

ERM

0494255 Hero Lands

**STANDARD LEVEL IV
REPORT OF ANALYSIS**

WORK ORDER #20-01124-OR

April 3, 2020

**EBERLINE ANALYTICAL/OAK RIDGE LABORATORY
OAK RIDGE, TN**

0001

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Eberline Services – Oak Ridge Laboratory
LABORATORY DATA SUPPORT CHECKLIST
MP-001-3

Eberline Services Work Order # 20F01124

The checklist items listed below are to be initialed by appropriate staff upon completion/verification.

Date for Partial	Initials	Date	Initials	Checklist Items
		1/28/20	JB	Sample Log-In
		2/13/20	JB	Data Compilation
		2/17/20	WMT	First Technical Data Review
		2/18/20	JB	Second Technical Data Review
		3/25/20	CW	Data Entry/Electronic Deliverable
		3/25/20	CW	Case Narrative
		3/31/20	JB	Electronic Deliverable Proof
		4/1/20	JB	Samples Analyzed within Holding Time Yes? <input checked="" type="checkbox"/> No? <input type="checkbox"/>
		4/1/20	JB	QA/QC Review
		4/3/20	EJT	Client in Possession of Data Electronic or Hard Copy
				Invoiced by Laboratory

Technical/Clerical Corrections, Signatures Needed, Problems, Etc	Date/Initials

Date package approved by:

Laboratory Manager

2/13/20

Date

Copy No. _____

Radiochemistry Services

0003

SECTION I
CHAIN OF CUSTODY
& pH CHECK

0004


Chain of Custody Record

No.

Eberline Services
 501 Scarboro Road
 Oak Ridge, TN 37830
 (865) 481-0683 Phone • (865) 483-4621 Fax




Project Name: H500 LANDS		Project Number: 0494255		Page 1 of 1	
Send Report To: DAVID UPINEGRAVE		Sampler (Print Name): DDY SUGGARD		Purchase Order #: 20501124	
Address: ERM		Sampler (Print Name): JCS		Comments, Special Instructions, etc.	
840 W. Sam Houston Pkwy		Shipment Method:		Lab Sample ID (to be completed by lab)	
SURE-GO		Airbill Number:			
HOUSTON TX 77024		Laboratory Receiving:			
Phone: 281-600-1000					
Fax:					
Field Sample ID		Sample Date	Sample Time	Sample Matrix	Number of Containers
4	MW 8B	1-21-20	0845	W	1
5	MW 1A	1-21-20	1010		
6	MW 1B	1-21-20	1130		
7	MW 6A	1-21-20	1550		
8	MW 5A	1-22-20	0835		
Analysis Requested: R 226 / R 228					
REC'D JAN 28 2020					
Relinquished by: (Signature)		Received by: (Signature)		Date:	
0005		650 EX		1-24-20	
Relinquished by: (Signature)		Received by: (Signature)		Date:	
Felix		David Upinegrave		1/28/20 0915	
Relinquished by: (Signature)		Received by: (Signature)		Date:	
Sample Custodian Remarks (Completed By Laboratory):		QA/QC Level		Sample Receipt	
		Level I <input type="checkbox"/>		Total # Containers Received? <input checked="" type="checkbox"/>	
		Level II <input type="checkbox"/>		COC Seals Present? <input type="checkbox"/>	
		Level III <input type="checkbox"/>		COC Seals Intact? <input type="checkbox"/>	
		Other <input type="checkbox"/>		Received Containers Intact? <input type="checkbox"/>	
		Turnaround		Temperature? <input type="checkbox"/>	
		Routing <input checked="" type="checkbox"/>			
		24 Hour <input type="checkbox"/>			
		1 Week <input type="checkbox"/>			
		Other <input type="checkbox"/>			

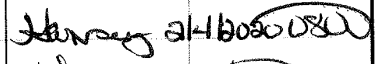
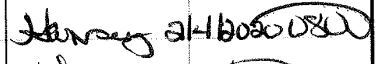

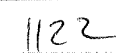

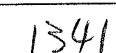
	Internal Chain of Custody	Work Order #	20-01124
		Lab Deadline	2/10/2020
		Analysis	Ra226 - Level 4
		Sample Matrix	Water


Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
	04	20	QQ1.6
	05	10	QQ1.6
	06	20	QQ1.6
	07	30	QQ1.6
	08	40	QQ1.6

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	<i>J. King</i>	2/10/20 <u>08/0</u>
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	DB	2/5/20 0810
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	2/5/20 1122
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		

	<h1>Internal Chain of Custody</h1>	Work Order #	20-01124
		Lab Deadline	2/10/2020
		Analysis	Ra228 - Level 4
		Sample Matrix	Water


Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
	04	20	QQ1.6
	05	10	QQ1.6
	06	20	QQ1.6
	07	30	QQ1.6
	08	40	QQ1.6

	Location (circle one)					Initials	Date
	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage						
Relinquished by	Sample Storage		Prep				
Received by	Sample Storage			Separations		DB 2/5/20	
Relinquished by	Sample Storage			Separations			
Received by	Sample Storage				Count Room	KP 2/5/20	
Relinquished by	Sample Storage				Count Room		
Received by	Sample Storage			Separations		DB 2/6/20	
Relinquished by	Sample Storage			Separations			
Received by	Sample Storage				Count Room	KP 2/12/20	
Relinquished by	Sample Storage				Count Room		
Received by	Sample Storage						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						

	<h1>Internal Chain of Custody</h1>	Work Order #	20-01124
		Lab Deadline	1/29/2020
		Analysis	TDS - Level 4
		Sample Matrix	Water

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
	04	20	QQ1.6
	05	10	QQ1.6
	06	20	QQ1.6
	07	30	QQ1.6
	08	40	QQ1.6

	Location (circle one)					Initials	Date
	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage					<i>Ma</i>	<i>30 JAN 20</i>
Relinquished by	Sample Storage					<i>Ma</i>	<i>30 JAN 20 0415</i>
Received by	Sample Storage						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						

	Sample Receiving Report (Volumes, pH, & CPM)	Internal Work Order
		20-01124
		Received By RSPENCER

FR	ClientID	# Btls	Comments	Matrix	Storage	Rec Vol Ttl	CPM Max
01	LCS	0		WA	QQ1.6		
02	BLANK	0		WA	QQ1.6		
03	DUP	0		WA	QQ1.6		
04	MW 8B	1		WA	QQ1.6	3.76	20
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	20
05	MW 1A	1		WA	QQ1.6	3.76	10
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	10
06	MW 1B	1		WA	QQ1.6	3.76	20
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	20
07	MW 6A	1		WA	QQ1.6	3.76	30
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	30
08	MW 5A	1		WA	QQ1.6	3.76	40
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	40

1/28/20

Received by: *R Spencer* Date: *1-28-20*

MP-001, Rev 5
Effective: 11/22/02
0009

SECTION II
SAMPLE ACKNOWLEDGEMENT

0010



Eberline Services – Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST
MP-001-2

WORK ORDER # 20-01124

SAMPLE MATRIX/MATRICES:

(CIRCLE ONE OR BOTH)

AQUEOUS NON-AQUEOUS

(CIRCLE EITHER YES, NO, OR N/A)

WERE SAMPLES:

Received in good condition?	<input checked="" type="radio"/> Y	<input type="radio"/> N	
If aqueous, properly preserved	<input checked="" type="radio"/> Y	<input type="radio"/> N	N/A

WERE CHAIN OF CUSTODY SEALS:

Present on outside of package?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Unbroken on outside of package?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Present on samples?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Unbroken on samples?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Was chain of custody present upon sample receipt?	<input checked="" type="radio"/> Y	<input type="radio"/> N

IF THE RESPONSE TO ANY OF THE ABOVE IS NO, A DISCREPANT SAMPLE RECEIPT REPORT (DSR) HAS BEEN ISSUED.

REMARKS: _____

SIGNATURE: Randolph Spencer DATE: 1-28-20

SECTION III
CASE NARRATIVE

0013



EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD
OAK RIDGE, TENNESSEE 37830
PHONE (865) 481-0683
FAX (865) 483-4621

EBS-OR-46981

April 3, 2020

Dave Upthegrove
ERM
840 W Sam Houston Pkwy N #600
Houston, TX 77478

CASE NARRATIVE
Work Order # 20-01124-OR

SAMPLE RECEIPT

This work order contains five water samples received 01/28/2020. Samples were analyzed for Radium-226/228 and Total Dissolved Solids.

<u>CLIENT ID</u>	<u>LAB ID</u>	<u>CLIENT ID</u>	<u>LAB ID</u>
MW 8B	20-01124-04	MW 6A	20-01124-07
MW 1A	20-01124-05	MW 5A	20-01124-08
MW 1B	20-01124-06		

ANALYTICAL METHODS

Radium-226 was analyzed using EPA Method 903.0 Modified. Radium-228 was analyzed using EPA Method 904.0. Total Dissolved Solids were performed using Standard Methods 2540C.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

Minimum Detectable Activity (MDA) values for data represented in this report are sample-specific. MDA measurements are determined based on factors and conditions including instrument settings, aliquot size and matrix type.

RADIUM-226

Samples were prepared by removing representative aliquots followed by mixed acid digestions as appropriate. This was followed by precipitations of Radium/Barium Sulfate. Precipitates were dissolved in alkaline EDTA. Radium was selectively precipitated and mounted on micro-porous filter media. Samples were counted by alpha spectroscopy using an energy specific region of interest for Radium-226. Inherent self-absorption from elemental Barium was corrected for in the final result. Chemical recovery was calculated using a Barium-133 tracer, which was determined by HPGe gamma spectroscopy.

ANALYTICAL RESULTS CONTINUED

RADIUM-226 CONTINUED

Samples demonstrated acceptable results for all Radium-226 analyses. Chemical recovery was acceptable for all samples. The Radium-226 method blank demonstrated an acceptable result. Results for the Radium-226 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Radium-226 laboratory control sample demonstrated an acceptable percent recovery.

RADIUM-228

Following alpha spectroscopy analysis of Radium-226, Barium/Radium Sulfate precipitates were redissolved and allowed for sufficient ingrowth of the Actinium-228 daughter. After ingrowth, Actinium-228 was selectively precipitated. Precipitates were filtered and beta emissions for Actinium-228 were counted on a gas proportional counter. Chemical recovery was determined using a Barium-133 tracer, the activity of which was determined by HPGe gamma spectroscopy and an elemental Yttrium carrier by gravimetric measurements. The product of these two recoveries was used to calculate chemical yield.

Samples demonstrated acceptable results for all Radium-228 analyses. Chemical recovery was acceptable for all samples. The Radium-228 method blank demonstrated an acceptable result. Results for the Radium-228 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Radium-228 laboratory control sample demonstrated an acceptable percent recovery.

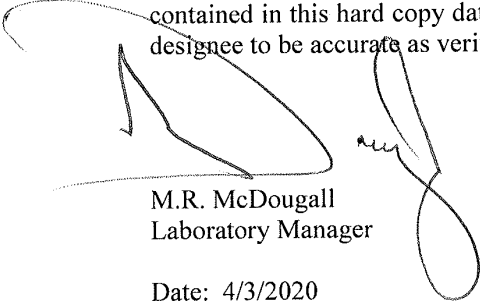
TOTAL DISSOLVED SOLIDS (TDS)

A volumetric aliquot of each sample was filtered through 0.45µm filter media into a tared 250 ml beaker. Samples were dried on a hot plate and allowed to cool. The TDS content was determined by reweighing tared beakers.

Samples demonstrated Total Dissolved Solids content that ranged from 5,518.0 to 66,403.0 mg/L.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.



M.R. McDougall
Laboratory Manager

Date: 4/3/2020

Eberline Analytical wants and encourages your feedback regarding our performance providing radioanalytical services. Please visit <http://eberlineanalytical.com/> to provide us with feedback on our services.

SECTION IV
ANALYTICAL RESULTS SUMMARY

Eberline Analytical Final Report of Analysis		Report To:				Work Order Details:							
Dave Upthegrove ERM 840 W Sam Houston Pkwy N Suite 600 Houston, TX 77478		SDG: 20-01124		Project: 0494255 Hero Lands		Analysis Category: ENVIRONMENTAL		Sample Matrix: WA					
Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
20-01124-01	LCS	KNOWN	01/28/20 00:00	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	9.95E+00	4.58E-01			pCi/l
20-01124-01	LCS	SPIKE	01/28/20 00:00	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	1.02E+01	1.48E+00	2.63E+00	3.95E-01	pCi/l
20-01124-02	MBL	BLANK	01/28/20 00:00	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	9.38E-02	1.79E-01	1.81E-01	3.34E-01	pCi/l
20-01124-03	DUP	MW 1A	01/21/20 10:10	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	2.00E+00	6.03E-01	7.36E-01	3.69E-01	pCi/l
20-01124-04	TRG	MW 8B	01/21/20 08:45	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	3.71E-01	3.11E-01	3.20E-01	4.17E-01	pCi/l
20-01124-05	DO	MW 1A	01/21/20 10:10	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	1.38E+00	5.02E-01	5.80E-01	3.57E-01	pCi/l
20-01124-06	TRG	MW 1B	01/21/20 11:30	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	1.75E+01	3.50E+00	5.10E+00	1.70E+00	pCi/l
20-01124-07	TRG	MW 6A	01/21/20 15:50	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	9.75E-01	4.62E-01	5.06E-01	3.86E-01	pCi/l
20-01124-08	TRG	MW 5A	01/22/20 08:35	1/28/2020	2/5/2020	20-01124	Radium-226	EPA 903.0 Modified	7.27E+00	1.26E+00	1.99E+00	2.62E-01	pCi/l
20-01124-01	LCS	KNOWN	01/28/20 00:00	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	9.18E+00	4.68E-01			pCi/l
20-01124-01	LCS	SPIKE	01/28/20 00:00	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	8.09E+00	6.79E-01	1.95E+00	7.87E-01	pCi/l
20-01124-02	MBL	BLANK	01/28/20 00:00	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	3.98E-02	2.90E-01	2.91E-01	6.21E-01	pCi/l
20-01124-03	DUP	MW 1A	01/21/20 10:10	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	1.34E+00	4.56E-01	5.48E-01	8.30E-01	pCi/l
20-01124-04	TRG	MW 8B	01/21/20 08:45	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	7.77E-01	4.33E-01	4.67E-01	8.36E-01	pCi/l
20-01124-05	DO	MW 1A	01/21/20 10:10	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	7.47E-01	3.46E-01	3.85E-01	6.50E-01	pCi/l
20-01124-06	TRG	MW 1B	01/21/20 11:30	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	1.04E+01	7.45E-01	2.46E+00	8.54E-01	pCi/l
20-01124-07	TRG	MW 6A	01/21/20 15:50	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	1.30E+00	4.79E-01	5.62E-01	8.81E-01	pCi/l
20-01124-08	TRG	MW 5A	01/22/20 08:35	1/28/2020	2/12/2020	20-01124	Radium-228	EPA 904.0	4.69E+00	6.44E-01	1.24E+00	9.47E-01	pCi/l
20-01124-04	TRG	MW 8B	01/21/20 08:45	1/28/2020	1/30/2020	20-01124	TDS	SM2540C	1.20E+04				mg/l
20-01124-05	TRG	MW 1A	01/21/20 10:10	1/28/2020	1/30/2020	20-01124	TDS	SM2540C	9.07E+03				mg/l
20-01124-06	TRG	MW 1B	01/21/20 11:30	1/28/2020	1/30/2020	20-01124	TDS	SM2540C	6.64E+04				mg/l
20-01124-07	TRG	MW 6A	01/21/20 15:50	1/28/2020	1/30/2020	20-01124	TDS	SM2540C	5.52E+03				mg/l
20-01124-08	TRG	MW 5A	01/22/20 08:35	1/28/2020	1/30/2020	20-01124	TDS	SM2540C	2.42E+04				mg/l

0017

CU=Counting Uncertainty; CSU=Combined Standard Uncertainty (1-sigma); MDA=Minimal Detected Activity; LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate Sample; DO=Duplicate Original



EBERLINE
ANALYTICAL

EBERLINE ANALYTICAL CORPORATION

601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

SECTION V
ANALYTICAL STANDARD

0018

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

^{Ra-5}
QA/QC REVIEWED
Date 2/8/94 Initials W

Radionuclide: Ra-226
Half Life: 1600 ± 7 years
Catalog No.: 7226
Source No.: 453-26
Customer: TMA EBERLINE
P.O.No.: VH1888
Reference Date: February 1 1994 12:00 PST.
Contained Radioactivity: (Ra-226) 1.001 µCi.
Contained Radioactivity: (Ra-226) 37.0 kBq.

Description of Solution
a. Mass of solution: 5.1864 g (in a 5 ml Flame Sealed Ampoule)
b. Chemical form: Ra(NO3)2 in 1 N HNO3
c. Carrier content: None added
d. Density: 1.0318 g/ml @ 20°C.

Radioimpurities: None detected (other than daughters)

Radioactive Daughters: Rn-222, Po-218, At-218, Pb-214, Bi-214, Po-214, Tl-210, Pb-210, Bi-210, Po-210 and Tl-206.

Radionuclide Concentration: (Ra-226) 0.1929 µCi/g.

Method of Calibration

Weighed aliquots of the solution were assayed using gamma spectrometry:
Energy peak(s) integrated under: 186 keV.
Branching ratio(s) used: 0.0351 gamma rays per decay.

Uncertainty of Measurement

- a. Systematic uncertainty in instrument calibration: ± 3.4%
- b. Random uncertainty in assay: ± 3.1%
- c. Random uncertainty in weighing(s): ± 0.2%
- d. Total uncertainty at the 99% confidence level: ± 4.6%

NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

Leak Test(s)

See reverse side for Leak Test(s) applied to this source.

Notes

1. Nuclear data were taken from "Table of Radioactive Isotopes", edited by Virginia S. Shirley, 1986.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).



ISOTOPE PRODUCTS LABORATORIES
1800 North Keystone Street
Burbank, California 91504
(818) 843 - 7000

Ana H. Kuen
QUALITY CONTROL

Feb. 3, 1994
Date Signed



QUALITY CONTROL PROGRAM
MP 009

Rev.8; 11/01/03
Title: Radioactive Reference Standards Solutions & Records

EBERLINE SERVICES - OAK RIDGE LABORATORY
RADIOACTIVE REFERENCE SOLUTIONS
PRIMARY DILUTION RECERTIFICATION
MP 009

SOLUTION REFERENCE # IPL 453-26 CURRENT DATE 9/12/2019 0:00
SOLUTION # Ra-5

Principal Radionuclide ²²⁶Radium Half Life, Years 1.600E+03 Half Life, Days 5.844E+05

Radionuclide ²²⁶Radium Reference Date 2/1/1994 0:00
Certified Activity 1.001E+00 μCi
Certified Concentration $\mu\text{Ci per gram}$

Ampoule /Solution Gross Weight, Grams
Empty Ampoule Weight, Grams
Solution Net Weight, Grams
Total Activity in Ampoule 1.0010 μCi

Chemical Composition of Standard Solution
²²⁶Ra(NO₃)₂ in 1M HNO₃

Dilution Instructions: Dilution Solvent Used 1M HNO₃

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 1.0010 μCi Which Equals 2.222E+06 dpm at the date listed above

And after dilution the activity of this solution is 2.222E+03 dpm/ml
This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.

Expiration Date: September 9, 2020

Verified & Approved By [Signature]
QC Approval [Signature]

Date: 9/12/2019
Date: 9/16/19



QUALITY CONTROL PROGRAM
MP 009

Rev.8; 11/01/03
Title: **Radioactive Reference Standards Solutions & Records**

EBERLINE SERVICES - OAK RIDGE LABORATORY
RADIOACTIVE REFERENCE STANDARD SOLUTIONS
SECONDARY DILUTION RECERTIFICATION

MP 009		Date	9/12/2019 0:00
Solution Reference #	PL-453-26	Solution #	Ra-5b
Principal Radionuclide	Half Life, Years	Half Life, Days	
²²⁶ Radium	1.600E+03	5.844E+05	
Radionuclide of Interest	²²⁶ Radium	Reference Date	2/1/1994 0:00
Parent Solution Conc.	2.22E+03 dpm/ml		
Chemical Composition of Standard Solution			
²²⁶ Ra(NO ₃) ₂ in 1M HNO ₃			

Dilution Instructions: Dilution Solvent Used **1M HNO₃**


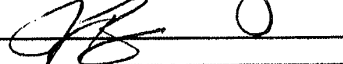
SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: **20.0000** ml
Total Activity: **4.4440E+04** dpm
Final Volume: **1000.00** ml
Final Activity Concentration: **4.4440E+01** dpm/ml

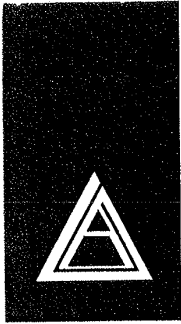
This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.

NOTES:

Expiration Date: **9-Sep-20**

Verified & Approved By 
QC Approval 

Date: **9/12/2019 0:00**
Date: **9/16/19**



ANALYTICS #411 Rec'd 2/15/06 Printed

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

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

CERTIFICATE OF CALIBRATION Standard Radionuclide Source

72325-207

Ra²²⁸

Ra-228 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated using a germanium gamma spectrometer system.

Radionuclide purity and calibration were checked using a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

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

ISOTOPE:	Ra-228
ACTIVITY (dps):	4.022 E3
HALF-LIFE:	5.75 years
CALIBRATION DATE:	February 10, 2006 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	4.0%

Impurities: γ -impurities <0.1%

5.10721 grams 0.1M HCl solution with 50 μ g/g Ba carrier.

P O NUMBER 00003181, Item 1

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

Q A APPROVED: *W.M. [Signature] 2-13-06*



QUALITY CONTROL PROGRAM
MP-009

Rev.8; 1/10/03
Title: Radioactive Reference Standards Solutions & Records

EBERLINE SERVICES - OAK RIDGE LABORATORY
RADIOACTIVE REFERENCE SOLUTIONS
RECERTIFICATION
MP 009

SOLUTION REFERENCE # Analytics 7235-207 CURRENT DATE 1/15/2020 0:00
SOLUTION # Ra-12

Principal Radionuclide ²²⁶Ra Half Life, Years 5.750E+00 Half Life, Days 2.100E+03

Radionuclide ²²⁶Ra Reference Date 2/10/2006 0:00
Certified Activity 1.087E-01 μCi
Certified Concentration $\mu\text{Ci per gram}$

Ampoule /Solution Gross	<u>9.0741</u>	Weight, Grams
Empty Ampoule	<u>3.9858</u>	Weight, Grams
Solution Net	<u>5.0883</u>	Weight, Grams
Total Activity in Ampoule	<u>0.1087</u>	μCi

Chemical Composition of Standard Solution
²²⁶Ra(NO₃)₂ in 0.5 M HCl

Dilution Instructions: Dilution Solvent Used 0.5 M HCl

Dilute to a volume of 991.00 Kg

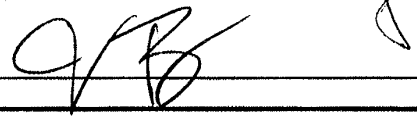
Certified Total Activity of 0.1087 μCi Which Equals 2.413E+05 dpm at the date listed above

And after dilution the activity of this solution is 2.435E+02 dpm/ml. This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.

Expiration Date: January 15, 2021

Recertified By 

Date: 1/15/20

QC Approval 

Date: 1/15/20



Ba-6
(+6a)

National Institute of Standards & Technology
Certificate

Standard Reference Material 4251C
Barium-133 Radioactivity Standard

ORIGINAL

This Standard Reference Material (SRM) consists of radioactive barium-133 chloride, non-radioactive barium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of ionization chambers and solid-state gamma-ray spectrometry systems.

Radiological Hazard

The SRM ampoule contains barium-133 with a total activity of approximately 2.5 MBq. Barium-133 decays by electron capture and during the decay process X-rays and gamma-rays with energies from 4 to 400 keV are emitted. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least June 2004.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group and D.B. Golas, Nuclear Energy Institute Research Associate.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899
October 1994

Thomas E. Gills, Chief
Standard Reference Materials Program



QUALITY CONTROL PROGRAM

QCP-009

Rev. 8; 11/10/03
Title: Radioactive Reference Standards Solutions & Records

EBERLINE SERVICES - OAK RIDGE LABORATORY
RADIOACTIVE REFERENCE STANDARD SOLUTIONS
SECONDARY DILUTION RECERTIFICATION

Solution Reference #		QCP-009-1-A NIST SRM4251C	Date	4/26/19
Solution #				Ba-6a
Principal Radionuclide	Half Life, Years	Half Life, Days		
¹³³ Ba	1.048E+01	3.828E+03		
Radionuclide of Interest	¹³³ Ba	Reference Date		
Parent Solution Conc.	1.48E+05 dpm/ml	9/1/1993 0:00		
Chemical Composition of Standard Solution				
¹³³ BaCl ₂ in 1M HCl				

Dilution Instructions: Dilution Solvent Used 1M HCl

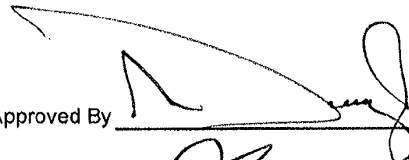
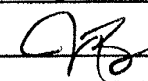
SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution:	25.0000 ml	Final Activity Concentration:	3.6950E+03 dpm/ml
Total Activity:	3.6950E+06 dpm		
Final Volume:	1000.00 ml		

NOTES:

This activity concentration is based on the original reference date listed above. All activities are corrected to the date and time of analysis by the laboratory data processing software.

