

**MICHAEL PISANI & ASSOCIATES, INC.**  
**Metairie, LA**

**07-214**

**HERO LANDS**

**STANDARD LEVEL IV  
REPORT OF ANALYSIS**

**WORK ORDER #18-09025-OR**

**October 10, 2018**

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

## TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
I	Chain of Custody & pH Check Sheet	0004
II	Sample Acknowledgement	0013
III	Case Narrative	0016
IV	Analytical Results Summary	0020
V	Analytical Standards	0023
VI	Quality Control Sample Results Summary	0032
VII	Laboratory Technician's Notes & Runlogs	0039
VIII	Analytical Data (Radium-226)	0060
IX	Analytical Data (Radium-228)	0197
X	Barium-133 Analytical Tracer Data	0213
XI	Analytical Data (Total Dissolved Solids)	0377
	Last Page Number	0379



**SECTION I**  
**CHAIN OF CUSTODY**  
**&**  
**pH CHECK SHEET**





Richmond Laboratory

# Chain of Custody

18 09025

PURCHASE ORDER NO. \_\_\_\_\_

CLIENT: Michael Pisani & Associates (MP&A)

ADDRESS: 3838 N. Causeway Suite 3000

Metairie, LA 70002

PROJECT: Hero Lands 07-214

SAMPLERS SIGNATURE: \_\_\_\_\_

SAMPLE NO.	DATE	TIME	LOCATION
10 BC-1	8-28-18	0800	
11 BC-4C	8-28-18	1130	
12 BC-4B	8-28-18	1350	
13 BC-4A	8-28-18	1500	
14 BC-6	8-28-18	1700	
15 BC-7B	8-29-18	0800	

PARAMETERS

RECD	SEP 10 2018	SAMPLE TYPE OR MATRIX
X		Water
X		Water
X		Water
X		Water
X		Water
X		Water

# CONTAINERS

DATE \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_

TAT (IN DAYS) \_\_\_\_\_

OBSERVATIONS, COMMENTS, VOLUMES, SPECIAL OR ADDITIONAL TEST

1 No filter / No Preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative

1) RELINQUISHED BY / DATE:	3) RELINQUISHED BY / DATE:	4) RECEIVED BY / DATE:	TOTAL NO. OF CONTAINERS:
Christopher Young 9/5/18 COMPANY: IMPRA			
3) RECEIVED BY / DATE: Hannah Spencer 9-10-18 COMPANY: Eberline			
5) RELINQUISHED BY / DATE:	7) RELINQUISHED BY / DATE:	8) RECEIVED BY / DATE:	METHOD OF SHIPMENT:
			SPECIAL SHIPMENT-HANDLING, STORAGE REQUIREMENTS, OR POSSIBLE HAZARDS

2030 Wright Avenue P.O. Box 4040 Richmond, CA 94804-0040 (510) 235-2633 FAX No. (510) 235-0438



Richmond Laboratory

# Chain of Custody

18 09025

CLIENT: Michael Pisoni & Associates (M&A)  
 ADDRESS: 3838 N. Causeway Suite 3000  
Metairie, LA 70002  
 PROJECT: Hero Lands 07-214

SAMPLERS SIGNATURE: 

SAMPLE NO.	DATE	TIME	LOCATION
4 BC-3A	8-27-18	1140	
5 BC-3B	8-27-18	1210	
6 BC-2A	8-27-18	1435	
7 BC-2D	8-27-18	1530	
8 BC-2C	8-27-18	1650	
9 BC-5	8-27-18	1810	

PURCHASE ORDER NO. \_\_\_\_\_

PARAMETERS

RECD	SEP 10 2018	SAMPLE TYPE OR MATRIX
X	X	Water
X	X	Water
X	X	Water
X	X	Water
X	X	Water
X	X	Water

DATE \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_

TAT (IN DAYS) \_\_\_\_\_

OBSERVATIONS, COMMENTS, VOLUMES, SPECIAL OR ADDITIONAL TEST

# CONTAINERS

1 No filter / No preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative  
 1 No filter / No Preservative

TOTAL NO. OF CONTAINERS:  
 METHOD OF SHIPMENT:  
 SPECIAL SHIPMENT-HANDLING, STORAGE REQUIREMENTS, OR POSSIBLE HAZARDS

1) RELINQUISHED BY / DATE: <i>Chris Thomas Young</i> COMPANY: M&A	3) RELINQUISHED BY / DATE: COMPANY:	4) RECEIVED BY / DATE: COMPANY:
5) RELINQUISHED BY / DATE: COMPANY:	7) RELINQUISHED BY / DATE: COMPANY:	8) RECEIVED BY / DATE: COMPANY:

RECEIVED BY / DATE:  
*Michael Pisoni*  
 10.25.18  
 COMPANY: EBERLINE

2030 Wright Avenue P.O. Box 4040 Richmond, CA 94804-0040 (510) 235-2633 FAX No. (510) 235-0438



**EBERLINE**  
SERVICES  
Oak Ridge Laboratory

# Internal Chain of Custody

Work Order #

**18-09025**

Lab Deadline

**9/21/2018**

Analysis

**Ra226 - Level 4**

Sample Matrix

**Water**

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
	04	35	III.6 TOP
	05	25	III.6 TOP
	06	34	III.6 TOP
	07	35	III.6 TOP
	08	32	III.6 TOP
	09	37	III.6 TOP
	10	34	III.6 TOP
	11	34	III.6 TOP
	12	38	III.0
	13	44	III.0
	14	31	III.0
	15	37	III.0
	16	50	III.0
	17	33	III.0
	18	37	III.0

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	Henry	9/12/18 040
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	Henry	9/13/18 0950
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	9/18/18 1000
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	OB	9/18/18 1305
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KP	9/18/18 1309
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	9/18/18 1223
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		





Oak Ridge Laboratory

# Internal Chain of Custody

Work Order #

**18-09025**

Lab Deadline

**See Comments**

Analysis

**Ra226 - Level 4**

Sample Matrix

**WA**

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
<p>Re-Analysis: 2  <i>Fraction 18 ONLY</i>  <i>EYT 9/19/18</i></p>	04	35	111.6 TOP
	05	25	111.6 TOP
	06	34	111.6 TOP
	07	35	111.6 TOP
	08	32	111.6 TOP
	09	37	111.6 TOP
	10	34	111.6 TOP
	11	34	111.6 TOP
	12	38	111.0
	13	44	111.0
	14	31	111.0
<p>Original Lab Deadline: 10/01/18            Rerun Lab Deadline: 10/01/18</p>	15	37	111.0
	16	50	111.0
	17	33	111.0
	18	37	111.0

	Location (circle one)						Technician Initials	
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room			<i>J. Henry 9/20/18 0800</i>
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room			<i>J. Henry 9/21/18 0410</i>
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room			<i>JB 9/24/18 0750</i>
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room			<i>JB 9/24/18 1255</i>
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room			<i>KP 9/24/18 1255</i>
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room			<i>KB 9/24/18 1307</i>
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			



# Internal Chain of Custody

Work Order #

**18-09025**

Lab Deadline

**9/21/2018**

Analysis

**Ra228 - Level 4**

Sample Matrix

**Water**

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
	04	35	III.6 TOP
	05	25	III.6 TOP
	06	34	III.6 TOP
	07	35	III.6 TOP
	08	32	III.6 TOP
	09	37	III.6 TOP
	10	34	III.6 TOP
	11	34	III.6 TOP
	12	38	III.0
	13	44	III.0
	14	31	III.0
	15	37	III.0
	16	50	III.0
	17	33	III.0
	18	37	III.0

	Location (circle one)					Initials	Date
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		
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		



**EBERLINE**  
SERVICES  
Oak Ridge Laboratory

# Internal Chain of Custody

Work Order #

**18-09025**

Lab Deadline

**9/11/2018**

Analysis


**TDS - Level 4**

Sample Matrix

**Water**

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
	04	35	II1.6 TOP
	05	25	II1.6 TOP
	06	34	II1.6 TOP
	07	35	II1.6 TOP
	08	32	II1.6 TOP
	09	37	II1.6 TOP
	10	34	II1.6 TOP
	11	34	II1.6 TOP
	12	38	II1.0
	13	44	II1.0
	14	31	II1.0
	15	37	II1.0
	16	50	II1.0
	17	33	II1.0
	18	37	II1.0

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	M4	10 SEP 18
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	M4	11 SEP 18 0536
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		
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		

	<b>Sample Receiving Report</b> (Volumes, pH, & CPM)	Internal Work Order <b>18-09025</b>
		Received By <b>RSPENCER</b>

FR	ClientID	# Btls	Comments	Matrix	Storage	Rec Vol	Ttl	CPM Max
01	LCS	0		WA	II1.6 TOP			
02	BLANK	0		WA	II1.6 TOP			
03	DUP	0		WA	II1.6 TOP			
04	BC-3A ✓	1		WA	II1.6 TOP	3.76		35
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		35
05	BC-3B ✓	1		WA	II1.6 TOP	3.76		25
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		25
06	BC-2A ✓	1		WA	II1.6 TOP	3.76		34
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		34
07	BC-2D ✓	1		WA	II1.6 TOP	3.76		35
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		35
08	BC-2C ✓	1		WA	II1.6 TOP	3.76		32
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		32
09	BC-5 ✓	1		WA	II1.6 TOP	3.76		37
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		37
10	BC-1 ✓	1		WA	II1.6 TOP	3.76		34
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		34
11	BC-4C ✓	1		WA	II1.6 TOP	3.76		34
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		34
12	BC-4B ✓	1		WA	II1.0	3.76		38
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		38
13	BC-4A ✓	1		WA	II1.0	3.76		44
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		44
14	BC-6 ✓	1		WA	II1.0	3.76		31
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		31
15	BC-7B ✓	1		WA	II1.0	3.76		37
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		37
16	BC-7A ✓	1		WA	II1.0	3.76		50
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		50
17	BC-8B ✓	1		WA	II1.0	3.76		33
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		33
18	BC-8A ✓	1		WA	II1.0	3.76		37
			Container Number	pH Orig	pH Final	Volume (L)		CPM
			1	7	7	3.7600		37

*1491  
9/10/18*

Received by: *R Spencer* Date: *9-10-18*

**SECTION II**  
**SAMPLE ACKNOWLEDGEMENT**





Eberline Services - Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST  
MP-001-2

WORK ORDER # 18<sup>09025</sup>

SAMPLE MATRIX/MATRICES:

(CIRCLE ONE OR BOTH)

AQUEOUS NON-AQUEOUS

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

WERE SAMPLES:

Received in good condition?	<u>Y</u>	N	
If aqueous, properly preserved	<u>Y</u>	N	N/A

WERE CHAIN OF CUSTODY SEALS:

Present on outside of package?	<u>Y</u>	N
Unbroken on outside of package?	<u>Y</u>	N
Present on samples?	<u>Y</u>	N
Unbroken on samples?	<u>Y</u>	N
Was chain of custody present upon sample receipt?	<u>Y</u>	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: 9-10-18

**SECTION III**  
**CASE NARRATIVE**





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

EBS-OR-44454

October 10, 2018

Jon Miller  
Michael Pisani & Associates, Inc.  
3838 N Causeway Blvd, Suite 3000  
Metairie, LA 70002

CASE NARRATIVE  
Work Order # 18-09025-OR

SAMPLE RECEIPT

This work order contains fifteen water samples received 09/10/2018. 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>
BC-3A	18-09025-04	BC-4B	18-09025-12
BC-3B	18-09025-05	BC-4A	18-09025-13
BC-2A	18-09025-06	BC-6	18-09025-14
BC-2D	18-09025-07	BC-7B	18-09025-15
BC-2C	18-09025-08	BC-7A	18-09025-16
BC-5	18-09025-09	BC-8B	18-09025-17
BC-1	18-09025-10	BC-8A	18-09025-18
BC-4C	18-09025-11		

ANALYTICAL METHODS

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

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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 then mounted on micro-porous filter media. Sample was counted by alpha spectroscopy using an energy specific region of interest for Radium-226. The final result was corrected for inherent self-absorption from elemental Barium. Chemical recovery was calculated by the use of a Barium-133 tracer, which was determined by HPGe gamma spectroscopy.

## ANALYTICAL RESULTS CONTINUED

### RADIUM-226 CONTINUED

#### *1<sup>st</sup> Analytical Attempt*

Samples demonstrated acceptable results for all Radium-226 analyses. Chemical recovery was low for sample fraction -18 (Client ID: BC-8A). Chemical recovery was acceptable for all other 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.

#### *2<sup>nd</sup> Analytical Attempt*

Sample fraction -18 (Client ID: BC-8A) that demonstrated a low chemical recovery was reanalyzed using a smaller aliquot. Sample 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 an acceptable relative percent difference and normalized difference. 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 re-dissolved and time allowed for sufficient ingrowth of the Actinium-228 daughter. Actinium-228 was selectively precipitated after ingrowth. Precipitates were filtered and beta emissions for Actinium-228 were then counted on a gas proportional counter. Chemical recovery was determined by the use of 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 analyses. Due to low Radium-226 chemical recovery for sample fraction -18 (Client ID: BC-8A) chemical recovery for the Radium-228 is reported by gravimetric recovery only. 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.

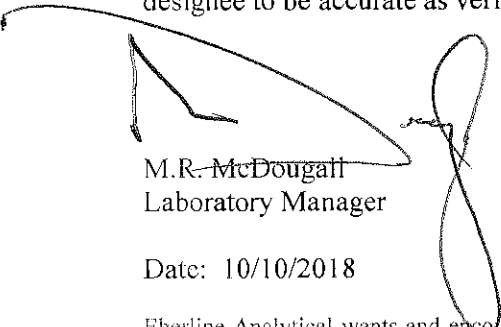
### TOTAL DISSOLVED SOLIDS (TDS)

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

Samples demonstrated Total Dissolved Solids contents that ranged from 2202.0 to 111,044.0 mg/L of Total Dissolved Solids.

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

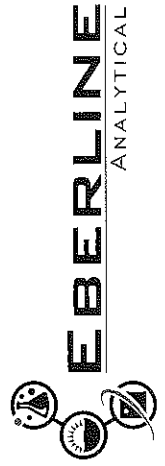
Date: 10/10/2018

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:							
Jonathan Miller Michael Pisani & Associates 3838 N Causeway Blvd Suite 3000 Metairie, LA 70002		SDG: 18-09025		Project: 07-214 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
18-09025-01	LCS	KNOWN	09/10/18 00:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	1.01E+01	4.64E-01			pCi/l
18-09025-01	LCS	SPIKE	09/10/18 00:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	9.62E+00	1.36E+00	2.45E+00	2.81E-01	pCi/l
18-09025-02	MBL	BLANK	09/10/18 00:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	6.45E-02	1.61E-01	1.61E-01	3.36E-01	pCi/l
18-09025-03	DUP	BC-1	08/28/18 08:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	2.55E-01	2.73E-01	2.79E-01	4.01E-01	pCi/l
18-09025-04	TRG	BC-3A	08/27/18 11:40	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	4.60E+00	1.31E+00	1.63E+00	7.46E-01	pCi/l
18-09025-05	TRG	BC-3B	08/27/18 12:10	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	7.54E-01	3.88E-01	4.20E-01	3.59E-01	pCi/l
18-09025-06	TRG	BC-2A	08/27/18 14:35	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	8.48E+01	9.71E+00	2.04E+01	2.49E+00	pCi/l
18-09025-07	TRG	BC-2D	08/27/18 15:30	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	1.81E+00	3.97E-01	5.10E-01	9.34E-02	pCi/l
18-09025-08	TRG	BC-2C	08/27/18 16:50	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	9.52E-01	4.39E-01	4.83E-01	3.78E-01	pCi/l
18-09025-09	TRG	BC-5	08/27/18 18:10	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	2.94E+00	6.98E-01	9.34E-01	2.36E-01	pCi/l
18-09025-10	DO	BC-1	08/28/18 08:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	6.90E-01	3.36E-01	3.64E-01	2.24E-01	pCi/l
18-09025-11	TRG	BC-4C	08/28/18 11:30	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	5.51E+00	9.25E-01	1.49E+00	2.80E-01	pCi/l
18-09025-12	TRG	BC-4B	08/28/18 13:50	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	1.87E+00	5.37E-01	6.68E-01	2.83E-01	pCi/l
18-09025-13	TRG	BC-4A	08/28/18 15:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	3.39E-01	2.46E-01	2.56E-01	2.11E-01	pCi/l
18-09025-14	TRG	BC-6	08/28/18 17:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	5.09E-01	3.10E-01	3.28E-01	3.40E-01	pCi/l
18-09025-15	TRG	BC-7B	08/29/18 08:00	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	1.69E-02	1.68E-01	1.68E-01	4.15E-01	pCi/l
18-09025-16	TRG	BC-7A	08/29/18 09:10	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	3.30E+00	1.53E+00	1.69E+00	9.37E-01	pCi/l
18-09025-17	TRG	BC-8B	08/29/18 10:45	9/10/2018	9/18/2018	18-09025	Radium-226	EPA 903.0 Modified	5.92E-01	3.75E-01	3.96E-01	3.61E-01	pCi/l
18-09025-18	DO	BC-8A	08/29/18 12:05	9/10/2018	9/25/2018	18-09025	Radium-226	EPA 903.0 Modified	2.82E+00	1.42E+00	1.54E+00	8.82E-01	pCi/l

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



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

# Eberline Analytical

## Final Report of Analysis

Report To:

Jonathan Miller  
 Michael Pisani & Associates  
 3838 N Causeway Blvd Suite 3000  
 Metairie, LA 70002

Work Order Details:

SDG: **18-09025**  
 Project: 07-214 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
18-09025-01	LCS	KNOWN	09/10/18 00:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	9.15E+00	4.67E-01			pCi/l
18-09025-01	LCS	SPIKE	09/10/18 00:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	8.43E+00	6.92E-01	2.03E+00	7.88E-01	pCi/l
18-09025-02	MBL	BLANK	09/10/18 00:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	-4.17E-01	4.01E-01	4.12E-01	8.95E-01	pCi/l
18-09025-03	DUP	BC-1	08/28/18 08:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	3.78E-01	4.12E-01	4.21E-01	8.39E-01	pCi/l
18-09025-04	TRG	BC-3A	08/27/18 11:40	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	5.90E+00	6.32E-01	1.48E+00	8.46E-01	pCi/l
18-09025-05	TRG	BC-3B	08/27/18 12:10	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	8.89E-01	3.94E-01	4.42E-01	7.42E-01	pCi/l
18-09025-06	TRG	BC-2A	08/27/18 14:35	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	6.45E+01	2.13E+00	1.48E+01	1.35E+00	pCi/l
18-09025-07	TRG	BC-2D	08/27/18 15:30	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	6.16E+00	6.16E-01	1.52E+00	7.62E-01	pCi/l
18-09025-08	TRG	BC-2C	08/27/18 16:50	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	4.12E-01	4.12E-01	4.37E-01	8.12E-01	pCi/l
18-09025-09	TRG	BC-5	08/27/18 18:10	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	2.05E+00	4.75E-01	6.64E-01	8.12E-01	pCi/l
18-09025-10	DO	BC-1	08/28/18 08:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	9.06E-01	4.77E-01	5.19E-01	9.30E-01	pCi/l
18-09025-11	TRG	BC-4C	08/28/18 11:30	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	6.05E+00	6.28E-01	1.51E+00	8.23E-01	pCi/l
18-09025-12	TRG	BC-4B	08/28/18 13:50	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	2.29E+00	5.09E-01	7.20E-01	8.33E-01	pCi/l
18-09025-13	TRG	BC-4A	08/28/18 15:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	1.20E+00	4.00E-01	4.83E-01	7.26E-01	pCi/l
18-09025-14	TRG	BC-6	08/28/18 17:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	7.57E-01	4.07E-01	4.42E-01	7.89E-01	pCi/l
18-09025-15	TRG	BC-7B	08/29/18 08:00	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	-6.41E-01	5.35E-01	5.55E-01	1.20E+00	pCi/l
18-09025-16	TRG	BC-7A	08/29/18 09:10	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	2.99E+00	7.18E-01	9.87E-01	1.20E+00	pCi/l
18-09025-17	TRG	BC-8B	08/29/18 10:45	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	1.07E+00	3.76E-01	4.47E-01	6.82E-01	pCi/l
18-09025-18	TRG	BC-8A	08/29/18 12:05	9/10/2018	9/21/2018	18-09025	Radium-228	EPA 904.0	2.16E-01	3.60E-01	3.63E-01	7.46E-01	pCi/l
18-09025-04	TRG	BC-3A	08/27/18 11:40	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	2.43E+04				mg/l
18-09025-05	TRG	BC-3B	08/27/18 12:10	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	5.85E+03				mg/l
18-09025-06	TRG	BC-2A	08/27/18 14:35	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	1.11E+05				mg/l
18-09025-07	TRG	BC-2D	08/27/18 15:30	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	1.28E+04				mg/l
18-09025-08	TRG	BC-2C	08/27/18 16:50	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	1.40E+04				mg/l
18-09025-09	TRG	BC-5	08/27/18 18:10	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	1.16E+04				mg/l
18-09025-10	TRG	BC-1	08/28/18 08:00	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	3.00E+03				mg/l
18-09025-11	TRG	BC-4C	08/28/18 11:30	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	1.94E+04				mg/l
18-09025-12	TRG	BC-4B	08/28/18 13:50	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	1.56E+04				mg/l
18-09025-13	TRG	BC-4A	08/28/18 15:00	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	2.20E+03				mg/l
18-09025-14	TRG	BC-6	08/28/18 17:00	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	5.58E+03				mg/l
18-09025-15	TRG	BC-7B	08/29/18 08:00	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	4.05E+03				mg/l
18-09025-16	TRG	BC-7A	08/29/18 09:10	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	8.54E+04				mg/l
18-09025-17	TRG	BC-8B	08/29/18 10:45	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	4.01E+03				mg/l
18-09025-18	TRG	BC-8A	08/29/18 12:05	9/10/2018	9/11/2018	18-09025	TDS	SM 2540C	9.15E+04				mg/l

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

# CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

<sup>Ra-5</sup>  
QA/QC REVIEWED  
Date 2/8/94 Initials WT

Radionuclide: Ra-226 Customer: TMA EBERLINE  
Half Life: 1600 ± 7 years P.O.No.: VH1888  
Catalog No.: 7226 Reference Date: February 1 1994 12:00 PST.  
Source No.: 453-26 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(NO<sub>3</sub>)<sub>2</sub> in 1 N HNO<sub>3</sub>  
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

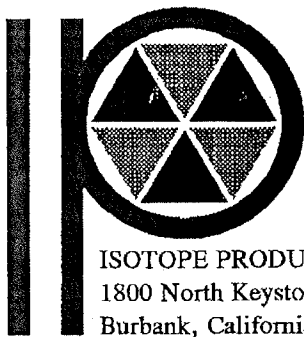
This calibration is implicitly traceable to the National Institute of Standards and Technology.

## 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).

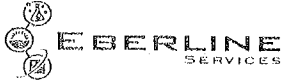


ISOTOPE PRODUCTS LABORATORIES  
1800 North Keystone Street  
Burbank, California 91504  
(818) 843 - 7000

Ana U. 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 9/17/2018 0:00  
SOLUTION # Ra-5

Principal Radionuclide <sup>226</sup>Radium Half Life, Years 1.600E+03 Half Life, Days 5.844E+05

Radionuclide <sup>226</sup>Radium Reference Date 2/1/1994 0:00  
Certified Activity 1.001E+00  $\mu\text{Ci}$   
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  $\mu\text{Ci}$

Chemical Composition of Standard Solution  
<sup>226</sup>Ra(NO<sub>3</sub>)<sub>2</sub> in 1M HNO<sub>3</sub>

Dilution Instructions: Dilution Solvent Used 1M HNO<sub>3</sub>

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 1.0010  $\mu\text{Ci}$  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 10, 2019

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

Date: 9/17/2018  
Date: 9/18/18



# 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

Solution Reference # MP 009 IPL-453-26 Date 9/17/2018 0:00  
Solution # Ra-5b

Principal Radionuclide	Half Life, Years	Half Life, Days
<sup>226</sup> Radium	1.600E+03	5.844E+05

Radionuclide of Interest: <sup>226</sup>Radium Reference Date: 2/1/1994 0:00  
Parent Solution Conc. 2.22E+03 dpm/ml

### Chemical Composition of Standard Solution

<sup>226</sup>Ra(NO<sub>3</sub>)<sub>2</sub> in 1M HNO<sub>3</sub>

Dilution Instructions: Dilution Solvent Used 1M HNO<sub>3</sub>

### 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:

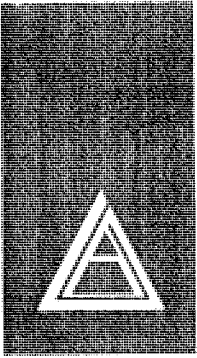
Expiration Date: 10-Sep-19

Verified & Approved By [Signature]

Date: 9/17/2018 0:00

QC Approval [Signature]

Date: 9/18/18



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

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

*Ra<sup>228</sup>*

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:  $\gamma$ -impurities <0.1%

5.10721 grams 0.1M HCl solution with 50  $\mu$ 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  
INITIAL DILUTION  
MP 009

SOLUTION REFERENCE # Analytics 7235-207 CURRENT DATE 2/28/2017 0:00  
SOLUTION # Ra-12

Principal Radionuclide <sup>228</sup>Ra Half Life, Years 5.750E+00 Half Life, Days 2.100E+03

Radionuclide <sup>228</sup>Ra Reference Date 2/10/2006 0:00  
Certified Activity 1.087E-01  $\mu\text{Ci}$   
Certified Concentration                       $\mu\text{Ci per gram}$

Ampoule /Solution Gross 9.0741 Weight, Grams  
Empty Ampoule 3.9858 Weight, Grams  
Solution Net 5.0883 Weight, Grams  
Total Activity in Ampoule 0.1087  $\mu\text{Ci}$

Chemical Composition of Standard Solution  
<sup>228</sup>Ra(NO<sub>3</sub>)<sub>2</sub> in 0.5 M HCl

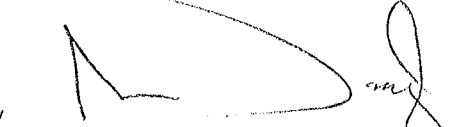
Dilution Instructions: Dilution Solvent Used 0.5 M HCl

Dilute to a volume of 991.00 Kg

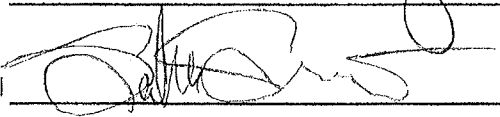
Certified Total Activity of 0.1087  $\mu\text{Ci}$  Which Equals 2.413E+05 dpm at the date listed above

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: February 12, 2019

Recertified By 

Date: 2/12/18

QC Approval 

Date: 2/13/18



Ba-6  
(f 6a)

# National Institute of Standards & Technology Certificate

ORIGINAL

## Standard Reference Material 4251C Barium-133 Radioactivity Standard

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.

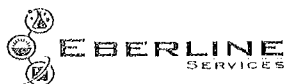
### Preparation

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 SOLUTIONS**  
*PRIMARY DILUTION RECERTIFICATION*  
QCP 009-1

CURRENT DATE

SOLUTION REFERENCE #

SOLUTION #

Principal Radionuclide

Half Life, Years

Half Life, Days

<sup>133</sup>Barium

Radionuclide

Reference Date

Certified Activity   $\mu\text{Ci}$

Certified Concentration   $\mu\text{Ci per gram}$

Ampoule /Solution Gross  Weight, Grams

Empty Ampoule  Weight, Grams

Solution Net  Weight, Grams

Total Activity in Ampoule   $\mu\text{Ci}$

**Chemical Composition of Standard Solution**

Dilution Instructions:

Dilution Solvent Used

Dilute to a volume of  milliliters

Certified Total Activity of   $\mu\text{Ci}$

Which Equals  dpm at the date listed above

And after dilution the activity of this solution is  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:

Verified & Approved By

Date:

QC Approval

Date:



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	Date	5/5/18
Solution Reference #		NIST SRM4251C	Solution #	Ba-6a
Principal Radionuclide	Half Life, Years	Half Life, Days		
<sup>133</sup> Ba	1.048E+01	3.828E+03		
Radionuclide of Interest	<sup>133</sup> Ba	Reference Date		
Parent Solution Conc.	1.48E+05 dpm/ml	9/1/1993 0:00		
Chemical Composition of Standard Solution				
<sup>133</sup> BaCl <sub>2</sub> 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 26, 2019

Verified & Approved By 

Date: 5/5/18

QC Approval 

Date: 5/5/18

**SECTION VI**  
**QUALITY CONTROL SAMPLE RESULTS SUMMARY**



WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09025</b>	<b>Ra226</b>	<b>1</b>	<b>pCi</b>	<b>I</b>	<b>Michael Pisani &amp; Associates, Inc.</b>

**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	95.26%	25.44%	100.00%	4.60%	1.01E+01	4.64E-01	9.62E+00	2.45E+00	Ra-5b	4.40E+01	4.60E+00	5.10E-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)

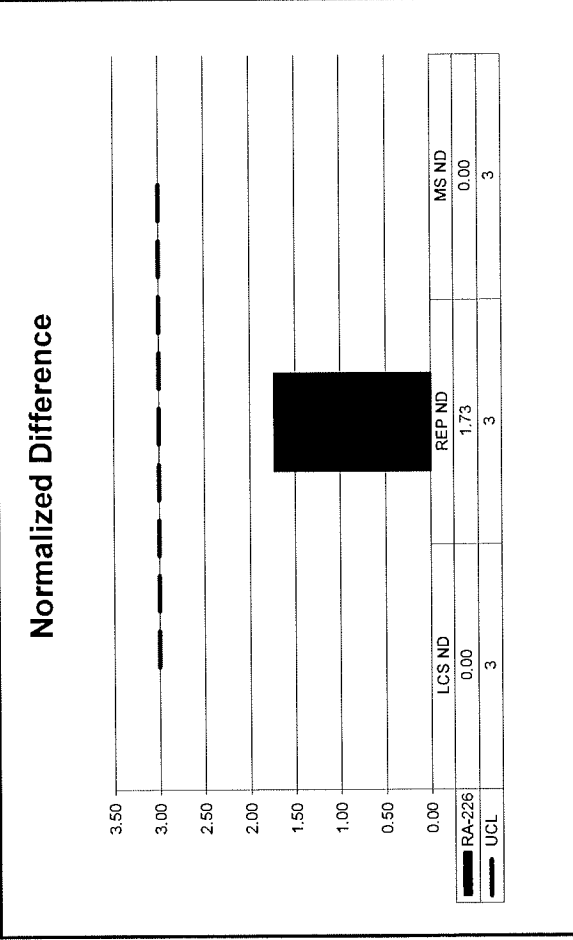
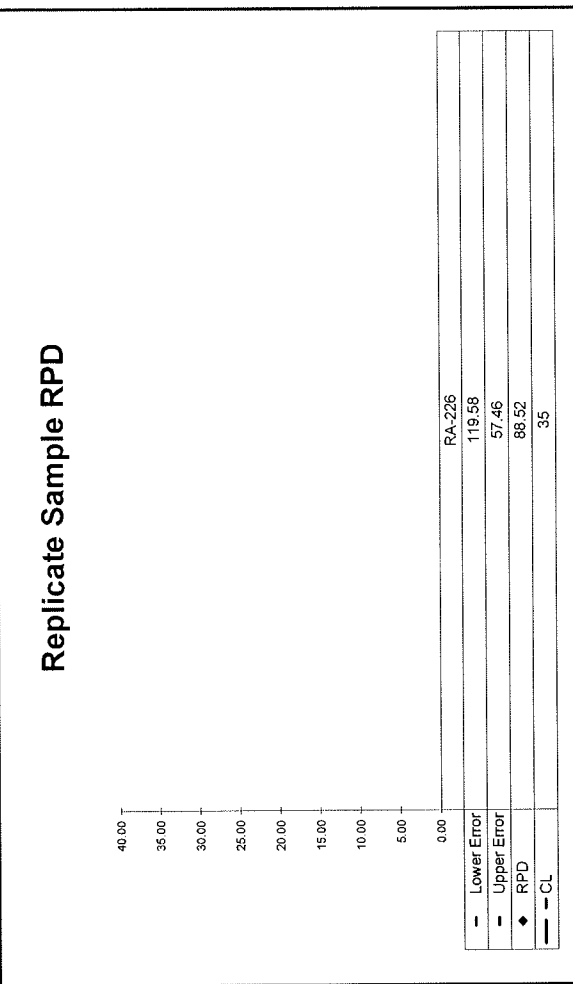
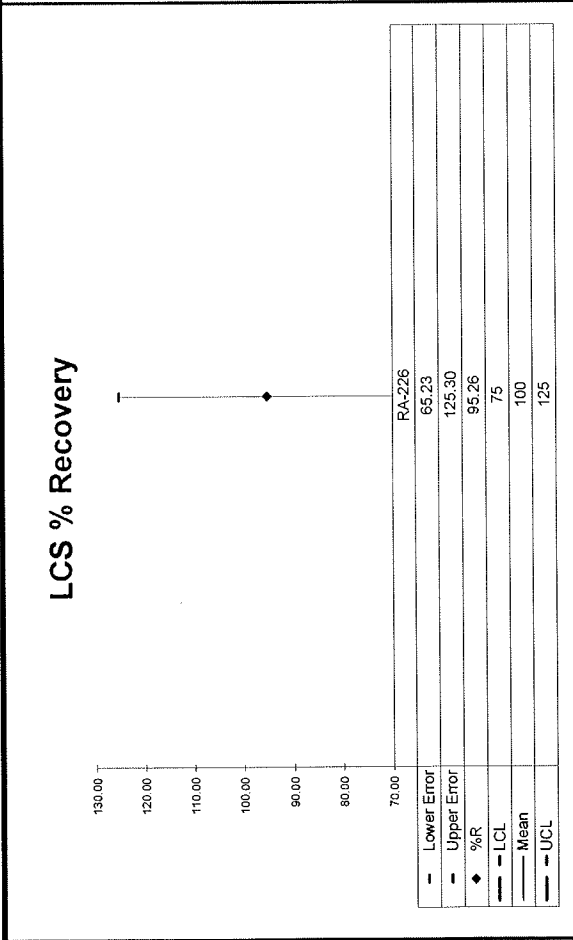
**Duplicate Results**

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	1.73	88.52	6.60E-01	3.64E-01	2.55E-01	2.79E-01	0.95	OK			NA	OK

**QC Summary**

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	1.73	88.52	6.60E-01	3.64E-01	2.55E-01	2.79E-01	0.95	OK			NA	OK

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09025</b>	<b>Ra226</b>	<b>1</b>	<b>pCi</b>	<b>I</b>	<b>Michael Pisani &amp; Associates, Inc.</b>



No Matrix Spike

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09025</b>	<b>Ra226</b>	<b>2</b>	<b>pCi</b>	<b>1</b>	<b>Michael Pisani &amp; Associates, Inc.</b>

**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	105.21%	25.62%	100.00%	4.60%	1.01E+01	4.66E-01	1.06E+01	2.73E+00	Ra-5b	4.40E+01	4.60E+00	5.11E-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)

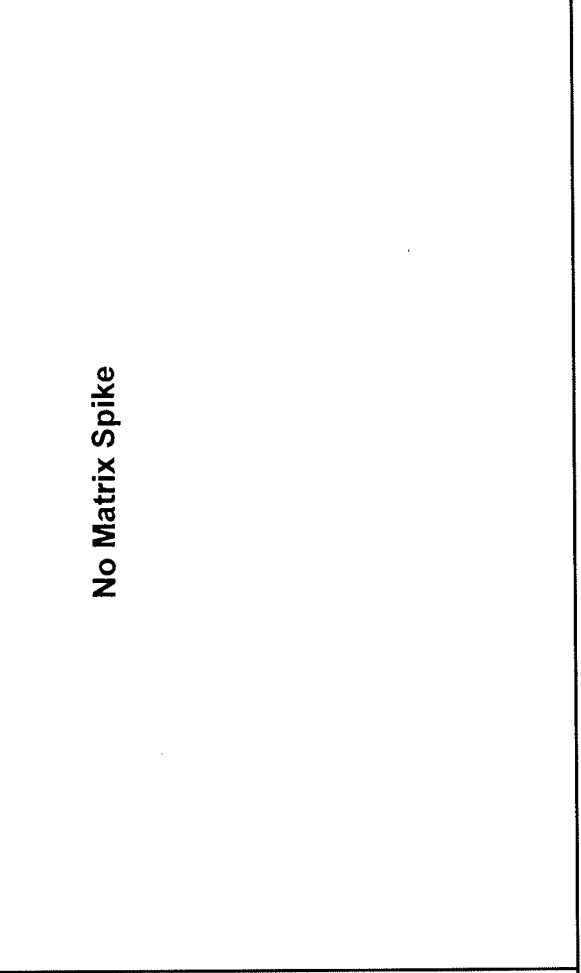
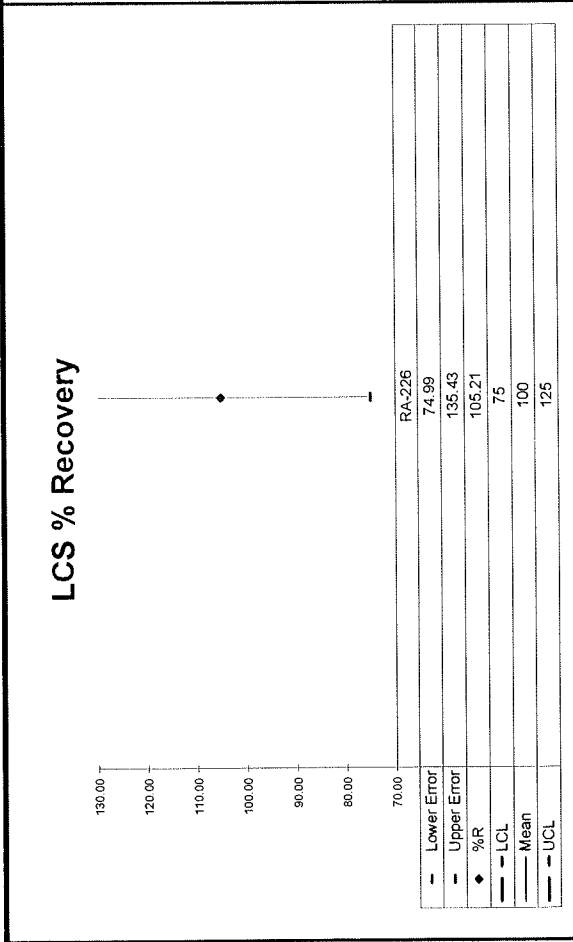
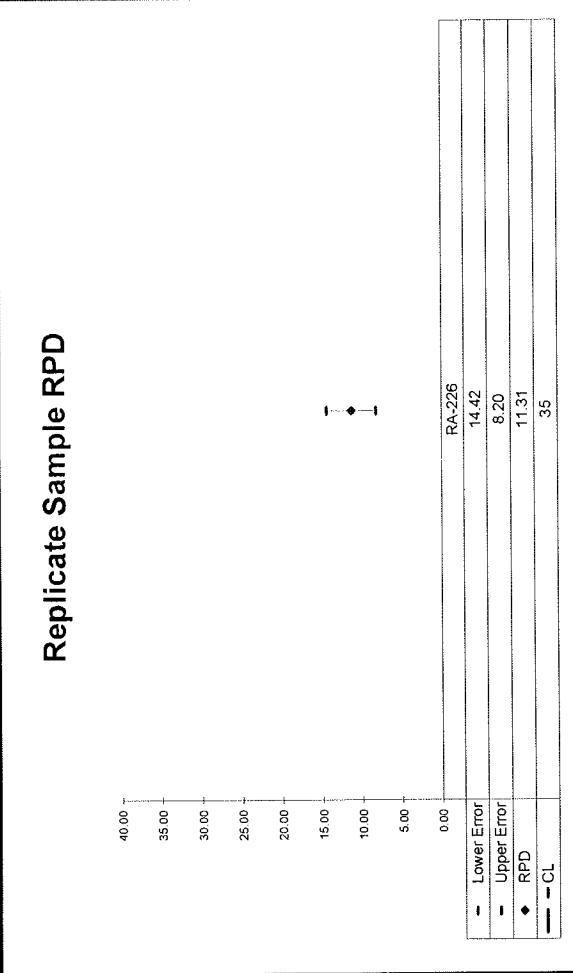
**Duplicate Results**

Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-226	0.28	11.31	2.82E+00	1.54E+00	2.52E+00	1.40E+00	OK			NA	OK

**QC Summary**

Analyte	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-226	1.05	OK			NA	OK

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09025</b>	<b>Ra226</b>	<b>2</b>	<b>pCi</b>	<b>I</b>	<b>Michael Pisani &amp; Associates, Inc.</b>



**No Matrix Spike**

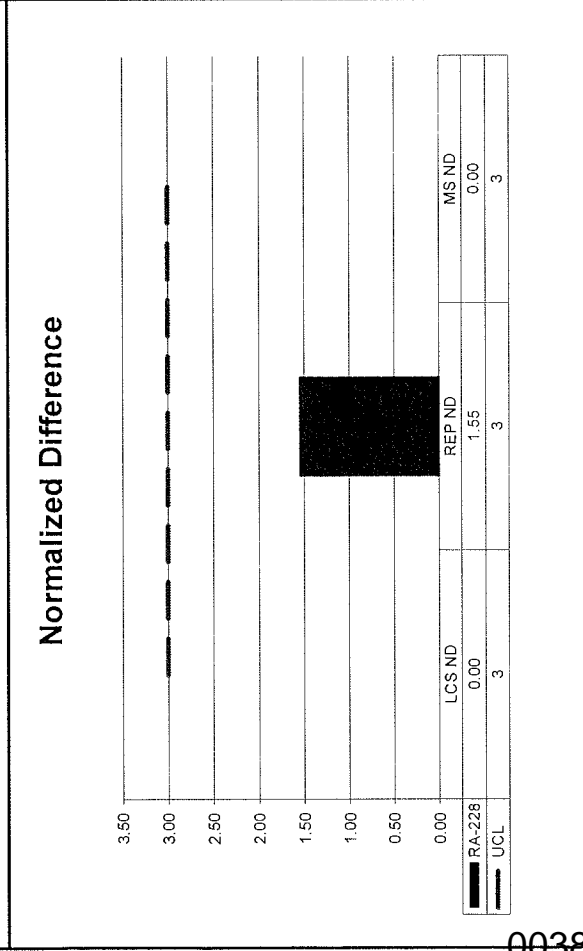
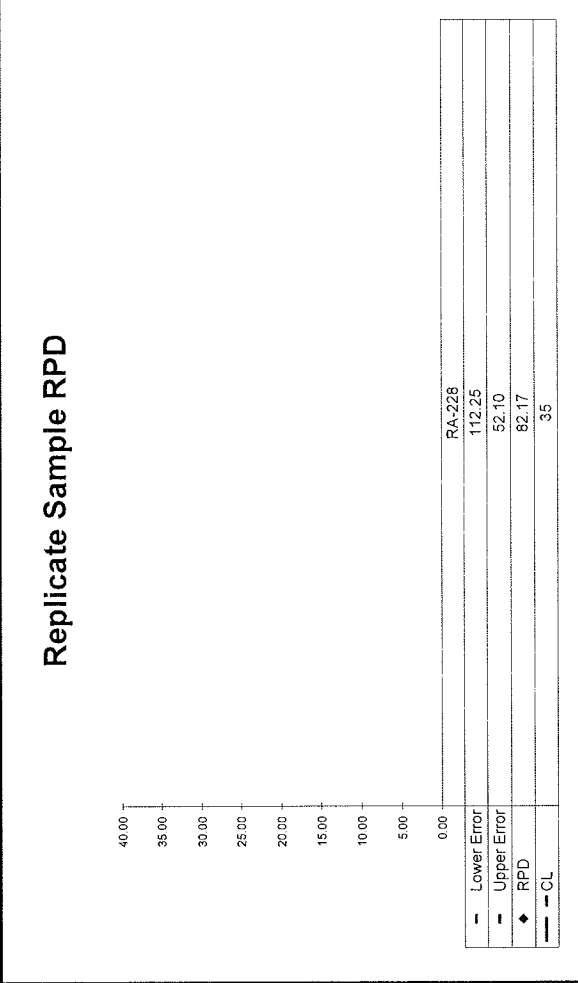
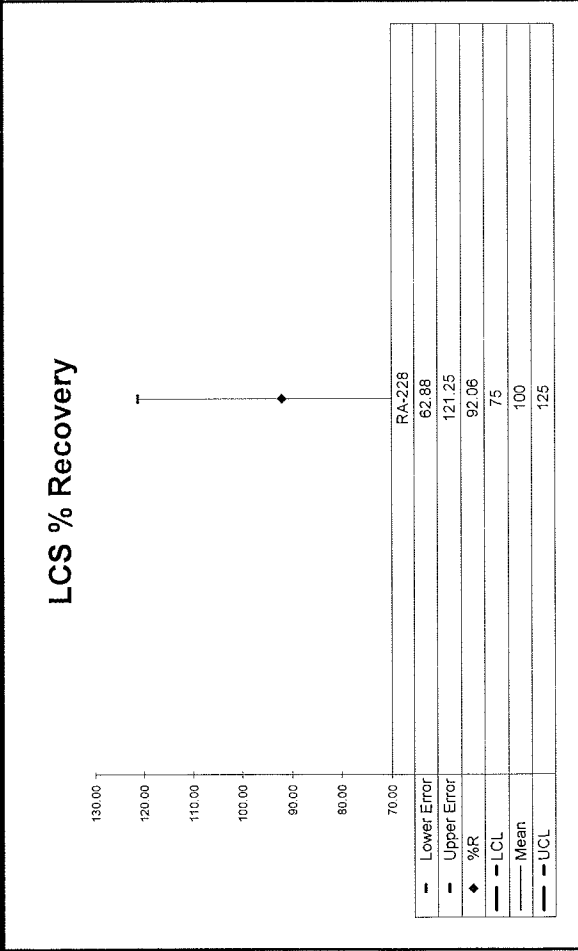
WO	Analysis		Run	Activity Units	Aliquot Units	Client Name			
<b>18-09025</b>	<b>Ra228</b>	<b>1</b>	<b>pCi</b>	<b>I</b>	<b>Michael Pisani &amp; Associates, Inc.</b>				

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	92.06%	24.09%	100.00%	5.10%	9.15E+00	4.67E-01	8.43E+00	2.03E+00	Ra-12	5.33E+01	5.10E+00	3.82E-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										QC Summary			
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	1.55	82.17	9.06E-01	5.19E-01	3.78E-01	4.21E-01	0.92	OK			NA	OK	

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09025</b>	<b>Ra228</b>	<b>1</b>	<b>pCi</b>	<b>I</b>	<b>Michael Pisani &amp; Associates, Inc.</b>



No Matrix Spike

**SECTION VII**  
**LABORATORY TECHNICIAN'S NOTES & RUNLOGS**

**RA-226 NOTES – RUN 1**



 <b>EBERLINE</b> <small>SERVICES</small> <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b> 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09025
		Analysis Code	Ra226
		Run Number	1


#	Date	Dept	User	Notes
1	09/12/18 11:48	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

*J Harvey*  
 9/12/18

 <b>EBERLINE</b> <small>SERVICES</small> <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b> 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09025
		Analysis Code	Ra226
		Run Number	1

#	Date	Dept	User	Notes
1	09/12/18 11:48	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	09/18/18 13:06	CHEM	JBAILEY	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.

*JBA*  
 9/18/18

 <b>Reagents Used in an Analysis</b>		Internal Work Order		
		18-09025		
		Analysis Code		Run
		Ra226		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/12/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/12/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/12/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/12/2018
020000P	Nitric Acid	Reagent Grade	JHARVEY	9/12/2018
019210P	Acetic Acid	Reagent Grade	JBAILEY	9/18/2018
019733D02	Ammonium Sulfate	200 mg/ml	JBAILEY	9/18/2018
020249S	EDTA	0.25M	JBAILEY	9/18/2018

# Alpha 3

25


Date	Sample #	Client	Load time	Counttime	Analysis	Tech
9/18/18	1809042A (1,2)	TN Dept. of H.	0818	2hrs50min	UU	KP
9/18/18	1809043A (1-8)	TN Dept. of H.	0819	16hrs	UU	KP
9/18/18	1809057A (3-4)	Bungess Niple	1112	2hrs50 =	UU	KB
9/19/18	1809066A (1-4)	Smoky mtn.	1112	2hrs50 =	UU	KB
9/18/18	1809016A (1-13)	Wis N. America	1250	2hrs50 =	Rob	KB
9/18/18	1809025A (1-18)	MPA	1524	2hrs50 =	Rob	KB

**RA-226 NOTES – RUN 2**

 <b>EBERLINE</b> <small>SERVICES</small> <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b> 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09025
		Analysis Code	Ra226
		Run Number	2


#	Date	Dept	User	Notes
1	09/20/18 10:41	PREP	JHARVEY	ALIQUOTED AND FILTERED SAMPLE- 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

*J. Harvey*  
 9/20/18

 <b>EBERLINE</b> <small>SERVICES</small> <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b> 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09025
		Analysis Code	Ra226
		Run Number	2

#	Date	Dept	User	Notes
1	09/20/18 10:41	PREP	JHARVEY	ALIQUOTED AND FILTERED SAMPLE- 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	09/24/18 12:52	CHEM	JBAILEY	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.

*JBA*  
 9/24/18

 <b>Reagents Used in an Analysis</b>		Internal Work Order		
		18-09025		
		Analysis Code		Run
		Ra226		2
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/20/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/20/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/20/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/20/2018
020283P	Nitric Acid	Reagent Grade	JHARVEY	9/20/2018
019210P	Acetic Acid	Reagent Grade	JBAILEY	9/24/2018
019733D02	Ammonium Sulfate	200 mg/ml	JBAILEY	9/24/2018
020249S	EDTA	0.25M	JBAILEY	9/24/2018





Reagents Used in an Analysis

Internal Work Order

**18-09025**

Analysis Code

Run

**Ra226**

**2**

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/20/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/20/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/20/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/20/2018
020283P	Nitric Acid	Reagent Grade	JHARVEY	9/20/2018
019210P	Acetic Acid	Reagent Grade	JBAILEY	9/24/2018
019733D02	Ammonium Sulfate	200 mg/ml	JBAILEY	9/24/2018
020249S	EDTA	0.25M	JBAILEY	9/24/2018

Alpha 3

Date	Sample #	Client too	Load time	Count time	Analysis	Tech
9/24/18	1809049A(9)	DOE	0818	5hr35min	Am <sup>241</sup>	KP
9/24/18	1809049A(1-5,8,9)	DOE	0819	5hr35min	Pu	KP
9/24/18	1809063A(1-5,7)	DOE	0820	5hr35min	Pu	KP
9/24/18	1809099A(1-5,8,9)	DOE	0821	5hr35min	UU	KP
9/24/18	1809063A(1-5)	DOE	0822	5hr35min	UU	KP
9/24/18	1809063A(7)	DOE	1408	5hr35-	UU	KB
9/24/18	1809025B(1-3,14)	MPA	1409	2hr50-	Pu	KB
9/24/18	1809086A(1-4)	Indust. Env.	1411	2hr50-	Pu	KB

Alpha 3

27

Date	Sample #	Client too	Load time	Count time	Analysis	Tech
9/24/18	1809049A(9)	DOE	0818	5hr35min	Am <sup>241</sup>	KP
9/24/18	1809049A(1-5,8,9)	DOE	0819	5hr35min	Pu	KP
9/24/18	1809063A(1-5,7)	DOE	0820	5hr35min	Pu	KP
9/24/18	1809049A(1-5,8,9)	DOE	0821	5hr35min	UU	KP
9/24/18	1809063A(1-5)	DOE	0822	5hr35min	UU	KP
9/24/18	1809063A(7)	DOE	1407	5hr35min	UU	KB
9/24/18	1809025B(1-3,14)	MPA	1409	2hr50min	Pu	KB
9/24/18	1809046A(1-4)	Indust Env.	1411	2hr50min	Pu	KB
9/24/18	1809083A(1-4)	UCOR	1432	2hr50min	Pu	KB
9/24/18	1809064A(1-6)	Sci N. America	1725	2hr50min	Pu	KB
9/24/18	1809075A(1-5)	Sci N. America	1726	2hr50min	Pu	KB
9/25/18	Daily Pulser	Lab	0505	10min	Na	KP
9/25/18	1809083A(1-4)	UCOR	0812	2hr50min	Th	KP
9/25/18	1809083A(1-4,7)	UCOR	0813	2hr50min	Pu	KP
9/25/18	1809083A(1-4)	UCOR	0814	2hr50min	Pu <sup>242</sup>	KP
9/25/18	1809083A(1-4)	UCOR	0815	2hr50min	Th <sup>232</sup>	KP
9/25/18	1809083A(4)	UCOR	0816	2hr50min	UUNT	KP
9/25/18	1809083A(1-4)	UCOR	0816	2hr50min	UU	KP
9/25/18	1809095A(1-4)	USA	1110	2hr50min	Pu	KB
9/25/18	1809083A(1-2)	UCOR	1111	2hr50min	Pu	KB
9/25/18	1809083A(1-2)	UCOR	1112	2hr50min	Pu <sup>242</sup>	KB
9/25/18	1809063A(1-5,7)	DOE	1113	5hr35min	Pu	KB
9/25/18	1809025B(3,18)	MPA	1402	2hr50min	Pu	KB

**RA-228 NOTES**

 <b>EBERLINE</b> <small>SERVICES</small> <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b> 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com		Internal Work Order	18-09025
			Analysis Code	Ra228
			Run Number	1


#	Date	Dept	User	Notes
1	09/12/18 11:48	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*  
 9/12/18

 <b>EBERLINE</b> <small>SERVICES</small> <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b> 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09025
		Analysis Code	Ra228
		Run Number	1

#	Date	Dept	User	Notes
1	09/12/18 11:48	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	09/21/18 14:07	CHEM	JBAILEY	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.

*JBA*  
 9/21/18

 <b>Reagents Used in an Analysis</b>		Internal Work Order		
		18-09025		
		Analysis Code		Run
		Ra228		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/12/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/12/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/12/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/12/2018
020000P	Nitric Acid	Reagent Grade	JHARVEY	9/12/2018
018297D01	Ammonium Oxalate	5%	JBAILEY	9/21/2018
018971D06	Nitric Acid	1N	JBAILEY	9/21/2018
019673D02	Nitric Acid	6N	JBAILEY	9/21/2018
018699D10	Sodium Hydroxide	10M	JBAILEY	9/21/2018
019344D01	Sodium Hydroxide	18M	JBAILEY	9/21/2018
019519S	Yttrium Carrier	9 mg/ml	JBAILEY	9/21/2018

Red LB4110

Date	Sample #	Client	Load time	Count time	Analysis	Tech
9/18/18	Daily Bkgd/QC	Lab	0535/0503	1hr/30min	αβ	KP
9/18/18	Cross Talk	Lab	0640	5 min	αβ	KP
9/18/18	Cross Talk	Lab	0649	5 min	αβ	KP
9/18/18	1809077AB(1-3,5)	UCOR	1650	30mins	αβ	KB
9/19/18	Daily Bkgd/QC	Lab	0540/0508	1hr/30min	αβ	KP
9/19/18	Cross Talk	Lab	0646	5 min	αβ	KP
9/19/18	Cross Talk	Lab	0654	5 min	αβ	KP
9/19/18	1809016RAC(1-6)	South America	1405	2 hrs	Rev 8	KB
9/19/18	1809088AB(1-3,5)	UCOR	1727	30mins	αβ	KB
9/19/18	1809089AB(1-2)	UCOR	1729	30mins	αβ	KB
9/20/18	Daily Bkgd/QC	Lab	0624/0520	1hr/30min	αβ	KP
9/20/18	Cross Talk	Lab	0658	5 min	αβ	KP
9/20/18	Cross Talk	Lab	0707	5 min	αβ	KP
9/21/18	Daily Bkgd/QC	Lab	0605/0525	1hr/30min	αβ	KP
9/21/18	Cross Talk	Lab	0707	5 min	αβ	KP
9/21/18	Cross Talk	Lab	0715	5 min	αβ	KP
9/21/18	1809025RAC(15-18)	MPA	1426	2 hr	Rev 5	KB



Aqua LB4110

Date	Sample #	Client	Load time	Count time	Analysis	Tech
9/20/18	1809071A(1-13)	Auxier	1345	2 hrs	αβ	ICB
9/21/18	Daily Bkgd/AC	Lab	0520/0628	1hr/30min	αβ	KP
9/21/18	Cross Talk	Lab	0704	5 min	αβ	KP
9/21/18	Cross Talk	Lab	0714	5 min	αβ	KP
9/21/18	1809153RA(1-6)	Cal Energy	1128	2 hrs	Rad	ICB
9/21/18	1809044RA(1-7)	USA	1129	2 hr	Rad	ICB
9/21/18	1809025RA(1-14)	MPA	1426	2 hrs	Rad	ICB

**TDS NOTES**

 <b>EBERLINE</b> SERVICES <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b> 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09025
		Analysis Code	TDS
		Run Number	1

#	Date	Dept	User	Notes
1	09/11/18 01:16	PREP	MHIGHTOWER	Filtered sample into tared beaker, dried, re-weighed

MW 11SEP18

**SECTION VIII**  
**ANALYTICAL DATA (RADIUM-226)**

**RUN 1**

<b>Work Order</b>	<b>18-09025</b>
<b>Analysis Code</b>	<b>Ra226</b>
<b>Run</b>	<b>1</b>
<b>Date Received</b>	<b>9/10/2018</b>
<b>Lab Deadline</b>	<b>9/21/2018</b>
<b>Client</b>	Michael Pisani & Associates, Inc.
<b>Project</b>	07-214
<b>Report Level</b>	4
<b>Activity Units</b>	pCi
<b>Aliquot Units</b>	I
<b>Matrix</b>	WA
<b>Method</b>	EPA 903.0 Modified
<b>Instrument Type</b>	Alpha Spectroscopy
<b>Radiometric Tracer</b>	Ba-133
<b>Radiometric Sol#</b>	Ba-6a
<b>Tracer Act (dpm/g)</b>	474.78
<b>Carrier</b>	
<b>Carrier Conc (mg/ml)</b>	

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/10/18 00:00	1.0000E+00
02	MBL	BLANK		09/10/18 00:00	1.0000E+00
03	DUP	BC-1	34	08/28/18 08:00	1.0000E+00
04	TRG	BC-3A	35	08/27/18 11:40	5.0000E-01
05	TRG	BC-3B	25	08/27/18 12:10	1.0000E+00
06	TRG	BC-2A	34	08/27/18 14:35	2.5000E-01
07	TRG	BC-2D	35	08/27/18 15:30	1.0000E+00
08	TRG	BC-2C	32	08/27/18 16:50	1.0000E+00
09	TRG	BC-5	37	08/27/18 18:10	1.0000E+00
10	DO	BC-1	34	08/28/18 08:00	1.0000E+00
11	TRG	BC-4C	34	08/28/18 11:30	1.0000E+00
12	TRG	BC-4B	38	08/28/18 13:50	1.0000E+00
13	TRG	BC-4A	44	08/28/18 15:00	1.0000E+00
14	TRG	BC-6	31	08/28/18 17:00	1.0000E+00
15	TRG	BC-7B	37	08/29/18 08:00	1.0000E+00
16	TRG	BC-7A	50	08/29/18 09:10	5.0000E-01
17	TRG	BC-8B	33	08/29/18 10:45	1.0000E+00
18	TRG	BC-8A	37	08/29/18 12:05	1.0000E+00

0062

\* 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.

