50	0.1476	88	0.0361
Co-57	271.79	7/1/2009	01/01/13	1280.50	0.0382	122	0.856
Ce-139	137.6	7/1/2009	01/01/13	1280.50	0.0016	166	0.79866
Hg-203	46.61	7/1/2009	01/01/13	1280.50	0.0000	279	0.8146
Sn-113	115.1	7/1/2009	01/01/13	1280.50	0.0004	392	0.64
Cs-137	10983.1	7/1/2009	01/01/13	1280.50	0.9224	662	0.851
Y-88	106.6	7/1/2009	01/01/13	1280.50	0.0002	898	0.937
Co-60	1924.9	7/1/2009	01/01/13	1280.50	0.6306	1173	0.999736
Co-60	1924.9	7/1/2009	01/01/13	1280.50	0.6306	1332	0.9998561
Y-88	106.6	7/1/2009	01/01/13	1280.50	0.0002	1836	0.992

Isotope	Primary Source GPS	Primary Mass	Peak pCi/g	13-051CVD2-8OZCAN D2 8-oz Measured	13-051CVD2-8OZCAN D2 8-oz %Rec
Pb-210	6299	2000	1796.1	1886.0	105.0%
Cd-109	6044	2000	334.0		0.0%
Co-57	3220	2000	1.9		0.0%
Ce-139	4527	2000	0.1		0.0%
Hg-203	9843	2000	0.0		0.0%
Sn-113	6324	2000	0.1		0.0%
Cs-137	4100	2000	60.1	64.1	106.7%
Y-88	15300	2000	0.1		0.0%
Co-60	7558	2000	64.4	64.4	99.9%
Co-60	7569	2000	64.5	65.0	100.7%
Y-88	16170	2000	0.1		0.0%

Gamma Spectroscopy

Calibration Data

Detector D5

Geometry (8-ounce can)

Date: 12/16/13

Eckert & Ziegler
Analytics

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

95232

Sieved Macon Soil in 1.5 Liter Wide Mouth PE "K" Bottle

Customer: Pace Analytical Services, Inc.
P.O. No.: PI-15443, Item 1 Product Code: 8403-EG-SOI
Reference Date: 01-Oct-2013 12:00 PM EST **Grams of Master Source:** 0.032362

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	-------	6.301E+03	0.1	1.6	3.2	4π LS
Am-241	59.5	1.580E+05	-------	3.966E+03	0.1	1.6	3.2	4π LS
Cd-109	88.0	4.614E+02	1.716E+05	5.553E+03	0.5	2.0	4.1	HPGe
Co-57	122.1	2.717E+02	9.779E+04	3.165E+03	0.4	1.7	3.5	HPGe
Ce-139	165.9	1.376E+02	1.365E+05	4.482E+03	0.4	1.7	3.5	HPGe
Hg-203	279.2	4.659E+01	3.025E+05	9.791E+03	0.3	1.7	3.5	HPGe
Sn-113	391.7	1.151E+02	1.821E+05	5.893E+03	0.4	1.9	3.9	HPGe
Cs-137	661.7	1.099E+04	1.169E+05	3.782E+03	0.7	1.9	4.0	HPGe
Y-88	898.0	1.066E+02	4.396E+05	1.423E+04	0.5	1.7	3.5	HPGe
Co-60	1173.2	1.925E+03	2.171E+05	7.027E+03	0.6	1.8	3.8	HPGe
Co-60	1332.5	1.925E+03	2.172E+05	7.029E+03	0.7	1.8	3.9	HPGe
Y-88	1836.1	1.066E+02	4.654E+05	1.506E+04	0.7	1.7	3.7	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:
~ 2000 grams soil

This standard will expire one year after the reference date.

Source Prepared by: _____
K. Eardley, Radiochemist

QA Approved: _____ Date: 5 DEC 13
J.D. McCorvey, Counting Room Manager

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 3-R056-0

Standard ID: 13-056
Parent Source: 95232
Parent Conc: Various (see below)
Reference Date: 10/1/13 12:00

Nuclide: Mixed γ

Std Conc.: See below
Prepared By: WTF
Prep Date:
Expiration Date:

Balance ID: GX-8K 14900804
Diluent: NA
Diluent IDs: NA

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

Transferred 371.44g of 95232 to an 8-oz can and sealed.

Dilution Calculations:

Pb-210 Conc (46.5 keV) = $\frac{371.44g}{2000g}$ (6301 gps) = 1170.2 gps

Cs-137 Conc (661.6 keV) = $\frac{371.44g}{2000g}$ (3782 gps) = 702.39 gps

Y-88 Conc (1836 keV) = $\frac{371.44g}{2000g}$ (15060 gps) = 2796.94 gps

Container Tare Weight:
Container + Standard Final Weight:

Balance ID:

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst initials: Date:

Mixed Gamma Soil Source 13-056

Isotope	Half-Life (Days)	Reference Date	Energy	Abundance	Primary Source GPS
Pb-210	8109.0	10/1/2013	46.5	0.0425	6301
Am-241	157864.7	10/1/2013	59.5	0.359	3966
Cd-109	463.9	10/1/2013	88	0.0361	5553
Co-57	271.79	10/1/2013	122	0.856	3165
Ce-139	137.6	10/1/2013	166	0.79886	4482
Hg-203	46.61	10/1/2013	279	0.8146	9791
Sn-113	115.1	10/1/2013	392	0.64	5893
Cs-137	10963.1	10/1/2013	662	0.851	3782
Y-88	106.6	10/1/2013	898	0.937	14230
Co-60	1924.9	10/1/2013	1173	0.999736	7027
Co-60	1924.9	10/1/2013	1332	0.9998561	7029
Y-88	106.6	10/1/2013	1836	0.992	15060

Isotope	Primary Mass	Peak pCi	Analyte uCi	Mass (g)	uCi/g
Pb-210	2000	4006995.2	4.007	2,000	2.00E-03
Am-241	2000	298577.1	0.299	2,000	1.49E-04
Cd-109	2000	4157370.7	4.157	2,000	2.08E-03
Co-57	2000	99930.5	0.100	2,000	5.00E-05
Ce-139	2000	151635.0	0.152	2,000	7.58E-05
Hg-203	2000	324848.5	0.325	2,000	1.62E-04
Sn-113	2000	248859.8	0.249	2,000	1.24E-04
Cs-137	2000	120113.1	0.120	2,000	6.01E-05
Y-88	2000	410453.1	0.410	2,000	2.05E-04
Co-60	2000	189969.1	0.190	2,000	9.50E-05
Co-60	2000	190000.3		2,000	
Y-88	2000	410308.5		2,000	
		Total =	10.009		

Isotope	Energy	Source Mass	Source GPS	Uncertainty from Certificate (%)
Pb-210	46.5	371.44	1170.22	3.2
Am-241	59.5	371.44	736.57	3.2
Cd-109	88	371.44	1031.30	4.1
Co-57	122	371.44	587.80	3.5
Ce-139	166	371.44	852.40	3.5
Hg-203	279	371.44	1818.38	3.5
Sn-113	392	371.44	1094.45	3.9
Cs-137	662	371.44	702.39	4.0
Y-88	898	371.44	2642.80	3.5
Co-60	1173	371.44	1305.05	3.8
Co-60	1332	371.44	1305.43	3.9
Y-88	1836	371.44	2796.94	3.7

RS/2/14

Calibration Data from file: DET_5_8 OZ_CAN(121613).Clb
Energy Calibration Date: 1/31/2014 Time: 3:17:29 PM
Efficiency Calibration Date: 1/31/2014 Time: 3:24:20 PM

Calibration Description:
Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.

Energy Calibration Fit
Energy = 0.0908 +0.250109*Channel -2.20401e-008*Channel**2
FWHM (ch) = 3.6467 +0.000916*Channel -2.65067e-008*Channel**2

Energy/FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM(keV)	Fit(keV)	Delta
185.76	46.54	46.55	-0.03%	0.95	0.95	-0.25%
237.86	59.54	59.58	-0.07%	0.96	0.97	-0.68%
352.02	88.03	88.13	-0.11%	0.98	0.99	-1.08%
487.85	122.06	122.10	-0.03%	1.01	1.02	-1.36%
662.45	165.85	165.77	0.05%	1.07	1.06	0.98%
1118.60	279.20	279.08	0.04%	1.19	1.16	2.32%
1568.88	391.69	391.68	0.00%	1.26	1.25	0.25%
2645.44	661.66	661.58	0.01%	1.46	1.47	-0.53%
3591.49	898.04	898.07	-0.00%	1.66	1.65	0.89%
4692.67	1173.24	1173.28	-0.00%	1.86	1.84	1.01%
5330.11	1332.50	1332.57	-0.01%	1.90	1.94	-2.54%
7345.24	1836.06	1836.01	0.00%	2.25	2.23	0.64%

Efficiency Calibration Fit
Polynomial Uncertainty = 0.7979 %
Coefficients:
-0.299196 -4.550221 0.502791 -0.057551 0.002743 -0.000050

Efficiency Table

Energy	Efficiency	Fit	Delta
46.54	2.1591E-002	2.1578E-002	0.06%
59.54	3.4563E-002	3.4659E-002	-0.28%
88.03	4.5105E-002	4.4710E-002	0.88%
122.06	4.7707E-002	4.7435E-002	0.57%
165.85	4.2995E-002	4.3908E-002	-2.12%
279.20	3.1798E-002	3.1637E-002	0.51%
391.69	2.4652E-002	2.4347E-002	1.24%
661.66	1.6843E-002	1.6399E-002	2.64%
898.04	1.2991E-002	1.3211E-002	-1.69%
1173.24	1.0874E-002	1.0967E-002	-0.86%
1332.50	9.8437E-003	1.0023E-002	-1.80%
1836.06	8.0155E-003	7.8885E-003	1.58%

Calibration Certificate Table

Isotope	Energy	Pct	Halflife	Activity	GPS	Error	Date & Time
Pb-210	46.54	4.25	8.15E+003	27535.00	1170.22	3.20%	10/1/2013 12:00:00 PM
Am-241	59.54	36.30	1.58E+005	2029.10	736.57	3.20%	10/1/2013 12:00:00 PM
Cd-109	88.03	3.61	4.64E+002	28568.00	1031.30	4.10%	10/1/2013 12:00:00 PM
Co-57	122.06	85.60	2.72E+002	686.68	587.80	3.50%	10/1/2013 12:00:00 PM
Ce-139	165.85	79.89	1.38E+002	1042.00	832.40	3.50%	10/1/2013 12:00:00 PM
Hg-203	279.20	81.46	4.66E+001	2232.20	1818.38	3.50%	10/1/2013 12:00:00 PM
Sn-113	391.69	64.00	1.15E+002	1710.10	1094.45	3.90%	10/1/2013 12:00:00 PM
Cs-137	661.66	85.10	1.10E+004	825.37	702.39	4.00%	10/1/2013 12:00:00 PM
Y-88	898.04	93.70	1.07E+002	2820.50	2642.80	3.50%	10/1/2013 12:00:00 PM
Co-60	1173.24	99.97	1.92E+003	1305.40	1305.05	3.60%	10/1/2013 12:00:00 PM
Co-60	1332.50	99.99	1.92E+003	1305.60	1305.43	3.90%	10/1/2013 12:00:00 PM
Y-88	1836.06	99.20	1.07E+002	2819.50	2796.94	3.70%	10/1/2013 12:00:00 PM

Eckert & Ziegler
Analytics

Atlanta, Georgia 30318
Tel 404-352-8677
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www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

80581-493

2000 Grams of Sieved Griffin Soil in 1500 mL Wide Mouth <K> Bottle

Customer: Pace Analytical Services, Inc.
P.O. No.: PI-11862, Item 1
Calibration Date: 01-Jul-2003 12:00 EST **Grams of Master Source:** 0.036871

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	8119.5	-------	6.299E+03	0.1	2.1	4.1	4π LS
Cd-109	88.0	462.6	1.685E+05	6.044E+03	0.6	2.3	4.3	HPGe
Co-57	122.1	271.8	8.978E+04	3.220E+03	0.6	2.0	4.2	HPGe
Ce-139	165.9	137.6	1.262E+05	4.527E+03	0.5	1.9	3.9	HPGe
Hg-203	279.2	46.61	2.772E+05	9.943E+03	0.4	1.9	3.9	HPGe
Sn-113	391.7	115.1	1.763E+05	6.324E+03	0.4	1.9	3.9	HPGe
Cs-137	661.7	10983	1.143E+05	4.100E+03	0.6	1.9	4.0	HPGe
Y-88	898.0	106.6	4.264E+05	1.530E+04	0.4	1.9	3.9	HPGe
Co-60	1173.2	1925.2	2.107E+05	7.558E+03	0.5	1.9	3.9	HPGe
Co-60	1332.5	1925.2	2.110E+05	7.569E+03	0.5	1.9	3.9	HPGe
Y-88	1836.1	106.6	4.509E+05	1.617E+04	0.4	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)

Mass measurement upon receipt of this standard indicated a total mass of 2003.1 g. 10/6/09

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1381 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 3-R056-0

Standard ID: 13-051
Parent Source: 80581-493
Parent Conc: see certificate
Reference Date: 7/1/2009 1200

Nuclide: Mixed γ

Std Conc.: see below
Prepared By: WTF
Prep Date: 8/27/13
Expiration Date: 8/27/18

Balance ID: NA
Diluent: NA Mixed Soil
Diluent IDs: NA

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

369.5 grams of 80581-493 canned in 8 oz can and sealed on 8/27/2013.

Dilution Calculations:

NA

Container Tare Weight: _____
Container + Standard Final Weight: _____

Balance ID: _____

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst Initials: _____ Date: _____

```
ORTEC g v - i (3263) Env32  G53W4.24  1/31/2014 3:36:35 PM    Page  1
                          Spectrum name: 13-051CVD5-8OZCAN.An1

Sample description
     CALIBRATION


Spectrum Filename: C:\User\13-051CVD5-8OZCAN.An1

Acquisition information
       Start time:                 1/3/2014 12:25:52 PM
       Live time:                900
       Real time:                916
       Dead time:                  1.70 %
       Detector ID:                    5

Detector system
     DET 5


Calibration
       Filename:                   DET_5_8_OZ_CAN(121613).Clb
     Pace Std ID 13-056 (371.44g of SRM 95232 in an 8-oz can). RMK.


       Energy Calibration
            Created:               1/31/2014 3:17:29 PM
            Zero offset:           0.091 keV
            Gain:                  0.250 keV/channel
            Quadratic:            -2.204E-08 keV/channel^2

       Efficiency Calibration
            Created:               1/31/2014 3:24:20 PM
            Type:                  Polynomial
            Uncertainty:           0.798 %
            Coefficients:         -0.299196  -4.550221   0.502791
                                  -0.057551   0.002743  -0.000050

Library Files
       Main analysis library:      Calib(wPbandAm).Lib
       Library Match Width:        0.500
       Peak stripping:             Library based

Analysis parameters
       Analysis engine:            Env32   G53W4.24
       Start channel:            120 (     30.10keV )
       Stop channel:            8144 (   2035.52keV )
       Peak rejection level:     100.000%
       Peak search sensitivity:    3
       Sample Size:                3.6950E+02
       Activity scaling factor:    1.0000E+06/(  1.0000E+00*  3.6950E+02) =
                                   2.7064E+03
       Detection limit method:     Currie limit

       Random error:               5.0000000E+00
       Systematic error:           4.9600000E+00
       Fraction Limit:             0.000%
       Background width:           average of three points.

       Half lives decay limit:   100.000
]
                                   Page 1
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ORTEC g v - i (3263) Env32 GS3W4.24 1/31/2014 3:36:35 PM Page 2
Spectrum name: 13-051CVD5-80ZCAN.An1

Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	YES	7/1/2009 12:00:00 PM
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	Det_5_Bkg_122713Calib w Pb and A 1/31/2014 3:34:23 PM
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 8 cutoff 20.00000 %
Energy Calibration
Normalized diff: 0.0443

***** 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. pCi/G	Nuc
31.96	248.	24.14	0.85	7.042E-03				
36.50	458.	16.32	1.03	1.157E-02				
46.49	22002.	0.96	0.94	2.154E-02	46.54	4.250	2.243E+03	PB210
77.04	132.	37.87	0.98	4.195E-02				
79.19	137.	35.66	0.98	4.258E-02				
88.06	4324.	2.48	0.97	4.472E-02	88.03	3.610	2.551E+03	CO109
122.12	416.	13.03	1.02	4.743E-02	122.06	85.600	5.549E+01	CO57
136.06	61.	80.90	1.03	4.677E-02	136.47	10.680	6.589E+01	CO57
351.82	102.	30.11	0.84	2.647E-02				
439.87	36.	58.63	0.49	2.225E-02				
661.51	11041.	1.03	1.40	1.640E-02	661.66	85.100	7.134E+01	CS137
745.66	71.	40.21	0.56	1.505E-02				
751.44	48.	49.75	0.49	1.497E-02				
775.50	44.	44.56	0.73	1.464E-02				
851.74	54.	37.07	0.68	1.371E-02				
897.23	43.	77.39	1.65	1.321E-02	898.04	93.700	1.249E+04	Y88
1099.78	39.	47.59	0.47	1.147E-02				
1173.20	8085.	1.23	1.69	1.097E-02	1173.24	99.974	1.084E+02	CO60
1332.49	7195.	1.22	1.88	1.002E-02	1332.50	99.986	1.055E+02	CO60

********** 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	Intensity Cts/Sec	Uncert 2 Sigma %	FWHM keV	Suspected Nuclide	
127.41	31.96	958.	248.	0.276	48.29	0.850	-	
145.56	36.50	1462.	458.	0.508	32.64	1.030	-	s
307.68	77.08	1190.	132.	0.147	75.74	0.982	-	D
316.29	79.23	1127.	137.	0.152	71.32	0.984	-	D
1406.48	351.82	297.	102.	0.113	60.23	0.841	-	s
1758.63	439.87	189.	36.	0.040	117.26	0.487	-	s
2981.75	745.66	186.	71.	0.079	80.42	0.556	-	s
3004.89	751.44	152.	48.	0.054	99.50	0.491	-	s
3101.14	775.50	119.	44.	0.049	89.12	0.731	-	s

3406.12	851.74	130.	54.	0.060	74.14	0.680	-	s
4398.55	1099.78	117.	39.	0.044	95.19	0.468	-	s

a

ORTEC g v - i (3263) Env32 G53W4.24 1/31/2014 3:36:35 PM Page 3
Spectrum name: 13-051CVD5-8OZCAN.An1

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

This section based on library: Calib(wPbandAm).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 2 Sigma %	FWHM keV
PB-210	185.50	46.49	4774.	22000.	24.444	1.93	0.942
CD-109	351.75	88.06	1732.	4324.	4.804	4.97	0.971
CO-57	487.91	122.12	795.	416.	0.462	26.05	1.015
CO-57	543.67	136.06	1175.	61.	0.067	161.79	1.035
CS-137	2645.13	661.51	324.	11041.	12.268	2.05	1.398
Y-88	3588.14	897.23	540.	43.	0.047	154.77	1.648s
CO-60	4692.32	1173.20	223.	8082.	8.980	2.46	1.685
CO-60	5329.79	1332.49	60.	7132.	7.991	2.43	1.884

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 pCi/G	Peak Energy kev	Peak Activity pCi/G	Peak Code	Peak MDA Value pCi/G	COMMENTS
PB-210	N	2.2430E+03					
			46.54	2.243E+03	(P	1.159E+01 9.65E-01 G K	
AM-241		1.6352E-03					
			59.54	1.635E-03	%(P	4.479E-01 3.52E+03 G	
CD-109	F	2.5514E+03					
			88.03	2.551E+03	(	4.040E+01 2.48E+00 G K	
CO-57	C	5.6645E+01					
			122.06	5.549E+01	(P	6.195E+00 1.30E+01 G K	
			136.47	6.589E+01	(	6.121E+01 8.09E+01 G	
CE-139	F	1.8653E+02					
			165.85	1.865E+02	%(P	4.942E+02 2.28E+02 G K	

c

ORTEC g v - i (3263) Env32 G53W4.24 1/31/2014 3:36:35 PM Page 4
Spectrum name: 13-051CVD5-8OZCAN.An1

Nuclide	Ave activity	Energy	Activity	Code	Peak MDA	Comments

```
HG-203    F   2.1539E+08
                          279.20 2.154E+08 %(P 6.835E+09 2.61E+03 G K

SN-113    F   6.6135E+02
                          391.69 6.613E+02 %(P 4.975E+03 6.37E+02 G K

CS-137    I   7.1343E+01
                          661.66 7.134E+01  (  1.913E-01 1.03E+00 G K

CO-60     F   1.0698E+02
                         1332.50 1.055E+02  (P 1.867E-01 1.22E+00 G
                         1173.24 1.084E+02  (P 3.293E-01 1.23E+00 G

Y-88      C   5.9774E+03
                         1836.06-1.764E+02 %(P 3.382E+03 1.72E+03 G K
                          898.04 1.249E+04 &(P 1.118E+04 7.74E+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	

- -

ORTEC g v - i (3263) Env32 G53W4.24 1/31/2014 3:36:35 PM Page 5
Spectrum name: 13-051CVD5-80ZCAN.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 pCi/G	Time Corrected Activity pCi/G	Uncertainty Counting pCi/G	2 Sigma Total pCi/G	MDA pCi/G
PB-210	1.9497E+03	2.2430E+03	4.3290E+01	3.1915E+02	1.159E+01
AM-241 #A	1.6234E-03	1.6352E-03	7.6992E-01	7.6932E-01	4.479E-01
CD-109	2.1772E+02	2.5514E+03	1.2678E+02	3.8413E+02	4.040E+01
CO-57	8.4909E-01	5.6645E+01	1.4766E+01	1.6605E+01	6.195E+00

CE-139	#B	4.6621E-02	1.8653E+02	8.5370E+02	8.5406E+02	4.942E+02
HG-203	#B	4.9657E-03	2.1539E+08	1.1756E+10	1.1756E+10	6.835E+09
SN-113	#B	3.2545E-02	6.6135E+02	8.5695E+03	8.5700E+03	4.975E+03
CS-137		6.4299E+01	7.1343E+01	1.4634E+00	9.5690E+00	1.913E-01
CO-60		5.9116E+01	1.0698E+02	1.8528E+00	1.4123E+01	1.867E-01
Y-88	#F	1.3417E-01	5.9774E+03	9.3762E+03	9.4099E+03	3.382E+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 (87.9 to 2035.5 keV) 2.292E+03 pCi/G
Total Decayed Activity (87.9 to 2035.5 keV) 5.0293696E+03 pCi/G

Analyzed by: _____
Operator

Reviewed by: _____ 8/21/19
Supervisor

Laboratory:

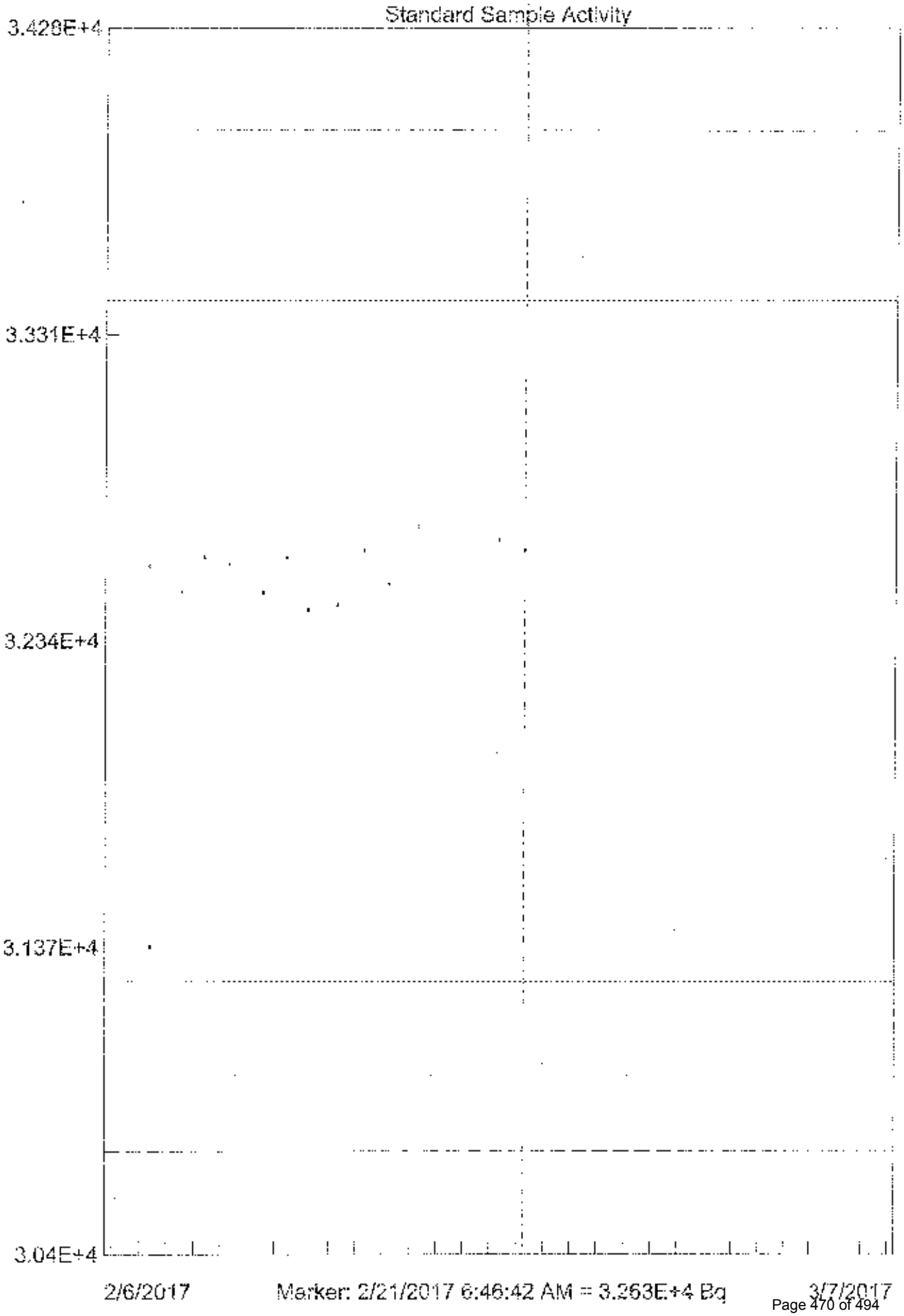
Isotope	Half-Life (Days)	Reference Date	Count Date	Decay Days	DF	Energy	Abundance
Pb-210	8145.1	7/1/2009	07/01/09	0.00	1.0000	46.5	0.0425
Cd-109	463.9	7/1/2009	07/01/09	0.00	1.0000	88	0.0361
Co-57	271.79	7/1/2009	07/01/09	0.00	1.0000	122	0.856
Ce-139	137.6	7/1/2009	07/01/09	0.00	1.0000	166	0.79886
Hg-203	46.61	7/1/2009	07/01/09	0.00	1.0000	279	0.8146
Sn-113	115.1	7/1/2009	07/01/09	0.00	1.0000	392	0.64
Cs-137	10983.1	7/1/2009	07/01/09	0.00	1.0000	662	0.851
Y-88	106.6	7/1/2009	07/01/09	0.00	1.0000	898	0.937
Co-60	1924.9	7/1/2009	07/01/09	0.00	1.0000	1173	0.999736
Co-60	1924.9	7/1/2009	07/01/09	0.00	1.0000	1332	0.9998561
Y-88	106.6	7/1/2009	07/01/09	0.00	1.0000	1836	0.992

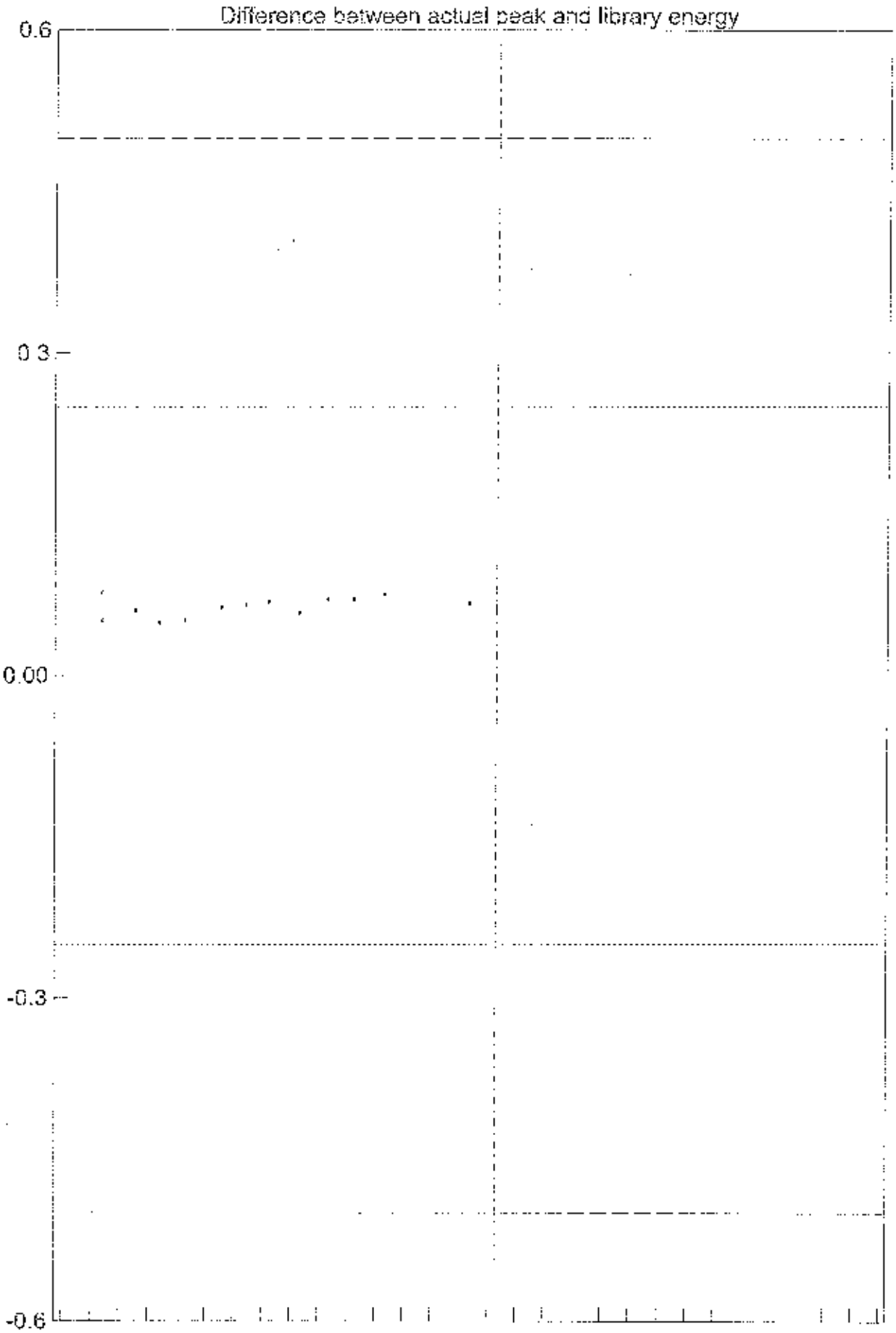
Isotope	Primary Source GPS	Primary Mass	Peak pCi/g	13-051CVD5-8OZCAN D5 8-oz Measured	13-051CVD5-8OZCAN D5 8-oz %Rec
Pb-210	6299	2000	2002.9	2243.0	112.0%
Cd-109	6044	2000	2262.5		0.0%
Co-57	3220	2000	50.6		0.0%
Ce-139	4527	2000	76.3		0.0%
Hg-203	9943	2000	164.9		0.0%
Sn-113	6324	2000	133.5		0.0%
Cs-137	4100	2000	65.1	71.3	109.6%
Y-88	15300	2000	220.7		0.0%
Co-60	7558	2000	102.2	105.5	103.3%
Co-60	7569	2000	102.3	108.4	106.0%
Y-88	16170	2000	220.3		0.0%