Expiration Date: April 25, 2020

Verified & Approved By 
QC Approval 

Date: 4/26/19

Date: 4/26/19

SECTION VI
QUALITY CONTROL SAMPLE RESULTS SUMMARY

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
20-01124	Ra226	1	pCi	I	ERM

Laboratory Control Sample

Analyte	LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
RA-226	102.92%	25.63%	100.00%	4.60%	9.95E+00	4.58E-01	1.02E+01	2.63E+00	Ra-5b	4.39E+01	4.60E+00	5.03E-01

Matrix Spike

Analyte	Normalized Difference	MS Actual % Rec	Expected MS Result	Expected MS Uncert	Actual MS Result	Actual MS CSU	Sample Result	Sample CSU	Sample Aliquot	Standard ID	Standard ACT (dpm)	Standard Error %	Standard Added (g)

Duplicate Results

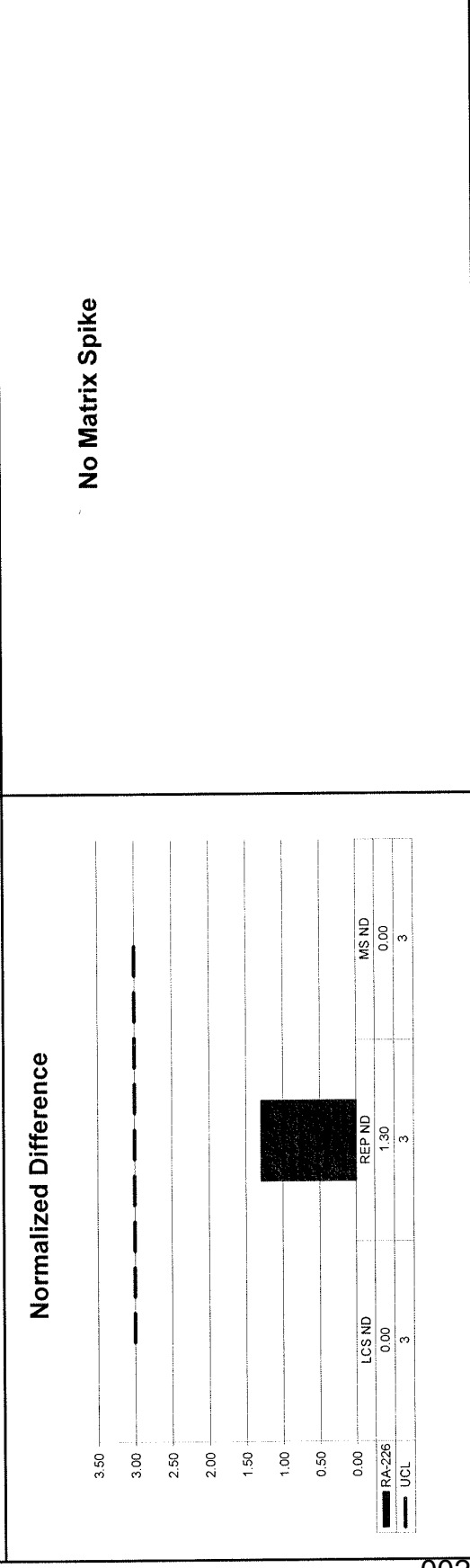
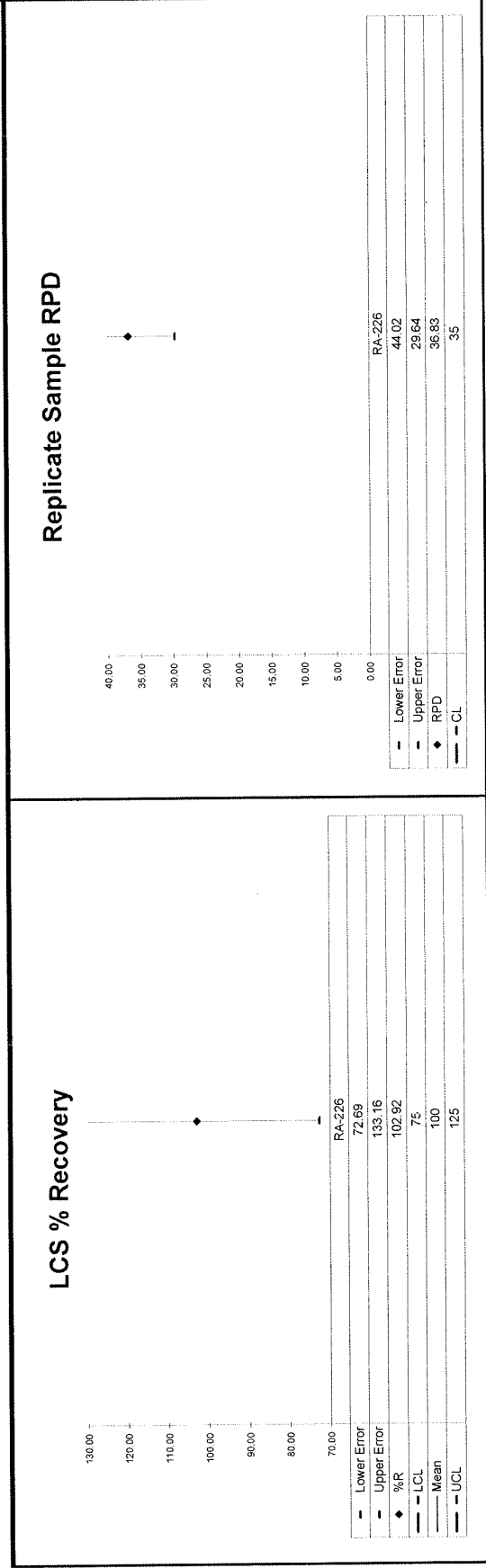
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-226	1.30	36.83	1.38E+00	5.80E-01	2.00E+00	7.36E-01	1.03	OK			INV	OK

QC Summary

0027

Version

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
20-01124	Ra226	1	pCi	I	ERM



Version

0028

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
20-01124	Ra228	1	pCi	I	ERM

Laboratory Control Sample

Analyte	LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
RA-228	88.17%	24.15%	100.00%	5.10%	9.18E+00	4.68E-01	8.09E+00	1.95E+00	Ra-12	4.51E+01	5.10E+00	4.52E-01

Matrix Spike

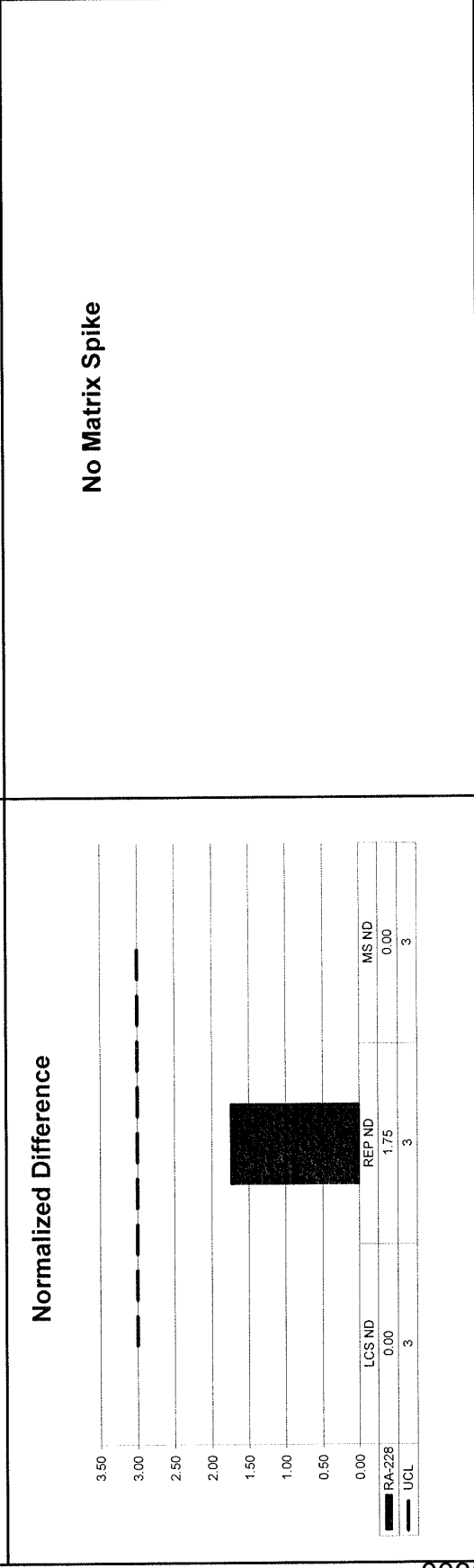
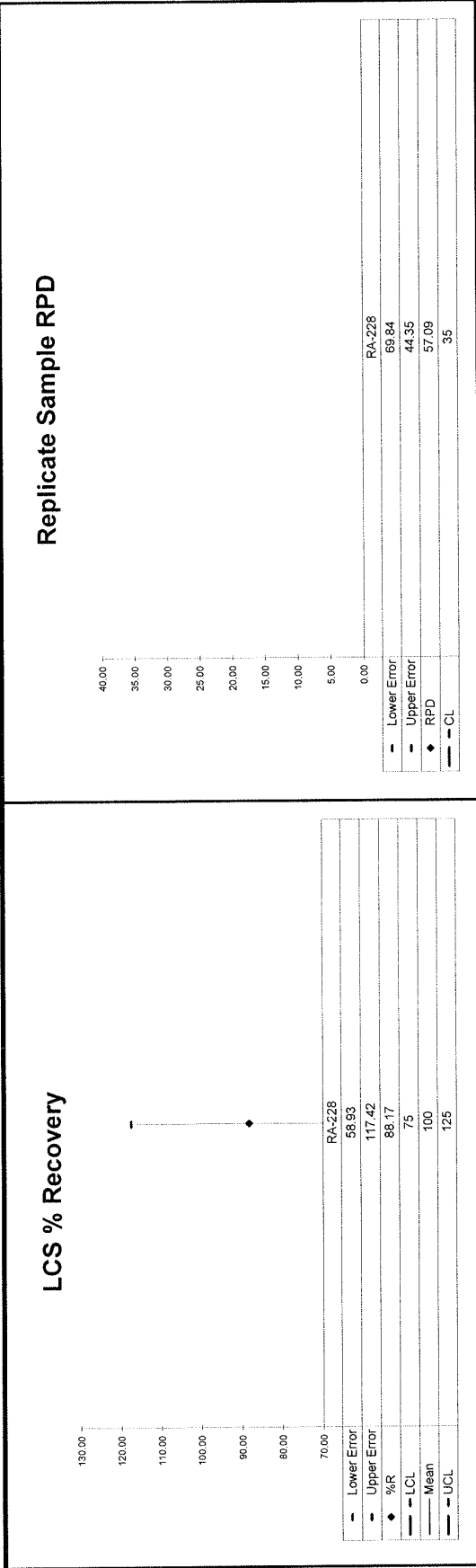
Analyte	Normalized Difference	MS Actual % Rec	Expected MS Result	Expected MS Uncert	Actual MS Result	Actual MS CSU	Sample Result	Sample CSU	Sample Aliquot	Standard ID	Standard ACT (dpm)	Standard Error %	Standard Added (g)

Duplicate Results

Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-228	1.75	57.09	7.47E-01	3.85E-01	1.34E+00	5.48E-01	0.88	OK			NA	OK

QC Summary

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
20-01124	Ra228	1	pCi	I	ERM



0030

SECTION VII
LABORATORY TECHNICIAN'S NOTES

0031

RA-226 NOTES

0032

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com		Internal Work Order	20-01124
			Analysis Code	Ra226
			Run Number	1

#	Date	Dept	User	Notes
1	02/04/20 10:34	PREP	JHARVEY	ALIQUOTED AND FILTERED SAMPLES- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS

Jharvey
2/4/2020


0033

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	20-01124
		Analysis Code	Ra226
		Run Number	1

#	Date	Dept	User	Notes
1	02/04/20 10:34	PREP	JHARVEY	ALIQOTED AND FILTERED SAMPLES- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS
2	02/05/20 11:19	CHEM	DBUSH	ADDED EDTA TO SAMPLES AND LET SIT. ADDED AMMONIUM SULFATE AND ACETIC ACID TO SAMPLES. FILTERED ONTO TARED FILTER PAPERS, LET DRY UNDER HEAT LAMP, REWEIGHED, AND SUBMITTED TO COUNT.

Dylan Bush
2/5/20

0034

 Reagents Used in an Analysis		Internal Work Order		
		20-01124		
		Analysis Code		Run
		Ra226		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
021318P	Ammonium Hydroxide	Reagent Grade	JHARVEY	2/4/2020
021302D04	Ammonium Sulfate	200 mg/ml	JHARVEY	2/4/2020
020921D14	Barium Carrier	1 mg/ml	JHARVEY	2/4/2020
020825D01	Lead Carrier	166 mg/ml	JHARVEY	2/4/2020
021834P	Nitric Acid	Reagent Grade	JHARVEY	2/4/2020
021557P	Acetic Acid	Reagent Grade	DBUSH	2/5/2020
021302D05	Ammonium Sulfate	200 mg/ml	DBUSH	2/5/2020
021573S	EDTA	0.25M	DBUSH	2/5/2020

0035

Alpha 1

7

Date	Sample #	Client	Load Time	Count Time	Analysis	Tech
2/3/20	2001075A(1-6)	PCC Structural	1113	2hr50min	Th	KB
2/4/20	Daily Pulser	Lab	0537	10min	Na	KP
2/4/20	2001128A(1-6)	URENCO	0853	2hr50min	UU	KP
2/4/20	2001049A(1-6)	Env. Manage.	1150	2hr50min	Th	KB
2/5/20	Daily Pulser	Lab	0504	10min	Na	KP
2/5/20	2001063B(1-4)	UCOR	0824	2hr50min	Pu	KP
2/5/20	2001053A(1)	Unitech	0825	2hr50min	Am ²⁴¹	KP
	2001053					KP 45hr
2/5/20	2001091A(6)	TBE	1125	2hr50-	Th	KB
2/5/20	2001053A(1-4)	Unitech	1126	2hr50-	Na	KB
2/5/20	2001088A(1)	TBE	1126	2hr50-	Th	KB
2/5/20	200124A(1-6)	ERM	1426	2hr50-	Pak	KB

0036

Alpha 3

31

Date	Sample #	Client	Lead time	Count time	Analysis	Tech
2/4/20	20010911A (6-7)	TBE	1445	2hr 50 min	Th	KB
2/4/20	2001049A (1-6)	Env. Management	1446	2hr 50 min	UU	KB
2/5/20	Daily Pulser	Labs	0504	10 min	Na	KP
2/5/20	2001053A (2-4)	Unitech	0825	2hr 50 min	Am ²⁴¹	KP
2/5/20	2001053A (1-4)	Unitech	0826	2hr 50 min	Pu	KP
2/5/20	2001053A (1-4)	Unitech	0826	2hr 50 min	Th	KP
2/5/20	2001070A (1-5)	Mirion	0827	5hr 35 min	UU	KP
2/5/20	2001053A (1-4)	Unitech	0828	2hr 50 min	UU	KP
2/5/20	2001054A (1-8)	Pace Gulf Coast	1127	2hr 50 -	Ra	KB
2/5/20	2001058A (2-7)	TBE	1129	2hr 50 -	Th	KB
2/5/20	2001022A (4-7)	TN Dept. of Health	1130	16 hrs	UU	KB
2/5/20	2001124A (7-8)	ERM	1426	2hr 50 -	Ra	KB
2/5/20	2001078A (8-19)	TBE	1427	2hr 50 -	Th	KB
2/5/20	2001053A (1-5)	Unitech	1427	2hr 50 -	Pu	KB

0037

RA-228 NOTES

0038

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com		Internal Work Order	20-01124
			Analysis Code	Ra228
			Run Number	1

#	Date	Dept	User	Notes
1	02/04/20 10:34	PREP	JHARVEY	ALIQOTED AND FILTERED SAMPLES- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS


Jharvey
 2/4/2020

 EBERLINE SERVICES Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	20-01124
		Analysis Code	Ra228
		Run Number	1

#	Date	Dept	User	Notes
1	02/04/20 10:34	PREP	JHARVEY	ALIQUOTED AND FILTERED SAMPLES- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS
2	02/12/20 13:28	CHEM	DBUSH	ADDED FILTER PAPERS FROM COUNT ROOM TO LABELED C-TUBES, FILLED WITH EDTA SOLUTION AND LET SIT OVERNIGHT. REMOVED FILTER FROM EDTA-ADDED 2MLS YTTRIUM 9MG/ML CARRIER ADDED 18N NAOH TO SAMPLES AND RECORDED T1. HOT BATHED FOR 15 MIN, CENTRIFUGED AND DISCARDED SUPERNANT. ADDED 6N HNO3, DI WATER, AND 10N NAOH. HOT BATHED FOR 15 MIN, CENTRIFUGED AND DISCARDED SUPERNANT. ADDED 1N HNO3, DI WATER, AND AMMONIUM OXALATE. FILTERED ONTO TARED FILTER PAPERS. LET DRY UNDER HEAT LAMP, REWEIGHED AND SUBMITTED TO COUNT.

Dylan Bush
 2/12/20

0040

 EBERLINE SERVICES Reagents Used in an Analysis		Internal Work Order		
		20-01124		
		Analysis Code		Run
		Ra228		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
021318P	Ammonium Hydroxide	Reagent Grade	JHARVEY	2/4/2020
021302D04	Ammonium Sulfate	200 mg/ml	JHARVEY	2/4/2020
020921D14	Barium Carrier	1 mg/ml	JHARVEY	2/4/2020
020825D01	Lead Carrier	166 mg/ml	JHARVEY	2/4/2020
021834P	Nitric Acid	Reagent Grade	JHARVEY	2/4/2020
021198D01	Ammonium Oxalate	5%	DBUSH	2/12/2020
021573S	EDTA	0.25M	DBUSH	2/12/2020
020241D07	Nitric Acid	1N	DBUSH	2/12/2020
020774D19	Nitric Acid	6N	DBUSH	2/12/2020
021257D01	Sodium Hydroxide	18M	DBUSH	2/12/2020
021833S	Yttrium Carrier	9 mg/ml	DBUSH	2/12/2020

LB4110 Red

15

Date	Sample #	Client	Lead time	Count time	Analysis	Tech
2/8/20	Weekly Bldg	Lab	0724	12 hrs	XB	KP
2/10/20	Daily Bldg/QC	Lab	0547/0509	1hr/30min	XB	KP
2/10/20	Cross Talk	Lab	0657	5 min	XB	KP
2/10/20	Cross Talk	Lab	0705	5 min	XB	KP
2/10/20	20020145v(1-4)	Unitech	0713	1 hr	Tot Sr	KP
2/10/20	2001054 Ra(1-8)	Race Golf	1141	2 hrs	Ra ⁸	KP
2/11/20	Daily Bldg/QC	Lab	0553/0519	1hr/30min	XB	KP
2/11/20	Cross Talk	Lab	0658	5 min	XB	KP
2/11/20	Cross Talk	Lab	0706	5 min	XB	KP
2/11/20	20020495r(1-4) 0900	UCOR	0714	1 hr	Tot Sr	KP
2/11/20	2001106 Np(1-4)	Unitech	0870	10 min	Np	KP
2/11/20	2002017 AB(1-4)	Unitech	0916	2 hrs	XB	KP
2/11/20	2002009 AB(13-16)	Cal Energy	0917	2 hrs	XB	KP
2/11/20	2002042 AB(9-16)	Hudson Ranch	1122	2 hrs	XB	KP
2/12/20	Daily Bldg/QC	Lab	0617/0544	1hr/30min	XB	KP
2/12/20	Cross Talk	Lab	0721	5 min	XB	KP
2/12/20	Cross Talk	Lab	0729	5 min	XB	KP
2/12/20	2001114 Np(1-4)	Unitech	0747	10 min	Np	KP
2/12/20	2001120 Np(1-4)	Unitech	0748	10 min	Np	KP
2/12/20	2002037 Pb(1-4)	USA	0832	2 hrs	Pb	KP
2/12/20	2002039 Pb(1-4)	USA	0833	2 hrs	Pb	KP
2/12/20	2002007 AB(1-7)	Grace	1053	2 hrs	XB	KP
2/12/20	2001124 Ra(1-8)	ERM	1343	2 hrs	Ra ⁸	KP

0042

TDS NOTES

0043

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	20-01124
		Analysis Code	TDS
		Run Number	1

#	Date	Dept	User	Notes
1	01/30/20 01:11	PREP	MHIGHTOWER	Filtered sample into tared beaker, dried, re-weighed

Mu 30 JAN 20

SECTION VIII
ANALYTICAL DATA (RADIUM-226)

0045

Work Order	20-01124
Analysis Code	Ra226
Run	1
Date Received	1/28/2020
Lab Deadline	2/10/2020
Client	ERM
Project	HERO LANDS
Report Level	4
Activity Units	pCi
Aliquot Units	l
Matrix	WA
Method	EPA 903.0 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	Ba-133
Radiometric Sol#	Ba-6a
Tracer Act (dpm/g)	432.9
Carrier	
Carrier Conc (mg/ml)	

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		01/28/20 00:00	1.0000E+00
02	MBL	BLANK		01/28/20 00:00	1.0000E+00
03	DUP	MW 1A	10	01/21/20 10:10	1.0000E+00
04	TRG	MW 8B	20	01/21/20 08:45	1.0000E+00
05	DO	MW 1A	10	01/21/20 10:10	1.0000E+00
06	TRG	MW 1B	20	01/21/20 11:30	2.5000E-01
07	TRG	MW 6A	30	01/21/20 15:50	1.0000E+00
08	TRG	MW 5A	40	01/22/20 08:35	1.0000E+00

* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. ^ Indicates estimated SAF value.
** Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

Spike and Tracer Worksheet

Internal Work Order		Run	Analysis Code		Date	Technician		Technician Initials		Witness Initials								
20-01124		1	Ra226		2/4/2020 9:51	JHARVEY												
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	LCS		MSD		LCS		MS		LCS		MSD			
					Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Known pCi	Error Estimate	Known pCi	Error Estimate	Known pCi	Error Estimate	Known pCi	Error Estimate		
Ra-226	Ra-5b	43.940	2/4/2020	0.500	0.5028				9.95	0.458			0.00	0.000		0.00		
IC-99 MS TC-2a 22043636 7/5/2014 0.1																		
Tracers																		
fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition	Tracer										LCS	
01	Ba-133	Ba-6a	432.900	2/4/2020	1.9929	2.3400												
02	Ba-133	Ba-6a	432.900	2/4/2020	1.9931	2.3400												
03	Ba-133	Ba-6a	432.900	2/4/2020	2.1901	2.3400												
04	Ba-133	Ba-6a	432.900	2/4/2020	2.1922	2.3400												
05	Ba-133	Ba-6a	432.900	2/4/2020	2.1873	2.3400												
06	Ba-133	Ba-6a	432.900	2/4/2020	2.1840	2.3400												
07	Ba-133	Ba-6a	432.900	2/4/2020	2.1851	2.3400												
08	Ba-133	Ba-6a	432.900	2/4/2020	2.1838	2.3400												
Matrix Spike																		

0053



KB
2/5/20

Sample Description: SPIKE
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002672
 Batch Identification: 2001124A-RA
 Sample Identification: 01
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_003
 Chamber Serial Number:
 Detector Serial Number: 3
 Env. Background: System Bkgd 271787
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 2/5/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:04 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1522 +/- 0.0027 on 2/22/2019 4:02:55 PM
 Effective Efficiency: 0.1522 +/- 0.0027

Control Certificate Name: Ra226_Ra-5b
 Chem. Recov. of Control: RA-226 0.343048 +/- 0.027380
 Peak Match Tolerance: 0.350 MeV

 ----- PEAK AREA REPORT -----

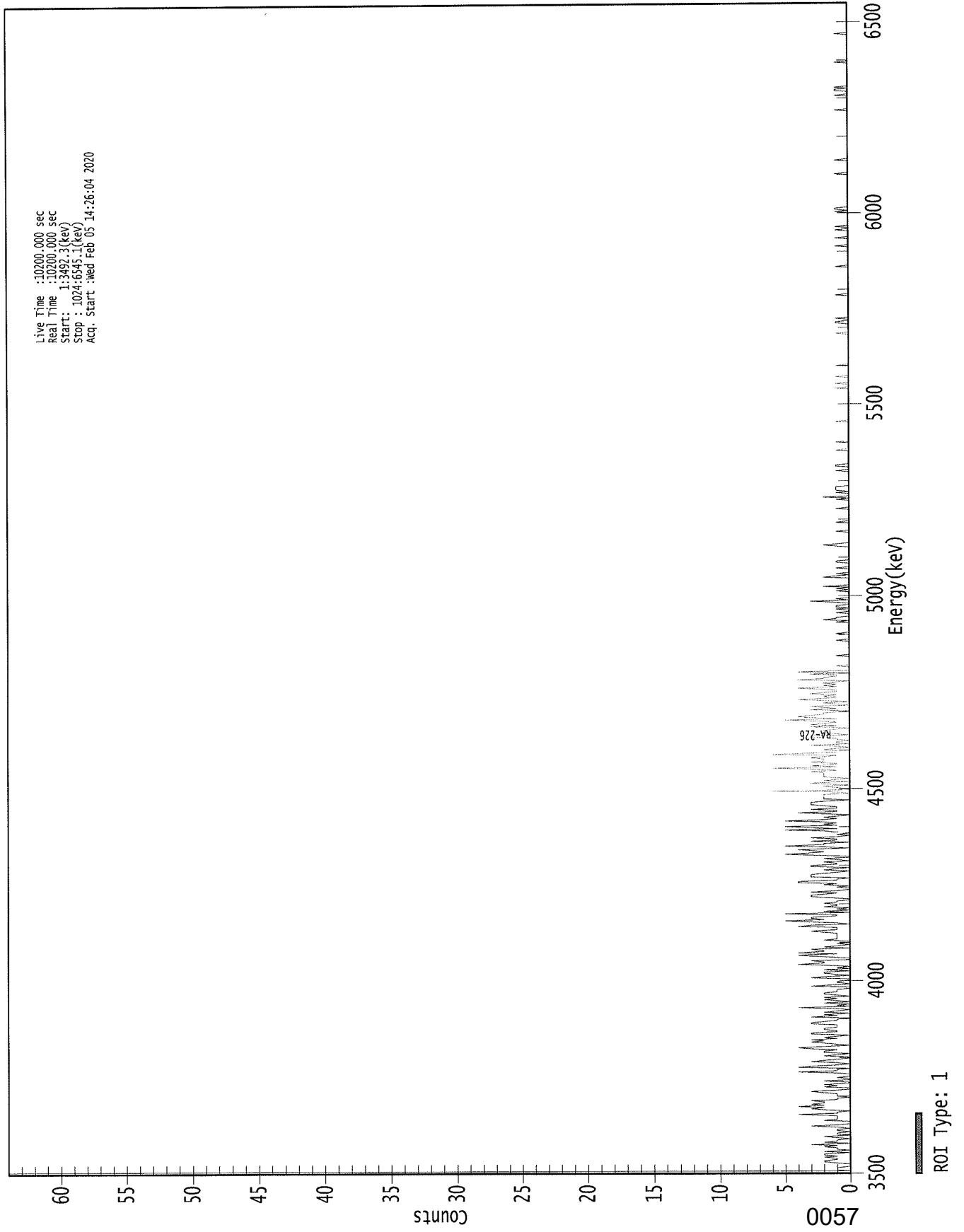
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.516	5.45	104.44	2.55	0.00E+000	3.0
RA-226	4.637	196.13	14.07	1.87	0.00E+000	3.3

 ----- NUCLIDE ANALYSIS RESULTS -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.963	5685.50*	2.99E-001 +/- 3.13E-001	4.61E-001 +/- 1.60E-002
RA-226	0.972	4785.00*	1.02E+001 +/- 1.48E+000	3.95E-001 +/- 1.37E-002

AG
2/6/20

0000267203.CNF



 ***** S P E C T R A L D A T A R E P O R T *****

Sample Title: 01

Elapsed Live time: 10200
 Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	10200	10200	0	1	1	1	0	0
9:	0	1	2	2	1	1	2	1
17:	2	2	0	2	0	1	1	2
25:	1	3	0	2	1	1	0	1
33:	2	0	1	1	0	1	1	0
41:	1	3	1	0	0	0	2	1
49:	1	1	1	4	1	1	0	2
57:	3	2	4	2	3	2	2	3
65:	1	1	0	1	1	1	2	3
73:	1	0	0	2	1	2	0	0
81:	2	0	0	1	0	0	0	1
89:	4	1	1	0	4	3	1	0
97:	1	3	2	1	0	0	2	1
105:	0	2	2	1	3	4	2	0
113:	1	2	3	2	3	1	2	1
121:	0	3	3	1	1	2	2	1
129:	1	1	3	3	2	1	1	0
137:	3	1	2	0	2	1	0	1
145:	4	0	1	0	2	0	1	2
153:	1	2	0	1	2	2	1	1
161:	1	0	0	3	1	0	1	1
169:	0	0	3	2	0	1	2	2
177:	0	2	0	1	0	2	4	2
185:	2	3	0	0	1	3	4	1
193:	4	2	2	3	0	2	1	0
201:	1	0	0	2	1	1	1	1
209:	1	1	2	3	1	1	1	4
217:	3	0	1	3	5	2	3	3
225:	1	1	5	0	2	0	1	0
233:	2	1	1	2	1	1	0	0
241:	2	3	3	2	1	3	1	0
249:	0	1	0	2	1	4	4	1
257:	1	0	3	3	3	2	1	0
265:	2	1	0	3	3	1	1	2
273:	0	1	2	0	0	3	5	3
281:	2	3	4	0	2	5	2	2
289:	0	3	1	1	3	1	0	1
297:	0	1	2	5	1	3	5	1
305:	2	1	2	5	2	1	2	1
313:	0	2	4	1	1	3	1	1
321:	2	3	3	3	2	0	2	2
329:	2	2	2	0	1	6	0	0
337:	1	2	0	2	3	0	2	1
345:	0	2	2	2	2	2	3	1
353:	2	6	1	3	1	1	3	2
361:	2	2	3	2	1	6	3	1