Internal Fraction	Sample Desc	Tracer Aliquot (g)	Tracer Total ACT (dpm)	Radiometric Tracer (pCi)	Radiometric % Rec	Grav Carrier Added (ml)	Grav Filter Tare (g)	Grav Filter Final (g)	Grav Filter Net (g)	Grav % Rec	Mean % Rec	SAF 1*	SAF 2*
01	LCS	2.2067	1047.7	1020.0	216.13		0.0210	0.0302	0.0092		110.00	3.00^	1.00
02	MBL	2.2037	1046.3	1000.0	212.18		0.0207	0.0310	0.0103		110.00	3.00^	1.00
03	DUP	2.2039	1046.4	678.0	143.85		0.0206	0.0290	0.0084		110.00	2.87	1.00
04	TRG	2.2027	1045.8	515.0	109.32		0.0204	0.0327	0.0123		109.32	3.00^	1.00
05	TRG	2.1998	1044.4	656.0	139.44		0.0205	0.0294	0.0089		110.00	2.99	1.00
06	TRG	2.2025	1045.7	328.0	69.63		0.0209	0.0433	0.0224		69.63	3.00^	1.00
07	TRG	2.1995	1044.3	545.0	115.86		0.0205	0.0245	0.0040		110.00	1.11	1.00
08	TRG	2.1979	1043.5	864.0	183.81		0.0204	0.0305	0.0101		110.00	3.00^	1.00
09	TRG	2.1970	1043.1	648.0	137.91		0.0200	0.0296	0.0096		110.00	3.00^	1.00
10	DO	2.1975	1043.3	621.0	132.14		0.0207	0.0295	0.0088		110.00	2.96	1.00
11	TRG	2.1915	1040.5	521.0	111.16		0.0206	0.0276	0.0070		110.00	2.50	1.00
12	TRG	2.1915	1040.5	909.0	193.95		0.0204	0.0277	0.0073		110.00	2.58	1.00
13	TRG	2.1930	1041.2	623.0	132.83		0.0206	0.0292	0.0086		110.00	2.91	1.00
14	TRG	2.1951	1042.2	613.0	130.58		0.0205	0.0278	0.0073		110.00	2.58	1.00
15	TRG	2.1978	1043.5	417.0	88.72		0.0204	0.0292	0.0088		88.72	2.96	1.00
16	TRG	2.1934	1041.4	305.0	65.02		0.0206	0.0369	0.0163		65.02	3.00^	1.00
17	TRG	2.1956	1042.4	544.0	115.85		0.0204	0.0311	0.0107		110.00	3.00^	1.00
18	TRG	2.1945	1041.9	20.2	4.30		0.0203	0.0293	0.0090		4.30	3.00^	1.00

\* 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.

Internal Fraction	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep t0 Date/Time	Sep t0 By	Sep t1 Date/Time	Sep t1 By
01	LCS			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
02	MBL			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
03	DUP			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
04	TRG			09/12/18 09:25	JHARVEY	09/18/18 12:45	JBAILEY		
05	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
06	TRG			09/12/18 09:25	JHARVEY	09/18/18 12:45	JBAILEY		
07	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
08	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
09	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
10	DO			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
11	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
12	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
13	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
14	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
15	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
16	TRG			09/12/18 09:25	JHARVEY	09/18/18 12:45	JBAILEY		
17	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		
18	TRG			09/12/18 09:25	JHARVEY	09/18/18 10:17	JBAILEY		

\* 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.



	Run	1
	Analysis Code	Ra226
Eberline Analytical Work Order	18-09025	
Client	Michael Pisani & Associates, Inc.	

5900

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	RA-226	LCS	LCS	pCi/l	9.62E+00	1.36E+00	2.81E-01	1.01E+01	95.26	OK		OK	
02	RA-226	MBL	BLANK	pCi/l	6.45E-02	1.61E-01	3.36E-01					OK	OK
03	RA-226	DUP	BC-1	pCi/l	2.55E-01	2.73E-01	4.01E-01				NA	OK	
04	RA-226	TRG	BC-3A	pCi/l	4.60E+00	1.31E+00	7.46E-01					OK	
05	RA-226	TRG	BC-3B	pCi/l	7.54E-01	3.88E-01	3.59E-01					OK	
06	RA-226	TRG	BC-2A	pCi/l	8.48E+01	9.71E+00	2.49E+00					INV	
07	RA-226	TRG	BC-2D	pCi/l	1.81E+00	3.37E-01	9.34E-02					OK	
08	RA-226	TRG	BC-2C	pCi/l	9.52E-01	4.39E-01	3.78E-01					OK	
09	RA-226	TRG	BC-5	pCi/l	2.94E+00	6.98E-01	2.36E-01					OK	
10	RA-226	DO	BC-1	pCi/l	6.60E-01	3.36E-01	2.24E-01					OK	
11	RA-226	TRG	BC-4C	pCi/l	5.51E+00	9.25E-01	2.80E-01					OK	
12	RA-226	TRG	BC-4B	pCi/l	1.87E+00	5.37E-01	2.63E-01					OK	
13	RA-226	TRG	BC-4A	pCi/l	3.39E-01	2.46E-01	2.11E-01					OK	
14	RA-226	TRG	BC-6	pCi/l	5.09E-01	3.10E-01	3.40E-01					OK	
15	RA-226	TRG	BC-7B	pCi/l	1.69E-02	1.68E-01	4.15E-01					OK	
16	RA-226	TRG	BC-7A	pCi/l	3.30E+00	1.53E+00	9.37E-01					OK	
17	RA-226	TRG	BC-8B	pCi/l	5.92E-01	3.75E-01	3.61E-01					OK	
18	RA-226	TRG	BC-8A	pCi/l	1.39E+00	4.50E+00	9.33E+00					INV	



	Run	1
	Analysis Code	Ra226
	Eberline Analytical Work Order	18-09025
Client	Michael Pisani & Associates, Inc.	

7900

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Half-life (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-226	LCS	09/18/18 15:23		A_Spec	Alpha_033	170	2.05 E+02	5.00 E-03	17
02	RA-226	MBL	09/18/18 15:23		A_Spec	Alpha_034	170	1.15 E+00	5.00 E-03	14.2
03	RA-226	DUP	09/18/18 15:23		A_Spec	Alpha_035	170	4.96 E+00	1.20 E-02	14.8
04	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_036	170	5.06 E+01	1.40 E-02	17.5
05	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_039	170	1.68 E+01	1.30 E-02	17.6
06	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_040	170	3.26 E+02	2.20 E-02	17.6
07	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_041	170	1.16 E+02	5.00 E-03	18.8
08	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_042	170	2.06 E+01	1.40 E-02	17.2
09	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_043	170	7.03 E+01	4.00 E-03	19
10	RA-226	DO	09/18/18 15:23		A_Spec	Alpha_044	170	1.55 E+01	3.00 E-03	18.4
11	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_045	170	1.44 E+02	1.00 E-02	17.4
12	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_046	170	4.86 E+01	8.00 E-03	17.8
13	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_047	170	7.66 E+00	2.00 E-03	17.4
14	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_048	170	1.31 E+01	1.70 E-02	17.6
15	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_049	170	3.00 E-01	1.00 E-02	15.6
16	RA-226	TRG	09/18/18 15:23		A_Spec	Alpha_050	170	1.85 E+01	3.00 E-03	13.7
17	RA-226	TRG	09/18/18 15:24		A_Spec	Alpha_051	170	1.08 E+01	7.00 E-03	14.5
18	RA-226	TRG	09/18/18 15:24		A_Spec	Alpha_052	170	1.28 E+00	1.60 E-02	17

Internal Fraction	Sample Desc	Client ID	Sample Date	Sample Aliquot	Tracer Aliquot (g)	Tracer ACT (dpm)	Radiometric Tracer (pCi)	Radiometric % Rec	SAF 1*	SAF 2*
01	LCS	LCS	09/10/18 00:00	1.0000	2.2067	1047.6970	1020.0000	216.13	3.00^	1.00
02	MBL	BLANK	09/10/18 00:00	1.0000	2.2037	1046.2727	1000.0000	212.18	3.00^	1.00
03	DUP	BC-1	08/28/18 08:00	1.0000	2.2039	1046.3676	678.0000	143.85	2.87	1.00
04	TRG	BC-3A	08/27/18 11:40	0.5000	2.2027	1045.7979	515.0000	109.32	3.00^	1.00
05	TRG	BC-3B	08/27/18 12:10	1.0000	2.1998	1044.4210	656.0000	139.44	2.99	1.00
06	TRG	BC-2A	08/27/18 14:35	0.2500	2.2025	1045.7030	328.0000	69.63	3.00^	1.00
07	TRG	BC-2D	08/27/18 15:30	1.0000	2.1995	1044.2786	545.0000	115.86	1.11	1.00
08	TRG	BC-2C	08/27/18 16:50	1.0000	2.1979	1043.5190	864.0000	183.81	3.00^	1.00
09	TRG	BC-5	08/27/18 18:10	1.0000	2.1970	1043.0917	648.0000	137.91	3.00^	1.00
10	DO	BC-1	08/28/18 08:00	1.0000	2.1975	1043.3291	621.0000	132.14	2.96	1.00
11	TRG	BC-4C	08/28/18 11:30	1.0000	2.1915	1040.4804	521.0000	111.16	2.50	1.00
12	TRG	BC-4B	08/28/18 13:50	1.0000	2.1915	1040.4804	909.0000	193.95	2.58	1.00
13	TRG	BC-4A	08/28/18 15:00	1.0000	2.1930	1041.1925	623.0000	132.83	2.91	1.00
14	TRG	BC-6	08/28/18 17:00	1.0000	2.1951	1042.1896	613.0000	130.58	2.58	1.00
15	TRG	BC-7B	08/29/18 08:00	1.0000	2.1978	1043.4715	417.0000	88.72	2.96	1.00
16	TRG	BC-7A	08/29/18 09:10	0.5000	2.1934	1041.3825	305.0000	65.02	3.00^	1.00
17	TRG	BC-8B	08/29/18 10:45	1.0000	2.1956	1042.4270	544.0000	115.85	3.00^	1.00
18	TRG	BC-8A	08/29/18 12:05	1.0000	2.1945	1041.9047	20.2000	4.30	3.00^	1.00

# Spike and Tracer Worksheet

Internal Work Order		Run	Analysis Code		Date	Technician		Technician Initials		Witness Initials			
<b>18-09025</b>		<b>1</b>	<b>Ra226</b>		<b>9/12/2018 9:06</b>	<b>JHARVEY</b>							
LCS & Matrix Spikes													
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	LCS Volume Used (g)	MS Volume Used (g)	LCS Volume Used (g)	MSD Volume Used (g)	LCS Known pCi	MS Error Estimate	LCS Error Estimate	MSD Added pCi	Error Estimate
Ra-226	Ra-5b	43.970	9/12/2018	0.500	0.5097				10.10	0.464	0.000	0.00	0.000

Tracers												
fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition	Balance Printer Tapes					
01	Ba-133	Ba-6a	474.780	9/12/2018	2.2067	2.1300	Tracer					LCS
02	Ba-133	Ba-6a	474.780	9/12/2018	2.2037	2.1300						
03	Ba-133	Ba-6a	474.780	9/12/2018	2.2039	2.1300						
04	Ba-133	Ba-6a	474.780	9/12/2018	2.2027	2.1300						
05	Ba-133	Ba-6a	474.780	9/12/2018	2.1998	2.1300						
06	Ba-133	Ba-6a	474.780	9/12/2018	2.2025	2.1300						
07	Ba-133	Ba-6a	474.780	9/12/2018	2.1995	2.1300						
08	Ba-133	Ba-6a	474.780	9/12/2018	2.1979	2.1300						
09	Ba-133	Ba-6a	474.780	9/12/2018	2.1970	2.1300						
10	Ba-133	Ba-6a	474.780	9/12/2018	2.1975	2.1300						
11	Ba-133	Ba-6a	474.780	9/12/2018	2.1915	2.1300						
12	Ba-133	Ba-6a	474.780	9/12/2018	2.1915	2.1300						
13	Ba-133	Ba-6a	474.780	9/12/2018	2.1930	2.1300						
14	Ba-133	Ba-6a	474.780	9/12/2018	2.1951	2.1300						
15	Ba-133	Ba-6a	474.780	9/12/2018	2.1978	2.1300						
16	Ba-133	Ba-6a	474.780	9/12/2018	2.1934	2.1300						
17	Ba-133	Ba-6a	474.780	9/12/2018	2.1956	2.1300						
18	Ba-133	Ba-6a	474.780	9/12/2018	2.1945	2.1300						
							Matrix Spike					

0069

# Aliquot Worksheet

<b>Work Order</b>	<b>Run</b>	<b>Analysis Code</b>	<b>Rpt Units</b>	<b>Lab Deadline</b>	<b>Technician</b>
<b>18-09025</b>	<b>1</b>	<b>Ra226</b>	<b>liters</b>	<b>9/21/2018</b>	<b>JBAILEY</b>

Lab Fraction	Client ID		Sample Type	Muffle Data		Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
	Client ID	Sample Type		Ratio Post/Pre	No of Dils	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq	
01	LCS	LCS	TRG						1.0000E+00	1.0000E+00				
02	BLANK	MBL	DUP						1.0000E+00	1.0000E+00				
03	BC-1	DUP	TRG						1.0000E+00	1.0000E+00				
04	BC-3A	TRG	TRG						5.0000E-01	5.0000E-01				
05	BC-3B	TRG	TRG						1.0000E+00	1.0000E+00				
06	BC-2A	TRG	TRG						2.5000E-01	2.5000E-01				
07	BC-2D	TRG	TRG						1.0000E+00	1.0000E+00				
08	BC-2C	TRG	TRG						1.0000E+00	1.0000E+00				
09	BC-5	TRG	TRG						1.0000E+00	1.0000E+00				
10	BC-1	DO	TRG						1.0000E+00	1.0000E+00				
11	BC-4C	TRG	TRG						1.0000E+00	1.0000E+00				
12	BC-4B	TRG	TRG						1.0000E+00	1.0000E+00				
13	BC-4A	TRG	TRG						1.0000E+00	1.0000E+00				
14	BC-6	TRG	TRG						1.0000E+00	1.0000E+00				
15	BC-7B	TRG	TRG						1.0000E+00	1.0000E+00				
16	BC-7A	TRG	TRG						5.0000E-01	5.0000E-01				
17	BC-8B	TRG	TRG						1.0000E+00	1.0000E+00				
18	BC-8A	TRG	TRG						1.0000E+00	1.0000E+00				

<b>Comments</b>	
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0070

Technician:  Date: 9 / 18 / 18

# Gravimetric Worksheet

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
<b>18-09025</b>	<b>1</b>	<b>Ra226</b>			<b>JBAILEY</b>

TRetek Fraction	Michael Pisani & Associates, Inc. Client ID	Sample Type	Carrier Data		Filter Data			Gravimetric % Recovery
			Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)		
01	LCS	LCS		0.0210	0.0302	0.0092		
02	BLANK	MBL		0.0207	0.0310	0.0103		
03	DUP	DUP		0.0206	0.0290	0.0084		
04	BC-3A	TRG		0.0204	0.0327	0.0123		
05	BC-3B	TRG		0.0205	0.0294	0.0089		
06	BC-2A	TRG		0.0209	0.0433	0.0224		
07	BC-2D	TRG		0.0205	0.0245	0.0040		
08	BC-2C	TRG		0.0204	0.0305	0.0101		
09	BC-5	TRG		0.0200	0.0296	0.0096		
10	BC-1	DO		0.0207	0.0295	0.0088		
11	BC-4C	TRG		0.0206	0.0276	0.0070		
12	BC-4B	TRG		0.0204	0.0277	0.0073		
13	BC-4A	TRG		0.0206	0.0292	0.0086		
14	BC-6	TRG		0.0205	0.0278	0.0073		
15	BC-7B	TRG		0.0204	0.0292	0.0088		
16	BC-7A	TRG		0.0206	0.0369	0.0163		
17	BC-8B	TRG		0.0204	0.0311	0.0107		
18	BC-8A	TRG		0.0203	0.0293	0.0090		

Technician:  Date: 9/18/18



# Apex-Alpha™

CS  
9/18/18

Sample Description: SPIKE  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 01  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_033  
 Chamber Serial Number: 04026479A  
 Detector Serial Number: 91132  
 Env. Background: System Bkgd 225244  
 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: 9/18/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:21 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1696 +/- 0.0030 on 2/16/2018 9:34:38 AM  
 Effective Efficiency: 0.1696 +/- 0.0030

Control Certificate Name: Ra226\_Ra-5b  
 Chem. Recov. of Control: RA-226 0.317547 +/- 0.024828  
 Peak Match Tolerance: 0.350 MeV

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 ----- PEAK AREA REPORT -----  
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Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.476	9.81	66.87	1.19	0.00E+000	0.0
RA-226	4.593	205.15	13.72	0.85	0.00E+000	4.0

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 ----- NUCLIDE ANALYSIS RESULTS -----  
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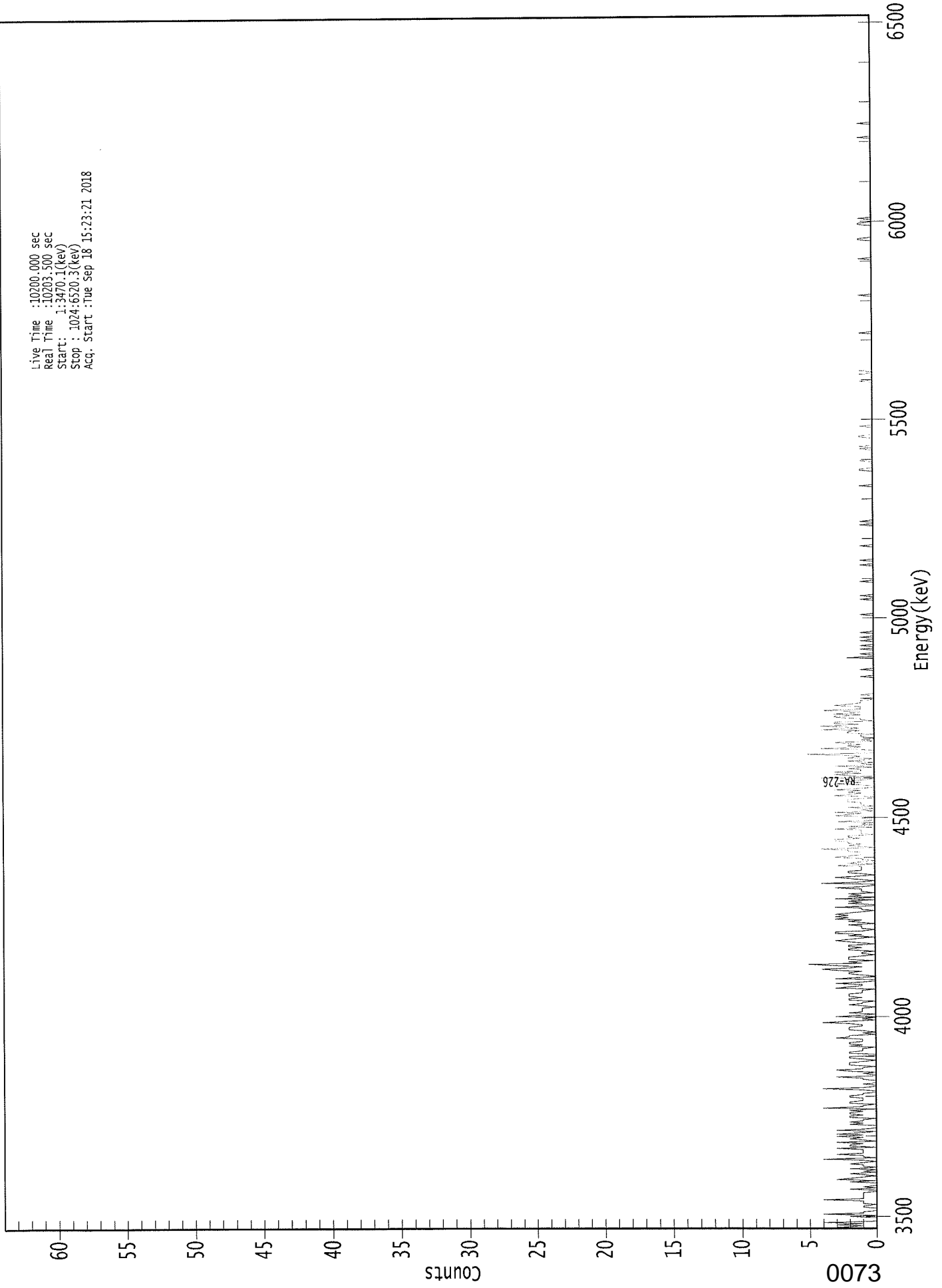
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.944	5685.50*	4.84E-001 +/- 3.24E-001	3.25E-001 +/- 1.13E-002
RA-226	0.953	4785.00*	9.62E+000 +/- 1.36E+000	2.81E-001 +/- 9.76E-003

AG  
9/19/18



0000222546.CNF

Live Time :10200.000 sec  
Real Time :10203.500 sec  
Start : 1:3470.1(kev)  
Stop : 1024:6520.3(kev)  
Acq. Start :Tue Sep 18 15:23:21 2018



ROI Type: 1

\*\*\*\*\*  
 \*\*\*\*\* 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: 10204

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

369: 1 3 1 0 0 1 3 1

Sample Title: 01

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	2	1	0	4	0	2	3	1
385:	3	1	1	2	0	3	0	1
393:	0	2	1	0	2	1	2	5
401:	0	0	0	1	4	1	2	1
409:	2	3	0	1	0	0	1	1
417:	0	2	2	1	4	1	2	4
425:	1	3	3	0	1	1	3	3
433:	1	3	1	1	4	1	1	1
441:	3	2	1	1	1	0	1	0
449:	0	1	0	0	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:	2	0	0	1	0	0	0	1
489:	0	0	1	0	0	0	1	0
497:	0	1	0	0	0	1	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	1	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	1	0	0	1	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	1	0
561:	0	0	1	0	0	0	0	0
569:	0	0	0	0	0	0	1	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	1	0	0	1	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	1	0	0	0	0	0	0
633:	0	0	0	0	0	0	1	1
641:	0	0	0	0	0	0	1	0
649:	0	0	0	0	0	0	0	0
657:	1	0	1	0	0	0	0	0
665:	0	0	1	1	0	0	0	0
673:	0	0	0	1	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	1	0	0	0	0	0	1
721:	0	0	1	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	1	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	1	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801: 0 0 0 0 0 0 0 0

Sample Title: 01

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	0	0
817:	0	1	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	1	1	0	0	0	0	0
841:	0	0	0	0	0	0	1	1
849:	0	0	0	1	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	1
921:	0	0	0	0	0	0	0	0
929:	0	0	0	1	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:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0

KB  
9/19/18

# Apex-Alpha™

Sample Description: BLANK  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 02  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_034  
 Chamber Serial Number: 04026479B  
 Detector Serial Number: 91136  
 Env. Background: System Bkgd 225245  
 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: 9/18/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:23 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1418 +/- 0.0026 on 2/16/2018 9:34:36 AM  
 Effective Efficiency: 0.1418 +/- 0.0026

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	5.532	-0.85	246.69	0.85	0.00E+000	0.0
RA-226	4.685	1.15	249.59	0.85	0.00E+000	3.0

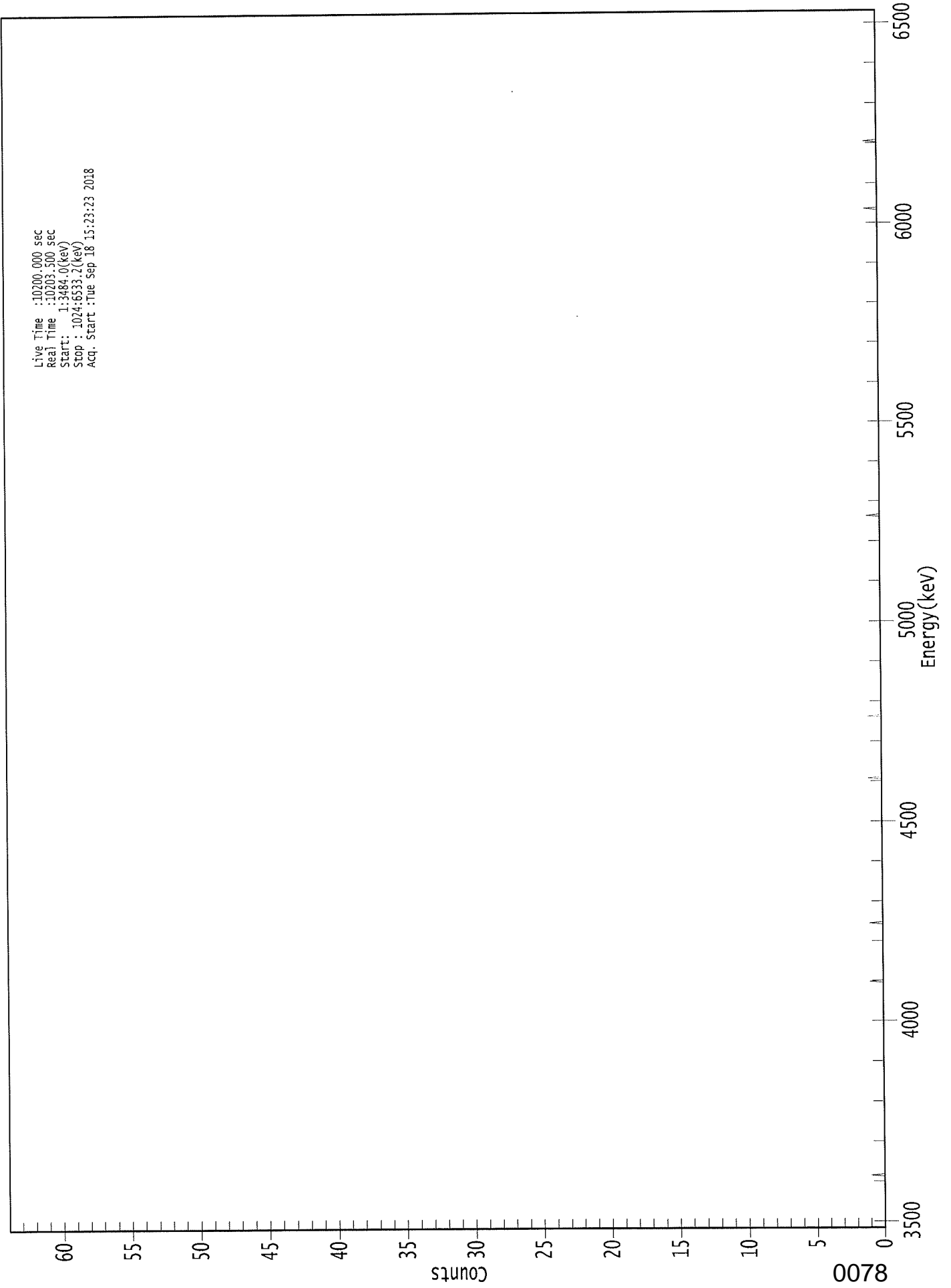
-----  
 ----- NUCLIDE ANALYSIS RESULTS -----  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.970	5685.50*	-5.01E-002 +/- 1.24E-001	3.53E-001 +/- 1.25E-002
RA-226	0.987	4785.00*	6.45E-002 +/- 1.61E-001	3.36E-001 +/- 1.19E-002

AG  
9/19/18

0000222536.CNF

Live Time :10200.000 sec  
Real Time :10203.500 sec  
Start : 1:3484.0(kev)  
Stop : 1024:6533.2(kev)  
Acq. Start :Tue Sep 18 15:23:23 2018



0078



369: 0 0 0 0 0 0 0 0

Sample Title: 02

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	1	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	0
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	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	1	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	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	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



801: 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:	1	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	1	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	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



WB  
9/18/18

Sample Description: BC-1 DUP  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 03  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_035  
 Chamber Serial Number: 04026477A  
 Detector Serial Number: 58771  
 Env. Background: System Bkgd 225246  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.870E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/28/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:25 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1479 +/- 0.0027 on 2/16/2018 9:34:34 AM  
 Effective Efficiency: 0.1479 +/- 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	5.555	7.98	74.39	1.02	0.00E+000	3.0
RA-226	4.529	4.96	107.11	2.04	0.00E+000	3.0

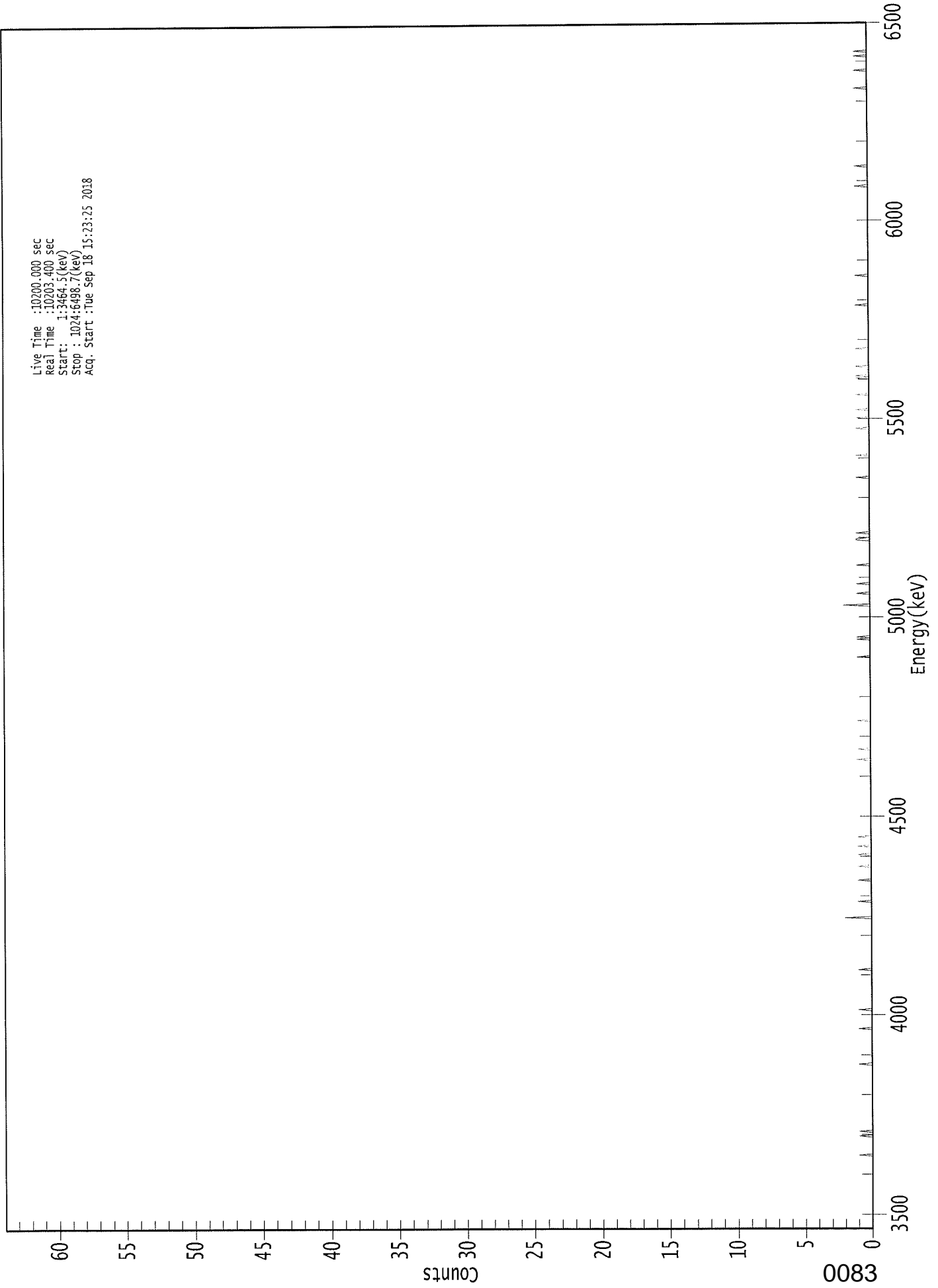
-----  
 ----- NUCLIDE ANALYSIS RESULTS -----  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.978	5685.50*	4.34E-001 +/- 3.24E-001	3.43E-001 +/- 1.21E-002
RA-226	0.918	4785.00*	2.55E-001 +/- 2.73E-001	4.01E-001 +/- 1.41E-002

AG  
9/19/18

0000222547.CNF

Live Time :10200.000 sec  
Real Time :10203.400 sec  
Start : 1:3464.5(kev)  
Stop : 1024:6498.7(kev)  
Acq. Start :Tue Sep 18 15:23:25 2018



ROI Type: 1



369: 0 0 0 0 0 0 0 0 0

Sample Title: 03

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	1	0	0
401:	0	0	0	0	0	0	0	1	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	1	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	0	0	0	0
481:	0	0	0	0	0	1	0	0	0
489:	0	0	0	0	0	0	0	0	0
497:	0	0	0	1	0	0	1	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	0	0	0
529:	2	0	0	0	0	0	0	0	0
537:	0	0	1	0	0	0	0	0	0
545:	0	0	1	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0	0
561:	0	0	1	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	1
585:	1	0	0	0	0	0	1	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	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	1	0	0	0
641:	0	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0	1
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	1	0
681:	0	0	0	0	0	0	0	0	1
689:	0	0	0	0	0	0	0	1	0
697:	0	0	0	0	0	0	0	0	0
705:	0	0	0	1	0	0	0	0	0
713:	0	0	0	0	0	0	0	0	0
721:	0	1	0	1	0	0	0	0	0
729:	0	0	0	1	0	0	0	0	0
737:	0	0	0	0	0	0	0	0	0
745:	0	0	1	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0	1
785:	0	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0	0

801: 0 0 0 0 0 0 0 0 0

Sample Title: 03

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	1	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	1	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	1	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	0	1
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	1	0
985:	0	0	0	0	0	0	0	0
993:	0	0	1	0	0	0	1	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



YBS  
9/18/18

Sample Description: BC-3A  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 04  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_036  
 Chamber Serial Number: 04026477B  
 Detector Serial Number: 84167  
 Env. Background: System Bkgd 225247  
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter  
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/27/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:27 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1748 +/- 0.0031 on 2/16/2018 9:34:33 AM  
 Effective Efficiency: 0.1748 +/- 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	5.574	8.13	77.44	1.87	0.00E+000	3.0
RA-226	4.555	50.62	28.30	2.38	0.00E+000	3.0

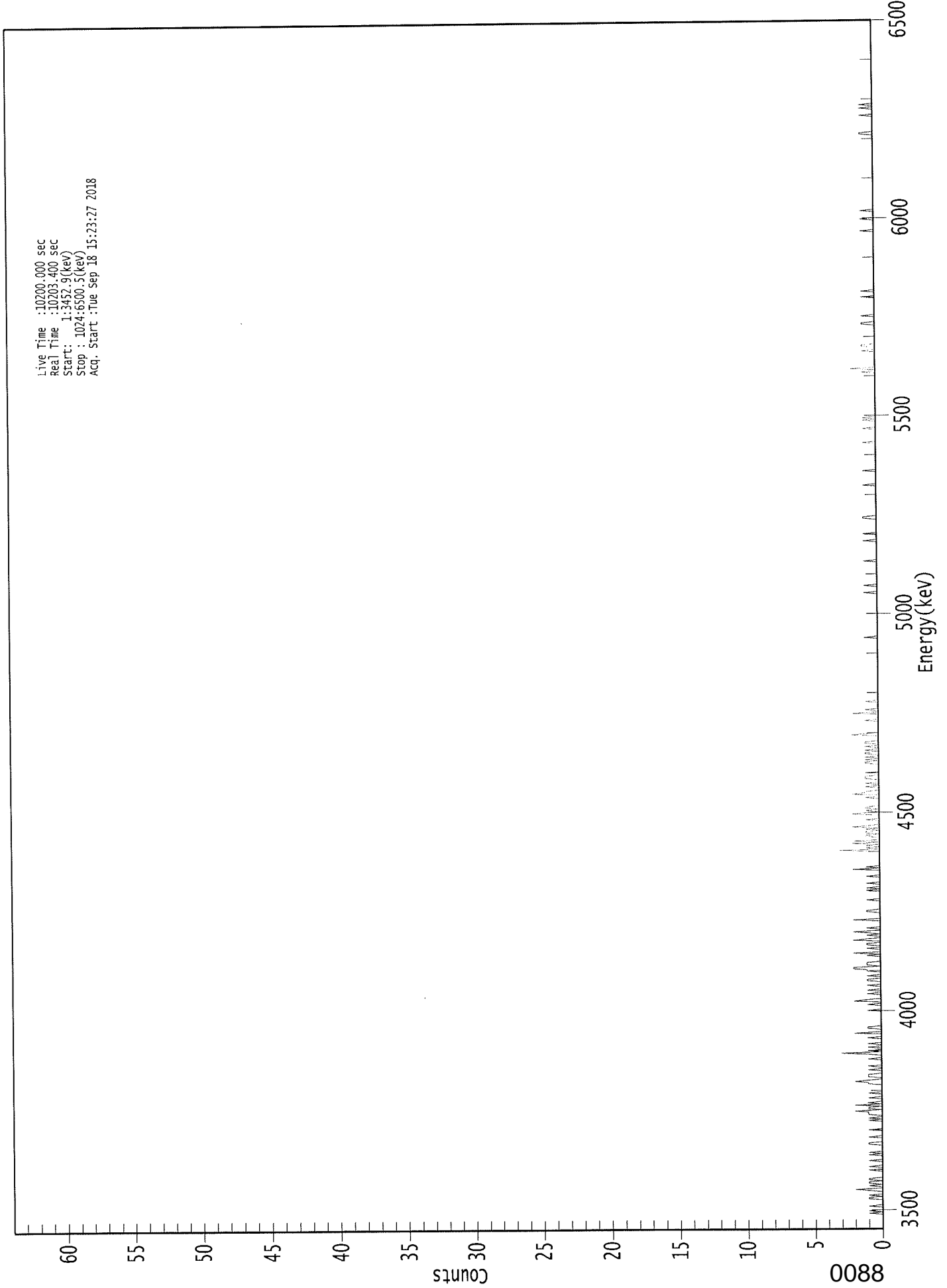
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.984	5685.50*	7.83E-001 +/- 6.07E-001	7.30E-001 +/- 2.52E-002
RA-226	0.933	4785.00*	4.60E+000 +/- 1.31E+000	7.46E-001 +/- 2.57E-002

AG  
9/19/18

0000222545.CNF

Live Time :10200.000 sec  
Real Time :10203.400 sec  
Start: 1:3452.9(kev)  
Stop : 1024:6500.5(kev)  
Acq. Start :Tue Sep 18 15:23:27 2018



ROI Type: 1



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

Sample Title: 04

Elapsed Live time: 10200  
 Elapsed Real Time: 10203

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

369: 1 1 0 0 0 1 0 0

Sample Title: 04

Channel	1	2	3	4	5	6	7	8	9
377:	1	0	0	0	1	1	1	0	0
385:	0	1	0	0	0	0	0	0	0
393:	0	1	1	0	1	0	1	0	0
401:	0	1	1	0	1	0	0	0	1
409:	0	0	1	1	0	0	0	0	0
417:	0	2	1	0	0	0	0	0	0
425:	0	0	0	0	0	1	0	0	0
433:	0	0	0	2	0	0	1	0	0
441:	0	0	0	0	0	1	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	0	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	1	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	0	0	0
529:	0	0	0	0	0	0	0	0	0
537:	0	1	0	0	0	0	0	0	1
545:	0	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0	0
561:	0	0	0	0	1	0	0	0	0
569:	0	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	1	0	0	0
585:	0	0	0	1	0	0	0	0	0
593:	0	0	0	0	0	0	0	0	0
601:	1	1	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0	0
625:	0	0	0	0	1	0	0	0	0
633:	0	0	0	0	0	0	0	0	0
641:	1	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:	1	0	0	0	0	0	0	0	0
673:	0	0	0	0	1	0	0	0	0
681:	0	0	0	1	0	1	0	0	0
689:	0	0	0	0	0	0	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	0	0	0	0	0	0
721:	0	0	0	0	1	0	0	0	2
729:	0	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	1	0	0
745:	0	0	1	1	0	0	0	0	0
753:	0	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	1	1	0	0
769:	0	0	0	0	1	0	0	0	0
777:	0	0	0	0	0	0	0	0	0
785:	0	0	0	0	1	0	0	0	0
793:	0	1	0	0	0	0	0	0	0

801: 0 0 0 0 0 0 0 0 0

Sample Title: 04

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	1	0	0	0
849:	0	0	0	0	0	0	1	0
857:	0	0	0	0	0	1	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	0	0	0	1	1
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	1	0
945:	0	0	0	0	1	0	0	1
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:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	1



KB  
9/18/18

Sample Description: BC-3B  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 05  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_039  
 Chamber Serial Number: 06027396A  
 Detector Serial Number: 83109  
 Env. Background: System Bkgd 225250  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.990E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/27/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:30 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1765 +/- 0.0031 on 2/16/2018 9:34:28 AM  
 Effective Efficiency: 0.1765 +/- 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	5.474	1.47	240.74	1.53	0.00E+000	3.0
RA-226	4.609	16.79	51.38	2.21	0.00E+000	3.0

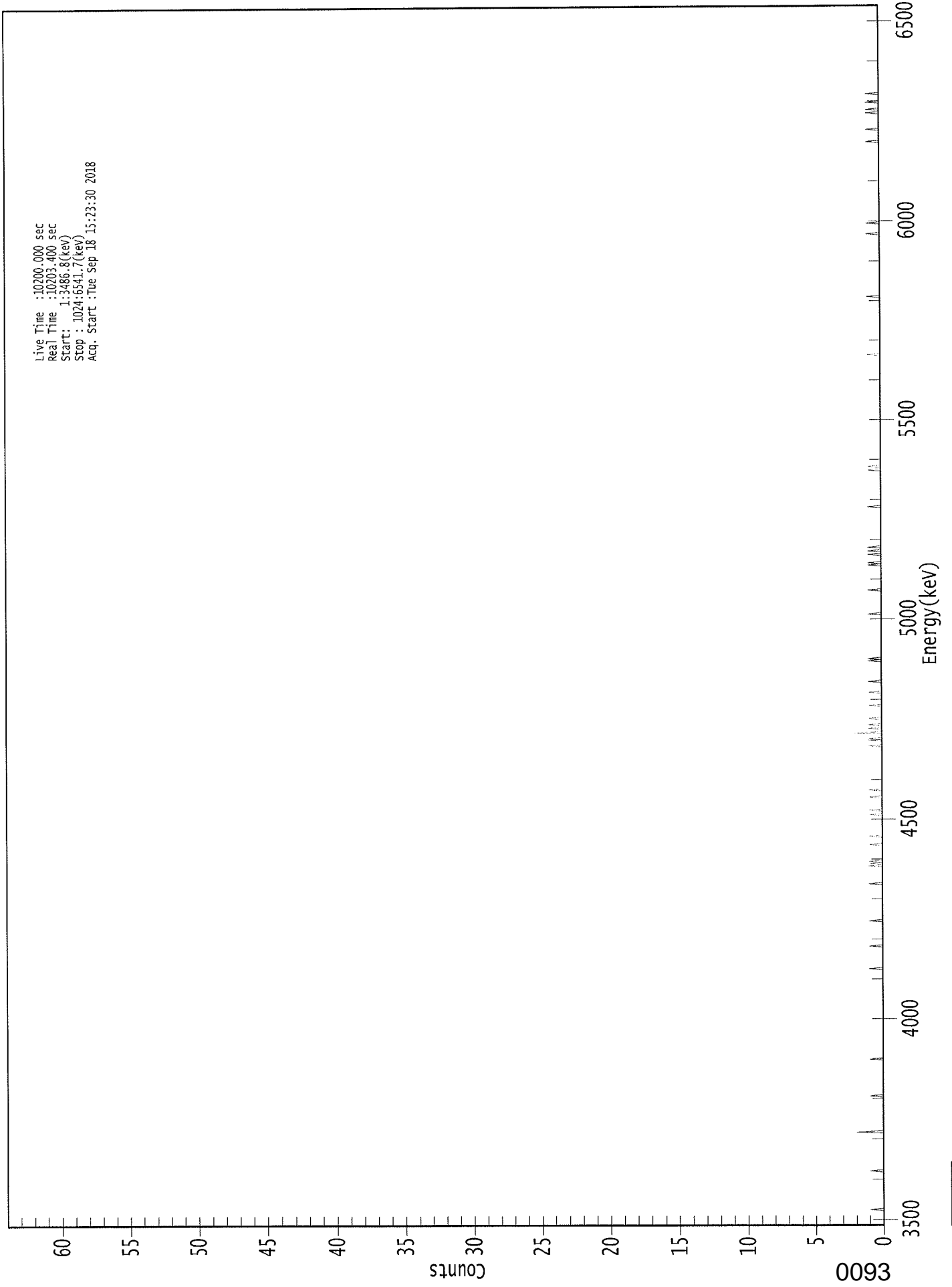
-----  
 ----- NUCLIDE ANALYSIS RESULTS -----  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.943	5685.50*	6.99E-002 +/- 1.68E-001	3.38E-001 +/- 1.17E-002
RA-226	0.960	4785.00*	7.54E-001 +/- 3.88E-001	3.59E-001 +/- 1.24E-002

AG  
9/19/18

# 0000222548.CNF

Live Time : 10200.000 sec  
Real Time : 10203.400 sec  
Start : 1:3486.8(keV)  
Stop : 1024:6541.7(keV)  
Acq. Start : Tue Sep 18 15:23:30 2018



ROI Type: 1



369: 0 0 0 0 0 0 0 0 0

Sample Title: 05

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	1	0	0	0	0	1	1
409:	0	0	0	0	2	0	0	0
417:	1	0	0	1	0	0	0	0
425:	1	0	0	0	0	0	0	0
433:	0	0	0	1	0	0	0	0
441:	0	0	0	0	0	0	1	0
449:	0	0	0	0	0	0	0	1
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0
473:	1	0	1	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	1
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	1	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	1	0	1	0	0	0	0	0
561:	0	1	0	0	1	0	0	1
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	1	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:	1	0	0	1	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:	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	1	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	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

Sample Title: 05

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	1
833:	0	0	0	0	0	0	0	0
841:	1	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	1	0	0	0
913:	0	0	0	0	0	0	1	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	1	0	0	1
937:	0	0	0	0	0	1	0	0
945:	0	0	0	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	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





KS  
9/19/18

Sample Description: BC-2A  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 06  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_040  
 Chamber Serial Number: 06027396B  
 Detector Serial Number: 91135  
 Env. Background: System Bkgd 225251  
 Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter  
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/27/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:32 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 0.6963 +/- 0.0000  
 Counting Efficiency: 0.1757 +/- 0.0031 on 2/16/2018 9:34:27 AM  
 Effective Efficiency: 0.1224 +/- 0.0021

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	5.515	20.62	45.99	2.38	0.00E+000	4.5
RA-226	4.591	326.26	10.92	3.74	0.00E+000	3.9

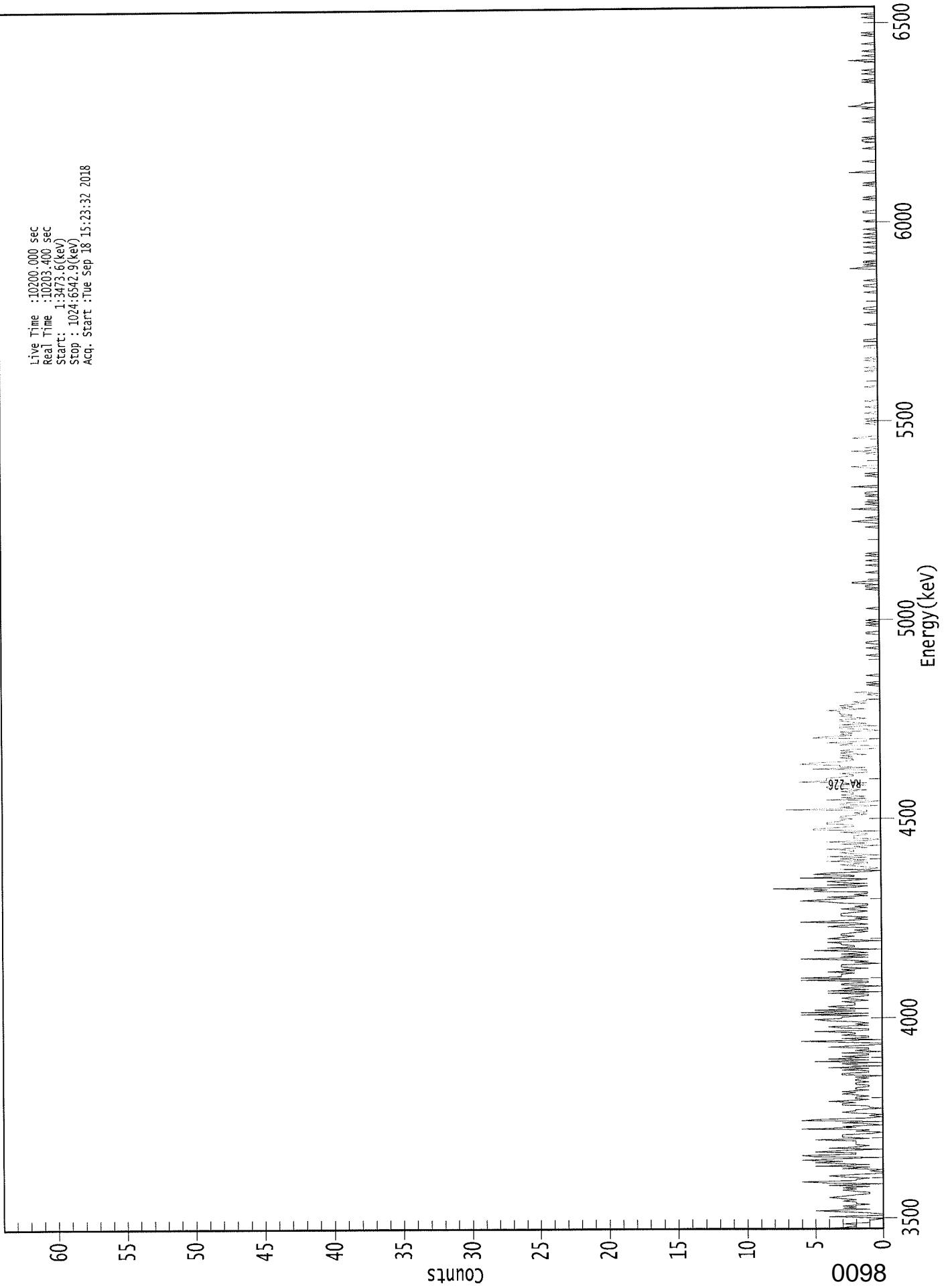
-----  
 ----- NUCLIDE ANALYSIS RESULTS -----  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.963	5685.50*	5.68E+000 +/- 2.62E+000	2.26E+000 +/- 7.77E-002
RA-226	0.952	4785.00*	8.48E+001 +/- 9.71E+000	2.49E+000 +/- 8.56E-002

AG  
9/19/18

0000222550.CNF

Live Time :10200.000 sec  
Real Time :10203.400 sec  
Start: 1:3473.6(kev)  
Stop : 1024:6542.9(kev)  
Acq. Start :Tue Sep 18 15:23:32 2018



ROI Type: 1

\*\*\*\*\*  
 \*\*\*\*\* 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: 10203

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

369: 4 4 1 3 1 6 4 4

Sample Title: 06

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

801: 0 0 0 2 1 0 1 0

Sample Title: 06

Channel	1	2	3	4	5	6	7	8	9
809:	1	1	0	0	0	0	0	0	0
817:	1	0	0	0	0	0	1	0	0
825:	0	1	0	0	0	0	1	0	0
833:	1	0	0	0	1	0	0	0	0
841:	0	0	0	1	0	0	0	0	0
849:	0	0	1	1	0	0	0	0	0
857:	0	0	0	0	0	0	1	0	1
865:	0	0	0	0	0	0	0	0	0
873:	0	1	0	1	0	0	0	0	0
881:	0	0	0	0	2	0	0	0	0
889:	0	0	0	0	0	0	1	0	0
897:	0	0	0	0	0	0	0	0	0
905:	1	0	0	0	0	0	0	1	1
913:	0	1	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	1	0
929:	0	1	0	0	0	0	0	0	0
937:	0	1	0	2	1	1	0	0	0
945:	0	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0	1
961:	0	1	0	0	0	0	0	1	0
969:	0	1	0	0	0	0	0	0	0
977:	0	2	0	0	0	0	1	0	0
985:	0	1	0	0	0	0	0	0	1
993:	0	0	0	0	0	0	0	1	0
1001:	1	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	1	0	0
1017:	1	0	0	0	0	0	0	0	0



KB  
9/10/18

Sample Description: BC-2D  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 07  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_041  
 Chamber Serial Number: 05026930A  
 Detector Serial Number: 91087  
 Env. Background: System Bkgd 225252  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 1.110E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/27/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:35 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1885 +/- 0.0033 on 2/16/2018 9:34:24 AM  
 Effective Efficiency: 0.1885 +/- 0.0033

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	5.535	10.83	60.10	0.17	0.00E+000	4.5
RA-226	4.614	116.15	18.26	0.85	0.00E+000	3.0