Gamma Spectroscopy Daily Checks

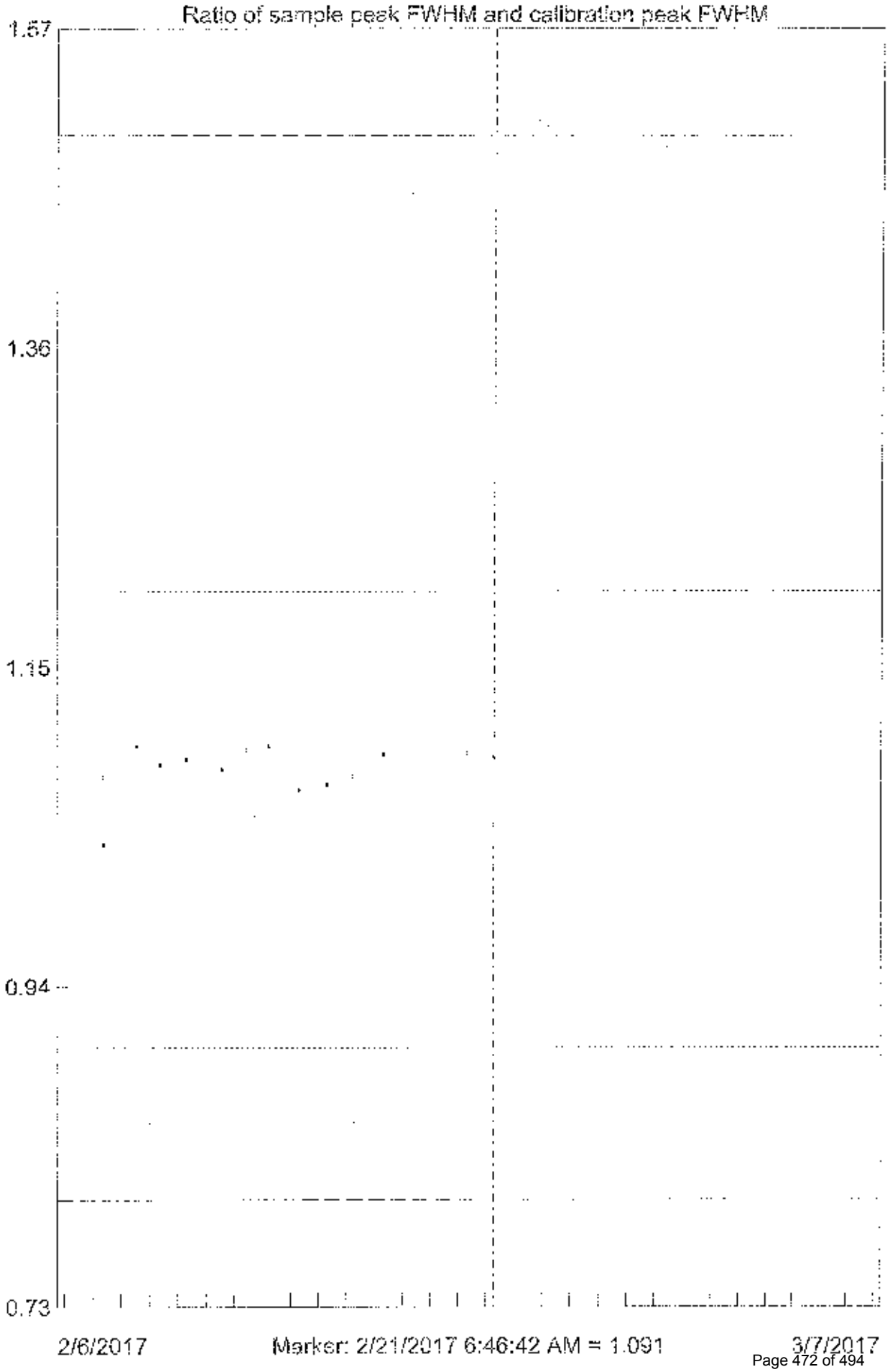
ORTEC
2 DET 2

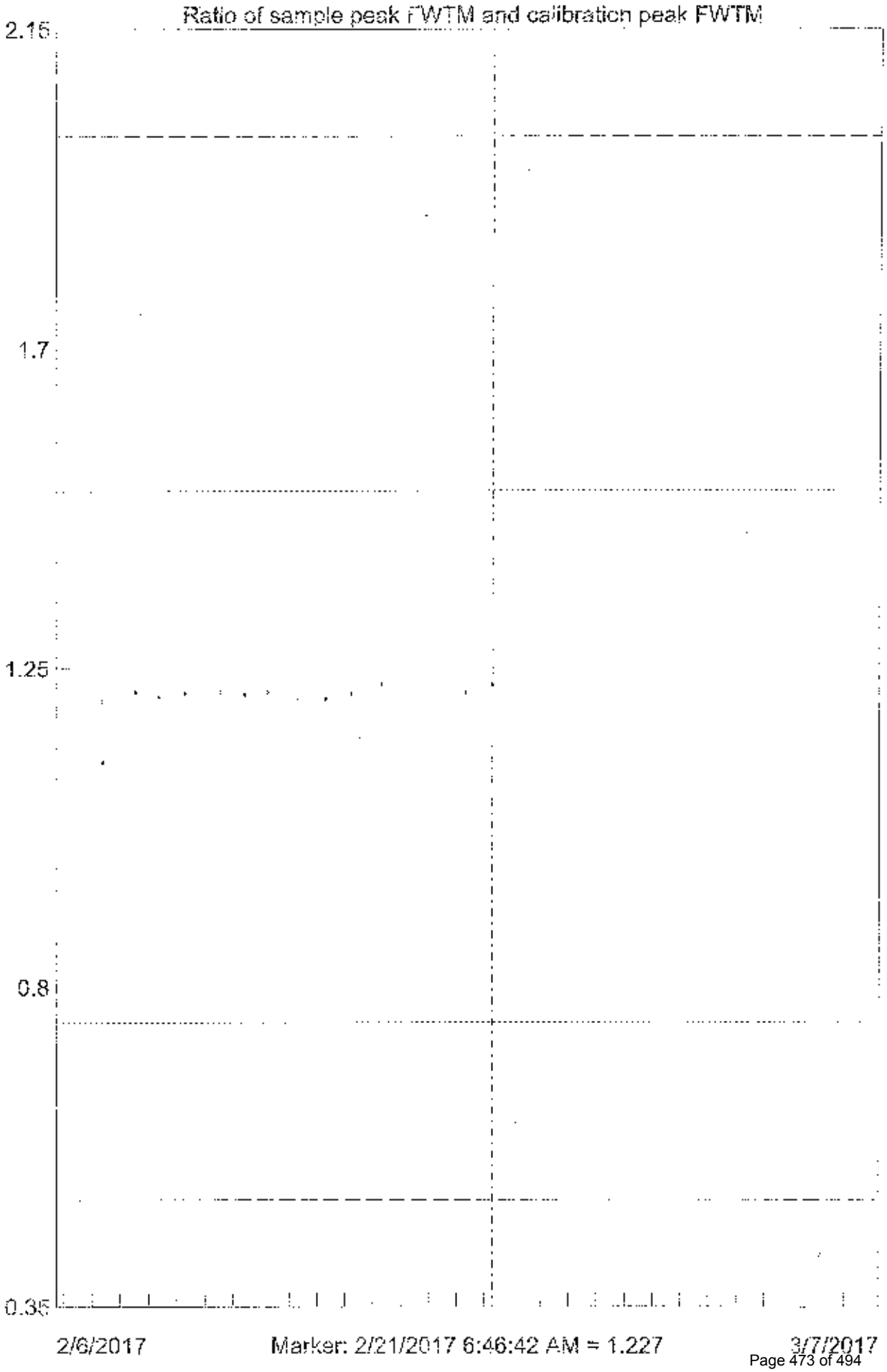
2/21/2017 6:47:21 AM





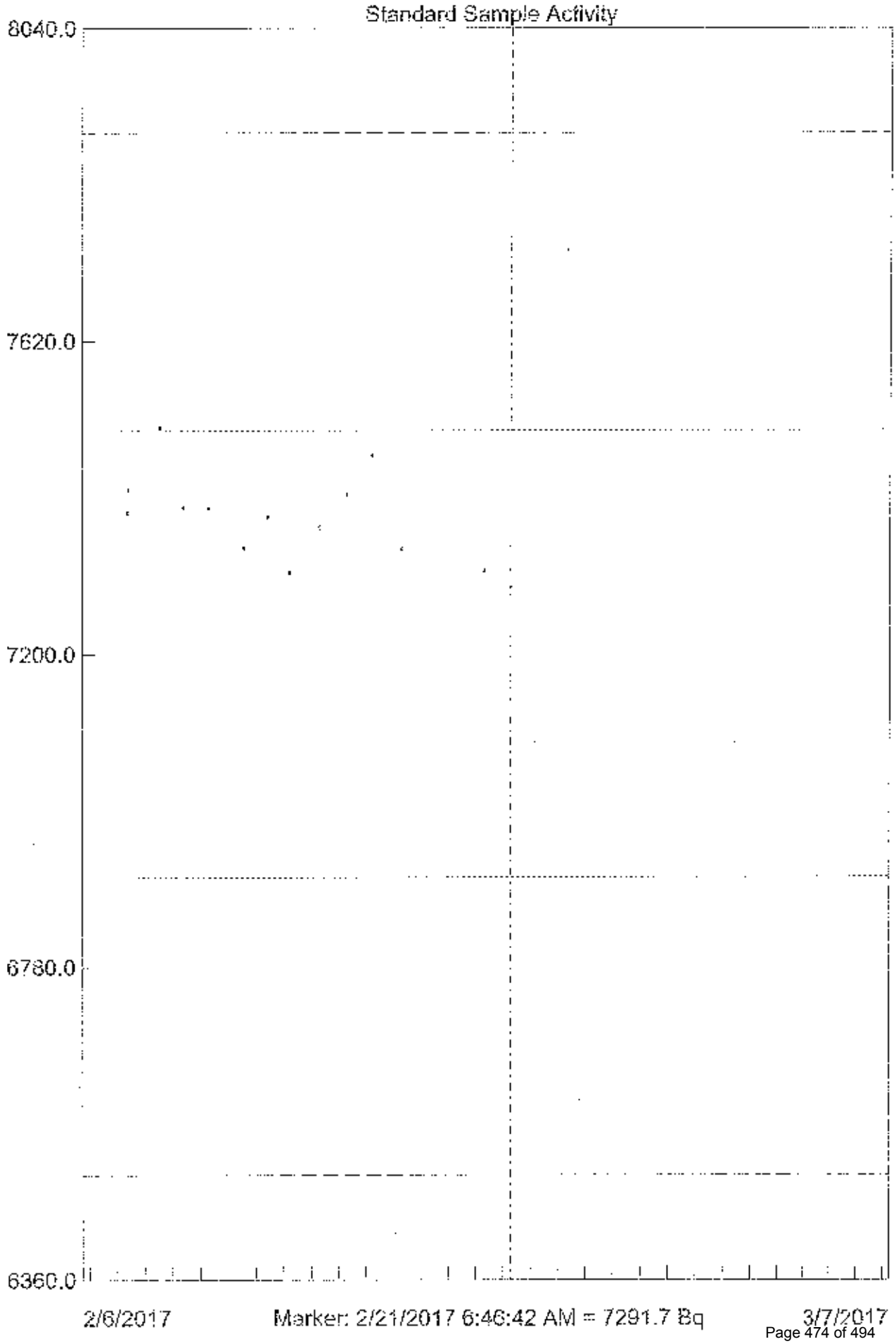
2/6/2017 Marker: 2/21/2017 6:46:42 AM = 0.065 KeV 3/7/2017

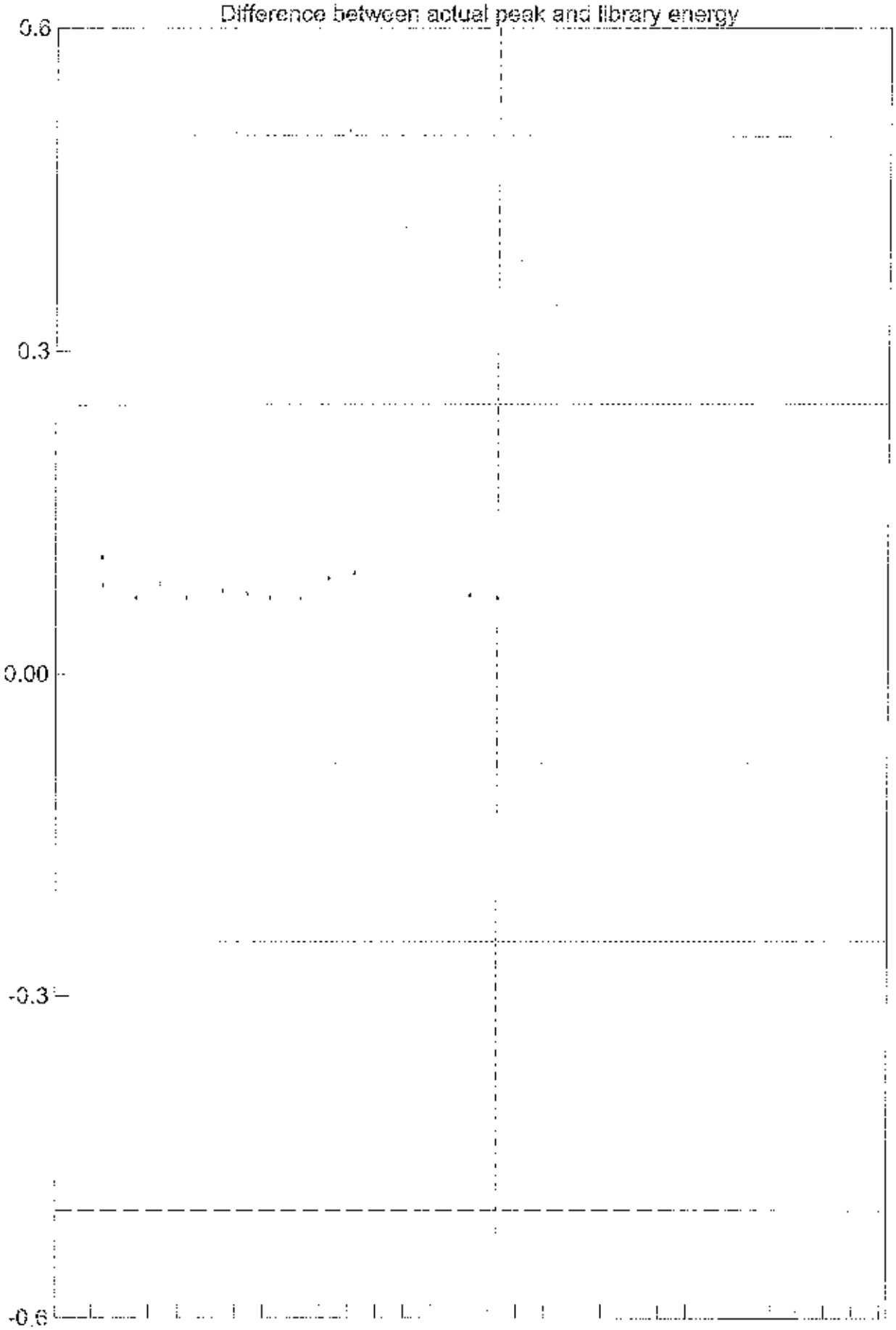

Ratio of sample peak FWHM and calibration peak FWHM
1.57
1.36
1.15
0.94
0.73
2/6/2017
Marker: 2/21/2017 6:46:42 AM = 1.091
3/7/2017