369: 1 2 1 0 1 3 0 1

Sample Title: 01

Channel	1	2	3	4	5	6	7	8	9
377:	1	0	1	1	3	3	0	1	
385:	2	2	2	1	0	3	1	3	
393:	2	1	2	5	1	3	4	3	
401:	2	2	1	0	3	1	2	3	
409:	0	1	2	0	2	4	2	1	
417:	2	1	3	2	1	1	2	4	
425:	1	2	1	2	1	0	4	2	
433:	2	1	1	3	0	4	0	0	
441:	0	0	1	0	0	0	0	0	
449:	0	0	0	1	0	0	0	0	
457:	0	0	0	0	0	0	0	0	
465:	1	0	0	0	0	0	1	0	
473:	0	0	0	0	0	0	0	0	
481:	1	0	2	1	1	0	0	0	
489:	1	0	0	1	0	1	1	0	
497:	0	1	3	0	1	0	0	0	
505:	0	0	0	1	0	1	0	2	
513:	0	0	0	0	0	0	0	2	
521:	1	0	1	0	0	0	0	1	
529:	0	0	0	0	1	1	0	0	
537:	0	0	0	0	0	0	0	0	
545:	0	0	1	2	1	0	0	0	
553:	0	0	0	0	0	0	0	1	
561:	0	0	0	0	0	0	0	1	
569:	0	0	0	0	0	0	0	0	
577:	0	0	0	1	0	0	0	0	
585:	0	0	0	1	0	2	0	0	
593:	0	1	0	1	1	1	1	0	
601:	0	0	0	0	0	0	0	0	
609:	0	0	0	0	1	0	0	0	
617:	1	1	0	0	0	0	0	0	
625:	0	0	0	0	0	0	1	0	
633:	0	0	0	0	0	1	0	0	
641:	0	0	0	0	0	0	0	0	
649:	0	0	0	0	0	0	0	1	
657:	0	0	0	0	0	0	0	0	
665:	0	0	0	0	0	0	0	0	
673:	0	0	0	0	0	0	0	0	
681:	0	0	0	0	1	0	0	0	
689:	1	0	0	0	0	0	1	0	
697:	0	0	0	0	0	0	0	0	
705:	1	0	0	0	0	0	0	0	
713:	0	0	0	0	0	0	0	0	
721:	0	0	0	0	0	0	0	0	
729:	0	0	0	0	1	0	0	0	
737:	0	0	0	0	0	1	1	0	
745:	0	1	0	0	0	0	0	0	
753:	0	0	0	0	0	0	0	0	
761:	0	0	0	0	0	0	1	0	
769:	0	0	0	0	0	0	0	0	
777:	0	0	0	0	0	0	0	0	
785:	0	0	0	0	0	0	0	1	
793:	0	0	0	0	0	0	0	0	

801: 0 0 0 0 0 0 0 0 0

Sample Title: 01

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	1	0	0	0	0	0	0
817:	1	0	0	0	0	0	0	1
825:	0	0	1	0	0	0	0	0
833:	0	0	0	0	0	0	0	1
841:	0	1	1	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	1	0	0	0	0	0	0	0
881:	0	0	0	0	1	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	1	0	0	0	0	0	0	0
937:	0	0	0	0	0	1	0	0
945:	0	1	1	0	1	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	1	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	1	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



V/S
2/5/20

Sample Description: BLANK
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002671
 Batch Identification: 2001124A-RA
 Sample Identification: 02
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_004
 Chamber Serial Number:
 Detector Serial Number: 4
 Env. Background: System Bkgd 271788
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 2/5/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:05 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1804 +/- 0.0031 on 2/22/2019 4:02:54 PM
 Effective Efficiency: 0.1804 +/- 0.0031

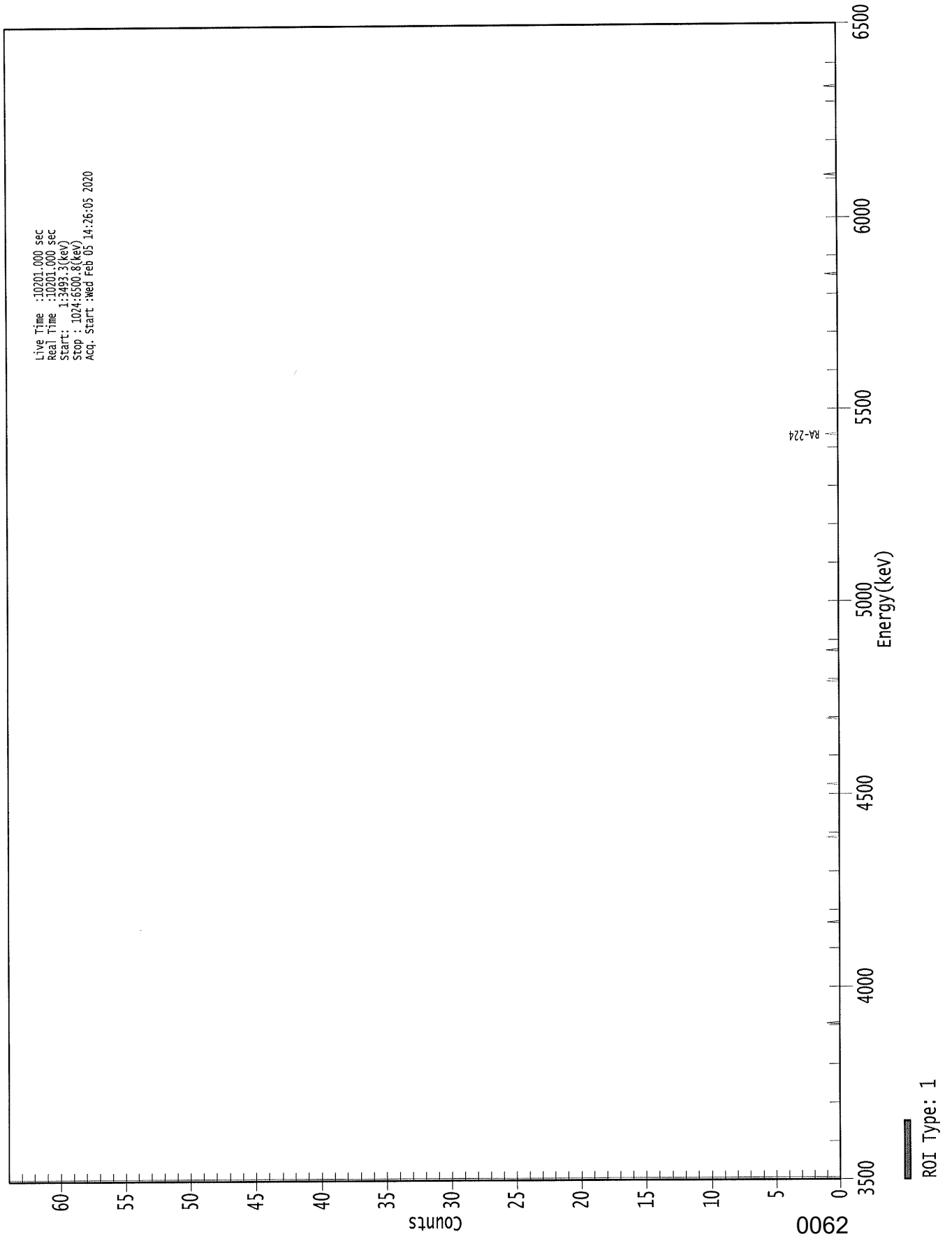
Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT						
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.428	-1.89	126.63	2.89	0.00E+000	2.9
RA-226	4.594	2.13	191.23	1.87	0.00E+000	2.9

NUCLIDE ANALYSIS RESULTS						
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)		
RA-224	0.917	5685.50*	-8.76E-002 +/- 1.11E-001	4.06E-001 +/- 1.36E-002		
RA-226	0.954	4785.00*	9.38E-002 +/- 1.79E-001	3.34E-001 +/- 1.12E-002		

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2/6/20

0000267178.CNF



 ***** S P E C T R A L D A T A R E P O R T *****

Sample Title: 02

Elapsed Live time: 10201
 Elapsed Real Time: 10201

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	10201	10201	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	1	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	1	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	1	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	1	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

0063

369: 0 0 0 0 0 0 0 0 0

Sample Title: 02

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	1
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	0	0
441:	1	0	0	0	0	0	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	1	0	0	0	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	1	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

0064

801: 1 0 0 0 0 0 0 0 0

Sample Title: 02

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	1	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	1	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



KB
2/5/20

Sample Description: MW 1A DUP
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002671
 Batch Identification: 2001124A-RA
 Sample Identification: 03
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_010
 Chamber Serial Number:
 Detector Serial Number: 10
 Env. Background: System Bkgd 271789
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 1/21/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:06 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1809 +/- 0.0031 on 2/22/2019 4:02:52 PM
 Effective Efficiency: 0.1809 +/- 0.0031

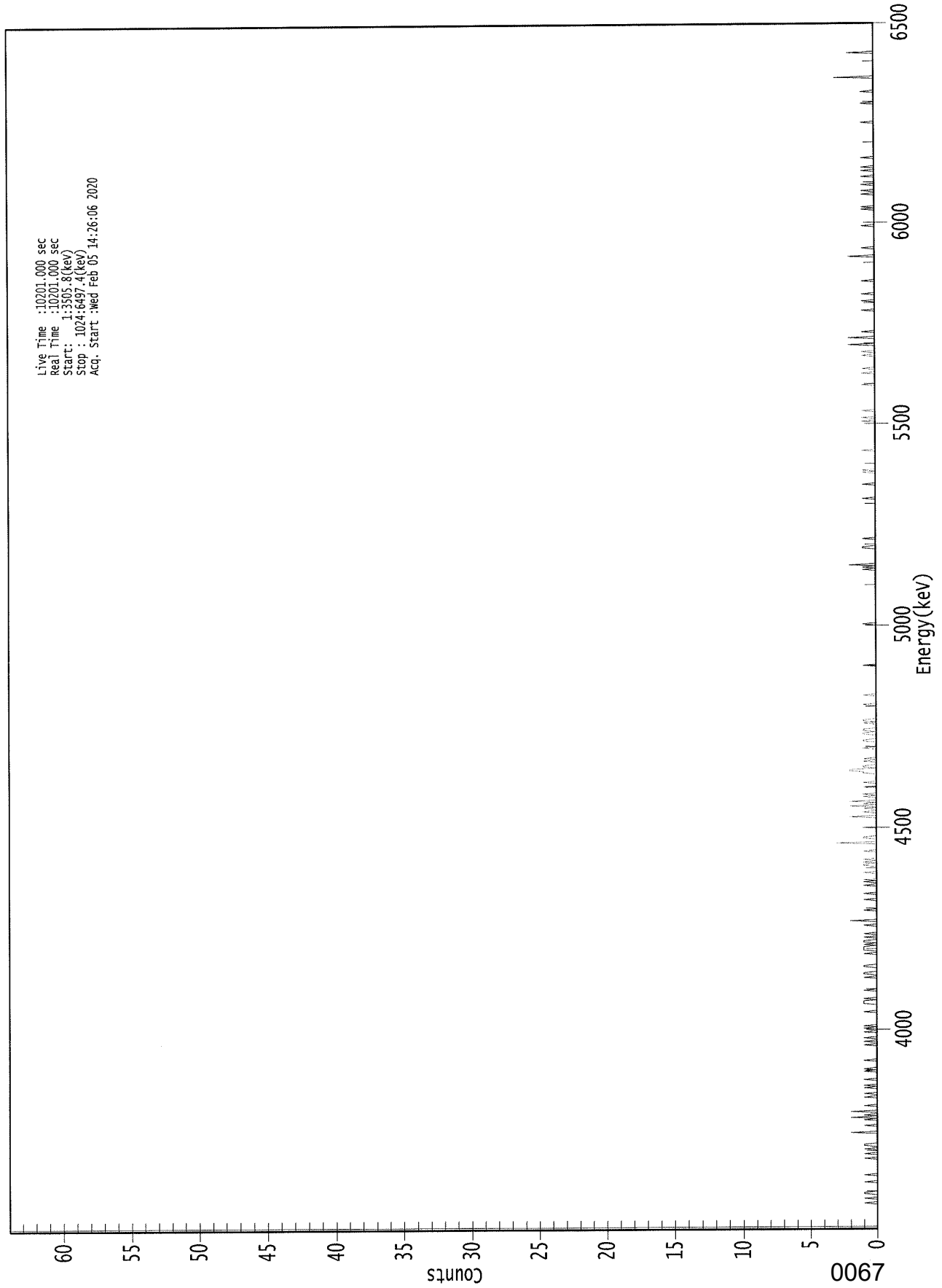
Peak Match Tolerance: 0.350 MeV

----- PEAK AREA REPORT -----						
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.541	8.62	76.79	2.38	0.00E+000	2.9
RA-226	4.593	45.45	30.01	2.55	0.00E+000	2.9

----- NUCLIDE ANALYSIS RESULTS -----						
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)		MDA (pCi/liter)	
RA-224	0.973	5685.50*	4.00E-001 +/- 3.08E-001	3.81E-001 +/- 1.28E-002		
RA-226	0.953	4785.00*	2.00E+000 +/- 6.03E-001	3.69E-001 +/- 1.24E-002		

AG
2/6/20

0000267179.CNF



 ***** S P E C T R A L D A T A R E P O R T *****

Sample Title: 03

Elapsed Live time: 10201
 Elapsed Real Time: 10201

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	10201	10201	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	1	0
25:	0	0	1	0	0	0	1	1
33:	0	0	0	0	0	0	0	0
41:	1	0	0	0	0	0	1	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	1	0	0	0
65:	1	0	0	0	1	0	0	1
73:	1	0	0	0	0	0	0	0
81:	0	0	2	0	0	0	0	0
89:	1	0	0	0	0	1	0	2
97:	0	1	0	0	2	0	0	0
105:	0	1	0	0	0	0	0	0
113:	1	0	0	1	0	0	0	0
121:	1	0	1	0	0	0	0	1
129:	0	0	0	0	0	0	1	0
137:	1	0	0	0	0	0	0	1
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	1	0	0	1
161:	0	0	1	0	0	0	0	1
169:	0	0	1	0	1	0	0	0
177:	0	0	0	0	0	0	0	0
185:	1	0	0	0	0	0	0	1
193:	1	1	0	1	0	0	0	0
201:	0	0	1	0	0	0	0	0
209:	0	0	0	0	0	1	0	0
217:	1	1	0	0	0	0	1	1
225:	0	0	0	0	0	0	0	0
233:	0	1	0	0	1	1	1	1
241:	0	1	0	1	1	0	0	1
249:	0	0	1	0	0	0	0	0
257:	0	1	0	0	0	2	0	0
265:	0	0	0	0	0	0	1	0
273:	0	0	0	0	0	0	0	1
281:	0	0	0	0	1	0	0	0
289:	0	0	0	1	0	0	1	0
297:	1	0	0	0	0	0	1	0
305:	0	0	0	0	1	1	0	1
313:	0	1	0	0	0	0	0	0
321:	1	0	0	0	0	0	0	3
329:	0	0	0	1	1	0	0	0
337:	0	0	0	0	1	0	0	0
345:	0	0	0	0	0	2	0	0
353:	0	1	0	0	1	0	2	0
361:	1	0	2	0	0	0	1	0

0068

369: 1 0 0 0 0 0 0 1 0

Sample Title: 03

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	1	0	0	0	0	0	0
385:	0	0	1	1	2	2	1	0	1
393:	1	0	0	0	1	0	0	1	0
401:	0	0	0	0	0	0	0	0	1
409:	0	0	0	0	0	1	1	1	0
417:	0	0	0	1	1	0	1	1	1
425:	0	0	0	0	1	0	1	1	1
433:	0	0	0	0	0	0	0	0	0
441:	0	0	0	0	1	0	0	0	0
449:	0	0	0	0	1	0	0	0	0
457:	0	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0	0
473:	0	0	0	0	0	1	0	0	0
481:	0	0	0	0	0	0	0	0	0
489:	0	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0	0
513:	1	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	1	0
561:	1	0	2	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0	0
577:	1	1	0	0	0	0	0	0	0
585:	1	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0	0
617:	0	0	1	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	1	0
633:	0	0	0	0	0	0	0	0	0
641:	1	0	1	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0	0
657:	0	0	0	1	0	0	0	0	0
665:	0	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0	0
681:	0	0	0	0	1	0	0	0	1
689:	0	0	0	0	0	1	0	0	0
697:	0	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0	0
713:	0	0	0	1	0	0	0	0	0
721:	0	0	0	0	0	0	1	0	0
729:	0	1	0	0	0	0	0	0	0
737:	0	0	0	0	1	0	0	0	1
745:	0	0	0	0	0	2	0	0	0
753:	0	0	0	2	0	0	0	0	0
761:	1	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0	0
777:	0	0	1	0	0	0	0	0	0
785:	0	0	1	0	0	0	0	0	0
793:	1	0	0	0	0	0	0	0	0

801: 0 0 0 1 0 0 0 0

Sample Title: 03

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	2	0	0	0	0	0	0	1
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	1	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	1	0	1	0	0	0	0	0
873:	0	0	0	0	0	1	0	0
881:	1	0	0	0	0	1	0	0
889:	0	0	0	0	1	0	0	0
897:	0	1	0	0	1	0	0	0
905:	0	0	0	0	1	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	1	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	1	0	0	0	0	0
961:	0	0	0	0	1	0	0	0
969:	0	0	0	0	0	0	0	0
977:	3	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	2	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



Sample Description: MW 8B
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002672
 Batch Identification: 2001124A-RA
 Sample Identification: 04
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_011
 Chamber Serial Number:
 Detector Serial Number: 11
 Env. Background: System Bkgd 271790
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.790E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 1/21/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:07 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 0.8772 +/- 0.0000
 Counting Efficiency: 0.1806 +/- 0.0031 on 2/22/2019 4:02:50 PM
 Effective Efficiency: 0.1584 +/- 0.0027

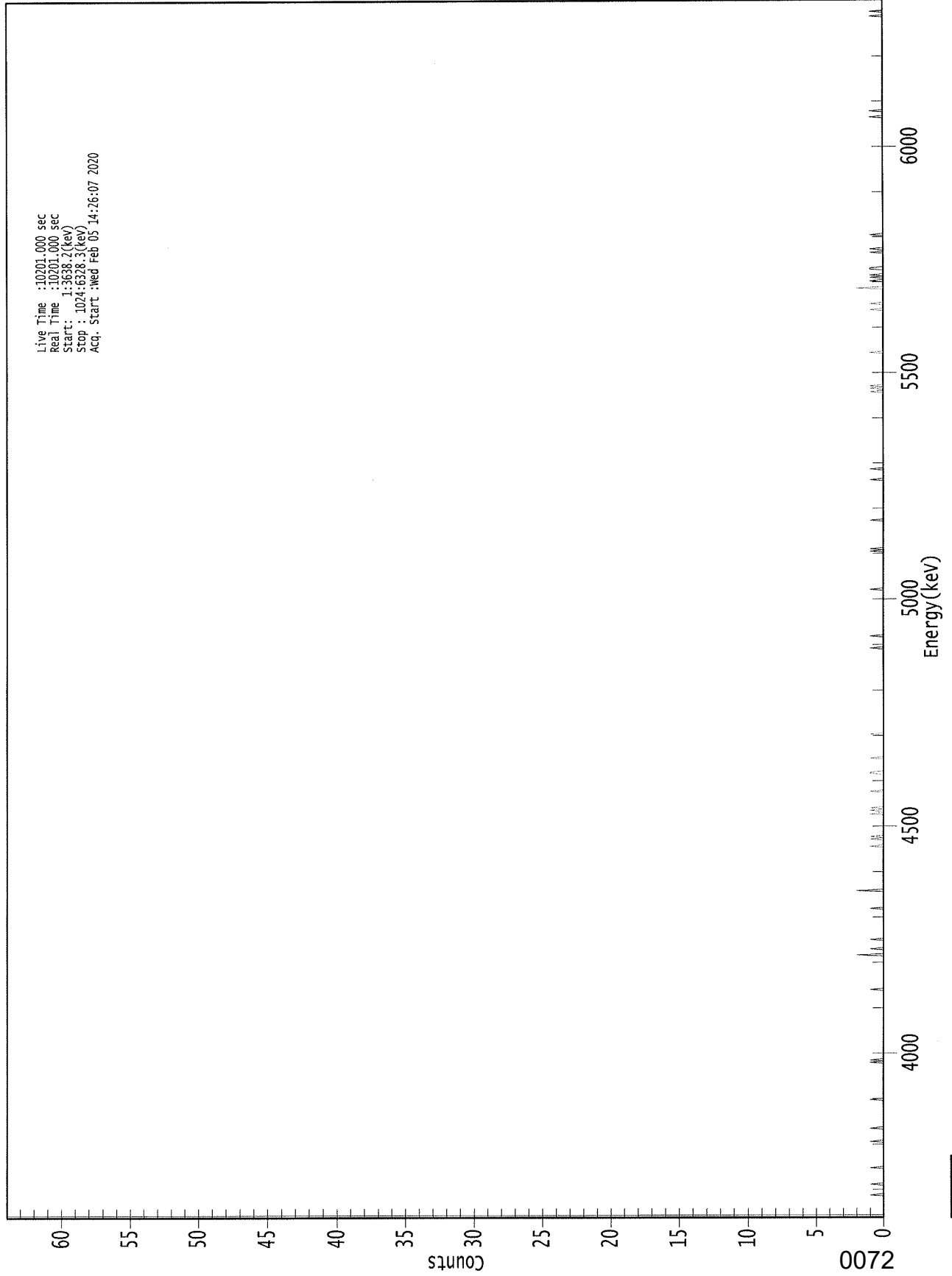
Peak Match Tolerance: 0.350 MeV

----- ----- PEAK AREA REPORT ----- -----						
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.576	5.28	107.99	2.72	0.00E+000	2.6
RA-226	4.561	7.94	83.79	3.06	0.00E+000	2.6

----- ----- NUCLIDE ANALYSIS RESULTS ----- -----						
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)		
RA-224	0.984	5685.50*	2.60E-001 +/- 2.81E-001	4.23E-001 +/- 1.42E-002		
RA-226	0.937	4785.00*	3.71E-001 +/- 3.11E-001	4.17E-001 +/- 1.40E-002		

AG
2/6/20

0000267180.CNF



 ***** S P E C T R A L D A T A R E P O R T *****

Sample Title: 04

Elapsed Live time: 10201
 Elapsed Real Time: 10201

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	10201	10201	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	1	0	0	0	0
25:	0	0	0	0	1	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	1	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	1	0	0	0	0	0	0	0
73:	0	0	0	1	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	1	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	1	0	1	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	1
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	2	0	0	0
225:	0	1	0	0	0	0	0	0
233:	0	1	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	1	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	2	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	1
313:	0	0	0	0	0	1	0	1
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	1	0	0	1	0	1
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	1	0	0
361:	0	0	0	0	0	0	0	0

0073

369: 0 0 0 0 1 1 0 0

Sample Title: 04

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	0	0	0	0
385:	0	1	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	1	0	0	0
409:	0	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0	0
449:	0	0	0	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0	0
473:	0	0	0	0	0	1	0	0	0
481:	0	0	0	0	0	0	0	0	1
489:	0	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	1	0	0
529:	0	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	1	0	0
561:	1	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0	0
585:	1	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0	0
617:	0	0	1	0	0	0	0	0	0
625:	0	0	0	1	0	0	0	0	0
633:	0	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0	0
689:	0	0	0	0	1	0	0	0	1
697:	0	1	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	1	0	0	0
729:	0	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0	0
761:	0	1	0	0	0	0	1	0	0
769:	0	0	0	0	0	0	0	0	0
777:	0	0	0	2	0	0	0	0	0
785:	0	1	0	0	1	0	1	0	0
793:	0	0	0	1	1	0	0	0	0

0074

801: 0 0 0 0 0 0 0 0 0

Sample Title: 04

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	1	0	0	1	0	0	0
817:	0	0	0	0	0	0	0	0
825:	1	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	1	0	0	0	0
929:	1	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	1	0	0	0	1	0	0	0
1017:	0	0	0	0	0	0	0	0



2/5/20

Sample Description: MW 1A
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002671
 Batch Identification: 2001124A-RA
 Sample Identification: 05
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_012
 Chamber Serial Number:
 Detector Serial Number: 12
 Env. Background: System Bkgd 271791
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 1/21/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:08 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1827 +/- 0.0031 on 2/22/2019 4:02:49 PM
 Effective Efficiency: 0.1827 +/- 0.0031

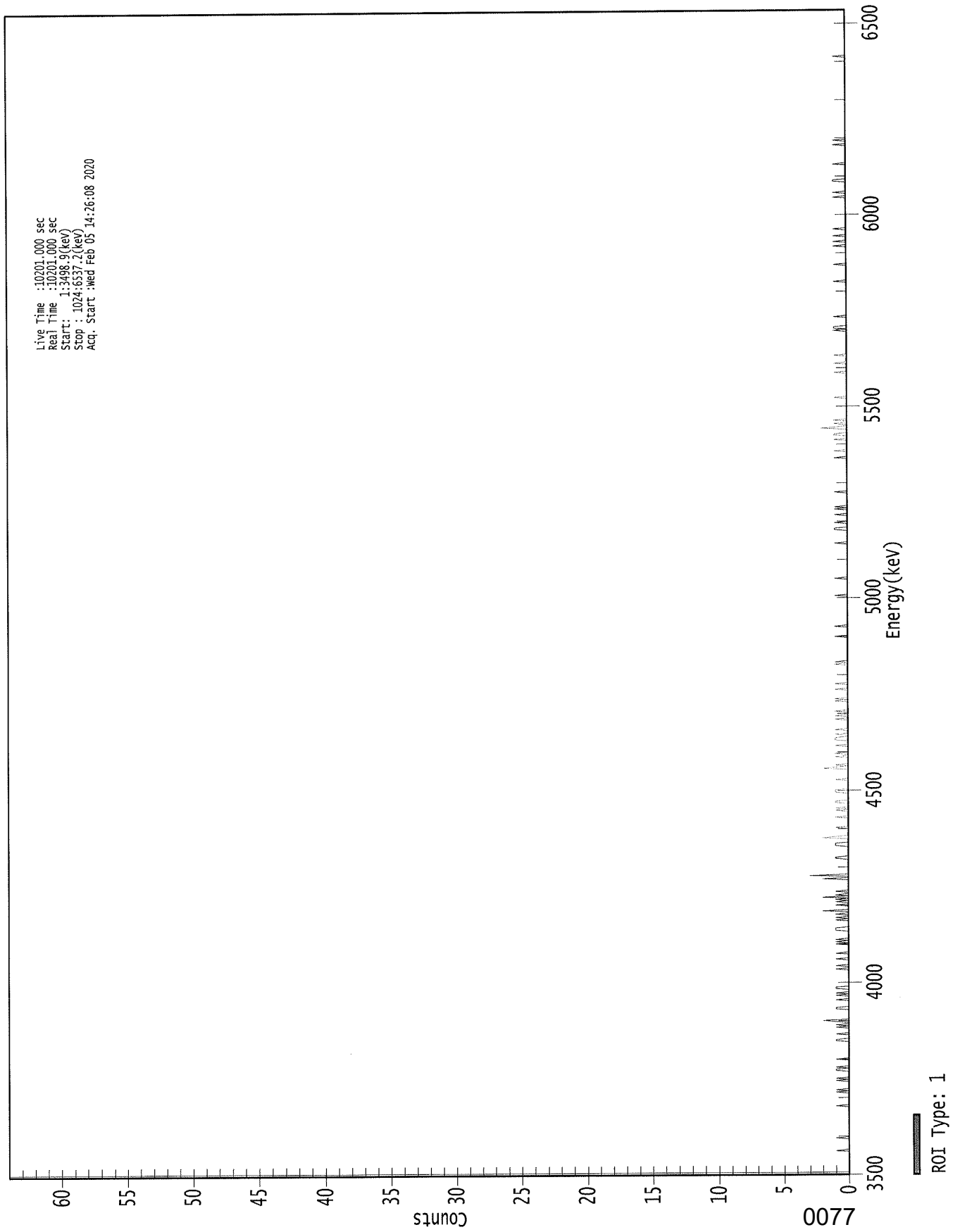
Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT						
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.480	11.30	63.23	1.70	0.00E+000	4.5
RA-226	4.582	31.62	36.36	2.38	0.00E+000	4.5