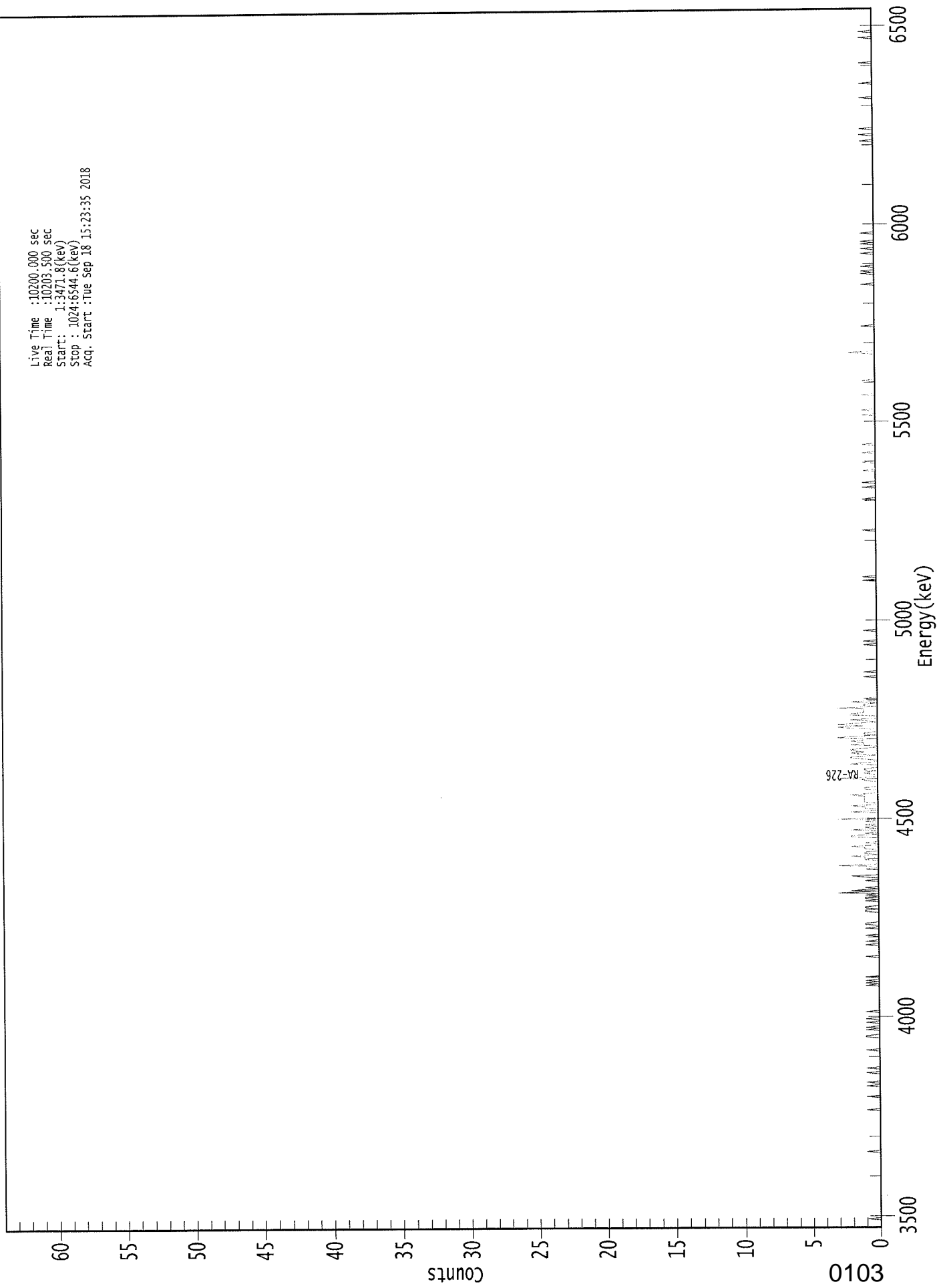
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.971	5685.50*	1.79E-001 +/- 1.08E-001	6.90E-002 +/- 2.35E-003
RA-226	0.963	4785.00*	1.81E+000 +/- 3.37E-001	9.34E-002 +/- 3.18E-003

AG  
9/19/18

0000222544.CNF

Live Time :10200.000 sec  
Real Time :10203.500 sec  
Start: 1:3471.8(kev)  
Stop : 1024:6544.6(kev)  
Acq. Start :Tue Sep 18 15:23:35 2018



ROI Type: 1

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

Sample Title: 07

Elapsed Live time: 10200  
 Elapsed Real Time: 10204

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



369: 1 0 0 0 0 0 1 1

Sample Title: 07

Channel	1	2	3	4	5	6	7	8
377:	3	0	0	0	1	1	0	1
385:	1	0	0	0	2	1	0	0
393:	1	2	2	0	1	2	1	2
401:	2	1	0	0	2	1	1	2
409:	1	1	3	2	0	1	1	0
417:	0	0	2	3	1	3	2	0
425:	1	2	0	0	0	2	2	1
433:	1	1	1	3	0	1	1	0
441:	2	0	0	1	0	0	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	0	0	1	0	0
465:	0	1	0	0	0	0	0	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	0
489:	1	0	0	1	0	0	0	0
497:	0	0	0	0	1	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	1	0
545:	0	1	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:	1	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	1	0	0	0	0	0
617:	0	0	0	0	1	0	0	0
625:	1	0	0	0	0	0	0	0
633:	0	0	1	0	0	0	0	0
641:	0	1	0	0	0	0	0	0
649:	0	1	0	0	0	0	0	0
657:	1	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	1	0	0	0	1	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	1	0	0	0	0	0
705:	0	0	0	0	0	0	1	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	2	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	1	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	1
793:	0	0	0	0	0	0	0	0

801: 1 0 1 0 0 0 1 0

Sample Title: 07

Channel	1	2	3	4	5	6	7	8	9
809:	0	0	0	0	0	0	0	0	0
817:	0	1	0	0	0	0	1	0	0
825:	0	1	0	1	0	0	0	0	0
833:	0	0	1	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0	0
913:	1	0	0	0	0	0	1	0	0
921:	0	0	1	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	1	0	0	0
953:	0	0	0	0	0	0	0	0	0
961:	1	0	0	0	0	0	0	0	0
969:	0	0	0	0	0	0	0	0	0
977:	0	1	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	1	0
1001:	0	0	0	0	1	0	0	0	0
1009:	0	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0	0



165  
9/19/18

Sample Description: BC-2C  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 08  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_042  
 Chamber Serial Number: 05026930B  
 Detector Serial Number: 84185  
 Env. Background: System Bkgd 225253  
 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: 8/27/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:38 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1722 +/- 0.0030 on 2/16/2018 9:34:23 AM  
 Effective Efficiency: 0.1722 +/- 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	5.459	1.60	289.32	3.40	0.00E+000	3.0
RA-226	4.609	20.62	45.99	2.38	0.00E+000	4.5

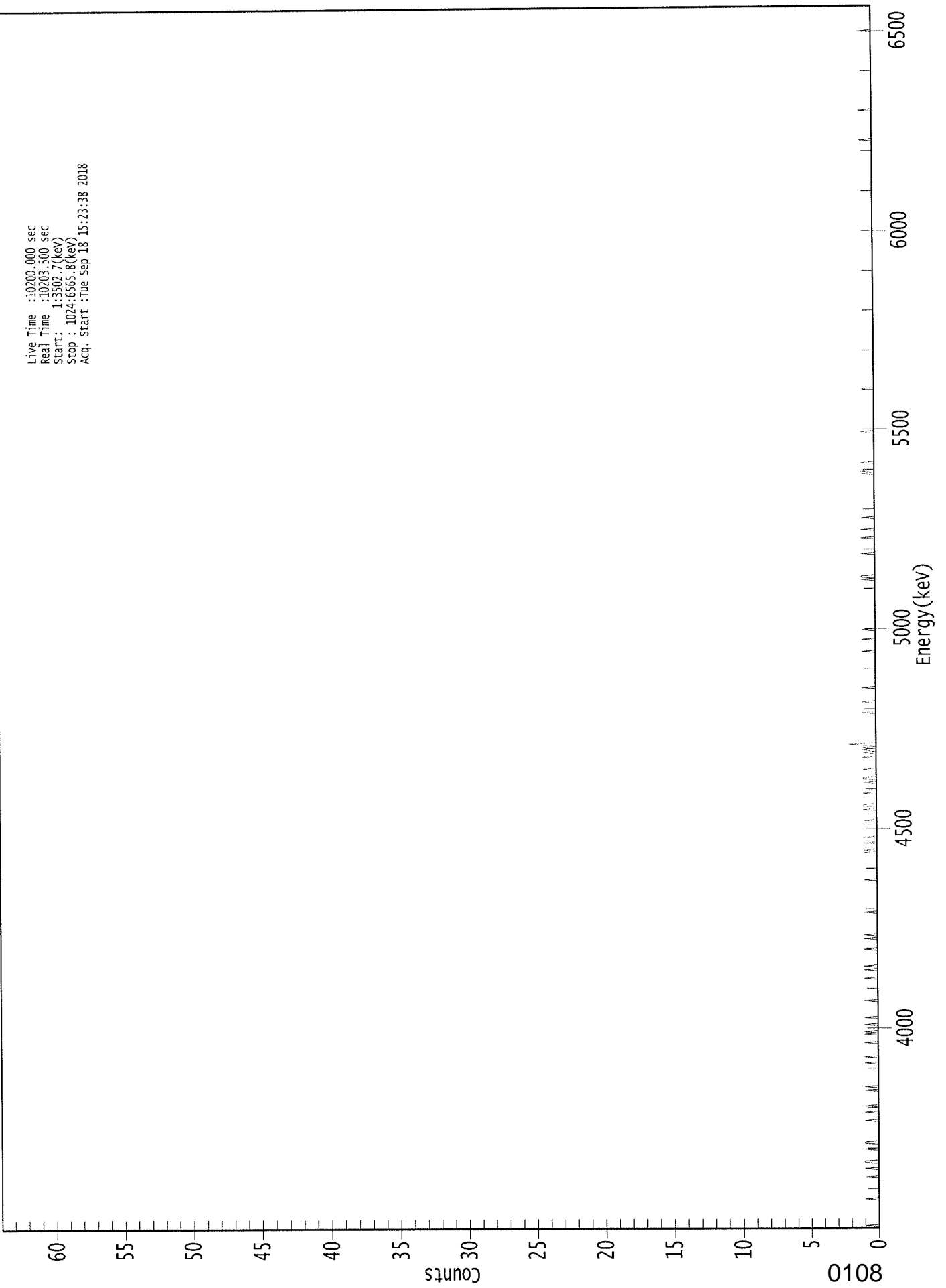
-----  
 ----- NUCLIDE ANALYSIS RESULTS -----  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.935	5685.50*	7.82E-002 +/- 2.26E-001	4.53E-001 +/- 1.56E-002
RA-226	0.960	4785.00*	9.52E-001 +/- 4.39E-001	3.78E-001 +/- 1.30E-002

AG  
9/19/18

0000222551.CNF

Live Time :10200.000 sec  
Real Time :10203.500 sec  
Start: 1:3502.7(kev)  
Stop : 1024:6565.8(kev)  
Acq. Start :Tue Sep 18 15:23:38 2018



ROI Type: 1



369: 0 0 0 0 1 0 0 1

Sample Title: 08

Channel	1	2	3	4	5	6	7	8
377:	1	0	0	0	0	0	0	1
385:	0	0	0	0	0	0	0	0
393:	0	1	0	0	0	1	0	1
401:	0	1	0	1	2	0	0	0
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	1	0
433:	0	0	0	0	0	0	0	1
441:	0	0	0	0	0	0	0	0
449:	0	0	0	1	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0
473:	0	0	0	0	0	0	0	0
481:	0	1	0	0	0	0	0	0
489:	0	0	0	1	0	0	0	0
497:	0	0	0	1	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	1	0	1
545:	1	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	0	1	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	1	0	0	0	0	0	0	1
585:	0	0	0	0	0	0	0	0
593:	0	1	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	1	0
633:	1	0	0	0	0	0	0	1
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:	0	1	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	1	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

801: 0 0 0 0 0 0 0 0 0

Sample Title: 08

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:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	1	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	1
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	1	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



100  
alpha

Sample Description: BC-5  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 09  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_043  
 Chamber Serial Number: 04026481A  
 Detector Serial Number: 91088  
 Env. Background: System Bkgd 225254  
 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: 8/27/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:40 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1903 +/- 0.0033 on 2/16/2018 9:34:21 AM  
 Effective Efficiency: 0.1903 +/- 0.0033

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	5.511	6.66	78.18	0.34	0.00E+000	3.0
RA-226	4.581	70.32	23.50	0.68	0.00E+000	4.5

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

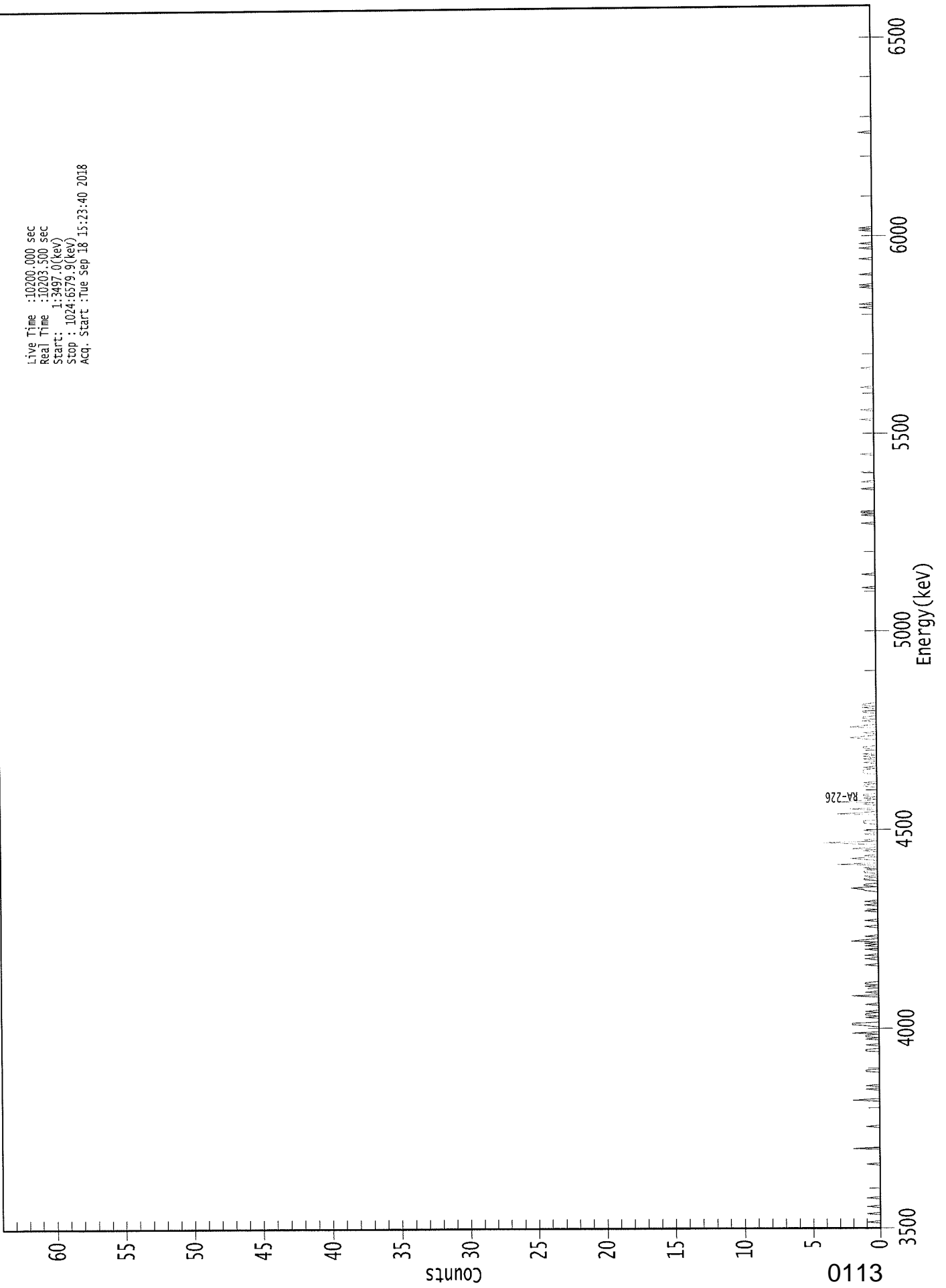
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.961	5685.50*	2.95E-001 +/- 2.31E-001	2.12E-001 +/- 7.24E-003
RA-226	0.947	4785.00*	2.94E+000 +/- 6.98E-001	2.36E-001 +/- 8.04E-003

AG  
 9/19/18



0000222552.CNF

Live Time :10200.000 sec  
Real Time :10203.500 sec  
Start: 1:3497.0(kev)  
Stop : 1024:0579.9(kev)  
Acq. Start :Tue Sep 18 15:23:40 2018



ROI Type: 1

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

Sample Title: 09

Elapsed Live time: 10200  
 Elapsed Real Time: 10204

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

369: 1 1 0 1 0 0 0 0

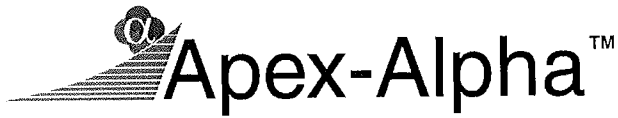
Sample Title: 09

Channel	1	2	3	4	5	6	7	8
377:	0	0	0	1	1	1	1	0
385:	1	0	0	0	1	0	0	1
393:	0	1	0	1	0	0	0	0
401:	1	1	0	0	0	0	0	0
409:	1	2	1	0	0	1	0	0
417:	0	0	2	1	0	0	0	1
425:	0	1	1	0	0	0	1	1
433:	0	0	1	0	1	1	0	0
441:	0	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	0	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	1	0
537:	0	0	0	0	0	0	0	0
545:	0	1	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	1	0	0	0
593:	0	0	0	1	0	1	1	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	1	0	0	0	0	0	1
625:	0	0	0	0	0	0	0	1
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	1	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	1	0	0	0	0
681:	0	0	0	1	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	1	0
705:	0	0	0	0	0	0	0	0
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	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	1	0	0	1	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	1	0	1	0	0	0
793:	0	0	0	0	0	1	0	0

801: 0 0 0 0 0 0 0 0

Sample Title: 09

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	1	0	0	0	0	0
817:	0	0	0	1	0	0	0	1
825:	0	0	0	0	0	0	0	0
833:	0	0	1	0	1	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	1	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	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



108  
9/19/18

Sample Description: BC-1  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 10  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_044  
 Chamber Serial Number: 04026481B  
 Detector Serial Number: 84168  
 Env. Background: System Bkgd 225255  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.960E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/28/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:43 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.1 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1840 +/- 0.0032 on 2/16/2018 9:34:19 AM  
 Effective Efficiency: 0.1840 +/- 0.0032

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	5.466	4.15	107.12	0.85	0.00E+000	3.0
RA-226	4.602	15.49	50.75	0.51	0.00E+000	4.5

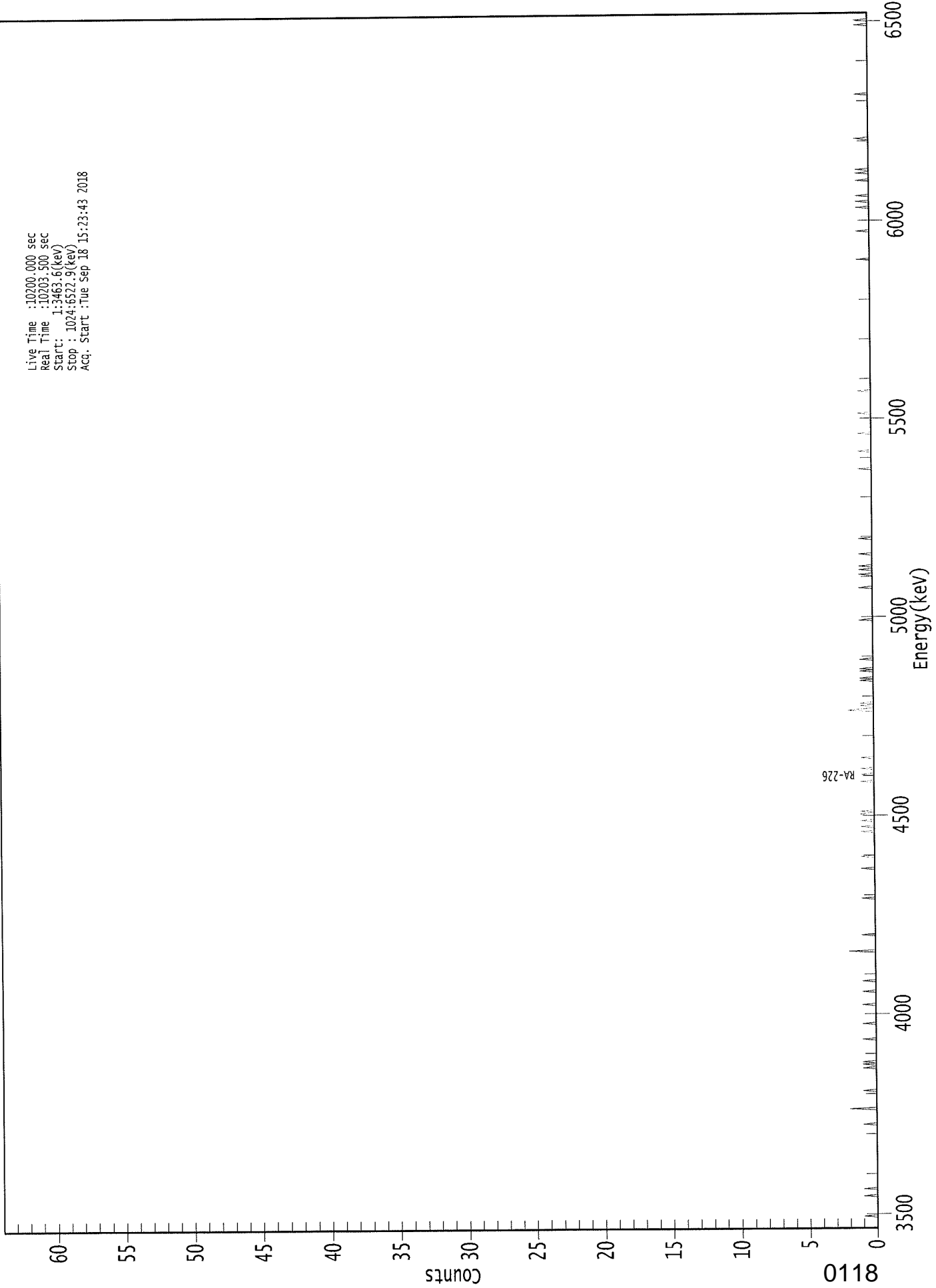
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.939	5685.50*	1.87E-001 +/- 2.01E-001	2.70E-001 +/- 9.29E-003
RA-226	0.957	4785.00*	6.60E-001 +/- 3.36E-001	2.24E-001 +/- 7.67E-003

AG  
9/19/18

0000222549.CNF

Live Time :10200.000 sec  
Real Time :10203.500 sec  
Start: 1:3463.6(kev)  
Stop : 1024:6522.9(kev)  
Acq. Start :Tue Sep '18 15:23:43 2018



ROI Type: 1

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

Sample Title: 10

Elapsed Live time: 10200  
 Elapsed Real Time: 10204

Channel	1	0	0	0	0	0	0	0
1:	1	0	0	0	0	0	0	0
9:	0	0	1	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	1	0	0	0	0
33:	0	1	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	1
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	2	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	1	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	1	0
137:	0	1	0	1	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	1	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	1	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	1	0	0	0	0
193:	0	0	0	0	0	0	1	0
201:	0	0	0	0	0	0	0	1
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	2	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	1	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	1	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:	1	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	1	0	0
337:	0	1	0	0	0	0	1	0
345:	0	0	0	1	1	0	1	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

369: 0 0 0 0 0 0 0 0 1

Sample Title: 10

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	1	0	0	
385:	0	0	1	0	0	0	0	0	
393:	0	0	0	1	0	0	0	0	
401:	0	0	0	0	0	0	0	0	
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	2	1	0	0	1	
441:	0	1	0	0	0	0	0	0	
449:	0	0	0	0	0	0	0	0	
457:	0	0	0	0	1	0	1	0	
465:	0	0	0	0	1	0	1	0	
473:	0	0	0	0	0	0	1	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	1	
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	1	0	0	0	0	0	
545:	0	0	0	0	0	1	0	0	
553:	0	1	0	0	1	0	0	0	
561:	0	0	0	0	0	0	1	0	
569:	0	0	0	0	0	0	0	0	
577:	0	0	0	1	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	1	0	
641:	0	0	0	0	0	0	0	0	
649:	0	0	0	0	0	1	0	0	
657:	0	0	0	0	0	0	0	0	
665:	0	0	0	0	1	0	0	0	
673:	0	0	0	0	0	0	0	0	
681:	0	0	0	0	0	1	0	0	
689:	0	0	0	0	0	0	0	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	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	



801: 0 0 0 0 0 0 0 0 0

Sample Title: 10

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	0	1
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	1
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	1	0	0	0	0
865:	1	0	0	0	0	1	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	1	0	0	0	0	0
889:	1	0	0	1	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	1	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	1	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:	0	0	0	0	1	0	0	0
1017:	1	0	0	0	0	0	0	0



165  
9/19/18

Sample Description: BC-4C  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 11  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_045  
 Chamber Serial Number: 04026482A  
 Detector Serial Number: 91131  
 Env. Background: System Bkgd 225256  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.500E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/28/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:45 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1735 +/- 0.0031 on 2/16/2018 9:34:18 AM  
 Effective Efficiency: 0.1735 +/- 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	5.539	14.49	52.54	0.51	0.00E+000	3.0
RA-226	4.604	144.30	16.43	1.70	0.00E+000	6.0

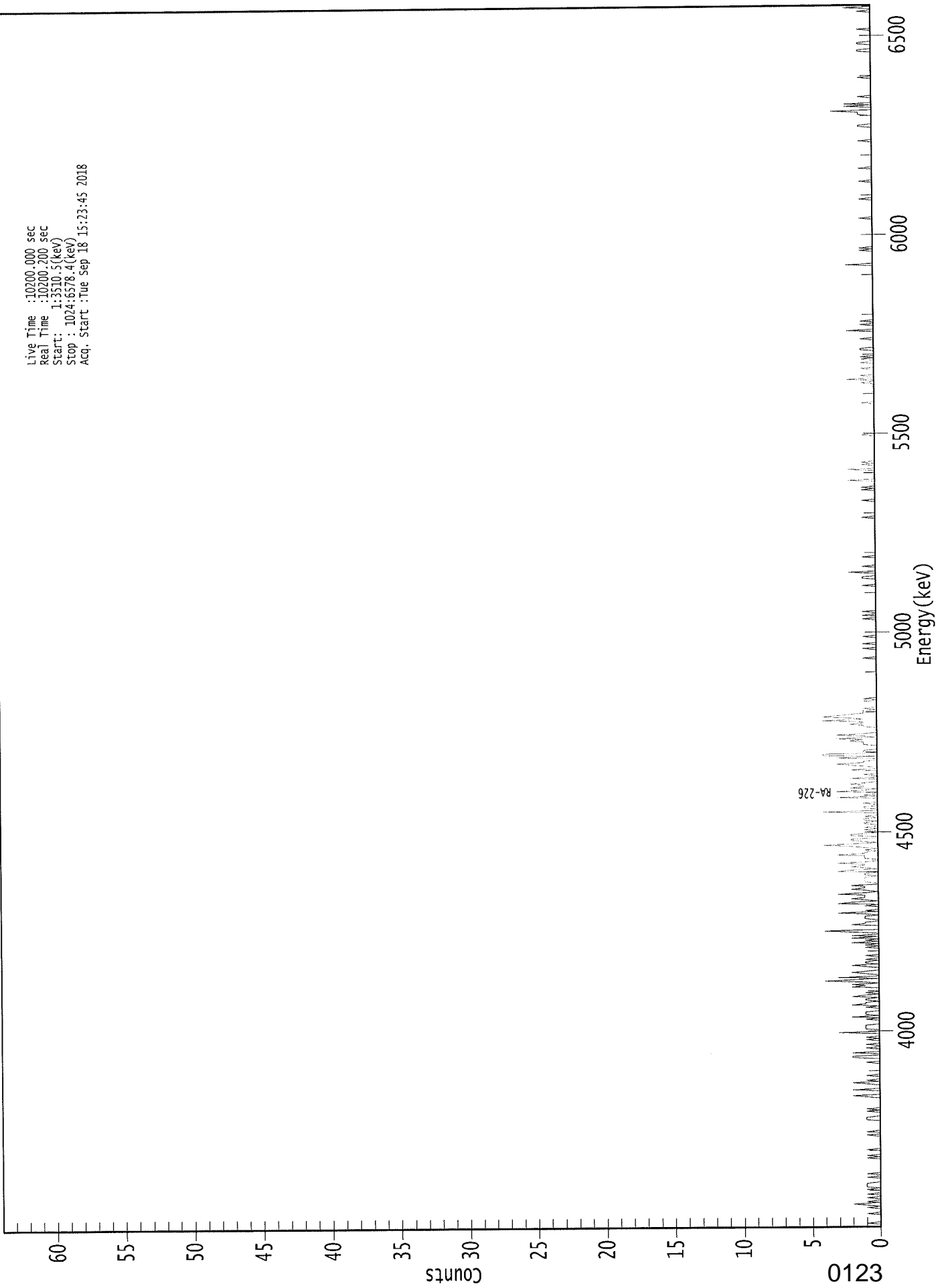
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.972	5685.50*	5.86E-001 +/- 3.08E-001	2.12E-001 +/- 7.35E-003
RA-226	0.958	4785.00*	5.51E+000 +/- 9.25E-001	2.80E-001 +/- 9.69E-003

AG  
9/19/18

0000222535.CNF

Live Time :10200.000 sec  
Real Time :10200.200 sec  
Start : 1:3510.5(kev)  
Stop : 1024:0378.4(kev)  
Acq. Start :Tue Sep 18 15:23:45 2018



ROI Type: 1

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

Sample Title: 11

Elapsed Live time: 10200

Elapsed Real Time: 10200

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

369: 1 1 2 1 0 0 0 2

Sample Title: 11

Channel	1	2	3	4	5	6	7	8
377:	0	0	1	0	0	0	2	0
385:	0	1	2	3	1	1	0	0
393:	3	0	4	4	0	1	1	0
401:	0	0	0	1	1	1	2	1
409:	3	0	1	3	1	0	0	0
417:	0	0	1	1	2	1	1	4
425:	1	2	4	3	2	1	1	1
433:	0	1	0	0	0	0	0	1
441:	0	1	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	0	0	0	0	0
473:	0	0	0	1	0	0	0	0
481:	0	0	0	1	0	0	0	1
489:	0	0	0	0	0	1	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	1	0	0	1
513:	0	0	1	0	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	1	0	0	0	0	0	1	1
545:	0	0	0	2	0	0	0	0
553:	1	0	0	0	0	0	0	0
561:	1	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	1	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	1
609:	0	0	0	0	0	0	0	0
617:	1	0	1	0	0	0	0	0
625:	2	0	0	0	0	0	0	0
633:	0	2	0	0	0	1	0	1
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	1	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	1	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	1	0	0	2	0	0
713:	1	0	0	0	0	0	1	0
721:	0	0	0	1	0	0	1	0
729:	1	0	0	0	0	0	1	1
737:	0	0	0	0	0	0	0	1
745:	0	0	0	0	0	0	2	0
753:	0	0	0	1	0	0	1	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

801: 0 0 0 0 0 2 0 0

Sample Title: 11

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



yes  
9/19/18

Sample Description: BC-4B  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 12  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_046  
 Chamber Serial Number: 04026482B  
 Detector Serial Number: 58762  
 Env. Background: System Bkgd 225257  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.580E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/28/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:48 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1783 +/- 0.0031 on 2/16/2018 9:34:16 AM  
 Effective Efficiency: 0.1783 +/- 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	5.535	5.32	91.11	0.68	0.00E+000	3.0
RA-226	4.603	48.64	28.56	1.36	0.00E+000	3.0

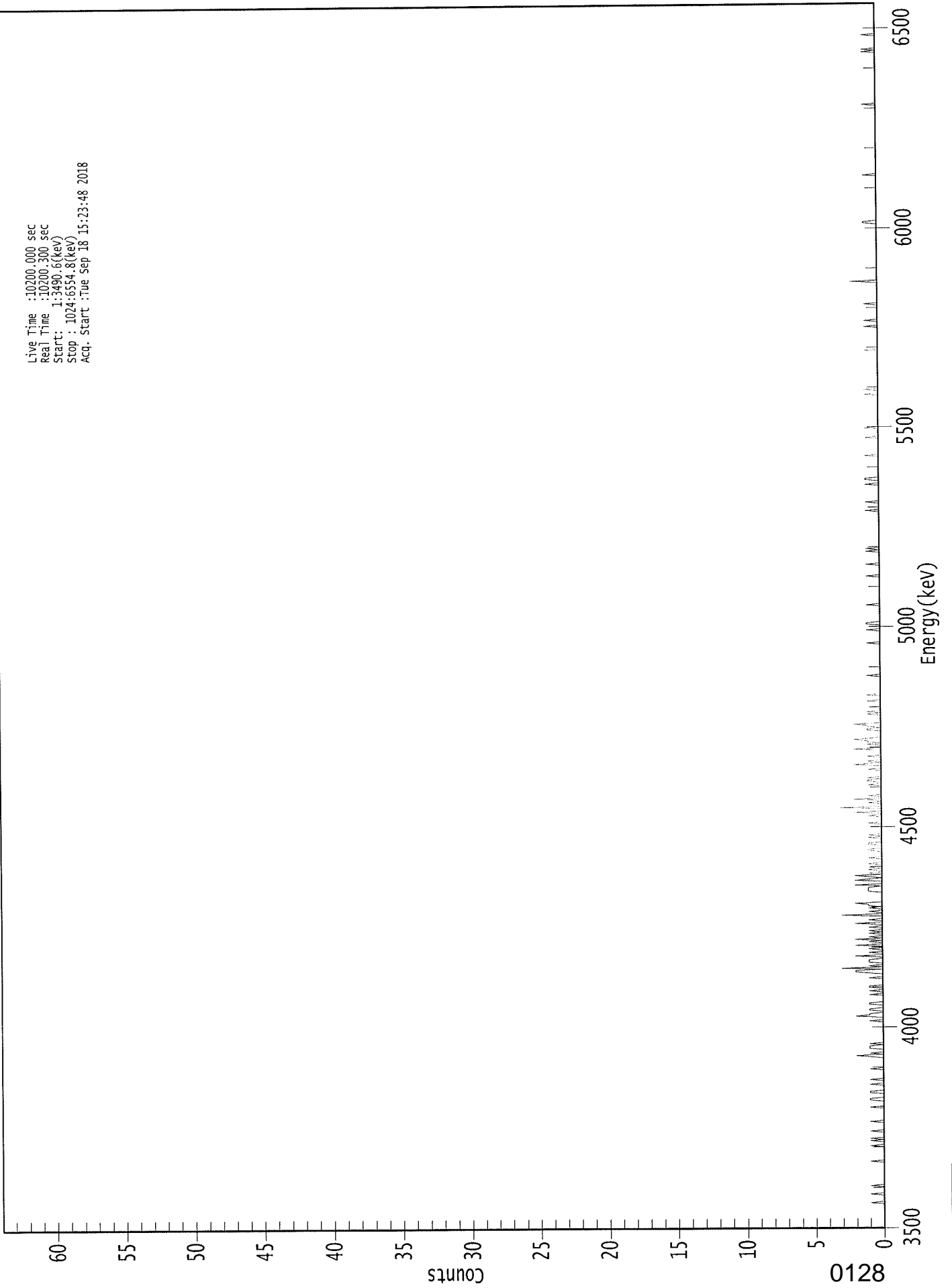
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.971	5685.50*	2.16E-001 +/- 1.97E-001	2.29E-001 +/- 7.91E-003
RA-226	0.958	4785.00*	1.87E+000 +/- 5.37E-001	2.63E-001 +/- 9.06E-003

AG  
 9/19/18

0000222537.CNF

Live Time :10200.000 sec  
Real Time :10200.300 sec  
Start : 1:3490.6(kev)  
Stop : 1024:6554.8(kev)  
Acq. Start :Tue Sep 18 15:23:48 2018



ROI Type: 1



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

Sample Title: 12

Elapsed Live time: 10200  
 Elapsed Real Time: 10200

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

369: 0 1 0 0 1 1 0 1

Sample Title: 12

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	0	1	0	
385:	0	0	2	1	0	1	0	0	
393:	0	1	0	0	0	0	0	2	
401:	0	0	0	1	0	1	1	2	
409:	1	0	0	0	0	0	0	1	
417:	1	0	1	1	2	0	0	0	
425:	0	0	0	0	1	0	1	0	
433:	0	0	0	0	0	0	0	1	
441:	0	0	0	0	1	0	0	0	
449:	0	0	0	0	0	0	0	0	
457:	0	0	0	0	1	0	0	0	
465:	0	0	0	0	0	0	0	0	
473:	0	0	0	0	0	0	0	0	
481:	0	0	0	0	0	0	0	1	
489:	0	0	0	0	0	0	0	0	
497:	0	0	1	0	0	0	0	1	
505:	1	0	0	0	0	0	0	0	
513:	0	0	0	0	0	0	0	1	
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	1	
545:	0	0	0	0	0	0	0	0	
553:	0	1	0	0	0	0	0	0	
561:	0	0	0	0	1	0	1	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	1	0	
601:	0	0	0	0	0	1	0	0	
609:	0	0	0	0	0	0	0	0	
617:	0	0	0	0	1	0	0	0	
625:	1	1	0	0	0	0	0	0	
633:	0	0	0	0	0	0	0	0	
641:	0	0	0	0	1	0	0	0	
649:	0	0	0	0	0	0	0	0	
657:	0	0	0	1	0	0	0	0	
665:	0	0	0	1	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	1	
697:	0	0	0	1	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	1	0	0	0	
737:	0	0	0	0	0	0	0	0	
745:	0	0	0	0	0	0	0	0	
753:	1	0	0	0	0	1	0	0	
761:	0	0	0	0	0	0	0	0	
769:	0	0	0	1	0	0	0	0	
777:	0	0	0	0	0	0	0	0	
785:	0	0	0	0	0	0	2	0	
793:	0	0	0	0	0	0	0	0	

801: 0 0 0 0 0 0 0 0 0

Sample Title: 12

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	1
841:	1	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	1
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	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	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	1	0
985:	1	0	0	0	0	0	0	0
993:	0	0	0	0	1	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  
9/18/18

# Apex-Alpha™

Sample Description: BC-4A  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 13  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_047  
 Chamber Serial Number: 10006125A  
 Detector Serial Number: 91086  
 Env. Background: System Bkgd 225258  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.910E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/28/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:51 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1744 +/- 0.0030 on 6/6/2018 2:37:41 PM  
 Effective Efficiency: 0.1744 +/- 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	5.539	2.81	142.99	1.19	0.00E+000	3.0
RA-226	4.579	7.66	72.63	0.34	0.00E+000	3.0

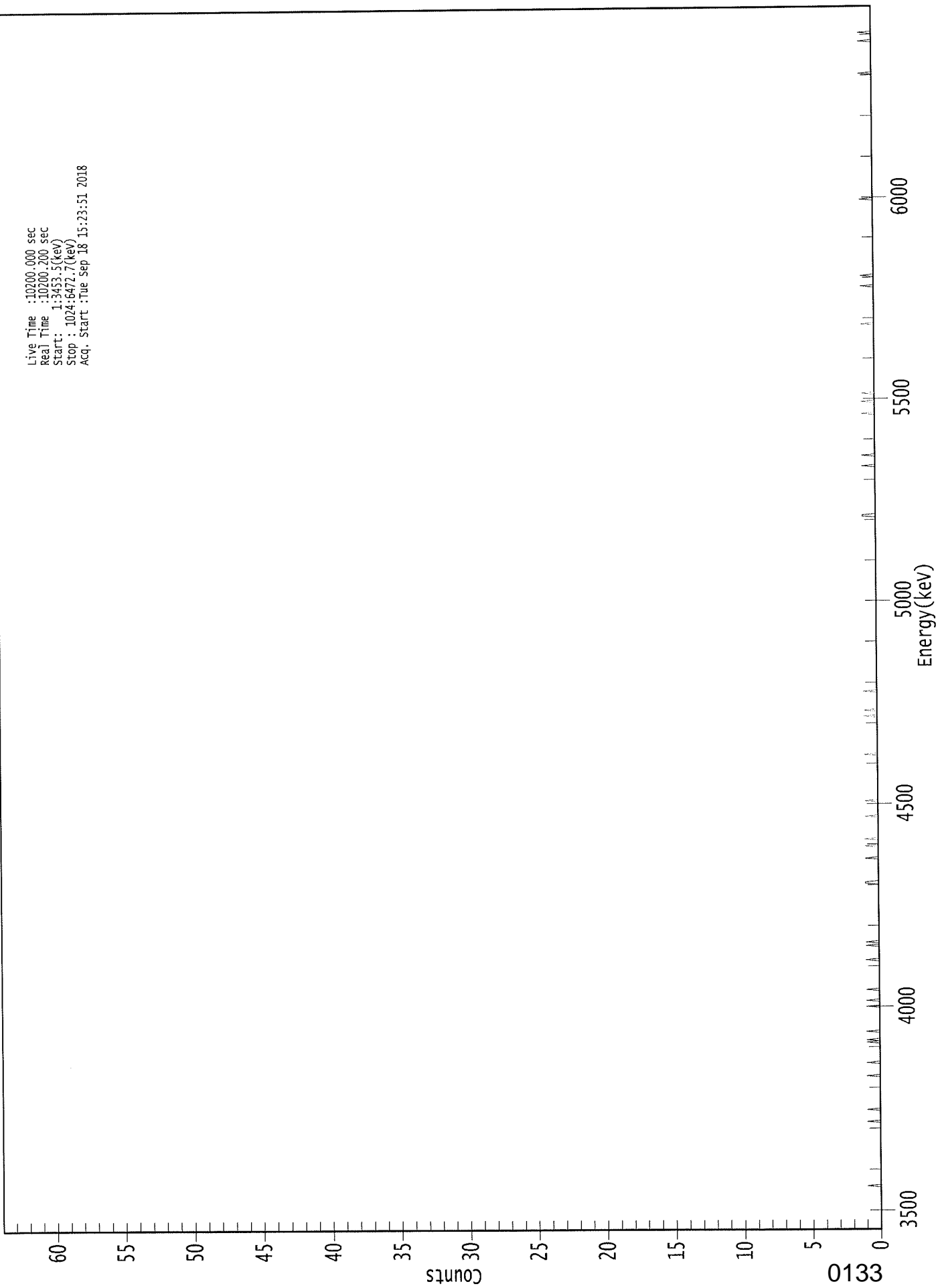
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.972	5685.50*	1.32E-001 +/- 1.88E-001	3.08E-001 +/- 1.05E-002
RA-226	0.946	4785.00*	3.39E-001 +/- 2.46E-001	2.11E-001 +/- 7.16E-003

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9/19/18

0000222538.CNF

Live Time :10200.000 sec  
Real Time :10200.200 sec  
Start: 1:3453.5(kev)  
Stop : 1024:6472.7(kev)  
Acq. Start :Tue Sep 18 15:23:51 2018



ROI Type: 1

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

Sample Title: 13

Elapsed Live time: 10200  
 Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	0	0	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	1	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	1	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	1
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	1	0	1	0	0
161:	0	0	0	0	1	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	1	0	0	0	0	1	0
193:	0	0	0	0	0	0	0	1
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:	1	0	0	0	0	0	0	0
233:	0	0	0	0	1	0	0	1
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:	1	1	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	1	0	0
313:	0	0	0	0	0	0	0	1
321:	0	0	0	0	0	1	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	1	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

369: 0 0 0 0 0 0 0 0 0

Sample Title: 13

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	1	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	1	0	0	0
433:	0	1	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
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	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	1	1	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	1	0	0
641:	0	0	0	0	0	0	1	0
649:	0	0	0	0	0	0	0	0
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	1	0	0	0	0	0	0
689:	0	0	0	1	0	0	0	0
697:	0	0	1	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	1	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	1	0	0	0
793:	0	0	0	0	0	1	0	0

801: 0 0 0 0 0 0 0 0 0

Sample Title: 13

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	1	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	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	1	0	0	0	0	0	0
1001:	1	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





US  
9/19/18

Sample Description: BC-6  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 14  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_048  
 Chamber Serial Number: 10006125B  
 Detector Serial Number: 83111  
 Env. Background: System Bkgd 225259  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.580E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/28/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:54 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1760 +/- 0.0030 on 6/6/2018 2:37:42 PM  
 Effective Efficiency: 0.1760 +/- 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	5.532	2.13	191.21	1.87	0.00E+000	3.0
RA-226	4.596	13.11	60.71	2.89	0.00E+000	3.0

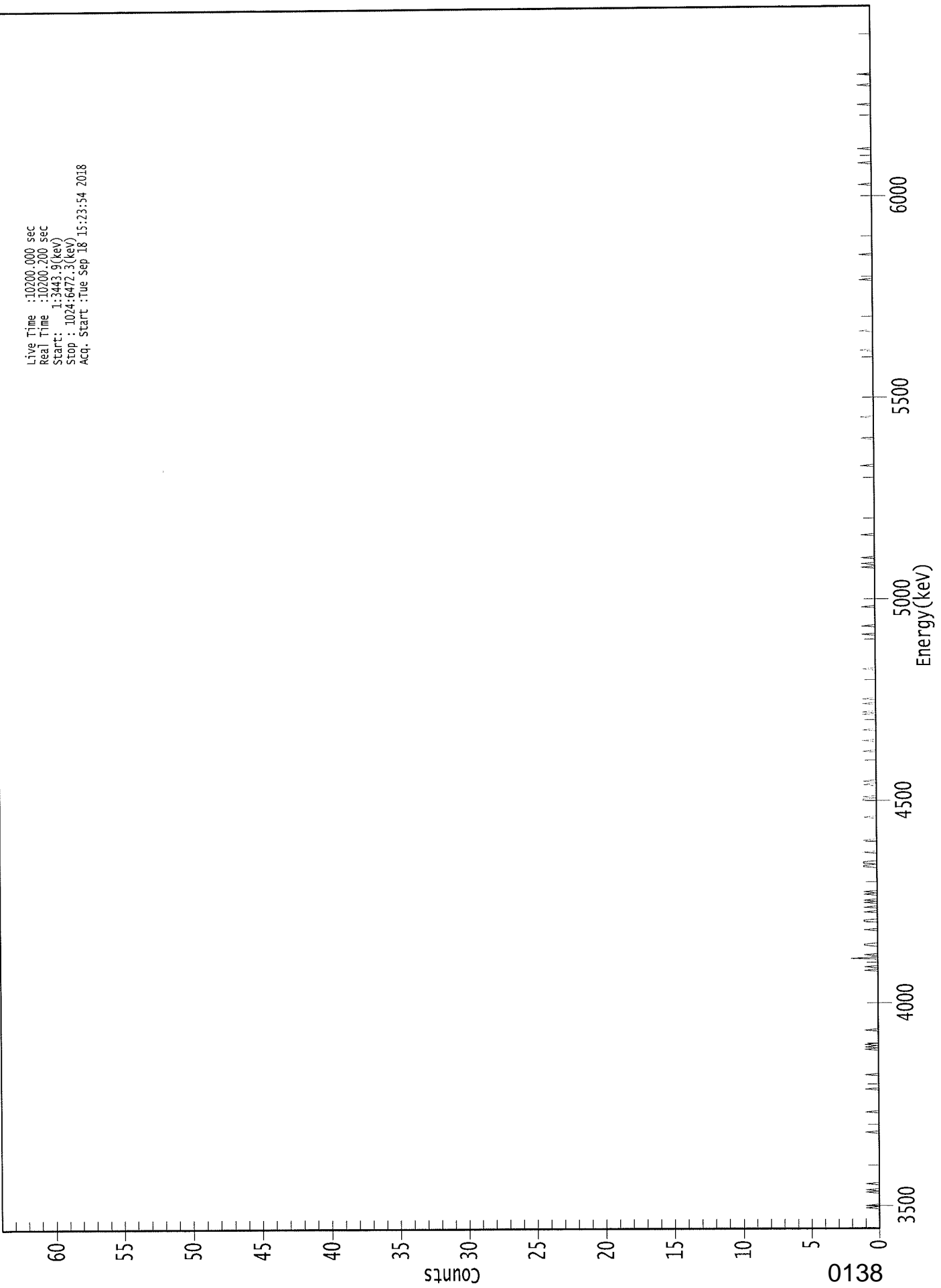
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.970	5685.50*	8.76E-002 +/- 1.68E-001	3.11E-001 +/- 1.05E-002
RA-226	0.954	4785.00*	5.09E-001 +/- 3.10E-001	3.40E-001 +/- 1.15E-002

AG  
9/19/18

0000222539.CNF

Live Time :10200.000 sec  
Real Time :10200.200 sec  
Start: 1:3443.9(kev)  
Stop : 1024:0472.3(kev)  
Acq. Start :Tue Sep 18 15:23:54 2018



ROI Type: 1

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

Sample Title: 14

Elapsed Live time: 10200

Elapsed Real Time: 10200

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

369: 0 0 1 0 0 1 0 0

Sample Title: 14

Channel	1	2	3	4	5	6	7	8
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	1	0
401:	0	0	0	0	0	0	0	1
409:	0	0	0	0	0	0	0	0
417:	1	0	0	0	0	0	0	0
425:	0	0	0	0	0	1	0	1
433:	0	0	0	0	0	0	1	0
441:	0	0	1	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:	1	0	0	0	0	0	0	1
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	1
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:	1	0	0	1	0	0	0	0
561:	1	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	1	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	1	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	1	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	1	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	1	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0

801: 0 0 0 0 0 0 0 0

Sample Title: 14

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	1	0	0	0	0
897:	0	0	0	0	0	0	0	1
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	1	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	1	0	0	0
961:	0	0	0	0	0	1	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:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



VB  
9/19/18

Sample Description: BC-7B  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 15  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_049  
 Chamber Serial Number: 10006121A  
 Detector Serial Number: 49  
 Env. Background: System Bkgd 225260  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.960E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/29/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:56 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 0.8872 +/- 0.0000  
 Counting Efficiency: 0.1565 +/- 0.0028 on 2/16/2018 12:37:01 PM  
 Effective Efficiency: 0.1388 +/- 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	5.530	-3.74	67.03	3.74	0.00E+000	0.0
RA-226	4.694	0.30	988.46	1.70	0.00E+000	3.0

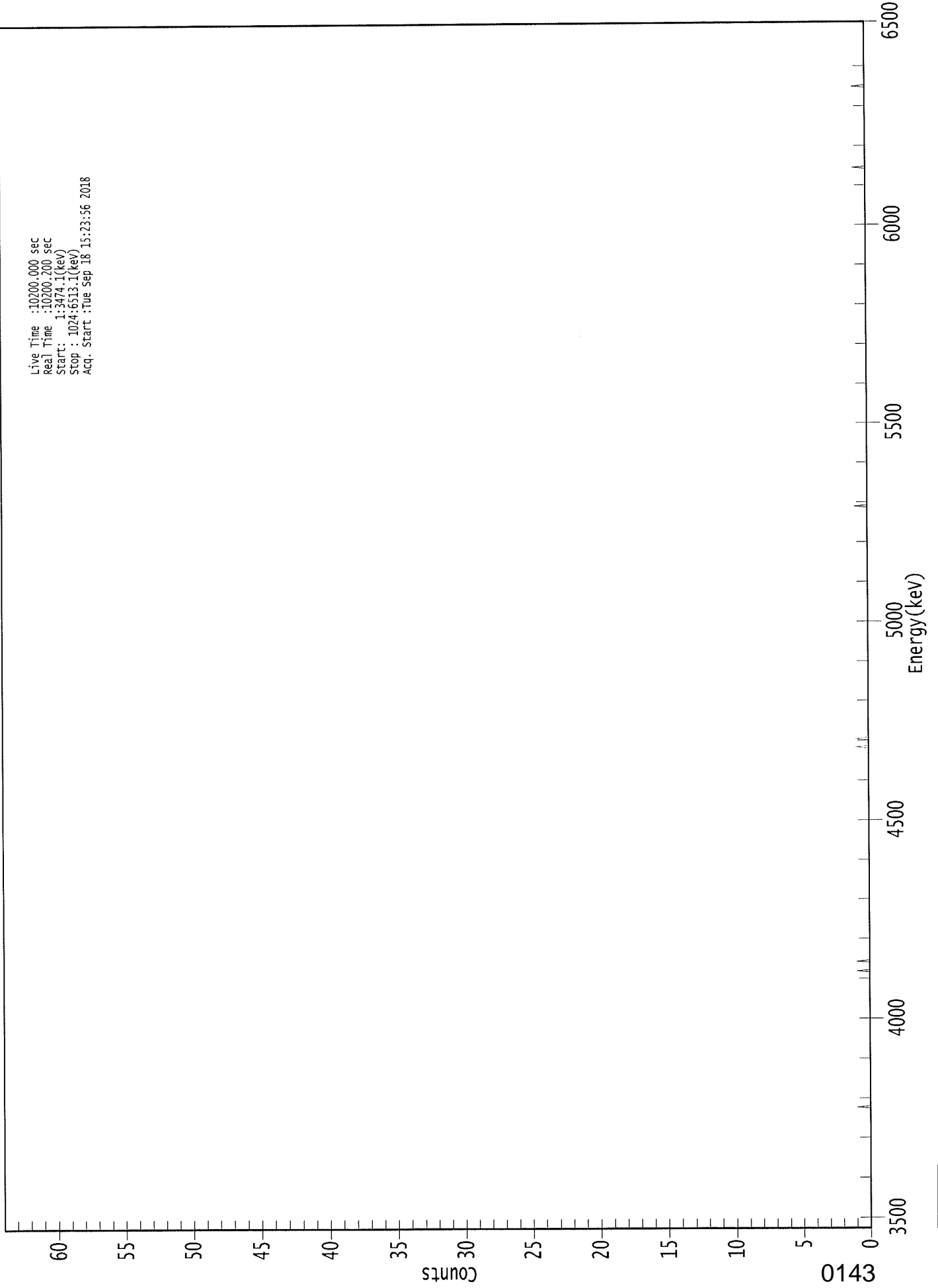
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.969	5685.50*	-2.24E-001 +/- 1.50E-001	5.73E-001 +/- 2.02E-002
RA-226	0.989	4785.00*	1.69E-002 +/- 1.68E-001	4.15E-001 +/- 1.46E-002

AG  
9/19/18

0000222540.CNF

Live Time :10200.000 sec  
Real Time :10200.200 sec  
Start : 1:3474.1(kev)  
Stop : 1024:6513.1(kev)  
Acq. Start :Tue Sep 18 15:23:56 2018



ROI Type: 1

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

Sample Title: 15

Elapsed Live time: 10200  
 Elapsed Real Time: 10200

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



369: 0 0 0 0 0 0 0 0 0

Sample Title: 15

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	1	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:	0	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	0	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	1	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	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	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

801: 0 0 0 0 0 0 0 0 0

Sample Title: 15

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:	0	0	0	0	0	0	0	0
897:	0	0	0	1	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	0	0
969:	1	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  
9/19/18

# Apex-Alpha™

Sample Description: BC-7A  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 16  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_050  
 Chamber Serial Number: 10006121B  
 Detector Serial Number: 50  
 Env. Background: System Bkgd 225261  
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter  
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/29/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:23:59 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 0.6502 +/- 0.0000  
 Counting Efficiency: 0.1369 +/- 0.0025 on 2/16/2018 12:37:00 PM  
 Effective Efficiency: 0.0890 +/- 0.0016

Peak Match Tolerance: 0.350 MeV

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

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.522	2.32	149.12	0.68	0.00E+000	3.0
RA-226	4.599	18.49	46.31	0.51	0.00E+000	4.4