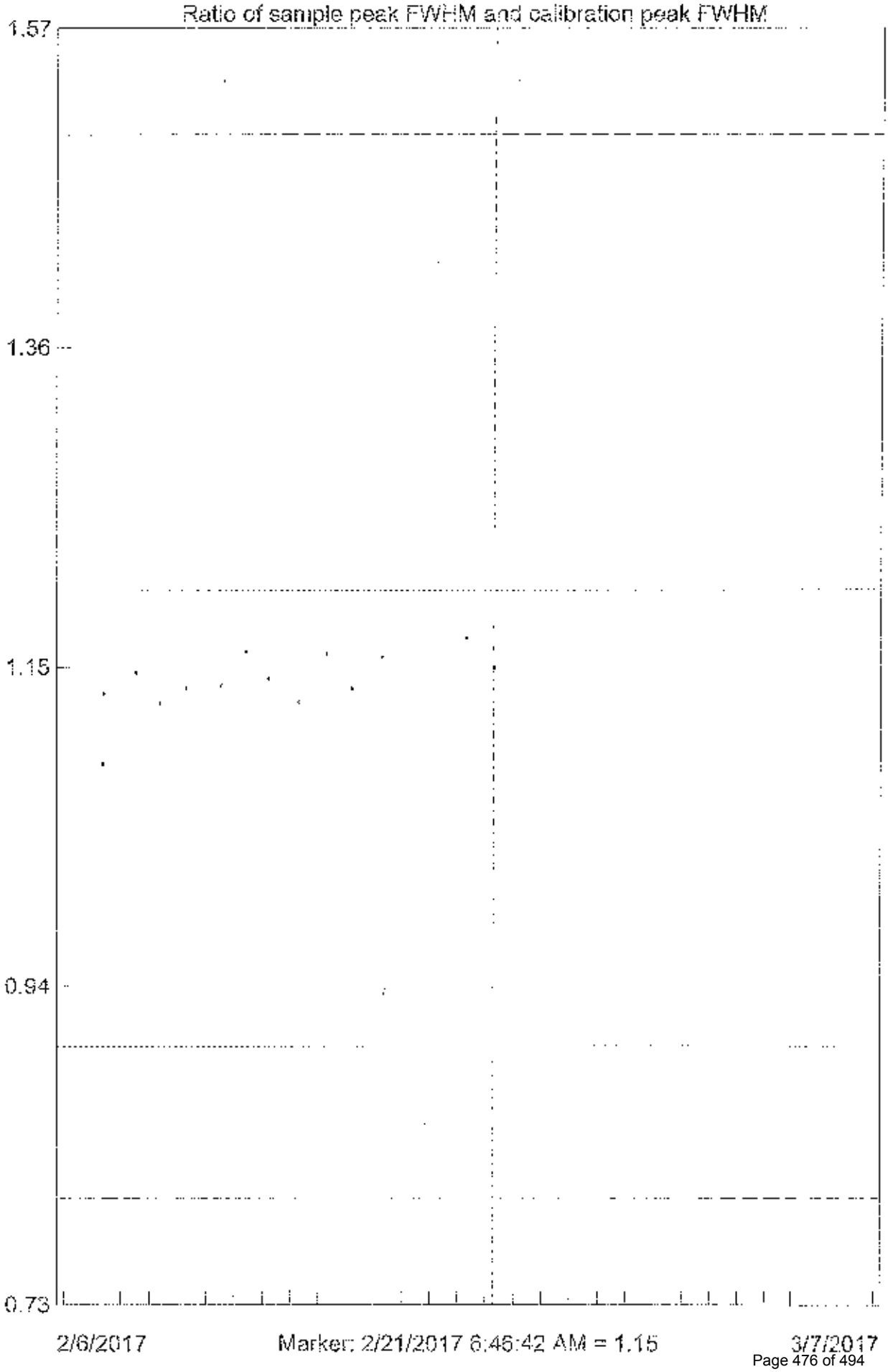

Ratio of sample peak FWTM and calibration peak FWTM
2.15
1.7
1.25
0.8
0.35
2/6/2017
Marker: 2/21/2017 6:46:42 AM = 1.227
3/7/2017

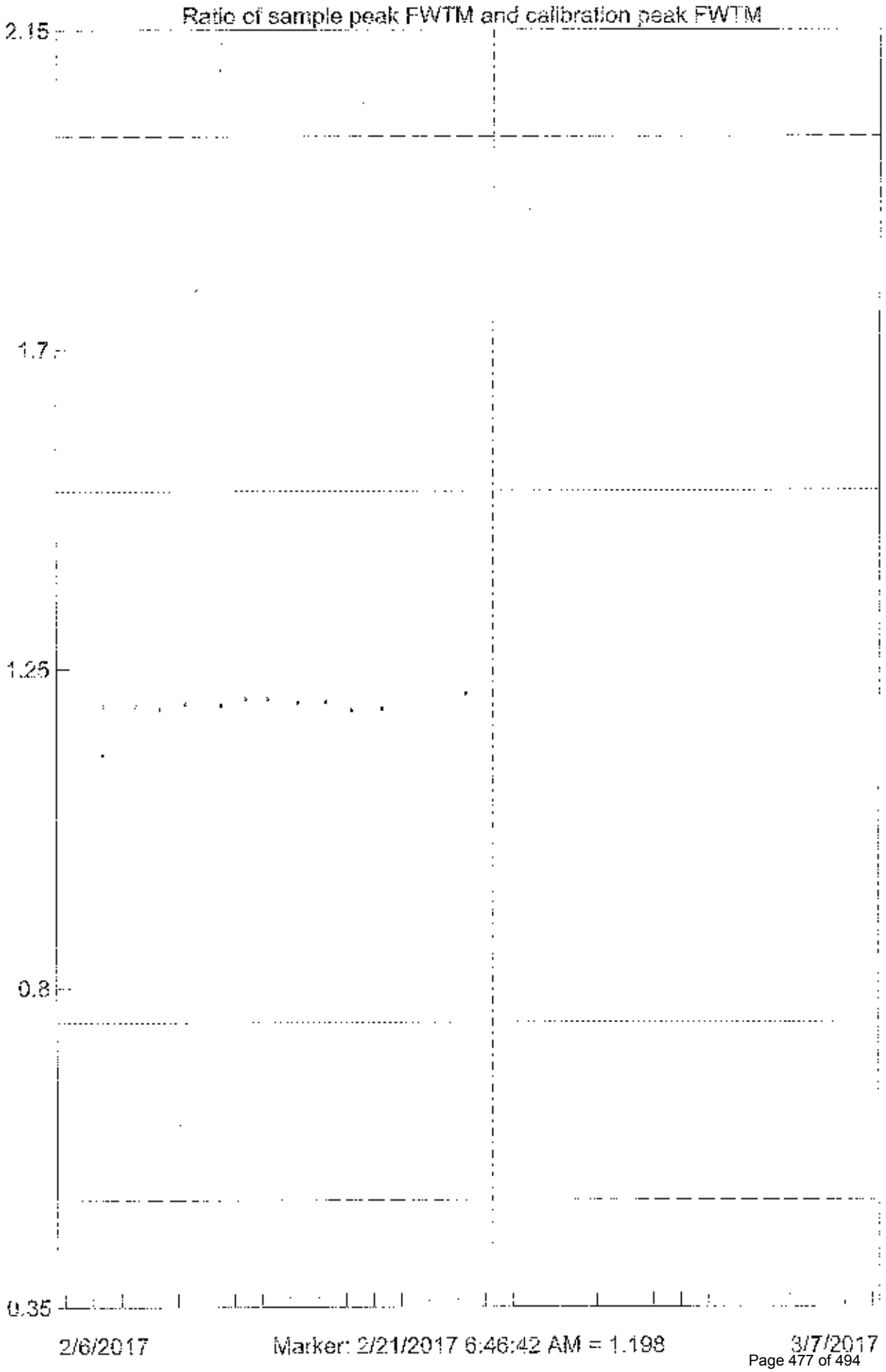
ORTEC
5 DET 5

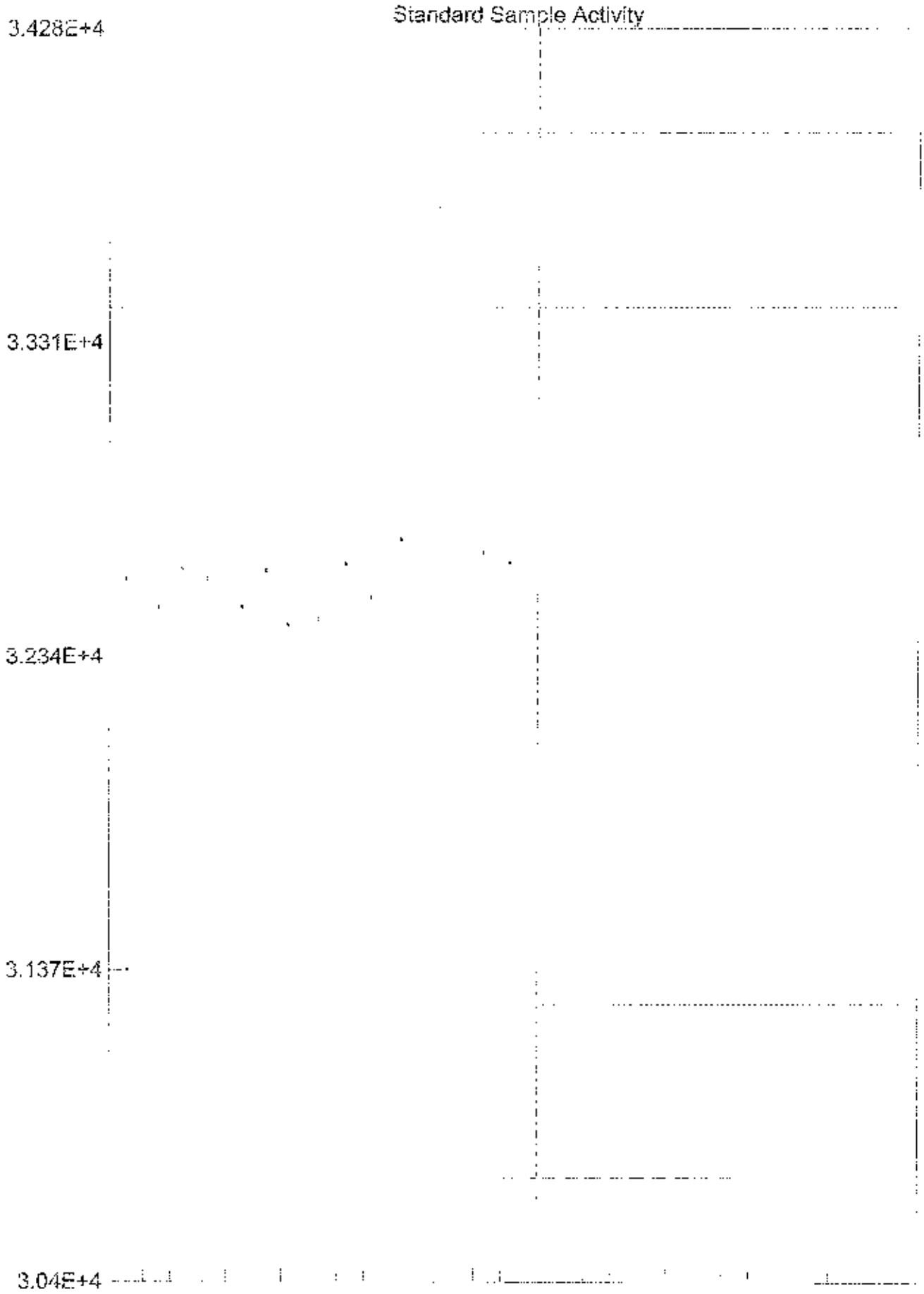
2/21/2017 6:48:15 AM

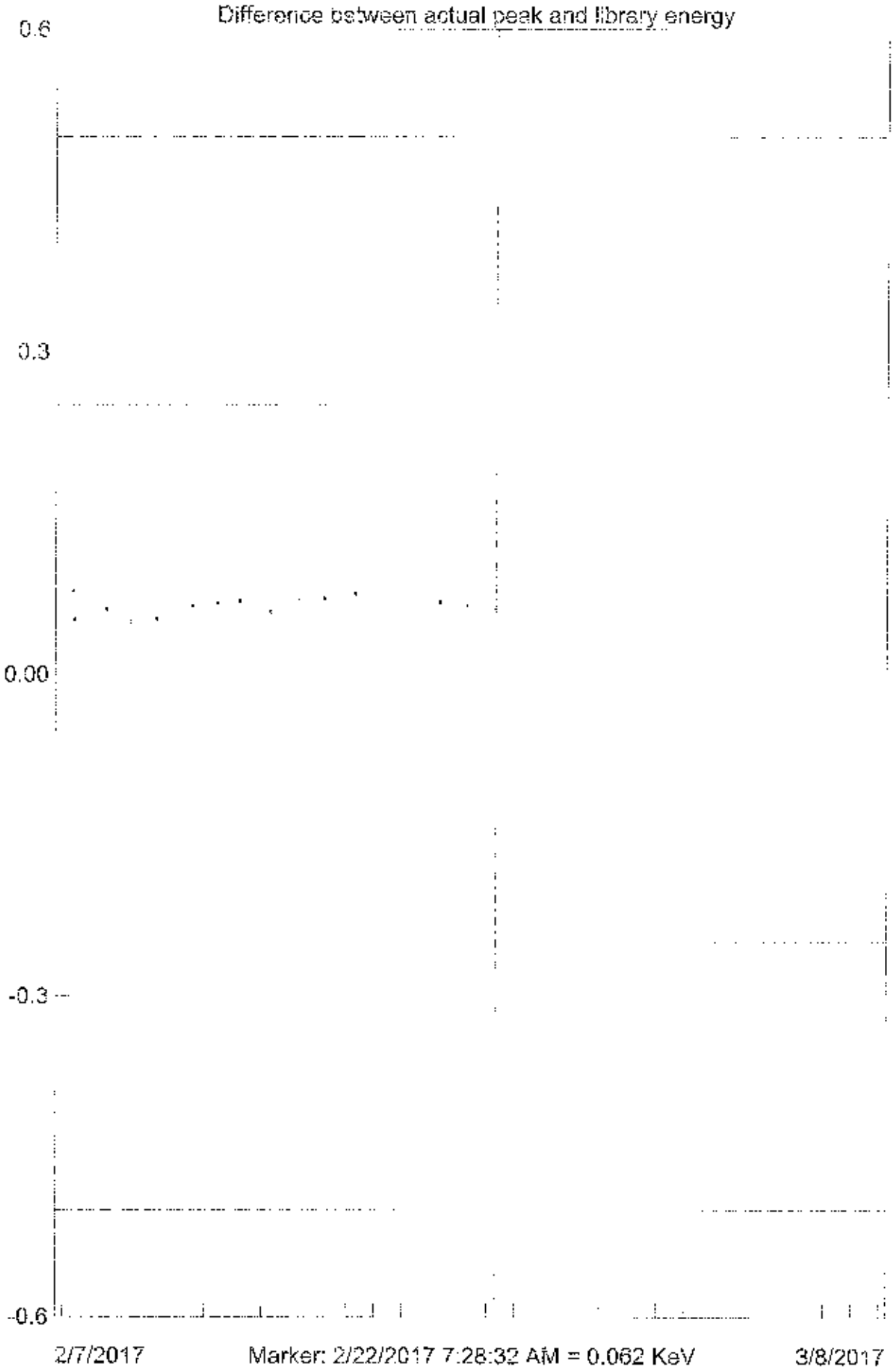


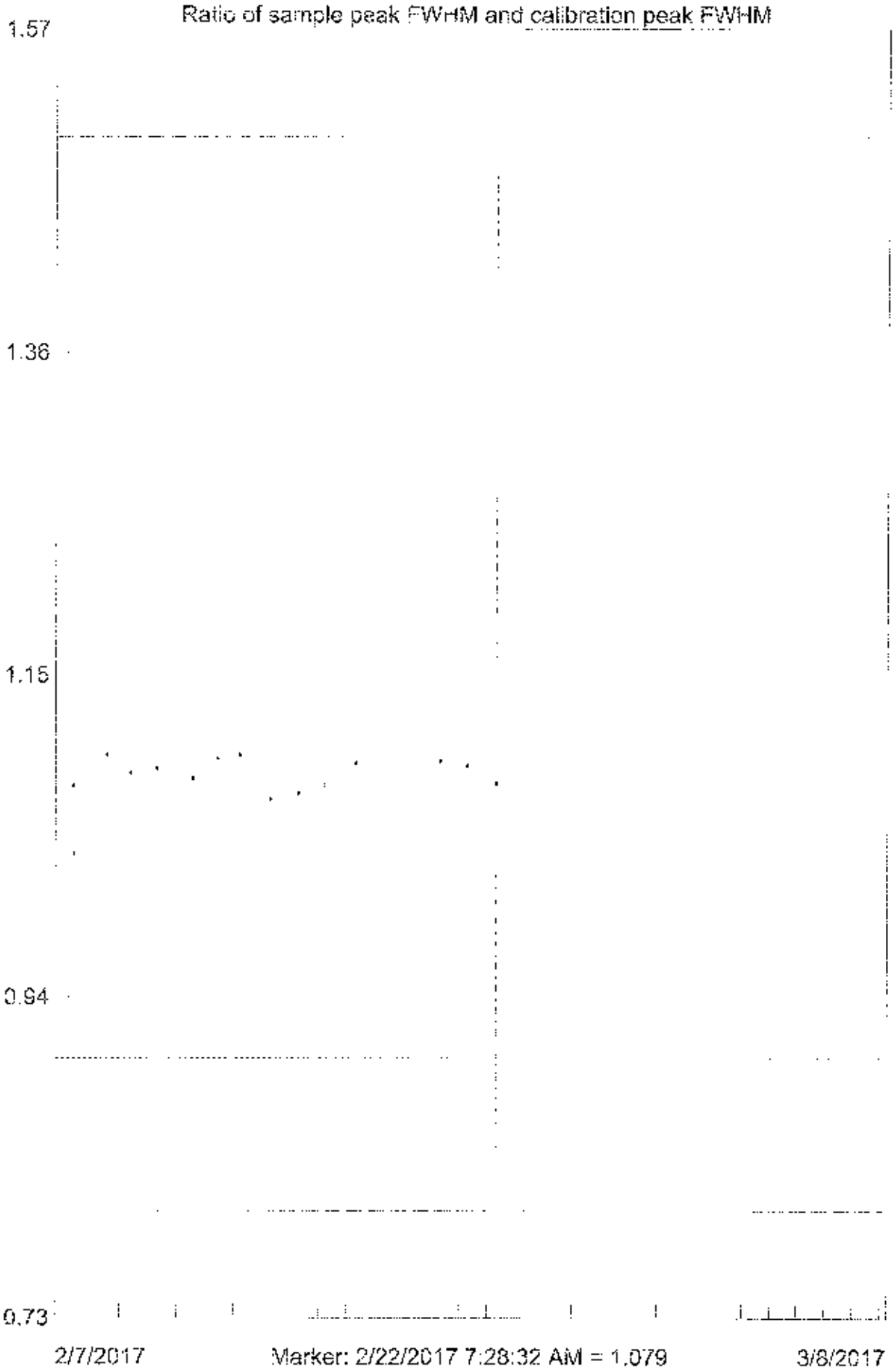

Difference between actual peak and library energy
0.6
0.3
0.00
-0.3
-0.6
2/6/2017
Marker: 2/21/2017 6:46:42 AM = 0.071 KeV
3/7/2017