NUCLIDE ANALYSIS RESULTS							
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)		MDA (pCi/liter)		
RA-224	0.946	5685.50*	5.20E-001 +/-	3.29E-001	3.38E-001 +/-	1.14E-002	
RA-226	0.948	4785.00*	1.38E+000 +/-	5.02E-001	3.57E-001 +/-	1.20E-002	

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2/6/20

0000267181.CNF



 ***** S P E C T R A L D A T A R E P O R T *****

Sample Title: 05

Elapsed Live time: 10201
 Elapsed Real Time: 10201

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	10201	10201	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	1	0	0
25:	0	0	0	0	0	0	0	0
33:	1	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	1	0	0	0
65:	0	0	0	0	0	0	0	0
73:	1	0	1	0	0	0	0	0
81:	0	0	1	0	1	0	0	0
89:	0	0	0	1	1	0	1	0
97:	0	0	0	0	0	1	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	1	1	0
121:	0	0	0	1	0	0	0	0
129:	0	1	0	1	0	0	1	2
137:	0	0	0	0	0	0	0	0
145:	0	1	1	0	0	0	0	0
153:	0	1	0	0	0	1	0	1
161:	0	0	0	1	1	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	1	0	0	1
185:	0	0	0	0	0	1	0	0
193:	0	0	1	0	0	0	0	0
201:	0	0	1	0	1	0	1	0
209:	0	0	0	0	0	0	1	1
217:	1	0	0	0	0	0	0	1
225:	0	1	0	0	1	0	0	2
233:	0	0	0	0	1	0	0	1
241:	0	1	0	2	0	1	0	0
249:	1	0	0	0	0	0	0	0
257:	0	0	0	2	0	0	3	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	1	1	0
281:	0	0	0	0	0	0	0	0
289:	1	1	1	0	0	0	0	2
297:	1	0	0	0	0	0	0	0
305:	1	0	0	0	0	0	0	0
313:	0	1	0	0	0	0	0	1
321:	0	1	0	0	0	0	1	1
329:	0	0	0	0	0	0	0	1
337:	1	1	0	0	0	0	0	0
345:	0	0	1	0	0	0	0	0
353:	0	0	0	0	2	1	0	1
361:	0	0	0	0	0	0	1	0

0078

369: 0 1 0 0 0 0 0 0 0

Sample Title: 05

Channel	1	0	0	0	0	1	1	1
377:	1	0	0	0	0	1	1	1
385:	0	0	1	0	0	0	1	0
393:	0	0	0	0	0	0	0	1
401:	0	0	1	0	0	0	1	0
409:	0	0	0	0	0	0	0	1
417:	0	1	0	0	0	0	0	0
425:	0	1	0	0	0	0	1	0
433:	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	1
449:	0	1	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	1
473:	0	0	0	0	0	0	0	0
481:	1	0	0	0	0	0	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	1	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	1	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	0	1	0	0	0	0	0	0
561:	0	0	0	0	0	1	1	0
569:	0	0	0	1	0	0	0	0
577:	0	0	1	0	0	0	0	1
585:	0	1	0	0	0	0	0	0
593:	0	0	0	0	0	0	1	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	1	0	0	0
633:	0	0	1	0	0	0	0	0
641:	0	0	0	0	1	0	0	0
649:	1	1	0	0	0	0	2	1
657:	0	0	1	0	0	1	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	1	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	1
705:	0	0	0	0	0	0	0	1
713:	0	0	0	0	0	0	1	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	1	0	1	1
745:	0	0	0	0	0	0	0	0
753:	1	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	1
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	1	0

0079

801: 0 0 0 0 0 0 0 0 0

Sample Title: 05

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	1	0
817:	0	0	1	0	0	0	0	1
825:	0	0	0	0	0	1	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	1	0	0	0	1	0	0
865:	0	0	0	0	0	0	0	1
873:	1	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	1	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	1
905:	0	0	0	1	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	1	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



KB
2/5/20

Sample Description: MW 1B
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002671
 Batch Identification: 2001124A-RA
 Sample Identification: 06
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_014
 Chamber Serial Number:
 Detector Serial Number: 14
 Env. Background: System Bkgd 271792
 Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.820E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 1/21/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:08 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1769 +/- 0.0030 on 2/22/2019 4:02:58 PM
 Effective Efficiency: 0.1769 +/- 0.0030

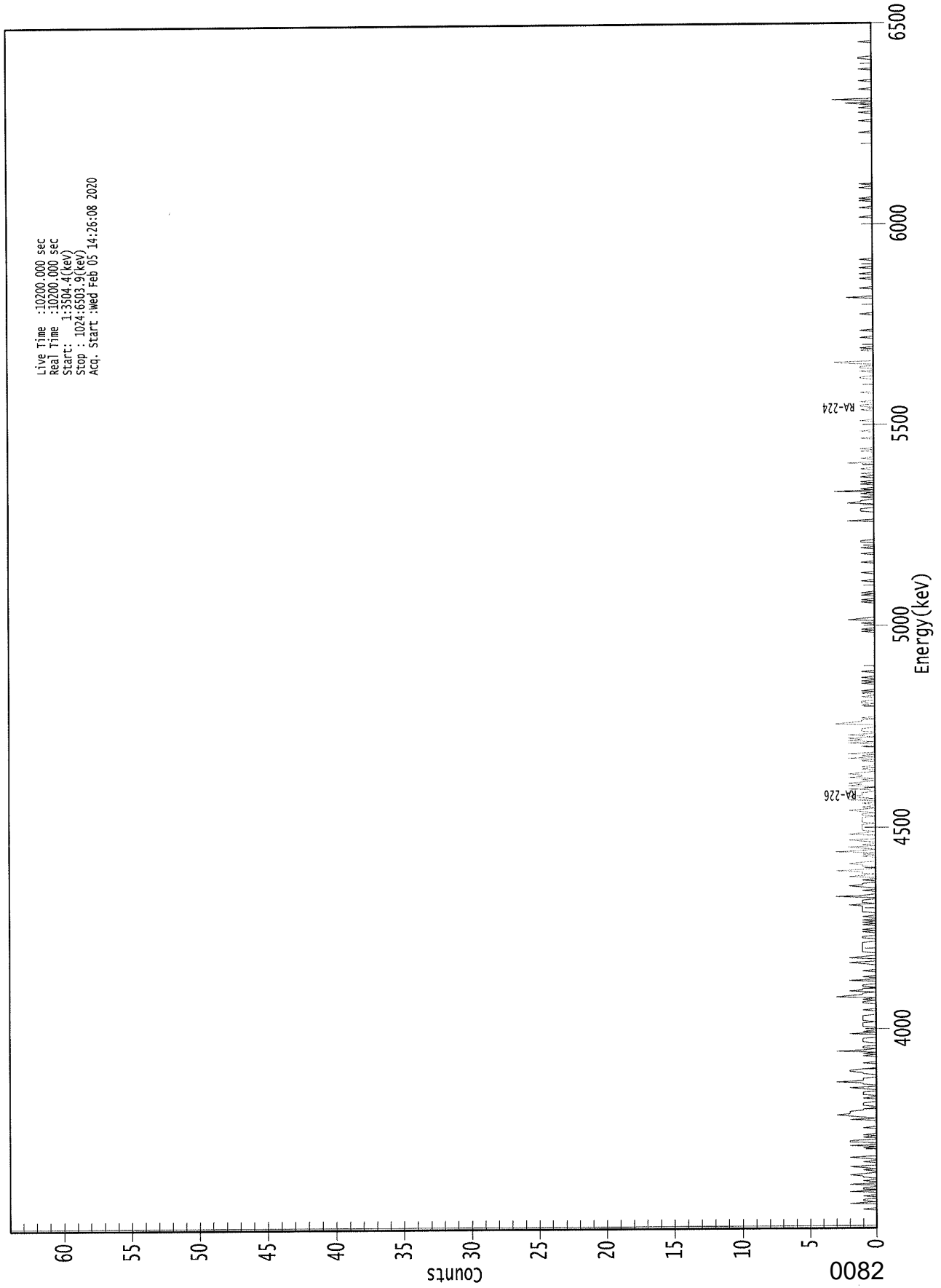
Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT						
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.546	22.77	44.35	3.23	0.00E+000	5.1
RA-226	4.582	103.75	19.70	4.25	0.00E+000	4.4

NUCLIDE ANALYSIS RESULTS						
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)		MDA (pCi/liter)	
RA-224	0.975	5685.50*	4.07E+000 +/-	1.81E+000	1.63E+000 +/-	5.49E-002
RA-226	0.948	4785.00*	1.75E+001 +/-	3.50E+000	1.70E+000 +/-	5.72E-002

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2/6/20

0000267182.CNF



 ***** S P E C T R A L D A T A R E P O R T *****

Sample Title: 06

Elapsed Live time: 10200
 Elapsed Real Time: 10200

Channel	10200	10200	0	0	0	0	0	0	0
1:	10200	10200	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0	0
17:	1	0	0	0	0	2	0	1	1
25:	1	0	0	1	0	0	0	2	2
33:	0	1	1	0	0	2	0	0	0
41:	1	0	0	1	1	2	1	0	0
49:	0	1	0	1	2	0	0	0	0
57:	1	0	0	1	2	0	0	0	0
65:	0	0	0	0	1	0	2	0	0
73:	0	2	2	0	0	1	0	1	1
81:	0	0	0	0	0	1	0	0	0
89:	0	0	0	0	2	0	1	2	2
97:	3	2	2	2	1	1	0	0	0
105:	1	1	1	0	0	0	1	0	0
113:	0	1	1	1	0	0	1	2	2
121:	0	0	1	1	3	1	1	1	1
129:	0	0	0	1	1	2	2	1	1
137:	0	0	0	0	1	0	0	0	0
145:	0	0	1	0	1	0	3	1	1
153:	0	1	1	0	0	0	1	1	1
161:	1	1	0	0	0	2	0	1	1
169:	0	0	0	1	1	1	1	0	0
177:	1	1	1	1	1	0	0	0	0
185:	0	1	0	0	0	0	0	1	1
193:	1	0	1	0	3	2	1	1	1
201:	0	2	1	1	0	1	1	0	0
209:	0	0	2	0	0	1	0	0	0
217:	0	0	1	0	0	0	0	0	0
225:	1	2	0	0	0	2	1	0	0
233:	0	0	1	1	1	1	1	1	1
241:	1	1	1	0	0	0	1	1	1
249:	0	0	0	1	0	1	0	0	0
257:	0	1	0	1	0	1	0	0	0
265:	1	0	0	0	1	1	1	1	1
273:	1	1	2	0	1	1	1	0	0
281:	0	3	1	0	0	0	1	0	0
289:	0	1	2	1	1	0	0	1	1
297:	0	0	2	1	0	1	1	3	3
305:	1	0	0	1	1	2	1	0	0
313:	0	0	0	1	0	1	0	3	3
321:	1	0	1	2	0	1	0	0	0
329:	1	2	0	0	0	0	2	1	1
337:	0	1	1	1	1	1	1	0	0
345:	1	1	1	1	1	0	1	1	1
353:	0	1	2	1	0	1	0	0	0
361:	1	0	0	2	0	1	2	1	1

0083

369: 1 1 0 0 2 0 0 2

Sample Title: 06

Channel	1	2	3	4	5	6	7	8	9
377:	1	2	1	0	1	0	2	1	
385:	1	2	1	0	0	1	0	1	
393:	0	0	0	0	1	0	2	0	
401:	1	0	2	0	0	0	0	0	
409:	1	0	0	2	0	2	1	2	
417:	0	1	2	0	0	1	1	1	
425:	0	0	0	3	2	1	1	0	
433:	1	0	0	0	0	0	0	0	
441:	0	0	0	1	0	1	1	0	
449:	0	0	1	0	0	1	0	1	
457:	0	0	0	0	0	1	0	1	
465:	0	0	1	0	0	0	0	1	
473:	0	0	0	0	0	0	0	0	
481:	0	0	0	0	0	0	0	0	
489:	0	0	0	0	0	0	0	0	
497:	0	0	0	0	0	0	0	0	
505:	0	1	0	1	0	0	0	0	
513:	1	0	0	2	1	0	0	0	
521:	0	0	0	0	0	0	0	0	
529:	0	0	1	0	1	0	0	0	
537:	1	0	1	0	0	0	0	0	
545:	0	0	0	0	1	0	0	0	
553:	0	0	0	1	0	0	0	0	
561:	0	0	0	0	1	0	0	0	
569:	0	0	0	1	0	0	0	0	
577:	1	0	0	0	0	1	1	0	
585:	0	0	0	0	0	0	0	0	
593:	0	0	0	0	0	0	0	2	
601:	0	0	0	0	0	0	0	1	
609:	1	1	0	0	0	0	2	1	
617:	1	0	0	1	0	0	1	0	
625:	3	0	1	0	0	0	1	0	
633:	1	0	0	0	1	0	0	1	
641:	0	0	0	1	0	0	0	0	
649:	2	0	0	0	1	0	0	0	
657:	0	0	1	0	1	0	0	0	
665:	0	0	0	0	0	1	0	0	
673:	0	0	0	1	0	0	0	0	
681:	0	0	0	0	1	0	0	0	
689:	0	0	0	0	0	1	0	0	
697:	1	1	0	0	1	0	0	0	
705:	0	0	0	0	1	0	0	0	
713:	0	0	0	0	0	0	0	0	
721:	1	1	0	0	0	0	1	0	
729:	0	1	1	0	0	2	3	0	
737:	0	0	0	0	0	0	0	0	
745:	1	0	1	0	0	0	0	0	
753:	0	0	0	1	0	0	0	0	
761:	0	1	0	0	0	0	0	0	
769:	0	0	0	0	0	0	0	1	
777:	0	0	0	0	0	0	0	0	
785:	0	0	0	0	0	2	0	0	
793:	0	0	0	0	0	1	0	0	

801: 0 0 0 0 0 0 1 0 0

Sample Title: 06

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	1	0	0	0	0	1	0
817:	0	0	0	0	0	1	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	1	0	0	0	0	0	0
865:	0	1	0	0	0	0	0	1
873:	0	1	0	0	0	0	0	0
881:	0	0	1	0	0	1	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	1	0	0	0	0	0	0
937:	0	0	0	1	0	0	0	0
945:	0	0	1	0	0	0	1	0
953:	0	1	2	0	0	3	0	0
961:	0	0	0	0	0	0	1	0
969:	0	0	0	0	0	1	0	0
977:	0	0	0	0	0	0	0	1
985:	0	0	0	0	0	0	0	0
993:	1	1	0	0	0	0	0	0
1001:	0	0	0	0	0	0	1	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



Apex-Alpha™

LB
2/15/20

Sample Description: MW 6A
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002671
 Batch Identification: 2001124A-RA
 Sample Identification: 07
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_036
 Chamber Serial Number: 04026477B
 Detector Serial Number: 84167
 Env. Background: System Bkgd 271793
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 1/21/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:10 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 0.9247 +/- 0.0000
 Counting Efficiency: 0.1687 +/- 0.0029 on 2/22/2019 8:51:50 AM
 Effective Efficiency: 0.1560 +/- 0.0027

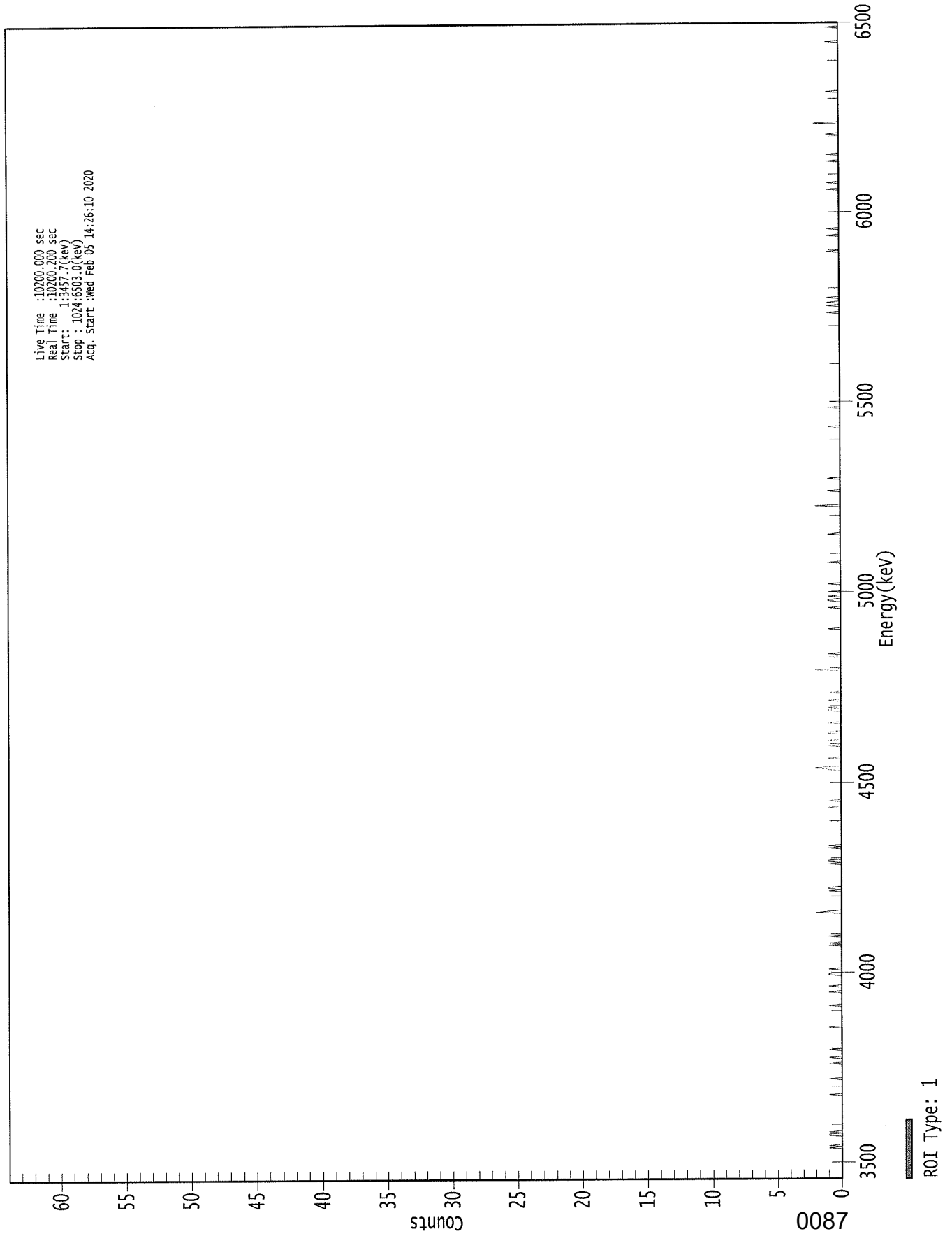
Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT						
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.460	1.66	169.38	0.34	0.00E+000	3.0
RA-226	4.621	19.13	47.31	1.87	0.00E+000	4.5

NUCLIDE ANALYSIS RESULTS						
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)		
RA-224	0.936	5685.50*	8.94E-002 +/- 1.51E-001	2.57E-001 +/-	8.76E-003	
RA-226	0.966	4785.00*	9.75E-001 +/- 4.62E-001	3.86E-001 +/-	1.31E-002	

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2/6/20

0000267183.CNF



369: 0 0 0 1 0 0 0 0

Sample Title: 07

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	1	0
385:	0	0	0	1	0	0	0	0
393:	0	1	1	0	0	0	0	0
401:	0	0	1	0	0	0	0	0
409:	0	0	0	0	0	1	1	0
417:	1	0	0	0	0	0	1	0
425:	0	0	0	0	0	1	0	0
433:	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
449:	0	2	0	0	0	0	0	0
457:	0	0	0	0	1	0	0	1
465:	0	0	0	0	0	0	0	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	1	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	1	0	0	0	0	0	1	1
513:	0	0	1	0	0	0	1	0
521:	0	0	0	0	0	1	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	1	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	1	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	2	0	0	0	0	0
601:	0	0	0	0	0	0	0	1
609:	0	0	0	0	0	0	0	0
617:	0	0	1	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	1	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	1	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	1	0	0
769:	0	0	0	1	0	0	1	0
777:	0	0	1	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801: 0 0 0 0 0 0 0 0 0

Sample Title: 07

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	0	0
817:	0	0	0	1	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	1	0	0	0	0	0	1
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	1	0	0	0	0	0
881:	1	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	1	0	0	0	0
905:	0	1	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	1	0	0	0	0
929:	0	0	0	0	0	2	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	1	0	0	0	0	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	0	0	0	0	0	1	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	1	0	0	0	0	0



KB
2/15/20

Sample Description: MW 5A
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002671
 Batch Identification: 2001124A-RA
 Sample Identification: 08
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_037
 Chamber Serial Number: 04026478A
 Detector Serial Number: 91133
 Env. Background: System Bkgd 271794
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 1/21/2020 11:49:12 AM
 Acquisition Date/Time: 2/5/2020 2:26:11 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 0.9393 +/- 0.0000
 Counting Efficiency: 0.1544 +/- 0.0027 on 2/22/2019 8:51:49 AM
 Effective Efficiency: 0.1450 +/- 0.0025

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

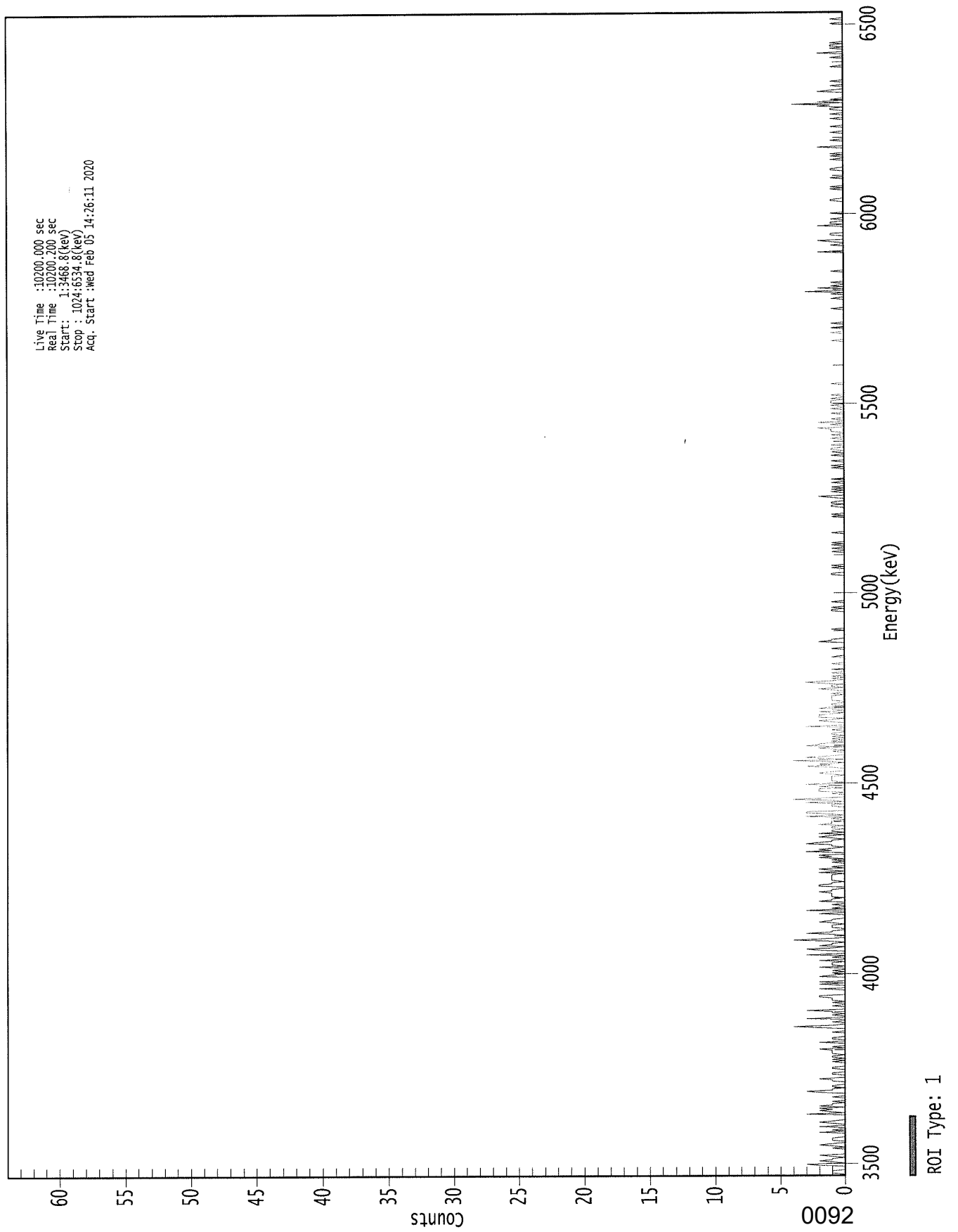
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.470	25.32	39.56	0.68	0.00E+000	4.5
RA-226	4.576	132.66	17.04	0.34	0.00E+000	5.0

 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.941	5685.50*	1.47E+000 +/- 5.82E-001	3.27E-001 +/- 1.12E-002
RA-226	0.945	4785.00*	7.27E+000 +/- 1.26E+000	2.62E-001 +/- 9.00E-003