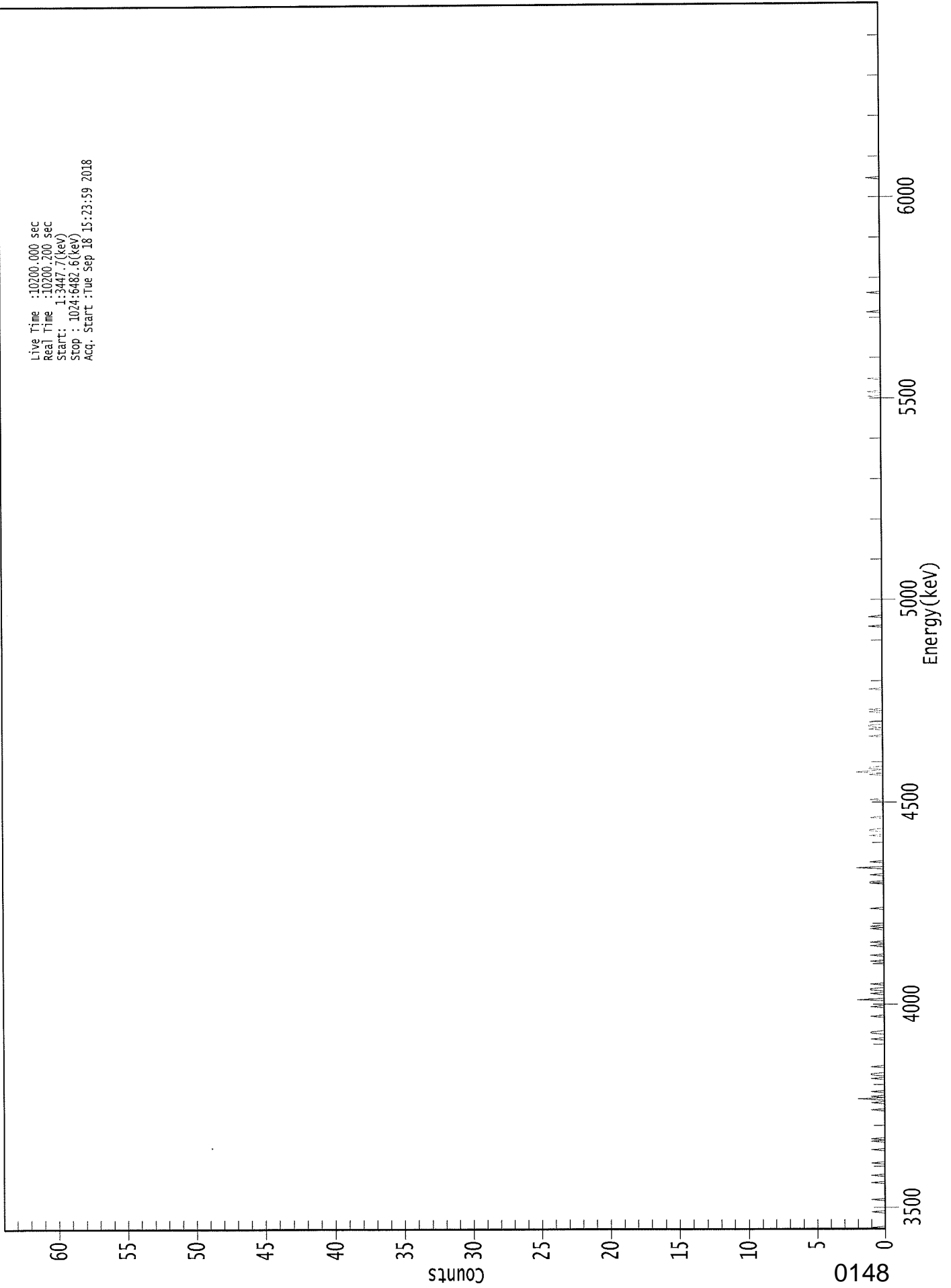
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 -----  
 NUCLIDE ANALYSIS RESULTS  
 -----  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.966	5685.50*	4.39E-001 +/- 6.54E-001	1.07E+000 +/- 3.81E-002
RA-226	0.956	4785.00*	3.30E+000 +/- 1.53E+000	9.37E-001 +/- 3.34E-002

AG  
 9/19/18

0000222542.CNF

Live Time :10200.000 sec  
Real Time :10200.200 sec  
Start: 1:3447.7(kev)  
Stop : 1024:6482.6(kev)  
Acq. Start :Tue Sep 18 15:23:59 2018



ROI Type: 1



369: 0 0 0 0 0 0 0 0 0

Sample Title: 16

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	1	0	2	1	0	1
385:	1	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	1	0	0	0	0	0
417:	1	0	1	1	0	0	1	0
425:	0	0	0	0	0	0	1	0
433:	1	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
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	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	1	0	0
505:	0	0	0	0	0	1	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	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	0	0	0	0
689:	0	0	0	0	0	1	0	0
697:	0	1	0	0	0	0	0	0
705:	0	0	0	0	1	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	1	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	1	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

Sample Title: 16

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	1	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	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	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  
9/19/18

# Apex-Alpha™

Sample Description: BC-8B  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225  
 Batch Identification: 1809025A-RA  
 Sample Identification: 17  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_051  
 Chamber Serial Number: 10006123A  
 Detector Serial Number: 51  
 Env. Background: System Bkgd 225274  
 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: 8/29/2018 1:12:44 PM  
 Acquisition Date/Time: 9/18/2018 3:24:02 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1452 +/- 0.0026 on 2/16/2018 12:36:58 PM  
 Effective Efficiency: 0.1452 +/- 0.0026

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	5.659	-1.21	189.99	2.21	0.00E+000	3.0
RA-226	4.591	10.81	63.34	1.19	0.00E+000	3.0

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

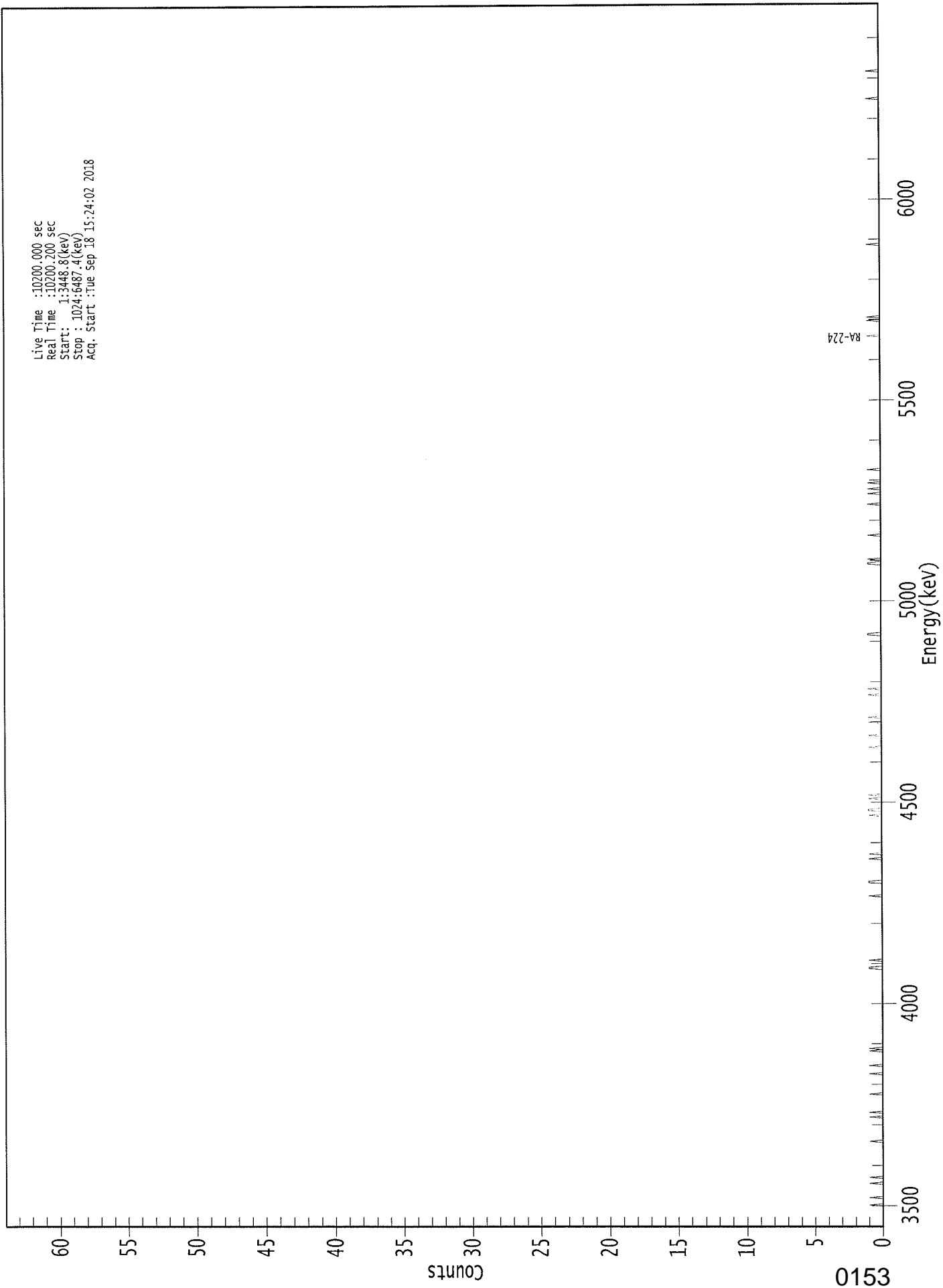
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.999	5685.50*	-7.01E-002 +/- 1.33E-001	4.63E-001 +/- 1.64E-002
RA-226	0.952	4785.00*	5.92E-001 +/- 3.75E-001	3.61E-001 +/- 1.28E-002

AG  
9/19/18



0000222543.CNF

Live Time :10200.000 sec  
Real Time :10200.200 sec  
Start: 1:3448.8(kev)  
Stop : 1024:6487.4(kev)  
Acq. Start :Tue Sep 18 15:24:02 2018



ROI Type: 1

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

Sample Title: 17

Elapsed Live time: 10200

Elapsed Real Time: 10200

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

369: 0 0 0 0 0 0 0 0 0

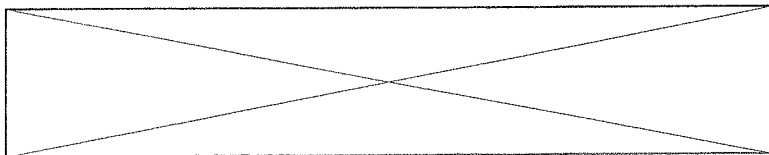
Sample Title: 17

Channel									
377:	0	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0	0
401:	1	0	0	0	0	0	0	0	0
409:	0	0	1	0	0	0	0	0	0
417:	0	0	0	0	0	1	0	0	0
425:	0	1	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	0	0	0
441:	0	0	0	0	1	0	0	0	0
449:	0	1	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	0	0	0	0
481:	0	0	0	0	0	0	0	0	0
489:	0	0	0	0	0	0	1	1	1
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	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	1	1	0	0	1	0	0	0
561:	0	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0	0
577:	0	1	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0	0
601:	0	0	0	1	0	0	0	0	0
609:	0	0	0	0	1	0	0	0	0
617:	1	0	0	0	0	1	0	0	0
625:	0	0	0	0	0	0	0	0	0
633:	1	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	0	0	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	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0	0
745:	1	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	1	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	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0	0

801: 0 0 0 0 0 0 0 0 0

Sample Title: 17

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	0	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	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	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	1
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



## QA SUMMARY REPORT

### Review Of QA Results - Pulser Check

Date : 9/18/2018  
Time : 5:07:46 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	9/18/2018 4:54:15 AM
Alpha 004	21f	ALL	Passed	9/18/2018 4:54:15 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	Not Done	
Alpha 011	21f	ALL	Passed	9/18/2018 4:54:16 AM
Alpha 012	21f	ALL	Passed	9/18/2018 4:54:17 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	9/18/2018 4:54:18 AM
Alpha 015	21f	Peak Energy	Action	9/17/2018 5:01:16 AM
Alpha 015	21f	Peak FWHM	Action	9/17/2018 5:01:16 AM
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	Peak Energy	Action	9/14/2018 5:06:36 AM
Alpha 034	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:22 AM
Alpha 035	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:23 AM
Alpha 036	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:25 AM
Alpha 037	Alpha Analyst100DC	ALL	Not Done	
Alpha 038	Alpha Analyst100DC	ALL	Not Done	
Alpha 039	Alpha Analyst100DC	Peak FWHM	Action	9/18/2018 4:54:27 AM
Alpha 040	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:28 AM
Alpha 041	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:30 AM
Alpha 042	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:32 AM
Alpha 043	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:34 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:36 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:39 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:41 AM
Alpha 047	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:43 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:46 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:48 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:50 AM
Alpha 051	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:53 AM
Alpha 052	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:55 AM
Alpha 053	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:58 AM
Alpha 054	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:00 AM
Alpha 055	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:03 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:05 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:08 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 058	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:10 AM
Alpha 059	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:14 AM
Alpha 060	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:16 AM

APPROVED BY:     KP    APPROVAL DATE:     9/18/18

\*\*\*\*\*  
 \*\*\*\*\* 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

**RUN 2**



18-09025  
 Ra226  
 Run 2

18-09025					
Ra226					
2					
Work Order	Analysis Code	Date Received	Lab Deadline		
Michael Pisani & Associates, Inc.		9/10/2018	9/21/2018		
Project		07-214			
Report Level		4			
Activity Units		pCi			
Aliquot Units		1			
Matrix		WA			
Method		EPA 903.0 Modified			
Instrument Type		Alpha Spectroscopy			
Radiometric Tracer		Ba-133			
Radiometric Sol#		Ba-6a			
Tracer Act (dpm/g)		474.1			
Carrier					
Carrier Conc (mg/ml)					
Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/10/18 00:00	1.0000E+00
02	MBL	BLANK		09/10/18 00:00	1.0000E+00
03	DUP	BC-8A	37	08/29/18 12:05	2.5000E-01
18	DO	BC-8A	37	08/29/18 12:05	2.5000E-01

\* 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.

0161



**18-09025**  
**Ra226**  
Run 2

Internal Fraction	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep t0 Date/Time	Sep t0 By	Sep t1 Date/Time	Sep t1 By
01	LCS			09/20/18 10:36	JHARVEY	09/24/18 12:06	JBAILEY		
02	MBL			09/20/18 10:36	JHARVEY	09/24/18 12:06	JBAILEY		
03	DUP			09/20/18 10:36	JHARVEY	09/24/18 12:06	JBAILEY		
18	DO			09/20/18 10:36	JHARVEY	09/24/18 12:06	JBAILEY		

\* 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.







Count Room Report  
Client: Michael Pisani Associat  
18-09025-Ra226-2 (pCi/l) in  
Tracer ID: Ba-6a

Internal Fraction	Sample Desc	Client ID	Sample Date	Sample Aliquot	Tracer Aliquot (g)	Tracer ACT (dpm)	Radiometric Tracer (pCi)	Radiometric % Rec	SAF 1*	SAF 2*
01	LCS	LCS	09/10/18 00:00	1.0000	2.0399	967.1166	617.0000	141.63	3.00^	1.00
02	MBL	BLANK	09/10/18 00:00	1.0000	2.0349	964.7461	655.0000	150.72	3.00^	1.00
03	DUP	BC-8A	08/29/18 12:05	0.2500	2.0347	964.6513	462.0000	106.32	2.77	1.00
18	DO	BC-8A	08/29/18 12:05	0.2500	2.0307	962.7549	426.0000	98.23	2.77	1.00

AC-ES A

Internal Work Order				Analysis Code				Date				Technician				Technician Initials				Witness Initials							
<b>18-09025</b>				<b>2</b>				<b>Ra226</b>				<b>9/20/2018 10:32</b>				<b>JHARVEY</b>											
LCS & Matrix Spikes		LCS		MS		LCS		MSD		LCS		MS		LCS		MSD		LCS		MSD							
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Known pCi	Error Estimate	Added pCi	Error Estimate	Known pCi	Error Estimate	Added pCi	Error Estimate	Known pCi	Error Estimate	Added pCi	Error Estimate						
Ra-226	Ra-5b	43.970	9/20/2018	0.500	0.5110					10.12	0.466	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000						
<b>Tracers</b>																											
fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition																					
01	Ba-133	Ba-6a	474.100	9/20/2018	2.0399	2.1400																					
02	Ba-133	Ba-6a	474.100	9/20/2018	2.0349	2.1400																					
03	Ba-133	Ba-6a	474.100	9/20/2018	2.0347	2.1400																					
18	Ba-133	Ba-6a	474.100	9/20/2018	2.0307	2.1400																					
							<b>Balance Printer Tapes</b>																				
							Tracer										LCS										
Matrix Spike																											



# Aliquot Worksheet

Work Order		Run	Analysis Code	Rpt Units	Lab Deadline	Technician
<b>18-09025</b>		<b>2</b>	<b>Ra226</b>	<b>liters</b>	<b>9/21/2018</b>	<b>JHARVEY</b>

Lab Fraction	Client ID	Sample Type	Muffle Data		Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
			Ratio Post/Pre	No of Dils	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	BC-8A	DUP						2.5000E-01	2.5000E-01				
18	BC-8A	DO						2.5000E-01	2.5000E-01				

Comments	
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0169

Technician: J. Harvey Date: 9/20/18

# Gravimetric Worksheet

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
<b>18-09025</b>	<b>2</b>	<b>Ra226</b>			<b>JBAILEY</b>

TRetek Fraction	Michael Pisani & Associates, Inc. Client ID	Sample Type	Carrier Data			Filter Data			Gravimetric % Recovery
			Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)	Filter Net (g)		
01	LCS	LCS		0.0204	0.0303		0.0099		
02	BLANK	MBL		0.0202	0.0301		0.0099		
03	DUP	DUP		0.0208	0.0288		0.0080		
18	BC-8A	DO		0.0209	0.0289		0.0080		

Technician: *JBA* Date: 9/25/18



KB  
9/28/18

# Apex-Alpha™

Sample Description: SPIKE  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229  
 Batch Identification: 1809025B-RA  
 Sample Identification: 01  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_035  
 Chamber Serial Number: 04026477A  
 Detector Serial Number: 58771  
 Env. Background: System Bkgd 225702  
 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: 9/24/2018 12:57:38 PM  
 Acquisition Date/Time: 9/24/2018 2:09:17 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1479 +/- 0.0027 on 2/16/2018 9:34:34 AM  
 Effective Efficiency: 0.1479 +/- 0.0027

Control Certificate Name: Ra226\_Ra-5b  
 Chem. Recov. of Control: RA-226 0.350699 +/- 0.027964  
 Peak Match Tolerance: 0.350 MeV

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 -----  
 PEAK AREA REPORT  
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Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.514	3.47	129.55	1.53	0.00E+000	3.0
RA-226	4.589	198.11	14.04	2.89	0.00E+000	4.3

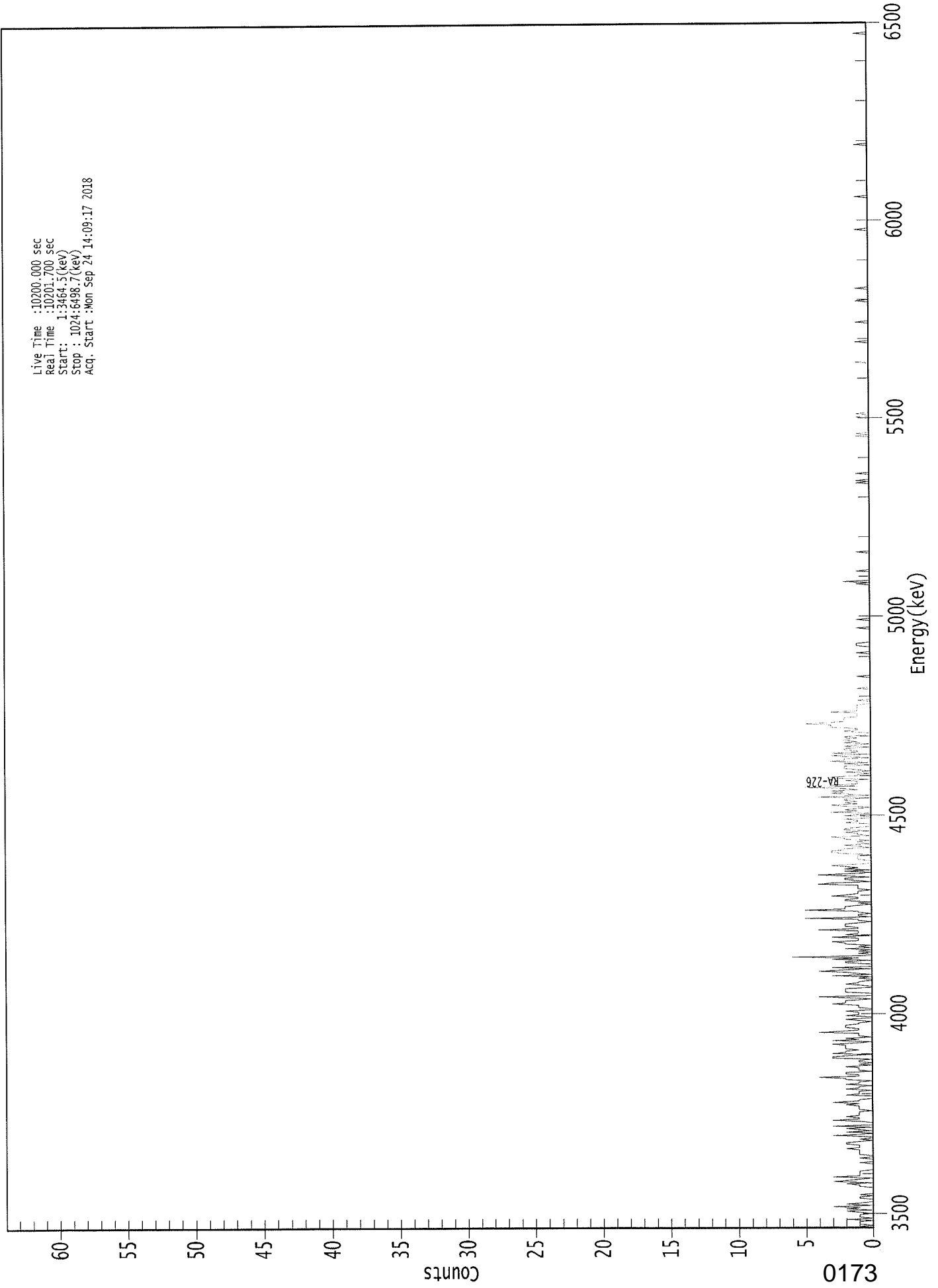
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 -----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.962	5685.50*	1.96E-001 +/- 2.54E-001	4.02E-001 +/- 1.42E-002
RA-226	0.951	4785.00*	1.06E+001 +/- 1.54E+000	4.71E-001 +/- 1.66E-002

AG  
9/25/18

0000222953.CNF

Live Time :10200.000 sec  
Real Time :10201.700 sec  
Start : 1:3464.5(kev)  
Stop : 1024:6498.7(kev)  
Acq. Start : Mon Sep 24 14:09:17 2018



ROI Type: 1

\*\*\*\*\*  
 \*\*\*\*\* 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: 10202

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

369: 3 2 3 1 2 5 1 3

Sample Title: 01

Channel	1	2	3	4	5	6	7	8
377:	1	1	1	2	0	3	3	1
385:	1	0	2	0	1	2	2	2
393:	0	2	0	3	2	2	0	2
401:	3	0	3	1	1	2	2	0
409:	2	1	0	2	1	2	2	1
417:	2	1	0	0	1	2	1	1
425:	3	3	3	5	3	2	2	2
433:	2	1	1	1	1	3	1	1
441:	1	1	1	1	0	0	0	1
449:	0	0	0	0	0	0	0	0
457:	0	1	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	1
489:	0	0	0	0	0	1	1	1
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	1	0	0	0
513:	0	0	0	1	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	1	0	2	0	0	0	0
553:	0	0	0	0	1	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	0	0	1	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	1
633:	0	1	0	0	0	0	0	1
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:	0	0	0	0	0	0	0	1
673:	0	1	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	1
689:	0	0	1	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	1	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	1
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	1	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	1	0	0	0	0	0
793:	0	0	0	0	0	1	0	0

801: 0 0 0 0 0 0 0 0

Sample Title: 01

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	1
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	1	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	1
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	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	1	0	0
1017:	0	0	0	0	0	0	0	0





KB  
9/24/18

Sample Description: BLANK  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229  
 Batch Identification: 1809025B-RA  
 Sample Identification: 02  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_036  
 Chamber Serial Number: 04026477B  
 Detector Serial Number: 84167  
 Env. Background: System Bkgd 225703  
 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: 9/24/2018 12:57:38 PM  
 Acquisition Date/Time: 9/24/2018 2:09:19 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1748 +/- 0.0031 on 2/16/2018 9:34:33 AM  
 Effective Efficiency: 0.1748 +/- 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	5.457	2.98	134.36	1.02	0.00E+000	3.0
RA-226	4.622	1.79	229.05	2.21	0.00E+000	3.0

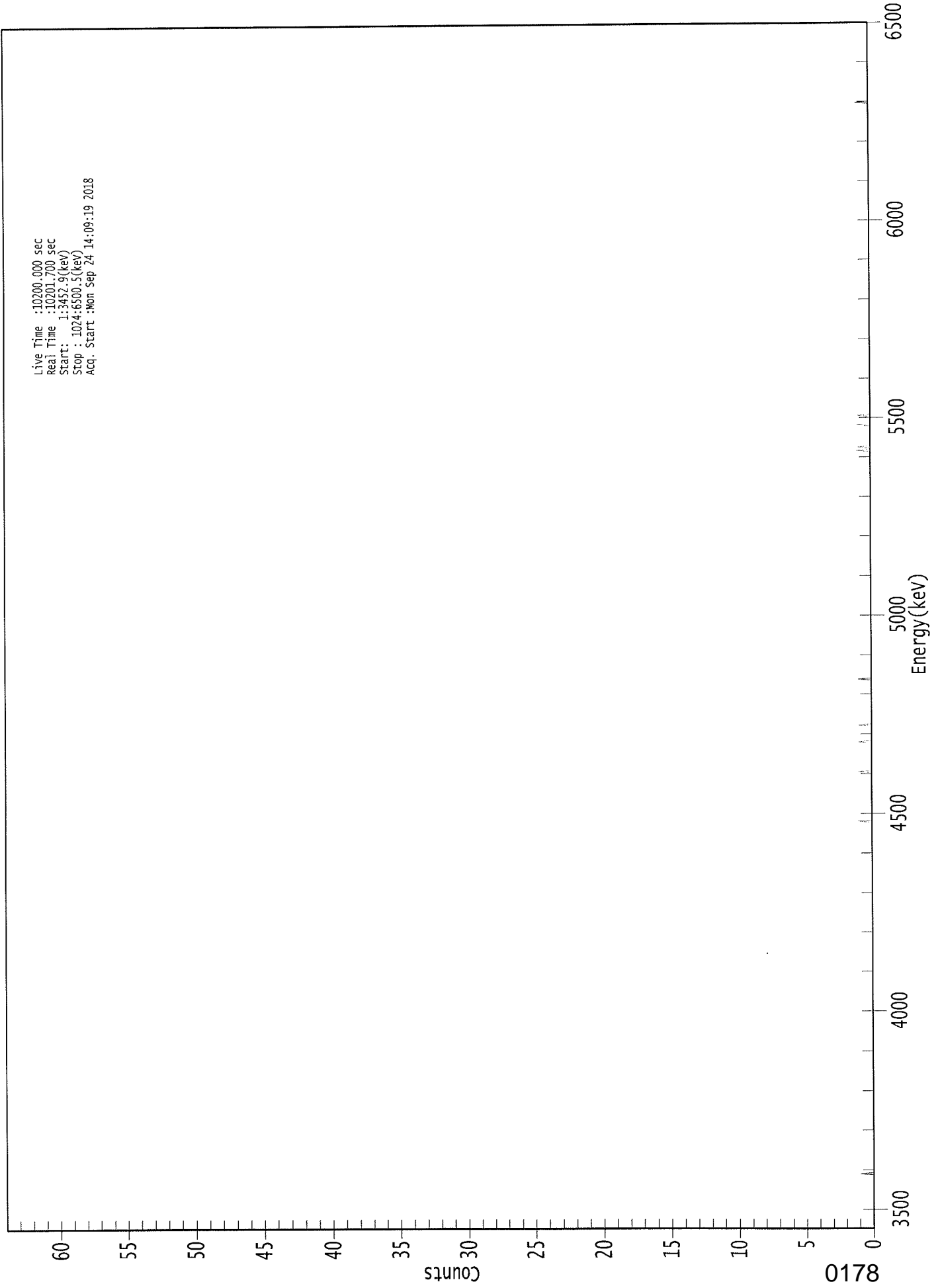
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.934	5685.50*	1.43E-001 +/- 1.92E-001	3.01E-001 +/- 1.04E-002
RA-226	0.966	4785.00*	8.14E-002 +/- 1.86E-001	3.64E-001 +/- 1.25E-002

AG  
9/25/18

0000222952.CNF

Live Time :10200.000 sec  
Real Time :10201.700 sec  
Start : 1:3457.9(keV)  
Stop : 1024:6500.5(keV)  
Acq. Start :Mon Sep 24 14:09:19 2018



0178

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

Sample Title: 02

Elapsed Live time: 10200  
Elapsed Real Time: 10202

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

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	1	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	0	0	1	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	1	0	0	0	0	0
433:	0	0	0	0	0	0	0	0
441:	0	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	1	0	0	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	0	1	0	0	1	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	1	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

801: 0 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:	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	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	1	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:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



KP  
9/26/18

Sample Description: BC-8A DUP  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002230  
 Batch Identification: 1809025B-RA  
 Sample Identification: 03  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_033  
 Chamber Serial Number: 04026479A  
 Detector Serial Number: 91132  
 Env. Background: System Bkgd 225700  
 Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.720E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/29/2018 3:14:45 PM  
 Acquisition Date/Time: 9/25/2018 4:01:10 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1696 +/- 0.0030 on 2/16/2018 9:34:38 AM  
 Effective Efficiency: 0.1696 +/- 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	5.450	0.81	359.09	1.19	0.00E+000	3.0
RA-226	4.619	14.83	51.24	0.17	0.00E+000	3.0

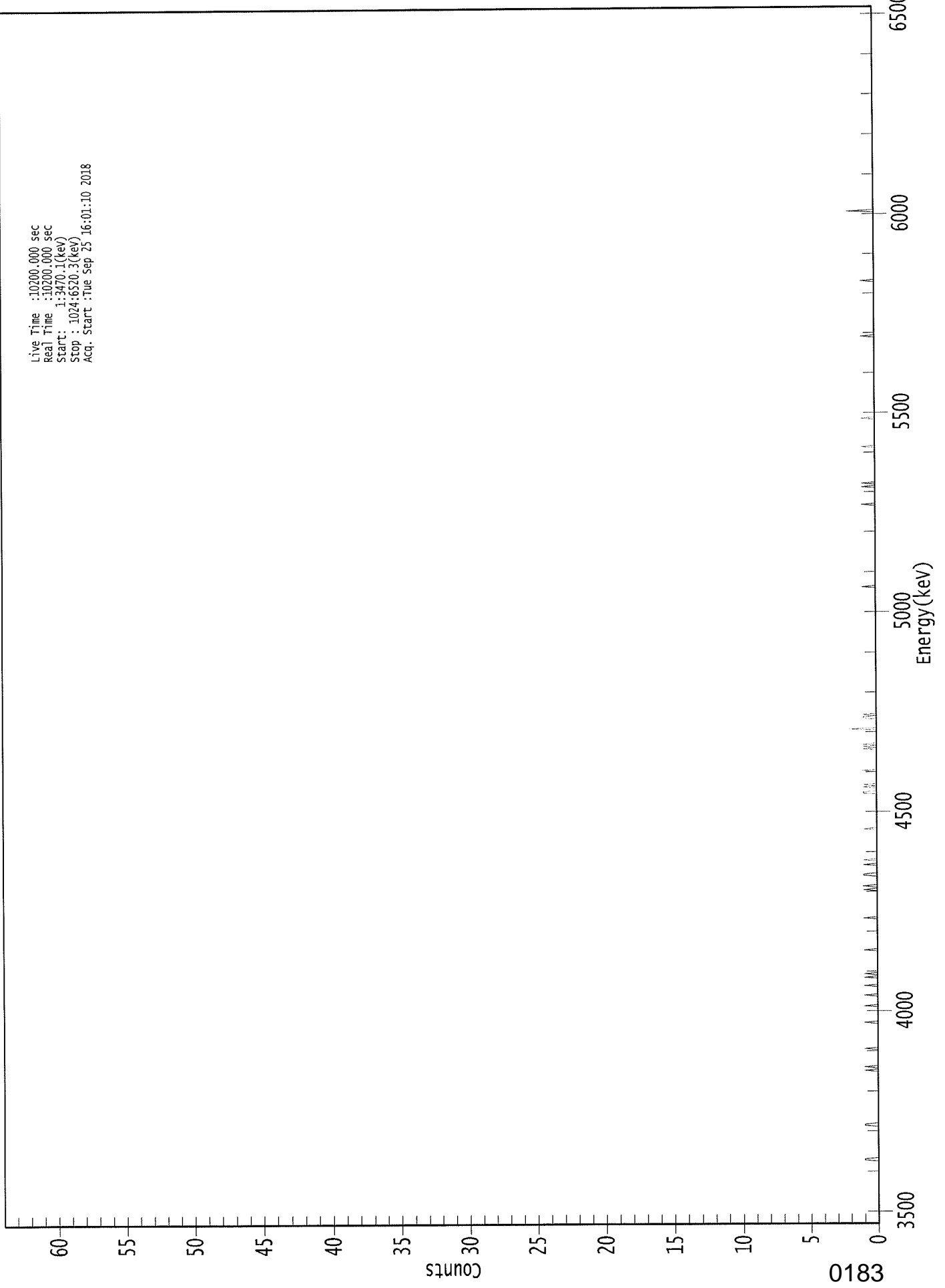
-----  
 ----- NUCLIDE ANALYSIS RESULTS -----  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.930	5685.50*	1.46E-001 +/- 5.25E-001	1.19E+000 +/- 4.15E-002
RA-226	0.965	4785.00*	2.52E+000 +/- 1.29E+000	7.10E-001 +/- 2.47E-002

AG  
9/26/18

0000223066.CNF

Live Time :10200.000 sec  
Real Time :10200.000 sec  
Start: 1:3470.1(kev)  
Stop : 1024:6520.3(kev)  
Acq. Start :Tue Sep 25 16:01:10 2018



ROI Type: 1

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

Sample Title: 03

Elapsed Live time: 10200  
 Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	0	0	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	1	1	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	1	1	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:	1	0	0	1	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	1	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	1	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	1	0
185:	0	0	0	0	0	0	0	1
193:	0	0	0	0	0	0	0	1
201:	0	0	0	0	0	0	1	0
209:	0	1	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	1	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:	1	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:	1	0	0	1	0	0	0	0
289:	0	0	0	0	1	1	0	0
297:	0	0	0	0	0	1	0	0
305:	0	1	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	1	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	0	1	1	0	0	0	1	0



369: 1 0 0 0 0 0 0 0

Sample Title: .03

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	1	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	1	0
401:	1	0	1	0	0	0	0	0
409:	0	0	0	0	0	0	0	2
417:	0	0	0	0	0	0	0	0
425:	1	1	0	1	0	0	0	0
433:	0	0	0	0	0	0	0	0
441:	0	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	0	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	1	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	1	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	1	0	0	1	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	1	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	1	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	1	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:	1	0	0	0	0	0	0	0

801: 0 0 0 0 0 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:	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	2	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	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	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



KP  
9/26/18

Sample Description: BC-8A  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002230  
 Batch Identification: 1809025B-RA  
 Sample Identification: 18  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_034  
 Chamber Serial Number: 04026479B  
 Detector Serial Number: 91136  
 Env. Background: System Bkgd 225701  
 Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.370E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 8/29/2018 3:14:45 PM  
 Acquisition Date/Time: 9/25/2018 4:01:11 PM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 0.9823 +/- 0.0000  
 Counting Efficiency: 0.1418 +/- 0.0026 on 2/16/2018 9:34:36 AM  
 Effective Efficiency: 0.1393 +/- 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	5.469	3.15	126.67	0.85	0.00E+000	3.0
RA-226	4.600	15.66	50.15	0.34	0.00E+000	3.0

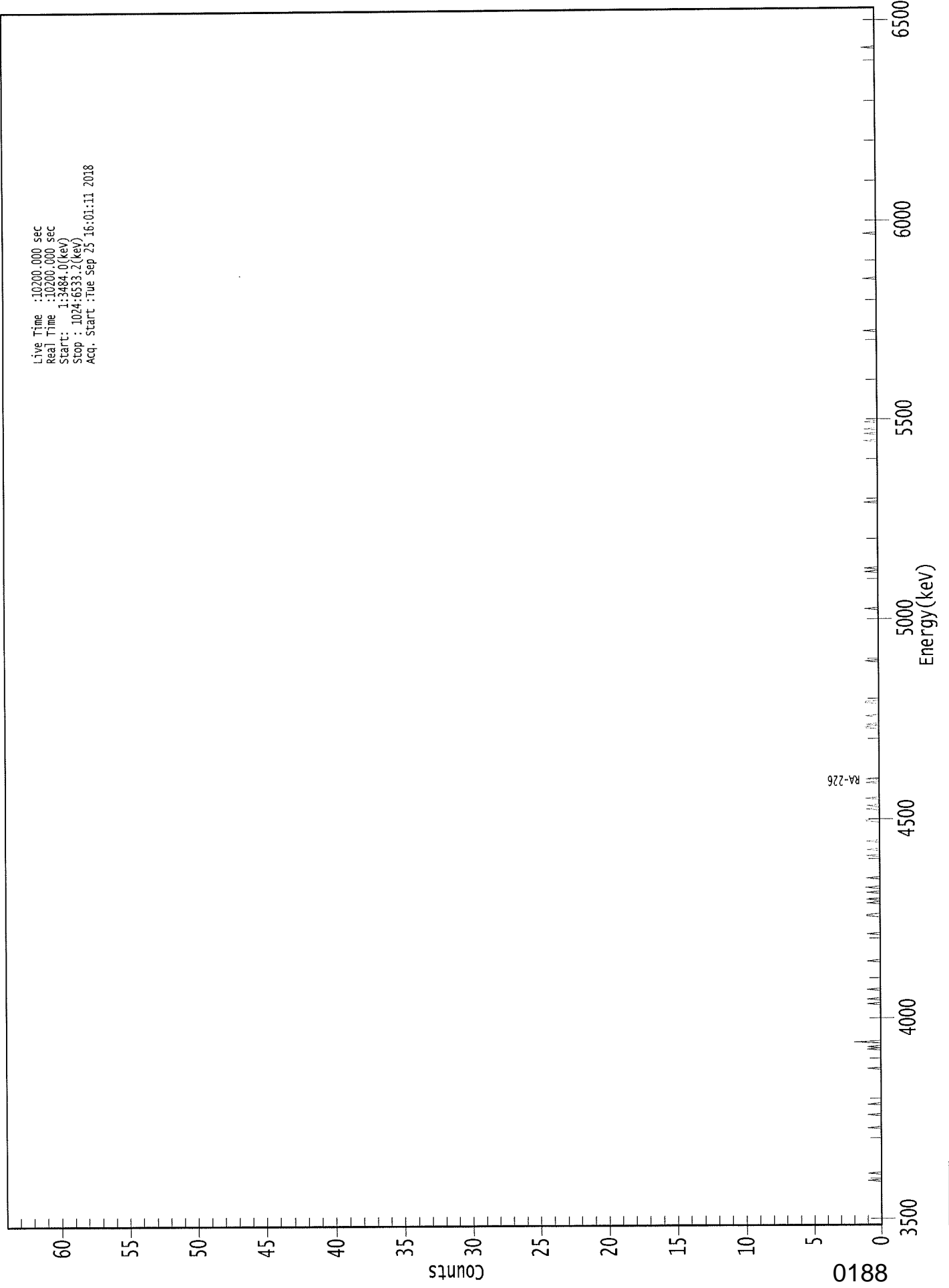
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter )	MDA (pCi/liter )
RA-224	0.941	5685.50*	6.03E-001 +/- 7.64E-001	1.15E+000 +/- 4.08E-002
RA-226	0.956	4785.00*	2.82E+000 +/- 1.42E+000	8.62E-001 +/- 3.06E-002

AG  
9/26/18

# 0000223067.CNF

Live Time : 10200.000 sec  
Real Time : 10200.000 sec  
Start : 1:3484.0(keV)  
Stop : 1024:6533.2(keV)  
Acq. Start : Tue Sep 25 16:01:11 2018



ROI Type: 1

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

Sample Title: 18

Elapsed Live time: 10200  
Elapsed Real Time: 10200

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

369: 0 0 0 1 0 0 1 0

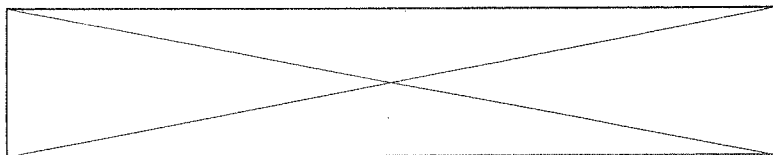
Sample Title: 18

Channel	1	2	3	4	5	6	7	8
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	0
409:	0	0	0	0	0	0	0	0
417:	0	1	1	0	1	0	0	0
425:	0	0	0	1	0	0	0	0
433:	0	0	0	0	0	0	1	1
441:	0	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	0	0	0	0	0
473:	0	1	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	1	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	1	0	0	1
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	1	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:	1	0	0	0	1	0	0	0
673:	0	0	1	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	1
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	1	0	0	0	0

801: 0 0 0 0 0 0 0 0 0

Sample Title: 18

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	1	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	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	0	0	0
985:	0	0	0	0	0	1	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



## QA SUMMARY REPORT

### Review Of QA Results - Pulser Check

Date : 9/24/2018  
Time : 5:11:31 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	9/24/2018 4:58:11 AM
Alpha 004	21f	ALL	Passed	9/24/2018 4:58:12 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	Not Done	
Alpha 011	21f	ALL	Passed	9/24/2018 4:58:13 AM
Alpha 012	21f	ALL	Passed	9/24/2018 4:58:14 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	9/24/2018 4:58:15 AM
Alpha 015	21f	Peak Energy	Action	9/24/2018 4:58:16 AM
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	Peak Energy	Action	9/21/2018 5:02:35 AM
Alpha 034	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:19 AM
Alpha 035	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:20 AM
Alpha 036	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:22 AM
Alpha 037	Alpha Analyst100DC	ALL	Not Done	
Alpha 038	Alpha Analyst100DC	ALL	Not Done	
Alpha 039	Alpha Analyst100DC	Peak FWHM	Action	9/24/2018 4:58:24 AM
Alpha 040	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:25 AM
Alpha 041	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:27 AM
Alpha 042	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:28 AM
Alpha 043	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:30 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:31 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:33 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:35 AM
Alpha 047	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:36 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:38 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:40 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:41 AM
Alpha 051	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:43 AM
Alpha 052	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:45 AM
Alpha 053	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:47 AM
Alpha 054	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:49 AM
Alpha 055	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:52 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:54 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:56 AM
Alpha 058	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:58 AM



CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 059	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:59 AM
Alpha 060	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:59:01 AM

APPROVED BY:     KP    APPROVAL DATE:     9/24/18



QA SUMMARY REPORT  
Review Of QA Results - Pulser Check

Date : 9/25/2018  
Time : 5:27:02 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	9/25/2018 5:04:34 AM
Alpha 004	21f	ALL	Passed	9/25/2018 5:04:35 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	Not Done	
Alpha 011	21f	ALL	Passed	9/25/2018 5:04:35 AM
Alpha 012	21f	ALL	Passed	9/25/2018 5:04:36 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	9/25/2018 5:04:37 AM
Alpha 015	21f	Peak Energy	Action	9/25/2018 5:04:38 AM
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	Peak Energy	Action	9/21/2018 5:02:35 AM
Alpha 034	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:41 AM
Alpha 035	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:43 AM
Alpha 036	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:45 AM
Alpha 037	Alpha Analyst100DC	ALL	Not Done	
Alpha 038	Alpha Analyst100DC	ALL	Not Done	
Alpha 039	Alpha Analyst100DC	Peak FWHM	Action	9/25/2018 5:04:47 AM
Alpha 040	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:49 AM
Alpha 041	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:51 AM
Alpha 042	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:53 AM
Alpha 043	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:56 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:04:58 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:00 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:03 AM
Alpha 047	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:05 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:08 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:10 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:12 AM
Alpha 051	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:15 AM
Alpha 052	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:17 AM
Alpha 053	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:20 AM
Alpha 054	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:23 AM
Alpha 055	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:25 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:28 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:30 AM
Alpha 058	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:33 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_059	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:36 AM
Alpha_060	Alpha Analyst100DC	ALL	Passed	9/25/2018 5:05:38 AM

APPROVED BY: KPAPPROVAL DATE: 9/25/18

\*\*\*\*\*  
\*\*\*\*\* LIBRARY LISTING REPORT \*\*\*\*\*  
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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)**

Work Order	<b>18-09025</b>
Analysis Code	<b>Ra228</b>
Run	<b>1</b>
Date Received	<b>9/10/2018</b>
Lab Deadline	<b>9/21/2018</b>
Client	Michael Pisani & Associates, Inc.
Project	07-214
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)	474.01
Carrier	Yttrium
Carrier Conc (mg/ml)	30.05

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/10/18 00:00	1.0000E+00
02	MBL	BLANK		09/10/18 00:00	1.0000E+00
03	DUP	BC-1	34	08/28/18 08:00	1.0000E+00
04	TRG	BC-3A	35	08/27/18 11:40	1.0000E+00
05	TRG	BC-3B	25	08/27/18 12:10	1.0000E+00
06	TRG	BC-2A	34	08/27/18 14:35	1.0000E+00
07	TRG	BC-2D	35	08/27/18 15:30	1.0000E+00
08	TRG	BC-2C	32	08/27/18 16:50	1.0000E+00
09	TRG	BC-5	37	08/27/18 18:10	1.0000E+00
10	DO	BC-1	34	08/28/18 08:00	1.0000E+00
11	TRG	BC-4C	34	08/28/18 11:30	1.0000E+00
12	TRG	BC-4B	38	08/28/18 13:50	1.0000E+00
13	TRG	BC-4A	44	08/28/18 15:00	1.0000E+00
14	TRG	BC-6	31	08/28/18 17:00	1.0000E+00
15	TRG	BC-7B	37	08/29/18 08:00	1.0000E+00
16	TRG	BC-7A	50	08/29/18 09:10	1.0000E+00
17	TRG	BC-8B	33	08/29/18 10:45	1.0000E+00
18	TRG	BC-8A	37	08/29/18 12:05	1.0000E+00

0198

\* 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.

Internal Fraction	Sample Desc	Tracer Aliquot (g)	Tracer Total ACT (dpm)	Radiometric Tracer (pCi)	Radiometric % Rec	Grav Carrier Added (ml)	Grav Filter Tare (g)	Grav Filter Final (g)	Grav Filter Net (g)	Grav % Rec	Mean % Rec	SAF 1*	SAF 2*
01	LCS	2.2067	1046.0	1020.0	216.48	2.000	0.0846	0.1392	0.0546	90.85	99.93	1.00	1.00
02	MBL	2.2037	1044.6	1000.0	212.53	2.000	0.0842	0.1424	0.0582	96.84	106.52	1.00	1.00
03	DUP	2.2039	1044.7	678.0	144.08	2.000	0.0837	0.1399	0.0562	93.51	102.86	1.00	1.00
04	TRG	2.2027	1044.1	515.0	109.50	2.000	0.0832	0.1407	0.0575	95.67	104.76	1.00	1.00
05	TRG	2.1998	1042.7	656.0	139.66	2.000	0.0802	0.1385	0.0583	97.00	106.71	1.00	1.00
06	TRG	2.2025	1044.0	328.0	69.75	2.000	0.0842	0.1431	0.0589	98.00	68.35	1.00	1.00
07	TRG	2.1995	1042.6	545.0	116.05	2.000	0.0845	0.1410	0.0565	94.01	103.41	1.00	1.00
08	TRG	2.1979	1041.8	864.0	184.11	2.000	0.0847	0.1406	0.0559	93.01	102.31	1.00	1.00
09	TRG	2.1970	1041.4	648.0	138.14	2.000	0.0845	0.1434	0.0589	98.00	107.80	1.00	1.00
10	DO	2.1975	1041.6	621.0	132.35	2.000	0.0850	0.1413	0.0563	93.68	103.04	1.00	1.00
11	TRG	2.1915	1038.8	521.0	111.34	2.000	0.0842	0.1403	0.0561	93.34	102.68	1.00	1.00
12	TRG	2.1915	1038.8	909.0	194.26	2.000	0.0841	0.1345	0.0504	83.86	92.25	1.00	1.00
13	TRG	2.1930	1039.5	623.0	133.05	2.000	0.0825	0.1422	0.0597	99.33	109.27	1.00	1.00
14	TRG	2.1951	1040.5	613.0	130.79	2.000	0.0792	0.1374	0.0582	96.84	106.52	1.00	1.00
15	TRG	2.1978	1041.8	417.0	88.86	2.000	0.0820	0.1352	0.0532	88.52	78.66	1.00	1.00
16	TRG	2.1934	1039.7	305.0	65.12	2.000	0.0778	0.1346	0.0568	94.51	61.55	1.00	1.00
17	TRG	2.1956	1040.7	544.0	116.04	2.200	0.0817	0.1470	0.0653	98.77	108.65	1.00	1.00
18	TRG	2.1945	1040.2	20.2	4.31	2.000	0.0779	0.1373	0.0594	98.84	4.26	1.00	1.00

0199

\* 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.

Internal Fraction	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep 10 Date/Time	Sep 10 By	Sep 11 Date/Time	Sep 11 By
01	LCS			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
02	MBL			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
03	DUP			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
04	TRG			09/21/18 12:39	JBAILEY	09/18/18 12:45	JBAILEY	09/21/18 12:44	JBAILEY
05	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
06	TRG			09/21/18 12:39	JBAILEY	09/18/18 12:45	JBAILEY	09/21/18 12:44	JBAILEY
07	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
08	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
09	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
10	DO			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
11	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
12	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
13	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
14	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
15	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
16	TRG			09/21/18 12:39	JBAILEY	09/18/18 12:45	JBAILEY	09/21/18 12:44	JBAILEY
17	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY
18	TRG			09/21/18 12:39	JBAILEY	09/18/18 10:17	JBAILEY	09/21/18 12:44	JBAILEY

\* 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.



	Run	1
	Analysis Code	Ra228
Eberline Analytical Work Order	18-09025	
Client	1020 Michael Pisani & Associates, Inc.	

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	RA-228	LCS	LCS	pCi/l	8.43E+00	6.92E-01	7.88E-01	9.15E+00	92.06	OK		OK	
02	RA-228	MBL	BLANK	pCi/l	-4.16E-01	4.01E-01	8.95E-01					OK	OK
03	RA-228	DUP	BC-1	pCi/l	3.78E-01	4.12E-01	8.39E-01				NA	OK	
04	RA-228	TRG	BC-3A	pCi/l	5.90E+00	6.32E-01	8.46E-01					OK	
05	RA-228	TRG	BC-3B	pCi/l	8.89E-01	3.94E-01	7.42E-01					OK	
06	RA-228	TRG	BC-2A	pCi/l	6.46E+01	2.13E+00	1.35E+00					OK	
07	RA-228	TRG	BC-2D	pCi/l	6.16E+00	6.16E-01	7.62E-01					OK	
08	RA-228	TRG	BC-2C	pCi/l	6.41E-01	4.12E-01	8.12E-01					OK	
09	RA-228	TRG	BC-5	pCi/l	2.05E+00	4.75E-01	8.12E-01					OK	
10	RA-228	DO	BC-1	pCi/l	9.06E-01	4.77E-01	9.30E-01					OK	
11	RA-228	TRG	BC-4C	pCi/l	6.05E+00	6.28E-01	8.23E-01					OK	
12	RA-228	TRG	BC-4B	pCi/l	2.29E+00	5.00E-01	8.33E-01					OK	
13	RA-228	TRG	BC-4A	pCi/l	1.20E+00	4.00E-01	7.26E-01					OK	
14	RA-228	TRG	BC-6	pCi/l	7.57E-01	4.07E-01	7.89E-01					OK	
15	RA-228	TRG	BC-7B	pCi/l	-6.41E-01	5.35E-01	1.20E+00					OK	
16	RA-228	TRG	BC-7A	pCi/l	2.99E+00	7.18E-01	1.20E+00					OK	
17	RA-228	TRG	BC-8B	pCi/l	1.07E+00	3.76E-01	6.82E-01					OK	
18	RA-228	TRG	BC-8A	pCi/l	2.16E-01	3.60E-01	7.46E-01					OK	

Preliminary Data Report & Analytical Calculations  
**Work Order: 18-09025-Ra228-1**

Lab Fraction	Nuclide	Sample Desc	Sample Date	Sample Aliquot	Radiometric % Rec	Grav % Rec	Mean % Rec	SAF	Sep 10 Date/Time	Sep 11 Date/Time
01	RA-228	LCS	09/10/18 00:00	1.00E+00	216.48	90.85	99.93	1.00	9/18/2018 10:17	9/21/2018 12:44
02	RA-228	MBL	09/10/18 00:00	1.00E+00	212.53	96.84	106.52	1.00	9/18/2018 10:17	9/21/2018 12:44
03	RA-228	DUP	08/28/18 08:00	1.00E+00	144.08	93.51	102.86	1.00	9/18/2018 10:17	9/21/2018 12:44
04	RA-228	TRG	08/27/18 11:40	1.00E+00	109.50	95.67	104.76	1.00	9/18/2018 12:45	9/21/2018 12:44
05	RA-228	TRG	08/27/18 12:10	1.00E+00	139.66	97.00	106.71	1.00	9/18/2018 10:17	9/21/2018 12:44
06	RA-228	TRG	08/27/18 14:35	1.00E+00	69.75	98.00	68.35	1.00	9/18/2018 12:45	9/21/2018 12:44
07	RA-228	TRG	08/27/18 15:30	1.00E+00	116.05	94.01	103.41	1.00	9/18/2018 10:17	9/21/2018 12:44
08	RA-228	TRG	08/27/18 16:50	1.00E+00	184.11	93.01	102.31	1.00	9/18/2018 10:17	9/21/2018 12:44
09	RA-228	TRG	08/27/18 18:10	1.00E+00	138.14	98.00	107.80	1.00	9/18/2018 10:17	9/21/2018 12:44
10	RA-228	DO	08/28/18 08:00	1.00E+00	132.35	93.68	103.04	1.00	9/18/2018 10:17	9/21/2018 12:44
11	RA-228	TRG	08/28/18 11:30	1.00E+00	111.34	93.34	102.68	1.00	9/18/2018 10:17	9/21/2018 12:44
12	RA-228	TRG	08/28/18 13:50	1.00E+00	194.26	83.86	92.25	1.00	9/18/2018 10:17	9/21/2018 12:44
13	RA-228	TRG	08/28/18 15:00	1.00E+00	133.05	99.33	109.27	1.00	9/18/2018 10:17	9/21/2018 12:44
14	RA-228	TRG	08/28/18 17:00	1.00E+00	130.79	96.84	106.52	1.00	9/18/2018 10:17	9/21/2018 12:44
15	RA-228	TRG	08/29/18 08:00	1.00E+00	88.86	88.52	78.66	1.00	9/18/2018 10:17	9/21/2018 12:44
16	RA-228	TRG	08/29/18 09:10	1.00E+00	65.12	94.51	61.55	1.00	9/18/2018 12:45	9/21/2018 12:44
17	RA-228	TRG	08/29/18 10:45	1.00E+00	116.04	98.77	108.65	1.00	9/18/2018 10:17	9/21/2018 12:44
18	RA-228	TRG	08/29/18 12:05	1.00E+00	4.31	98.84	98.84	1.00	9/18/2018 10:17	9/21/2018 12:44



Run

Analysis Code

Eberline Analytical Work Order

Client  
2020  
Michael Pisani & Associates, Inc.