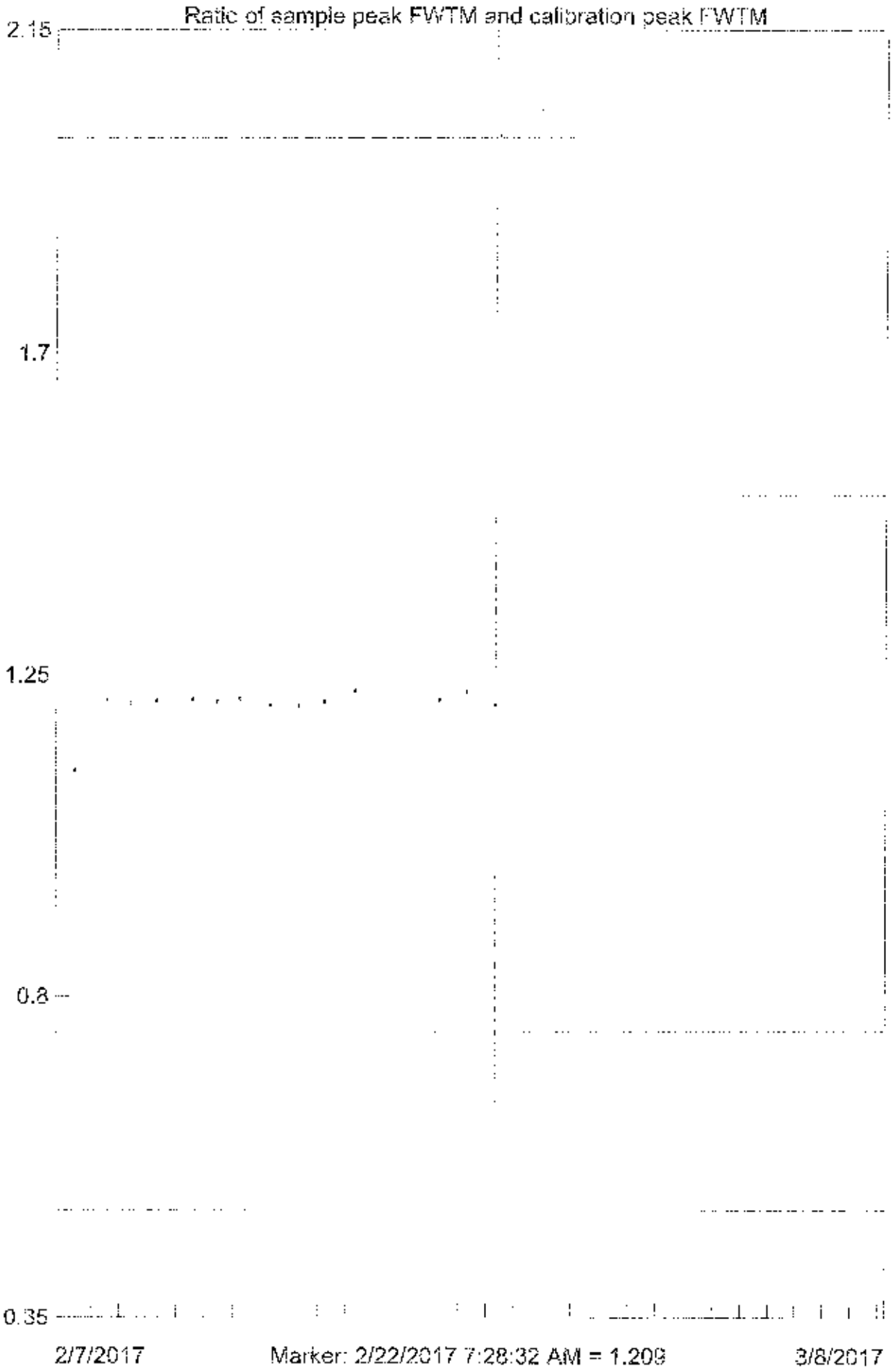

Ratio of sample peak FWHM and calibration peak FWHM
1.57
1.36
1.15
0.94
0.73
2/6/2017
Marker: 2/21/2017 6:46:42 AM = 1.15
3/7/2017

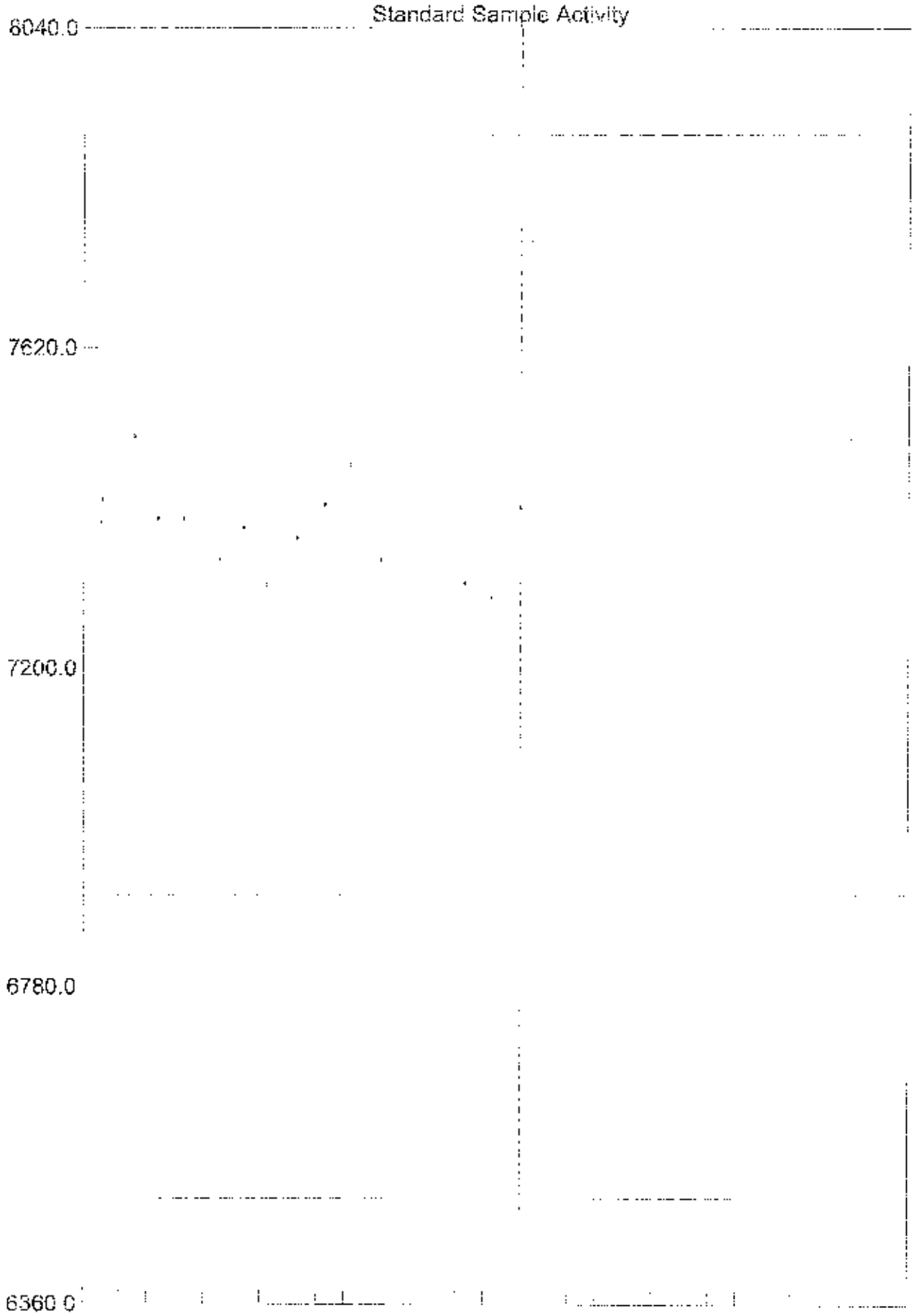

Ratio of sample peak FWTM and calibration peak FWTM
2.15
1.7
1.25
0.8
0.35
2/6/2017
Marker: 2/21/2017 6:46:42 AM = 1.198
3/7/2017

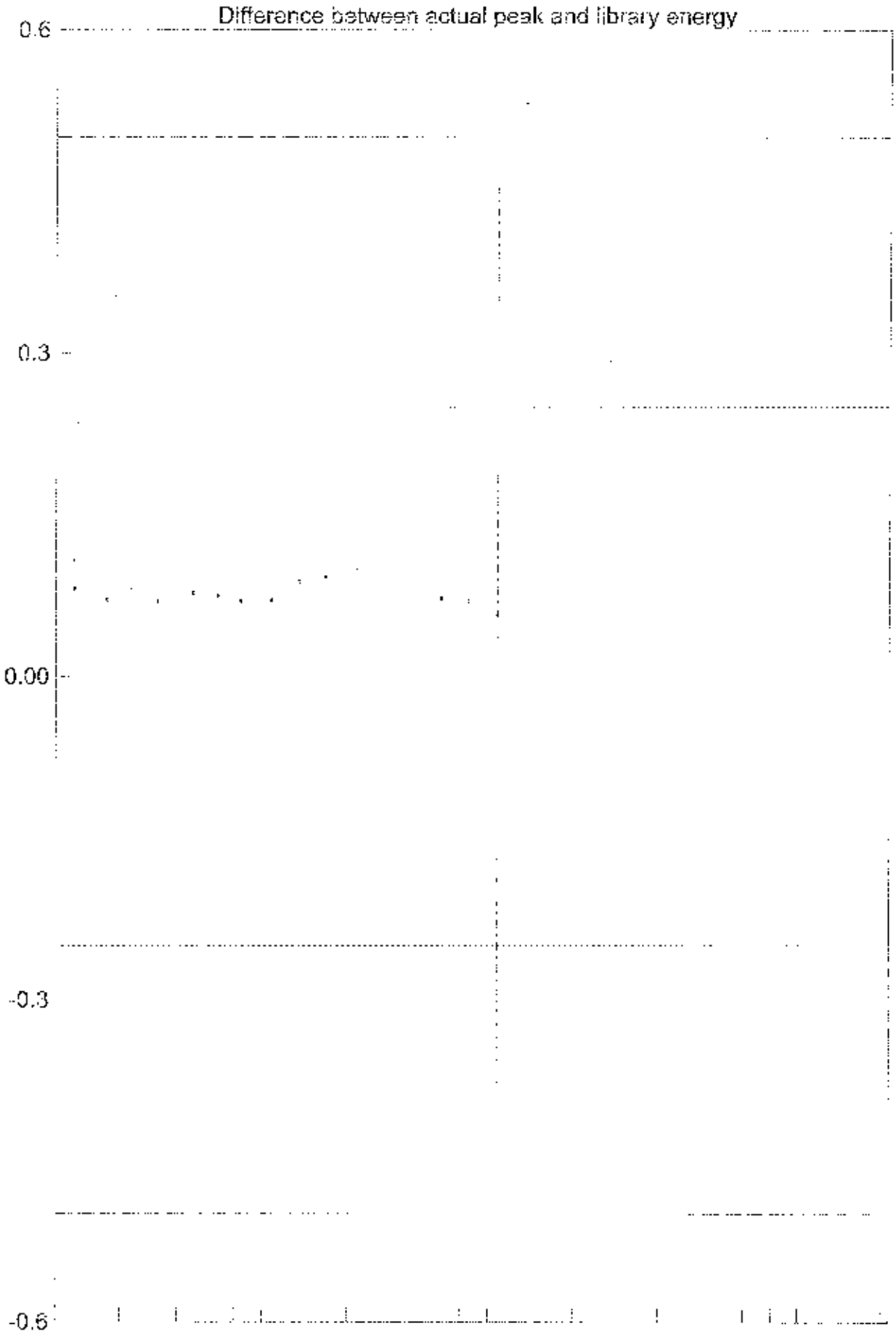

Standard Sample Activity
3.428E+4
3.331E+4
3.234E+4
3.137E+4
3.04E+4
2/7/2017
Marker: 2/22/2017 7:28:32 AM = 3.251E+4 Bq
3/8/2017


Difference between actual peak and library energy
0.6
0.3
0.00
-0.3
-0.6
2/7/2017
Marker: 2/22/2017 7:28:32 AM = 0.062 KeV
3/8/2017

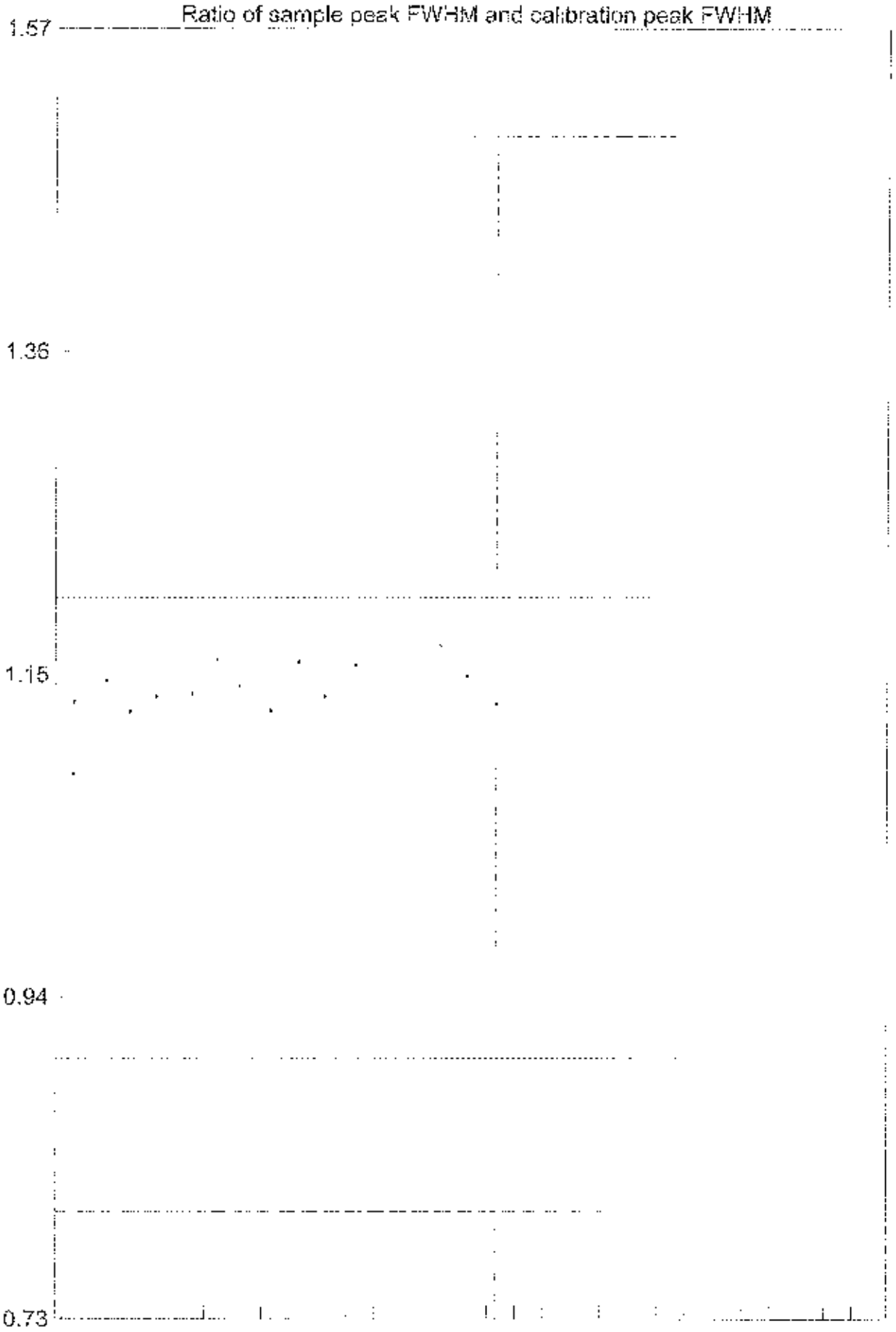

Ratio of sample peak FWHM and calibration peak FWHM
1.57
1.36
1.15
0.94
0.73
2/7/2017
Marker: 2/22/2017 7:28:32 AM = 1.079
3/8/2017