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2/6/20

0000267184.CNF



 ***** S P E C T R A L D A T A R E P O R T *****

Sample Title: 08

Elapsed Live time: 10200
 Elapsed Real Time: 10200

Channel	1	2	3	4	5	6	7	8	9
1:	1	0	1	1	1	0	0	0	0
9:	0	2	3	0	1	2	1	1	1
17:	0	1	2	0	0	0	0	0	0
25:	1	0	1	2	1	0	0	1	1
33:	1	1	0	0	0	0	2	0	0
41:	1	0	0	2	0	0	1	2	2
49:	1	0	0	0	0	0	3	0	0
57:	1	2	1	2	0	2	1	1	1
65:	0	1	0	0	0	1	0	0	0
73:	0	2	3	1	1	0	1	1	1
81:	0	0	0	1	1	2	0	0	0
89:	0	1	1	0	0	0	1	1	1
97:	0	0	0	0	1	0	1	0	0
105:	1	1	0	1	1	1	1	2	2
113:	0	1	0	0	0	2	0	0	0
121:	1	1	0	0	0	0	1	0	0
129:	0	0	2	4	1	0	0	1	1
137:	0	0	3	0	0	1	0	1	1
145:	1	3	0	0	0	1	0	0	0
153:	1	0	1	1	1	2	2	0	0
161:	0	0	0	0	2	0	0	0	0
169:	2	0	2	0	0	0	0	2	2
177:	1	0	1	0	1	0	0	2	2
185:	0	1	1	1	0	2	0	0	0
193:	1	0	3	0	0	0	2	3	3
201:	1	0	2	1	1	0	1	4	4
209:	2	0	0	0	1	3	1	1	1
217:	0	0	1	1	1	0	1	2	2
225:	1	1	0	0	0	0	2	0	0
233:	0	3	0	1	0	0	1	0	0
241:	0	2	1	1	0	1	1	1	1
249:	1	2	1	1	0	0	2	2	2
257:	1	1	0	1	1	1	1	1	1
265:	1	0	2	0	1	2	0	1	1
273:	0	0	0	1	0	1	0	2	2
281:	1	2	0	0	3	1	2	1	1
289:	0	1	1	3	2	1	1	0	0
297:	1	2	1	0	2	0	1	1	1
305:	0	1	1	0	2	1	1	1	1
313:	0	1	0	3	0	1	3	3	3
321:	0	0	0	0	1	1	0	3	3
329:	0	1	4	2	0	0	0	1	1
337:	0	2	2	2	0	2	0	3	3
345:	1	0	1	1	1	1	1	0	0
353:	1	2	1	0	0	0	1	3	3
361:	1	2	0	1	4	0	2	3	3

0093

369: 1 0 0 0 1 0 1 2

Sample Title: 08

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	3	2	2	0	1	0	1
385:	0	1	0	1	1	0	0	1
393:	0	0	3	0	0	0	1	2
401:	1	0	2	2	2	1	0	2
409:	0	0	2	1	0	1	1	0
417:	0	1	1	1	1	1	0	1
425:	0	0	1	2	0	1	1	0
433:	2	3	1	0	1	0	1	0
441:	0	1	0	0	1	0	0	0
449:	0	1	0	0	0	0	0	1
457:	0	0	0	0	0	0	1	0
465:	0	0	0	0	2	1	1	0
473:	0	0	0	0	0	0	0	1
481:	0	0	0	0	0	0	0	0
489:	0	0	0	0	0	0	0	1
497:	1	0	1	0	0	0	0	1
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	1
529:	1	0	0	0	0	1	0	1
537:	0	0	0	0	0	0	0	0
545:	0	0	0	1	0	0	1	0
553:	0	1	0	1	0	0	0	0
561:	0	0	0	0	1	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	1	0	1	0	0	0
585:	0	0	0	1	1	0	1	1
593:	0	0	0	1	2	0	0	0
601:	1	0	1	0	1	0	0	0
609:	1	0	0	1	0	0	0	0
617:	0	0	0	0	0	1	0	1
625:	0	0	0	1	0	0	0	0
633:	1	0	0	1	0	1	1	0
641:	0	1	0	0	0	0	0	1
649:	0	0	1	0	0	1	1	1
657:	2	0	0	1	0	2	0	0
665:	1	0	0	0	0	1	0	0
673:	0	1	0	0	1	0	1	1
681:	1	0	1	0	0	1	0	0
689:	0	0	0	0	0	0	0	1
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	1	0	0
737:	0	0	0	0	1	0	0	0
745:	1	0	0	0	1	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	1	0	0	0	0	0	0
769:	0	0	1	0	0	0	1	0
777:	3	0	0	2	0	1	0	0
785:	1	0	0	0	0	0	0	0
793:	0	0	1	0	0	0	0	0

0094

801: 0 0 0 0 0 0 0 0 0

Sample Title: 08

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	2	0	0	0	0
817:	0	1	0	0	1	2	0	0
825:	0	0	1	1	0	0	0	0
833:	0	0	2	0	1	1	0	0
841:	1	0	0	0	0	1	0	0
849:	0	0	0	0	0	0	0	0
857:	1	1	0	0	0	0	0	0
865:	0	0	1	0	1	0	0	0
873:	0	0	0	0	1	0	0	0
881:	0	0	0	1	1	0	0	0
889:	0	0	0	0	1	0	0	1
897:	0	1	0	0	0	0	0	2
905:	0	0	0	0	0	1	0	0
913:	0	0	0	0	1	0	0	0
921:	0	1	0	0	0	0	0	0
929:	1	0	0	0	1	0	0	0
937:	1	1	0	2	1	4	0	2
945:	0	1	0	0	0	0	0	0
953:	2	1	0	0	0	1	0	0
961:	0	1	0	0	0	0	0	0
969:	0	0	0	0	0	0	1	0
977:	0	0	0	0	0	0	1	0
985:	0	0	2	0	0	0	1	0
993:	1	1	0	1	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	1	0	0	0
1017:	1	0	0	0	0	0	0	0



QA SUMMARY REPORT
Review Of QA Results - Pulser Check

Date : 2/5/2020
Time : 5:17:22 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	2/5/2020 5:03:59 AM
Alpha 004	21f	ALL	Passed	2/5/2020 5:04:00 AM
Alpha 005	21f	ALL	Not Done	
Alpha 006	21f	ALL	Not Done	
Alpha 007	21f	ALL	Not Done	
Alpha 008	21f	ALL	Not Done	
Alpha 009	21f	ALL	Not Done	
Alpha 010	21f	ALL	Passed	2/5/2020 5:04:01 AM
Alpha 011	21f	ALL	Passed	2/5/2020 5:04:02 AM
Alpha 012	21f	ALL	Passed	2/5/2020 5:04:03 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	2/5/2020 5:04:03 AM
Alpha 015	21f	ALL	Not Done	
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	ALL	Not Done	
Alpha 034	Alpha Analyst100DC	ALL	Not Done	
Alpha 035	Alpha Analyst100DC	ALL	Not Done	
Alpha 036	Alpha Analyst100DC	Peak FWHM	Action	2/5/2020 5:04:05 AM
Alpha 037	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:06 AM
Alpha 038	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:08 AM
Alpha 039	Alpha Analyst100DC	Peak FWHM	Action	2/5/2020 5:04:09 AM
Alpha 040	Alpha Analyst100DC	ALL	Not Done	
Alpha 041	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:11 AM
Alpha 042	Alpha Analyst100DC	ALL	Not Done	
Alpha 043	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:14 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:15 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:17 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:19 AM
Alpha 047	Alpha Analyst100DC	Peak FWHM	Action	2/5/2020 5:04:20 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:22 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:24 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:25 AM
Alpha 051	Alpha Analyst100DC	ALL	Not Done	
Alpha 052	Alpha Analyst100DC	ALL	Not Done	
Alpha 053	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:28 AM
Alpha 054	Alpha Analyst100DC	ALL	Not Done	
Alpha 055	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:30 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:33 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:35 AM
Alpha 058	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:37 AM

0096

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_059	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:40 AM
Alpha_060	Alpha Analyst100DC	ALL	Passed	2/5/2020 5:04:43 AM

APPROVED BY: KP

APPROVAL DATE: 2/5/20

***** LIBRARY LISTING REPORT *****

Nuclide Library Title: Radium

Nuclide Library Description: Ra-226, Po-218, Rn-222

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert. (Abs.+)
PO-218	5.049E+010	6003.000*	0.000	99.9800	0.0000
RN-222	5.049E+010	5490.000*	0.000	99.9200	0.0000
RA-226	5.049E+010	4785.000*	0.000	100.0000	0.0000

* = key line

TOTALS: 3 Nuclides 3 Energy Lines

SECTION IX
ANALYTICAL DATA (RADIUM-228)

0099

Work Order	20-01124
Analysis Code	Ra228
Run	1
Date Received	1/28/2020
Lab Deadline	2/10/2020
Client	ERM
Project	HERO LANDS
Report Level	4
Activity Units	pCi
Aliquot Units	I
Matrix	WA
Method	EPA 904.0
Instrument Type	Alpha/Beta GPC
Radiometric Tracer	Ba-133
Radiometric Sol#	Ba-6a
Tracer Act (dpm/g)	432.43
Carrier	Yttrium
Carrier Conc (mg/ml)	29

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		01/28/20 00:00	1.0000E+00
02	MBL	BLANK		01/28/20 00:00	1.0000E+00
03	DUP	MW 1A	10	01/21/20 10:10	1.0000E+00
04	TRG	MW 8B	20	01/21/20 08:45	1.0000E+00
05	DO	MW 1A	10	01/21/20 10:10	1.0000E+00
06	TRG	MW 1B	20	01/21/20 11:30	1.0000E+00
07	TRG	MW 6A	30	01/21/20 15:50	1.0000E+00
08	TRG	MW 5A	40	01/22/20 08:35	1.0000E+00

0100

* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. ^ Indicates estimated SAF value.
** Actual mass exceeded the calibration curve range. Results should be qualified as appropriate.

Aliquot Worksheet

Work Order		Run		Analysis Code		Rpt Units		Lab Deadline		Technician	
20-01124		1		Ra228		liters		2/10/2020		JHARVEY	

Lab Fraction	ERM Client ID	Sample Type	Muffle Data		Dilution Data			Aliquot Data			MS Aliquot Data		H-3 Solids Only		
			Ratio Post/Pre	No of Dilis	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq			
01	LCS	LCS						1.0000E+00	1.0000E+00						
02	BLANK	MBL						1.0000E+00	1.0000E+00						
03	MW 1A	DUP						1.0000E+00	1.0000E+00						
04	MW 8B	TRG						1.0000E+00	1.0000E+00						
05	MW 1A	DO						1.0000E+00	1.0000E+00						
06	MW 1B	TRG						1.0000E+00	1.0000E+00						
07	MW 6A	TRG						1.0000E+00	1.0000E+00						
08	MW 5A	TRG						1.0000E+00	1.0000E+00						

Comments	
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0108

Technician: J Harvey Date: 2/4/2020

UB
2/12/20

Detector ID	Sample ID	Alpha	Beta	Count Time	Voltage	TOD
F1	2001124-01	31	932	120	1410	2/12/2020 1:43:02 PM
F2	2001124-02	14	114	120	1410	2/12/2020 1:43:02 PM
F3	2001124-03	21	276	120	1410	2/12/2020 1:43:02 PM
F4	2001124-04	21	203	120	1410	2/12/2020 1:43:03 PM
G1	2001124-05	20	190	120	1410	2/12/2020 1:43:03 PM
G2	2001124-06	24	1263	120	1410	2/12/2020 1:43:03 PM
G3	2001124-07	20	252	120	1410	2/12/2020 1:43:03 PM
G4	2001124-08	26	561	120	1410	2/12/2020 1:43:03 PM

0110

GPC Detector Report
(ALL Backgrounds)

UP
2/12/20

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	2/12/2020	1.33E-01	P	-4.15E-02	1.14E-01	2.69E-01
LB4110A - A2	Alpha	11/2/2017	2/12/2020	1.67E-01	P	-3.13E-02	1.22E-01	2.75E-01
LB4110A - A3	Alpha	11/2/2017	2/12/2020	1.17E-01	P	-3.52E-02	1.21E-01	2.78E-01
LB4110A - A4	Alpha	11/2/2017	2/12/2020	1.67E-01	P	-3.72E-02	1.22E-01	2.82E-01
LB4110A - B1	Alpha	11/2/2017	2/12/2020	2.33E-01	P	-3.81E-02	1.39E-01	3.16E-01
LB4110A - B2	Alpha	11/2/2017	2/12/2020	1.50E-01	P	-2.40E-02	1.65E-01	3.54E-01
LB4110A - B3	Alpha	11/2/2017	2/12/2020	1.33E-01	P	-4.80E-02	1.00E-01	2.49E-01
LB4110A - B4	Alpha	11/2/2017	2/12/2020	1.17E-01	P	-3.96E-02	9.89E-02	2.37E-01
LB4110A - C1	Alpha	11/2/2017	2/12/2020	1.00E-01	P	-5.39E-02	9.46E-02	2.43E-01
LB4110A - C2	Alpha	11/2/2017	2/12/2020	8.33E-02	P	-1.35E-01	1.02E-01	3.39E-01
LB4110A - C3	Alpha	11/2/2017	2/12/2020	5.00E-02	P	-5.08E-02	7.05E-02	1.92E-01
LB4110A - C4	Alpha	11/2/2017	2/12/2020	1.00E-01	P	-5.50E-02	1.28E-01	3.10E-01
LB4110A - D1	Alpha	11/2/2017	2/12/2020	6.67E-02	P	-5.26E-02	1.50E-01	3.53E-01
LB4110A - D2	Alpha	11/2/2017	2/12/2020	6.67E-02	P	-4.01E-02	1.05E-01	2.50E-01
LB4110A - D3	Alpha	11/2/2017	2/12/2020	1.00E-01	P	-4.93E-02	1.18E-01	2.85E-01
LB4110A - D4	Alpha	11/2/2017	2/12/2020	1.83E-01	P	-3.00E-03	1.65E-01	3.34E-01
LB4110A - E1	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-4.29E-02	1.10E-01	2.62E-01
LB4110A - E2	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-3.09E-02	6.37E-02	1.58E-01
LB4110A - E3	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-8.81E-02	9.11E-02	2.70E-01
LB4110A - E4	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-4.55E-02	7.04E-02	1.86E-01
LB4110A - F1	Alpha	11/2/2017	2/12/2020	1.00E-01	P	-4.65E-02	8.01E-02	2.07E-01
LB4110A - F2	Alpha	11/2/2017	2/12/2020	5.00E-02	P	-4.43E-02	5.40E-02	1.52E-01
LB4110A - F3	Alpha	11/2/2017	2/12/2020	1.33E-01	P	-4.77E-02	7.13E-02	1.90E-01
LB4110A - F4	Alpha	11/2/2017	2/12/2020	5.00E-02	P	-4.15E-02	6.75E-02	1.76E-01
LB4110A - G1	Alpha	11/2/2017	2/12/2020	1.00E-01	P	-4.38E-02	7.02E-02	1.84E-01
LB4110A - G2	Alpha	11/2/2017	2/12/2020	1.67E-02	P	-3.98E-02	8.12E-02	2.02E-01
LB4110A - G3	Alpha	11/2/2017	2/12/2020	1.33E-01	P	-4.08E-02	8.74E-02	2.16E-01
LB4110A - G4	Alpha	11/2/2017	2/12/2020	6.67E-02	P	-3.88E-02	8.61E-02	2.11E-01

GPC Detector Report
(ALL Backgrounds)

LP
2/12/20

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	2/12/2020	1.28E+00	P	8.81E-01	1.36E+00	1.84E+00
LB4110A - A2	Beta	11/2/2017	2/12/2020	1.63E+00	P	1.01E+00	1.57E+00	2.14E+00
LB4110A - A3	Beta	11/2/2017	2/12/2020	1.32E+00	P	9.98E-01	1.47E+00	1.93E+00
LB4110A - A4	Beta	11/2/2017	2/12/2020	1.33E+00	P	9.76E-01	1.44E+00	1.91E+00
LB4110A - B1	Beta	11/2/2017	2/12/2020	1.23E+00	P	1.02E+00	1.49E+00	1.97E+00
LB4110A - B2	Beta	11/2/2017	2/12/2020	1.50E+00	P	7.29E-01	1.43E+00	2.14E+00
LB4110A - B3	Beta	11/2/2017	2/12/2020	1.33E+00	P	9.16E-01	1.36E+00	1.81E+00
LB4110A - B4	Beta	11/2/2017	2/12/2020	1.37E+00	P	7.88E-01	1.33E+00	1.88E+00
LB4110A - C1	Beta	11/2/2017	2/12/2020	1.18E+00	P	-1.53E+00	1.62E+00	4.78E+00
LB4110A - C2	Beta	11/2/2017	2/12/2020	9.50E-01	P	-4.82E+00	1.95E+00	8.72E+00
LB4110A - C3	Beta	11/2/2017	2/12/2020	1.40E+00	P	3.13E-01	1.69E+00	3.06E+00
LB4110A - C4	Beta	11/2/2017	2/12/2020	1.18E+00	P	8.20E-01	1.27E+00	1.73E+00
LB4110A - D1	Beta	11/2/2017	2/12/2020	1.02E+00	P	9.79E-02	1.43E+00	2.76E+00
LB4110A - D2	Beta	11/2/2017	2/12/2020	4.00E+00	F	-1.99E+01	2.78E+00	2.54E+01
LB4110A - D3	Beta	11/2/2017	2/12/2020	1.28E+00	P	-2.08E+00	1.70E+00	5.48E+00
LB4110A - D4	Beta	11/2/2017	2/12/2020	1.55E+00	P	9.73E-01	1.47E+00	1.96E+00
LB4110A - E1	Beta	11/2/2017	3/23/2018	3.33E-02	P	7.66E-01	1.32E+00	1.88E+00
LB4110A - E2	Beta	11/2/2017	3/23/2018	1.67E-02	P	5.45E-01	9.58E-01	1.37E+00
LB4110A - E3	Beta	11/2/2017	3/23/2018	6.67E-02	P	4.98E-01	1.20E+00	1.91E+00
LB4110A - E4	Beta	11/2/2017	3/23/2018	0.00E+00	P	5.67E-01	1.04E+00	1.50E+00
LB4110A - F1	Beta	11/2/2017	2/12/2020	1.33E+00	P	7.80E-01	1.29E+00	1.79E+00
LB4110A - F2	Beta	11/2/2017	2/12/2020	9.17E-01	P	4.36E-01	9.21E-01	1.41E+00
LB4110A - F3	Beta	11/2/2017	2/12/2020	1.30E+00	P	4.06E-01	1.17E+00	1.94E+00
LB4110A - F4	Beta	11/2/2017	2/12/2020	1.15E+00	P	1.63E-01	1.18E+00	2.21E+00
LB4110A - G1	Beta	11/2/2017	2/12/2020	9.67E-01	P	6.11E-01	1.23E+00	1.85E+00
LB4110A - G2	Beta	11/2/2017	2/12/2020	1.78E+00	P	1.05E+00	1.71E+00	2.37E+00
LB4110A - G3	Beta	11/2/2017	2/12/2020	1.22E+00	P	6.41E-01	1.32E+00	2.00E+00
LB4110A - G4	Beta	11/2/2017	2/12/2020	1.45E+00	P	-1.14E+00	1.40E+00	3.94E+00

GPC Detector Report
(ALL Efficiencies)

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	2/12/2020	0.2344	P	0.2135	0.2283	0.2432
LB4110A - A2	Alpha	11/2/2017	2/12/2020	0.2032	P	0.1884	0.2071	0.2257
LB4110A - A3	Alpha	11/2/2017	2/12/2020	0.1995	P	0.1834	0.1982	0.2130
LB4110A - A4	Alpha	11/2/2017	2/12/2020	0.2284	P	0.2068	0.2258	0.2448
LB4110A - B1	Alpha	11/2/2017	2/12/2020	0.2147	P	0.2002	0.2210	0.2419
LB4110A - B2	Alpha	11/2/2017	2/12/2020	0.1969	P	0.1865	0.1995	0.2126
LB4110A - B3	Alpha	11/2/2017	2/12/2020	0.2346	P	0.2208	0.2348	0.2488
LB4110A - B4	Alpha	11/2/2017	2/12/2020	0.2255	P	0.2082	0.2236	0.2390
LB4110A - C1	Alpha	11/2/2017	2/12/2020	0.2016	P	0.1934	0.2060	0.2187
LB4110A - C2	Alpha	11/2/2017	2/12/2020	0.2104	P	0.0126	0.2175	0.4225
LB4110A - C3	Alpha	11/2/2017	2/12/2020	0.2384	P	0.2187	0.2378	0.2570
LB4110A - C4	Alpha	11/2/2017	2/12/2020	0.2169	P	0.2005	0.2158	0.2312
LB4110A - D1	Alpha	11/2/2017	2/12/2020	0.1898	W	0.1881	0.2162	0.2443
LB4110A - D2	Alpha	11/2/2017	2/12/2020	0.2298	P	0.2131	0.2413	0.2695
LB4110A - D3	Alpha	11/2/2017	2/12/2020	0.2355	P	0.2304	0.2486	0.2668
LB4110A - D4	Alpha	11/2/2017	2/12/2020	0.1830	P	0.1700	0.1916	0.2132
LB4110A - E1	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1687	0.2258	0.2830
LB4110A - E2	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1518	0.2051	0.2584
LB4110A - E3	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1547	0.2075	0.2603
LB4110A - E4	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1747	0.2355	0.2963
LB4110A - F1	Alpha	11/2/2017	2/12/2020	0.2156	P	0.1705	0.2133	0.2562
LB4110A - F2	Alpha	11/2/2017	2/12/2020	0.1799	P	0.1513	0.1814	0.2115
LB4110A - F3	Alpha	11/2/2017	2/12/2020	0.2253	P	0.1844	0.2277	0.2709
LB4110A - F4	Alpha	11/2/2017	2/12/2020	0.2143	P	0.1744	0.2124	0.2504
LB4110A - G1	Alpha	11/2/2017	2/12/2020	0.1874	P	0.1747	0.1921	0.2096
LB4110A - G2	Alpha	11/2/2017	2/12/2020	0.1803	P	0.1704	0.1934	0.2164
LB4110A - G3	Alpha	11/2/2017	2/12/2020	0.2154	P	0.2023	0.2190	0.2356
LB4110A - G4	Alpha	11/2/2017	2/12/2020	0.1819	P	0.1670	0.1896	0.2123

KP
2/12/20

GPC Detector Report
(ALL Efficiencies)

MP
2/12/20

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	2/12/2020	0.5619	P	0.5079	0.5485	0.5892
LB4110A - A2	Beta	11/2/2017	2/12/2020	0.4402	P	0.3995	0.4538	0.5082
LB4110A - A3	Beta	11/2/2017	2/12/2020	0.4798	P	0.4390	0.4779	0.5168
LB4110A - A4	Beta	11/2/2017	2/12/2020	0.5583	P	0.5047	0.5454	0.5860
LB4110A - B1	Beta	11/2/2017	2/12/2020	0.4858	P	0.4703	0.5314	0.5925
LB4110A - B2	Beta	11/2/2017	2/12/2020	0.4987	P	0.4685	0.4979	0.5274
LB4110A - B3	Beta	11/2/2017	2/12/2020	0.5890	P	0.5543	0.5845	0.6148
LB4110A - B4	Beta	11/2/2017	2/12/2020	0.5529	P	0.5133	0.5498	0.5863
LB4110A - C1	Beta	11/2/2017	2/12/2020	0.4792	P	0.4502	0.4790	0.5077
LB4110A - C2	Beta	11/2/2017	2/12/2020	0.4935	P	0.4671	0.5125	0.5579
LB4110A - C3	Beta	11/2/2017	2/12/2020	0.6011	P	0.5405	0.5888	0.6370
LB4110A - C4	Beta	11/2/2017	2/12/2020	0.5264	P	0.4874	0.5236	0.5599
LB4110A - D1	Beta	11/2/2017	2/12/2020	0.5611	W	0.5600	0.6268	0.6935
LB4110A - D2	Beta	11/2/2017	2/12/2020	0.5834	P	0.5197	0.6114	0.7030
LB4110A - D3	Beta	11/2/2017	2/12/2020	0.5814	W	0.5736	0.6351	0.6966
LB4110A - D4	Beta	11/2/2017	2/12/2020	0.4756	P	0.4496	0.4951	0.5406
LB4110A - E1	Beta	11/2/2017	3/23/2018	0.0436	F	0.4162	0.5409	0.6655
LB4110A - E2	Beta	11/2/2017	3/23/2018	0.0428	F	0.3730	0.4913	0.6097
LB4110A - E3	Beta	11/2/2017	3/23/2018	0.0551	F	0.3852	0.4994	0.6137
LB4110A - E4	Beta	11/2/2017	3/23/2018	0.0569	F	0.4534	0.5890	0.7247
LB4110A - F1	Beta	11/2/2017	2/12/2020	0.5346	P	0.4592	0.5331	0.6070
LB4110A - F2	Beta	11/2/2017	2/12/2020	0.4473	P	0.4168	0.4550	0.4933
LB4110A - F3	Beta	11/2/2017	2/12/2020	0.5837	P	0.4886	0.5875	0.6865
LB4110A - F4	Beta	11/2/2017	2/12/2020	0.5505	P	0.4648	0.5401	0.6154
LB4110A - G1	Beta	11/2/2017	2/12/2020	0.4452	P	0.4244	0.4513	0.4783
LB4110A - G2	Beta	11/2/2017	2/12/2020	0.4418	P	0.4030	0.4621	0.5213
LB4110A - G3	Beta	11/2/2017	2/12/2020	0.5239	P	0.4853	0.5278	0.5703
LB4110A - G4	Beta	11/2/2017	2/12/2020	0.4388	P	0.3981	0.4591	0.5201

SECTION X

BARIUM-133 ANALYTICAL TRACER DATA



Y.B.
2/5/20

Analysis Report for 2001124-01
SPIKE

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-01
 Sample Description : SPIKE
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:51:47AM
 Acquisition Started : 2/5/2020 11:36:28AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE1
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.3 seconds

Dead Time : 0.03 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 19 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/12/2019
 Efficiency Calibration Used Done On : 10/12/2019
 Efficiency Calibration Description :

Sample Number : 94130

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 11:51:31AM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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0116

Analysis Report for 2001124-01

SPIKE

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	30.65	26 -	39	31.14	2.22E+03	103.90	3.45E+02	2.12
m	2	34.71	26 -	39	35.19	4.82E+02	79.89	2.86E+02	2.13
	3	53.15	50 -	57	53.62	7.20E+01	39.75	2.14E+02	1.51
M	4	61.70	58 -	88	62.16	2.43E+02	45.78	1.74E+02	2.40
m	5	80.98	58 -	88	81.42	9.36E+02	68.41	1.70E+02	2.43
	6	92.13	89 -	97	92.56	7.64E+01	41.72	2.21E+02	2.07
M	7	111.77	105 -	125	112.19	2.05E+02	43.41	1.49E+02	2.72
m	8	120.59	105 -	125	121.00	2.11E+01	25.96	1.23E+02	2.06
	9	262.20	260 -	265	262.50	1.92E+01	14.59	2.76E+01	3.12
M	10	275.92	270 -	290	276.22	6.85E+01	23.24	5.78E+01	2.40
m	11	284.49	270 -	290	284.78	1.46E+01	19.80	5.20E+01	2.41
M	12	302.37	297 -	310	302.64	1.75E+02	31.62	5.81E+01	2.13
m	13	306.29	297 -	310	306.56	2.86E+01	32.00	8.60E+01	2.64
	14	334.65	329 -	342	334.90	1.10E+02	32.53	6.49E+01	6.94
M	15	355.54	350 -	371	355.78	5.91E+02	51.57	4.09E+01	2.46
m	16	364.00	350 -	371	364.22	2.71E+01	19.36	4.81E+01	2.46
M	17	385.53	379 -	393	385.74	3.27E+02	43.63	7.24E+01	3.99
m	18	390.79	379 -	393	390.99	2.62E+01	19.39	4.68E+01	2.60
M	19	414.04	410 -	420	414.23	3.55E+01	17.94	2.80E+01	2.50
m	20	416.59	410 -	420	416.77	2.35E+01	19.34	2.80E+01	2.50
	21	436.05	431 -	440	436.22	1.06E+02	22.23	9.48E+00	2.03
	22	446.94	444 -	450	447.10	9.75E+00	10.63	1.25E+01	1.91
M	23	467.08	462 -	475	467.23	2.12E+01	13.27	2.14E+01	2.53
m	24	471.09	462 -	475	471.23	2.11E+01	14.42	7.82E+00	2.53
	25	720.68	716 -	723	720.63	7.80E+00	7.48	4.40E+00	2.00