1

Ra228

18-09025

Preliminary Data Report & Analytical Calculations  
**Work Order: 18-09025-Ra228-1**

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Half-life (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-228	LCS	09/21/18 14:26		LB4110A	A1	120	949	1.3	0.4803
02	RA-228	MBL	09/21/18 14:26		LB4110A	A2	120	183	1.866666667	0.4724
03	RA-228	DUP	09/21/18 14:26		LB4110A	A3	120	218	1.516666667	0.4719
04	RA-228	TRG	09/21/18 14:26		LB4110A	A4	120	729	1.483333333	0.4548
05	RA-228	TRG	09/21/18 14:26		LB4110A	B1	120	232	1.216666667	0.4626
06	RA-228	TRG	09/21/18 14:26		LB4110A	B3	120	4070	1.566666667	0.4449
07	RA-228	TRG	09/21/18 14:26		LB4110A	B4	120	721	1.2	0.4619
08	RA-228	TRG	09/21/18 14:26		LB4110A	C1	120	224	1.366666667	0.4667
09	RA-228	TRG	09/21/18 14:26		LB4110A	C2	120	374	1.466666667	0.4578
10	RA-228	DO	09/21/18 14:26		LB4110A	C3	120	310	1.866666667	0.4699
11	RA-228	TRG	09/21/18 14:26		LB4110A	C4	120	743	1.433333333	0.4692
12	RA-228	TRG	09/21/18 14:26		LB4110A	D1	120	360	1.3	0.4924
13	RA-228	TRG	09/21/18 14:26		LB4110A	D2	120	270	1.25	0.4682
14	RA-228	TRG	09/21/18 14:26		LB4110A	D4	120	249	1.45	0.4741
15	RA-228	TRG	09/21/18 14:26		LB4110A	F1	120	177	1.866666667	0.4754
16	RA-228	TRG	09/21/18 14:26		LB4110A	F2	120	296	1.066666667	0.4658
17	RA-228	TRG	09/21/18 14:26		LB4110A	F3	120	239	1.1	0.4713
18	RA-228	TRG	09/21/18 14:26		LB4110A	F4	120	154	1.116666667	0.4773

Run	1
Analysis Code	Ra228
Eberline Analytical Work Order	18-09025
Client	Michael Pisani & Associates, Inc.
3020	

Internal Fraction	Sample Desc	Client ID	Sample Date	Sample Aliquot	Tracer Aliquot (g)	Tracer ACT (dpm)	Radiometric Tracer (pCi)	Radiometric % Rec	SAF 1*	SAF 2*
01	LCS	LCS	09/10/18 00:00	1.0000	2.2067	1045.9979	1020.0000	216.48	1.00	1.00
02	MBL	BLANK	09/10/18 00:00	1.0000	2.2037	1044.5758	1000.0000	212.53	1.00	1.00
03	DUP	BC-1	08/28/18 08:00	1.0000	2.2039	1044.6706	678.0000	144.08	1.00	1.00
04	TRG	BC-3A	08/27/18 11:40	1.0000	2.2027	1044.1018	515.0000	109.50	1.00	1.00
05	TRG	BC-3B	08/27/18 12:10	1.0000	2.1998	1042.7272	656.0000	139.66	1.00	1.00
06	TRG	BC-2A	08/27/18 14:35	1.0000	2.2025	1044.0070	328.0000	69.75	1.00	1.00
07	TRG	BC-2D	08/27/18 15:30	1.0000	2.1995	1042.5850	545.0000	116.05	1.00	1.00
08	TRG	BC-2C	08/27/18 16:50	1.0000	2.1979	1041.8266	864.0000	184.11	1.00	1.00
09	TRG	BC-5	08/27/18 18:10	1.0000	2.1970	1041.4000	648.0000	138.14	1.00	1.00
10	DO	BC-1	08/28/18 08:00	1.0000	2.1975	1041.6370	621.0000	132.35	1.00	1.00
11	TRG	BC-4C	08/28/18 11:30	1.0000	2.1915	1038.7929	521.0000	111.34	1.00	1.00
12	TRG	BC-4B	08/28/18 13:50	1.0000	2.1915	1038.7929	909.0000	194.26	1.00	1.00
13	TRG	BC-4A	08/28/18 15:00	1.0000	2.1930	1039.5039	623.0000	133.05	1.00	1.00
14	TRG	BC-6	08/28/18 17:00	1.0000	2.1951	1040.4994	613.0000	130.79	1.00	1.00
15	TRG	BC-7B	08/29/18 08:00	1.0000	2.1978	1041.7792	417.0000	88.86	1.00	1.00
16	TRG	BC-7A	08/29/18 09:10	1.0000	2.1934	1039.6935	305.0000	65.12	1.00	1.00
17	TRG	BC-8B	08/29/18 10:45	1.0000	2.1956	1040.7364	544.0000	116.04	1.00	1.00
18	TRG	BC-8A	08/29/18 12:05	1.0000	2.1945	1040.2149	20.2000	4.31	1.00	1.00

Internal Work Order		Analysis Code		Date		Technician		Technician Initials		Witness Initials		
18-09025		Ra228		9/21/2018 12:39		JBAILEY		JBA				
Run		1										
LCS & Matrix Spikes												
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	LCS Volume Used (g)	MS Volume Used (g)	LCS Volume Used (g)	MSD Volume Used (g)	LCS Known pCi	MS Error Estimate	LCS Known pCi	MSD Error Estimate
Ra-228	Ra-12	53.250	9/21/2018	0.380	0.3816		9.15		0.467	0.000	0.00	0.000

Tracers												
fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition	Balance Printer Tapes					
01	Ba-133	Ba-6a	474.010	9/21/2018	2.2067	2.1400	Tracer					LCS
02	Ba-133	Ba-6a	474.010	9/21/2018	2.2037	2.1400						
03	Ba-133	Ba-6a	474.010	9/21/2018	2.2039	2.1400						
04	Ba-133	Ba-6a	474.010	9/21/2018	2.2027	2.1400						
05	Ba-133	Ba-6a	474.010	9/21/2018	2.1998	2.1400						
06	Ba-133	Ba-6a	474.010	9/21/2018	2.2025	2.1400						
07	Ba-133	Ba-6a	474.010	9/21/2018	2.1995	2.1400						
08	Ba-133	Ba-6a	474.010	9/21/2018	2.1979	2.1400						
09	Ba-133	Ba-6a	474.010	9/21/2018	2.1970	2.1400						
10	Ba-133	Ba-6a	474.010	9/21/2018	2.1975	2.1400						
11	Ba-133	Ba-6a	474.010	9/21/2018	2.1915	2.1400						
12	Ba-133	Ba-6a	474.010	9/21/2018	2.1915	2.1400						
13	Ba-133	Ba-6a	474.010	9/21/2018	2.1930	2.1400						
14	Ba-133	Ba-6a	474.010	9/21/2018	2.1951	2.1400						
15	Ba-133	Ba-6a	474.010	9/21/2018	2.1978	2.1400						
16	Ba-133	Ba-6a	474.010	9/21/2018	2.1934	2.1400						
17	Ba-133	Ba-6a	474.010	9/21/2018	2.1956	2.1400						
18	Ba-133	Ba-6a	474.010	9/21/2018	2.1945	2.1400						
							Matrix Spike					

0205

# Aliquot Worksheet

Work Order		Run	Analysis Code	Rpt Units	Lab Deadline	Technician	
<b>18-09025</b>		<b>1</b>	<b>Ra228</b>	<b>liters</b>	<b>9/21/2018</b>	<b>JHARVEY</b>	

Lab Fraction	Client ID	Sample Type	Muffle Data		Dilution Data			Aliquot Data			MS Aliquot Data		H-3 Solids Only	
			Ratio Post/Pre	No of Dis	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	BC-1	DUP							1.0000E+00	1.0000E+00				
04	BC-3A	TRG							1.0000E+00	1.0000E+00				
05	BC-3B	TRG							1.0000E+00	1.0000E+00				
06	BC-2A	TRG							1.0000E+00	1.0000E+00				
07	BC-2D	TRG							1.0000E+00	1.0000E+00				
08	BC-2C	TRG							1.0000E+00	1.0000E+00				
09	BC-5	TRG							1.0000E+00	1.0000E+00				
10	BC-1	DO							1.0000E+00	1.0000E+00				
11	BC-4C	TRG							1.0000E+00	1.0000E+00				
12	BC-4B	TRG							1.0000E+00	1.0000E+00				
13	BC-4A	TRG							1.0000E+00	1.0000E+00				
14	BC-6	TRG							1.0000E+00	1.0000E+00				
15	BC-7B	TRG							1.0000E+00	1.0000E+00				
16	BC-7A	TRG							1.0000E+00	1.0000E+00				
17	BC-8B	TRG							1.0000E+00	1.0000E+00				
18	BC-8A	TRG							1.0000E+00	1.0000E+00				

Comments
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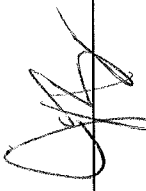
0206

Technician: J Harvey Date: 9/12/18

# Gravimetric Worksheet

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
<b>18-09025</b>	<b>1</b>	<b>Ra228</b>	<b>Yttrium</b>	<b>30.0500</b>	<b>JBAILEY</b>

TRetek Fraction	Michael Pisani & Associates, Inc.		Sample Type	Carrier Data		Filter Data			Gravimetric	
	Client ID			Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)	% Recovery		
01	LCS		LCS	2.0000	0.0846	0.1392	0.0546	90.85		
02	BLANK		MBL	2.0000	0.0842	0.1424	0.0582	96.84		
03	DUP		DUP	2.0000	0.0837	0.1399	0.0562	93.51		
04	BC-3A		TRG	2.0000	0.0832	0.1407	0.0575	95.67		
05	BC-3B		TRG	2.0000	0.0802	0.1385	0.0583	97.00		
06	BC-2A		TRG	2.0000	0.0842	0.1431	0.0589	98.00		
07	BC-2D		TRG	2.0000	0.0845	0.1410	0.0565	94.01		
08	BC-2C		TRG	2.0000	0.0847	0.1406	0.0559	93.01		
09	BC-5		TRG	2.0000	0.0845	0.1434	0.0589	98.00		
10	BC-1		DO	2.0000	0.0850	0.1413	0.0563	93.68		
11	BC-4C		TRG	2.0000	0.0842	0.1403	0.0561	93.34		
12	BC-4B		TRG	2.0000	0.0841	0.1345	0.0504	83.86		
13	BC-4A		TRG	2.0000	0.0825	0.1422	0.0597	99.33		
14	BC-6		TRG	2.0000	0.0792	0.1374	0.0582	96.84		
15	BC-7B		TRG	2.0000	0.0820	0.1352	0.0532	88.52		
16	BC-7A		TRG	2.0000	0.0778	0.1346	0.0568	94.51		
17	BC-8B		TRG	2.2000	0.0817	0.1470	0.0653	98.77		
18	BC-8A		TRG	2.0000	0.0779	0.1373	0.0594	98.84		

Technician:  Date: 9/21/18

11/18  
12/18

Detector ID	Sample ID	Alpha	Beta	Count Time	Voltage	TOD
A1	1809025-01	36	949	120	1410	9/21/2018 2:26:20 PM
A2	1809025-02	14	183	120	1410	9/21/2018 2:26:20 PM
A3	1809025-03	24	218	120	1410	9/21/2018 2:26:20 PM
A4	1809025-04	25	729	120	1410	9/21/2018 2:26:20 PM
B1	1809025-05	19	232	120	1410	9/21/2018 2:26:20 PM
B3	1809025-06	50	4070	120	1410	9/21/2018 2:26:20 PM
B4	1809025-07	24	721	120	1410	9/21/2018 2:26:20 PM
C1	1809025-08	18	224	120	1410	9/21/2018 2:26:20 PM
C2	1809025-09	16	374	120	1410	9/21/2018 2:26:21 PM
C3	1809025-10	11	310	120	1410	9/21/2018 2:26:21 PM
C4	1809025-11	18	743	120	1410	9/21/2018 2:26:21 PM
D1	1809025-12	22	360	120	1410	9/21/2018 2:26:21 PM
D2	1809025-13	20	270	120	1410	9/21/2018 2:26:21 PM
D4	1809025-14	26	249	120	1410	9/21/2018 2:26:21 PM
F1	1809025-15	21	177	120	1410	9/21/2018 2:26:21 PM
F2	1809025-16	11	296	120	1410	9/21/2018 2:26:21 PM
F3	1809025-17	18	239	120	1410	9/21/2018 2:26:21 PM
F4	1809025-18	11	154	120	1410	9/21/2018 2:26:22 PM



GPC Detector Report  
(ALL Backgrounds)

KP  
9/21/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	9/21/2018	8.33E-02	P	-3.53E-02	9.20E-02	2.19E-01
LB4110A - A2	Alpha	11/2/2017	9/21/2018	1.83E-01	P	-5.10E-02	9.62E-02	2.43E-01
LB4110A - A3	Alpha	11/2/2017	9/21/2018	8.33E-02	P	-3.29E-02	1.04E-01	2.40E-01
LB4110A - A4	Alpha	11/2/2017	9/21/2018	1.67E-02	P	-3.15E-02	9.17E-02	2.15E-01
LB4110A - B1	Alpha	11/2/2017	9/21/2018	1.17E-01	P	-3.43E-02	1.12E-01	2.58E-01
LB4110A - B2	Alpha	11/2/2017	9/21/2018	2.33E-01	P	-1.81E-02	1.17E-01	2.53E-01
LB4110A - B3	Alpha	11/2/2017	9/21/2018	1.00E-01	P	-5.56E-02	7.99E-02	2.15E-01
LB4110A - B4	Alpha	11/2/2017	9/21/2018	3.33E-02	P	-3.93E-02	7.97E-02	1.99E-01
LB4110A - C1	Alpha	11/2/2017	9/21/2018	1.67E-01	P	-2.39E-02	8.77E-02	1.99E-01
LB4110A - C2	Alpha	11/2/2017	9/21/2018	3.33E-02	P	-3.95E-02	5.94E-02	1.58E-01
LB4110A - C3	Alpha	11/2/2017	9/21/2018	5.00E-02	P	-5.50E-02	6.80E-02	1.91E-01
LB4110A - C4	Alpha	11/2/2017	9/21/2018	8.33E-02	P	-3.07E-02	8.07E-02	1.92E-01
LB4110A - D1	Alpha	11/2/2017	9/21/2018	1.50E-01	P	-3.34E-02	1.36E-01	3.06E-01
LB4110A - D2	Alpha	11/2/2017	9/21/2018	5.00E-02	P	-1.77E-02	1.24E-01	2.67E-01
LB4110A - D3	Alpha	11/2/2017	9/21/2018	2.17E-01	P	-4.47E-02	1.06E-01	2.56E-01
LB4110A - D4	Alpha	11/2/2017	9/21/2018	2.00E-01	P	-2.08E-02	1.47E-01	3.14E-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	9/21/2018	2.00E-01	P	-4.18E-02	7.52E-02	1.92E-01
LB4110A - F2	Alpha	11/2/2017	9/21/2018	6.67E-02	P	-3.23E-02	5.14E-02	1.35E-01
LB4110A - F3	Alpha	11/2/2017	9/21/2018	3.33E-02	P	-4.78E-02	6.17E-02	1.71E-01
LB4110A - F4	Alpha	11/2/2017	9/21/2018	3.33E-02	P	-2.25E-02	7.22E-02	1.67E-01
LB4110A - G1	Alpha	11/2/2017	9/21/2018	1.33E-01	P	-4.62E-02	6.08E-02	1.68E-01
LB4110A - G2	Alpha	11/2/2017	9/21/2018	1.50E-01	P	-4.26E-02	7.59E-02	1.94E-01
LB4110A - G3	Alpha	11/2/2017	9/21/2018	8.33E-02	P	-4.57E-02	8.27E-02	2.11E-01
LB4110A - G4	Alpha	11/2/2017	9/21/2018	6.67E-02	P	-3.03E-02	8.10E-02	1.92E-01

GPC Detector Report  
(ALL Backgrounds)

JP  
9/21/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PRW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	9/21/2018	1.30E+00	P	8.46E-01	1.37E+00	1.90E+00
LB4110A - A2	Beta	11/2/2017	9/21/2018	1.87E+00	P	9.16E-01	1.51E+00	2.11E+00
LB4110A - A3	Beta	11/2/2017	9/21/2018	1.52E+00	P	1.02E+00	1.51E+00	2.00E+00
LB4110A - A4	Beta	11/2/2017	9/21/2018	1.48E+00	P	9.45E-01	1.41E+00	1.87E+00
LB4110A - B1	Beta	11/2/2017	9/21/2018	1.22E+00	P	1.05E+00	1.55E+00	2.04E+00
LB4110A - B2	Beta	11/2/2017	9/21/2018	1.82E+00	P	6.68E-01	1.52E+00	2.37E+00
LB4110A - B3	Beta	11/2/2017	9/21/2018	1.57E+00	P	9.19E-01	1.37E+00	1.81E+00
LB4110A - B4	Beta	11/2/2017	9/21/2018	1.20E+00	P	7.36E-01	1.37E+00	2.01E+00
LB4110A - C1	Beta	11/2/2017	9/21/2018	1.37E+00	P	8.21E-01	1.26E+00	1.70E+00
LB4110A - C2	Beta	11/2/2017	9/21/2018	1.47E+00	P	-3.98E-01	1.27E+00	2.93E+00
LB4110A - C3	Beta	11/2/2017	9/21/2018	1.87E+00	P	9.67E-01	1.80E+00	2.64E+00
LB4110A - C4	Beta	11/2/2017	9/21/2018	1.43E+00	P	7.90E-01	1.22E+00	1.66E+00
LB4110A - D1	Beta	11/2/2017	9/21/2018	1.30E+00	P	8.60E-01	1.33E+00	1.79E+00
LB4110A - D2	Beta	11/2/2017	9/21/2018	1.25E+00	P	-2.42E-01	1.63E+00	3.50E+00
LB4110A - D3	Beta	11/2/2017	9/21/2018	1.03E+00	P	7.61E-01	1.27E+00	1.78E+00
LB4110A - D4	Beta	11/2/2017	9/21/2018	1.45E+00	P	9.47E-01	1.44E+00	1.93E+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	9/21/2018	1.87E+00	P	8.73E-01	1.36E+00	1.84E+00
LB4110A - F2	Beta	11/2/2017	9/21/2018	1.07E+00	P	5.24E-01	8.99E-01	1.27E+00
LB4110A - F3	Beta	11/2/2017	9/21/2018	1.10E+00	P	3.76E-02	1.24E+00	2.43E+00
LB4110A - F4	Beta	11/2/2017	9/21/2018	1.12E+00	P	6.87E-01	1.15E+00	1.61E+00
LB4110A - G1	Beta	11/2/2017	9/21/2018	1.27E+00	P	6.90E-01	1.37E+00	2.05E+00
LB4110A - G2	Beta	11/2/2017	9/21/2018	1.62E+00	P	1.06E+00	1.82E+00	2.57E+00
LB4110A - G3	Beta	11/2/2017	9/21/2018	1.30E+00	P	7.60E-01	1.50E+00	2.24E+00
LB4110A - G4	Beta	11/2/2017	9/21/2018	1.40E+00	P	5.60E-01	1.47E+00	2.37E+00

GPC Detector Report  
(ALL Efficiencies)

RP  
9/21/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	9/21/2018	0.2251	P	0.2137	0.2252	0.2368
LB4110A - A2	Alpha	11/2/2017	9/21/2018	0.2082	P	0.1968	0.2115	0.2261
LB4110A - A3	Alpha	11/2/2017	9/21/2018	0.1945	P	0.1837	0.1997	0.2157
LB4110A - A4	Alpha	11/2/2017	9/21/2018	0.2274	P	0.2060	0.2260	0.2460
LB4110A - B1	Alpha	11/2/2017	9/21/2018	0.2249	P	0.2036	0.2229	0.2423
LB4110A - B2	Alpha	11/2/2017	9/21/2018	0.1966	P	0.1833	0.2006	0.2179
LB4110A - B3	Alpha	11/2/2017	9/21/2018	0.2418	P	0.2176	0.2346	0.2516
LB4110A - B4	Alpha	11/2/2017	9/21/2018	0.2230	P	0.2035	0.2211	0.2388
LB4110A - C1	Alpha	11/2/2017	9/21/2018	0.2071	P	0.1948	0.2073	0.2199
LB4110A - C2	Alpha	11/2/2017	9/21/2018	0.2205	P	-0.1004	0.2241	0.5486
LB4110A - C3	Alpha	11/2/2017	9/21/2018	0.2425	P	0.2294	0.2423	0.2552
LB4110A - C4	Alpha	11/2/2017	9/21/2018	0.2161	P	0.1983	0.2147	0.2311
LB4110A - D1	Alpha	11/2/2017	9/21/2018	0.2180	P	0.2102	0.2219	0.2335
LB4110A - D2	Alpha	11/2/2017	9/21/2018	0.2500	P	0.2319	0.2509	0.2698
LB4110A - D3	Alpha	11/2/2017	9/21/2018	0.2523	P	0.2340	0.2496	0.2651
LB4110A - D4	Alpha	11/2/2017	9/21/2018	0.1928	P	0.1763	0.1958	0.2153
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	9/21/2018	0.2165	P	0.1612	0.2122	0.2633
LB4110A - F2	Alpha	11/2/2017	9/21/2018	0.1830	P	0.1710	0.1830	0.1950
LB4110A - F3	Alpha	11/2/2017	9/21/2018	0.2365	P	0.2215	0.2367	0.2519
LB4110A - F4	Alpha	11/2/2017	9/21/2018	0.2057	P	0.1929	0.2095	0.2261
LB4110A - G1	Alpha	11/2/2017	9/21/2018	0.1851	F	0.1853	0.1983	0.2113
LB4110A - G2	Alpha	11/2/2017	9/21/2018	0.1939	W	0.1918	0.2018	0.2117
LB4110A - G3	Alpha	11/2/2017	9/21/2018	0.2155	P	0.2105	0.2239	0.2372
LB4110A - G4	Alpha	11/2/2017	9/21/2018	0.1773	F	0.1840	0.1985	0.2129

GPC Detector Report  
(ALL Efficiencies)

KP  
9/21/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	9/21/2018	0.5512	P	0.5098	0.5372	0.5646
LB4110A - A2	Beta	11/2/2017	9/21/2018	0.4670	P	0.4159	0.4643	0.5127
LB4110A - A3	Beta	11/2/2017	9/21/2018	0.4785	P	0.4360	0.4790	0.5220
LB4110A - A4	Beta	11/2/2017	9/21/2018	0.5437	P	0.4983	0.5409	0.5834
LB4110A - B1	Beta	11/2/2017	9/21/2018	0.5566	P	0.4987	0.5393	0.5800
LB4110A - B2	Beta	11/2/2017	9/21/2018	0.4920	P	0.4621	0.4994	0.5366
LB4110A - B3	Beta	11/2/2017	9/21/2018	0.5893	P	0.5442	0.5823	0.6204
LB4110A - B4	Beta	11/2/2017	9/21/2018	0.5544	P	0.5005	0.5430	0.5854
LB4110A - C1	Beta	11/2/2017	9/21/2018	0.4764	P	0.4434	0.4794	0.5154
LB4110A - C2	Beta	11/2/2017	9/21/2018	0.5221	P	0.4903	0.5180	0.5458
LB4110A - C3	Beta	11/2/2017	9/21/2018	0.6043	P	0.5674	0.5996	0.6317
LB4110A - C4	Beta	11/2/2017	9/21/2018	0.5224	P	0.4811	0.5237	0.5662
LB4110A - D1	Beta	11/2/2017	9/21/2018	0.6354	P	0.6150	0.6405	0.6659
LB4110A - D2	Beta	11/2/2017	9/21/2018	0.6404	P	0.5877	0.6423	0.6969
LB4110A - D3	Beta	11/2/2017	9/21/2018	0.6419	P	0.5995	0.6407	0.6818
LB4110A - D4	Beta	11/2/2017	9/21/2018	0.5069	P	0.4635	0.5038	0.5441
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	9/21/2018	0.5274	P	0.4018	0.5277	0.6536
LB4110A - F2	Beta	11/2/2017	9/21/2018	0.4519	P	0.4289	0.4576	0.4862
LB4110A - F3	Beta	11/2/2017	9/21/2018	0.6035	P	0.5701	0.6105	0.6509
LB4110A - F4	Beta	11/2/2017	9/21/2018	0.5189	P	0.4885	0.5298	0.5710
LB4110A - G1	Beta	11/2/2017	9/21/2018	0.4483	P	0.4334	0.4570	0.4805
LB4110A - G2	Beta	11/2/2017	9/21/2018	0.4723	P	0.4669	0.4854	0.5038
LB4110A - G3	Beta	11/2/2017	9/21/2018	0.5176	P	0.5093	0.5413	0.5732
LB4110A - G4	Beta	11/2/2017	9/21/2018	0.4433	F	0.4472	0.4840	0.5207

**SECTION X**  
**BARIUM-133 ANALYTICAL TRACER DATA**

**RUN 1**

KP  
9/18/18

Analysis Report for 1809025-01  
SPIKE

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-01  
 Sample Description : SPIKE  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/18/2018 9:58:46AM  
 Acquisition Started : 9/18/2018 1:11:07PM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 901.5 seconds

Dead Time : 0.17 %

Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 9 - 4096  
 Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Used Done On : 11/9/2014  
 Efficiency Calibration Description :

Sample Number : 71955

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 1:26:10PM  
 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 1809025-01

SPIKE

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.70	14 -	24	19.76	1.49E+02	65.62	4.93E+02	2.41
M	2	31.43	25 -	44	30.49	3.39E+03	122.82	2.43E+02	2.31
m	3	35.74	25 -	44	34.81	8.66E+02	78.09	1.57E+02	2.15
	4	53.69	49 -	58	52.77	1.09E+02	52.28	3.37E+02	2.74
M	5	62.32	58 -	69	61.40	3.30E+02	52.94	2.70E+02	2.40
m	6	66.61	58 -	69	65.70	1.36E+02	53.78	2.94E+02	2.50
	7	81.65	76 -	86	80.75	1.42E+03	91.20	3.42E+02	2.26
M	8	112.48	108 -	120	111.61	2.69E+02	43.71	1.56E+02	2.39
m	9	116.87	108 -	120	116.00	6.29E+01	32.34	1.06E+02	2.16
	10	162.13	158 -	164	161.29	2.79E+01	32.44	1.70E+02	3.33
	11	276.49	270 -	281	275.75	1.06E+02	30.07	5.92E+01	1.81
M	12	303.45	297 -	314	302.73	2.12E+02	31.97	3.08E+01	1.98
m	13	307.72	297 -	314	307.00	3.79E+01	31.11	3.49E+01	2.79
M	14	334.21	327 -	340	333.51	6.06E+01	22.72	2.91E+01	2.81
m	15	338.11	327 -	340	337.42	4.05E+01	20.92	2.22E+01	2.45
	16	356.68	350 -	361	356.00	6.50E+02	55.93	6.56E+01	2.14
M	17	386.88	380 -	398	386.23	3.59E+02	44.05	5.51E+01	4.58
m	18	391.95	380 -	398	391.30	2.83E+01	23.20	2.24E+01	2.21
M	19	415.13	410 -	424	414.50	4.08E+01	16.12	1.00E+01	2.78
m	20	418.53	410 -	424	417.90	3.42E+01	19.10	1.54E+01	2.86
	21	437.93	432 -	443	437.32	7.77E+01	22.36	2.25E+01	2.55
m	22	514.05	507 -	517	513.51	5.88E+00	11.52	1.14E+01	2.92
	23	868.21	865 -	870	868.00	5.00E+00	4.47	0.00E+00	2.98

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 : 9/18/2018 1:26:10PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000071072.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.70	1.49E+02	65.62			1.49E+02	6.56E+01
M	2	31.43	3.39E+03	122.82			3.39E+03	1.23E+02
m	3	35.74	8.66E+02	78.09			8.66E+02	7.81E+01
	4	53.69	1.09E+02	52.28			1.09E+02	5.23E+01
M	5	62.32	3.30E+02	52.94	1.33E+01	2.31E+00	3.17E+02	5.30E+01
m	6	66.61	1.36E+02	53.78			1.36E+02	5.38E+01



Analysis Report for 1809025-01

SPIKE

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	7	81.65	1.42E+03	91.20			1.42E+03	9.12E+01
M	8	112.48	2.69E+02	43.71			2.69E+02	4.37E+01
m	9	116.87	6.29E+01	32.34			6.29E+01	3.23E+01
	10	162.13	2.79E+01	32.44			2.79E+01	3.24E+01
	11	276.49	1.06E+02	30.07			1.06E+02	3.01E+01
M	12	303.45	2.12E+02	31.97			2.12E+02	3.20E+01
m	13	307.72	3.79E+01	31.11			3.79E+01	3.11E+01
M	14	334.21	6.06E+01	22.72			6.06E+01	2.27E+01
m	15	338.11	4.05E+01	20.92			4.05E+01	2.09E+01
	16	356.68	6.50E+02	55.93			6.50E+02	5.59E+01
M	17	386.88	3.59E+02	44.05			3.59E+02	4.40E+01
m	18	391.95	2.83E+01	23.20			2.83E+01	2.32E+01
M	19	415.13	4.08E+01	16.12			4.08E+01	1.61E+01
m	20	418.53	3.42E+01	19.10			3.42E+01	1.91E+01
	21	437.93	7.77E+01	22.36			7.77E+01	2.24E+01
m	22	514.05	5.88E+00	11.52			5.88E+00	1.15E+01
	23	868.21	5.00E+00	4.47			5.00E+00	4.47E+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	4.46E+01	3.70E+01
I-125	0.99	35.49 *	6.49	7.95E+02	7.45E+01
BA-133	0.99	30.80 *	97.60	1.59E+02	6.54E+00
		302.84 *	17.80	1.04E+03	3.57E+02
		356.01 *	60.00	1.02E+03	1.60E+02
TH-234	0.98	63.29 *	3.80	1.36E+03	2.48E+02

Analysis Report for 1809025-01

SPIKE

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

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## INTERFERENCE CORRECTED REPORT

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<i><b>Nuclide Name</b></i>	<i><b>Nuclide Id Confidence</b></i>	<i><b>Wt mean Activity (pCi/units)</b></i>	<i><b>Wt mean Activity Uncertainty</b></i>	<i><b>Comments</b></i>
SN-113	0.945	4.46E+01	3.70E+01	
I-125	0.999	7.95E+02	7.45E+01	
X I-129	0.591			
BA-133	0.992	1.60E+02	6.53E+00	
TH-234	0.982	1.36E+03	2.48E+02	

? = 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 1809025-01

SPIKE

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 1:26:10PM  
 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	20.70	1.65867E-01	21.98	
	4	53.69	1.20778E-01	24.05	
m	6	66.61	1.50676E-01	19.83	Sum
	7	81.65	1.57425E+00	3.22	
M	8	112.48	2.98844E-01	8.13	Tol. U-237
m	9	116.87	6.98615E-02	25.72	
	10	162.13	3.09931E-02	58.15	
	11	276.49	1.18243E-01	14.13	
m	13	307.72	4.21582E-02	41.00	
M	14	334.21	6.73290E-02	18.74	Sum
m	15	338.11	4.49688E-02	25.85	Sum
M	17	386.88	3.98889E-01	6.13	Sum
M	19	415.13	4.53628E-02	19.75	
m	20	418.53	3.79984E-02	27.92	Sum
	21	437.93	8.63795E-02	14.38	
m	22	514.05	6.53788E-03	97.91	
	23	868.21	5.55556E-03	44.72	

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

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**NUCLIDE MDA REPORT**


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

Analysis Report for 1809025-01

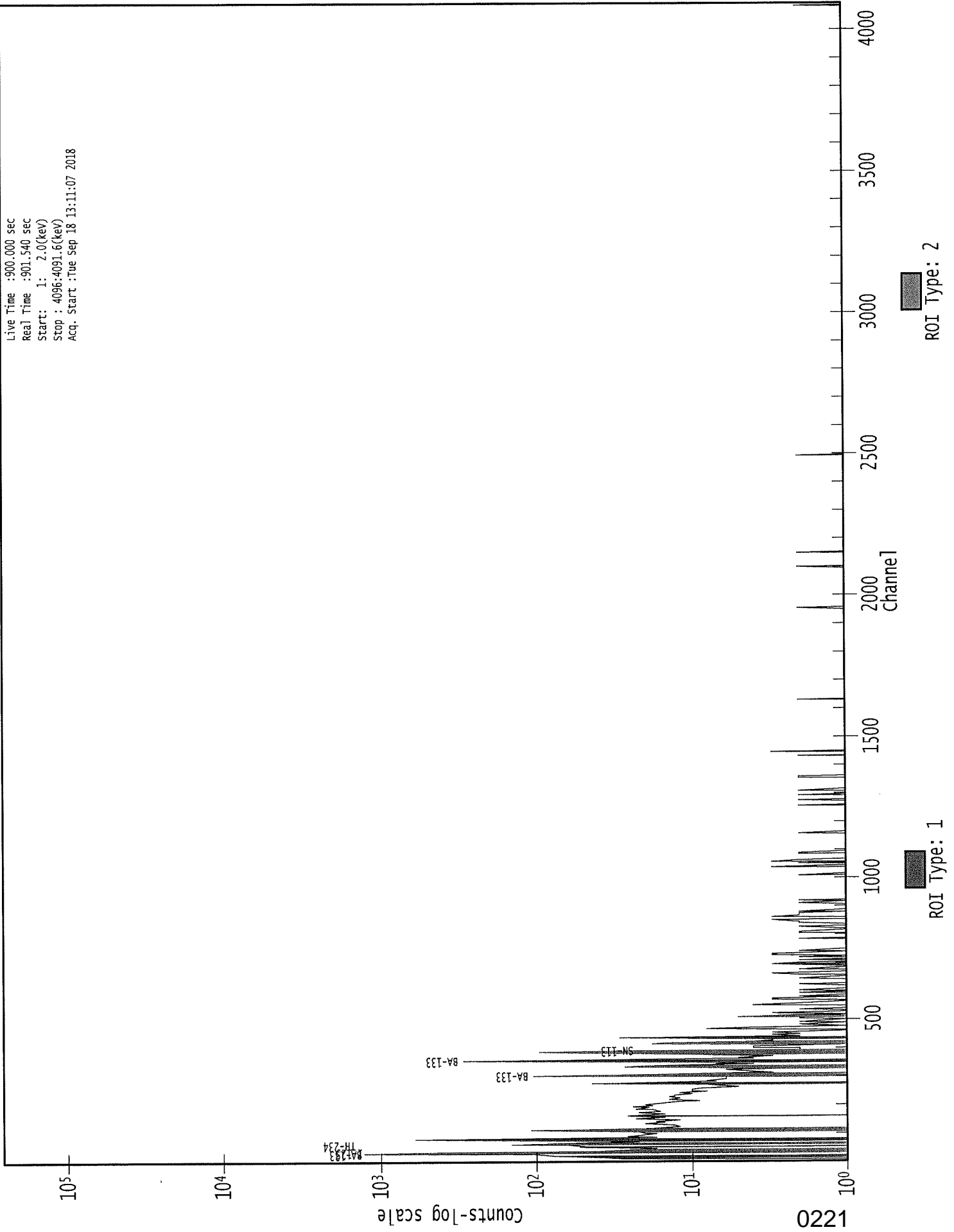
## SPIKE

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	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.14E+01	2.14E+01	-1.15E+00	1.00E+01
	136.48	10.60	2.09E+02		2.53E+00	9.84E+01
NI-59	6.92	29.80	4.64E-02	4.64E-02	-5.15E-02	1.94E-02
MO-93	16.59	52.90	1.33E+00	1.33E+00	-2.92E+00	6.37E-01
	18.60	10.00	1.13E+01		1.66E+01	5.47E+00
NB-93M	16.57	9.43	7.42E+00	7.42E+00	-1.63E+01	3.56E+00
CD-109	88.03	3.72	3.81E+02	3.81E+02	-4.44E+01	1.80E+02
+ SN-113	255.12	1.93	1.37E+03	8.01E+01	-2.33E+02	6.30E+02
	391.69	*	61.90	8.01E+01	4.46E+01	3.79E+01
SN-119M	23.87	16.10	1.21E+01	9.08E+00	-2.50E+01	5.84E+00
	25.10	22.70	9.08E+00		-1.29E+02	4.37E+00
+ I-125	35.49	*	6.49	1.28E+02	7.95E+02	6.28E+01
I-129	29.78	*	57.00	1.13E+01	2.72E+02	5.54E+00
	33.60		1.16E+02		1.30E+03	5.73E+01
	39.58	7.52	7.62E+01		-2.45E+02	3.68E+01
+ BA-133	30.80	*	97.60	6.60E+00	1.59E+02	3.24E+00
	302.84	*	17.80		1.04E+03	1.20E+02
	356.01	*	60.00		1.02E+03	2.97E+01
CE-139	165.85	80.35	3.46E+01	3.46E+01	-1.78E-01	1.64E+01
CE-144	133.54	10.80	2.11E+02	2.11E+02	7.54E+01	9.99E+01
HG-203	279.19	77.30	5.43E+01	5.43E+01	7.33E+01	2.57E+01
PB-210	46.50	4.25	1.15E+02	1.15E+02	-6.35E+00	5.43E+01
PA-231	9.28	42.00	1.95E-01	1.95E-01	1.25E-01	9.08E-02
	10.11	20.20	6.05E-01		4.47E-01	2.85E-01
	283.67	1.60	1.58E+03		2.05E+02	7.18E+02
	302.67	2.30	2.84E+03		6.92E+03	1.37E+03
TH-231	25.64	14.70	1.55E+01	1.55E+01	-4.95E+02	7.49E+00
	84.21	6.40	7.08E+02		4.90E+03	3.48E+02
PA-234M	9.89	89.00	1.29E-01	1.29E-01	9.52E-02	6.06E-02
	21.72	64.90	2.52E+00		3.97E+00	1.22E+00
	37.93	23.75	4.03E+01		1.48E+02	1.98E+01
	131.42	20.40	1.11E+02		5.35E+01	5.27E+01
+ TH-234	63.29	*	3.80	4.21E+02	1.36E+03	2.05E+02
NP-237	29.37	14.00	7.39E+01	7.39E+01	7.09E+02	3.65E+01
	86.50	12.60	1.21E+02		7.88E+00	5.76E+01
U-237	97.08	16.30	1.01E+02	6.50E+01	-3.96E+01	4.80E+01
	101.07	26.30	6.50E+01		-1.16E+01	3.08E+01
	114.00	12.30	2.97E+02		8.70E+02	1.44E+02
	208.01	22.00	1.41E+02		-1.93E+01	6.63E+01
AM-241	59.54	35.90	4.14E+01	4.14E+01	7.01E+01	2.01E+01
AM-243	74.67	66.00	1.98E+01	1.98E+01	6.97E+00	9.43E+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

# 0000071955.CNF

Live Time :900.000 sec  
Real Time :901.540 sec  
Start : 1: 2.0(keV)  
Stop : 4096:4091.6(keV)  
Acq. Start :Tue Sep 18 13:11:07 2018



Analysis Report for 1809025-02  
BLANK

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-02  
 Sample Description : BLANK  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 9:58:57AM  
 Acquisition Started : 9/18/2018 1:26:24PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.6 seconds  
  
 Dead Time : 0.07 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 9 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Used Done On : 11/9/2014  
 Efficiency Calibration Description :  
  
 Sample Number : 71956

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 1:41:28PM  
 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 1809025-02

BLANK

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	21.38	14 -	39	20.43	1.65E+02	49.36	3.74E+02	2.75
m	2	31.49	14 -	39	30.55	3.37E+03	121.38	2.23E+02	2.12
m	3	35.79	14 -	39	34.85	8.58E+02	108.36	1.70E+02	2.28
	4	53.54	48 -	57	52.62	1.25E+02	49.22	2.75E+02	2.48
M	5	62.43	57 -	68	61.52	3.25E+02	53.52	2.64E+02	2.72
m	6	66.59	57 -	68	65.68	1.22E+02	38.30	1.72E+02	1.80
	7	81.53	74 -	85	80.63	1.42E+03	89.26	2.87E+02	2.20
M	8	112.16	105 -	120	111.28	2.90E+02	42.94	1.24E+02	2.38
m	9	116.71	105 -	120	115.84	1.36E+02	43.96	1.09E+02	2.88
	10	160.90	155 -	165	160.06	6.66E+01	43.79	2.21E+02	3.44
	11	173.74	168 -	177	172.91	4.67E+01	38.00	1.79E+02	6.51
	12	276.62	272 -	278	275.87	3.85E+01	24.49	1.25E+02	2.13
M	13	303.43	295 -	315	302.71	2.13E+02	32.66	3.91E+01	2.23
m	14	307.70	295 -	315	306.98	4.04E+01	28.68	2.22E+01	2.40
m	15	312.23	295 -	315	311.52	1.94E+01	20.30	1.89E+01	2.79
M	16	329.47	327 -	341	328.77	1.42E+01	7.43	6.16E+00	3.08
m	17	333.58	327 -	341	332.88	6.39E+01	21.85	2.13E+01	3.09
m	18	338.92	327 -	341	338.23	2.68E+01	15.79	2.01E+01	3.09
	19	356.62	351 -	360	355.94	6.40E+02	52.28	2.47E+01	2.23
M	20	386.05	372 -	395	385.40	2.62E+02	43.26	4.60E+01	4.26
m	21	391.12	372 -	395	390.47	6.65E+01	36.71	2.70E+01	3.70
M	22	416.41	411 -	425	415.78	3.91E+01	17.22	6.69E+00	3.15
m	23	422.86	411 -	425	422.24	1.01E+01	12.17	1.44E+01	2.60
	24	428.89	425 -	431	428.27	1.05E+01	9.84	9.00E+00	3.54
	25	437.68	433 -	440	437.07	9.00E+01	20.20	8.00E+00	2.63
	26	467.88	465 -	471	467.29	9.40E+00	9.84	1.12E+01	2.15
	27	498.79	496 -	500	498.23	5.50E+00	6.67	5.00E+00	1.62

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 : 9/18/2018 1:41:28PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000071072.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	21.38	1.65E+02	49.36			1.65E+02	4.94E+01
m	2	31.49	3.37E+03	121.38			3.37E+03	1.21E+02

Analysis Report for 1809025-02

BLANK

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	3	35.79	8.58E+02	108.36			8.58E+02	1.08E+02
	4	53.54	1.25E+02	49.22			1.25E+02	4.92E+01
M	5	62.43	3.25E+02	53.52	1.33E+01	2.31E+00	3.12E+02	5.36E+01
m	6	66.59	1.22E+02	38.30			1.22E+02	3.83E+01
	7	81.53	1.42E+03	89.26			1.42E+03	8.93E+01
M	8	112.16	2.90E+02	42.94			2.90E+02	4.29E+01
m	9	116.71	1.36E+02	43.96			1.36E+02	4.40E+01
	10	160.90	6.66E+01	43.79			6.66E+01	4.38E+01
	11	173.74	4.67E+01	38.00	0.00E+00	0.00E+00	4.67E+01	3.80E+01
	12	276.62	3.85E+01	24.49			3.85E+01	2.45E+01
M	13	303.43	2.13E+02	32.66			2.13E+02	3.27E+01
m	14	307.70	4.04E+01	28.68			4.04E+01	2.87E+01
m	15	312.23	1.94E+01	20.30			1.94E+01	2.03E+01
M	16	329.47	1.42E+01	7.43			1.42E+01	7.43E+00
m	17	333.58	6.39E+01	21.85			6.39E+01	2.18E+01
m	18	338.92	2.68E+01	15.79			2.68E+01	1.58E+01
	19	356.62	6.40E+02	52.28			6.40E+02	5.23E+01
M	20	386.05	2.62E+02	43.26			2.62E+02	4.33E+01
m	21	391.12	6.65E+01	36.71			6.65E+01	3.67E+01
M	22	416.41	3.91E+01	17.22			3.91E+01	1.72E+01
m	23	422.86	1.01E+01	12.17			1.01E+01	1.22E+01
	24	428.89	1.05E+01	9.84			1.05E+01	9.84E+00
	25	437.68	9.00E+01	20.20			9.00E+01	2.02E+01
	26	467.88	9.40E+00	9.84			9.40E+00	9.84E+00
	27	498.79	5.50E+00	6.67			5.50E+00	6.67E+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	1.05E+02	5.95E+01
I-125	0.99	35.49 *	6.49	7.89E+02	1.02E+02
BA-133	0.99	30.80 *	97.60	1.58E+02	6.50E+00

0224



Analysis Report for 1809025-02

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<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
BA-133	0.99	302.84 *		17.80	1.05E+03	3.60E+02
		356.01 *		60.00	1.00E+03	1.55E+02
TH-234	0.98	63.29 *		3.80	1.35E+03	2.50E+02

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.941	1.05E+02	5.95E+01	
I-125	0.998	7.89E+02	1.02E+02	
X I-129	0.588			
BA-133	0.992	1.60E+02	6.49E+00	
TH-234	0.986	1.35E+03	2.50E+02	

? = 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

Analysis Report for 1809025-02

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 1:41:28PM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide	
M	1	21.38	1.82904E-01	14.99	Tol.	PA-234M
	4	53.54	1.38564E-01	19.74		
m	6	66.59	1.35470E-01	15.71	Sum	
	7	81.53	1.57392E+00	3.15		
M	8	112.16	3.22322E-01	7.40		
m	9	116.71	1.50971E-01	16.18		
	10	160.90	7.39893E-02	32.88		
	11	173.74	5.18954E-02	40.68		
	12	276.62	4.28016E-02	31.79		
m	14	307.70	4.48407E-02	35.53		
m	15	312.23	2.15723E-02	52.27		
M	16	329.47	1.58126E-02	26.12		
m	17	333.58	7.09510E-02	17.11	Sum	
m	18	338.92	2.97760E-02	29.46	Sum	
M	20	386.05	2.91203E-01	8.25		
M	22	416.41	4.34388E-02	22.02		
m	23	422.86	1.11921E-02	60.39	Sum	
	24	428.89	1.16667E-02	46.84	Sum	
	25	437.68	1.00000E-01	11.22		
	26	467.88	1.04444E-02	52.32		
	27	498.79	6.11111E-03	60.64		

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

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**NUCLIDE MDA REPORT**


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

0226

Analysis Report for 1809025-02

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<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.09E+01	2.09E+01	-2.80E-01	9.79E+00
	136.48	10.60	2.04E+02		-4.11E+01	9.62E+01
NI-59	6.92	29.80	3.65E-02	3.65E-02	-5.29E-02	1.45E-02
MO-93	16.59	52.90	1.35E+00	1.35E+00	-2.46E+00	6.47E-01
	18.60	10.00	1.15E+01		1.71E+01	5.55E+00
NB-93M	16.57	9.43	7.53E+00	7.53E+00	-1.38E+01	3.62E+00
CD-109	88.03	3.72	3.74E+02	3.74E+02	-8.50E+01	1.77E+02
+ SN-113	255.12	1.93	1.50E+03	8.86E+01	-6.43E+01	6.93E+02
	391.69	*	61.90		1.05E+02	4.22E+01
SN-119M	23.87	16.10	1.27E+01	9.98E+00	-1.88E+01	6.15E+00
	25.10	22.70	9.98E+00		-9.92E+01	4.82E+00
+ I-125	35.49	*	6.49	1.68E+02	7.89E+02	8.29E+01
I-129	29.78	*	57.00	1.48E+01	2.71E+02	7.27E+00
	33.60		13.20		1.37E+03	5.81E+01
	39.58		7.52		9.68E+00	3.86E+01
+ BA-133	30.80	*	97.60	8.62E+00	1.58E+02	4.25E+00
	302.84	*	17.80		1.05E+03	1.39E+02
	356.01	*	60.00		1.00E+03	1.71E+01
CE-139	165.85	80.35	3.29E+01	3.29E+01	2.08E+00	1.55E+01
CE-144	133.54	10.80	1.92E+02	1.92E+02	-7.34E+01	9.01E+01
HG-203	279.19	77.30	5.46E+01	5.46E+01	-4.78E+00	2.58E+01
PB-210	46.50	4.25	1.13E+02	1.13E+02	2.38E+01	5.32E+01
PA-231	9.28	42.00	1.78E-01	1.78E-01	4.26E-02	8.26E-02
	10.11	20.20	5.65E-01		3.00E-01	2.65E-01
	283.67	1.60	1.70E+03		5.25E+02	7.79E+02
	302.67	2.30	2.83E+03		6.51E+03	1.36E+03
TH-231	25.64	14.70	1.61E+01	1.61E+01	-5.17E+02	7.80E+00
	84.21	6.40	7.05E+02		4.90E+03	3.47E+02
PA-234M	9.89	89.00	1.20E-01	1.20E-01	6.38E-02	5.63E-02
	21.72	64.90	2.59E+00		2.85E+00	1.25E+00
	37.93	23.75	3.97E+01		1.34E+02	1.95E+01
	131.42	20.40	1.01E+02		1.30E+01	4.74E+01
+ TH-234	63.29	*	3.80	4.01E+02	1.35E+03	1.95E+02
NP-237	29.37	14.00	7.46E+01	7.46E+01	7.19E+02	3.69E+01
	86.50	12.60	1.17E+02		1.06E+00	5.56E+01
U-237	97.08	16.30	9.88E+01	6.22E+01	-2.75E+01	4.68E+01
	101.07	26.30	6.22E+01		1.61E+01	2.94E+01
	114.00	12.30	3.12E+02		8.84E+02	1.52E+02
	208.01	22.00	1.42E+02		1.97E+01	6.68E+01
AM-241	59.54	35.90	3.94E+01	3.94E+01	6.60E+01	1.91E+01
AM-243	74.67	66.00	1.75E+01	1.75E+01	-9.93E-01	8.31E+00

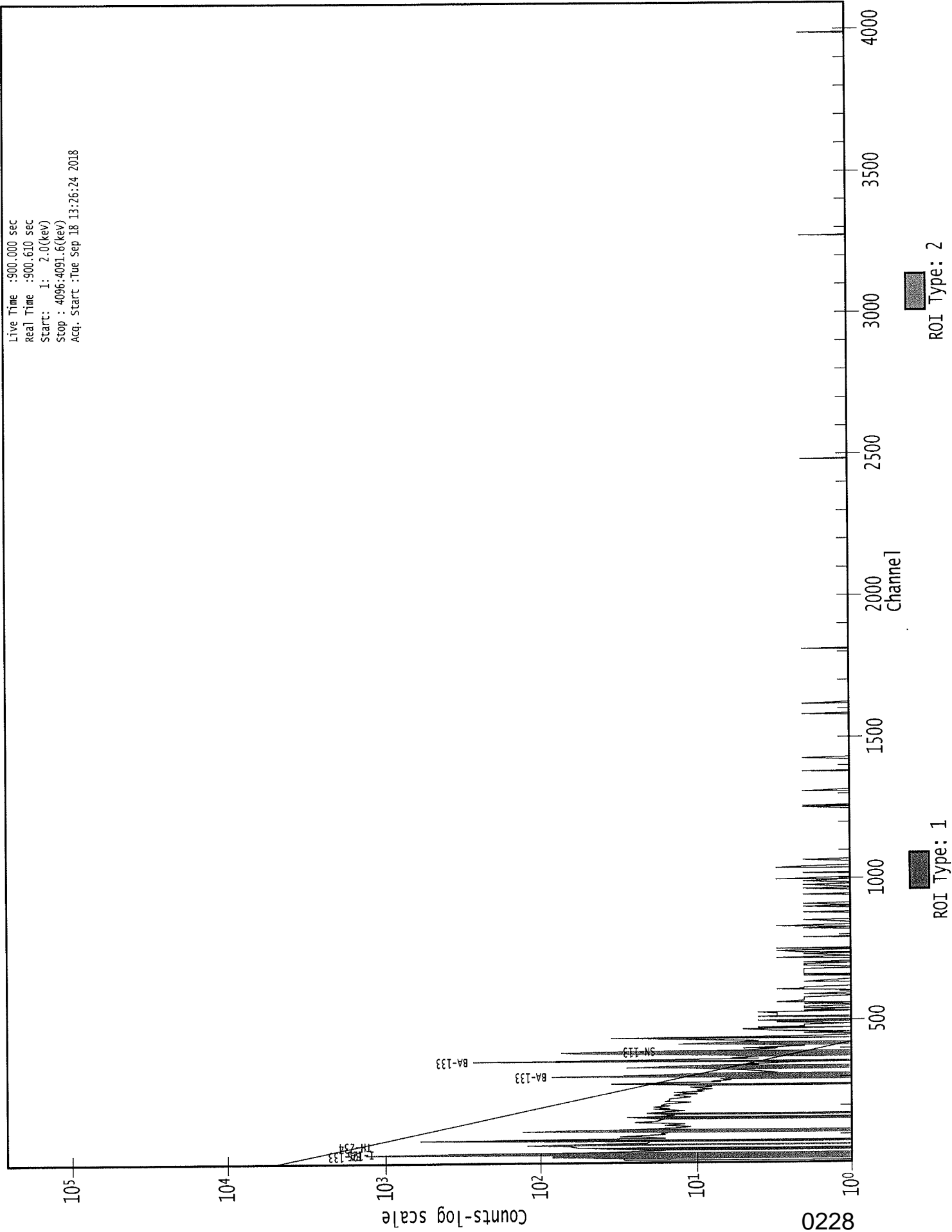
+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

# 0000071956.CNF



*KS  
9/18/17*

Analysis Report for 1809025-03  
BC-1

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-03  
 Sample Description : BC-1  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/18/2018 9:59:07AM  
 Acquisition Started : 9/18/2018 1:36:42PM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE1  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.4 seconds

Dead Time : 0.04 %

Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 19 - 4096  
 Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 6/16/2018  
 Efficiency Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Description :

Sample Number : 71957

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 1:51:46PM  
 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 1809025-03

BC-1

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	30.83	25 -	42	31.21	3.06E+03	115.75	2.38E+02	1.97
m	2	35.26	25 -	42	35.64	7.77E+02	92.40	2.13E+02	2.12
m	3	38.00	25 -	42	38.37	1.08E+02	68.35	2.41E+02	2.18
	4	52.65	50 -	56	53.01	8.23E+01	37.87	2.03E+02	2.20
M	5	61.91	58 -	70	62.27	3.10E+02	53.54	3.02E+02	1.92
m	6	65.90	58 -	70	66.26	1.29E+02	52.21	3.90E+02	2.02
	7	81.07	76 -	86	81.44	1.15E+03	95.58	6.06E+02	2.05
	8	88.08	87 -	91	88.44	3.82E+01	35.07	2.42E+02	2.67
M	9	111.98	106 -	122	112.34	3.30E+02	48.92	1.87E+02	2.22
m	10	116.39	106 -	122	116.74	9.09E+01	44.55	1.66E+02	2.32
	11	134.92	132 -	140	135.26	3.25E+01	40.21	2.27E+02	2.30
	12	160.33	157 -	164	160.67	4.50E+01	37.79	2.08E+02	2.23
	13	276.66	273 -	280	276.98	6.85E+01	26.53	7.10E+01	1.41
M	14	294.89	292 -	316	295.20	2.21E+01	17.32	4.13E+01	2.52
m	15	303.06	292 -	316	303.37	2.38E+02	32.42	3.04E+01	1.78
m	16	307.64	292 -	316	307.95	5.39E+01	30.72	4.30E+01	2.53
M	17	333.77	329 -	342	334.07	7.33E+01	26.61	5.80E+01	2.32
M	18	351.94	350 -	360	352.24	3.05E+01	18.06	3.55E+01	2.24
m	19	356.14	350 -	360	356.43	8.03E+02	59.10	5.30E+01	1.90
	20	363.46	361 -	367	363.76	5.14E+01	22.98	5.72E+01	3.09
M	21	377.08	374 -	397	377.37	2.38E+01	18.03	4.82E+01	2.14
m	22	384.08	374 -	397	384.37	1.61E+02	32.88	4.93E+01	2.14
m	23	386.94	374 -	397	387.23	2.88E+02	43.97	5.13E+01	2.07
m	24	391.08	374 -	397	391.37	5.81E+01	31.45	5.32E+01	2.15
M	25	414.90	409 -	422	415.18	3.63E+01	21.05	3.98E+01	1.96
m	26	418.54	409 -	422	418.82	4.22E+01	22.69	7.91E+01	1.97
	27	437.18	435 -	442	437.46	1.36E+02	27.71	4.01E+01	2.20
	28	444.81	443 -	448	445.08	1.30E+01	12.81	2.00E+01	1.36
	29	467.60	464 -	471	467.88	3.59E+01	15.49	1.63E+01	2.58
	30	525.28	523 -	528	525.54	7.83E+00	6.71	2.33E+00	1.55
	31	609.79	607 -	613	610.03	1.64E+01	12.38	1.33E+01	1.30
	32	842.93	840 -	845	843.13	8.00E+00	5.66	0.00E+00	2.83
	33	1121.30	1118 -	1123	1121.45	4.33E+00	5.74	3.33E+00	1.66
	34	1582.11	1578 -	1584	1582.20	5.00E+00	4.47	0.00E+00	2.75
	35	1729.33	1725 -	1731	1729.40	5.00E+00	4.47	0.00E+00	1.24

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 : 9/18/2018 1:51:46PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070287.CNF

0230

Analysis Report for 1809025-03

BC-1

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	30.83	3.06E+03	115.75			3.06E+03	1.16E+02
m	2	35.26	7.77E+02	92.40			7.77E+02	9.24E+01
m	3	38.00	1.08E+02	68.35			1.08E+02	6.83E+01
	4	52.65	8.23E+01	37.87			8.23E+01	3.79E+01
M	5	61.91	3.10E+02	53.54			3.10E+02	5.35E+01
m	6	65.90	1.29E+02	52.21			1.29E+02	5.22E+01
	7	81.07	1.15E+03	95.58			1.15E+03	9.56E+01
	8	88.08	3.82E+01	35.07			3.82E+01	3.51E+01
M	9	111.98	3.30E+02	48.92			3.30E+02	4.89E+01
m	10	116.39	9.09E+01	44.55			9.09E+01	4.46E+01
	11	134.92	3.25E+01	40.21			3.25E+01	4.02E+01
	12	160.33	4.50E+01	37.79			4.50E+01	3.78E+01
	13	276.66	6.85E+01	26.53			6.85E+01	2.65E+01
M	14	294.89	2.21E+01	17.32			2.21E+01	1.73E+01
m	15	303.06	2.38E+02	32.42			2.38E+02	3.24E+01
m	16	307.64	5.39E+01	30.72			5.39E+01	3.07E+01
M	17	333.77	7.33E+01	26.61			7.33E+01	2.66E+01
M	18	351.94	3.05E+01	18.06			3.05E+01	1.81E+01
m	19	356.14	8.03E+02	59.10			8.03E+02	5.91E+01
	20	363.46	5.14E+01	22.98			5.14E+01	2.30E+01
M	21	377.08	2.38E+01	18.03			2.38E+01	1.80E+01
m	22	384.08	1.61E+02	32.88			1.61E+02	3.29E+01
m	23	386.94	2.88E+02	43.97			2.88E+02	4.40E+01
m	24	391.08	5.81E+01	31.45			5.81E+01	3.14E+01
M	25	414.90	3.63E+01	21.05			3.63E+01	2.10E+01
m	26	418.54	4.22E+01	22.69			4.22E+01	2.27E+01
	27	437.18	1.36E+02	27.71			1.36E+02	2.77E+01
	28	444.81	1.30E+01	12.81			1.30E+01	1.28E+01
	29	467.60	3.59E+01	15.49			3.59E+01	1.55E+01
	30	525.28	7.83E+00	6.71			7.83E+00	6.71E+00
	31	609.79	1.64E+01	12.38	1.92E+00	1.08E+00	1.45E+01	1.24E+01
	32	842.93	8.00E+00	5.66			8.00E+00	5.66E+00
	33	1121.30	4.33E+00	5.74	3.30E-01	6.26E-01	4.00E+00	5.78E+00
	34	1582.11	5.00E+00	4.47			5.00E+00	4.47E+00
	35	1729.33	5.00E+00	4.47			5.00E+00	4.47E+00