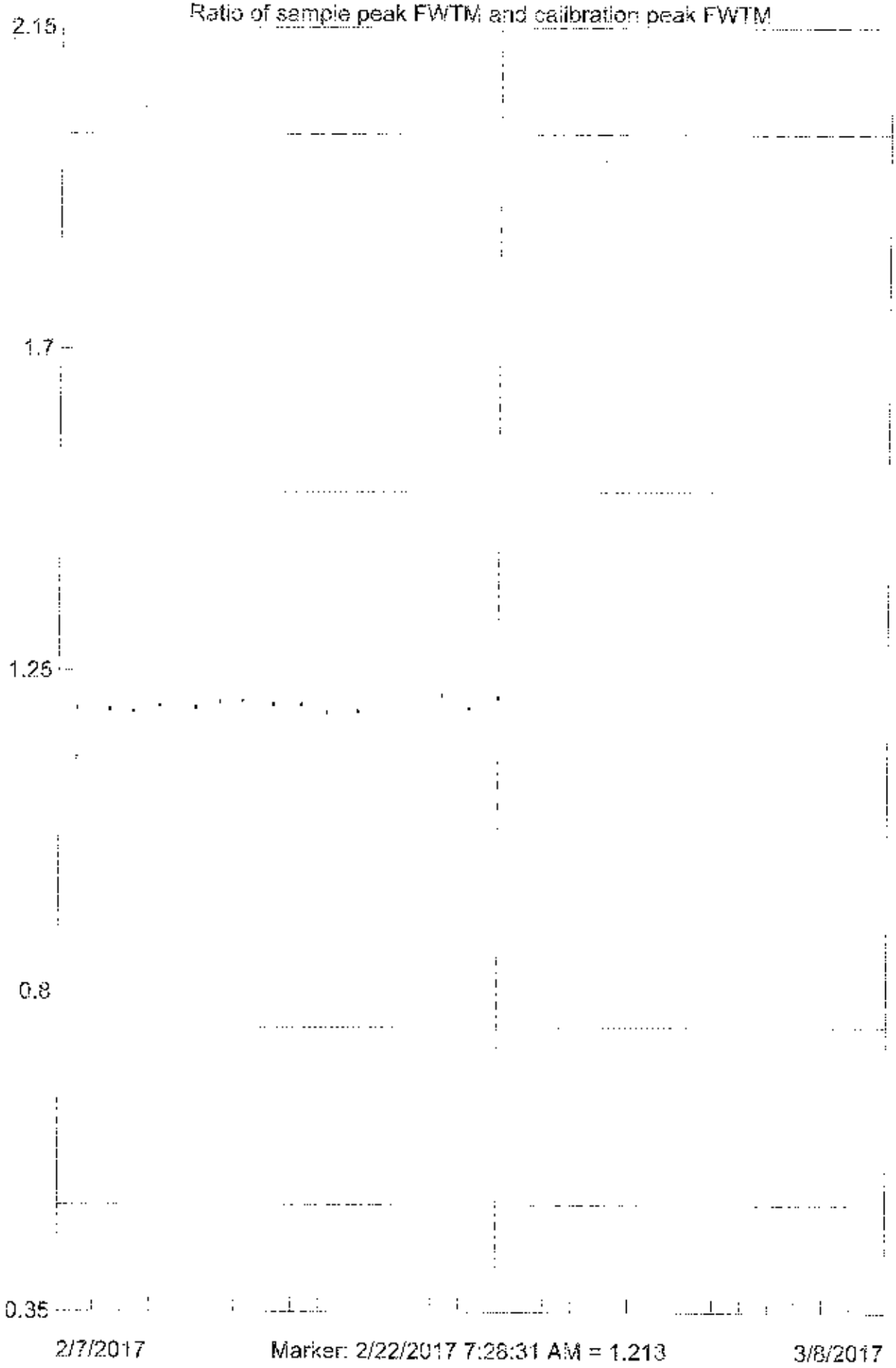

Ratio of sample peak FWTM and calibration peak FWTM
2.15
1.7
1.25
0.8
0.35
2/7/2017
Marker: 2/22/2017 7:28:32 AM = 1.209
3/8/2017


Standard Sample Activity
8040.0
7620.0
7200.0
6780.0
6360.0
2/7/2017
Marker: 2/22/2017 7:28:31 AM = 7411.2 Bq
3/8/2017



2/7/2017 Marker: 2/22/2017 7:28:31 AM = 0.058 KeV 3/8/2017


Ratio of sample peak FWHM and calibration peak FWHM
1.57
1.36
1.15
0.94
0.73
2/7/2017
Marker: 2/22/2017 7:28:31 AM = 1.131
3/8/2017


Ratio of sample peak FWTM and calibration peak FWTM
2.15
1.7
1.25
0.8
0.35
2/7/2017
Marker: 2/22/2017 7:28:31 AM = 1.213
3/8/2017

Standards

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 3-R056-0

Standard ID: 13-051
Parent Source: 80581-493
Parent Conc: see certificate
Reference Date: 7/1/2009 [illegible]

Nuclide: Mixed γ

Std Conc.: see below
Prepared By: WTF
Prep Date: 8/27/13
Expiration Date: 8/27/18

Balance ID: NA
Diluent: NA Mixed Soil
Diluent IDs: NA

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

31.65 grams of 80581-493 cammed in 8 oz can and sealed on 8/27/2013.

Dilution Calculations:

NA

Container Tare Weight: _____
Container + Standard Final Weight: _____

Balance ID: _____

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst initials: _____ Date: _____

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 2-R056-0

Standard ID: 12-018
Parent Source: 85228-493
Parent Conc: 3741.9175 Bq/g
Reference Date: 7/13/2011 12:00

Nuclide: Th-230

Std Conc.: 26.497 pCi/ml
Prepared By: JAL
Prep Date: 4/25/12
Expiration Date: 4/25/17

Balance ID: 88319
Diluent: 0.5 M HNO_3
Diluent IDs: DU2-111 (1.0 N HNO_3)

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

diluted 0.0655 g of 85228-493 to 250.0 ml w/ 0.5 M HNO_3

(0.5 M HNO_3 made by diluting 125 ml of 1.0 M HNO_3 to 250 ml w/ DI water)

JL 4/25/12

Dilution Calculations:

$$0.0655\,g \left| \frac{3741.9175\ Bq}{g} \right| \frac{60\ dpm}{Bq} \left| \frac{pCi}{2.22\ dpm} \right| \frac{}{250\ ml} = 26.497\ pCi/ml$$

Container Tare Weight: _____ Balance ID: _____
Container + Standard Final Weight: _____

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst initials: _____ Date: _____

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

85228-493
5 mL Liquid in Flame Sealed Vial

Customer: Pace Analytical Services, Inc.
P.O. No.: PI-14763, Item 2

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	2.763E+07	1.908E+04	0.1	0.9	1.8	07/13/2011

***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%. 5.09899 grams 0.5M HNO3 solution.

Source Prepared by: _____
Z. Dimitrova, Radiochemist

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

Date: 13-Jul-11

ACCREDITED SOURCE CALIBRATION LABORATORY
HEALTH PHYSICS SOCIETY
FOUNDED 1959

Single Isotope Certificate, Rev 1 9/28/2009

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 1-R056-1 **SOP ID: PGH-R-018**

Standard ID: 17-001
Nuclide: Th-234
Std Conc.: N/A
Parent Source: RFD9-0027
Prepared By: [illegible]
Parent Conc: 10mg/mL Nat U
Prep Date: 1/9/17
Reference Date: Last separation date
Expiration Date: 1/9/18

Balance ID: N/A
Conversions: 60 dpm = 1 dps
Diluent: 2 N HCl
1 Bq = 1 dps
Diluent IDs: D4U4123
2.22 dpm = 1 pCi

Dilution Description:

Initial weight of 25.9418 g of RFD9-0027 (natural Uranium) + 1.0 mL Iron Carrier were added to a glass beaker and evaporated to dryness. Residue was dissolved in 40 mL 9 N HCl and taken through two sequential anion columns. Load and rinses were collected, evaporated to dryness with a few drops of Iron Carrier then dissolved in approximately 100 mL 2 N HCl.
Uranium saved for ingrowth.

Last separation date: 7/18/16 1340
This separation date: 1/9/17 0945

Dilution Calculations:

No calcs. for activity
Recovery determination is made by a direct comparison to a reference source made from the same solution

Container Tare Weight: N/A
Balance ID: N/A
Container + Standard Final Weight: N/A

Standard Final Disposal (circle one): **Consumed** **Destroyed** **Discarded**
Analyst initials: [illegible] Date: _____

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 3-R056-C

Standard ID: 15-046
Parent Source: SRS 99211
Parent Conc: 861.39 Bq/g
Reference Date: 12/5/14 1200

Nuclide: U-232

Std Conc.: 105.85 dpm/ml
Prepared By: JAL
Prep Date: 11/20/2015
Expiration Date: 11/20/2020

Balance ID: 88219
Diluent: H_2SO_4 + Ba in DI H_2O
Diluent IDs: see below

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

weighed 0.5120 g of SRS 99211 into a 250 ml glass beaker. Added 25 ml concentrated Sulfuric acid heated until white hazy precipitate. Added 25 g Potassium persulfate + 4 drops H_2O_2 heated to dissolve. added 150 ml DI water. Transferred to a 250 ml flask, added 3.0 ml 16 mg/ml barium carrier and diluted to 250 ml w/ DI water.

16 mg/ml barium carrier
$K_2(SO_4)_2$ RTS-0018-1
H_2SO_4 RF184-0208-1
H_2O_2 RF15-0220-1a

Dilution Calculations:

$$0.5120\,g \left| \frac{861.39\,Bq}{g} \right| \frac{60\,dpm}{Bq} \left| \frac{}{250\,ml} \right. = 105.85\,\frac{dpm}{ml}$$

47.679 pCi/ml

Container Tare Weight: _____
Container + Standard Final Weight: _____
Balance ID: _____

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst initials: _____ Date: _____

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2337
www.ezag.com

CERTIFICATE OF CALIBRATION

Standard Reference Source

99211

U-232 5 mL Liquid in Flame Sealed Vial

Customer: Pace Analytical Pittsburgh
P.O. No.: PO1238839, Item 2 Product Code: 8332

This standard radionuclide source was prepared gravimetrically from a master solution calibrated by Eckert & Ziegler Analytics, using a germanium gamma spectrometer system. Radionuclide purity and calibration 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 N42.22-1996, "Traceability of Radioactive Sources to NIST."

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty* , % Type u_A	u_B	U	Reference Date (12:00 PM EST)
U-232	2.517E+04	4.482E+03	0.5	1.1	2.5	12/05/2014

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

Comments:
Impurities: γ-impurities (other than decay products)<0.1%.
5.20320 g 1M HNO3 solution. Carrier free.

Source Prepared by: _____
K. Eardley, Radiochemist

QC Approved: _____ Date: 4 DEC 14
J. S. Lahr, Spectroscopist

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Pace Analytical

Pace Analytical Services, Inc.-PGH

Radiological Standards Dilution Logbook

Logbook ID: 3-R056-0

Standard ID: 15-025
Parent Source: 85299.493
Parent Conc: SEE CERT.
Reference Date: 7/31/2011 1200

Nuclide: U-NOT

Std Conc.: 90.814 pCi/ml Total U
Prepared By: JAL
Prep Date: 8/18/2015
Expiration Date: 8/18/2020

Balance ID: 88918
Diluent: 1 M HNO3
Diluent IDs: DLIS.0544

Conversions: 60 dpm = 1 dps
1 Bq = 1 dps
2.22 dpm = 1 pCi

Dilution Description:

1.2028 g of 85299.493 diluted to 250.0 ml in vol flask w/ 1M HNO3 on 8/18/2015 by JAL

U-238 1.2028 g | 87.28 Bq / 5.5001 g | 60 dpm / Bq | pCi / 2.22 dpm | 250.0 ml = 2.063 pCi/ml U-235

Dilution Calculations:

U-234. 1.2028 g | 1858 Bq / 5.5001 g | 60 dpm / Bq | pCi / 2.22 dpm | 250.0 ml = 43.926 pCi/ml

U-238 1.2028 g | 1896 Bq / 5.5001 g | 60 dpm / Bq | pCi / 2.22 dpm | 250.0 ml = 44.825 pCi/ml

Total U w/ U-235 = 90.814 pCi/ml

Container Tare Weight: _____ Balance ID: _____
Container + Standard Final Weight: _____

Standard Final Disposal (circle one) **Consumed** **Destroyed** **Discarded**
Analyst initials: _____ Date: _____

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

85229-493

5 mL Liquid in Flame Sealed Vial

Customer: Pace Analytical Services, Inc.
P.O. No.: PI-14763, Item 3

This standard radionuclide source was prepared gravimetrically from calibrated master solution. The master solution was calibrated by dissolution of solid U_3O_8 in nitric acid. The Physikalisch-Technische Bundesanstalt (PTB), Germany, calibrated the U_3O_8. Radionuclide purity and calibration were checked by alpha 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.

Reference Date: 7/13/2011 12:00 PM EST

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, % Type u_1	u_3	U	Calibration Method*
U-234	8.867E+07	1.858E+03	0.1	0.9	1.8	4π LS
U-235	2.571E+11	8.728E+01	0.1	0.9	1.8	4π LS | HPGe
U-238	1.632E+12	1.896E+03	0.1	0.9	1.8	4π LS

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:
Impurities: γ-impurities < 0.1 %, α-impurities (other than decay products) < 0.1 %. 5.50011 grams 1M HNO3 solution with Uranium 27.92 mg/g.

Source Prepared by: _____
Z. Dimitrova, Radiochemist

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

Date: 13-July-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

ATTACHMENT H

Validated Radon Analytical Data Package

Weston Solutions, Inc.
Suite 201
1090 King Georges Post Road
Edison, New Jersey 08837-3703
732-585-4400 • Fax: 732-225-7037
www.westonsolutions.com

The Trusted Integrator for Sustainable Solutions

REMOVAL SUPPORT TEAM 3
EPA CONTRACT EP-S2-14-01

RST 3-04-F-0029

TRANSMITTAL MEMO

To:	Mr. Eric Daly, On-Scene Coordinator Response and Prevention Branch U.S. EPA, Region II
From:	Smita Sumbaly, Data Reviewer RST 3, Region II
Subject:	738 Upper Mountain Road Site Data Validation Assessment
Date:	September 20, 2017

The purpose of this memo is to transmit the following information:

- Data validation results for the following parameter:

  Radon Testing 8 Samples

- Matrices and Number of Samples

  Indoor Air 8 Samples

- Sampling Dates: August 11 through 14, 2017

The final data assessment narrative and original analytical data package are attached.

cc:	RST 3 SPM:	Patrick Buster
	RST 3 SITE FILE TDD #:	TO-0010-0030
	RST 3 ANALYTICAL TDD #:	TO-0010-0077
	TASK#:	4077

U.S. ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

DATE: **September 20, 2017**

TO: **Eric Daly , On-Scene Coordinator**
U.S. EPA, Region II

FROM: **Smita Sumbaly**
RST 3 Data Review Team

SUBJECT: **QA/QC Compliance Review Summary**

As requested quality control and performance measures for the data packages noted have been examined and compared to EPA standards for compliance. Measures for the following general areas were evaluated as applicable:

Field Blanks	Laboratory Blanks
Field Duplicates	Blanks
Data Completeness	Continuous Radon Monitor (CRM)

Any statistical measures used to support the following conclusions are attached so that the review may be reviewed by others.

Summary of Results

Radon Testing

Acceptable as Submitted	X
Acceptable with Comments	
Unacceptable, Action Pending	
Unacceptable	

Data Reviewed by: Smita Sumbaly Date: 9/20/17

Approved By: [signature] Date: 9/20/17

Area Code/Phone No.: (732) 585-4410

NARRATIVE

PCS No. 4077

SITE NAME: **738 Upper Mountain Road Site**
Lewiston
Niagara County
New York

Laboratory Name: Accu-View Property Inspection, Inc., P.O. Box 641, East Amherst, NY 14051 (deploy and retrieve canisters) and Radon Testing Corporation of America (RTCA), 2 Hayes Street, Elmsford, NY 10523 (Radon Testing).