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 11:51:31AM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093995.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	30.65	2.22E+03	103.90	2.77E+00	8.03E-01	2.22E+03	1.04E+02
m	2	34.71	4.82E+02	79.89			4.82E+02	7.99E+01
	3	53.15	7.20E+01	39.75	1.19E+00	8.72E-01	7.08E+01	3.98E+01
M	4	61.70	2.43E+02	45.78	2.48E+01	2.58E+00	2.18E+02	4.59E+01

0117

Analysis Report for 2001124-01

SPIKE

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	5	80.98	9.36E+02	68.41			9.36E+02	6.84E+01
	6	92.13	7.64E+01	41.72	3.37E+01	1.62E+00	4.27E+01	4.17E+01
M	7	111.77	2.05E+02	43.41			2.05E+02	4.34E+01
m	8	120.59	2.11E+01	25.96			2.11E+01	2.60E+01
	9	262.20	1.92E+01	14.59			1.92E+01	1.46E+01
M	10	275.92	6.85E+01	23.24			6.85E+01	2.32E+01
m	11	284.49	1.46E+01	19.80			1.46E+01	1.98E+01
M	12	302.37	1.75E+02	31.62			1.75E+02	3.16E+01
m	13	306.29	2.86E+01	32.00			2.86E+01	3.20E+01
	14	334.65	1.10E+02	32.53			1.10E+02	3.25E+01
M	15	355.54	5.91E+02	51.57			5.91E+02	5.16E+01
m	16	364.00	2.71E+01	19.36			2.71E+01	1.94E+01
M	17	385.53	3.27E+02	43.63			3.27E+02	4.36E+01
m	18	390.79	2.62E+01	19.39			2.62E+01	1.94E+01
M	19	414.04	3.55E+01	17.94			3.55E+01	1.79E+01
m	20	416.59	2.35E+01	19.34			2.35E+01	1.93E+01
	21	436.05	1.06E+02	22.23			1.06E+02	2.22E+01
	22	446.94	9.75E+00	10.63			9.75E+00	1.06E+01
M	23	467.08	2.12E+01	13.27			2.12E+01	1.33E+01
m	24	471.09	2.11E+01	14.42			2.11E+01	1.44E+01
	25	720.68	7.80E+00	7.48			7.80E+00	7.48E+00

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
CO-57	0.78	122.06 *	85.51	7.76E+00	9.66E+00
		136.48	10.60		
SN-113	0.93	255.12	1.93		
		391.69 *	61.90	2.04E+01	1.52E+01
T-129	0.87	29.78 *	57.00	6.35E+01	3.03E+00
		33.60 *	13.20	8.70E+01	1.45E+01
		39.58	7.52		
BA-133	0.99	81.00 *	34.06	4.81E+02	5.95E+01

0118

Analysis Report for 2001124-01

SPIKE

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
BA-133	0.99	302.84 *		18.33	4.94E+02	1.65E+02
		356.01 *		62.05	4.75E+02	6.87E+01
TH-234	0.93	63.29 *		3.80	5.91E+02	1.29E+02
AM-241	0.88	59.54 *		35.90	6.26E+01	1.37E+01

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.500 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
CO-57	0.785	7.76E+00	9.66E+00	
SN-113	0.933	2.04E+01	1.52E+01	
I-129	0.872	6.45E+01	2.97E+00	
BA-133	0.996	4.80E+02	4.34E+01	
? TH-234	0.938	5.91E+02	1.29E+02	
X NP-237	0.666			
? AM-241	0.887	6.26E+01	1.37E+01	

? = 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 2.000sigma

0119

Analysis Report for 2001124-01

SPIKE

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 11:51:31AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	3	53.15	7.86598E-02		
	6	92.13	4.74305E-02	Sum	
M	7	111.77	2.27898E-01	Sum	
	9	262.20	2.13131E-02		
M	10	275.92	7.60914E-02		
m	11	284.49	1.61683E-02		
m	13	306.29	3.17416E-02		
	14	334.65	1.21721E-01	Sum	
m	16	364.00	3.01626E-02	Sum	
M	17	385.53	3.63383E-01	Sum	
M	19	414.04	3.94394E-02		
m	20	416.59	2.61397E-02	Sum	
	21	436.05	1.18068E-01	Sum	
	22	446.94	1.08333E-02		
M	23	467.08	2.35964E-02		
m	24	471.09	2.34962E-02	Sum	
	25	720.68	8.66667E-03		

M = First peak in a multiplet region
 m = Other peak in a multiplet region
 F = Fitted singlet
 Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

0120

Analysis Report for 2001124-01

SPIKE

Nuclide Name	Energy (keV)		Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
	FE-55		24.50	1.49E-04	1.49E-04	0.00E+00	0.00E+00
+	CO-57	122.06 *	85.51	4.14E+01	4.14E+01	7.76E+00	2.02E+01
		136.48	10.60	1.61E+02		5.34E+01	7.60E+01
	NI-59	6.92	29.80	2.91E-04	2.91E-04	0.00E+00	0.00E+00
	MO-93	16.59	52.90	1.28E-01	1.28E-01	-1.37E-01	5.95E-02
		18.60	10.00	1.98E+00		2.27E-01	9.49E-01
	NB-93M	16.57	9.43	7.17E-01	7.17E-01	-7.67E-01	3.32E-01
	CD-109	88.03	3.72	2.95E+02	2.95E+02	-1.06E+03	1.40E+02
!	SN-113	255.12	1.93	8.41E+02	3.75E+01	2.65E+02	3.84E+02
		391.69 *	61.90	3.75E+01		2.04E+01	1.77E+01
	SN-119M	23.87	16.10	4.49E+00	4.01E+00	9.99E+00	2.18E+00
		25.10	22.70	4.01E+00		4.96E+00	1.96E+00
+	I-129	29.78 *	57.00	3.77E+00	3.77E+00	6.35E+01	1.84E+00
		33.60 *	13.20	2.35E+01		8.70E+01	1.15E+01
		39.58	7.52	3.26E+01		1.36E+01	1.57E+01
+	BA-133	81.00 *	34.06	9.45E+01	5.40E+01	4.81E+02	4.65E+01
		302.84 *	18.33	1.61E+02		4.94E+02	7.69E+01
		356.01 *	62.05	5.40E+01		4.75E+02	2.59E+01
	CE-139	165.85	80.35	2.35E+01	2.35E+01	-2.22E+00	1.10E+01
	CE-144	133.54	10.80	1.34E+02	1.34E+02	-1.10E+02	6.27E+01
	HG-203	279.19	77.30	3.02E+01	3.02E+01	2.29E+01	1.42E+01
	PB-210	46.50	4.25	6.55E+01	6.55E+01	-2.98E+01	3.11E+01
	TH-231	25.64	14.70	6.66E+00	6.66E+00	7.19E+00	3.25E+00
		84.21	6.40	3.25E+02		7.41E+02	1.59E+02
	PA-234M	9.89	89.00	5.79E-04	5.79E-04	0.00E+00	0.00E+00
		21.72	64.90	7.86E-01		2.47E+00	3.82E-01
		37.93	23.75	1.50E+01		2.00E-01	7.31E+00
		131.42	20.40	7.18E+01		-2.26E+01	3.36E+01
+	TH-234	63.29 *	3.80	5.01E+02	5.01E+02	5.91E+02	2.47E+02
	NP-237	29.37 *	14.00	1.53E+01	1.53E+01	2.59E+02	7.51E+00
		86.50	12.60	8.83E+01		-7.90E+02	4.21E+01
	U-237	97.08	16.30	7.09E+01	4.59E+01	1.32E+01	3.35E+01
		101.07	26.30	4.59E+01		1.85E+01	2.17E+01
		114.00	12.30	2.01E+02		4.29E+02	9.75E+01
		208.01	22.00	9.36E+01		2.39E+01	4.38E+01
!	AM-241	59.54 *	35.90	5.30E+01	5.30E+01	6.26E+01	2.61E+01
	AM-243	74.67	66.00	1.34E+01	1.34E+01	-5.07E+01	6.37E+00

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

0121



KB
2/5/20

Analysis Report for 2001124-02
BLANK

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-02
 Sample Description : BLANK
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:51:53AM
 Acquisition Started : 2/5/2020 11:37:38AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE3
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 902.0 seconds

Dead Time : 0.22 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 10 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/19/2019
 Efficiency Calibration Used Done On : 10/19/2019
 Efficiency Calibration Description :

Sample Number : 94131

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 11:52:42AM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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0122

Analysis Report for 2001124-02

BLANK

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.41	17 -	24	20.83	1.10E+02	47.41	3.04E+02	2.22
M	2	30.97	26 -	40	31.38	2.43E+03	105.65	2.91E+02	1.97
m	3	35.20	26 -	40	35.61	6.02E+02	91.49	2.46E+02	2.20
M	4	57.60	49 -	73	58.00	2.34E+01	27.63	1.46E+02	1.65
m	5	62.00	49 -	73	62.40	3.18E+02	49.73	1.86E+02	2.21
m	6	66.00	49 -	73	66.40	1.77E+02	48.18	1.63E+02	2.26
	7	81.07	76 -	86	81.45	1.05E+03	83.88	3.79E+02	2.15
M	8	111.91	106 -	122	112.27	2.86E+02	49.92	2.04E+02	2.52
m	9	116.36	106 -	122	116.72	7.28E+01	44.50	1.91E+02	2.52
	10	143.17	140 -	146	143.51	2.86E+01	31.23	1.55E+02	2.96
	11	159.57	156 -	164	159.90	5.61E+01	34.94	1.54E+02	5.37
	12	231.92	229 -	236	232.21	2.61E+01	25.53	8.98E+01	2.73
	13	277.12	273 -	284	277.38	6.70E+01	30.66	8.40E+01	2.98
	14	303.08	300 -	306	303.33	1.34E+02	31.91	8.83E+01	2.02
	15	334.98	329 -	341	335.20	1.07E+02	30.34	5.69E+01	2.24
	16	356.26	351 -	361	356.47	5.63E+02	49.97	3.29E+01	2.23
M	17	376.77	373 -	401	376.97	1.61E+01	13.62	2.10E+01	3.74
m	18	386.32	373 -	401	386.51	3.16E+02	41.59	3.30E+01	3.51
m	19	391.17	373 -	401	391.36	4.86E+01	26.38	2.40E+01	2.57
M	20	415.82	411 -	426	416.00	2.01E+01	18.00	4.01E+01	1.94
m	21	421.83	411 -	426	422.00	1.59E+01	15.87	2.82E+01	1.95
M	22	433.19	433 -	443	433.35	5.82E+00	0.00	0.00E+00	2.60
m	23	437.46	433 -	443	437.62	1.06E+02	23.86	1.76E+01	2.30
	24	468.40	467 -	470	468.54	1.66E+01	10.00	8.76E+00	1.77
	25	485.00	482 -	487	485.13	4.58E+00	5.74	2.83E+00	2.72
	26	511.60	507 -	518	511.72	3.17E+01	13.11	4.62E+00	2.50

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 11:52:42AM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093997.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.41	1.10E+02	47.41			1.10E+02	4.74E+01
M	2	30.97	2.43E+03	105.65			2.43E+03	1.06E+02
m	3	35.20	6.02E+02	91.49			6.02E+02	9.15E+01

0123

Analysis Report for 2001124-02

BLANK

	<i>Peak No.</i>	<i>Energy (keV)</i>	<i>Original Area</i>	<i>Orig. Area Uncertainty</i>	<i>Ambient Background</i>	<i>Backgr. Uncert.</i>	<i>Subtracted Area</i>	<i>Subtracted Uncert.</i>
M	4	57.60	2.34E+01	27.63			2.34E+01	2.76E+01
m	5	62.00	3.18E+02	49.73	1.19E+01	2.85E+00	3.06E+02	4.98E+01
m	6	66.00	1.77E+02	48.18			1.77E+02	4.82E+01
	7	81.07	1.05E+03	83.88			1.05E+03	8.39E+01
M	8	111.91	2.86E+02	49.92			2.86E+02	4.99E+01
m	9	116.36	7.28E+01	44.50			7.28E+01	4.45E+01
	10	143.17	2.86E+01	31.23			2.86E+01	3.12E+01
	11	159.57	5.61E+01	34.94			5.61E+01	3.49E+01
	12	231.92	2.61E+01	25.53			2.61E+01	2.55E+01
	13	277.12	6.70E+01	30.66			6.70E+01	3.07E+01
	14	303.08	1.34E+02	31.91			1.34E+02	3.19E+01
	15	334.98	1.07E+02	30.34			1.07E+02	3.03E+01
	16	356.26	5.63E+02	49.97			5.63E+02	5.00E+01
M	17	376.77	1.61E+01	13.62			1.61E+01	1.36E+01
m	18	386.32	3.16E+02	41.59			3.16E+02	4.16E+01
m	19	391.17	4.86E+01	26.38			4.86E+01	2.64E+01
M	20	415.82	2.01E+01	18.00			2.01E+01	1.80E+01
m	21	421.83	1.59E+01	15.87			1.59E+01	1.59E+01
M	22	433.19	5.82E+00	0.00			5.82E+00	0.00E+00
m	23	437.46	1.06E+02	23.86			1.06E+02	2.39E+01
	24	468.40	1.66E+01	10.00			1.66E+01	1.00E+01
	25	485.00	4.58E+00	5.74			4.58E+00	5.74E+00
	26	511.60	3.17E+01	13.11	1.44E+01	1.28E+00	1.73E+01	1.32E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

<i>Nuclide Name</i>	<i>Id Confidence</i>	<i>Energy (keV)</i>	<i>Yield(%)</i>	<i>Activity (pCi/units)</i>	<i>Activity Uncertainty</i>
SN-113	0.94	255.12	1.93		
		391.69 *	61.90	4.11E+01	2.28E+01
1-129	0.86	29.78 *	57.00	3.30E+01	1.44E+00
		33.60 *	13.20	5.91E+01	8.99E+00
		39.58	7.52		
BA-133	0.99	81.00 *	34.06	5.17E+02	6.53E+01

0124

Analysis Report for 2001124-02

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Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
BA-133	0.99	302.84 *	18.33	4.41E+02	1.65E+02
		356.01 *	62.05	5.08E+02	7.75E+01
HG-203	0.89	279.19 *	77.30	5.36E+01	2.94E+01
TH-234	0.95	63.29 *	3.80	6.89E+02	1.17E+02
AM-241	0.90	59.54 *	35.90	4.53E+00	5.34E+00

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.500 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
SN-113	0.949	4.11E+01	2.28E+01	
I-129	0.867	3.37E+01	1.42E+00	
BA-133	0.999	5.07E+02	4.78E+01	
HG-203	0.896	5.36E+01	2.94E+01	
TH-234	0.959	6.89E+02	1.17E+02	
X NP-237	0.744			
AM-241	0.908	4.53E+00	5.34E+00	

? = 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 2.000sigma

0125

Analysis Report for 2001124-02

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UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 11:52:42AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	20.41	1.22294E-01	21.54		
m 6	66.00	1.96801E-01	13.60	Sum	
M 8	111.91	3.17641E-01	8.73	Sum	
m 9	116.36	8.09148E-02	30.55	Sum	
10	143.17	3.17453E-02	54.65	Sum	
11	159.57	6.23058E-02	31.15		
12	231.92	2.89984E-02	48.92		
15	334.98	1.18383E-01	14.24	Sum	
M 17	376.77	1.79005E-02	42.27		
m 18	386.32	3.51342E-01	6.58	Sum	
M 20	415.82	2.23623E-02	44.72	Sum	
m 21	421.83	1.77034E-02	49.82	Sum	
M 22	433.19	6.46236E-03	0.00		
m 23	437.46	1.17991E-01	11.23	Sum	
24	468.40	1.84656E-02	30.09		
25	485.00	5.09259E-03	62.67		
26	511.60	1.92339E-02	38.06		

M = First peak in a multiplet region
 m = Other peak in a multiplet region
 F = Fitted singlet
 Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

0126

Analysis Report for 2001124-02

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Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	6.04E-06	6.04E-06	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.03E+01	2.03E+01	2.19E+00	9.59E+00
	136.48	10.60	1.84E+02		-3.11E+01	8.66E+01
NI-59	6.92	29.80	1.59E-05	1.59E-05	0.00E+00	0.00E+00
MO-93	16.59	52.90	3.65E-02	3.65E-02	-6.99E-03	1.72E-02
	18.60	10.00	4.61E-01		2.89E-01	2.20E-01
NB-93M	16.57	9.43	2.04E-01	2.04E-01	-3.90E-02	9.61E-02
CD-109	88.03	3.72	2.97E+02	2.97E+02	-8.56E+01	1.41E+02
+ SN-113	255.12	1.93	1.10E+03	5.26E+01	-2.78E+02	5.07E+02
	391.69	*	61.90		4.11E+01	2.52E+01
SN-119M	23.87	16.10	9.18E-01	7.89E-01	-6.68E-01	4.38E-01
	25.10	22.70	7.89E-01		-6.36E+00	3.76E-01
+ I-129	29.78	*	57.00	1.72E+00	3.30E+01	8.40E-01
	33.60	*	13.20		5.91E+01	6.02E+00
	39.58	7.52	1.25E+01		1.88E+00	5.88E+00
+ BA-133	81.00	*	34.06	2.58E+01	5.17E+02	2.17E+01
	302.84	*	18.33		4.41E+02	5.96E+01
	356.01	*	62.05		5.08E+02	1.17E+01
CE-139	165.85	80.35	2.87E+01	2.87E+01	1.04E+01	1.35E+01
CE-144	133.54	10.80	1.80E+02	1.80E+02	1.28E+01	8.50E+01
+ HG-203	279.19	*	77.30	3.63E+01	5.36E+01	1.71E+01
FB-210	46.50	4.25	4.01E+01	4.01E+01	1.03E+01	1.89E+01
TH-231	25.64	14.70	1.34E+00	1.34E+00	-1.08E+01	6.39E-01
	84.21	6.40	3.51E+02		6.71E+00	1.72E+02
PA-234M	9.89	89.00	1.13E-03	1.13E-03	1.39E-03	5.36E-04
	21.72	64.90	1.65E-01		1.39E-01	7.92E-02
	37.93	23.75	6.98E+00		1.66E+01	3.39E+00
	131.42	20.40	9.20E+01		-1.30E+01	4.34E+01
+ TH-234	63.29	*	3.80	3.52E+02	6.89E+02	1.73E+02
NP-237	29.37	*	14.00	6.99E+00	1.35E+02	3.42E+00
	86.50	12.60	8.67E+01		9.13E+00	4.13E+01
U-237	97.08	16.30	8.93E+01	5.81E+01	-2.28E+01	4.26E+01
	101.07	26.30	5.81E+01		2.80E+01	2.77E+01
	114.00	12.30	2.59E+02		7.14E+02	1.26E+02
	208.01	22.00	1.14E+02		1.91E+00	5.31E+01
AM-241	59.54	*	35.90	2.99E+01	4.53E+00	1.47E+01
AM-243	74.67	66.00	1.09E+01	1.09E+01	-1.96E+00	5.18E+00

- + = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction



10P
2/5/20

Analysis Report for 2001124-03
MW 1A

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-03
 Sample Description : MW 1A
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:52:04AM
 Acquisition Started : 2/5/2020 11:53:15AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE3
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 901.9 seconds

Dead Time : 0.21 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 9 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/19/2019
 Efficiency Calibration Used Done On : 10/19/2019
 Efficiency Calibration Description :

Sample Number : 94133

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 12:08:19PM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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Analysis Report for 2001124-03

MW 1A

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.66	17 -	24	21.08	1.05E+02	50.56	3.56E+02	1.62
M	2	30.94	26 -	44	31.35	2.32E+03	103.17	2.71E+02	2.00
m	3	35.19	26 -	44	35.60	5.84E+02	88.59	2.39E+02	2.20
	4	52.88	49 -	57	53.27	1.00E+02	48.30	2.98E+02	2.74
M	5	61.88	58 -	70	62.27	3.30E+02	51.26	2.46E+02	2.05
m	6	65.86	58 -	70	66.25	1.16E+02	52.06	3.46E+02	2.21
	7	81.15	76 -	86	81.53	1.05E+03	80.59	3.08E+02	2.18
M	8	111.96	109 -	127	112.33	2.95E+02	44.02	1.51E+02	2.08
m	9	116.29	109 -	127	116.65	8.53E+01	33.73	1.25E+02	2.09
	10	276.86	273 -	280	277.13	5.44E+01	24.49	6.33E+01	2.03
M	11	302.94	299 -	315	303.18	1.61E+02	29.78	3.83E+01	2.27
m	12	307.15	299 -	315	307.39	4.68E+01	26.06	4.93E+01	2.27
M	13	333.99	328 -	343	334.22	8.60E+01	24.13	3.18E+01	2.29
m	14	337.79	328 -	343	338.02	2.15E+01	20.25	2.91E+01	2.29
M	15	351.78	351 -	362	352.00	1.21E+01	7.48	1.20E+01	1.90
m	16	356.34	351 -	362	356.55	5.26E+02	47.58	3.60E+01	2.13
	17	377.38	375 -	380	377.58	1.24E+01	14.07	2.92E+01	2.34
M	18	384.12	380 -	395	384.32	1.26E+02	33.92	4.39E+01	2.33
m	19	387.15	380 -	395	387.34	1.90E+02	38.04	3.66E+01	2.33
m	20	391.40	380 -	395	391.60	3.88E+01	26.13	2.98E+01	2.33
M	21	416.47	413 -	427	416.64	5.17E+01	21.07	1.11E+01	2.58
m	22	421.42	413 -	427	421.59	1.65E+01	17.68	1.28E+01	2.35
	23	437.15	432 -	440	437.31	1.23E+02	24.18	1.56E+01	2.21
	24	468.45	464 -	474	468.59	2.88E+01	12.42	4.48E+00	2.92
	25	570.92	568 -	574	571.00	1.10E+01	6.63	0.00E+00	4.50
M	26	584.10	583 -	589	584.17	6.23E+00	3.46	0.00E+00	2.70
m	27	587.12	583 -	589	587.18	8.95E+00	5.66	0.00E+00	2.32
	28	933.89	929 -	936	933.74	4.79E+00	6.63	4.43E+00	2.60

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.00sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 12:08:19PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093997.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
1	20.66	1.05E+02	50.56			1.05E+02	5.06E+01

0129

Analysis Report for 2001124-03

MW 1A

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	2	30.94	2.32E+03	103.17			2.32E+03	1.03E+02
m	3	35.19	5.84E+02	88.59			5.84E+02	8.86E+01
	4	52.88	1.00E+02	48.30			1.00E+02	4.83E+01
M	5	61.88	3.30E+02	51.26	1.19E+01	2.85E+00	3.18E+02	5.13E+01
m	6	65.86	1.16E+02	52.06	1.19E+01	2.85E+00	1.04E+02	5.21E+01
	7	81.15	1.05E+03	80.59			1.05E+03	8.06E+01
M	8	111.96	2.95E+02	44.02			2.95E+02	4.40E+01
m	9	116.29	8.53E+01	33.73			8.53E+01	3.37E+01
	10	276.86	5.44E+01	24.49			5.44E+01	2.45E+01
M	11	302.94	1.61E+02	29.78			1.61E+02	2.98E+01
m	12	307.15	4.68E+01	26.06			4.68E+01	2.61E+01
M	13	333.99	8.60E+01	24.13			8.60E+01	2.41E+01
m	14	337.79	2.15E+01	20.25			2.15E+01	2.03E+01
M	15	351.78	1.21E+01	7.48			1.21E+01	7.48E+00
m	16	356.34	5.26E+02	47.58			5.26E+02	4.76E+01
	17	377.38	1.24E+01	14.07			1.24E+01	1.41E+01
M	18	384.12	1.26E+02	33.92			1.26E+02	3.39E+01
m	19	387.15	1.90E+02	38.04			1.90E+02	3.80E+01
m	20	391.40	3.88E+01	26.13			3.88E+01	2.61E+01
M	21	416.47	5.17E+01	21.07			5.17E+01	2.11E+01
m	22	421.42	1.65E+01	17.68			1.65E+01	1.77E+01
	23	437.15	1.23E+02	24.18			1.23E+02	2.42E+01
	24	468.45	2.88E+01	12.42			2.88E+01	1.24E+01
	25	570.92	1.10E+01	6.63			1.10E+01	6.63E+00
M	26	584.10	6.23E+00	3.46	1.56E+00	8.45E-01	4.67E+00	3.57E+00
m	27	587.12	8.95E+00	5.66			8.95E+00	5.66E+00
	28	933.89	4.79E+00	6.63			4.79E+00	6.63E+00

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.95	255.12 391.69 *	1.93 61.90	3.28E+01	2.24E+01

0130

Analysis Report for 2001124-03
MW 1A

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
I-129	0.86	29.78 *	57.00	3.14E+01	1.40E+00
		33.60 *	13.20	5.72E+01	8.70E+00
		39.58	7.52		
BA-133	0.99	81.00 *	34.06	5.18E+02	6.44E+01
		302.84 *	18.33	5.31E+02	1.82E+02
		356.01 *	62.05	4.75E+02	7.29E+01
HG-203	0.87	279.19 *	77.30	4.35E+01	2.36E+01
TH-234	0.95	63.29 *	3.80	7.11E+02	1.20E+02
AM-241	0.87	59.54 *	35.90	7.53E+01	1.27E+01

* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.500 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
SN-113	0.953	3.28E+01	2.24E+01	
I-129	0.868	3.21E+01	1.39E+00	
BA-133	0.998	5.01E+02	4.67E+01	
HG-203	0.871	4.35E+01	2.36E+01	
? TH-234	0.950	7.11E+02	1.20E+02	
X NP-237	0.745			
? AM-241	0.870	7.53E+01	1.27E+01	

? = 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 2.000sigma

0131

Analysis Report for 2001124-03

MW 1A

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 12:08:19PM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	20.66	1.16500E-01	24.11	Tol.	MO-93
4	52.88	1.11091E-01	24.15		
m 6	65.86	1.15719E-01	25.03	Sum	
M 8	111.96	3.27560E-01	7.47	Sum	
m 9	116.29	9.47736E-02	19.77	Sum	
m 12	307.15	5.19656E-02	27.86	Sum	
M 13	333.99	9.55842E-02	14.02	Sum	
m 14	337.79	2.39186E-02	47.05	Sum	
M 15	351.78	1.34512E-02	30.91		
17	377.38	1.37860E-02	56.71		
M 18	384.12	1.39867E-01	13.47	Sum	
m 19	387.15	2.11369E-01	10.00	Sum	
M 21	416.47	5.74184E-02	20.39	Sum	
m 22	421.42	1.83311E-02	53.60	Sum	
23	437.15	1.36904E-01	9.81	Sum	
24	468.45	3.19534E-02	21.59		
25	570.92	1.22222E-02	30.15		
M 26	584.10	5.18464E-03	38.21		
m 27	587.12	9.94484E-03	31.60		
28	933.89	5.31746E-03	69.30		

M = First peak in a multiplet region
 m = Other peak in a multiplet region
 F = Fitted singlet
 Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