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

Analysis Report for 1809025-03

BC-1

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## NUCLIDE IDENTIFICATION REPORT

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

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### IDENTIFIED NUCLIDES

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<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
CD-109	1.00	88.03	*	3.72	2.59E+02	2.41E+02
SN-113	0.96	255.12		1.93		
		391.69	*	61.90	3.46E+01	1.89E+01
I-125	0.99	35.49	*	6.49	7.64E+00	9.07E-01
BA-133	1.00	30.80	*	97.60	5.75E-01	2.17E-02
		302.84	*	17.80	1.05E+03	4.82E+02
		356.01	*	60.00	6.78E+02	8.93E+01
CE-144	0.94	133.54	*	10.80	2.77E+02	3.69E+02
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	8.13E+03	3.73E+03
PA-234M	0.99	9.89		89.00		
		21.72		64.90		
		37.93	*	23.75	5.56E-01	3.51E-01
		131.42		20.40		
TH-234	0.94	63.29	*	3.80	3.46E+02	6.01E+01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

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## INTERFERENCE CORRECTED REPORT

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Analysis Report for 1809025-03

BC-1

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	CD-109	1.000	2.59E+02	2.41E+02	
	SN-113	0.961	3.46E+01	1.89E+01	
	I-125	0.998	7.64E+00	9.07E-01	
X	I-129	0.747			
	BA-133	1.000	5.75E-01	2.17E-02	
	CE-144	0.945	2.77E+02	3.69E+02	
	PA-231	1.000	8.13E+03	3.73E+03	
	PA-234M	0.994	5.56E-01	3.51E-01	
	TH-234	0.944	3.46E+02	6.01E+01	
X	NP-237	0.936			

? = 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

Analysis Report for 1809025-03

BC-1

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 1:51:46PM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

<i>Peak No.</i>	<i>Energy (keV)</i>	<i>Peak Size (CPS)</i>	<i>Peak CPS (%) Uncertainty</i>	<i>Peak Type</i>	<i>Tolerance Nuclide</i>
	4	52.65	9.14644E-02	23.00	
m	6	65.90	1.42890E-01	20.30	Sum
	7	81.07	1.27676E+00	4.16	
M	9	111.98	3.66282E-01	7.42	
m	10	116.39	1.01048E-01	24.50	
	12	160.33	5.00000E-02	41.99	
	13	276.66	7.61325E-02	19.36	
M	14	294.89	2.45088E-02	39.26	
m	16	307.64	5.98489E-02	28.52	
M	17	333.77	8.14444E-02	18.15	Sum
M	18	351.94	3.39037E-02	29.60	
	20	363.46	5.71042E-02	22.36	Sum
M	21	377.08	2.64514E-02	37.86	
m	22	384.08	1.78799E-01	10.22	
m	23	386.94	3.20472E-01	7.62	Sum
M	25	414.90	4.03002E-02	29.02	
m	26	418.54	4.68397E-02	26.92	Sum
	27	437.18	1.51058E-01	10.19	Sum
	28	444.81	1.44444E-02	49.25	Sum
	29	467.60	3.98485E-02	21.60	
	30	525.28	8.70370E-03	42.82	Sum
	31	609.79	1.60557E-02	43.00	
	32	842.93	8.88889E-03	35.36	
	33	1121.30	4.44773E-03	72.18	
	34	1582.11	5.55556E-03	44.72	
	35	1729.33	5.55556E-03	44.72	

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

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Analysis Report for 1809025-03

BC-1

## NUCLIDE MDA REPORT

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

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	1.90E-13	1.90E-13	0.00E+00	0.00E+00
CO-57	122.06	85.51	3.81E+01	3.81E+01	2.38E+00	1.79E+01
	136.48	10.60	4.11E+02		1.69E+02	1.94E+02
NI-59	6.92	29.80	2.77E-12	2.77E-12	0.00E+00	0.00E+00
MO-93	16.59	52.90	8.76E-06	8.76E-06	-5.21E-06	3.94E-06
	18.60	10.00	4.40E-04		3.22E-04	2.10E-04
NB-93M	16.57	9.43	4.84E-05	4.84E-05	-2.88E-05	2.17E-05
+ CD-109	88.03	* 3.72	4.60E+02	4.60E+02	2.59E+02	2.21E+02
+ SN-113	255.12	1.93	2.11E+03	5.11E+01	-1.97E+02	9.77E+02
	391.69	* 61.90	5.11E+01		3.46E+01	2.48E+01
SN-119M	23.87	16.10	5.20E-03	5.20E-03	2.20E-05	2.49E-03
	25.10	22.70	5.65E-03		-2.17E-03	2.69E-03
+ I-125	35.49	* 6.49	1.35E+00	1.35E+00	7.64E+00	6.59E-01
I-129	29.78	* 57.00	4.42E-02	4.42E-02	9.84E-01	2.17E-02
	33.60	13.20	6.28E-01		-2.41E+00	3.10E-01
	39.58	7.52	1.53E+00		-1.05E+00	7.35E-01
+ BA-133	30.80	* 97.60	2.58E-02	2.58E-02	5.75E-01	1.27E-02
	302.84	* 17.80	3.32E+02		1.05E+03	1.60E+02
	356.01	* 60.00	3.69E+01		6.78E+02	1.73E+01
CE-139	165.85	80.35	6.59E+01	6.59E+01	6.97E+00	3.09E+01
+ CE-144	133.54	* 10.80	5.63E+02	5.63E+02	2.77E+02	2.70E+02
HG-203	279.19	77.30	5.46E+01	5.46E+01	-8.07E-01	2.57E+01
PB-210	46.50	4.25	6.46E+00	6.46E+00	-2.03E+00	3.03E+00
+ PA-231	9.28	42.00	2.61E-10	2.61E-10	0.00E+00	0.00E+00
	10.11	20.20	2.08E-09		0.00E+00	0.00E+00
	283.67	1.60	1.78E+03		-2.83E+01	8.12E+02
	302.67	* 2.30	2.57E+03		8.13E+03	1.24E+03
TH-231	25.64	14.70	1.14E-02	1.14E-02	-4.17E-02	5.43E-03
	84.21	6.40	2.36E+02		-1.95E+03	1.14E+02
+ PA-234M	9.89	89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
	21.72	64.90	5.29E-04		7.35E-04	2.55E-04
	37.93	* 23.75	7.07E-01		5.56E-01	3.47E-01
	131.42	20.40	1.83E+02		-1.10E+01	8.56E+01
+ TH-234	63.29	* 3.80	1.38E+02	1.38E+02	3.46E+02	6.74E+01
NP-237	29.37	* 14.00	1.80E-01	1.80E-01	4.01E+00	8.82E-02
	86.50	12.60	1.16E+02		-1.03E+02	5.53E+01
U-237	97.08	16.30	1.05E+02	7.89E+01	-2.07E+01	4.93E+01
	101.07	26.30	7.89E+01		3.44E+01	3.72E+01
	114.00	12.30	4.78E+02		9.23E+02	2.32E+02
	208.01	22.00	2.40E+02		-4.22E+01	1.12E+02
AM-241	59.54	35.90	7.74E+00	7.74E+00	7.87E+00	3.74E+00
AM-243	74.67	66.00	9.90E+00	9.90E+00	-2.23E+00	4.71E+00

Analysis Report for 1809025-03

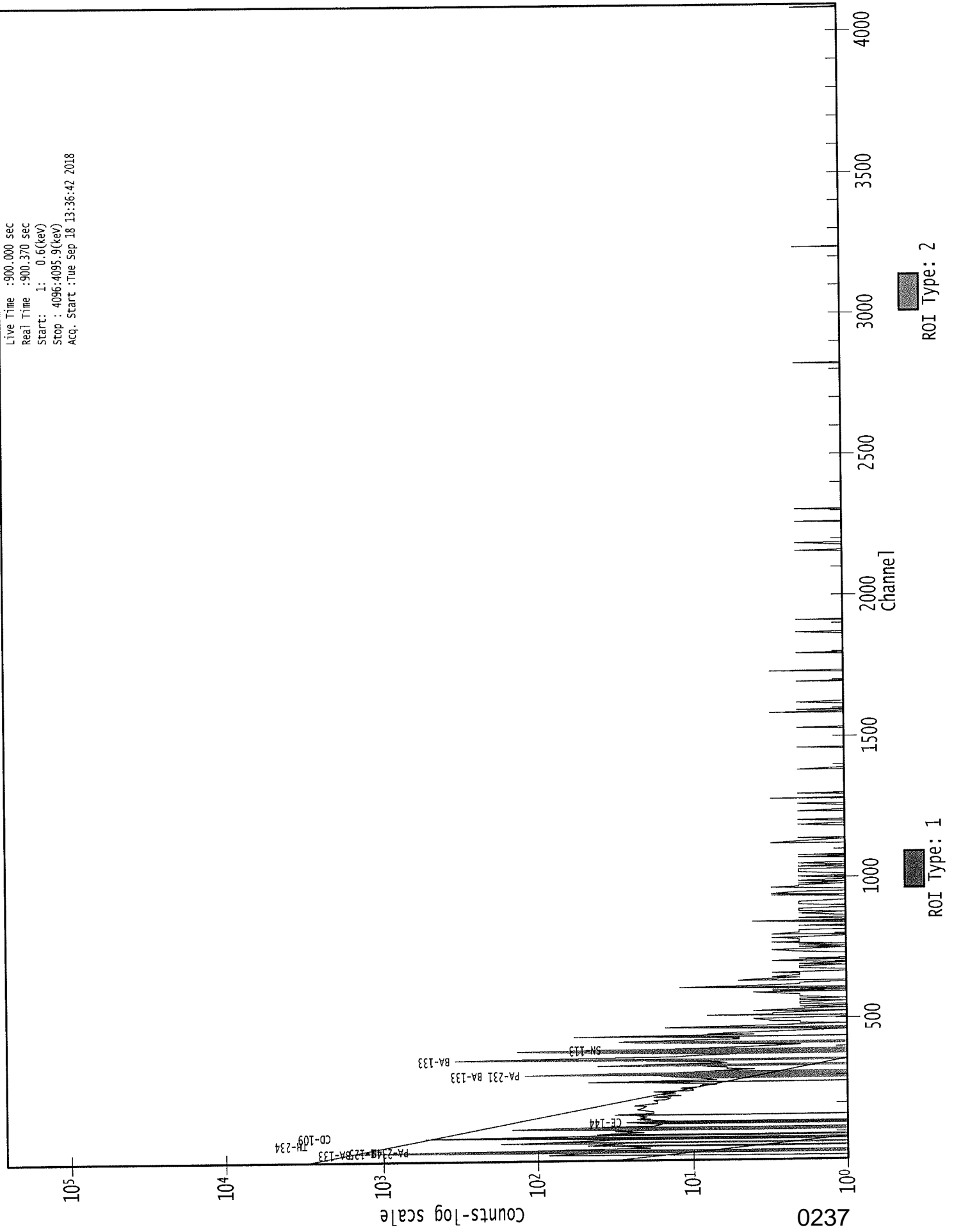
BC-1

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- + = 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
-

0000071957.CNF

Live Time : 900.000 sec  
Real Time : 900.370 sec  
Start : 1: 0.6(keV)  
Stop : 4096:4095.9(keV)  
Acq. Start : Tue Sep 18 13:36:42 2018



*KB  
9/18/18*

Analysis Report for 1809025-04  
BC-3A

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-04  
 Sample Description : BC-3A  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 9:59:18AM  
 Acquisition Started : 9/18/2018 1:42:14PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.6 seconds  
  
 Dead Time : 0.07 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 9 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Used Done On : 11/9/2014  
 Efficiency Calibration Description :  
  
 Sample Number : 71959

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 1:57:18PM  
 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 1809025-04

BC-3A

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.04	16 -	24	20.10	4.40E+01	51.82	3.84E+02	1.81
M	2	31.44	25 -	39	30.50	1.87E+03	93.35	2.04E+02	2.17
m	3	35.79	25 -	39	34.85	4.51E+02	60.15	1.13E+02	2.18
	4	52.95	47 -	55	52.03	3.17E+01	39.50	2.21E+02	2.44
	5	63.67	57 -	69	62.75	2.25E+02	64.44	3.80E+02	2.37
	6	81.60	75 -	87	80.70	7.68E+02	71.06	2.27E+02	2.26
M	7	112.15	105 -	123	111.27	1.68E+02	37.20	1.00E+02	2.61
m	8	116.42	105 -	123	115.55	4.55E+01	33.41	8.67E+01	2.62
m	9	121.33	105 -	123	120.46	1.78E+01	19.90	6.09E+01	2.62
	10	136.89	132 -	141	136.04	4.11E+01	30.08	1.08E+02	6.83
	11	161.73	155 -	166	160.89	3.85E+01	36.11	1.43E+02	1.86
	12	174.48	169 -	181	173.65	5.09E+01	34.71	1.20E+02	4.11
	13	277.28	273 -	280	276.54	5.68E+01	22.54	4.44E+01	2.18
M	14	303.48	297 -	310	302.75	1.25E+02	25.89	3.39E+01	2.34
m	15	307.72	297 -	310	307.00	1.72E+01	18.29	4.08E+01	2.30
M	16	334.59	329 -	341	333.89	4.48E+01	18.65	1.73E+01	2.52
m	17	338.76	329 -	341	338.06	2.10E+01	13.89	8.66E+00	2.88
	18	356.60	350 -	362	355.92	3.28E+02	43.73	6.79E+01	2.27
M	19	384.97	378 -	397	384.32	7.19E+01	26.08	3.42E+01	2.71
m	20	387.70	378 -	397	387.04	5.96E+01	23.86	1.31E+01	1.79
m	21	393.12	378 -	397	392.47	3.46E+01	23.86	6.18E+00	4.39
	22	437.52	433 -	440	436.91	5.90E+01	16.85	8.00E+00	3.00
	23	467.96	464 -	470	467.38	1.60E+01	8.00	0.00E+00	3.31
	24	487.23	481 -	491	486.67	1.50E+01	7.75	0.00E+00	3.66

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 : 9/18/2018 1:57:18PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000071072.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	21.04	4.40E+01	51.82			4.40E+01	5.18E+01
M	2	31.44	1.87E+03	93.35			1.87E+03	9.33E+01
m	3	35.79	4.51E+02	60.15			4.51E+02	6.01E+01
	4	52.95	3.17E+01	39.50			3.17E+01	3.95E+01
	5	63.67	2.25E+02	64.44	1.33E+01	2.31E+00	2.12E+02	6.45E+01

Analysis Report for 1809025-04

BC-3A

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	6	81.60	7.68E+02	71.06		7.68E+02	7.11E+01
M	7	112.15	1.68E+02	37.20		1.68E+02	3.72E+01
m	8	116.42	4.55E+01	33.41		4.55E+01	3.34E+01
m	9	121.33	1.78E+01	19.90		1.78E+01	1.99E+01
	10	136.89	4.11E+01	30.08		4.11E+01	3.01E+01
	11	161.73	3.85E+01	36.11		3.85E+01	3.61E+01
	12	174.48	5.09E+01	34.71	0.00E+00	5.09E+01	3.47E+01
	13	277.28	5.68E+01	22.54	0.00E+00	5.68E+01	2.25E+01
M	14	303.48	1.25E+02	25.89		1.25E+02	2.59E+01
m	15	307.72	1.72E+01	18.29		1.72E+01	1.83E+01
M	16	334.59	4.48E+01	18.65		4.48E+01	1.87E+01
m	17	338.76	2.10E+01	13.89		2.10E+01	1.39E+01
	18	356.60	3.28E+02	43.73		3.28E+02	4.37E+01
M	19	384.97	7.19E+01	26.08		7.19E+01	2.61E+01
m	20	387.70	5.96E+01	23.86		5.96E+01	2.39E+01
m	21	393.12	3.46E+01	23.86		3.46E+01	2.39E+01
	22	437.52	5.90E+01	16.85		5.90E+01	1.69E+01
	23	467.96	1.60E+01	8.00		1.60E+01	8.00E+00
	24	487.23	1.50E+01	7.75		1.50E+01	7.75E+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	0.99	122.06	*	85.51	8.60E+00	9.71E+00
		136.48	*	10.60	1.83E+02	1.38E+02
SN-113	0.90	255.12		1.93		
		391.69	*	61.90	5.46E+01	3.83E+01
I-125	0.99	35.49	*	6.49	4.15E+02	5.64E+01
BA-133	0.99	30.80	*	97.60	8.77E+01	4.70E+00
		302.84	*	17.80	6.17E+02	2.28E+02
		356.01	*	60.00	5.15E+02	9.61E+01
HG-203	0.93	279.19	*	77.30	<del>6.16E+01</del>	3.07E+01
TH-234	0.99	63.29	*	3.80	9.44E+02	2.96E+02



Analysis Report for 1809025-04

BC-3A

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

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## INTERFERENCE CORRECTED REPORT

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<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>
CO-57	0.990	9.46E+00	9.69E+00	
SN-113	0.909	5.46E+01	3.83E+01	
I-125	0.998	4.15E+02	5.64E+01	
X I-129	0.590			
BA-133	0.993	8.89E+01	4.69E+00	
HG-203	0.933	6.16E+01	3.07E+01	
TH-234	0.997	9.44E+02	2.96E+02	

? = 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 1809025-04  
BC-3A

**UNIDENTIFIED PEAKS**

Peak Locate Performed on : 9/18/2018 1:57:18PM  
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	21.04	4.89171E-02	58.85		
4	52.95	3.52700E-02	62.22		
6	81.60	8.53663E-01	4.62		
M 7	112.15	1.86989E-01	11.05		
m 8	116.42	5.05810E-02	36.69		
11	161.73	4.27778E-02	46.90		
12	174.48	5.65616E-02	34.09	Sum	
m 15	307.72	1.91530E-02	53.05	Sum	
M 16	334.59	4.97233E-02	20.84	Sum	
m 17	338.76	2.33616E-02	33.04	Sum	
M 19	384.97	7.98764E-02	18.14		
m 20	387.70	6.62410E-02	20.01	Sum	
22	437.52	6.55556E-02	14.28		
23	467.96	1.77778E-02	25.00		
24	487.23	1.66667E-02	25.82		

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

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
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Analysis Report for 1809025-04

BC-3A

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
	FE-55	5.89		24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
+	CO-57	122.06	*	85.51	3.93E+01	3.93E+01	8.60E+00	1.90E+01
		136.48	*	10.60	2.11E+02		1.83E+02	9.95E+01
	NI-59	6.92		29.80	3.65E-02	3.65E-02	-3.62E-02	1.45E-02
	MO-93	16.59		52.90	1.20E+00	1.20E+00	1.95E-01	5.75E-01
		18.60		10.00	9.09E+00		1.55E+00	4.36E+00
	NB-93M	16.57		9.43	6.73E+00	6.73E+00	1.09E+00	3.22E+00
	CD-109	88.03		3.72	2.82E+02	2.82E+02	-8.15E+01	1.31E+02
+	SN-113	255.12		1.93	1.16E+03	6.84E+01	3.03E+01	5.26E+02
		391.69	*	61.90	6.84E+01		5.46E+01	3.21E+01
	SN-119M	23.87		16.10	1.02E+01	7.74E+00	-4.45E+00	4.91E+00
		25.10		22.70	7.74E+00		-6.25E+01	3.70E+00
+	I-125	35.49	*	6.49	8.90E+01	8.90E+01	4.15E+02	4.33E+01
	I-129	29.78	*	57.00	7.95E+00	7.95E+00	1.50E+02	3.87E+00
		33.60		13.20	8.67E+01		7.38E+02	4.28E+01
		39.58		7.52	5.83E+01		5.19E+00	2.79E+01
+	BA-133	30.80	*	97.60	4.64E+00	4.64E+00	8.77E+01	2.26E+00
		302.84	*	17.80	2.05E+02		6.17E+02	9.58E+01
		356.01	*	60.00	6.75E+01		5.15E+02	3.16E+01
	CE-139	165.85		80.35	2.58E+01	2.58E+01	-1.61E-01	1.19E+01
	CE-144	133.54		10.80	1.58E+02	1.58E+02	-5.29E+01	7.33E+01
+	HG-203	279.19	*	77.30	3.28E+01	3.28E+01	6.16E+01	1.49E+01
	PB-210	46.50		4.25	9.07E+01	9.07E+01	-2.88E+01	4.22E+01
	PA-231	9.28		42.00	1.59E-01	1.59E-01	-1.12E-02	7.27E-02
		10.11		20.20	5.14E-01		6.73E-02	2.39E-01
		283.67		1.60	1.16E+03		1.27E+02	5.08E+02
		302.67		2.30	2.18E+03		3.76E+03	1.04E+03
	TH-231	25.64		14.70	1.29E+01	1.29E+01	-3.36E+02	6.18E+00
		84.21		6.40	5.22E+02		2.62E+03	2.56E+02
	PA-234M	9.89		89.00	1.09E-01	1.09E-01	1.43E-02	5.09E-02
		21.72		64.90	2.07E+00		1.37E+00	9.92E-01
		37.93		23.75	2.93E+01		6.92E+01	1.43E+01
		131.42		20.40	8.63E+01		8.47E+00	4.02E+01
+	TH-234	63.29	*	3.80	4.34E+02	4.34E+02	9.44E+02	2.11E+02
	NP-237	29.37		14.00	5.60E+01	5.60E+01	3.97E+02	2.76E+01
		86.50		12.60	8.81E+01		-7.81E+00	4.11E+01
	U-237	97.08		16.30	7.86E+01	5.10E+01	-9.40E+00	3.67E+01
		101.07		26.30	5.10E+01		1.71E+01	2.38E+01
		114.00		12.30	2.42E+02		4.95E+02	1.17E+02
		208.01		22.00	1.17E+02		2.19E+01	5.41E+01
	AM-241	59.54		35.90	3.19E+01	3.19E+01	4.71E+01	1.54E+01
	AM-243	74.67		66.00	1.52E+01	1.52E+01	3.58E+00	7.13E+00

+ = Nuclide identified during the nuclide identification

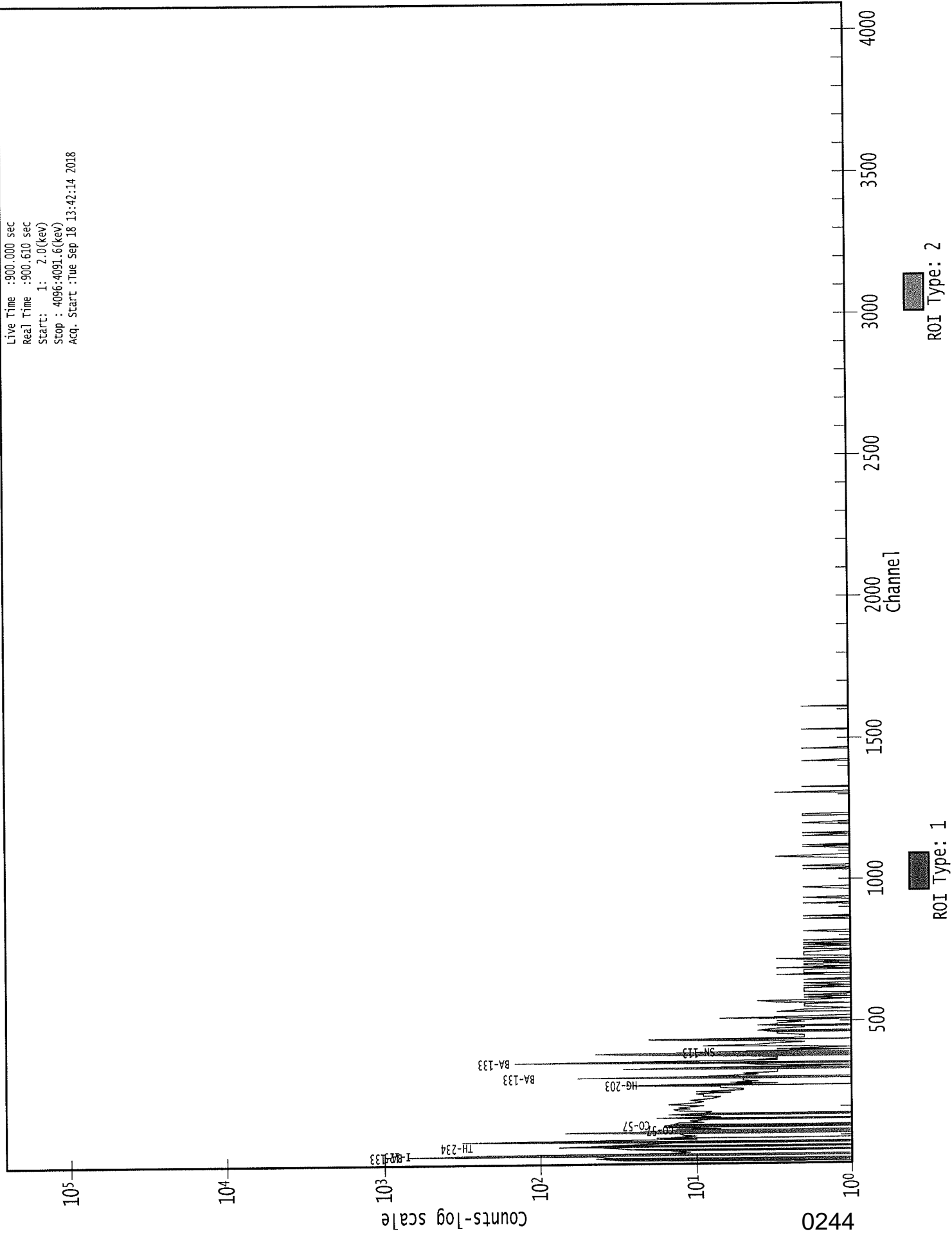
\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

# 0000071959.CNF

Live Time :900.000 sec  
Real Time :900.610 sec  
Start: 1: 2.0(keV)  
Stop : 4096:4091.6(keV)  
Acq. Start :Tue Sep 18 13:42:14 2018



Analysis Report for 1809025-05  
BC-3B

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-05  
 Sample Description : BC-3B  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/18/2018 9:59:29AM  
 Acquisition Started : 9/18/2018 1:52:13PM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE1  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.4 seconds

Dead Time : 0.04 %

Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 19 - 4096  
 Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 6/16/2018  
 Efficiency Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Description :

Sample Number : 71960

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:07:17PM  
 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 1809025-05

BC-3B

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	30.89	26 -	41	31.26	2.68E+03	113.89	4.68E+02	1.87
m	2	35.36	26 -	41	35.73	7.13E+02	95.62	3.03E+02	2.39
	3	52.73	50 -	56	53.10	9.12E+01	40.30	2.32E+02	2.53
M	4	61.92	58 -	73	62.28	3.18E+02	53.85	2.75E+02	2.23
m	5	66.33	58 -	73	66.69	1.42E+02	51.45	2.70E+02	2.24
	6	81.17	77 -	86	81.53	1.08E+03	89.50	5.15E+02	2.03
M	7	111.97	108 -	121	112.33	2.93E+02	45.68	1.92E+02	2.09
m	8	116.30	108 -	121	116.66	7.47E+01	44.45	2.14E+02	2.26
	9	184.64	180 -	188	184.98	5.11E+01	39.34	2.06E+02	1.68
	10	222.38	220 -	226	222.70	2.83E+01	27.28	1.13E+02	3.70
	11	276.74	273 -	282	277.05	7.02E+01	35.38	1.36E+02	2.16
M	12	303.03	299 -	321	303.34	2.03E+02	30.77	3.00E+01	1.83
m	13	307.33	299 -	321	307.64	4.89E+01	22.27	3.60E+01	2.09
m	14	311.41	299 -	321	311.72	2.21E+01	17.89	3.60E+01	2.09
m	15	318.59	299 -	321	318.89	1.44E+01	14.56	3.60E+01	2.10
M	16	334.00	330 -	344	334.30	1.20E+02	25.77	4.20E+01	2.15
m	17	338.51	330 -	344	338.81	3.28E+01	25.30	3.33E+01	2.55
M	18	352.90	350 -	360	353.20	3.35E+01	25.36	3.57E+01	2.82
m	19	356.14	350 -	360	356.43	7.78E+02	57.89	3.23E+01	1.91
	20	363.59	362 -	368	363.89	2.89E+01	23.36	7.42E+01	2.92
M	21	378.08	373 -	396	378.37	1.21E+01	16.03	5.30E+01	2.14
m	22	384.08	373 -	396	384.37	1.56E+02	32.51	4.79E+01	2.14
m	23	387.02	373 -	396	387.31	3.13E+02	45.31	3.80E+01	2.14
m	24	391.34	373 -	396	391.63	6.43E+01	32.51	2.76E+01	2.15
M	25	414.66	411 -	429	414.94	3.98E+01	17.83	2.24E+01	2.38
m	26	418.31	411 -	429	418.59	3.06E+01	20.14	2.48E+01	2.38
	27	436.91	432 -	441	437.18	1.36E+02	27.46	2.97E+01	2.12
	28	467.94	463 -	471	468.21	3.00E+01	18.81	3.60E+01	2.18
	29	700.87	698 -	705	701.09	1.10E+01	6.63	0.00E+00	3.75
	30	750.12	747 -	752	750.33	6.00E+00	4.90	0.00E+00	1.92
	31	771.62	769 -	774	771.83	6.00E+00	4.90	0.00E+00	2.74
	32	1119.35	1116 -	1122	1119.50	8.00E+00	5.66	0.00E+00	1.47
	33	1209.06	1206 -	1211	1209.20	5.00E+00	4.47	0.00E+00	2.31

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 : 9/18/2018 2:07:17PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070287.CNF

Analysis Report for 1809025-05

BC-3B

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	30.89	2.68E+03	113.89			2.68E+03	1.14E+02
m	2	35.36	7.13E+02	95.62			7.13E+02	9.56E+01
	3	52.73	9.12E+01	40.30			9.12E+01	4.03E+01
M	4	61.92	3.18E+02	53.85			3.18E+02	5.38E+01
m	5	66.33	1.42E+02	51.45			1.42E+02	5.15E+01
	6	81.17	1.08E+03	89.50			1.08E+03	8.95E+01
M	7	111.97	2.93E+02	45.68			2.93E+02	4.57E+01
m	8	116.30	7.47E+01	44.45			7.47E+01	4.44E+01
	9	184.64	5.11E+01	39.34	1.58E+01	1.83E+00	3.52E+01	3.94E+01
	10	222.38	2.83E+01	27.28			2.83E+01	2.73E+01
	11	276.74	7.02E+01	35.38			7.02E+01	3.54E+01
M	12	303.03	2.03E+02	30.77			2.03E+02	3.08E+01
m	13	307.33	4.89E+01	22.27			4.89E+01	2.23E+01
m	14	311.41	2.21E+01	17.89			2.21E+01	1.79E+01
m	15	318.59	1.44E+01	14.56			1.44E+01	1.46E+01
M	16	334.00	1.20E+02	25.77			1.20E+02	2.58E+01
m	17	338.51	3.28E+01	25.30	6.20E-01	1.14E+00	3.22E+01	2.53E+01
M	18	352.90	3.35E+01	25.36			3.35E+01	2.54E+01
m	19	356.14	7.78E+02	57.89			7.78E+02	5.79E+01
	20	363.59	2.89E+01	23.36			2.89E+01	2.34E+01
M	21	378.08	1.21E+01	16.03			1.21E+01	1.60E+01
m	22	384.08	1.56E+02	32.51			1.56E+02	3.25E+01
m	23	387.02	3.13E+02	45.31			3.13E+02	4.53E+01
m	24	391.34	6.43E+01	32.51			6.43E+01	3.25E+01
M	25	414.66	3.98E+01	17.83			3.98E+01	1.78E+01
m	26	418.31	3.06E+01	20.14			3.06E+01	2.01E+01
	27	436.91	1.36E+02	27.46			1.36E+02	2.75E+01
	28	467.94	3.00E+01	18.81			3.00E+01	1.88E+01
	29	700.87	1.10E+01	6.63			1.10E+01	6.63E+00
	30	750.12	6.00E+00	4.90			6.00E+00	4.90E+00
	31	771.62	6.00E+00	4.90			6.00E+00	4.90E+00
	32	1119.35	8.00E+00	5.66	3.30E-01	6.26E-01	7.67E+00	5.69E+00
	33	1209.06	5.00E+00	4.47			5.00E+00	4.47E+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

Analysis Report for 1809025-05  
BC-3B

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
SN-113	0.96	255.12	1.93		
		391.69 *	61.90	3.82E+01	1.96E+01
I-125	0.99	35.49 *	6.49	7.18E+00	9.62E-01
BA-133	1.00	30.80 *	97.60	5.12E-01	2.18E-02
		302.84 *	17.80	8.96E+02	4.15E+02
		356.01 *	60.00	6.56E+02	8.68E+01
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	6.93E+03	3.21E+03
TH-234	0.94	63.29 *	3.80	3.55E+02	6.05E+01

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

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.968	3.82E+01	1.96E+01	
I-125	0.999	7.18E+00	9.62E-01	
X I-129	0.744			
BA-133	1.000	5.12E-01	2.18E-02	
PA-231	1.000	6.93E+03	3.21E+03	
TH-234	0.945	3.55E+02	6.05E+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



Analysis Report for 1809025-05

BC-3B

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:07:17PM  
 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	52.73	1.01353E-01		
m	5	66.33	1.58131E-01		Sum
	6	81.17	1.20291E+00		
M	7	111.97	3.25639E-01		
m	8	116.30	8.30027E-02		
	9	184.64	3.91235E-02		
	10	222.38	3.14052E-02		
	11	276.74	7.80193E-02		
m	13	307.33	5.42886E-02		
m	14	311.41	2.45581E-02		
m	15	318.59	1.60040E-02		
M	16	334.00	1.33196E-01		Sum
m	17	338.51	3.57911E-02		Sum
M	18	352.90	3.72386E-02		
	20	363.59	3.21044E-02		Sum
M	21	378.08	1.34708E-02		
m	22	384.08	1.73595E-01		
m	23	387.02	3.47678E-01		Sum
M	25	414.66	4.42555E-02		
m	26	418.31	3.39721E-02		Sum
	27	436.91	1.51273E-01		
	28	467.94	3.33333E-02		
	29	700.87	1.22222E-02		
	30	750.12	6.66667E-03		
	31	771.62	6.66667E-03		
	32	1119.35	8.52180E-03		
	33	1209.06	5.55556E-03		

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

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Analysis Report for 1809025-05  
BC-3B

## NUCLIDE MDA REPORT

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

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	1.90E-13	1.90E-13	0.00E+00	0.00E+00
CO-57	122.06	85.51	3.67E+01	3.67E+01	1.96E+00	1.72E+01
	136.48	10.60	3.98E+02		1.13E+02	1.87E+02
NI-59	6.92	29.80	2.77E-12	2.77E-12	0.00E+00	0.00E+00
MO-93	16.59	52.90	9.18E-06	9.18E-06	-1.34E-05	4.15E-06
	18.60	10.00	5.26E-04		6.79E-04	2.53E-04
NB-93M	16.57	9.43	5.07E-05	5.07E-05	-7.38E-05	2.29E-05
CD-109	88.03	3.72	3.80E+02	3.80E+02	1.03E+02	1.81E+02
+ SN-113	255.12	1.93	2.16E+03	4.45E+01	8.93E+02	1.00E+03
	391.69	* 61.90	4.45E+01		3.82E+01	2.15E+01
SN-119M	23.87	16.10	6.59E-03	6.59E-03	-2.21E-03	3.18E-03
	25.10	22.70	7.51E-03		-2.57E-04	3.62E-03
+ I-125	35.49	* 6.49	1.63E+00	1.63E+00	7.18E+00	8.04E-01
I-129	29.78	* 57.00	5.41E-02	5.41E-02	8.77E-01	2.66E-02
	33.60	13.20	6.01E-01		-2.06E+00	2.96E-01
	39.58	7.52	1.44E+00		-2.54E+00	6.89E-01
+ BA-133	30.80	* 97.60	3.16E-02	3.16E-02	5.12E-01	1.55E-02
	302.84	* 17.80	3.80E+02		8.96E+02	1.84E+02
	356.01	* 60.00	3.00E+01		6.56E+02	1.38E+01
CE-139	165.85	80.35	6.34E+01	6.34E+01	2.70E+01	2.97E+01
CE-144	133.54	10.80	3.68E+02	3.68E+02	6.09E+01	1.73E+02
HG-203	279.19	77.30	5.79E+01	5.79E+01	2.89E+01	2.73E+01
PB-210	46.50	4.25	6.53E+00	6.53E+00	-2.09E+00	3.07E+00
+ PA-231	9.28	42.00	2.61E-10	2.61E-10	0.00E+00	0.00E+00
	10.11	20.20	2.08E-09		0.00E+00	0.00E+00
	283.67	1.60	1.82E+03		-4.32E+02	8.33E+02
	302.67	* 2.30	2.94E+03		6.93E+03	1.42E+03
TH-231	25.64	14.70	1.49E-02	1.49E-02	7.21E-03	7.16E-03
	84.21	6.40	2.24E+02		-1.58E+03	1.08E+02
PA-234M	9.89	89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
	21.72	64.90	6.49E-04		6.62E-04	3.15E-04
	37.93	23.75	5.69E-01		1.25E+00	2.77E-01
	131.42	20.40	1.68E+02		-6.52E+01	7.84E+01
+ TH-234	63.29	* 3.80	1.39E+02	1.39E+02	3.55E+02	6.82E+01
NP-237	29.37	14.00	2.02E-01	2.02E-01	1.89E+00	9.98E-02
	86.50	12.60	1.08E+02		3.07E+01	5.17E+01
U-237	97.08	16.30	1.01E+02	8.02E+01	-9.81E+01	4.76E+01
	101.07	26.30	8.02E+01		2.55E+01	3.79E+01
	114.00	12.30	4.52E+02		8.04E+02	2.19E+02
	208.01	22.00	2.37E+02		-1.93E+01	1.10E+02
AM-241	59.54	35.90	7.77E+00	7.77E+00	7.77E+00	3.76E+00
AM-243	74.67	66.00	9.94E+00	9.94E+00	-4.84E+00	4.73E+00

Analysis Report for 1809025-05

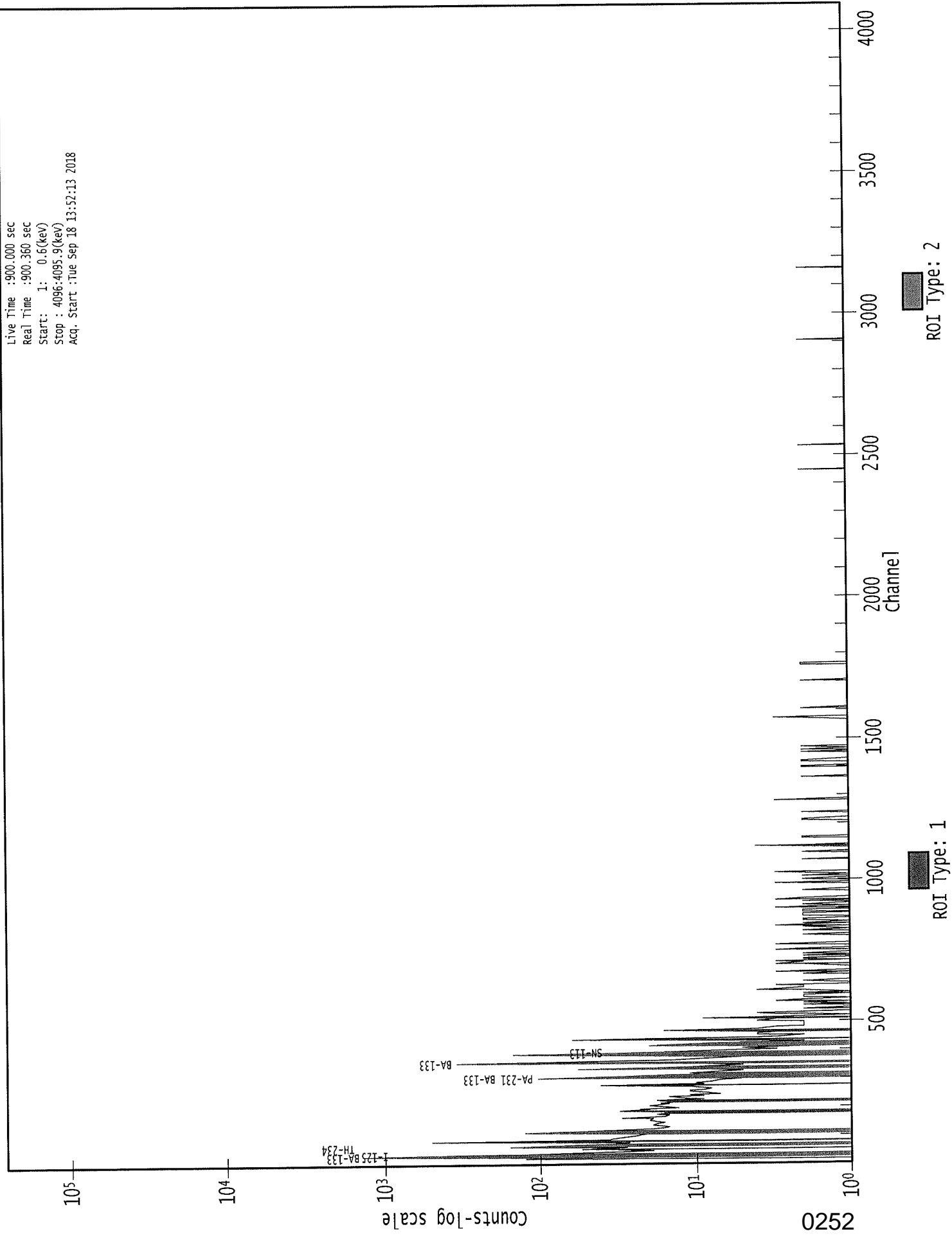
BC-3B

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- + = 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
-

0000071960.CNF

Live Time :900.000 sec  
Real Time :900.360 sec  
Start: 1: 0.6(keV)  
Stop : 4096.4095.9(keV)  
Acq. Start :Tue Sep 18 13:52:13 2018



*MS  
9/18/18*

Analysis Report for 1809025-06  
BC-2A

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-06  
 Sample Description : BC-2A  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 9:59:39AM  
 Acquisition Started : 9/18/2018 1:53:57PM  
  
 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) : 28 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 71961

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:09:00PM  
 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 1809025-06

BC-2A

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.97	35 - 39	35.75	3.18E+02	54.52	2.00E+02	2.58
	2	53.13	49 - 57	52.90	7.51E+01	35.95	1.52E+02	2.90
M	3	62.47	58 - 69	62.24	1.21E+02	30.69	7.81E+01	1.65
m	4	66.22	58 - 69	65.99	5.80E+01	29.08	7.63E+01	1.67
	5	81.62	79 - 85	81.38	5.79E+02	56.10	1.52E+02	1.73
	6	103.15	100 - 106	102.90	2.75E+01	24.71	9.10E+01	3.43
	7	112.32	109 - 115	112.06	6.93E+01	35.10	1.77E+02	1.37
	8	160.71	157 - 163	160.43	2.40E+01	28.09	1.26E+02	1.27
M	9	273.46	272 - 287	273.14	7.12E+00	5.66	4.00E+00	1.49
m	10	276.89	272 - 287	276.56	5.32E+01	18.22	1.20E+01	1.99
M	11	299.34	298 - 317	299.00	5.79E+00	5.66	4.14E+00	1.39
m	12	303.48	298 - 317	303.14	1.22E+02	24.12	1.92E+01	1.53
m	13	307.21	298 - 317	306.86	1.52E+01	13.19	2.60E+01	1.54
M	14	334.22	330 - 340	333.86	3.35E+01	17.27	4.28E+01	1.57
m	15	356.41	351 - 359	356.04	4.03E+02	41.05	1.39E+01	1.61
	16	377.31	373 - 381	376.93	1.19E+01	15.68	2.83E+01	1.51
	17	385.98	381 - 389	385.60	1.97E+02	31.46	3.07E+01	3.98
	18	415.81	411 - 419	415.41	2.73E+01	20.75	4.94E+01	1.76
	19	437.19	432 - 439	436.78	4.95E+01	17.20	1.71E+01	1.52
	20	466.91	462 - 469	466.48	1.40E+01	10.20	8.00E+00	1.21
m	21	514.45	505 - 518	514.00	6.22E+00	9.43	3.37E+00	1.59
	22	550.99	548 - 552	550.52	4.75E+00	5.50	2.50E+00	1.79

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 : 9/18/2018 2:09:00PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070288.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	3.18E+02	54.52			3.18E+02	5.45E+01
	2	7.51E+01	35.95			7.51E+01	3.60E+01
M	3	1.21E+02	30.69			1.21E+02	3.07E+01
m	4	5.80E+01	29.08	3.70E+00	1.42E+00	5.43E+01	2.91E+01
	5	5.79E+02	56.10			5.79E+02	5.61E+01
	6	2.75E+01	24.71			2.75E+01	2.47E+01
	7	6.93E+01	35.10			6.93E+01	3.51E+01

Analysis Report for 1809025-06

BC-2A

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	8	160.71	2.40E+01	28.09			2.40E+01	2.81E+01
M	9	273.46	7.12E+00	5.66			7.12E+00	5.66E+00
m	10	276.89	5.32E+01	18.22			5.32E+01	1.82E+01
M	11	299.34	5.79E+00	5.66			5.79E+00	5.66E+00
m	12	303.48	1.22E+02	24.12			1.22E+02	2.41E+01
m	13	307.21	1.52E+01	13.19			1.52E+01	1.32E+01
M	14	334.22	3.35E+01	17.27			3.35E+01	1.73E+01
m	15	356.41	4.03E+02	41.05			4.03E+02	4.11E+01
	16	377.31	1.19E+01	15.68			1.19E+01	1.57E+01
	17	385.98	1.97E+02	31.46			1.97E+02	3.15E+01
	18	415.81	2.73E+01	20.75			2.73E+01	2.08E+01
	19	437.19	4.95E+01	17.20			4.95E+01	1.72E+01
	20	466.91	1.40E+01	10.20	0.00E+00	0.00E+00	1.40E+01	1.02E+01
m	21	514.45	6.22E+00	9.43			6.22E+00	9.43E+00
	22	550.99	4.75E+00	5.50			4.75E+00	5.50E+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-125	0.99	35.49 *	6.49	1.27E+01	2.18E+00
PA-231	0.99	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	3.59E+03	1.29E+03
TH-234	0.98	63.29 *	3.80	2.08E+02	5.28E+01

Analysis Report for 1809025-06

BC-2A

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

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## INTERFERENCE CORRECTED REPORT

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
I-125	0.994	1.27E+01	2.18E+00	
PA-231	0.999	3.59E+03	1.29E+03	
TH-234	0.982	2.08E+02	5.28E+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



Analysis Report for 1809025-06

BC-2A

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:09:00PM  
 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	53.13	8.34437E-02		
m	4	66.22	6.03033E-02		
	5	81.62	6.43584E-01		
	6	103.15	3.05556E-02		
	7	112.32	7.70042E-02	Tol.	U-237
	8	160.71	2.66667E-02		
M	9	273.46	7.91029E-03		
m	10	276.89	5.90607E-02		
M	11	299.34	6.43049E-03		
m	13	307.21	1.68508E-02		
M	14	334.22	3.71808E-02		
m	15	356.41	4.48262E-01	Tol.	BA-133
	16	377.31	1.31838E-02		
	17	385.98	2.18488E-01		
	18	415.81	3.03419E-02		
	19	437.19	5.49617E-02		
	20	466.91	1.55556E-02		
m	21	514.45	6.91009E-03		
	22	550.99	5.27778E-03		

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

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**NUCLIDE MDA REPORT**


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

0257

Analysis Report for 1809025-06

BC-2A

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.61E+01	2.61E+01	1.02E+00	1.21E+01
	136.48	10.60	2.32E+02		-2.68E+01	1.07E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.55E+02	2.55E+02	-7.63E+01	1.18E+02
SN-113	255.12	1.93	1.12E+03	1.53E+01	8.15E+01	4.98E+02
	391.69	61.90	1.53E+01		7.96E+00	6.83E+00
SN-119M	23.87	16.10	1.78E-03	1.78E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	2.82E+00	2.82E+00	1.27E+01	1.36E+00
I-129	29.78	57.00	1.77E-01	1.77E-01	4.97E-01	8.69E-02
	33.60	13.20	1.44E+00		-3.28E-01	7.03E-01
	39.58	7.52	1.77E+00		-1.15E+00	7.95E-01
BA-133	30.80	97.60	1.62E-01	1.62E-01	1.25E+00	7.98E-02
	302.84	17.80	2.12E+02		4.00E+02	1.01E+02
	356.01	60.00	7.85E+01		3.28E+02	3.82E+01
CE-139	165.85	80.35	3.85E+01	3.85E+01	6.68E+00	1.77E+01
CE-144	133.54	10.80	2.15E+02	2.15E+02	1.23E+01	9.88E+01
HG-203	279.19	77.30	3.42E+01	3.42E+01	5.43E+00	1.58E+01
PB-210	46.50	4.25	8.56E+00	8.56E+00	-3.89E-01	3.85E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.03E+03		-4.71E+02	4.51E+02
	302.67	* 2.30	1.48E+03		3.59E+03	6.99E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	2.73E+02		2.08E+02	1.32E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	5.94E-01		-6.26E-01	2.76E-01
	131.42	20.40	1.07E+02		4.86E+00	4.90E+01
+ TH-234	63.29	* 3.80	1.05E+02	1.05E+02	2.08E+02	5.02E+01
NP-237	29.37	14.00	2.29E-01	2.29E-01	-5.11E+00	1.09E-01
	86.50	12.60	7.68E+01		-2.46E+01	3.58E+01
U-237	97.08	16.30	6.22E+01	5.48E+01	-1.26E+00	2.82E+01
	101.07	26.30	5.48E+01		-5.23E+00	2.53E+01
	114.00	12.30	2.60E+02		2.90E+02	1.24E+02
	208.01	22.00	1.42E+02		-3.16E+01	6.48E+01
AM-241	59.54	35.90	5.74E+00	5.74E+00	-2.63E+01	2.67E+00
AM-243	74.67	66.00	7.02E+00	7.02E+00	-5.65E+00	3.22E+00

+ = Nuclide identified during the nuclide identification

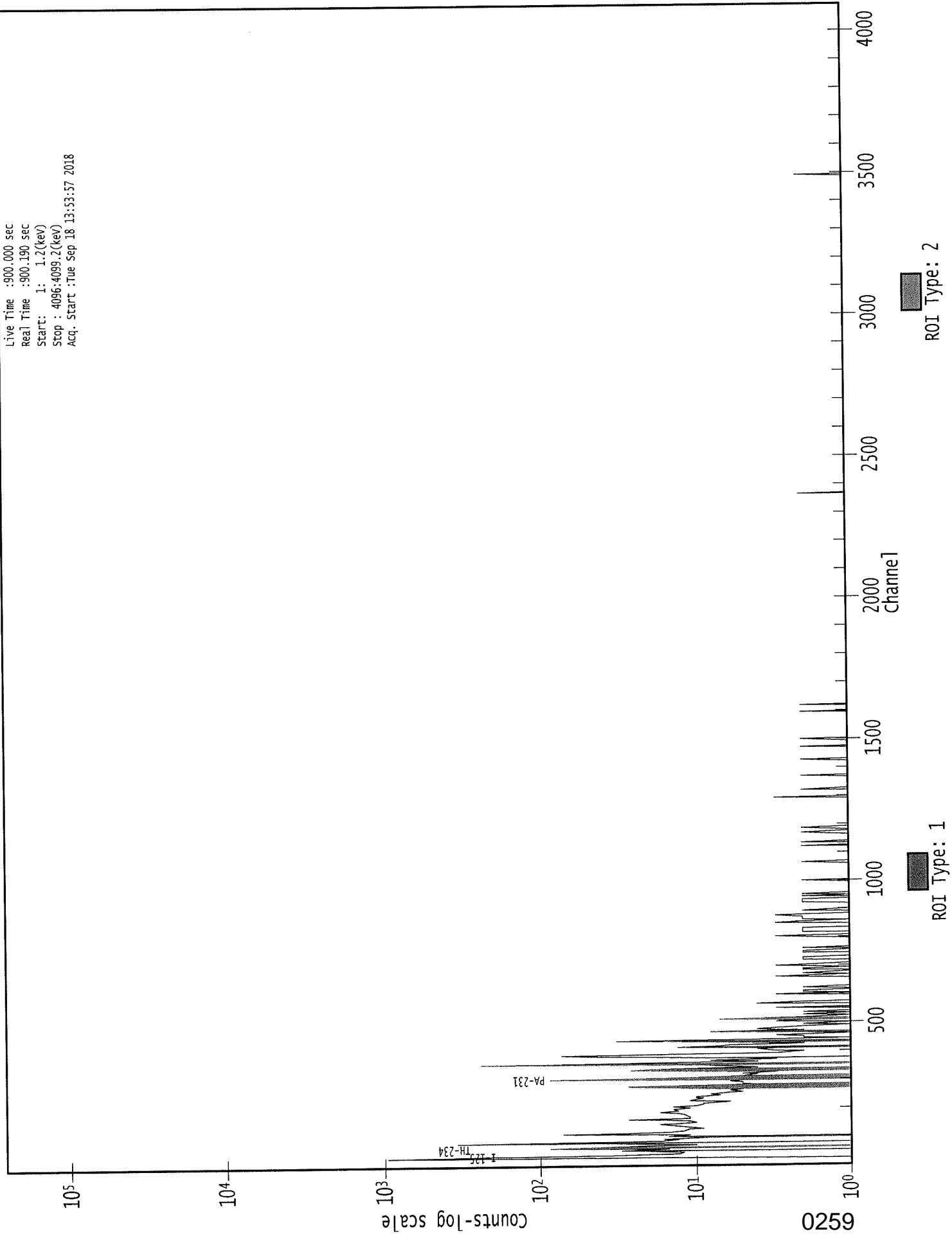
\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

0000071961.CNF

Live Time : 900.000 sec  
Real Time : 900.190 sec  
Start : 1: 1.2(keV)  
Stop : 4096:4095.2(keV)  
Acq. Start : Tue Sep 18 13:53:57 2018



*Handwritten initials: VLS, GWL*

Analysis Report for 1809025-07  
BC-2D

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-07  
 Sample Description : BC-2D  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 9:59:49AM  
 Acquisition Started : 9/18/2018 1:54:06PM  
  
 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 : 1.000FWHM  
  
 Energy Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 71962

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:09:14PM  
 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 1809025-07

BC-2D

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.76	18 -	24	21.13	1.32E+02	46.05	2.93E+02	2.60
M	2	31.08	26 -	46	31.45	2.70E+03	113.59	3.47E+02	2.19
m	3	35.37	26 -	46	35.73	6.25E+02	96.33	2.54E+02	2.23
	4	53.12	49 -	57	53.47	9.43E+01	46.16	2.69E+02	3.31
M	5	61.98	58 -	88	62.33	3.42E+02	50.61	2.01E+02	2.48
m	6	66.09	58 -	88	66.43	1.72E+02	49.54	1.98E+02	2.49
m	7	73.66	58 -	88	74.00	2.87E+01	31.54	1.67E+02	2.07
m	8	81.35	58 -	88	81.69	1.12E+03	75.06	1.89E+02	2.29
M	9	112.12	106 -	121	112.45	3.14E+02	53.67	2.64E+02	2.57
m	10	116.08	106 -	121	116.41	6.14E+01	42.07	1.83E+02	2.14
	11	160.55	156 -	165	160.85	4.80E+01	44.35	2.50E+02	2.37
	12	276.62	271 -	281	276.88	7.72E+01	31.11	8.76E+01	1.86
M	13	303.23	298 -	317	303.47	1.89E+02	31.43	4.54E+01	2.77
m	14	307.73	298 -	317	307.98	5.59E+01	28.57	4.18E+01	2.78
	15	334.75	328 -	341	334.99	9.45E+01	39.64	1.31E+02	2.45
	16	356.31	350 -	362	356.53	6.28E+02	53.85	4.55E+01	2.46
M	17	384.30	380 -	402	384.51	1.54E+02	37.20	6.24E+01	2.74
m	18	387.29	380 -	402	387.50	2.40E+02	40.84	3.57E+01	2.10
m	19	391.56	380 -	402	391.77	5.41E+01	31.18	2.88E+01	2.82
M	20	414.72	410 -	426	414.92	6.03E+01	21.94	2.34E+01	2.87
m	21	418.58	410 -	426	418.78	3.99E+01	23.01	2.80E+01	2.94
	22	437.32	432 -	442	437.51	1.06E+02	25.87	3.28E+01	2.58
	23	445.15	443 -	448	445.34	9.92E+00	8.12	4.17E+00	2.81
	24	468.13	465 -	472	468.31	3.57E+01	12.96	4.63E+00	2.87
	25	475.11	473 -	477	475.29	6.50E+00	6.96	5.00E+00	1.01