INTRODUCTION:

The laboratory's portion of this case consisted of eight air samples, including one field duplicate, for radon testing. All samples were collected on August 11 through 14, 2017.

The laboratory reported no problem(s) with the receipt of these samples:

The laboratory reported no problems with the analyses of Radon Testing.

The evaluator has commented on the criteria specified under each fraction heading. All criteria have been assessed, but no discussion is given where the evaluator has determined that criteria were adequately performed or require no comment. Details relevant to these comments are given on the following forms.

Appropriate Form Is and Chain of Custody have been copied from the original data package and appended to the data assessment narrative for reference.

Inorganic Data Review Narrative

Site: 738 upper Mountain Road Site	**RFP# 451**
Sampling Team: Accu-View Property Inspection Inc. **Laboratory: Radon Testing Corporation of America**	**TASK # 4077**
Reviewer: Smita Sumbaly	**Matrix: 8 Air**

Data Case Description:

On August 11 through 14, 2017, U.S. EPA, Region II, RST 3-subcontracted sampling personnel collected eight radon samples, including one field duplicate, from the 738 Upper Mountain Road Site located in Lewiston, Niagara County, New York. RST 3 subcontracted the services to Accu-View Property Inspection Inc., radon certified technician to deploy and remove canisters and submit them to the Radon Testing Corporation of America (RTCA) to perform the radon testing. Charcoal Canisters were deployed by NY radon certified technicians on August 11, 2017 and retrieved on August 14, 2017. After retrieving the samples, the Accu-View Property Inspection Inc., technician shipped the samples to RTCA, located at 2 Hayes Street, Elmsford, New York, to analyze the samples for radon testing.

The eight air samples, including one field duplicate, were collected for radon testing utilizing activated charcoal canisters (ACC) for at least 72 hours period of time. The radon testing samples were collected from the 738 Upper Mountain Road. The co-located ACC's were placed side-by-side, 4 inches apart.

The Accu-View Property Inspection, Inc. technician also set-up the E-Smart Continuous Radon Monitor in the basement of 738 Upper Mountain Road - Continuous Radon Monitors use an electronic detector to accumulate and store information related to the periodic average concentration of radon gas or radon decay products. They are activated and left on site for a period of not less than 48 hours.

All radon testing were performed in accordance with the EPA protocol for the analysis of radon in air (EPA 402-R-92-004) and RTCA standard operation procedure (SOP) for radon in air. The placement of the ACC's was conducted in accordance with Weston's instructions to Accu-View Property Inspection Inc.

Client identification (ID) and laboratory ID numbers are as follows:

Canisters ID Number	Sample Location	Canister Type	Analysis	Canisters Deployed	Canisters Retrieved
738 Upper Mountain Road					
2471303	1st Fl-SE bedrm	Charcoal Canister	Radon Testing	8/11/2017	8/14/2017
2523071	1st Fl-NE bedrm		Radon Testing	8/11/2017	8/14/2017
2559490	1st Fl-Liv rm		Radon Testing	8/11/2017	8/14/2017
2559505	Bsmt-SE		Radon Testing	8/11/2017	8/14/2017

Canisters ID Number	Sample Location	Canister Type	Analysis	Canisters Deployed	Canisters Retrieved
2559514*	Bsmt-Sump Rm	Charcoal Canister	Radon Testing	8/11/2017	8/14/2017
2559549	2nd FL-NW		Radon Testing	8/11/2017	8/14/2017
2559565	Bsmt-SW		Radon Testing	8/11/2017	8/14/2017
2559571	Bsmt-Sump Rm		Radon Testing	8/11/2017	8/14/2017

[1] A duplicate of canister # 2559571

A.2.3.3 Technical Review:

All samples were reviewed for the following quality control (QC) parameters. All QC results were evaluated, but only non-compliant QC observations, if any, are discussed in detail in this report.

- Field Duplicate
- Continuous Radon Monitor (CRM)

Field Duplicate:

Canisters ID Number	Sample Result (D1)	Field Duplicate Canister Number	Field duplicate Result (D2)	Average (M)	RPD
2559514	3.1 pCi/L	2559571	3.8 pCi/L	3.45 pCi/L	20.3%

According to Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings, duplicate samples were deployed at a rate of one per unit of the measurement location. Duplicate pairs of measurements greater than or equal to 4.0 pCi/L should produce a Relative Percent Difference (RPD) greater than 36% no more than 1% of the time. In the above field duplicate pairs all the samples and duplicates measurements are less than the 4.0 pCi/L. Therefore, no action was required.

Also, if one duplicate is equal to or greater than 4.0 pCi/L and the other below, the higher result may not be twice or more than the other. In the above field duplicate pairs, both sample and duplicate results are below 4.0 pCi/L. Since the maximum radon gas level is well below 4.0 pCi/L, the precision of the duplicate measurement is acceptable.

RPD = $[(D1-D2)/(D1 + D2/2)] \times 100\%$

Continuous Radon Monitor (CRM)

The average radon level measured for CRM was 1.5 pCi/L below the EPA action level of 4.0 pCi/l.

All eight samples were reported below 4.0 pCi/L which was below the EPA recommended action guideline level of 4.0 pCi/L. The national average indoor radon gas level is approximately 1.3 pCi/L.

Contract Problems/Non-Compliance:

None

Reviewer's Signature: Smita Sumbaly **Date:** 9/20/2017

Verified By: [illegible] **Date:** 9/20/17

Analytical Data Summary Table - Radon Testing
738 Upper Mountain Road Site
Lewiston, New York 14092
Sampling Dates: August 11 through 14, 2017

Canisters ID Number	Sample Location	Canister Type	Analysis	Radon Level
738 Upper Mountain Road				
2471303	1st Fl-SE bedrm	Charcoal Canister	Radon Testing	1.5 pCi/L
2523071	1st Fl-NE bedrm	Charcoal Canister	Radon Testing	1.2 pCi/L
2559490	1st Fl-Liv rm	Charcoal Canister	Radon Testing	1.3 pCi/L
2559505	Bsmt-SE	Charcoal Canister	Radon Testing	3.0 pCi/L
2559514*	Bsmt-Sump Rm	Charcoal Canister	Radon Testing	3.1 pCi/L
2559549	2nd FL-NW	Charcoal Canister	Radon Testing	1.1 pCi/L
2559565	Bsmt-SW	Charcoal Canister	Radon Testing	2.5 pCi/L
2559571	Bsmt-Sump Rm	Charcoal Canister	Radon Testing	3.8 pCi/L

* A duplicate of canister # 2559571

pCi/L - picoCuries per liter of air

FL/Fl - Floor
bedrm-Bedroom
Rm/rm - Room
Bsmt - Basement

SW - South West
SE - South East

NW - North West
NE- North East

ACCU-VIEW
PROPERTY INSPECTIONS

www.AccuviewInspections.com

Accu-View Property Inspections, Inc.
P.O. Box 641
Buffalo, New York 14051
(716)882-2200 - Phone
(425)962-1089 - E-Fax
e-mail: rick@AccuviewInspections.com

Inspector Name:

Richard F. Pezzino, CRI, RMS
NYS License #16000005200
American Society of Home Inspectors (ASHI)
ASHI Certified Inspector ID #250078
National Association of Home Inspectors (NAHI)
Certified Real Estate Inspector membe #10-10248
New York State Department of Environmental Conservation
(Pest Inspector 7C License #T9847715)
National Radon Safety Board (NRSB)
Radon Measurement Specialist Certification #1SS0032

RECEIVED
AUG 17 2017
BY:

Confidential Inspection Report

738 Upper Mountain Road
Lewiston, NY 14092

August 11, 2017

Prepared for: Weston Solutions, Inc

This report is the exclusive property of the inspection company and the client whose name appears herewith and its use by any unauthorized persons is prohibited.

Inspection Table of Contents

GENERAL INFORMATION 4
RADON SCREENING 6

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GENERAL INFORMATION

Client & Site Information:

Inspection Date:

August 11, 2017 8:00 AM.

Client:

Weston Solutions, Inc
1400 Weston Way
West Chester, PA 19380

Inspection Site:

738 Upper Mountain Road
Lewiston, NY 14092

Property Occupied?

Yes.

People Present:

Homeowner, Weston Rep., EPA Rep.

Building Characteristics:

Main Entry Faces:

North.

Building Style & Type:

1 Family. Cape Cod.

Stories:

1.5.

Space Below Grade:

Full Basement.

Climatic Conditions:

Weather:

Clear.

Soil Conditions:

Dry.

What is Radon?

Radon is a gas created in the soil from trace amounts of uranium and radium in the soil. These elements can be found everywhere in the world. Therefore, any building has the potential for elevated levels of radon. It is usually not a question of "Is there radon?" but rather, "How much radon is there?"

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Radon comes from natural deposits of uranium and radium in the soil. Typically, it is not a result of manmade landfills or other suspicious sources.

Uranium breaks down to radium, which in turn decays into radon gas. Radon is an inert gas, which means that it does not react or combine with the elements in the ground. Because of this, radon gas can move up through the soil into the atmosphere, where it is easily diluted. However, when it enters a building constructed on top of this soil, it can build up and become a health concern.

People cannot see, taste or smell radon. There is no way that one can sense the presence of radon. Despite this, it can have a detrimental effect on people by increasing their likelihood of developing lung cancer.

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RADON SCREENING

Radon Screening

Testing Technician:

Richard F Pezzino, RMS
National Radon Safety Board
Radon Measurement Specialist Certification #1SS0032.

E.P.A. Certified Laboratory:

RTCA
Radon Testing Corp of America
2 Hayes Street
Elmsford, New York 10523
NYS ELAP #10806.

NOTE:

Analysis method number used by the Laboratory:

EPA-402-R-92-004, New York

SM20-22 7500 Rn (-06)

Type of Screening Device Used:

E-Smart Continuous Radon Monitor

Continuous Radon Monitors use an electronic detector to accumulate and store information related to the periodic average concentration of radon gas or radon decay products. They are activated and left on site for a period of not less than 48 hours.

Charcoal Canisters(AC)

Charcoal canisters are small flat containers filled with a measured amount of **activated charcoal**. The lid is usually perforated or screened to keep the charcoal from falling out. Once set , they are left unattended for at least 48 hours but not over 144 hours. The canister after the test period is then sealed and sent to an E.P.A. Listed Lab where the contents are analyzed. Analysis consists of counting the gamma radiation emission rate from the radon decay products resulting from the radon absorbed in the charcoal.

Number of Sampling Units Set:

(1) - One continuous monitor
(8) - Charcoal Canisters.

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PC1708160158

RTCA RADON TESTING CORPORATION OF AMERICA

Site Radon Inspection Report

Date : 08/16/2017

Mr. Rick Pezzino
ACCU-VIEW PROPERTY INSP.
P.O. Box 641
East Amherst, NY 14051-

Client: Unknown
Test Location: 738 Upper Mountain Road
Lewiston, NY 14092-
Individual Canister Results

Canister ID# :	2471303	Test Start :	08/11/2017 @ 08:45
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:43
Location :	1st Fl- SE bedrm	Received:	08/16/2017 @ 13:25
Radon Level :	1.5 pCi/L	Analyzed:	08/16/2017 @ 17:11
Error for Measurement is: ±	0.3 pCi/L		

Canister ID# :	2523071	Test Start :	08/11/2017 @ 08:42
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:41
Location :	1st Fl- NE bedrm	Received:	08/16/2017 @ 13:25
Radon Level :	1.2 pCi/L	Analyzed:	08/16/2017 @ 16:36
Error for Measurement is: ±	0.3 pCi/L		

Canister ID# :	2559490	Test Start :	08/11/2017 @ 08:38
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:39
Location :	1st Fl- Liv rm	Received:	08/16/2017 @ 13:25
Radon Level :	1.3 pCi/L	Analyzed:	08/16/2017 @ 17:11
Error for Measurement is: ±	0.3 pCi/L		

Canister ID# :	2559505	Test Start :	08/11/2017 @ 08:15
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:31
Location :	Bsmt -SE	Received:	08/16/2017 @ 13:25
Radon Level :	3.0 pCi/L	Analyzed:	08/16/2017 @ 17:11
Error for Measurement is: ±	0.3 pCi/L		

Canister ID# :	2559514	Test Start :	08/11/2017 @ 08:32
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:36
Location :	Bsmt -Sump Rm	Received:	08/16/2017 @ 13:25
Radon Level :	3.1 pCi/L	Analyzed:	08/16/2017 @ 16:56
Error for Measurement is: ±	0.3 pCi/L		

Canister ID# :	2559549	Test Start :	08/11/2017 @ 08:47
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:45
Location :	2nd FL- NW	Received:	08/16/2017 @ 13:25
Radon Level :	1.1 pCi/L	Analyzed:	08/16/2017 @ 16:36
Error for Measurement is: ±	0.2 pCi/L		

National Radon Safety Board NRSB Certified Radon Professionals

Andreas C. George
Radon Measurement Specialist
NJ MES 11089

Dante Galan
Laboratory Director

NRSB ARL0001
NYS ELAP ID: 10806
PADEP ID: 0346
NJDEP ID: NY933
NJ MEB 90036
FL DOH RB1609
IL RNL2000201

(914)345-3380
FAX (914)345-8546

2 Hayes Street, Elmsford, NY 10523
www.rtca.com

RTCA RADON TESTING CORPORATION OF AMERICA

PC1708160158

Site Radon Inspection Report

Date : 08/16/2017

Mr. Rick Pezzino
ACCU-VIEW PROPERTY INSP.
P.O. Box 641
East Amherst, NY 14051-

Client: Unknown
Test Location: 738 Upper Mountain Road
Lewiston, NY 14092-
Individual Canister Results

Canister ID# :	2559565	Test Start :	08/11/2017 @ 08:23
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:33
Location :	Bsmt -SW	Received:	08/16/2017 @ 13:25
Radon Level :	2.5 pCi/L	Analyzed:	08/16/2017 @ 16:56
Error for Measurement is: ±	0.3 pCi/L		

Canister ID# :	2559571	Test Start :	08/11/2017 @ 08:32
Canister Type :	Charcoal Canister 3 inch	Test Stop :	08/14/2017 @ 08:36
Location :	Bsmt -Sump Rm	Received:	08/16/2017 @ 13:25
Radon Level :	3.8 pCi/L	Analyzed:	08/16/2017 @ 17:11
Error for Measurement is: ±	0.3 pCi/L		

The reported results indicate that radon levels in the building tested are below the United States Environmental Protection Agency (EPA) action level of 4.0 picoCuries per liter of air (pCi/L). The EPA recommends retesting if your living patterns change and you begin occupying a lower level of the building, such as a basement or if major remodeling is done.

General radon information may be obtained by consulting the EPA booklet: A Citizen's Guide to Radon (www.epa.gov/radon/pubs/citguide.html). To request a copy or for further information, please contact your state health department. The EPA maintains a radon information website, including copies of its publications, at www.epa.gov/iaq/radon.

For New Jersey clients: Please see the attached guidance document entitled Radon Testing and Mitigation: The Basics for further information.

For New York clients: If the radon level of one or more testing devices is equal to or exceeds 20 pCi/L please contact the New York State Department of Health, Bureau of Environmental Radiation Protection, for technical advice and assistance at 518-402-7556 or toll free 1-800-458-1158.

PLEDGE OF ASSURED QUALITY

All procedures used for generating this report are in complete accordance with the current EPA protocols for the analysis of radon in air (EPA 402-R-92-004). The analytical results relate only to the samples tested, in the condition received by the lab, and that calculations were based upon the information supplied by client. RTCA and its personnel do not assume responsibility or liability, collectively and individually, for analysis results when detectors have been improperly handled or placed by the consumer, nor does RTCA and its personnel accept responsibility for any financial or health consequences of subsequent action or lack of action, taken by the customer or it's consultants based on RTCA-provided results.

National Radon Safety Board NRSB Certified Radon Professionals

Andreas C. George
Radon Measurement Specialist
NJ MES 11089

Dante Galan
Laboratory Director

NRSB ARL0001
NYS ELAP ID: 10806
PADEP ID: 0346
NJDEP ID: NY933
NJ MEB 90036
FL DOH RB1609
IL RNL2000201

(914)345-3380
FAX (914)345-8546

2 Hayes Street, Elmsford, NY 10523
www.rtca.com

Radon Testing Corp: of America
2 Hayes Street, Elmsford, NY 10523, Phone: (914)345-3380

Radon Testing Summary Sheet
Please fill out all pertinent information legibly

Send Results Report to:
Contact: Richard F. Rezzino

Company/Agen: Accu-View Property Inspections, Inc.
Address: P.O. Box 641
Buffalo, NY 14051
716-882-2200
City: Zip:

Phone: Fax:

Email: info@AccuviewInspections.com

Test Location Information:
School District: School Code #:

County: Niagara Municipality: Lewiston

Building/School Name:

Address: 738 Upper Mountain Rd.