0132

Hero_ERM_Lab Reports 001423

Analysis Report for 2001124-03

MW 1A

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	6.04E-06	6.04E-06	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.13E+01	2.13E+01	-2.03E+01	1.01E+01
	136.48	10.60	1.85E+02		3.90E+01	8.71E+01
NI-59	6.92	29.80	4.33E-05	4.33E-05	-2.06E-04	1.37E-05
MO-93	16.59	52.90	3.83E-02	3.83E-02	-5.82E-03	1.81E-02
	18.60	10.00	4.87E-01		3.83E-01	2.34E-01
NB-93M	16.57	9.43	2.13E-01	2.13E-01	-3.24E-02	1.01E-01
CD-109	88.03	3.72	2.99E+02	2.99E+02	-9.43E+01	1.42E+02
+ SN-113	255.12	1.93	1.07E+03	4.07E+01	-5.30E+02	4.91E+02
	391.69	*	61.90	4.07E+01	3.28E+01	1.92E+01
SN-119M	23.87	16.10	9.04E-01	7.81E-01	-9.93E-01	4.31E-01
	25.10	22.70	7.81E-01		-6.12E+00	3.72E-01
+ I-129	29.78	*	57.00	2.04E+00	3.14E+01	1.00E+00
	33.60	*	13.20	1.47E+01	5.72E+01	7.24E+00
	39.58	7.52	1.31E+01		-6.42E+01	6.17E+00
+ BA-133	81.00	*	34.06	3.58E+01	5.18E+02	1.96E+01
	302.84	*	18.33		5.31E+02	8.33E+01
	356.01	*	62.05		4.75E+02	1.67E+01
CE-139	165.85	80.35	2.98E+01	2.98E+01	-1.58E+01	1.40E+01
CE-144	133.54	10.80	1.77E+02	1.77E+02	5.26E+01	8.32E+01
+ HG-203	279.19	*	77.30	2.79E+01	4.35E+01	1.29E+01
PB-210	46.50	4.25	4.14E+01	4.14E+01	2.97E+01	1.96E+01
TH-231	25.64	14.70	1.33E+00	1.33E+00	-1.04E+01	6.32E-01
	84.21	6.40	3.47E+02		3.48E+01	1.70E+02
PA-234M	9.89	89.00	1.11E-03	1.11E-03	1.15E-03	5.24E-04
	21.72	64.90	1.73E-01		2.20E-01	8.31E-02
	37.93	23.75	6.91E+00		1.55E+01	3.36E+00
	131.42	20.40	9.06E+01		3.47E+01	4.26E+01
+ TH-234	63.29	*	3.80	2.47E+02	7.11E+02	1.20E+02
NP-237	29.37	*	14.00	8.32E+00	1.28E+02	4.09E+00
	86.50	12.60	8.95E+01		-5.36E+00	4.27E+01
U-237	97.08	16.30	8.33E+01	5.56E+01	2.34E+00	3.96E+01
	101.07	26.30	5.56E+01		-2.08E+01	2.64E+01
	114.00	12.30	2.74E+02		9.29E+02	1.33E+02
	208.01	22.00	1.28E+02		5.95E+01	6.03E+01
+ AM-241	59.54	*	35.90	2.61E+01	7.53E+01	1.27E+01
AM-243	74.67	66.00	1.15E+01	1.15E+01	-5.36E+00	5.45E+00

- + = Nuclide identified during the nuclide identification
 * = Energy line found in the spectrum
 > = MDA value not calculated
 @ = Half-life too short to be able to perform the decay correction



KP
2/5/20

Analysis Report for 2001124-04
MW 8B

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-04
 Sample Description : MW 8B
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:52:15AM
 Acquisition Started : 2/5/2020 12:04:52PM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.2 seconds

Dead Time : 0.02 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 29 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/19/2019
 Efficiency Calibration Used Done On : 9/14/2019
 Efficiency Calibration Description :

Sample Number : 94134

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 12:19:55PM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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Analysis Report for 2001124-04

MW 8B

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.26	35 -	40	35.59	3.42E+02	64.65	2.39E+02	2.51
	2	52.86	50 -	57	53.17	4.27E+01	35.55	1.79E+02	2.42
M	3	61.83	58 -	73	62.13	1.69E+02	33.38	8.65E+01	1.74
m	4	65.78	58 -	73	66.08	1.02E+02	31.02	7.90E+01	1.75
	5	80.97	76 -	85	81.25	6.47E+02	66.92	2.70E+02	1.47
M	6	111.74	107 -	122	111.99	1.64E+02	30.68	5.69E+01	1.73
m	7	115.79	107 -	122	116.03	3.83E+01	24.11	5.25E+01	1.74
	8	260.53	257 -	264	260.62	1.98E+01	20.59	5.24E+01	3.14
	9	275.88	271 -	280	275.95	5.90E+01	25.61	6.00E+01	1.52
	10	292.39	288 -	295	292.44	1.39E+01	17.09	3.82E+01	1.11
M	11	302.88	299 -	314	302.92	1.21E+02	24.73	1.81E+01	1.58
m	12	306.89	299 -	314	306.93	2.07E+01	14.55	1.27E+01	1.58
	13	333.22	328 -	337	333.23	5.71E+01	26.72	6.78E+01	1.73
	14	355.84	351 -	360	355.83	4.41E+02	44.80	3.37E+01	1.52
	15	364.06	361 -	367	364.04	1.46E+01	10.81	1.09E+01	2.02
M	16	384.20	380 -	395	384.15	7.90E+01	25.65	2.44E+01	1.67
m	17	390.90	380 -	395	390.85	3.56E+01	17.15	1.23E+01	1.68
	18	415.15	409 -	420	415.07	5.05E+01	23.15	4.11E+01	1.94
	19	436.75	433 -	440	436.65	8.74E+01	19.90	7.21E+00	1.92
	20	455.65	452 -	458	455.53	6.38E+00	6.65	3.25E+00	1.28
	21	467.24	464 -	470	467.11	1.66E+01	12.04	1.48E+01	2.26

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 12:19:55PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093996.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	35.26	3.42E+02	64.65			3.42E+02	6.46E+01
	2	52.86	4.27E+01	35.55			4.27E+01	3.56E+01
M	3	61.83	1.69E+02	33.38	1.89E+00	8.55E-01	1.67E+02	3.34E+01
m	4	65.78	1.02E+02	31.02	2.48E+00	9.80E-01	9.96E+01	3.10E+01
	5	80.97	6.47E+02	66.92			6.47E+02	6.69E+01
M	6	111.74	1.64E+02	30.68			1.64E+02	3.07E+01
m	7	115.79	3.83E+01	24.11			3.83E+01	2.41E+01
	8	260.53	1.98E+01	20.59			1.98E+01	2.06E+01

0135

Analysis Report for 2001124-04

MW 8B

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	9	275.88	5.90E+01	25.61		5.90E+01	2.56E+01
	10	292.39	1.39E+01	17.09		1.39E+01	1.71E+01
M	11	302.88	1.21E+02	24.73		1.21E+02	2.47E+01
m	12	306.89	2.07E+01	14.55		2.07E+01	1.46E+01
	13	333.22	5.71E+01	26.72		5.71E+01	2.67E+01
	14	355.84	4.41E+02	44.80		4.41E+02	4.48E+01
	15	364.06	1.46E+01	10.81		1.46E+01	1.08E+01
M	16	384.20	7.90E+01	25.65		7.90E+01	2.57E+01
m	17	390.90	3.56E+01	17.15		3.56E+01	1.71E+01
	18	415.15	5.05E+01	23.15		5.05E+01	2.32E+01
	19	436.75	8.74E+01	19.90		8.74E+01	1.99E+01
	20	455.65	6.38E+00	6.65		6.38E+00	6.65E+00
	21	467.24	1.66E+01	12.04		1.66E+01	1.20E+01

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.95	255.12	1.93		
		391.69 *	61.90	2.34E+01	1.15E+01
BA-133	1.00	81.00 *	34.06	3.93E+02	5.69E+01
		302.84 *	18.33	4.29E+02	1.57E+02
		356.01 *	62.05	3.54E+02	5.34E+01
TH-234	0.94	63.29 *	3.80	3.44E+02	7.00E+01
AM-241	0.87	59.54 *	35.90	3.64E+01	7.41E+00

0136

Analysis Report for 2001124-04

MW 8B

* = Energy line found in the spectrum.
 - = Manually added nuclide.
 ? = Manually edited nuclide.
 @ = Energy line not used for Weighted Mean Activity
 Energy Tolerance : 2.500 keV
 Nuclide confidence index threshold = 0.30
 Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

<i>Nuclide Name</i>	<i>Nuclide Id Confidence</i>	<i>Wt mean Activity (pCi/units)</i>	<i>Wt mean Activity Uncertainty</i>	<i>Comments</i>
SN-113	0.950	2.34E+01	1.15E+01	
BA-133	1.000	3.75E+02	3.78E+01	
? TH-234	0.947	3.44E+02	7.00E+01	
? AM-241	0.875	3.64E+01	7.41E+00	

? = 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 2.000sigma

0137

Analysis Report for 2001124-04

MW 8B

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 12:19:55PM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	35.26	3.80534E-01	9.44	Tol.	I-129
2	52.86	4.74411E-02	41.63		
m 4	65.78	1.10626E-01	15.59		
M 6	111.74	1.82443E-01	9.34	Tol.	U-237
m 7	115.79	4.25312E-02	31.50	Tol.	U-237
8	260.53	2.20169E-02	51.96		
9	275.88	6.55306E-02	21.71		
10	292.39	1.54545E-02	61.43		
m 12	306.89	2.30514E-02	35.07		
13	333.22	6.34676E-02	23.39		
15	364.06	1.61944E-02	37.07	Sum	
M 16	384.20	8.77643E-02	16.24	Sum	
18	415.15	5.60720E-02	22.94		
19	436.75	9.71062E-02	11.38	Sum	
20	455.65	7.08333E-03	52.17		
21	467.24	1.84259E-02	36.31		

M = First peak in a multiplet region
 m = Other peak in a multiplet region
 F = Fitted singlet
 Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

0138

Analysis Report for 2001124-04

MW 8B

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	4.58E-09	4.58E-09	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.34E+01	2.34E+01	2.59E+00	1.08E+01
	136.48	10.60	2.13E+02		2.00E+01	9.81E+01
NI-59	6.92	29.80	2.55E-08	2.55E-08	0.00E+00	0.00E+00
MO-93	16.59	52.90	9.74E-05	9.74E-05	0.00E+00	0.00E+00
	18.60	10.00	1.34E-03		0.00E+00	0.00E+00
NB-93M	16.57	9.43	5.41E-04	5.41E-04	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.72E+02	2.72E+02	-2.78E+01	1.27E+02
+ SN-113	255.12	1.93	1.18E+03	2.69E+01	6.28E+02	5.37E+02
	391.69	*	61.90		2.34E+01	1.26E+01
SN-119M	23.87	16.10	5.80E-03	5.80E-03	0.00E+00	0.00E+00
	25.10	22.70	5.92E-03		0.00E+00	0.00E+00
I-129	29.78	57.00	4.67E-01	4.67E-01	1.87E+00	2.30E-01
	33.60	13.20	3.85E+00		-6.41E+00	1.89E+00
	39.58	7.52	3.74E+00		-2.41E-01	1.71E+00
+ BA-133	81.00	*	34.06	2.27E+01	3.93E+02	2.17E+01
	302.84	*	18.33		4.29E+02	6.43E+01
	356.01	*	62.05		3.54E+02	1.03E+01
CE-139	165.85	80.35	3.59E+01	3.59E+01	1.49E+01	1.66E+01
CE-144	133.54	10.80	2.23E+02	2.23E+02	1.96E+02	1.03E+02
HG-203	279.19	77.30	2.79E+01	2.79E+01	-3.80E+01	1.27E+01
PB-210	46.50	4.25	2.01E+01	2.01E+01	8.05E+00	9.37E+00
TH-231	25.64	14.70	1.06E-02	1.06E-02	0.00E+00	0.00E+00
	84.21	6.40	2.82E+02		-4.01E+01	1.36E+02
PA-234M	9.89	89.00	4.30E-07	4.30E-07	0.00E+00	0.00E+00
	21.72	64.90	7.08E-04		0.00E+00	0.00E+00
	37.93	23.75	2.22E+00		3.56E+00	1.07E+00
	131.42	20.40	1.06E+02		-4.55E+01	4.88E+01
+ TH-234	63.29	*	3.80	1.68E+02	3.44E+02	8.11E+01
NP-237	29.37	14.00	1.73E+00	1.73E+00	6.97E+00	8.53E-01
	86.50	12.60	7.94E+01		-4.09E+01	3.70E+01
U-237	97.08	16.30	8.00E+01	5.51E+01	5.49E+01	3.71E+01
	101.07	26.30	5.51E+01		7.35E-01	2.56E+01
	114.00	12.30	2.80E+02		4.52E+02	1.35E+02
	208.01	22.00	1.35E+02		1.99E+01	6.22E+01
+ AM-241	59.54	*	35.90	1.78E+01	3.64E+01	8.59E+00
AM-243	74.67	66.00	8.86E+00	8.86E+00	7.00E-01	4.11E+00

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

KP
2/5/20

Analysis Report for 2001124-05
MW 1A

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-05
 Sample Description : MW 1A
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:52:23AM
 Acquisition Started : 2/5/2020 12:08:36PM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE3
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 901.9 seconds

Dead Time : 0.21 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 10 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/19/2019
 Efficiency Calibration Used Done On : 10/19/2019
 Efficiency Calibration Description :

Sample Number : 94135

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 12:23:42PM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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0140

Analysis Report for 2001124-05

MW 1A

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.80	18 -	23	21.22	8.82E+01	41.98	2.82E+02	2.02
M	2	30.96	27 -	39	31.37	2.14E+03	99.48	2.74E+02	2.05
m	3	35.26	27 -	39	35.67	5.39E+02	63.09	1.89E+02	2.11
M	4	61.96	58 -	70	62.36	2.85E+02	53.54	3.17E+02	2.42
m	5	66.34	58 -	70	66.73	1.10E+02	39.78	2.22E+02	1.83
	6	81.16	77 -	87	81.54	9.05E+02	79.92	3.69E+02	2.30
	7	111.51	106 -	115	111.87	2.15E+02	60.94	4.01E+02	2.45
	8	215.16	210 -	221	215.46	5.19E+01	37.47	1.48E+02	9.00
	9	227.32	222 -	234	227.61	5.88E+01	36.57	1.28E+02	10.51
	10	276.47	273 -	281	276.74	5.34E+01	26.69	7.71E+01	2.11
M	11	303.09	299 -	312	303.34	1.43E+02	27.96	3.70E+01	2.01
m	12	307.55	299 -	312	307.79	2.42E+01	25.05	6.38E+01	2.27
	13	334.68	329 -	342	334.91	9.66E+01	36.54	1.07E+02	2.61
M	14	351.86	350 -	360	352.07	1.10E+01	11.55	2.45E+01	2.30
m	15	356.39	350 -	360	356.60	5.14E+02	46.20	1.98E+01	2.14
M	16	384.21	381 -	390	384.40	9.19E+01	37.40	1.14E+02	2.33
m	17	387.41	381 -	390	387.60	1.39E+02	37.36	1.63E+02	1.99
M	18	414.23	410 -	426	414.41	3.34E+01	15.64	1.24E+01	2.35
m	19	418.64	410 -	426	418.81	4.11E+01	19.92	1.18E+01	2.84
	20	437.18	432 -	443	437.34	1.03E+02	22.63	1.31E+01	2.52
M	21	463.85	463 -	472	464.00	5.92E+00	5.10	4.39E+00	1.97
m	22	467.81	463 -	472	467.95	1.39E+01	12.41	1.90E+01	2.17
	23	627.79	625 -	630	627.83	6.00E+00	4.90	0.00E+00	2.74

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 12:23:42PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093997.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.80	8.82E+01	41.98			8.82E+01	4.20E+01
M	2	30.96	2.14E+03	99.48			2.14E+03	9.95E+01
m	3	35.26	5.39E+02	63.09			5.39E+02	6.31E+01
M	4	61.96	2.85E+02	53.54	1.19E+01	2.85E+00	2.73E+02	5.36E+01
m	5	66.34	1.10E+02	39.78			1.10E+02	3.98E+01
	6	81.16	9.05E+02	79.92			9.05E+02	7.99E+01

0141

Analysis Report for 2001124-05

MW 1A

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	7	111.51	2.15E+02	60.94		2.15E+02	6.09E+01
	8	215.16	5.19E+01	37.47		5.19E+01	3.75E+01
	9	227.32	5.88E+01	36.57		5.88E+01	3.66E+01
	10	276.47	5.34E+01	26.69		5.34E+01	2.67E+01
M	11	303.09	1.43E+02	27.96		1.43E+02	2.80E+01
m	12	307.55	2.42E+01	25.05		2.42E+01	2.50E+01
	13	334.68	9.66E+01	36.54		9.66E+01	3.65E+01
M	14	351.86	1.10E+01	11.55		1.10E+01	1.16E+01
m	15	356.39	5.14E+02	46.20		5.14E+02	4.62E+01
M	16	384.21	9.19E+01	37.40		9.19E+01	3.74E+01
m	17	387.41	1.39E+02	37.36		1.39E+02	3.74E+01
M	18	414.23	3.34E+01	15.64		3.34E+01	1.56E+01
m	19	418.64	4.11E+01	19.92		4.11E+01	1.99E+01
	20	437.18	1.03E+02	22.63		1.03E+02	2.26E+01
M	21	463.85	5.92E+00	5.10		5.92E+00	5.10E+00
m	22	467.81	1.39E+01	12.41		1.39E+01	1.24E+01
	23	627.79	6.00E+00	4.90		6.00E+00	4.90E+00

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
I-129	0.86	29.78	* 57.00	2.91E+01	1.36E+00
		33.60	* 13.20	5.32E+01	6.24E+00
		39.58	7.52		
BA-133	0.99	81.00	* 34.06	4.48E+02	5.90E+01
		302.84	* 18.33	4.71E+02	1.64E+02
		356.01	* 62.05	4.64E+02	7.11E+01
TH-234	0.95	63.29	* 3.80	6.14E+02	1.24E+02
AM-241	0.86	59.54	* 35.90	6.50E+01	1.32E+01

0142

Analysis Report for 2001124-05

MW 1A

* = Energy line found in the spectrum.
 - = Manually added nuclide.
 ? = Manually edited nuclide.
 @ = Energy line not used for Weighted Mean Activity
 Energy Tolerance : 2.500 keV
 Nuclide confidence index threshold = 0.30
 Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
I-129	0.867	3.02E+01	1.33E+00	
BA-133	0.998	4.56E+02	4.38E+01	
? TH-234	0.956	6.14E+02	1.24E+02	
X NP-237	0.745			
? AM-241	0.860	6.50E+01	1.32E+01	

? = 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 2.000sigma

0143

Analysis Report for 2001124-05

MW 1A

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 12:23:42PM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	20.80	9.80107E-02	23.79	Tol.	PA-234M
m	5	66.34	1.22086E-01	18.10	Sum
	7	111.51	2.39172E-01	14.16	Sum
	8	215.16	5.76720E-02	36.09	
	9	227.32	6.53433E-02	31.09	
	10	276.47	5.93841E-02	24.97	
m	12	307.55	2.68622E-02	51.81	
	13	334.68	1.07300E-01	18.92	Sum
M	14	351.86	1.21986E-02	52.62	
M	16	384.21	1.02079E-01	20.36	Sum
m	17	387.41	1.53931E-01	13.48	Sum
M	18	414.23	3.70997E-02	23.43	
m	19	418.64	4.56517E-02	24.24	Sum
	20	437.18	1.14950E-01	10.94	Sum
M	21	463.85	6.57548E-03	43.08	
m	22	467.81	1.54979E-02	44.49	
	23	627.79	6.66667E-03	40.82	

M = First peak in a multiplet region
 m = Other peak in a multiplet region
 F = Fitted singlet
 Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

0144

Analysis Report for 2001124-05

MW 1A

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	6.04E-06	6.04E-06	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.04E+01	2.04E+01	-1.48E+01	9.64E+00
	136.48	10.60	1.91E+02		-5.47E+00	9.00E+01
NI-59	6.92	29.80	1.59E-05	1.59E-05	0.00E+00	0.00E+00
MO-93	16.59	52.90	4.03E-02	4.03E-02	-5.32E-03	1.91E-02
	18.60	10.00	4.54E-01		-3.05E-02	2.17E-01
NB-93M	16.57	9.43	2.24E-01	2.24E-01	-2.96E-02	1.07E-01
CD-109	88.03	3.72	3.14E+02	3.14E+02	-8.78E+01	1.49E+02
SN-113	255.12	1.93	1.06E+03	4.04E+01	-5.02E+01	4.85E+02
	391.69	61.90	4.04E+01		2.20E+01	1.91E+01
SN-119M	23.87	16.10	9.83E-01	8.18E-01	-2.84E-01	4.71E-01
	25.10	22.70	8.18E-01		-2.54E-01	3.90E-01
+ I-129	29.78	* 57.00	1.47E+00	1.47E+00	2.91E+01	7.15E-01
	33.60	* 13.20	1.04E+01		5.32E+01	5.09E+00
	39.58	7.52	1.20E+01		-3.16E-01	5.65E+00
+ BA-133	81.00	* 34.06	4.42E+01	2.45E+01	4.48E+02	2.14E+01
	302.84	* 18.33	1.59E+02		4.71E+02	7.48E+01
	356.01	* 62.05	2.45E+01		4.64E+02	1.10E+01
CE-139	165.85	80.35	2.87E+01	2.87E+01	-1.16E+01	1.35E+01
CE-144	133.54	10.80	1.84E+02	1.84E+02	5.06E+01	8.68E+01
HG-203	279.19	77.30	3.52E+01	3.52E+01	3.31E+01	1.65E+01
PB-210	46.50	4.25	3.87E+01	3.87E+01	1.44E+01	1.82E+01
TH-231	25.64	14.70	1.39E+00	1.39E+00	-4.31E-01	6.64E-01
	84.21	6.40	3.29E+02		7.10E+02	1.61E+02
PA-234M	9.89	89.00	1.16E-03	1.16E-03	1.32E-03	5.52E-04
	21.72	64.90	1.68E-01		1.36E-01	8.08E-02
	37.93	23.75	6.81E+00		1.70E+01	3.31E+00
	131.42	20.40	9.62E+01		1.50E+01	4.55E+01
+ TH-234	63.29	* 3.80	2.54E+02	2.54E+02	6.14E+02	1.24E+02
NP-237	29.37	* 14.00	5.97E+00	5.97E+00	1.18E+02	2.91E+00
	86.50	12.60	9.24E+01		-8.08E+00	4.41E+01
U-237	97.08	16.30	8.40E+01	5.82E+01	-4.80E+01	3.99E+01
	101.07	26.30	5.82E+01		3.39E+01	2.77E+01
	114.00	12.30	2.47E+02		4.31E+01	1.20E+02
	208.01	22.00	1.20E+02		4.31E+01	5.62E+01
+ AM-241	59.54	* 35.90	2.69E+01	2.69E+01	6.50E+01	1.31E+01
AM-243	74.67	66.00	1.15E+01	1.15E+01	-2.69E+00	5.49E+00

- + = Nuclide identified during the nuclide identification
 * = Energy line found in the spectrum
 > = MDA value not calculated
 @ = Half-life too short to be able to perform the decay correction

0145

Analysis Report for 2001124-06
MW 1B

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-06
 Sample Description : MW 1B
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:52:32AM
 Acquisition Started : 2/5/2020 12:20:13PM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.2 seconds

Dead Time : 0.03 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 29 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/19/2019
 Efficiency Calibration Used Done On : 9/14/2019
 Efficiency Calibration Description :

Sample Number : 94136

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 12:35:16PM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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0146

Analysis Report for 2001124-06

MW 1B

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	35.29	35 -	39	35.63	4.45E+02	66.83	2.97E+02	2.53
2	46.43	44 -	49	46.75	2.57E+01	24.08	9.46E+01	2.27
3	52.74	50 -	55	53.06	7.54E+01	29.05	1.09E+02	2.19
M 4	61.86	60 -	68	62.16	2.13E+02	38.63	1.40E+02	1.74
m 5	65.79	60 -	68	66.08	1.09E+02	36.17	1.46E+02	1.75
6	80.92	76 -	85	81.20	9.16E+02	72.62	2.30E+02	1.57
M 7	89.84	89 -	97	90.11	1.34E+01	13.08	4.20E+01	1.25
M 8	111.67	107 -	119	111.92	1.64E+02	34.51	1.10E+02	1.57
m 9	115.56	107 -	119	115.80	3.09E+01	27.48	1.03E+02	1.58
10	276.70	272 -	282	276.77	6.85E+01	31.28	9.50E+01	2.02
M 11	302.70	299 -	310	302.74	1.93E+02	29.95	3.12E+01	1.65
m 12	306.73	299 -	310	306.77	1.49E+01	17.80	4.66E+01	1.92
13	318.36	311 -	330	318.38	3.14E+01	35.94	8.32E+01	16.52
M 14	333.37	330 -	343	333.38	6.50E+01	18.92	1.20E+01	2.15
m 15	337.88	330 -	343	337.89	3.41E+01	16.43	2.44E+01	2.16
16	355.82	351 -	359	355.81	6.27E+02	52.90	4.50E+01	1.64
17	376.16	373 -	379	376.12	1.41E+01	15.17	3.19E+01	1.80
M 18	384.20	380 -	393	384.15	1.18E+02	28.82	2.72E+01	1.67
m 19	390.90	380 -	393	390.85	3.88E+01	19.35	2.09E+01	1.68
M 20	414.33	411 -	421	414.25	2.60E+01	13.59	5.80E+00	2.26
m 21	418.36	411 -	421	418.28	2.19E+01	14.45	1.61E+01	2.27
22	436.65	433 -	442	436.55	8.80E+01	25.14	4.00E+01	1.89
23	467.25	463 -	471	467.12	1.32E+01	10.42	7.65E+00	3.68
24	511.78	508 -	518	511.61	3.80E+01	12.33	0.00E+00	2.88
25	705.36	703 -	707	705.00	4.50E+00	6.36	5.00E+00	2.25

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 12:35:16PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093996.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
1	35.29	4.45E+02	66.83			4.45E+02	6.68E+01
2	46.43	2.57E+01	24.08	6.89E+00	1.99E+00	1.88E+01	2.42E+01
3	52.74	7.54E+01	29.05			7.54E+01	2.91E+01
M 4	61.86	2.13E+02	38.63	1.89E+00	8.55E-01	2.12E+02	3.86E+01

0147

Analysis Report for 2001124-06

MW 1B

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	5	65.79	1.09E+02	36.17	2.48E+00	9.80E-01	1.06E+02	3.62E+01
	6	80.92	9.16E+02	72.62			9.16E+02	7.26E+01
M	7	89.84	1.34E+01	13.08			1.34E+01	1.31E+01
M	8	111.67	1.64E+02	34.51			1.64E+02	3.45E+01
m	9	115.56	3.09E+01	27.48			3.09E+01	2.75E+01
	10	276.70	6.85E+01	31.28			6.85E+01	3.13E+01
M	11	302.70	1.93E+02	29.95			1.93E+02	3.00E+01
m	12	306.73	1.49E+01	17.80			1.49E+01	1.78E+01
	13	318.36	3.14E+01	35.94			3.14E+01	3.59E+01
M	14	333.37	6.50E+01	18.92			6.50E+01	1.89E+01
m	15	337.88	3.41E+01	16.43	2.21E+00	1.22E+00	3.19E+01	1.65E+01
	16	355.82	6.27E+02	52.90			6.27E+02	5.29E+01
	17	376.16	1.41E+01	15.17			1.41E+01	1.52E+01
M	18	384.20	1.18E+02	28.82			1.18E+02	2.88E+01
m	19	390.90	3.88E+01	19.35			3.88E+01	1.94E+01
M	20	414.33	2.60E+01	13.59			2.60E+01	1.36E+01
m	21	418.36	2.19E+01	14.45			2.19E+01	1.44E+01
	22	436.65	8.80E+01	25.14			8.80E+01	2.51E+01
	23	467.25	1.32E+01	10.42			1.32E+01	1.04E+01
	24	511.78	3.80E+01	12.33	1.82E+01	1.22E+00	1.98E+01	1.24E+01
	25	705.36	4.50E+00	6.36			4.50E+00	6.36E+00