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 : 9/18/2018 2:09:14PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070289.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.76	1.32E+02	46.05			1.32E+02	4.60E+01
M	2	31.08	2.70E+03	113.59			2.70E+03	1.14E+02
m	3	35.37	6.25E+02	96.33			6.25E+02	9.63E+01
	4	53.12	9.43E+01	46.16	2.82E-01	5.14E-01	9.40E+01	4.62E+01

Analysis Report for 1809025-07

BC-2D

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	5	61.98	3.42E+02	50.61	1.31E+01	8.56E-01	3.29E+02	5.06E+01
m	6	66.09	1.72E+02	49.54			1.72E+02	4.95E+01
m	7	73.66	2.87E+01	31.54			2.87E+01	3.15E+01
m	8	81.35	1.12E+03	75.06			1.12E+03	7.51E+01
M	9	112.12	3.14E+02	53.67			3.14E+02	5.37E+01
m	10	116.08	6.14E+01	42.07			6.14E+01	4.21E+01
	11	160.55	4.80E+01	44.35			4.80E+01	4.44E+01
	12	276.62	7.72E+01	31.11			7.72E+01	3.11E+01
M	13	303.23	1.89E+02	31.43			1.89E+02	3.14E+01
m	14	307.73	5.59E+01	28.57			5.59E+01	2.86E+01
	15	334.75	9.45E+01	39.64			9.45E+01	3.96E+01
	16	356.31	6.28E+02	53.85			6.28E+02	5.38E+01
M	17	384.30	1.54E+02	37.20			1.54E+02	3.72E+01
m	18	387.29	2.40E+02	40.84			2.40E+02	4.08E+01
m	19	391.56	5.41E+01	31.18			5.41E+01	3.12E+01
M	20	414.72	6.03E+01	21.94			6.03E+01	2.19E+01
m	21	418.58	3.99E+01	23.01			3.99E+01	2.30E+01
	22	437.32	1.06E+02	25.87			1.06E+02	2.59E+01
	23	445.15	9.92E+00	8.12			9.92E+00	8.12E+00
	24	468.13	3.57E+01	12.96			3.57E+01	1.30E+01
	25	475.11	6.50E+00	6.96			6.50E+00	6.96E+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	0.96	255.12	1.93		
		391.69 *	61.90	3.77E+01	2.20E+01
I-125	1.00	35.49 *	6.49	2.97E+01	4.59E+00
		30.80 *	97.60	3.68E+00	1.55E-01
BA-133	0.99	302.84 *	17.80	7.11E+02	2.83E+02
		356.01 *	60.00	5.45E+02	7.76E+01
		63.29 *	3.80	<del>5.19E+02</del>	8.19E+01
TH-234	0.97	63.29 *	3.80	5.21E+00	5.73E+00
AM-243	0.98	74.67 *	66.00		

0262

Analysis Report for 1809025-07

BC-2D

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

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## INTERFERENCE CORRECTED REPORT

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<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>
	0.964	3.77E+01	2.20E+01	
	1.000	2.97E+01	4.59E+00	
X	0.898			
	0.998	3.68E+00	1.55E-01	
	0.970	5.19E+02	8.19E+01	
X	0.883			
	0.982	5.21E+00	5.73E+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 1809025-07

BC-2D

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:09:14PM  
 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	20.76	1.46959E-01	17.41	Tol.	PA-234M
4	53.12	1.04478E-01	24.55		
m 6	66.09	1.91227E-01	14.39	Sum	
m 8	81.35	1.24892E+00	3.34		
M 9	112.12	3.48747E-01	8.55	Tol.	U-237
m 10	116.08	6.82249E-02	34.26		
11	160.55	5.33012E-02	46.23		
12	276.62	8.57714E-02	20.15		
m 14	307.73	6.20657E-02	25.57		
15	334.75	1.04948E-01	20.98	Sum	
M 17	384.30	1.70884E-01	12.09		
m 18	387.29	2.66214E-01	8.52	Sum	
M 20	414.72	6.69670E-02	18.20		
m 21	418.58	4.43540E-02	28.82	Sum	
22	437.32	1.17322E-01	12.25		
23	445.15	1.10185E-02	40.96		
24	468.13	3.96491E-02	18.16		
25	475.11	7.22222E-03	53.57		

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

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**NUCLIDE MDA REPORT**


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



Analysis Report for 1809025-07

BC-2D

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	4.26E-09	4.26E-09	-2.08E-08	1.35E-09
CO-57	122.06	85.51	2.90E+01	2.90E+01	9.14E+00	1.37E+01
	136.48	10.60	2.77E+02		2.73E+01	1.31E+02
NI-59	6.92	29.80	1.08E-07	1.08E-07	1.78E-08	4.94E-08
MO-93	16.59	52.90	1.10E-03	1.10E-03	-2.28E-04	5.24E-04
	18.60	10.00	2.00E-02		-3.29E-03	9.62E-03
NB-93M	16.57	9.43	6.09E-03	6.09E-03	-1.27E-03	2.91E-03
CD-109	88.03	3.72	2.99E+02	2.99E+02	-1.41E+02	1.42E+02
+ SN-113	255.12	1.93	1.49E+03	4.83E+01	3.44E+02	6.87E+02
	391.69	* 61.90	4.83E+01		3.77E+01	2.32E+01
SN-119M	23.87	16.10	1.01E-01	9.81E-02	-8.50E-02	4.86E-02
	25.10	22.70	9.81E-02		-1.09E+00	4.73E-02
+ I-125	35.49	* 6.49	8.29E+00	8.29E+00	2.97E+01	4.08E+00
I-129	29.78	* 57.00	4.10E-01	4.10E-01	6.30E+00	2.02E-01
	33.60	* 13.20	4.07E+00		1.46E+01	2.00E+00
	39.58	7.52	5.88E+00		-1.75E+01	2.83E+00
+ BA-133	30.80	* 97.60	2.40E-01	2.40E-01	3.68E+00	1.18E-01
	302.84	* 17.80	2.23E+02		7.11E+02	1.07E+02
	356.01	* 60.00	3.04E+01		5.45E+02	1.40E+01
CE-139	165.85	80.35	4.59E+01	4.59E+01	8.01E-02	2.17E+01
CE-144	133.54	10.80	2.75E+02	2.75E+02	1.40E+02	1.30E+02
HG-203	279.19	77.30	4.64E+01	4.64E+01	3.84E+01	2.19E+01
PB-210	46.50	4.25	1.83E+01	1.83E+01	1.26E+00	8.65E+00
PA-231	9.28	42.00	3.93E-06	3.93E-06	4.82E-06	1.87E-06
	10.11	20.20	2.07E-05		2.53E-05	9.82E-06
	283.67	1.60	1.56E+03		6.48E+02	7.19E+02
	302.67	2.30	2.00E+03		3.46E+03	9.61E+02
TH-231	25.64	14.70	1.82E-01	1.82E-01	-5.58E+00	8.79E-02
	84.21	6.40	3.99E+02		1.60E+03	1.95E+02
PA-234M	9.89	89.00	3.70E-06	3.70E-06	4.54E-06	1.76E-06
	21.72	64.90	1.21E-02		2.02E-02	5.83E-03
	37.93	23.75	2.48E+00		7.11E+00	1.21E+00
	131.42	20.40	1.40E+02		5.07E+01	6.65E+01
+ TH-234	63.29	* 3.80	3.08E+02	3.08E+02	5.19E+02	1.52E+02
NP-237	29.37	* 14.00	1.67E+00	1.67E+00	2.56E+01	8.22E-01
	86.50	12.60	9.95E+01		-7.84E+00	4.75E+01
U-237	97.08	16.30	9.67E+01	6.94E+01	-7.57E+01	4.59E+01
	101.07	26.30	6.94E+01		1.47E-01	3.30E+01
	114.00	12.30	3.60E+02		1.12E+03	1.75E+02
	208.01	22.00	1.80E+02		4.79E+01	8.48E+01
AM-241	59.54	35.90	1.35E+01	1.35E+01	2.34E+01	6.56E+00
+ AM-243	74.67	* 66.00	3.52E+01	3.52E+01	5.21E+00	1.74E+01

+ = Nuclide identified during the nuclide identification

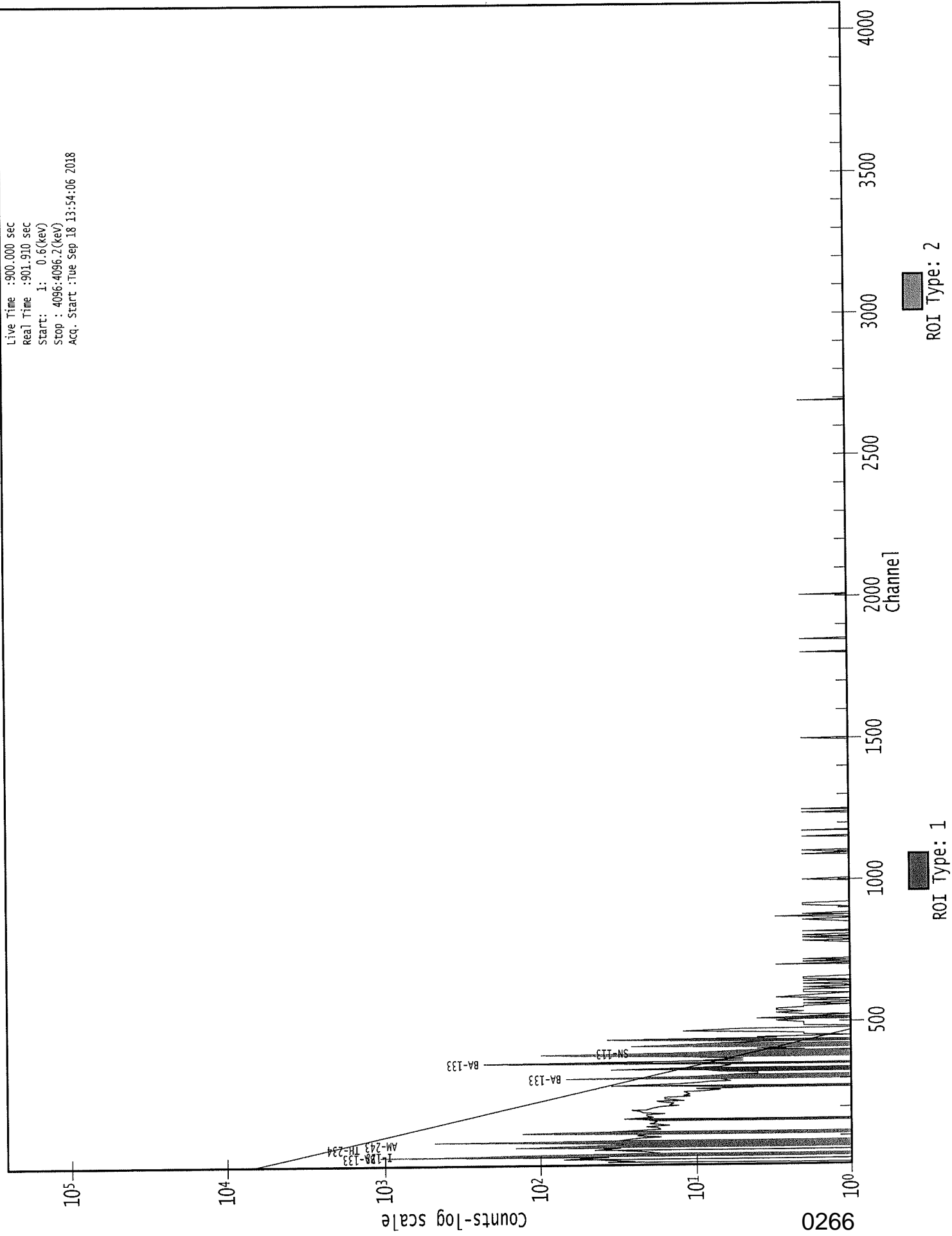
\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

0000071962.CNF

Live Time : 900.000 sec  
Real Time : 901.910 sec  
Start: 1: 0.5(keV)  
Stop : 4096.4096.2(keV)  
Acq. Start : Tue Sep 18 13:54:06 2018



Analysis Report for 1809025-08  
BC-2C

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**GAMMA SPECTRUM ANALYSIS**

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Sample Identification : 1809025-08  
Sample Description : BC-2C  
Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
Facility : Countroom

Sample Taken On : 9/18/2018 10:00:01AM  
Acquisition Started : 9/18/2018 1:58:02PM

Procedure : BAFIL  
Operator : Administrator  
Detector Name : GE4  
Geometry : BAFIL  
Live Time : 900.0 seconds  
Real Time : 900.5 seconds

Dead Time : 0.05 %

Peak Locate Threshold : 2.50  
Peak Locate Range (in channels) : 1 - 4096  
Peak Area Range (in channels) : 9 - 4096  
Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 2/24/2018  
Efficiency Calibration Used Done On : 11/9/2014  
Efficiency Calibration Description :

Sample Number : 71963

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**PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/18/2018 2:13:07PM  
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 1809025-08

BC-2C

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.30	17 -	24	20.35	1.32E+02	50.60	3.44E+02	2.05
M	2	31.42	25 -	43	30.48	2.73E+03	112.53	2.87E+02	2.22
m	3	35.81	25 -	43	34.87	6.26E+02	69.56	1.78E+02	2.11
M	4	53.36	47 -	72	52.44	5.91E+01	40.55	1.90E+02	2.53
m	5	62.30	47 -	72	61.38	2.87E+02	48.19	1.95E+02	2.37
m	6	66.47	47 -	72	65.56	1.31E+02	50.16	2.52E+02	2.55
	7	81.58	75 -	86	80.68	1.12E+03	85.18	3.48E+02	2.28
	8	101.91	98 -	103	101.03	2.20E+01	26.15	1.18E+02	1.68
M	9	112.28	107 -	119	111.40	2.50E+02	46.13	1.72E+02	2.61
m	10	116.42	107 -	119	115.55	4.13E+01	40.69	1.56E+02	2.62
	11	182.02	176 -	187	181.20	5.08E+01	42.90	2.06E+02	6.74
	12	277.24	272 -	279	276.49	6.19E+01	26.53	7.63E+01	2.24
	13	303.81	299 -	309	303.09	1.68E+02	36.61	9.23E+01	2.43
	14	335.56	328 -	340	334.87	1.05E+02	27.38	3.90E+01	2.50
	15	356.73	350 -	362	356.05	5.51E+02	50.33	3.90E+01	2.31
	16	387.20	379 -	395	386.55	3.08E+02	43.01	5.63E+01	5.11
	17	415.03	410 -	418	414.40	1.97E+01	21.24	5.46E+01	1.98
	18	437.57	432 -	440	436.96	7.36E+01	23.63	4.08E+01	2.03
	19	468.39	464 -	470	467.81	1.19E+01	10.23	1.03E+01	2.83
	20	623.37	621 -	625	622.93	5.14E+00	6.36	3.71E+00	2.66
	21	700.94	698 -	703	700.57	7.00E+00	5.29	0.00E+00	2.22

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 : 9/18/2018 2:13:07PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000071072.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	21.30	1.32E+02	50.60			1.32E+02	5.06E+01
M	2	31.42	2.73E+03	112.53			2.73E+03	1.13E+02
m	3	35.81	6.26E+02	69.56			6.26E+02	6.96E+01
M	4	53.36	5.91E+01	40.55			5.91E+01	4.05E+01
m	5	62.30	2.87E+02	48.19	1.33E+01	2.31E+00	2.74E+02	4.82E+01
m	6	66.47	1.31E+02	50.16			1.31E+02	5.02E+01
	7	81.58	1.12E+03	85.18			1.12E+03	8.52E+01
	8	101.91	2.20E+01	26.15			2.20E+01	2.62E+01

Analysis Report for 1809025-08

BC-2C

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	9	112.28	2.50E+02	46.13			2.50E+02	4.61E+01
m	10	116.42	4.13E+01	40.69			4.13E+01	4.07E+01
	11	182.02	5.08E+01	42.90			5.08E+01	4.29E+01
	12	277.24	6.19E+01	26.53			6.19E+01	2.65E+01
	13	303.81	1.68E+02	36.61			1.68E+02	3.66E+01
	14	335.56	1.05E+02	27.38			1.05E+02	2.74E+01
	15	356.73	5.51E+02	50.33			5.51E+02	5.03E+01
	16	387.20	3.08E+02	43.01			3.08E+02	4.30E+01
	17	415.03	1.97E+01	21.24			1.97E+01	2.12E+01
	18	437.57	7.36E+01	23.63			7.36E+01	2.36E+01
	19	468.39	1.19E+01	10.23			1.19E+01	1.02E+01
	20	623.37	5.14E+00	6.36			5.14E+00	6.36E+00
	21	700.94	7.00E+00	5.29			7.00E+00	5.29E+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-125	0.99	35.49	*	6.49	5.77E+02	6.58E+01
BA-133	0.99	30.80	*	97.60	1.27E+02	5.82E+00
		302.84	*	17.80	8.28E+02	3.11E+02
		356.01	*	60.00	8.64E+02	1.38E+02
HG-203	0.92	279.19	*	77.30	6.71E+01	3.52E+01
TH-234	0.98	63.29	*	3.80	1.18E+03	2.24E+02

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Analysis Report for 1809025-08

BC-2C

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## INTERFERENCE CORRECTED REPORT

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	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	I-125	0.998	5.77E+02	6.58E+01	
X	I-129	0.591			
	BA-133	0.991	1.29E+02	5.81E+00	
	HG-203	0.929	6.71E+01	3.52E+01	
	TH-234	0.981	1.18E+03	2.24E+02	
X	NP-237	0.548			

? = 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 1809025-08

BC-2C

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:13:07PM  
 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	21.30	1.46933E-01	19.13	Tol. PA-234M
M	4	53.36	6.56537E-02	34.31	
m	6	66.47	1.45686E-01	19.13	Sum
	7	81.58	1.24222E+00	3.81	
	8	101.91	2.44033E-02	59.54	Tol. U-237
M	9	112.28	2.77965E-01	9.22	Tol. U-237
m	10	116.42	4.58444E-02	49.31	
	11	182.02	5.64214E-02	42.24	
	14	335.56	1.16111E-01	13.10	Sum
	16	387.20	3.42054E-01	6.99	Sum
	17	415.03	2.19031E-02	53.88	
	18	437.57	8.17671E-02	16.05	
	19	468.39	1.31699E-02	43.17	
	20	623.37	5.71429E-03	61.87	
	21	700.94	7.77778E-03	37.80	

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

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**NUCLIDE MDA REPORT**


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

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
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Analysis Report for 1809025-08

BC-2C

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	1.99E+01	1.99E+01	6.80E+00	9.32E+00
	136.48	10.60	1.91E+02		-1.05E+02	8.93E+01
NI-59	6.92	29.80	5.42E-02	5.42E-02	-4.17E-02	2.33E-02
MO-93	16.59	52.90	1.18E+00	1.18E+00	2.39E-01	5.65E-01
	18.60	10.00	1.08E+01		4.10E-02	5.20E+00
NB-93M	16.57	9.43	6.61E+00	6.61E+00	1.34E+00	3.16E+00
CD-109	88.03	3.72	3.69E+02	3.69E+02	-1.38E+02	1.75E+02
SN-113	255.12	1.93	1.47E+03	9.78E+01	1.30E+02	6.79E+02
	391.69	61.90	9.78E+01		1.02E+02	4.68E+01
SN-119M	23.87	16.10	1.28E+01	9.53E+00	-9.13E+00	6.17E+00
	25.10	22.70	9.53E+00		-1.02E+02	4.60E+00
+ I-125	35.49	* 6.49	1.33E+02	1.33E+02	5.77E+02	6.52E+01
I-129	29.78	* 57.00	1.17E+01	1.17E+01	2.18E+02	5.74E+00
	33.60	13.20	1.03E+02		1.04E+03	5.12E+01
	39.58	7.52	6.99E+01		-1.08E+02	3.36E+01
+ BA-133	30.80	* 97.60	6.83E+00	6.83E+00	1.27E+02	3.35E+00
	302.84	* 17.80	2.23E+02		8.28E+02	1.05E+02
	356.01	* 60.00	5.13E+01		8.64E+02	2.35E+01
CE-139	165.85	80.35	3.43E+01	3.43E+01	8.11E+00	1.62E+01
CE-144	133.54	10.80	1.97E+02	1.97E+02	2.90E+01	9.28E+01
+ HG-203	279.19	* 77.30	4.11E+01	4.11E+01	6.71E+01	1.91E+01
PB-210	46.50	4.25	1.16E+02	1.16E+02	1.62E+01	5.51E+01
PA-231	9.28	42.00	2.02E-01	2.02E-01	1.11E-01	9.43E-02
	10.11	20.20	6.08E-01		3.75E-01	2.87E-01
	283.67	1.60	1.40E+03		-9.28E+02	6.28E+02
	302.67	2.30	2.49E+03		5.34E+03	1.19E+03
TH-231	25.64	14.70	1.54E+01	1.54E+01	-4.53E+02	7.44E+00
	84.21	6.40	6.35E+02		3.82E+03	3.12E+02
PA-234M	9.89	89.00	1.29E-01	1.29E-01	7.98E-02	6.10E-02
	21.72	64.90	2.51E+00		3.64E+00	1.21E+00
	37.93	23.75	3.53E+01		1.16E+02	1.72E+01
	131.42	20.40	1.07E+02		5.41E+01	5.04E+01
+ TH-234	63.29	* 3.80	7.17E+02	7.17E+02	1.18E+03	3.53E+02
NP-237	29.37	* 14.00	4.76E+01	4.76E+01	8.88E+02	2.34E+01
	86.50	12.60	1.17E+02		4.16E+00	5.58E+01
U-237	97.08	16.30	9.17E+01	5.99E+01	-1.49E+01	4.32E+01
	101.07	26.30	5.99E+01		4.05E+00	2.82E+01
	114.00	12.30	2.92E+02		8.28E+02	1.42E+02
	208.01	22.00	1.39E+02		-2.45E+01	6.53E+01
AM-241	59.54	35.90	3.81E+01	3.81E+01	6.02E+01	1.85E+01
AM-243	74.67	66.00	1.72E+01	1.72E+01	1.94E+00	8.13E+00

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

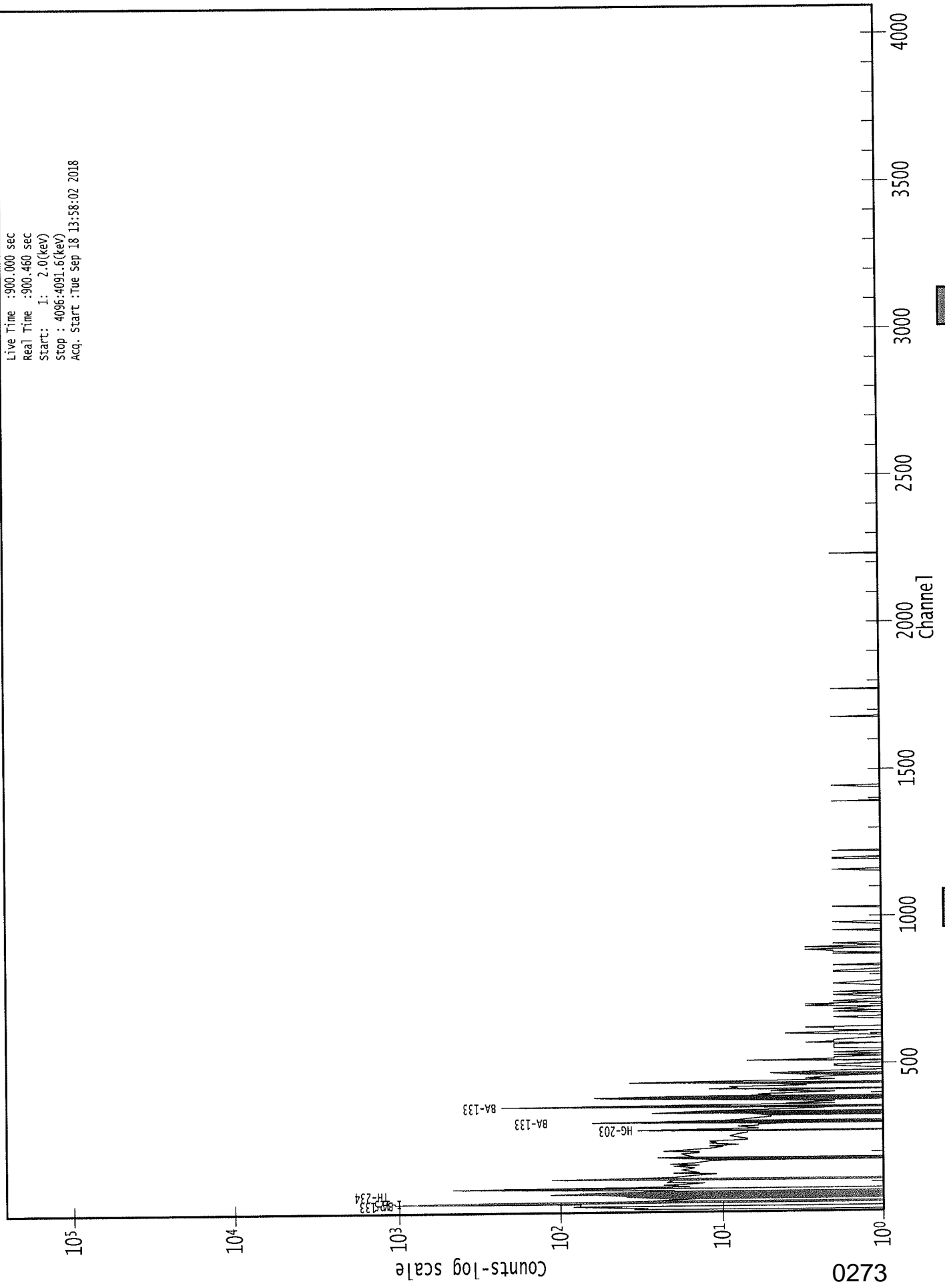
&gt; = MDA value not calculated

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



0000071963.CNF

Live Time :900.000 sec  
Real Time :900.460 sec  
Start: 1: 2.0(keV)  
Stop : 4096:4091.6(keV)  
Acq. Start :Tue Sep 18 13:58:02 2018



*RS  
9/18/18*

Analysis Report for 1809025-09  
BC-5

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-09  
 Sample Description : BC-5  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 10:00:14AM  
 Acquisition Started : 9/18/2018 2:08:06PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE1  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.3 seconds  
  
 Dead Time : 0.04 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 19 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 6/16/2018  
 Efficiency Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 71964

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:23:09PM  
 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 1809025-09

BC-5

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	30.86	25 -	42	31.23	2.67E+03	110.46	2.87E+02	1.93
m	2	35.46	25 -	42	35.83	7.10E+02	92.71	3.15E+02	2.39
	3	52.56	50 -	56	52.93	5.80E+01	36.08	1.98E+02	4.26
M	4	61.89	58 -	72	62.26	3.22E+02	49.53	2.30E+02	1.99
m	5	66.00	58 -	72	66.37	1.49E+02	51.33	2.71E+02	2.47
	6	81.16	76 -	86	81.52	1.14E+03	88.78	4.45E+02	2.09
M	7	110.14	107 -	124	110.50	6.55E+01	43.26	1.67E+02	3.07
m	8	112.06	107 -	124	112.42	2.04E+02	41.99	1.42E+02	1.99
m	9	116.00	107 -	124	116.35	9.04E+01	48.00	1.86E+02	2.81
M	10	273.51	271 -	290	273.83	1.35E+01	17.92	4.13E+01	1.88
m	11	276.86	271 -	290	277.17	9.27E+01	24.27	3.97E+01	1.88
M	12	303.01	299 -	323	303.32	1.84E+02	32.55	6.15E+01	1.69
m	13	307.49	299 -	323	307.80	5.17E+01	32.98	8.38E+01	2.53
M	14	334.03	331 -	346	334.33	9.29E+01	25.83	4.41E+01	2.22
m	15	338.03	331 -	346	338.33	5.30E+01	24.64	4.69E+01	2.32
m	16	341.68	331 -	346	341.98	1.17E+01	21.62	4.82E+01	2.32
	17	355.97	350 -	361	356.27	7.67E+02	64.84	1.36E+02	2.07
M	18	362.17	361 -	367	362.47	1.69E+01	13.60	3.53E+01	1.69
m	19	364.49	361 -	367	364.78	2.56E+01	21.45	4.93E+01	1.96
M	20	383.83	380 -	396	384.12	1.79E+02	32.74	3.22E+01	2.14
m	21	386.92	380 -	396	387.21	2.66E+02	42.61	3.65E+01	2.01
m	22	391.08	380 -	396	391.37	6.19E+01	28.91	4.05E+01	2.15
M	23	414.73	411 -	426	415.02	5.25E+01	20.17	3.17E+01	2.16
m	24	418.09	411 -	426	418.38	3.17E+01	22.16	3.36E+01	2.16
m	25	422.56	411 -	426	422.84	1.12E+01	15.84	3.55E+01	2.17
	26	437.23	433 -	442	437.51	1.22E+02	31.21	6.88E+01	1.99
	27	444.19	442 -	447	444.47	1.29E+01	10.82	1.03E+01	3.01
	28	469.01	465 -	475	469.28	4.05E+01	15.64	1.10E+01	2.41
	29	597.57	594 -	601	597.82	1.10E+01	6.63	0.00E+00	3.98
	30	650.46	648 -	653	650.69	5.71E+00	6.08	2.57E+00	2.93
	31	724.45	721 -	727	724.67	9.00E+00	6.00	0.00E+00	2.96

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 : 9/18/2018 2:23:09PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070287.CNF

Analysis Report for 1809025-09

BC-5

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	30.86	2.67E+03	110.46			2.67E+03	1.10E+02
m	2	35.46	7.10E+02	92.71			7.10E+02	9.27E+01
	3	52.56	5.80E+01	36.08			5.80E+01	3.61E+01
M	4	61.89	3.22E+02	49.53			3.22E+02	4.95E+01
m	5	66.00	1.49E+02	51.33			1.49E+02	5.13E+01
	6	81.16	1.14E+03	88.78			1.14E+03	8.88E+01
M	7	110.14	6.55E+01	43.26			6.55E+01	4.33E+01
m	8	112.06	2.04E+02	41.99			2.04E+02	4.20E+01
m	9	116.00	9.04E+01	48.00			9.04E+01	4.80E+01
M	10	273.51	1.35E+01	17.92			1.35E+01	1.79E+01
m	11	276.86	9.27E+01	24.27			9.27E+01	2.43E+01
M	12	303.01	1.84E+02	32.55			1.84E+02	3.26E+01
m	13	307.49	5.17E+01	32.98			5.17E+01	3.30E+01
M	14	334.03	9.29E+01	25.83			9.29E+01	2.58E+01
m	15	338.03	5.30E+01	24.64	6.20E-01	1.14E+00	5.24E+01	2.47E+01
m	16	341.68	1.17E+01	21.62			1.17E+01	2.16E+01
	17	355.97	7.67E+02	64.84			7.67E+02	6.48E+01
M	18	362.17	1.69E+01	13.60			1.69E+01	1.36E+01
m	19	364.49	2.56E+01	21.45			2.56E+01	2.14E+01
M	20	383.83	1.79E+02	32.74			1.79E+02	3.27E+01
m	21	386.92	2.66E+02	42.61			2.66E+02	4.26E+01
m	22	391.08	6.19E+01	28.91			6.19E+01	2.89E+01
M	23	414.73	5.25E+01	20.17			5.25E+01	2.02E+01
m	24	418.09	3.17E+01	22.16			3.17E+01	2.22E+01
m	25	422.56	1.12E+01	15.84			1.12E+01	1.58E+01
	26	437.23	1.22E+02	31.21			1.22E+02	3.12E+01
	27	444.19	1.29E+01	10.82			1.29E+01	1.08E+01
	28	469.01	4.05E+01	15.64			4.05E+01	1.56E+01
	29	597.57	1.10E+01	6.63			1.10E+01	6.63E+00
	30	650.46	5.71E+00	6.08			5.71E+00	6.08E+00
	31	724.45	9.00E+00	6.00			9.00E+00	6.00E+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

Analysis Report for 1809025-09

BC-5

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
SN-113	0.96	255.12	1.93		
		391.69 *	61.90	3.69E+01	1.75E+01
I-125	1.00	35.49 *	6.49	7.33E+00	9.57E-01
BA-133	1.00	30.80 *	97.60	5.05E-01	2.09E-02
		302.84 *	17.80	8.14E+02	3.84E+02
		356.01 *	60.00	6.48E+02	8.97E+01
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	6.30E+03	2.98E+03
TH-234	0.94	63.29 *	3.80	3.58E+02	5.56E+01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.961	3.69E+01	1.75E+01	
I-125	1.000	7.33E+00	9.57E-01	
X I-129	0.746			
BA-133	1.000	5.05E-01	2.09E-02	
PA-231	1.000	6.29E+03	2.98E+03	
TH-234	0.943	3.58E+02	5.56E+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

Analysis Report for 1809025-09

BC-5

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:23:09PM  
 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	52.56	6.44480E-02	31.10	
m	5	66.00	1.65783E-01	17.20	Sum
	6	81.16	1.26143E+00	3.91	
M	7	110.14	7.27947E-02	33.02	
m	8	112.06	2.26862E-01	10.28	Tol. U-237
m	9	116.00	1.00469E-01	26.54	Tol. U-237
M	10	273.51	1.50276E-02	66.24	
m	11	276.86	1.03049E-01	13.08	
m	13	307.49	5.74824E-02	31.88	
M	14	334.03	1.03272E-01	13.90	Sum
m	15	338.03	5.81792E-02	23.56	Sum
m	16	341.68	1.30429E-02	92.07	
M	18	362.17	1.87904E-02	40.21	
m	19	364.49	2.84446E-02	41.89	Sum
M	20	383.83	1.98354E-01	9.17	
m	21	386.92	2.95191E-01	8.02	Sum
M	23	414.73	5.83526E-02	19.21	
m	24	418.09	3.52461E-02	34.93	Sum
m	25	422.56	1.24452E-02	70.72	Sum
	26	437.23	1.35107E-01	12.83	
	27	444.19	1.42901E-02	42.05	
	28	469.01	4.50000E-02	19.30	
	29	597.57	1.22222E-02	30.15	
	30	650.46	6.34921E-03	53.22	
	31	724.45	1.00000E-02	33.33	

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

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Analysis Report for 1809025-09

BC-5

## NUCLIDE MDA REPORT

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

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	1.90E-13	1.90E-13	0.00E+00	0.00E+00
CO-57	122.06	85.51	3.45E+01	3.45E+01	-2.18E+01	1.61E+01
	136.48	10.60	4.09E+02		2.04E+02	1.93E+02
NI-59	6.92	29.80	2.77E-12	2.77E-12	0.00E+00	0.00E+00
MO-93	16.59	52.90	8.31E-06	8.31E-06	-3.26E-06	3.71E-06
	18.60	10.00	4.06E-04		2.66E-04	1.93E-04
NB-93M	16.57	9.43	4.59E-05	4.59E-05	-1.80E-05	2.05E-05
CD-109	88.03	3.72	3.58E+02	3.58E+02	1.84E+02	1.70E+02
+ SN-113	255.12	1.93	2.14E+03	3.18E+01	6.50E+02	9.95E+02
	391.69	*	61.90	3.18E+01	3.69E+01	1.51E+01
SN-119M	23.87	16.10	5.16E-03	5.16E-03	-2.62E-03	2.47E-03
	25.10	22.70	5.92E-03		-4.20E-03	2.82E-03
+ I-125	35.49	*	6.49	1.57E+00	7.33E+00	7.71E-01
I-129	29.78	*	57.00	4.91E-02	4.91E-02	8.65E-01
	33.60	13.20	5.97E-01		-2.48E+00	2.94E-01
	39.58	7.52	1.52E+00		-1.42E+00	7.31E-01
+ BA-133	30.80	*	97.60	2.87E-02	5.05E-01	1.41E-02
	302.84	*	17.80	4.55E+02	8.14E+02	2.22E+02
	356.01	*	60.00	4.91E+01	6.48E+02	2.34E+01
CE-139	165.85	80.35	6.63E+01	6.63E+01	5.33E+00	3.11E+01
CE-144	133.54	10.80	3.48E+02	3.48E+02	-1.01E+02	1.63E+02
HG-203	279.19	77.30	6.02E+01	6.02E+01	1.83E+01	2.84E+01
PB-210	46.50	4.25	6.38E+00	6.38E+00	-2.04E+00	3.00E+00
+ PA-231	9.28	42.00	2.61E-10	2.61E-10	0.00E+00	0.00E+00
	10.11	20.20	2.08E-09		0.00E+00	0.00E+00
	283.67	1.60	2.01E+03		-1.19E+01	9.31E+02
	302.67	*	2.30	3.52E+03	6.30E+03	1.71E+03
TH-231	25.64	14.70	1.27E-02	1.27E-02	-1.93E-02	6.08E-03
	84.21	6.40	2.33E+02		-1.36E+03	1.12E+02
PA-234M	9.89	89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
	21.72	64.90	4.85E-04		2.93E-04	2.33E-04
	37.93	23.75	5.93E-01		1.49E+00	2.89E-01
	131.42	20.40	1.75E+02		-2.95E+01	8.15E+01
+ TH-234	63.29	*	3.80	1.30E+02	1.30E+02	3.58E+02
NP-237	29.37	14.00	1.99E-01	1.99E-01	1.85E+00	9.82E-02
	86.50	12.60	1.03E+02		4.46E+01	4.91E+01
U-237	97.08	16.30	1.01E+02	7.03E+01	-2.17E+01	4.73E+01
	101.07	26.30	7.03E+01		-7.54E+00	3.29E+01
	114.00	12.30	4.26E+02		6.41E+02	2.06E+02
	208.01	22.00	2.34E+02		4.42E+01	1.09E+02
AM-241	59.54	35.90	7.77E+00	7.77E+00	1.01E+01	3.76E+00
AM-243	74.67	66.00	9.45E+00	9.45E+00	5.43E-01	4.48E+00

Analysis Report for 1809025-09

BC-5

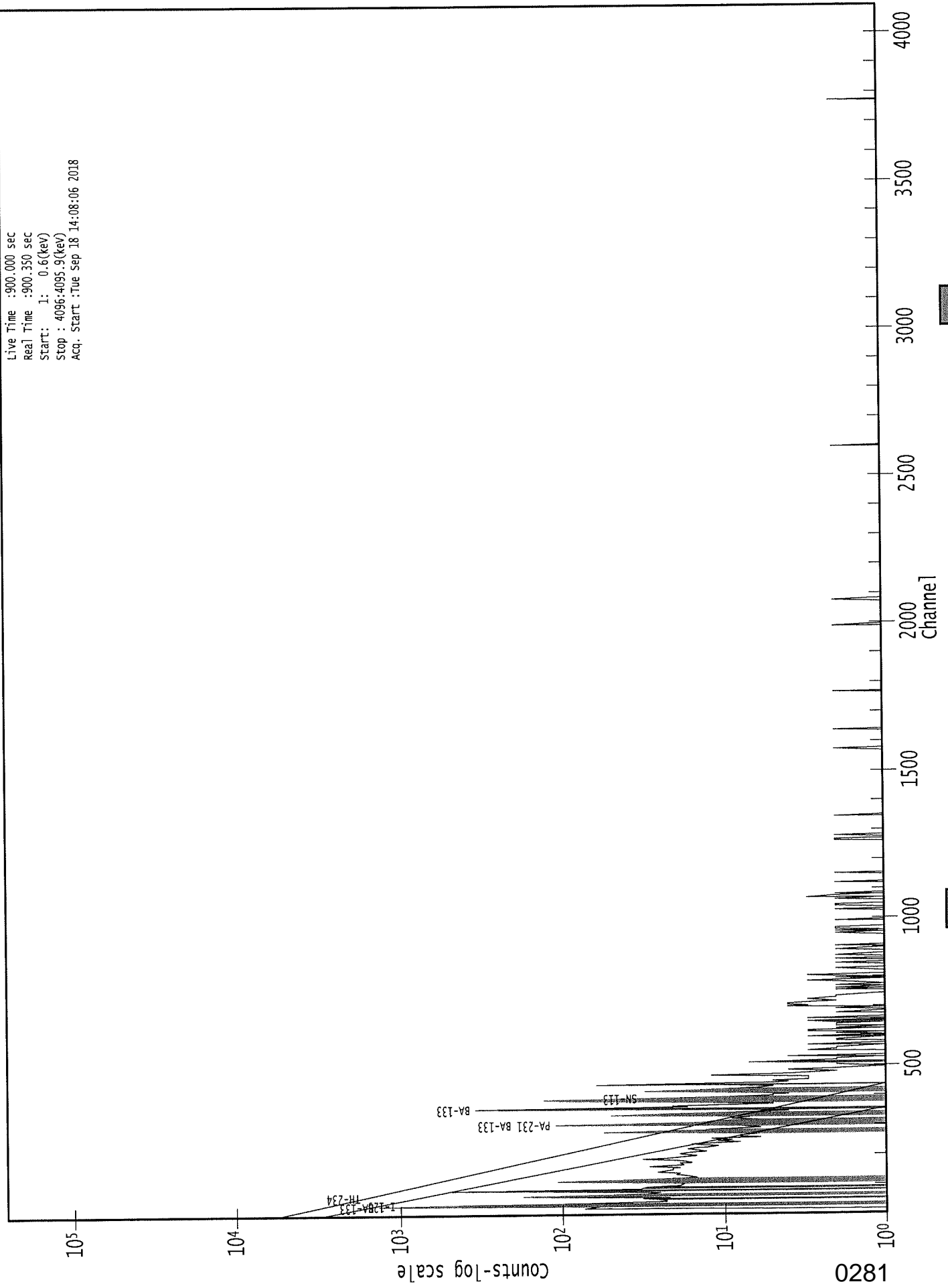
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- + = Nuclide identified during the nuclide identification
  - \* = Energy line found in the spectrum
  - > = MDA value not calculated
  - @ = Half-life too short to be able to perform the decay correction
-



0000071964.CNF

Live Time : 900.000 sec  
Real Time : 900.350 sec  
Start : 1: 0.6(keV)  
Stop : 4096:4095.9(keV)  
Acq. Start : Tue Sep 18 14:08:06 2018



ROI Type: 1

ROI Type: 2

Analysis Report for 1809025-10  
BC-1

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-10  
 Sample Description : BC-1  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/18/2018 10:00:22AM  
 Acquisition Started : 9/18/2018 2:09:44PM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE2  
 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) : 28 - 4096  
 Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Description :

Sample Number : 71965

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:24:49PM

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 1809025-10

BC-1

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.97	35 -	40	35.75	5.70E+02	79.76	3.79E+02	2.60
	2	54.10	51 -	57	53.87	7.27E+01	39.81	2.37E+02	1.83
M	3	62.35	58 -	73	62.12	2.80E+02	44.62	1.87E+02	1.50
m	4	66.38	58 -	73	66.14	1.27E+02	36.97	1.94E+02	1.52
	5	81.56	77 -	85	81.32	1.16E+03	83.09	3.47E+02	1.87
	6	101.35	97 -	104	101.11	4.14E+01	37.63	2.09E+02	4.60
M	7	112.30	108 -	118	112.04	2.07E+02	38.00	1.06E+02	1.37
m	8	116.02	108 -	118	115.76	3.42E+01	25.30	1.14E+02	1.38
M	9	242.48	237 -	249	242.16	2.19E+01	20.12	6.28E+01	1.76
m	10	246.32	237 -	249	246.00	9.94E+00	14.70	3.41E+01	1.33
	11	276.90	273 -	281	276.57	9.18E+01	27.92	6.44E+01	1.88
	12	296.28	292 -	299	295.94	2.77E+01	22.72	6.66E+01	1.97
M	13	303.27	299 -	310	302.93	2.26E+02	32.37	4.07E+01	1.50
m	14	307.88	299 -	310	307.54	2.80E+01	21.54	5.51E+01	1.86
M	15	334.22	330 -	342	333.86	8.62E+01	22.01	2.22E+01	1.57
m	16	338.32	330 -	342	337.96	2.63E+01	16.62	2.42E+01	1.57
M	17	352.37	351 -	359	352.00	3.30E+01	12.88	2.18E+01	1.44
m	18	356.36	351 -	359	355.99	7.72E+02	57.42	4.25E+01	1.51
	19	377.08	373 -	379	376.70	1.42E+01	14.49	2.76E+01	1.40
M	20	384.25	380 -	394	383.87	1.59E+02	28.32	2.33E+01	1.79
m	21	387.23	380 -	394	386.85	2.27E+02	38.44	1.93E+01	1.79
m	22	391.42	380 -	394	391.03	6.69E+01	21.59	1.60E+01	1.79
M	23	411.56	410 -	424	411.16	8.47E+00	1.12	1.00E+00	1.82
m	24	414.90	410 -	424	414.50	4.33E+01	18.36	1.09E+01	2.00
m	25	422.40	410 -	424	422.00	1.13E+01	11.10	1.93E+01	1.51
	26	437.27	433 -	440	436.86	1.03E+02	23.07	1.98E+01	1.26
	27	467.43	461 -	473	467.01	3.39E+01	18.89	2.62E+01	2.55
	28	521.31	518 -	523	520.86	6.00E+00	7.35	6.00E+00	2.99
	29	601.15	597 -	604	600.66	1.09E+01	8.25	4.23E+00	2.32
	30	609.21	605 -	612	608.71	3.28E+01	15.10	1.64E+01	1.26
	31	1002.34	998 -	1005	1001.63	8.00E+00	5.66	0.00E+00	3.41
	32	1120.84	1116 -	1122	1120.05	5.00E+00	6.34	4.00E+00	2.38

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 : 9/18/2018 2:24:49PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070288.CNF

Analysis Report for 1809025-10

BC-1

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	35.97	5.70E+02	79.76			5.70E+02	7.98E+01
	2	54.10	7.27E+01	39.81			7.27E+01	3.98E+01
M	3	62.35	2.80E+02	44.62			2.80E+02	4.46E+01
m	4	66.38	1.27E+02	36.97	3.70E+00	1.42E+00	1.23E+02	3.70E+01
	5	81.56	1.16E+03	83.09			1.16E+03	8.31E+01
	6	101.35	4.14E+01	37.63			4.14E+01	3.76E+01
M	7	112.30	2.07E+02	38.00			2.07E+02	3.80E+01
m	8	116.02	3.42E+01	25.30			3.42E+01	2.53E+01
M	9	242.48	2.19E+01	20.12			2.19E+01	2.01E+01
m	10	246.32	9.94E+00	14.70			9.94E+00	1.47E+01
	11	276.90	9.18E+01	27.92			9.18E+01	2.79E+01
	12	296.28	2.77E+01	22.72	2.67E+00	1.34E+00	2.50E+01	2.28E+01
M	13	303.27	2.26E+02	32.37			2.26E+02	3.24E+01
m	14	307.88	2.80E+01	21.54			2.80E+01	2.15E+01
M	15	334.22	8.62E+01	22.01			8.62E+01	2.20E+01
m	16	338.32	2.63E+01	16.62	1.24E+00	1.28E+00	2.51E+01	1.67E+01
M	17	352.37	3.30E+01	12.88	2.64E+00	1.38E+00	3.04E+01	1.30E+01
m	18	356.36	7.72E+02	57.42			7.72E+02	5.74E+01
	19	377.08	1.42E+01	14.49			1.42E+01	1.45E+01
M	20	384.25	1.59E+02	28.32			1.59E+02	2.83E+01
m	21	387.23	2.27E+02	38.44			2.27E+02	3.84E+01
m	22	391.42	6.69E+01	21.59			6.69E+01	2.16E+01
M	23	411.56	8.47E+00	1.12			8.47E+00	1.12E+00
m	24	414.90	4.33E+01	18.36			4.33E+01	1.84E+01
m	25	422.40	1.13E+01	11.10			1.13E+01	1.11E+01
	26	437.27	1.03E+02	23.07			1.03E+02	2.31E+01
	27	467.43	3.39E+01	18.89	0.00E+00	0.00E+00	3.39E+01	1.89E+01
	28	521.31	6.00E+00	7.35			6.00E+00	7.35E+00
	29	601.15	1.09E+01	8.25			1.09E+01	8.25E+00
	30	609.21	3.28E+01	15.10	2.25E+00	8.95E-01	3.05E+01	1.51E+01
	31	1002.34	8.00E+00	5.66			8.00E+00	5.66E+00
	32	1120.84	5.00E+00	6.34			5.00E+00	6.34E+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

Analysis Report for 1809025-10  
BC-1

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
SN-113	0.96	255.12	1.93		
		391.69 *	61.90	4.10E+01	1.36E+01
I-125	0.99	35.49 *	6.49	2.28E+01	3.19E+00
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	6.64E+03	2.22E+03
TH-234	0.97	63.29 *	3.80	4.74E+02	7.68E+01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.966	4.10E+01	1.36E+01	
I-125	0.994	2.28E+01	3.19E+00	
PA-231	1.000	6.64E+03	2.22E+03	
TH-234	0.977	4.74E+02	7.68E+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

Analysis Report for 1809025-10

BC-1

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:24:49PM  
 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	54.10	8.08028E-02		
m	4	66.38	1.36692E-01		
	5	81.56	1.28603E+00		
	6	101.35	4.60122E-02	Tol.	U-237
M	7	112.30	2.29630E-01	Tol.	U-237
m	8	116.02	3.79493E-02		
M	9	242.48	2.43717E-02		
m	10	246.32	1.10429E-02		
	11	276.90	1.02007E-01		
	12	296.28	2.78277E-02		
m	14	307.88	3.10636E-02		
M	15	334.22	9.58124E-02		
m	16	338.32	2.78646E-02	Sum	
M	17	352.37	3.37423E-02		
m	18	356.36	8.57642E-01	Tol.	BA-133
	19	377.08	1.57540E-02		
M	20	384.25	1.76708E-01		
m	21	387.23	2.51993E-01		
M	23	411.56	9.40797E-03		
m	24	414.90	4.81058E-02		
m	25	422.40	1.25373E-02		
	26	437.27	1.14548E-01		
	27	467.43	3.76714E-02		
	28	521.31	6.66667E-03		
	29	601.15	1.20940E-02		
	30	609.21	3.39178E-02		
	31	1002.34	8.88889E-03		
	32	1120.84	5.55556E-03		

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

Analysis Report for 1809025-10

BC-1

## NUCLIDE MDA REPORT

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

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	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.95E+01	2.95E+01	-1.26E+01	1.38E+01
	136.48	10.60	2.97E+02		9.38E+00	1.39E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	3.22E+02	3.22E+02	5.62E+01	1.52E+02
+ SN-113	255.12	1.93	1.51E+03	2.38E+01	2.69E+02	6.96E+02
	391.69	* 61.90	2.38E+01		4.10E+01	1.11E+01
SN-119M	23.87	16.10	1.78E-03	1.78E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	4.31E+00	4.31E+00	2.28E+01	2.10E+00
I-129	29.78	57.00	2.41E-01	2.41E-01	8.64E-01	1.19E-01
	33.60	13.20	1.96E+00		9.03E-01	9.66E-01
	39.58	7.52	1.94E+00		-3.11E+00	8.79E-01
BA-133	30.80	97.60	2.22E-01	2.22E-01	2.45E+00	1.10E-01
	302.84	17.80	2.88E+02		8.55E+02	1.39E+02
	356.01	60.00	1.08E+02		6.21E+02	5.31E+01
CE-139	165.85	80.35	4.74E+01	4.74E+01	-1.95E+01	2.22E+01
CE-144	133.54	10.80	2.76E+02	2.76E+02	2.08E+01	1.29E+02
HG-203	279.19	77.30	3.99E+01	3.99E+01	5.70E+00	1.86E+01
PB-210	46.50	4.25	1.10E+01	1.10E+01	-2.68E+00	5.08E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.29E+03		6.47E+01	5.79E+02
	302.67	* 2.30	1.45E+03		6.64E+03	6.84E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.88E+02		8.98E+02	1.89E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.80E-01		-5.72E-01	3.69E-01
	131.42	20.40	1.51E+02		3.62E+01	7.11E+01
+ TH-234	63.29	* 3.80	2.06E+02	2.06E+02	4.74E+02	1.01E+02
NP-237	29.37	14.00	3.10E-01	3.10E-01	-9.21E+00	1.49E-01
	86.50	12.60	9.43E+01		2.76E+01	4.45E+01
U-237	97.08	16.30	9.36E+01	7.82E+01	8.93E+00	4.39E+01
	101.07	26.30	7.82E+01		7.94E+01	3.71E+01
	114.00	12.30	3.78E+02		7.68E+02	1.83E+02
	208.01	22.00	1.58E+02		-6.42E+01	7.29E+01
AM-241	59.54	35.90	7.92E+00	7.92E+00	-6.51E+01	3.77E+00
AM-243	74.67	66.00	1.08E+01	1.08E+01	-2.50E+00	5.10E+00

0287

Analysis Report for 1809025-10

BC-1

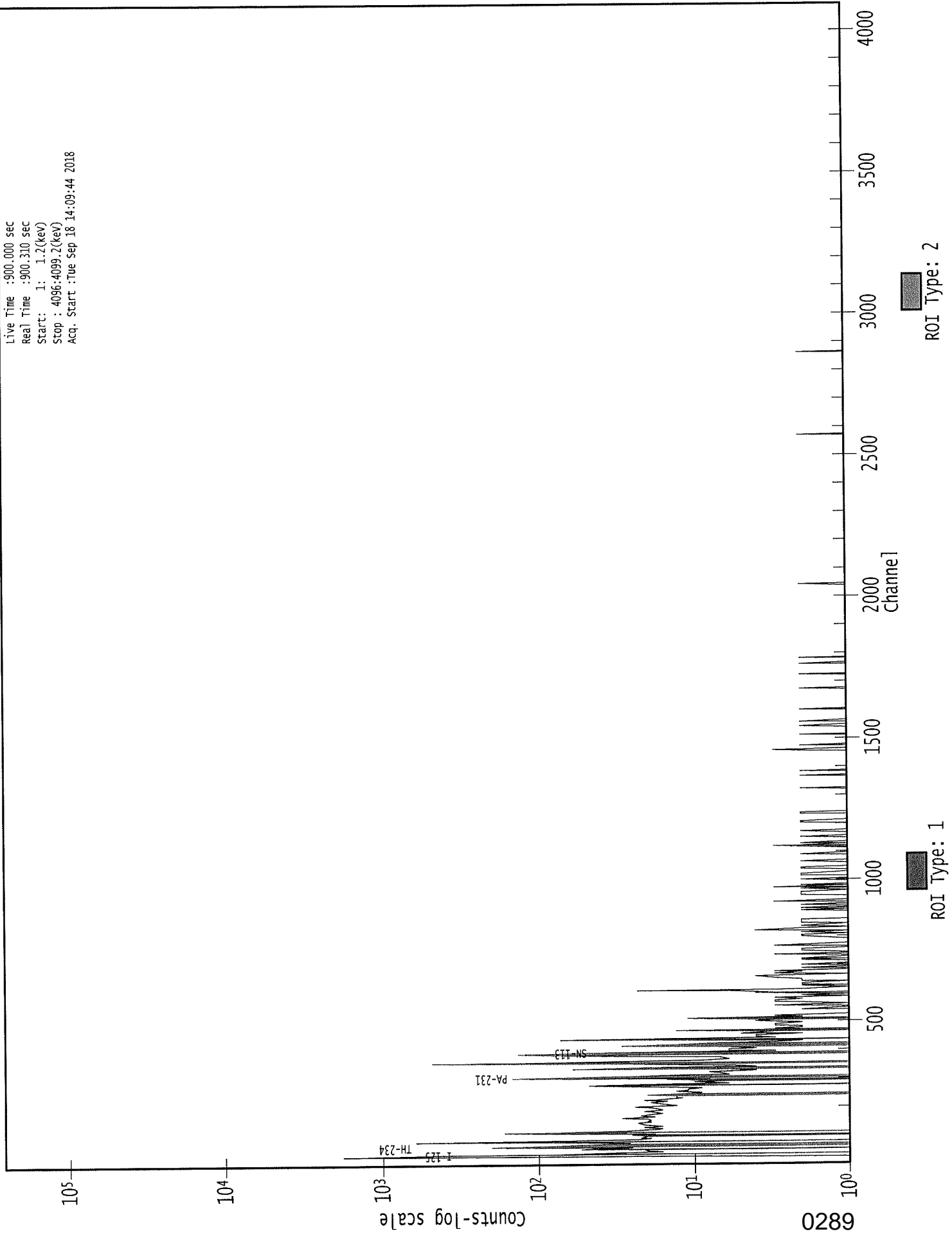
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- + = Nuclide identified during the nuclide identification
  - \* = Energy line found in the spectrum
  - > = MDA value not calculated
  - @ = Half-life too short to be able to perform the decay correction
-