City: Lewiston State: NY Zip: 14092

NRSB# Placed by ID#: 1SS0032 Retrieved by ID#: 1SS0032

Start Date: 8-11-2017 Stop Date: 8-14-2017

Time zone: EST Total # of detectors for this building: 8

PLEASE CIRCLE APPROPRIATE CONDITIONS

Building Type: Day Care-(D) Residential-(R) Non-Residential-(N) School-(S) Public School-(P) Unknown-(U)

Structural Type of Building: Basement-(B) Crawlspace-(C) Slab-on-grade-(S) Other-(O) Unknown-(U)

Purpose of Test: Screening-(S) Real Estate-(R) Post Mitigation-(POM)

Test Conditions: Open House-(OH) Closed House-(CH) Rainy-(RA) Windy-(WY) Unknown-(NO)

Instructions: Tear off center bar coded label from detector and affix to sheet in spaces provided. Please make sure top bar code label is left on detector. Record start & stop time, identify test location and indicate if QA measurement for each detector. Use additional sheets as necessary. Please mark clearly if any detector is missing or damaged at retrieval.

Bar Code Label

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559505

Start Time: 8:15 Am Stop Time: 8:31 Am

Room # or other identifier: [redacted] SE Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559565

Start Time: 8:23 Am Stop Time: 8:33 Am

Room # or other identifier: [redacted] SW Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559514

Start Time: 8:32 Am Stop Time: 8:36 Am

Room # or other identifier: Sump Rm Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559571

Start Time: 8:32 Am Stop Time: 8:36 Am

Room # or other identifier: Sump Rm Floor: B

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559490

Start Time: 8:38 Am Stop Time: 8:39 Am

Room # or other identifier: Liv Rm Floor: 1

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2523071

Start Time: 8:42 Am Stop Time: 8:41 Am

Room # or other identifier: NE Bedroo. Floor: 1

Please circle if QA Measurement: Blank Duplicate

Instructions: Tear off center bar coded label from detector and affix to sheet in spaces provided. Please make sure top bar code label is left on detector. Record start & stop time, identify test location and indicate if QA measurement for each detector. Use additional sheets as necessary. Please mark clearly if any detector is missing or damaged at retrieval.

Bar Code Label
REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2471303

Start Time: 8:45 Am Stop Time: 8:43 Am

Room # or other identifier: SE Bed Floor: 1

Please circle if QA Measurement: Blank Duplicate

REMOVE THIS PORTION AND AFFIX TO TEST INFORMATION FORM
2559549

Start Time: 8:47 Stop Time: 8:45 AM

Room # or other identifier: NW Floor: 2

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

Start Time: _____ Stop Time: _____

Room # or other identifier: _____ Floor: _____

Please circle if QA Measurement: Blank Duplicate

RTCA RADON TESTING CORPORATION OF AMERICA
2 HAYES STREET, ELMSFORD, NY 10523
PHONE: (914) 345-3380 FAX: (914) 345-8546

E-SMART RADON TEST REPORT

FAXED TO: (425)962-1089 @ 8/14/17 8:53:41 AM
COPY FAXED TO: NONE
TEST REPORT NUMBER: 23395

August 14 2017

Test Performed By:
Accu-View Property Inspections, Inc.
Richard Pezzino
NRSB 1SS0032
P.O. Box 641
East Amherst, New York 14051
Phone: (716)882-2200
Fax: (425)962-1089

Test Performed For:
Weston Solutions, Inc.
1090 Kings Georges Post Rd.
Suite 201
Edison, NJ 08837
Phone: Not Available
Fax: Not Available

Address Tested:			**Average radon level measured**
---	Level Tested:	Basement	
	Test Started:	8/11/17 @ 8:26:00 AM	
738 Upper Mountain Rd	Test Stopped:	8/14/17 @ 8:52:11 AM	
Lewiston, NY -	Device Type:	Continuous Radon Monitor	3 pCi/l
	Serial Number:	P0001065	

The average radon level measured was below the United States Environmental Protection Agency (EPA) action level of 4.0 picoCuries per liter of air (pCi/l). Since radon levels can vary significantly from season to season it is advisable to conduct at least one short-term test during the winter heating season. The EPA recommends retesting if your living patterns change or if you begin occupying a lower level of your home, such as a basement.

For more information on radon in your home please consult the EPA booklet: A Citizen's Guide to Radon (EPA Document #402-K92-001) or contact your state health department official. In New York, call the Bureau of Environmental Radiation Protection at (518) 458-6451. Also, the EPA maintains a radon information website, including copies of its publications, at www.epa.gov/iaq/radon.

All procedures used for generating this report are in complete accordance with the current EPA protocols for the analysis of radon in air.

PLEDGE OF ASSURED QUALITY

RTCA will provide the most accurate, reliable and fastest turnaround Radon Test Reporting Service possible.

RTCA and its personnel do not assume responsibility or liability, collectively and individually, for analysis results when detectors have been improperly handled or placed by the customer, nor does RTCA and its personnel accept responsibility for any financial or health consequences of subsequent action or lack of action, taken by the customer or its consultants based on RTCA-provided results.

NJDEP ID: NY933
NJ MEB 90036
NJ MES 11089
FL DOH RB1609

NRSB ARL0001
NYS ELAP ID: 10806
PADEP ID: 0346

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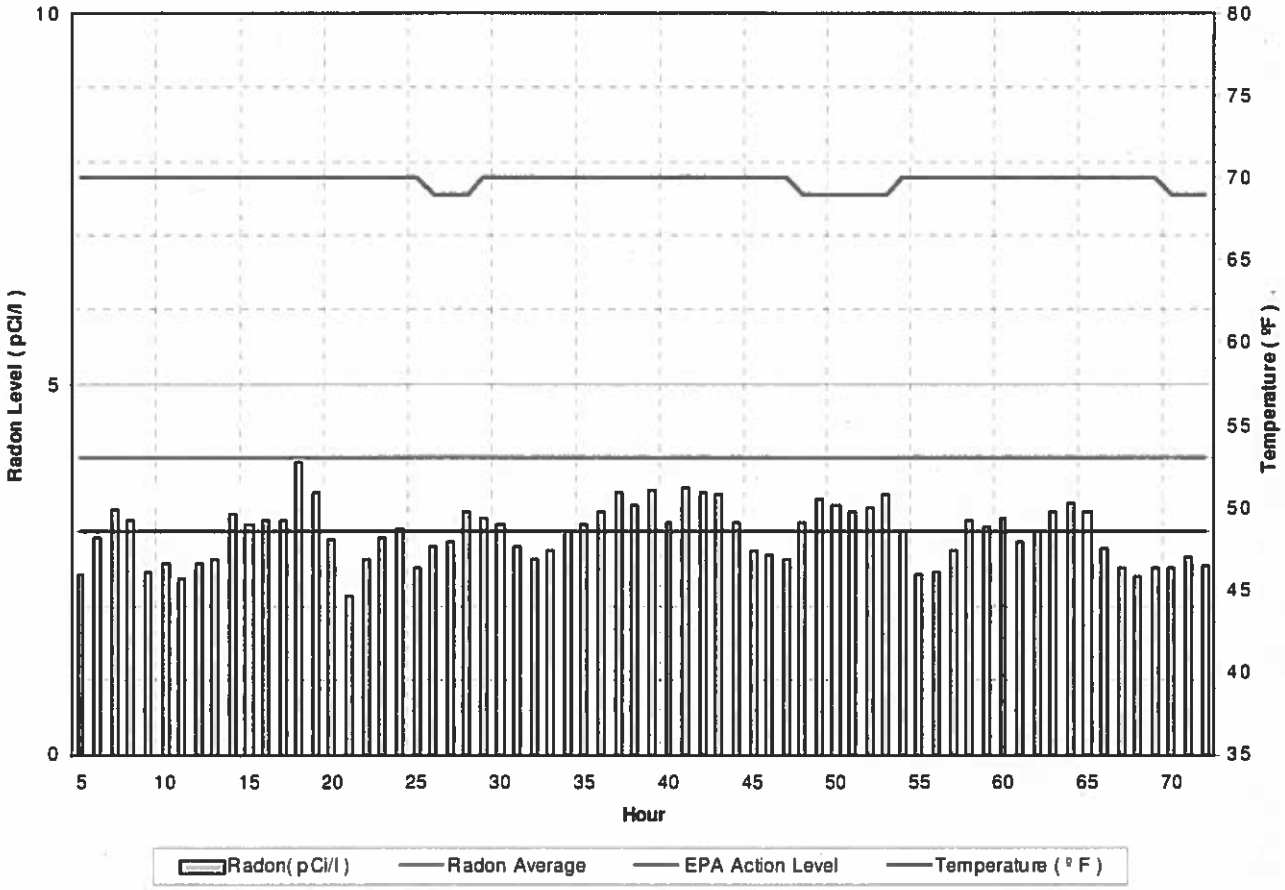
RTCA RADON TESTING CORPORATION OF AMERICA
2 HAYES STREET, ELMSFORD, NY 10523
PHONE: (914) 345-3380 FAX: (914) 345-8546

E-SMART RADON TEST REPORT

FAXED TO: (425)962-1089 @ 8/14/17 8:53:41 AM
COPY FAXED TO: NONE
TEST REPORT NUMBER: 23395

Hourly Radon Level and Temperature

738 Upper Mountain Rd
Test Start 8/11/17@ 8:26:00 AM - Test Stop 8/14/17 @ 8:52:11 AM
Average Radon Level Measured: 3 pCi/l



Radon is an odorless, colorless, naturally occurring radioactive gas produced by the decay of uranium, which is found in small amounts in nearly all soils. Radon gas can sometimes infiltrate through the foundation of a building and become concentrated in the enclosed space. It is normal for radon levels to fluctuate over time and with changes in weather patterns and season. The above graph shows the hourly radon levels and temperatures recorded during testing. Trained personnel use this graph to help determine if the recording device has been tampered with during testing. Action level recommendations for radon are based on average exposures over a minimum of two days. Radon readings for any single hour should not be used to assess the radon risk in your building.

NJDEP ID: NY933
NJ MEB 90036
NJ MES 11089
FL DOH RB1609

NRSB ARL0001
NYS ELAP ID: 10806
PADEP ID: 0346

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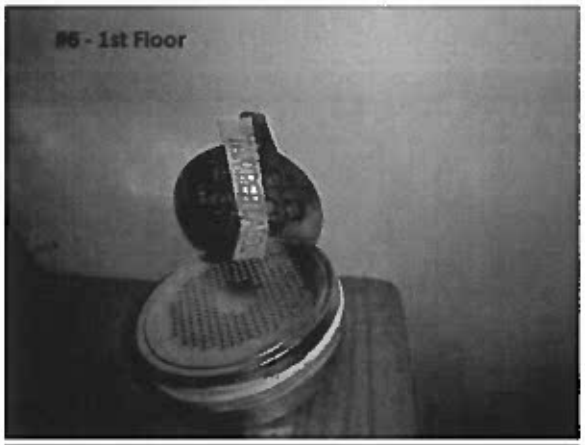

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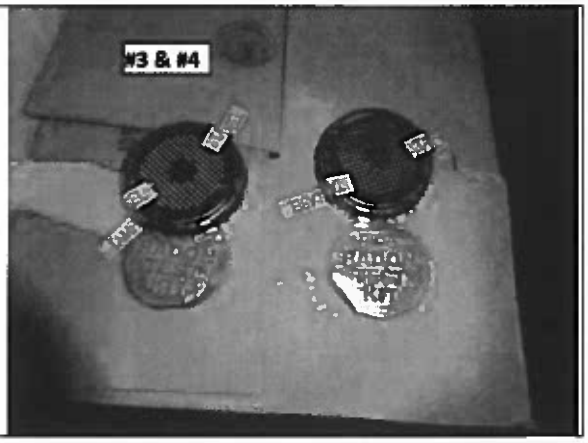
Duplicate or Sequential Sampling Taken:

(1) - Duplicate - Test Canister #3 & 4.



Sampling Location:

- Basement
- 1st Floor
- 2nd Floor.

Lowest Living Level Type:

The lowest living level would be considered the Basement level. According to the E.P.A. Measurement Protocols, the lowest living level or levels suitable for occupancy shall have one primary measurement.

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Testing Location Minimum 20" Above Floor:

Yes.

Testing Location Minimum 12" From Exterior Door:

Yes.

Minimum of 4" Clearance Around Monitor:

Yes.

High Winds Noted During The Sampling Period:

No.

Rain Noted During Screening Period:

Minimal rain during the screening period.

Was the Exposure Time Over 48 Hours:

Yes.

Start Date:

August 11, 2017.

Start Time:

SEE LAB REPORT FOR DETAILS OF EACH PLACEMENT TIME.

Stop Date:

August 14, 2017.

Stop Time:

SEE LAB REPORT FOR DETAILS OF EACH PLACEMENT TIME.

Closed House Conditions:

Yes, the structure had been in a closed condition for at least 12 hours prior to the start time of the measurement period. A closed-house condition means that all windows shall be kept closed for a period of 12 hours prior to and during the measurement period and all entry or access doors also be kept closed except for normal entry and egress.

Non-Interference Agreement:

Yes, There was a non-interference agreement signed at time of start of the measurement period.

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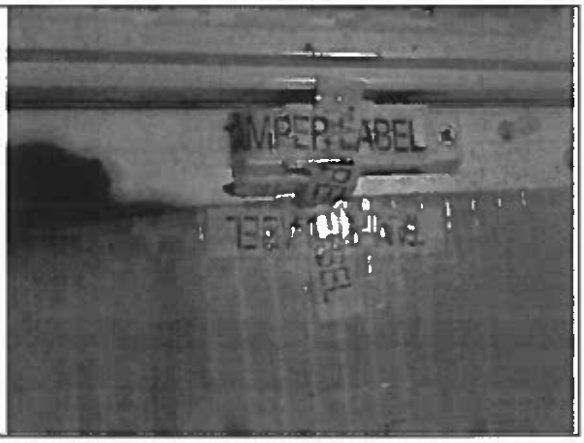
Radon Test In Progress Sign Posted:

Yes, a radon test in progress sign was posted in a conspicuous area of the structure. This notice also contained a listing of the testing conditions.

Windows & Non-essential Doors Sealed:

The windows and non-essential doors were sealed or tagged.



Window or Door Seals Disturbed:

None of the installed seals were disturbed.

Results Measurement & Recommendations:

The reported results indicate that Radon levels in the building tested are **BELOW** the United States Environmental Protection Agency (EPA) action level of ***4.0 pC/L.*** Mitigation is NOT recommended at this time.

- EPA recommended re-testing if living patterns change and/or any remodeling occurs to the building.
- EPA recommends re-testing your property every 2-3 years.

Signature Richard F. Pezzino August 17, 2017.

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ACCU-VIEW
PROPERTY INSPECTIONS

HOME INSPECTIONS • RADON TESTING • MOLD TESTING
NYS Lic # 16000005200

RESIDENTIAL **716.882.2200** COMMERCIAL

NON-INTERFERENCE AGREEMENT

PROPERTY LOCATION 738 Upper Mountain Rd.
Lewiston NY

As the owner/occupant of the above referenced property, I understand that a Radon Screening Test is being performed by Accu-View Property Inspections, Inc. with my permission. I understand and agree to maintain defined "closed–house" conditions during this test. I understand that windows and doors should be kept closed in the **entire house** as much as possible 12 hours before starting the test and throughout the test period.

I understand that I **must not** operate high volume attic or window fans, and other mechanical system that impacts the air quality or ventilation by the introduction of a fresh air supply, **12 hours prior to or during the measurement period (A MINIMUM OF 48 TESTING HOURS IS NEEDED)**. I understand the operation of the furnace and a central air-conditioning system, which recycles indoor air, is permissible during the test period.

I understand that alteration of the EPA defined "closed-house" condition may interfere with the validity of the test results and may result in legal liability, including **paying for the cost to re-test the property, in the amount of $200.00**

I agree not to tamper with the devices during the Measurement period, including but not limited to moving or covering the test device, or altering the measurement environment, under penalty of law.

I authorize Accu-View Property Inspections, Inc. to inspect this property prior to and during the test period and to disclose the test results to the party for whom this Radon Screening Measurement is being conducted.

I confirm that I have read and understand this statement by my signature below.

Signature John J. Grau Date 8/11/17

***PLEASE CALL/TEXT 716-882-2200 TO ARRANGE PICK-UP TIME