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
CD-109	0.91	88.03	*	3.72	1.01E+02
SN-113	0.95	255.12	*	1.93	9.99E+01
		391.69	*	61.90	2.56E+01
BA-133	0.99	81.00	*	34.06	1.30E+01
		302.84	*	18.33	5.55E+02
		356.01	*	62.05	7.14E+01
HG-203	0.85	279.19	*	77.30	2.34E+02
PB-210	1.00	46.50	*	4.25	5.02E+02
					7.04E+01
					3.70E+01
					1.21E+01

0148

Analysis Report for 2001124-06
MW 1B

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
TH-234	0.94	63.29	*	3.80	4.37E+02	8.15E+01
AM-241	0.87	59.54	*	35.90	4.62E+01	8.63E+00

* = Energy line found in the spectrum.
 - = Manually added nuclide.
 ? = Manually edited nuclide.
 @ = Energy line not used for Weighted Mean Activity
 Energy Tolerance : 2.500 keV
 Nuclide confidence index threshold = 0.30
 Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
CD-109	0.919	1.01E+02	9.99E+01	
SN-113	0.950	2.56E+01	1.30E+01	
BA-133	0.999	5.35E+02	4.90E+01	
HG-203	0.854	6.47E+01	3.70E+01	
PB-210	1.000	9.40E+00	1.21E+01	
? TH-234	0.949	4.37E+02	8.15E+01	
? AM-241	0.871	4.62E+01	8.63E+00	

? = 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 2.000sigma

0149

Analysis Report for 2001124-06
MW 1B

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 12:35:16PM
Peak Locate From Channel : 1
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	35.29	4.93916E-01	7.52	Tol.	I-129
3	52.74	8.37607E-02	19.27		
m 5	65.79	1.17859E-01	17.06	Tol.	TH-234
M 8	111.67	1.82199E-01	10.52		
m 9	115.56	3.43131E-02	44.49		
m 12	306.73	1.65705E-02	59.69		
13	318.36	3.48706E-02	57.27		
M 14	333.37	7.22160E-02	14.56		
m 15	337.88	3.54442E-02	25.83	Sum	
17	376.16	1.56111E-02	54.00		
M 18	384.20	1.31231E-01	12.20	Sum	
M 20	414.33	2.89149E-02	26.12		
m 21	418.36	2.43472E-02	32.97	Sum	
22	436.65	9.77778E-02	14.28	Sum	
23	467.25	1.46405E-02	39.53		
24	511.78	2.19634E-02	31.34		
25	705.36	5.00000E-03	70.71		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

0150

Analysis Report for 2001124-06

MW 1B

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	4.58E-09	4.58E-09	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.38E+01	2.38E+01	1.44E+00	1.10E+01
	136.48	10.60	2.32E+02		3.63E+01	1.07E+02
NI-59	6.92	29.80	2.55E-08	2.55E-08	0.00E+00	0.00E+00
MO-93	16.59	52.90	9.74E-05	9.74E-05	0.00E+00	0.00E+00
	18.60	10.00	1.34E-03		0.00E+00	0.00E+00
NB-93M	16.57	9.43	5.41E-04	5.41E-04	0.00E+00	0.00E+00
+ CD-109	88.03	*	3.72	4.21E+02	4.21E+02	1.01E+02
+ SN-113	255.12		1.93	1.17E+03	2.68E+01	3.74E+02
	391.69	*	61.90	2.68E+01		2.56E+01
SN-119M	23.87	16.10	5.80E-03	5.80E-03	0.00E+00	0.00E+00
	25.10	22.70	5.92E-03		0.00E+00	0.00E+00
I-129	29.78	57.00	5.32E-01	5.32E-01	2.17E+00	2.62E-01
	33.60	13.20	4.52E+00		-4.94E+00	2.23E+00
	39.58	7.52	4.13E+00		-1.17E+00	1.90E+00
+ BA-133	81.00	*	34.06	4.16E+01	2.47E+01	5.55E+02
	302.84	*	18.33	1.44E+02		6.85E+02
	356.01	*	62.05	2.47E+01		5.02E+02
CE-139	165.85	80.35	3.94E+01	3.94E+01	-1.72E+01	1.83E+01
CE-144	133.54	10.80	2.21E+02	2.21E+02	-4.89E+01	1.02E+02
+ HG-203	279.19	*	77.30	4.38E+01	4.38E+01	6.47E+01
+ PB-210	46.50	*	4.25	1.99E+01	1.99E+01	9.40E+00
TH-231	25.64	14.70	1.06E-02	1.06E-02	0.00E+00	0.00E+00
	84.21	6.40	3.22E+02		3.54E+02	1.56E+02
PA-234M	9.89	89.00	4.30E-07	4.30E-07	0.00E+00	0.00E+00
	21.72	64.90	7.08E-04		0.00E+00	0.00E+00
	37.93	23.75	2.59E+00		4.96E+00	1.25E+00
	131.42	20.40	1.11E+02		-2.49E+00	5.14E+01
+ TH-234	63.29	*	3.80	1.35E+02	1.35E+02	4.37E+02
NP-237	29.37	14.00	1.98E+00	1.98E+00	8.05E+00	9.74E-01
	86.50	12.60	7.27E+01		1.81E+00	3.36E+01
U-237	97.08	16.30	8.96E+01	5.09E+01	1.42E+01	4.19E+01
	101.07	26.30	5.09E+01		-3.41E+01	2.35E+01
	114.00	12.30	2.93E+02		4.36E+02	1.41E+02
	208.01	22.00	1.37E+02		-1.21E+01	6.29E+01
+ AM-241	59.54	*	35.90	1.42E+01	1.42E+01	4.62E+01
AM-243	74.67	66.00	9.09E+00	9.09E+00	-1.17E+00	4.22E+00

- + = Nuclide identified during the nuclide identification
 * = Energy line found in the spectrum
 > = MDA value not calculated
 @ = Half-life too short to be able to perform the decay correction

0151



KP
2/5/20

Analysis Report for 2001124-07
MW 6A

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-07
 Sample Description : MW 6A
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:52:41AM
 Acquisition Started : 2/5/2020 12:24:10PM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE3
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 901.8 seconds

Dead Time : 0.20 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 10 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/19/2019
 Efficiency Calibration Used Done On : 10/19/2019
 Efficiency Calibration Description :

Sample Number : 94138

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 12:39:15PM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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0152

Analysis Report for 2001124-07

MW 6A

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.55	18 -	24	20.97	7.80E+01	40.41	2.44E+02	2.75
M	2	30.93	26 -	44	31.35	1.98E+03	95.97	2.56E+02	1.97
m	3	35.17	26 -	44	35.58	4.58E+02	79.46	2.21E+02	2.13
	4	52.26	50 -	56	52.66	6.51E+01	34.64	1.76E+02	3.65
M	5	61.95	57 -	75	62.35	1.95E+02	44.71	2.19E+02	2.42
m	6	65.99	57 -	75	66.38	9.81E+01	42.93	2.00E+02	2.19
	7	81.12	76 -	88	81.50	8.12E+02	78.61	3.45E+02	2.22
	8	102.73	100 -	106	103.10	3.31E+01	31.61	1.58E+02	1.81
	9	112.53	107 -	119	112.89	2.39E+02	61.47	3.34E+02	2.44
	10	153.75	151 -	157	154.09	2.90E+01	22.83	7.40E+01	3.00
	11	160.89	158 -	165	161.22	3.14E+01	29.60	1.27E+02	3.17
	12	187.92	184 -	193	188.23	3.70E+01	33.65	1.42E+02	2.09
	13	255.19	252 -	260	255.47	2.63E+01	19.24	4.14E+01	3.07
	14	276.80	273 -	281	277.07	5.80E+01	25.29	6.20E+01	1.73
M	15	294.94	293 -	316	295.19	9.04E+00	10.58	2.73E+01	2.06
m	16	302.94	293 -	316	303.19	1.19E+02	25.73	3.21E+01	2.06
m	17	307.57	293 -	316	307.81	2.60E+01	16.91	2.20E+01	2.06
	18	334.98	328 -	342	335.21	7.90E+01	28.53	5.21E+01	3.50
	19	356.25	351 -	361	356.46	4.26E+02	44.63	3.84E+01	2.23
M	20	384.80	374 -	396	385.00	7.31E+01	26.76	1.41E+01	1.92
m	21	391.40	374 -	396	391.60	2.75E+01	21.93	8.07E+00	2.33
	22	415.51	412 -	420	415.69	2.58E+01	15.91	2.43E+01	2.36
	23	422.24	420 -	425	422.41	9.00E+00	11.22	1.80E+01	1.34
	24	437.26	433 -	443	437.42	7.47E+01	18.50	6.50E+00	2.22
	25	468.32	464 -	473	468.46	1.23E+01	9.22	5.33E+00	1.16
	26	693.82	690 -	696	693.82	6.44E+00	6.65	3.13E+00	1.51

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.00sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 12:39:15PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093997.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.55	7.80E+01	40.41			7.80E+01	4.04E+01
M	2	30.93	1.98E+03	95.97			1.98E+03	9.60E+01
m	3	35.17	4.58E+02	79.46			4.58E+02	7.95E+01

0153

Analysis Report for 2001124-07

MW 6A

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	4	52.26	6.51E+01	34.64			6.51E+01	3.46E+01
M	5	61.95	1.95E+02	44.71	1.19E+01	2.85E+00	1.83E+02	4.48E+01
m	6	65.99	9.81E+01	42.93			9.81E+01	4.29E+01
	7	81.12	8.12E+02	78.61			8.12E+02	7.86E+01
	8	102.73	3.31E+01	31.61			3.31E+01	3.16E+01
	9	112.53	2.39E+02	61.47			2.39E+02	6.15E+01
	10	153.75	2.90E+01	22.83			2.90E+01	2.28E+01
	11	160.89	3.14E+01	29.60			3.14E+01	2.96E+01
	12	187.92	3.70E+01	33.65	8.19E+00	1.65E+00	2.88E+01	3.37E+01
	13	255.19	2.63E+01	19.24			2.63E+01	1.92E+01
	14	276.80	5.80E+01	25.29			5.80E+01	2.53E+01
M	15	294.94	9.04E+00	10.58			9.04E+00	1.06E+01
m	16	302.94	1.19E+02	25.73			1.19E+02	2.57E+01
m	17	307.57	2.60E+01	16.91			2.60E+01	1.69E+01
	18	334.98	7.90E+01	28.53			7.90E+01	2.85E+01
	19	356.25	4.26E+02	44.63			4.26E+02	4.46E+01
M	20	384.80	7.31E+01	26.76			7.31E+01	2.68E+01
m	21	391.40	2.75E+01	21.93			2.75E+01	2.19E+01
	22	415.51	2.58E+01	15.91			2.58E+01	1.59E+01
	23	422.24	9.00E+00	11.22			9.00E+00	1.12E+01
	24	437.26	7.47E+01	18.50			7.47E+01	1.85E+01
	25	468.32	1.23E+01	9.22			1.23E+01	9.22E+00
	26	693.82	6.44E+00	6.65			6.44E+00	6.65E+00

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.99	255.12 *	1.93	8.47E+02	6.73E+02
		391.69 *	61.90	2.33E+01	1.87E+01
I-129	0.86	29.78 *	57.00	2.68E+01	1.30E+00
		33.60 *	13.20	4.47E+01	7.78E+00
		39.58	7.52		
BA-133	0.99	81.00 *	34.06	4.02E+02	5.52E+01

0154

Analysis Report for 2001124-07
MW 6A

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
BA-133	0.99	302.84 *	18.33	3.92E+02	1.42E+02
		356.01 *	62.05	3.84E+02	6.24E+01
HG-203	0.86	279.19 *	77.30	4.64E+01	2.46E+01
TH-234	0.95	63.29 *	3.80	4.12E+02	1.03E+02
AM-241	0.86	59.54 *	35.90	4.36E+01	1.09E+01

* = Energy line found in the spectrum.
- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 2.500 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
SN-113	0.998	2.39E+01	1.87E+01	
I-129	0.869	2.73E+01	1.29E+00	
BA-133	0.999	3.94E+02	3.97E+01	
HG-203	0.864	4.64E+01	2.46E+01	
? TH-234	0.955	4.12E+02	1.03E+02	
X NP-237	0.746			
? AM-241	0.861	4.36E+01	1.09E+01	

? = 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 2.000sigma

0155

Analysis Report for 2001124-07

MW 6A

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 12:39:15PM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	20.55	8.67111E-02	25.89	Tol.	MO-93
4	52.26	7.23457E-02	26.60		
m 6	65.99	1.09040E-01	21.87	Sum	
8	102.73	3.67262E-02	47.82		
9	112.53	2.65774E-01	12.85	Sum	
10	153.75	3.22222E-02	39.36		
11	160.89	3.49298E-02	47.07	Sum	
12	187.92	3.20466E-02	58.40		
M 15	294.94	1.00441E-02	58.54		
m 17	307.57	2.89385E-02	32.47	Sum	
18	334.98	8.77249E-02	18.07	Sum	
M 20	384.80	8.12535E-02	18.30	Sum	
22	415.51	2.87135E-02	30.79		
23	422.24	1.00000E-02	62.36	Sum	
24	437.26	8.30555E-02	12.37	Sum	
25	468.32	1.37037E-02	37.38		
26	693.82	7.15278E-03	51.67	Sum	

M = First peak in a multiplet region
 m = Other peak in a multiplet region
 F = Fitted singlet
 Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

0156

Analysis Report for 2001124-07

MW 6A

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	6.04E-06	6.04E-06	0.00E+00	0.00E+00
CO-57	122.06	85.51	1.88E+01	1.88E+01	-9.94E+00	8.81E+00
	136.48	10.60	1.68E+02		-2.05E+01	7.85E+01
NT-59	6.92	29.80	1.59E-05	1.59E-05	0.00E+00	0.00E+00
MO-93	16.59	52.90	3.47E-02	3.47E-02	-4.00E-03	1.63E-02
	18.60	10.00	3.93E-01		-1.26E-01	1.87E-01
NB-93M	16.57	9.43	1.93E-01	1.93E-01	-2.23E-02	9.09E-02
CD-109	88.03	3.72	2.60E+02	2.60E+02	-1.04E+02	1.23E+02
+ SN-113	255.12 *	1.93	9.48E+02	3.48E+01	8.47E+02	4.31E+02
	391.69 *	61.90	3.48E+01		2.33E+01	1.62E+01
SN-119M	23.87	16.10	8.80E-01	7.33E-01	-1.99E-01	4.19E-01
	25.10	22.70	7.33E-01		-5.56E+00	3.48E-01
+ I-129	29.78 *	57.00	2.02E+00	2.02E+00	2.68E+01	9.90E-01
	33.60 *	13.20	1.45E+01		4.47E+01	7.12E+00
	39.58	7.52	1.20E+01		-4.88E+01	5.61E+00
+ BA-133	81.00 *	34.06	4.54E+01	2.77E+01	4.02E+02	2.20E+01
	302.84 *	18.33	2.19E+02		3.92E+02	1.05E+02
	356.01 *	62.05	2.77E+01		3.84E+02	1.26E+01
CE-139	165.85	80.35	2.75E+01	2.75E+01	2.10E+00	1.29E+01
CE-144	133.54	10.80	1.70E+02	1.70E+02	6.22E+01	7.99E+01
+ HG-203	279.19 *	77.30	2.87E+01	2.87E+01	4.64E+01	1.33E+01
PB-210	46.50	4.25	3.59E+01	3.59E+01	4.22E+00	1.68E+01
TH-231	25.64	14.70	1.25E+00	1.25E+00	-9.44E+00	5.91E-01
	84.21	6.40	3.05E+02		7.57E+02	1.49E+02
PA-234M	9.89	89.00	1.10E-03	1.10E-03	1.28E-03	5.19E-04
	21.72	64.90	1.52E-01		1.40E-01	7.27E-02
	37.93	23.75	6.28E+00		1.32E+01	3.04E+00
	131.42	20.40	9.11E+01		5.22E+01	4.29E+01
+ TH-234	63.29 *	3.80	2.90E+02	2.90E+02	4.12E+02	1.42E+02
NP-237	29.37 *	14.00	8.21E+00	8.21E+00	1.09E+02	4.03E+00
	86.50	12.60	7.61E+01		-9.89E+00	3.60E+01
U-237	97.08	16.30	7.58E+01	5.36E+01	5.52E+00	3.58E+01
	101.07	26.30	5.36E+01		6.87E+00	2.54E+01
	114.00	12.30	2.26E+02		4.75E+02	1.09E+02
	208.01	22.00	1.00E+02		1.29E+01	4.64E+01
+ AM-241	59.54 *	35.90	3.07E+01	3.07E+01	4.36E+01	1.50E+01
AM-243	74.67	66.00	1.09E+01	1.09E+01	-3.73E+01	5.18E+00

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

0157



KP
2/5/20

Analysis Report for 2001124-08
MW 5A

GAMMA SPECTRUM ANALYSIS

Sample Identification : 2001124-08
 Sample Description : MW 5A
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 2/5/2020 8:52:49AM
 Acquisition Started : 2/5/2020 12:35:58PM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.2 seconds

Dead Time : 0.02 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 29 - 4096
 Identification Energy Tolerance : 2.500 keV

Energy Calibration Used Done On : 10/19/2019
 Efficiency Calibration Used Done On : 9/14/2019
 Efficiency Calibration Description :

Sample Number : 94142

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/5/2020 12:51:01PM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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Analysis Report for 2001124-08

MW 5A

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	35.55	35 -	42	35.88	3.32E+02	76.66	3.54E+02	2.55
2	52.94	50 -	57	53.26	4.46E+01	34.41	1.67E+02	1.81
M 3	61.71	58 -	73	62.01	1.83E+02	34.21	1.00E+02	1.58
m 4	65.85	58 -	73	66.15	1.26E+02	35.16	1.20E+02	1.93
5	80.93	76 -	83	81.21	6.86E+02	62.86	2.04E+02	1.53
M 6	111.74	107 -	119	111.98	1.37E+02	32.11	9.26E+01	1.57
m 7	115.42	107 -	119	115.66	2.64E+01	26.22	9.10E+01	1.58
8	141.33	137 -	146	141.54	3.50E+01	36.36	1.66E+02	5.73
9	212.75	211 -	215	212.89	1.51E+01	18.45	6.18E+01	1.62
10	277.16	273 -	283	277.22	8.47E+01	28.34	5.06E+01	2.25
M 11	302.71	299 -	317	302.75	1.27E+02	24.91	3.42E+01	1.64
m 12	306.94	299 -	317	306.97	1.45E+01	16.09	3.21E+01	1.92
M 13	333.36	329 -	347	333.37	6.75E+01	20.22	2.56E+01	2.05
14	355.79	351 -	360	355.78	4.70E+02	47.96	5.95E+01	1.64
M 15	376.72	372 -	393	376.68	1.31E+01	12.64	1.97E+01	1.83
m 16	383.36	372 -	393	383.32	9.52E+01	22.53	1.87E+01	1.84
m 17	386.73	372 -	393	386.68	1.68E+02	30.97	2.01E+01	1.84
m 18	390.83	372 -	393	390.78	3.56E+01	18.73	1.84E+01	1.84
M 19	414.23	411 -	423	414.15	1.62E+01	12.16	1.33E+01	1.70
m 20	419.93	411 -	423	419.85	1.57E+01	13.56	2.09E+01	1.71
21	436.70	434 -	439	436.61	7.77E+01	18.03	2.59E+00	1.88
22	590.20	586 -	593	589.95	7.11E+00	7.21	3.78E+00	1.53
23	599.43	596 -	602	599.18	6.44E+00	6.65	3.13E+00	1.52

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 2/5/2020 12:51:01PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000093996.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
1	35.55	3.32E+02	76.66			3.32E+02	7.67E+01
2	52.94	4.46E+01	34.41			4.46E+01	3.44E+01
M 3	61.71	1.83E+02	34.21	1.89E+00	8.55E-01	1.81E+02	3.42E+01
m 4	65.85	1.26E+02	35.16	2.48E+00	9.80E-01	1.24E+02	3.52E+01
5	80.93	6.86E+02	62.86			6.86E+02	6.29E+01
M 6	111.74	1.37E+02	32.11			1.37E+02	3.21E+01

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Analysis Report for 2001124-08

MW 5A

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	7	115.42	2.64E+01	26.22			2.64E+01	2.62E+01
	8	141.33	3.50E+01	36.36	1.54E+00	9.84E-01	3.35E+01	3.64E+01
	9	212.75	1.51E+01	18.45			1.51E+01	1.84E+01
	10	277.16	8.47E+01	28.34			8.47E+01	2.83E+01
M	11	302.71	1.27E+02	24.91			1.27E+02	2.49E+01
m	12	306.94	1.45E+01	16.09			1.45E+01	1.61E+01
M	13	333.36	6.75E+01	20.22			6.75E+01	2.02E+01
	14	355.79	4.70E+02	47.96			4.70E+02	4.80E+01
M	15	376.72	1.31E+01	12.64			1.31E+01	1.26E+01
m	16	383.36	9.52E+01	22.53			9.52E+01	2.25E+01
m	17	386.73	1.68E+02	30.97			1.68E+02	3.10E+01
m	18	390.83	3.56E+01	18.73			3.56E+01	1.87E+01
M	19	414.23	1.62E+01	12.16			1.62E+01	1.22E+01
m	20	419.93	1.57E+01	13.56			1.57E+01	1.36E+01
	21	436.70	7.77E+01	18.03			7.77E+01	1.80E+01
	22	590.20	7.11E+00	7.21			7.11E+00	7.21E+00
	23	599.43	6.44E+00	6.65			6.44E+00	6.65E+00

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.94	255.12	1.93		
		391.69 *	61.90	2.35E+01	1.25E+01
BA-133	0.99	81.00 *	34.06	4.16E+02	5.68E+01
		302.84 *	18.33	4.53E+02	1.64E+02
		356.01 *	62.05	3.77E+02	5.71E+01
HG-203	0.90	279.19 *	77.30	7.99E+01	3.82E+01
		9.89	89.00		
PA-234M	0.98	21.72	64.90		
		37.93 *	23.75	6.82E+00	1.57E+00
		131.42	20.40		
		63.29 *	3.80	3.70E+02	7.13E+01
AM-241	0.88	59.54 *	35.90	3.91E+01	7.55E+00

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Analysis Report for 2001124-08

MW 5A

* = Energy line found in the spectrum.
 - = Manually added nuclide.
 ? = Manually edited nuclide.
 @ = Energy line not used for Weighted Mean Activity
 Energy Tolerance : 2.500 keV
 Nuclide confidence index threshold = 0.30
 Errors quoted at 2.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
SN-113	0.947	2.35E+01	1.25E+01	
BA-133	0.999	4.00E+02	3.91E+01	
HG-203	0.900	7.99E+01	3.82E+01	
PA-234M	0.983	6.82E+00	1.57E+00	
? TH-234	0.938	3.70E+02	7.13E+01	
? AM-241	0.887	3.91E+01	7.55E+00	

? = 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 2.000sigma

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Analysis Report for 2001124-08
MW 5A

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/5/2020 12:51:01PM
Peak Locate From Channel : 1
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	2	52.94	4.95486E-02	38.58	
m	4	65.85	1.37538E-01	14.21	
M	6	111.74	1.52733E-01	11.68	Tol. U-237
m	7	115.42	2.93789E-02	49.57	Sum
	8	141.33	3.71925E-02	54.33	Sum
	9	212.75	1.67512E-02	61.18	
m	12	306.94	1.61531E-02	55.35	
M	13	333.36	7.50120E-02	14.98	
M	15	376.72	1.45376E-02	48.30	
m	16	383.36	1.05766E-01	11.84	Sum
m	17	386.73	1.87187E-01	9.19	
M	19	414.23	1.79816E-02	37.55	
m	20	419.93	1.74946E-02	43.05	Sum
	21	436.70	8.63361E-02	11.60	Sum
	22	590.20	7.90123E-03	50.70	
	23	599.43	7.15278E-03	51.67	

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 2.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\OR-GAMMA1\ApexRoot\Countroom\Library\WSRC.NLB

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Analysis Report for 2001124-08

MW 5A

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	4.58E-09	4.58E-09	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.54E+01	2.54E+01	9.39E+00	1.18E+01
	136.48	10.60	2.53E+02		3.93E+01	1.18E+02
NI-59	6.92	29.80	2.55E-08	2.55E-08	0.00E+00	0.00E+00
MO-93	16.59	52.90	9.74E-05	9.74E-05	0.00E+00	0.00E+00
	18.60	10.00	1.34E-03		0.00E+00	0.00E+00
NP-93M	16.57	9.43	5.41E-04	5.41E-04	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.68E+02	2.68E+02	1.14E+02	1.24E+02
+ SN-113	255.12	1.93	1.15E+03	3.40E+01	0.00E+00	5.20E+02
	391.69	*	61.90		2.35E+01	1.61E+01
SN-119M	23.87	16.10	5.80E-03	5.80E-03	0.00E+00	0.00E+00
	25.10	22.70	5.92E-03		0.00E+00	0.00E+00
I-129	29.78	57.00	4.87E-01	4.87E-01	1.92E+00	2.40E-01
	33.60	13.20	4.03E+00		-2.29E+00	1.98E+00
	39.58	7.52	4.71E+00		-3.29E+00	2.19E+00
+ BA-133	81.00	*	34.06	2.92E+01	4.16E+02	1.73E+01
	302.84	*	18.33		4.53E+02	1.48E+02
	356.01	*	62.05		3.77E+02	1.35E+01
CE-139	165.85	80.35	3.32E+01	3.32E+01	-6.34E+00	1.52E+01
CE-144	133.54	10.80	2.26E+02	2.26E+02	5.50E+01	1.05E+02
+ HG-203	279.19	*	77.30	3.60E+01	7.99E+01	1.67E+01
PB-210	46.50	4.25	1.87E+01	1.87E+01	7.64E+00	8.68E+00
TH-231	25.64	14.70	1.06E-02	1.06E-02	0.00E+00	0.00E+00
	84.21	6.40	2.88E+02		6.28E+00	1.39E+02
+ PA-234M	9.89	89.00	4.30E-07	4.30E-07	0.00E+00	0.00E+00
	21.72		7.08E-04		0.00E+00	0.00E+00
	37.93	*	23.75		6.82E+00	1.14E+00
	131.42		1.09E+02		-5.94E+01	5.04E+01
+ TH-234	63.29	*	3.80	1.82E+02	3.70E+02	8.85E+01
NP-237	29.37	14.00	1.81E+00	1.81E+00	7.13E+00	8.91E-01
	86.50	12.60	7.52E+01		2.50E+00	3.49E+01
U-237	97.08	16.30	7.67E+01	5.57E+01	0.00E+00	3.54E+01
	101.07	26.30	5.57E+01		5.97E+00	2.59E+01
	114.00	12.30	2.79E+02		3.95E+02	1.34E+02
	208.01	22.00	1.25E+02		-5.72E+01	5.73E+01
+ AM-241	59.54	*	35.90	1.93E+01	3.91E+01	9.36E+00
AM-243	74.67	66.00	9.59E+00	9.59E+00	5.29E-01	4.47E+00

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

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SECTION XI
ANALYTICAL DATA (TOTAL DISSOLVED SOLIDS)

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