# 0000071965.CNF

Live Time :900.000 sec  
Real Time :900.310 sec  
Start: 1: 1.2(keV)  
Stop : 4096:4099.2(keV)  
Acq. Start :Tue Sep 18 14:09:44 2018



*243  
9/18/2018*

Analysis Report for 1809025-11  
BC-4C

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-11  
 Sample Description : BC-4C  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 10:00:33AM  
 Acquisition Started : 9/18/2018 2:09:53PM  
  
 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 : 1.000FWHM  
  
 Energy Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 71966

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:25:04PM  
 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 1809025-11

BC-4C

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	21.19	17 -	41	21.55	1.13E+02	40.57	2.99E+02	2.02
m	2	31.10	17 -	41	31.46	2.63E+03	108.80	2.47E+02	2.15
m	3	35.36	17 -	41	35.72	6.24E+02	95.06	2.09E+02	2.35
	4	52.12	47 -	57	52.47	8.47E+01	57.20	3.93E+02	3.22
M	5	62.08	58 -	73	62.43	3.53E+02	53.12	2.55E+02	2.48
m	6	66.34	58 -	73	66.69	1.29E+02	49.77	2.28E+02	2.32
m	7	70.22	58 -	73	70.57	3.62E+01	40.81	2.15E+02	2.50
	8	81.20	76 -	86	81.54	1.07E+03	85.05	3.96E+02	2.20
	9	112.75	107 -	119	113.08	3.89E+02	65.29	3.17E+02	2.47
	10	170.45	167 -	174	170.75	3.28E+01	34.12	1.72E+02	3.11
	11	236.74	232 -	241	237.01	3.44E+01	32.28	1.27E+02	7.83
	12	253.22	243 -	264	253.49	6.24E+01	56.86	2.21E+02	18.40
	13	266.64	264 -	270	266.90	1.85E+01	16.93	3.90E+01	3.35
	14	276.28	271 -	282	276.54	9.04E+01	32.92	9.12E+01	2.15
M	15	295.79	290 -	313	296.03	2.37E+01	24.59	8.09E+01	3.68
m	16	303.22	290 -	313	303.46	1.85E+02	32.50	4.18E+01	2.54
m	17	307.16	290 -	313	307.41	4.05E+01	35.37	4.10E+01	3.36
	18	333.78	330 -	337	334.01	3.53E+01	34.29	1.73E+02	2.29
	19	338.60	337 -	342	338.83	2.72E+01	18.68	4.36E+01	1.25
	20	356.22	350 -	360	356.45	6.01E+02	53.09	5.67E+01	2.16
M	21	376.95	365 -	396	377.17	1.78E+01	16.29	4.84E+01	2.84
m	22	384.16	365 -	396	384.38	1.43E+02	33.55	2.80E+01	2.41
m	23	387.29	365 -	396	387.51	2.27E+02	38.80	1.56E+01	2.34
m	24	391.34	365 -	396	391.55	6.38E+01	28.73	3.25E+00	2.27
M	25	415.31	412 -	426	415.51	4.42E+01	16.26	7.00E+00	2.46
m	26	419.30	412 -	426	419.50	3.69E+01	18.11	8.00E+00	2.65
m	27	423.26	412 -	426	423.46	2.40E+01	14.16	7.00E+00	2.36
	28	437.24	432 -	443	437.43	1.41E+02	26.53	1.59E+01	2.50
M	29	464.03	463 -	476	464.21	6.20E+00	3.87	2.06E+00	2.64
m	30	467.97	463 -	476	468.16	2.58E+01	14.56	1.11E+01	2.64
	31	545.14	542 -	548	545.30	5.21E+00	6.34	3.57E+00	1.85
	32	609.11	605 -	612	609.24	2.10E+01	9.17	0.00E+00	3.00
	33	735.25	732 -	737	735.33	6.00E+00	4.90	0.00E+00	1.92
	34	881.07	877 -	884	881.11	4.08E+00	6.32	3.83E+00	1.16

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 : 9/18/2018 2:25:04PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070289.CNF

0291

Analysis Report for 1809025-11

BC-4C

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	21.19	1.13E+02	40.57			1.13E+02	4.06E+01
m	2	31.10	2.63E+03	108.80			2.63E+03	1.09E+02
m	3	35.36	6.24E+02	95.06			6.24E+02	9.51E+01
	4	52.12	8.47E+01	57.20	2.82E-01	5.14E-01	8.45E+01	5.72E+01
M	5	62.08	3.53E+02	53.12	1.31E+01	8.56E-01	3.40E+02	5.31E+01
m	6	66.34	1.29E+02	49.77			1.29E+02	4.98E+01
m	7	70.22	3.62E+01	40.81			3.62E+01	4.08E+01
	8	81.20	1.07E+03	85.05			1.07E+03	8.51E+01
	9	112.75	3.89E+02	65.29			3.89E+02	6.53E+01
	10	170.45	3.28E+01	34.12			3.28E+01	3.41E+01
	11	236.74	3.44E+01	32.28			3.44E+01	3.23E+01
	12	253.22	6.24E+01	56.86			6.24E+01	5.69E+01
	13	266.64	1.85E+01	16.93			1.85E+01	1.69E+01
	14	276.28	9.04E+01	32.92			9.04E+01	3.29E+01
M	15	295.79	2.37E+01	24.59			2.37E+01	2.46E+01
m	16	303.22	1.85E+02	32.50			1.85E+02	3.25E+01
m	17	307.16	4.05E+01	35.37			4.05E+01	3.54E+01
	18	333.78	3.53E+01	34.29			3.53E+01	3.43E+01
	19	338.60	2.72E+01	18.68			2.72E+01	1.87E+01
	20	356.22	6.01E+02	53.09			6.01E+02	5.31E+01
M	21	376.95	1.78E+01	16.29			1.78E+01	1.63E+01
m	22	384.16	1.43E+02	33.55			1.43E+02	3.35E+01
m	23	387.29	2.27E+02	38.80			2.27E+02	3.88E+01
m	24	391.34	6.38E+01	28.73			6.38E+01	2.87E+01
M	25	415.31	4.42E+01	16.26			4.42E+01	1.63E+01
m	26	419.30	3.69E+01	18.11			3.69E+01	1.81E+01
m	27	423.26	2.40E+01	14.16			2.40E+01	1.42E+01
	28	437.24	1.41E+02	26.53			1.41E+02	2.65E+01
M	29	464.03	6.20E+00	3.87			6.20E+00	3.87E+00
m	30	467.97	2.58E+01	14.56			2.58E+01	1.46E+01
	31	545.14	5.21E+00	6.34			5.21E+00	6.34E+00
	32	609.11	2.10E+01	9.17	1.01E+00	8.23E-01	2.00E+01	9.20E+00
	33	735.25	6.00E+00	4.90			6.00E+00	4.90E+00
	34	881.07	4.08E+00	6.32			4.08E+00	6.32E+00

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

Analysis Report for 1809025-11  
BC-4C

## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
SN-113	0.99	255.12 *		1.93	2.57E+03	2.59E+03
		391.69 *		61.90	4.45E+01	2.05E+01
I-125	1.00	35.49 *		6.49	2.96E+01	4.51E+00
BA-133	0.99	30.80 *		97.60	3.60E+00	1.49E-01
		302.84 *		17.80	6.96E+02	2.80E+02
		356.01 *		60.00	5.21E+02	7.51E+01
TH-234	0.97	63.29 *		3.80	5.41E+02	8.65E+01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

### INTERFERENCE CORRECTED REPORT

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	SN-113	0.996	4.46E+01	2.05E+01	
	I-125	1.000	2.96E+01	4.51E+00	
X	I-129	0.898			
	BA-133	0.999	3.60E+00	1.49E-01	
	TH-234	0.974	5.41E+02	8.65E+01	
X	NP-237	0.883			

Analysis Report for 1809025-11

BC-4C

- ? = 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 1809025-11

BC-4C

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:25:04PM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide	
M	1	21.19	1.25231E-01	18.00	Tol.	PA-234M
	4	52.12	9.38340E-02	33.87		
m	6	66.34	1.43532E-01	19.27	Sum	
m	7	70.22	4.01716E-02	56.44	Sum	
	8	81.20	1.18444E+00	3.99		
	9	112.75	4.32738E-01	8.38	Tol.	U-237
	10	170.45	3.64099E-02	52.06		
	11	236.74	3.82653E-02	46.87		
	13	266.64	2.05409E-02	45.80		
	14	276.28	1.00437E-01	18.21		
M	15	295.79	2.63503E-02	51.85		
m	17	307.16	4.49787E-02	43.69		
	18	333.78	3.92714E-02	48.51	Sum	
	19	338.60	3.02381E-02	34.32	Sum	
M	21	376.95	1.98163E-02	45.68		
m	22	384.16	1.58607E-01	11.75		
m	23	387.29	2.51967E-01	8.56	Sum	
M	25	415.31	4.91177E-02	18.40		
m	26	419.30	4.10299E-02	24.52	Sum	
m	27	423.26	2.66797E-02	29.49	Sum	
	28	437.24	1.56719E-01	9.41		
M	29	464.03	6.89148E-03	31.22		
m	30	467.97	2.87167E-02	28.17		
	31	545.14	5.79365E-03	60.84		
	32	609.11	2.22145E-02	23.01	Sum	
	33	735.25	6.66667E-03	40.82		
	34	881.07	4.53704E-03	77.44		

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

Analysis Report for 1809025-11

BC-4C

## NUCLIDE MDA REPORT

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

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	1.57E-09	1.57E-09	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.76E+01	2.76E+01	-6.93E+00	1.30E+01
	136.48	10.60	2.74E+02		-8.78E+01	1.29E+02
NI-59	6.92	29.80	1.09E-07	1.09E-07	-1.72E-09	5.01E-08
MO-93	16.59	52.90	1.15E-03	1.15E-03	-2.71E-04	5.50E-04
	18.60	10.00	2.07E-02		3.06E-02	1.00E-02
NB-93M	16.57	9.43	6.38E-03	6.38E-03	-1.50E-03	3.05E-03
CD-109	88.03	3.72	3.43E+02	3.43E+02	-2.68E+01	1.63E+02
+ SN-113	255.12 *	1.93	3.81E+03	4.69E+01	2.57E+03	1.85E+03
	391.69 *	61.90	4.69E+01		4.45E+01	2.25E+01
SN-119M	23.87	16.10	9.88E-02	9.88E-02	-7.65E-02	4.77E-02
	25.10	22.70	9.94E-02		-9.84E-01	4.80E-02
+ I-125	35.49 *	6.49	8.90E+00	8.90E+00	2.96E+01	4.39E+00
I-129	29.78 *	57.00	4.40E-01	4.40E-01	6.17E+00	2.17E-01
	33.60 *	13.20	4.37E+00		1.45E+01	2.15E+00
	39.58	7.52	5.95E+00		3.72E-01	2.87E+00
+ BA-133	30.80 *	97.60	2.57E-01	2.57E-01	3.60E+00	1.27E-01
	302.84 *	17.80	2.62E+02		6.96E+02	1.26E+02
	356.01 *	60.00	3.14E+01		5.21E+02	1.45E+01
CE-139	165.85	80.35	4.50E+01	4.50E+01	-1.06E+01	2.12E+01
CE-144	133.54	10.80	2.79E+02	2.79E+02	1.15E+02	1.32E+02
HG-203	279.19	77.30	4.59E+01	4.59E+01	4.18E+01	2.17E+01
PB-210	46.50	4.25	1.92E+01	1.92E+01	-1.55E+00	9.14E+00
PA-231	9.28	42.00	4.20E-06	4.20E-06	6.64E-06	2.00E-06
	10.11	20.20	2.21E-05		3.49E-05	1.05E-05
	283.67	1.60	1.35E+03		3.13E+02	6.12E+02
	302.67	2.30	2.03E+03		3.90E+03	9.75E+02
TH-231	25.64	14.70	1.78E-01	1.78E-01	-5.16E+00	8.61E-02
	84.21	6.40	3.80E+02		2.01E+01	1.86E+02
PA-234M	9.89	89.00	3.96E-06	3.96E-06	6.26E-06	1.89E-06
	21.72	64.90	1.14E-02		8.53E-03	5.51E-03
	37.93	23.75	2.45E+00		6.78E+00	1.20E+00
	131.42	20.40	1.41E+02		4.54E+01	6.68E+01
+ TH-234	63.29 *	3.80	1.90E+02	1.90E+02	5.41E+02	9.29E+01
NP-237	29.37 *	14.00	1.79E+00	1.79E+00	2.51E+01	8.84E-01
	86.50	12.60	1.03E+02		3.98E+00	4.91E+01
U-237	97.08	16.30	9.72E+01	6.84E+01	-3.99E+01	4.61E+01
	101.07	26.30	6.84E+01		3.50E+01	3.25E+01
	114.00	12.30	3.61E+02		1.13E+03	1.76E+02
	208.01	22.00	1.90E+02		-6.00E+01	8.96E+01
AM-241	59.54	35.90	1.39E+01	1.39E+01	2.85E+01	6.78E+00
AM-243	74.67	66.00	1.08E+01	1.08E+01	2.08E+00	5.14E+00



Analysis Report for 1809025-11

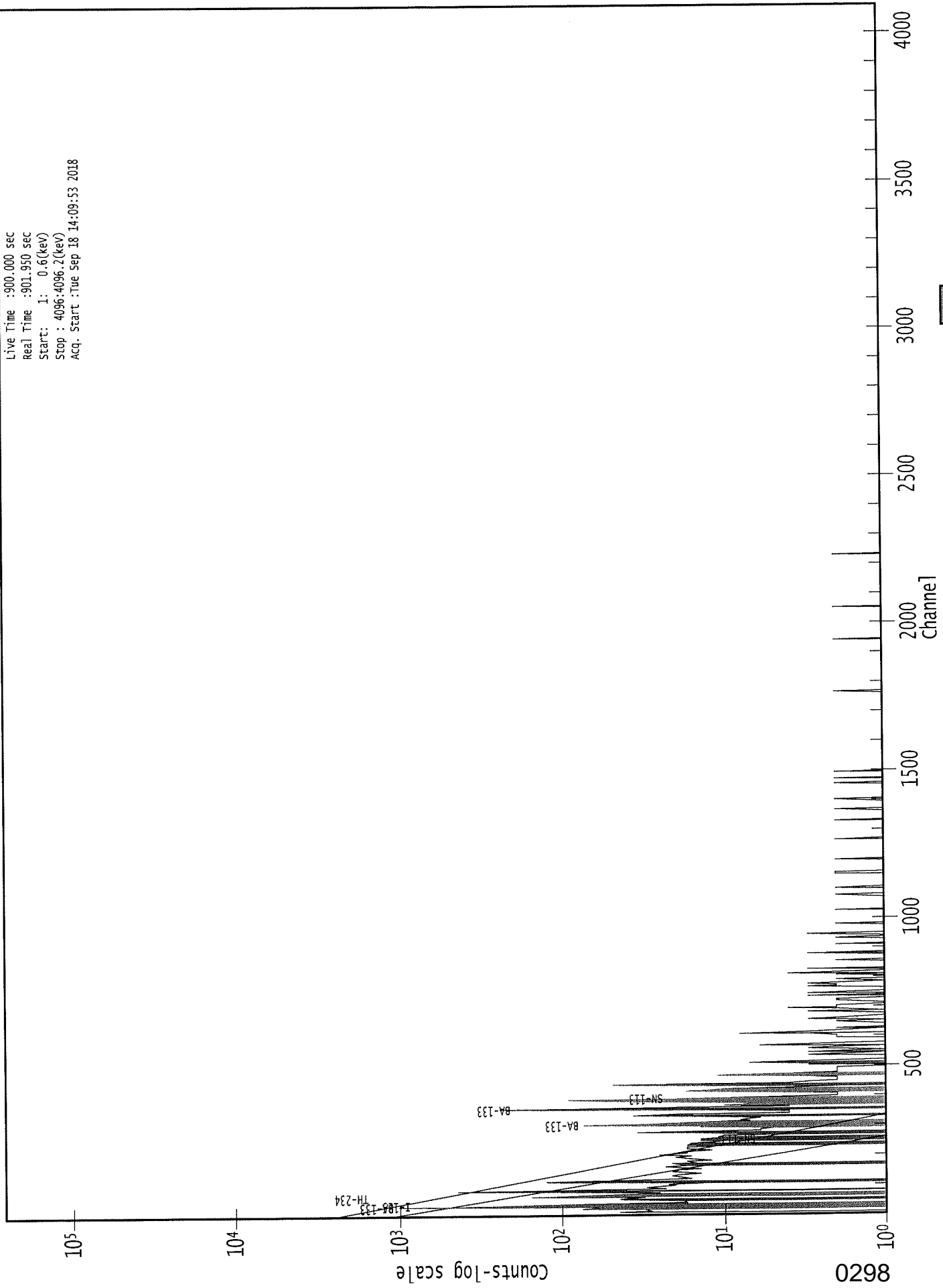
BC-4C

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- + = 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
-

0000071966.CNF

Live Time : 900.000 sec  
Real Time : 901.950 sec  
Start: I: 0.6(keV)  
Stop : 4096.4096.2(keV)  
Acq. Start : Tue Sep 18 14:09:53 2018



ROI Type: 1

ROI Type: 2

*MS  
2/18/18*

Analysis Report for 1809025-12  
BC-4B

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-12  
 Sample Description : BC-4B  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 10:00:43AM  
 Acquisition Started : 9/18/2018 2:13:57PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.5 seconds  
  
 Dead Time : 0.05 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 9 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Used Done On : 11/9/2014  
 Efficiency Calibration Description :  
  
 Sample Number : 71967

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:29:00PM  
 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 1809025-12

BC-4B

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.97	17 -	24	20.03	8.40E+01	56.07	4.76E+02	1.90
M	2	31.45	24 -	40	30.51	3.01E+03	117.21	2.79E+02	2.23
m	3	35.70	24 -	40	34.77	7.49E+02	101.90	1.88E+02	2.27
	4	53.06	48 -	55	52.14	7.84E+01	41.57	2.35E+02	2.06
M	5	62.13	57 -	70	61.21	3.00E+02	51.91	2.41E+02	2.31
m	6	66.70	57 -	70	65.79	1.42E+02	51.29	2.94E+02	2.32
	7	81.52	75 -	86	80.62	1.27E+03	89.42	3.65E+02	2.16
M	8	112.42	105 -	119	111.55	2.36E+02	47.20	1.80E+02	2.61
m	9	116.32	105 -	119	115.45	5.75E+01	40.49	1.65E+02	2.33
	10	135.16	132 -	137	134.30	2.43E+01	24.45	9.75E+01	1.89
	11	161.20	156 -	165	160.36	5.14E+01	41.81	2.21E+02	1.99
	12	242.50	237 -	248	241.73	3.09E+01	35.78	1.46E+02	7.35
	13	277.09	272 -	281	276.35	8.64E+01	31.14	8.71E+01	1.97
	14	295.52	289 -	299	294.79	4.41E+01	25.07	5.98E+01	4.26
M	15	303.60	299 -	310	302.88	1.85E+02	30.90	4.39E+01	2.27
m	16	307.84	299 -	310	307.12	4.21E+01	30.27	4.22E+01	2.53
	17	334.33	329 -	339	333.64	6.99E+01	34.43	1.20E+02	1.81
m	18	356.54	349 -	360	355.86	5.79E+02	50.35	3.62E+01	2.22
M	19	384.58	380 -	394	383.92	1.17E+02	28.58	2.28E+01	2.39
m	20	387.58	380 -	394	386.92	2.05E+02	36.67	1.28E+01	2.34
m	21	392.12	380 -	394	391.47	3.32E+01	19.92	1.37E+00	2.38
M	22	415.82	409 -	432	415.19	4.54E+01	18.69	2.99E+01	2.86
m	23	420.12	409 -	432	419.50	1.74E+01	18.47	1.80E+01	2.86
m	24	426.62	409 -	432	426.00	1.68E+01	12.38	6.12E+00	2.37
	25	437.71	433 -	440	437.11	7.60E+01	17.44	0.00E+00	2.25
	26	467.76	462 -	470	467.17	2.25E+01	12.19	9.00E+00	2.90
	27	494.73	492 -	496	494.17	6.00E+00	4.90	0.00E+00	2.74
	28	610.72	605 -	615	610.26	1.45E+01	9.91	5.06E+00	3.01

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 : 9/18/2018 2:29:00PM

Env. Background File : \\OR-GAMMA1\ApexRoof\Countroom\Data\0000071072.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
1	20.97	8.40E+01	56.07			8.40E+01	5.61E+01

Analysis Report for 1809025-12

BC-4B

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M 2	31.45	3.01E+03	117.21			3.01E+03	1.17E+02
m 3	35.70	7.49E+02	101.90			7.49E+02	1.02E+02
4	53.06	7.84E+01	41.57			7.84E+01	4.16E+01
M 5	62.13	3.00E+02	51.91	1.33E+01	2.31E+00	2.86E+02	5.20E+01
m 6	66.70	1.42E+02	51.29			1.42E+02	5.13E+01
7	81.52	1.27E+03	89.42			1.27E+03	8.94E+01
M 8	112.42	2.36E+02	47.20			2.36E+02	4.72E+01
m 9	116.32	5.75E+01	40.49			5.75E+01	4.05E+01
10	135.16	2.43E+01	24.45			2.43E+01	2.45E+01
11	161.20	5.14E+01	41.81			5.14E+01	4.18E+01
12	242.50	3.09E+01	35.78			3.09E+01	3.58E+01
13	277.09	8.64E+01	31.14			8.64E+01	3.11E+01
14	295.52	4.41E+01	25.07			4.41E+01	2.51E+01
M 15	303.60	1.85E+02	30.90			1.85E+02	3.09E+01
m 16	307.84	4.21E+01	30.27			4.21E+01	3.03E+01
17	334.33	6.99E+01	34.43			6.99E+01	3.44E+01
m 18	356.54	5.79E+02	50.35			5.79E+02	5.03E+01
M 19	384.58	1.17E+02	28.58			1.17E+02	2.86E+01
m 20	387.58	2.05E+02	36.67			2.05E+02	3.67E+01
m 21	392.12	3.32E+01	19.92			3.32E+01	1.99E+01
M 22	415.82	4.54E+01	18.69			4.54E+01	1.87E+01
m 23	420.12	1.74E+01	18.47			1.74E+01	1.85E+01
m 24	426.62	1.68E+01	12.38			1.68E+01	1.24E+01
25	437.71	7.60E+01	17.44			7.60E+01	1.74E+01
26	467.76	2.25E+01	12.19			2.25E+01	1.22E+01
27	494.73	6.00E+00	4.90			6.00E+00	4.90E+00
28	610.72	1.45E+01	9.91	1.31E+00	1.33E+00	1.32E+01	1.00E+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	0.94	255.12	1.93		
		391.69 *	61.90	5.22E+01	3.22E+01

Analysis Report for 1809025-12

BC-4B

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
I-125	0.99	35.49 *	6.49	6.87E+02	9.50E+01
BA-133	0.99	30.80 *	97.60	1.41E+02	6.15E+00
		302.84 *	17.80	9.14E+02	3.19E+02
		356.01 *	60.00	9.09E+02	1.43E+02
		133.54 *	10.80	1.04E+02	1.07E+02
CE-144	0.95	279.19 *	77.30	9.37E+01	4.41E+01
HG-203	0.91	63.29 *	3.80	1.23E+03	2.39E+02
TH-234	0.97				

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

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	SN-113	0.943	5.22E+01	3.22E+01
	I-125	0.999	6.87E+02	9.50E+01
X	I-129	0.590		
	BA-133	0.993	1.42E+02	6.14E+00
	CE-144	0.951	1.04E+02	1.07E+02
	HG-203	0.919	9.37E+01	4.41E+01
	TH-234	0.974	1.23E+03	2.39E+02

? = 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

Analysis Report for 1809025-12

BC-4B

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:29:00PM  
 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	20.97	9.33195E-02	33.38		
4	53.06	8.71429E-02	26.50		
m	6	66.70	1.58003E-01	18.03	Sum
	7	81.52	1.40849E+00	3.53	
M	8	112.42	2.62221E-01	10.00	
m	9	116.32	6.39005E-02	35.20	
	11	161.20	5.70919E-02	40.68	
	12	242.50	3.43376E-02	57.88	
	14	295.52	4.89940E-02	28.43	
m	16	307.84	4.68023E-02	35.93	Sum
	17	334.33	7.76325E-02	24.64	Sum
M	19	384.58	1.29858E-01	12.23	
m	20	387.58	2.28020E-01	8.94	Sum
M	22	415.82	5.03988E-02	20.60	
m	23	420.12	1.92929E-02	53.19	Sum
m	24	426.62	1.87021E-02	36.77	Sum
	25	437.71	8.44444E-02	11.47	Sum
	26	467.76	2.50000E-02	27.08	
	27	494.73	6.66667E-03	40.82	
	28	610.72	1.46273E-02	37.99	

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

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**NUCLIDE MDA REPORT**


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

Analysis Report for 1809025-12

BC-4B

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.18E+01	2.18E+01	-9.71E-01	1.02E+01
	136.48	10.60	2.11E+02		2.16E+01	9.95E+01
NI-59	6.92	29.80	3.92E-02	3.92E-02	-6.82E-02	1.59E-02
MO-93	16.59	52.90	1.35E+00	1.35E+00	3.06E-01	6.50E-01
	18.60	10.00	1.12E+01		4.44E-01	5.41E+00
NB-93M	16.57	9.43	7.56E+00	7.56E+00	1.71E+00	3.63E+00
CD-109	88.03	3.72	3.82E+02	3.82E+02	-1.88E+00	1.81E+02
+ SN-113	255.12	1.93	1.43E+03	4.34E+01	-3.03E+02	6.59E+02
	391.69	* 61.90	4.34E+01		5.22E+01	1.95E+01
SN-119M	23.87	16.10	1.30E+01	9.55E+00	-6.98E+00	6.30E+00
	25.10	22.70	9.55E+00		-1.06E+02	4.61E+00
+ I-125	35.49	* 6.49	1.17E+02	1.17E+02	6.87E+02	5.74E+01
I-129	29.78	* 57.00	1.04E+01	1.04E+01	2.41E+02	5.09E+00
	33.60	13.20	1.09E+02		1.16E+03	5.41E+01
	39.58	7.52	7.18E+01		-3.87E+00	3.46E+01
+ BA-133	30.80	* 97.60	6.08E+00	6.08E+00	1.41E+02	2.98E+00
	302.84	* 17.80	1.98E+02		9.14E+02	9.25E+01
	356.01	* 60.00	6.01E+01		9.09E+02	2.79E+01
CE-139	165.85	80.35	3.36E+01	3.36E+01	1.99E+00	1.59E+01
+ CE-144	133.54	* 10.80	1.70E+02	1.70E+02	1.04E+02	7.93E+01
+ HG-203	279.19	* 77.30	4.75E+01	4.75E+01	9.37E+01	2.23E+01
PB-210	46.50	4.25	1.19E+02	1.19E+02	4.65E+00	5.62E+01
PA-231	9.28	42.00	1.99E-01	1.99E-01	7.40E-02	9.29E-02
	10.11	20.20	6.21E-01		3.51E-01	2.93E-01
	283.67	1.60	1.49E+03		2.32E+02	6.75E+02
	302.67	2.30	2.62E+03		4.58E+03	1.26E+03
TH-231	25.64	14.70	1.61E+01	1.61E+01	-4.87E+02	7.77E+00
	84.21	6.40	6.73E+02		4.30E+03	3.31E+02
PA-234M	9.89	89.00	1.32E-01	1.32E-01	7.47E-02	6.23E-02
	21.72	64.90	2.56E+00		2.82E+00	1.24E+00
	37.93	23.75	3.75E+01		1.30E+02	1.84E+01
	131.42	20.40	1.00E+02		-2.12E+01	4.71E+01
+ TH-234	63.29	* 3.80	4.69E+02	4.69E+02	1.23E+03	2.29E+02
NP-237	29.37	14.00	7.06E+01	7.06E+01	6.37E+02	3.49E+01
	86.50	12.60	1.21E+02		1.66E+01	5.78E+01
U-237	97.08	16.30	9.51E+01	6.87E+01	-7.34E+01	4.49E+01
	101.07	26.30	6.87E+01		5.13E+01	3.26E+01
	114.00	12.30	2.88E+02		6.37E+02	1.40E+02
	208.01	22.00	1.53E+02		1.06E+01	7.22E+01
AM-241	59.54	35.90	4.01E+01	4.01E+01	9.20E+01	1.95E+01
AM-243	74.67	66.00	1.94E+01	1.94E+01	-1.77E+00	9.24E+00

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

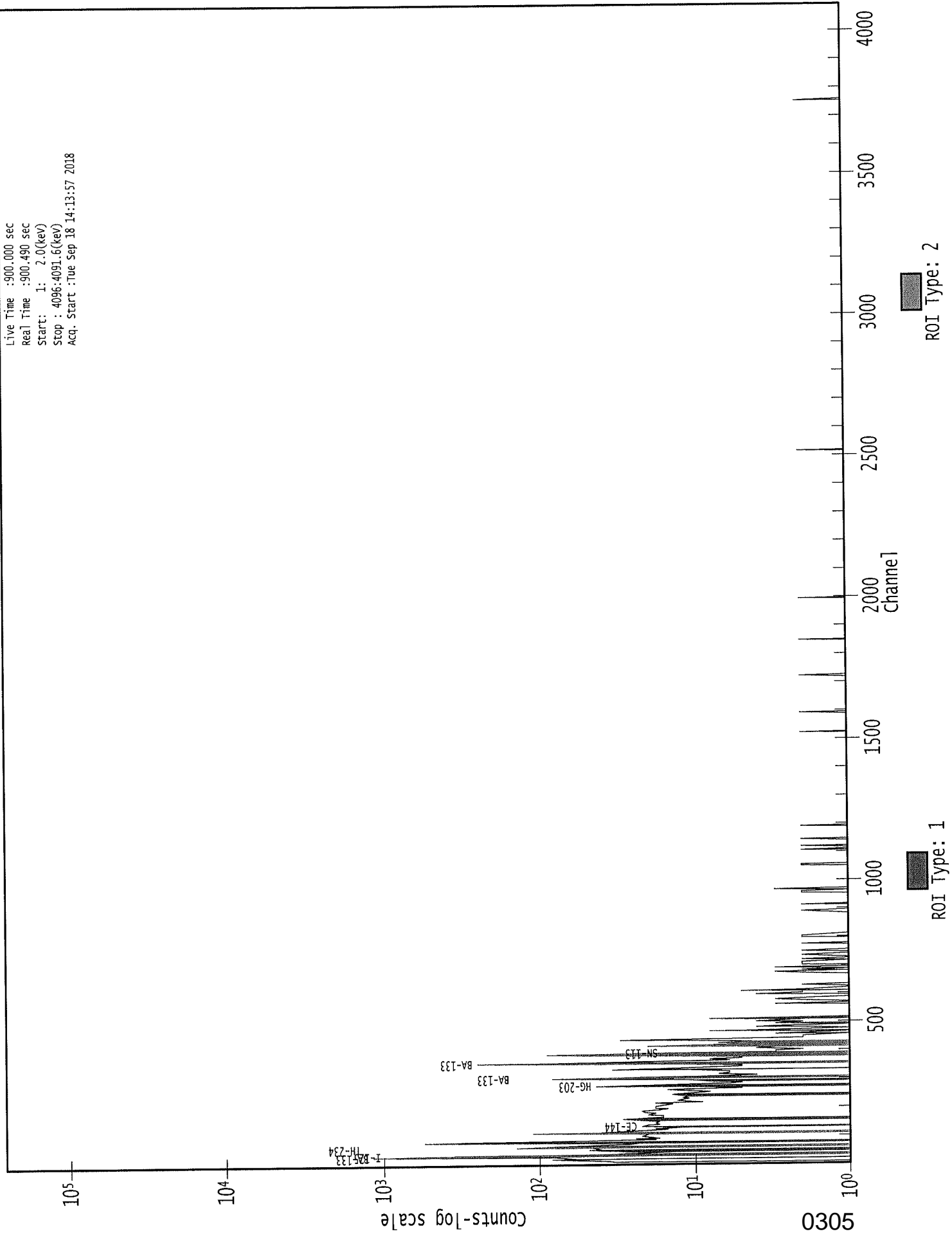
&gt; = MDA value not calculated

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



# 0000071967.CNF

Live Time : 900.000 sec  
Real Time : 900.490 sec  
Start : 1: 2.0(keV)  
Stop : 4096:4091.6(keV)  
Acq. Start : Tue Sep 18 14:13:57 2018



*W/S  
9/18/18*

Analysis Report for 1809025-13  
BC-4A

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 1809025-13  
 Sample Description : BC-4A  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 10:01:02AM  
 Acquisition Started : 9/18/2018 2:23:53PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE1  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.3 seconds  
  
 Dead Time : 0.04 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 19 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 6/16/2018  
 Efficiency Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 71968

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/18/2018 2:38:57PM  
 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 1809025-13

BC-4A

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	25.93	25 -	45	26.31	5.38E+01	23.00	1.28E+02	1.77
m	2	30.88	25 -	45	31.26	2.69E+03	110.22	2.18E+02	1.85
m	3	35.23	25 -	45	35.60	7.10E+02	67.14	1.65E+02	2.03
M	4	50.78	47 -	57	51.15	3.07E+01	30.90	1.60E+02	1.66
m	5	53.50	47 -	57	53.87	7.62E+01	34.85	1.72E+02	1.66
M	6	62.01	58 -	74	62.38	2.81E+02	51.86	2.52E+02	2.23
m	7	65.86	58 -	74	66.23	1.50E+02	50.29	2.37E+02	2.24
	8	81.16	77 -	86	81.52	1.06E+03	84.24	4.06E+02	2.07
	9	112.87	108 -	118	113.22	3.01E+02	62.58	3.59E+02	2.10
	10	160.74	157 -	164	161.09	4.88E+01	37.04	1.96E+02	1.44
	11	188.30	183 -	194	188.63	5.92E+01	48.95	2.70E+02	8.02
	12	276.72	272 -	281	277.03	9.37E+01	37.22	1.43E+02	1.74
M	13	302.96	299 -	313	303.27	2.22E+02	32.95	4.74E+01	2.06
m	14	307.53	299 -	313	307.84	4.80E+01	29.80	3.94E+01	2.53
M	15	333.81	328 -	343	334.11	8.80E+01	25.06	4.80E+01	1.92
m	16	338.07	328 -	343	338.37	3.62E+01	23.15	4.80E+01	2.11
	17	356.14	353 -	360	356.44	7.39E+02	60.56	1.16E+02	2.08
	18	363.22	361 -	367	363.51	6.31E+01	24.67	6.18E+01	3.11
	19	376.93	374 -	380	377.22	1.34E+01	17.18	4.12E+01	1.63
M	20	384.00	381 -	390	384.29	1.43E+02	45.83	1.03E+02	2.36
m	21	386.95	381 -	390	387.24	2.61E+02	43.27	1.61E+02	1.80
	22	391.64	391 -	395	391.93	5.66E+01	26.59	7.48E+01	1.37
M	23	414.95	411 -	432	415.23	5.21E+01	19.62	8.78E+00	2.38
m	24	418.12	411 -	432	418.40	3.35E+01	21.09	1.07E+01	2.38
m	25	421.56	411 -	432	421.84	1.67E+01	17.23	1.21E+01	2.38
	26	436.87	433 -	440	437.15	1.28E+02	25.14	1.99E+01	2.06
	27	445.78	442 -	449	446.06	1.91E+01	12.96	1.38E+01	2.08
	28	467.74	463 -	471	468.02	2.47E+01	15.66	2.26E+01	2.04
	29	474.37	472 -	479	474.64	1.36E+01	11.14	1.07E+01	1.93
	30	510.63	506 -	515	510.89	3.40E+01	14.35	9.95E+00	2.05
	31	552.86	550 -	555	553.11	4.58E+00	5.74	2.83E+00	1.84
	32	582.32	580 -	585	582.57	9.32E+00	7.28	3.36E+00	1.54
	33	597.63	595 -	601	597.88	8.00E+00	5.66	0.00E+00	3.25
	34	962.10	959 -	964	962.28	5.50E+00	6.08	3.00E+00	1.11
	35	1178.03	1174 -	1180	1178.17	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 : 9/18/2018 2:38:57PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070287.CNF

0307

Analysis Report for 1809025-13

BC-4A

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	25.93	5.38E+01	23.00			5.38E+01	2.30E+01
m	2	30.88	2.69E+03	110.22			2.69E+03	1.10E+02
m	3	35.23	7.10E+02	67.14			7.10E+02	6.71E+01
M	4	50.78	3.07E+01	30.90			3.07E+01	3.09E+01
m	5	53.50	7.62E+01	34.85			7.62E+01	3.49E+01
M	6	62.01	2.81E+02	51.86			2.81E+02	5.19E+01
m	7	65.86	1.50E+02	50.29			1.50E+02	5.03E+01
	8	81.16	1.06E+03	84.24			1.06E+03	8.42E+01
	9	112.87	3.01E+02	62.58			3.01E+02	6.26E+01
	10	160.74	4.88E+01	37.04			4.88E+01	3.70E+01
	11	188.30	5.92E+01	48.95			5.92E+01	4.89E+01
	12	276.72	9.37E+01	37.22			9.37E+01	3.72E+01
M	13	302.96	2.22E+02	32.95			2.22E+02	3.30E+01
m	14	307.53	4.80E+01	29.80			4.80E+01	2.98E+01
M	15	333.81	8.80E+01	25.06			8.80E+01	2.51E+01
m	16	338.07	3.62E+01	23.15	6.20E-01	1.14E+00	3.56E+01	2.32E+01
	17	356.14	7.39E+02	60.56			7.39E+02	6.06E+01
	18	363.22	6.31E+01	24.67			6.31E+01	2.47E+01
	19	376.93	1.34E+01	17.18			1.34E+01	1.72E+01
M	20	384.00	1.43E+02	45.83			1.43E+02	4.58E+01
m	21	386.95*	2.61E+02	43.27			2.61E+02	4.33E+01
	22	391.64	5.66E+01	26.59			5.66E+01	2.66E+01
M	23	414.95	5.21E+01	19.62			5.21E+01	1.96E+01
m	24	418.12	3.35E+01	21.09			3.35E+01	2.11E+01
m	25	421.56	1.67E+01	17.23			1.67E+01	1.72E+01
	26	436.87	1.28E+02	25.14			1.28E+02	2.51E+01
	27	445.78	1.91E+01	12.96			1.91E+01	1.30E+01
	28	467.74	2.47E+01	15.66			2.47E+01	1.57E+01
	29	474.37	1.36E+01	11.14			1.36E+01	1.11E+01
	30	510.63	3.40E+01	14.35	1.91E+01	1.44E+00	1.49E+01	1.44E+01
	31	552.86	4.58E+00	5.74			4.58E+00	5.74E+00
	32	582.32	9.32E+00	7.28			9.32E+00	7.28E+00
	33	597.63	8.00E+00	5.66			8.00E+00	5.66E+00
	34	962.10	5.50E+00	6.08			5.50E+00	6.08E+00
	35	1178.03	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

Analysis Report for 1809025-13

BC-4A

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## NUCLIDE IDENTIFICATION REPORT

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

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### IDENTIFIED NUCLIDES

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<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
SN-113	0.97	255.12	1.93		
		391.69 *	61.90	3.35E+01	1.60E+01
I-125	0.99	35.49 *	6.49	6.91E+00	6.54E-01
BA-133	1.00	30.80 *	97.60	5.14E-01	2.10E-02
		302.84 *	17.80	9.82E+02	4.55E+02
		356.01 *	60.00	6.23E+02	8.51E+01
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	7.60E+03	3.52E+03
TH-231	0.99	25.64 *	14.70	1.17E-02	5.01E-03
		84.21	6.40		
TH-234	0.95	63.29 *	3.80	3.16E+02	5.88E+01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

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## INTERFERENCE CORRECTED REPORT

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.971	3.35E+01	1.60E+01	
I-125	0.998	6.91E+00	6.54E-01	
X I-129	0.745			

0309

Analysis Report for 1809025-13  
BC-4A

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
BA-133	1.000	5.14E-01	2.10E-02	
PA-231	1.000	7.59E+03	3.52E+03	
TH-231	0.990	1.17E-02	5.01E-03	
TH-234	0.952	3.16E+02	5.88E+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

Analysis Report for 1809025-13

BC-4A

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:38:57PM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M	4	50.78	3.40756E-02	50.38	Sum
m	5	53.50	8.46913E-02	22.86	Sum
m	7	65.86	1.66721E-01	16.76	Sum
	8	81.16	1.18313E+00	3.96	
	9	112.87	3.33947E-01	10.41	Tol. U-237
	10	160.74	5.42593E-02	37.93	
	11	188.30	6.57703E-02	41.35	
	12	276.72	1.04121E-01	19.86	
m	14	307.53	5.33845E-02	31.01	
M	15	333.81	9.78023E-02	14.24	Sum
m	16	338.07	3.95742E-02	32.54	Sum
	18	363.22	7.01300E-02	19.55	Sum
	19	376.93	1.48693E-02	64.20	
M	20	384.00	1.59321E-01	15.98	Sum
m	21	386.95	2.90326E-01	8.28	Sum
M	23	414.95	5.78676E-02	18.83	
m	24	418.12	3.71908E-02	31.50	Sum
m	25	421.56	1.86054E-02	51.44	Sum
	26	436.87	1.42287E-01	9.82	
	27	445.78	2.11966E-02	33.97	
	28	467.74	2.74383E-02	31.71	
	29	474.37	1.51462E-02	40.84	
	30	510.63	1.65683E-02	48.37	
	31	552.86	5.09259E-03	62.67	
	32	582.32	1.03535E-02	39.06	
	33	597.63	8.88889E-03	35.36	
	34	962.10	6.11111E-03	55.30	
	35	1178.03	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

Analysis Report for 1809025-13

BC-4A

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## NUCLIDE MDA REPORT

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

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	1.90E-13	1.90E-13	0.00E+00	0.00E+00
CO-57	122.06	85.51	3.65E+01	3.65E+01	1.91E+01	1.71E+01
	136.48	10.60	3.86E+02		9.41E+01	1.81E+02
NI-59	6.92	29.80	2.77E-12	2.77E-12	0.00E+00	0.00E+00
MO-93	16.59	52.90	7.66E-06	7.66E-06	-1.07E-05	3.39E-06
	18.60	10.00	4.62E-04		5.88E-04	2.21E-04
NB-93M	16.57	9.43	4.23E-05	4.23E-05	-5.94E-05	1.87E-05
CD-109	88.03	3.72	3.82E+02	3.82E+02	2.59E+02	1.82E+02
+ SN-113	255.12	1.93	2.26E+03	2.30E+01	1.29E+03	1.05E+03
	391.69	*	61.90	2.30E+01	3.35E+01	1.07E+01
SN-119M	23.87	16.10	5.22E-03	5.22E-03	-1.89E-04	2.50E-03
	25.10	22.70	5.84E-03		-7.19E-04	2.79E-03
+ I-125	35.49	*	6.49	1.44E+00	1.44E+00	6.91E+00
I-129	29.78	*	57.00	4.87E-02	4.87E-02	8.79E-01
	33.60		13.20	6.02E-01	-1.86E+00	2.97E-01
	39.58		7.52	1.50E+00	-8.36E-01	7.21E-01
+ BA-133	30.80	*	97.60	2.85E-02	2.85E-02	5.14E-01
	302.84	*	17.80	2.28E+02		9.82E+02
	356.01	*	60.00	3.93E+01		6.23E+02
CE-139	165.85	80.35	6.59E+01	6.59E+01	9.52E+00	3.09E+01
CE-144	133.54	10.80	3.26E+02	3.26E+02	7.20E+01	1.52E+02
HG-203	279.19	77.30	6.29E+01	6.29E+01	6.39E+00	2.98E+01
PB-210	46.50	4.25	6.23E+00	6.23E+00	-5.02E+00	2.92E+00
+ PA-231	9.28	42.00	2.61E-10	2.61E-10	0.00E+00	0.00E+00
	10.11	20.20	2.08E-09		0.00E+00	0.00E+00
	283.67	1.60	1.57E+03		-7.92E+00	7.09E+02
	302.67	*	2.30	1.76E+03		7.60E+03
+ TH-231	25.64	*	14.70	3.21E-02	3.21E-02	1.17E-02
	84.21		6.40	2.24E+02		-1.50E+03
PA-234M	9.89	89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
	21.72	64.90	5.47E-04		1.16E-03	2.64E-04
	37.93	23.75	5.71E-01		1.24E+00	2.79E-01
	131.42	20.40	1.48E+02		-8.45E+01	6.83E+01
+ TH-234	63.29	*	3.80	1.41E+02	1.41E+02	3.16E+02
NP-237	29.37	14.00	2.01E-01	2.01E-01	1.95E+00	9.94E-02
	86.50	12.60	1.09E+02		8.93E+01	5.22E+01
U-237	97.08	16.30	1.03E+02	7.60E+01	-6.69E+01	4.86E+01
	101.07	26.30	7.60E+01		3.05E+01	3.57E+01
	114.00	12.30	4.46E+02		9.08E+02	2.16E+02
	208.01	22.00	2.41E+02		-5.40E+00	1.12E+02
AM-241	59.54	35.90	7.36E+00	7.36E+00	4.56E+00	3.55E+00
AM-243	74.67	66.00	8.28E+00	8.28E+00	-3.37E-01	3.90E+00

0312



Analysis Report for 1809025-13

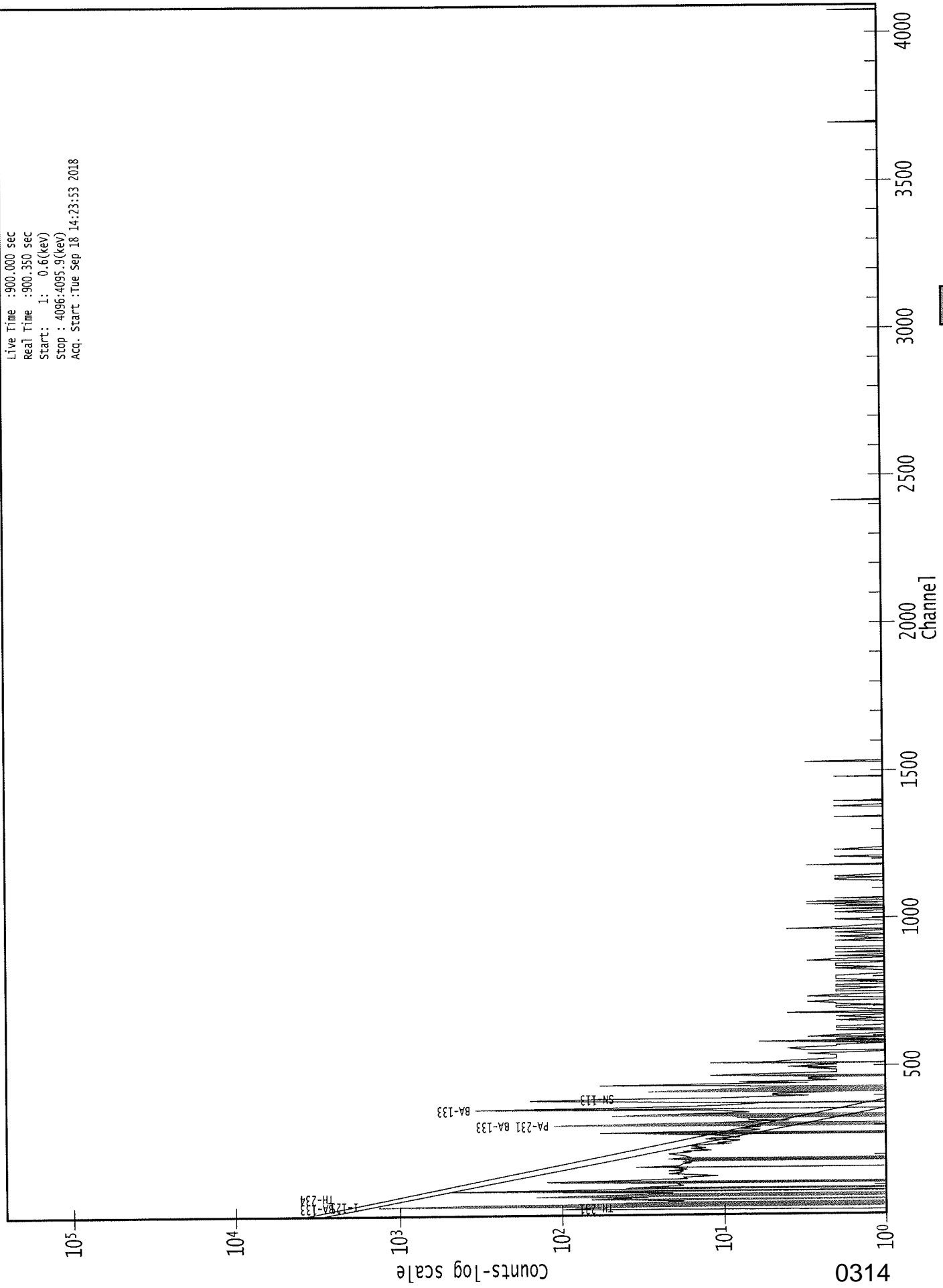
BC-4A

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- + = 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
-

0000071968.CNF

Live Time : 900.000 sec  
Real Time : 900.350 sec  
Start: 1: 0.6(keV)  
Stop : 4096.4095.9(keV)  
Acq. Start : Tue Sep 18 14:23:53 2018



ROI Type: 1

ROI Type: 2

K15  
9/18/18Analysis Report for 1809025-14  
BC-6

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**GAMMA SPECTRUM ANALYSIS**

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Sample Identification : 1809025-14  
Sample Description : BC-6  
Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
Facility : Countroom

Sample Taken On : 9/18/2018 10:01:16AM  
Acquisition Started : 9/18/2018 2:25:19PM

Procedure : BAFIL  
Operator : Administrator  
Detector Name : GE2  
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) : 28 - 4096  
Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 2/17/2018  
Efficiency Calibration Used Done On : 2/24/2018  
Efficiency Calibration Description :

Sample Number : 71969

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**PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/18/2018 2:40:23PM  
Peak Analysis From Channel : 1  
Peak Analysis To Channel : 4096

<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
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Analysis Report for 1809025-14

BC-6

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)	
1	35.95	35 -	42	35.73	5.70E+02	94.57	4.43E+02	2.56	
2	53.24	49 -	57	53.02	8.74E+01	44.65	2.55E+02	2.42	
M	3	62.27	58 -	69	62.04	2.51E+02	42.37	1.71E+02	1.50
m	4	66.56	58 -	69	66.32	1.10E+02	36.54	1.77E+02	1.52
5	81.58	77 -	85	81.34	1.09E+03	79.05	2.90E+02	1.78	
6	112.19	108 -	115	111.93	1.97E+02	51.81	3.08E+02	1.51	
7	144.46	141 -	148	144.19	4.29E+01	33.94	1.62E+02	5.62	
8	161.34	158 -	164	161.06	3.31E+01	32.31	1.68E+02	1.03	
9	184.07	176 -	192	183.78	7.50E+01	59.27	3.06E+02	7.83	
10	198.01	194 -	200	197.71	2.79E+01	29.84	1.38E+02	2.76	
11	206.36	201 -	212	206.06	6.02E+01	39.14	1.60E+02	8.93	
12	276.68	273 -	280	276.35	9.90E+01	27.06	5.60E+01	1.65	
M	13	303.28	299 -	310	302.94	2.03E+02	30.27	2.74E+01	1.47
m	14	307.37	299 -	310	307.02	3.96E+01	18.10	3.91E+01	1.54
15	333.80	330 -	336	333.44	6.93E+01	25.39	6.74E+01	1.78	
16	338.24	337 -	341	337.88	2.06E+01	16.45	3.47E+01	2.81	
17	356.35	352 -	359	355.98	7.50E+02	57.55	5.18E+01	1.35	
18	378.00	374 -	381	377.62	1.85E+01	12.96	1.50E+01	2.02	
M	19	384.38	381 -	389	384.00	1.34E+02	31.76	4.83E+01	1.62
m	20	387.24	381 -	389	386.85	2.05E+02	32.68	8.32E+01	1.49
21	391.58	390 -	395	391.20	5.20E+01	21.63	4.00E+01	1.41	
M	22	414.52	411 -	425	414.12	3.13E+01	16.12	2.18E+01	1.65
m	23	418.55	411 -	425	418.15	2.04E+01	13.11	1.18E+01	1.66
m	24	422.30	411 -	425	421.90	8.56E+00	11.65	7.16E+00	1.66
25	437.44	433 -	440	437.03	1.05E+02	24.25	2.71E+01	1.35	
26	468.22	465 -	471	467.80	1.53E+01	15.44	3.34E+01	1.28	
27	610.14	606 -	612	609.64	1.31E+01	10.43	9.83E+00	1.04	

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 : 9/18/2018 2:40:23PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070288.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
1	35.95	5.70E+02	94.57			5.70E+02	9.46E+01
2	53.24	8.74E+01	44.65			8.74E+01	4.47E+01

0316

Analysis Report for 1809025-14

BC-6

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	3	62.27	2.51E+02	42.37			2.51E+02	4.24E+01
m	4	66.56	1.10E+02	36.54	3.70E+00	1.42E+00	1.06E+02	3.66E+01
	5	81.58	1.09E+03	79.05			1.09E+03	7.90E+01
	6	112.19	1.97E+02	51.81			1.97E+02	5.18E+01
	7	144.46	4.29E+01	33.94	3.34E+00	1.35E+00	3.96E+01	3.40E+01
	8	161.34	3.31E+01	32.31			3.31E+01	3.23E+01
	9	184.07	7.50E+01	59.27			7.50E+01	5.93E+01
	10	198.01	2.79E+01	29.84	2.92E+00	1.69E+00	2.50E+01	2.99E+01
	11	206.36	6.02E+01	39.14			6.02E+01	3.91E+01
	12	276.68	9.90E+01	27.06			9.90E+01	2.71E+01
M	13	303.28	2.03E+02	30.27			2.03E+02	3.03E+01
m	14	307.37	3.96E+01	18.10			3.96E+01	1.81E+01
	15	333.80	6.93E+01	25.39			6.93E+01	2.54E+01
	16	338.24	2.06E+01	16.45	1.24E+00	1.28E+00	1.94E+01	1.65E+01
	17	356.35	7.50E+02	57.55			7.50E+02	5.75E+01
	18	378.00	1.85E+01	12.96			1.85E+01	1.30E+01
M	19	384.38	1.34E+02	31.76			1.34E+02	3.18E+01
m	20	387.24	2.05E+02	32.68			2.05E+02	3.27E+01
	21	391.58	5.20E+01	21.63			5.20E+01	2.16E+01
M	22	414.52	3.13E+01	16.12			3.13E+01	1.61E+01
m	23	418.55	2.04E+01	13.11			2.04E+01	1.31E+01
m	24	422.30	8.56E+00	11.65			8.56E+00	1.17E+01
	25	437.44	1.05E+02	24.25			1.05E+02	2.42E+01
	26	468.22	1.53E+01	15.44	0.00E+00	0.00E+00	1.53E+01	1.54E+01
	27	610.14	1.31E+01	10.43	2.25E+00	8.95E-01	1.08E+01	1.05E+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	0.96	255.12	1.93		
		391.69 *	61.90	3.19E+01	1.35E+01
I-125	0.99	35.49 *	6.49	2.27E+01	3.76E+00
PA-231	1.00	9.28	42.00		

0317

Analysis Report for 1809025-14

BC-6

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
PA-231	1.00	10.11 283.67 302.67 *	20.20 1.60 2.30	5.96E+03	2.01E+03
TH-234	0.97	63.29 *	3.80	4.23E+02	7.24E+01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.967	3.19E+01	1.35E+01	
I-125	0.995	2.27E+01	3.76E+00	
PA-231	1.000	5.96E+03	2.01E+03	
TH-234	0.973	4.23E+02	7.24E+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

Analysis Report for 1809025-14

BC-6

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 UNIDENTIFIED PEAKS
 

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Peak Locate Performed on : 9/18/2018 2:40:23PM  
 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	53.24	9.71447E-02	25.54	
m	4	66.56	1.18052E-01	17.21	
	5	81.58	1.20867E+00	3.63	
	6	112.19	2.19005E-01	13.14	
	7	144.46	4.39546E-02	42.93	
	8	161.34	3.67949E-02	48.78	
	9	184.07	8.33333E-02	39.51	
	10	198.01	2.77436E-02	59.84	
	11	206.36	6.69246E-02	32.49	
	12	276.68	1.10000E-01	13.66	
m	14	307.37	4.40178E-02	22.84	
	15	333.80	7.69903E-02	18.32	
	16	338.24	2.15557E-02	42.54	Sum
	17	356.35	8.33441E-01	3.84	Tol. BA-133
	18	378.00	2.05556E-02	35.03	
M	19	384.38	1.48507E-01	11.88	
m	20	387.24	2.27414E-01	7.98	
M	22	414.52	3.47970E-02	25.73	
m	23	418.55	2.26370E-02	32.16	
m	24	422.30	9.50771E-03	68.08	
	25	437.44	1.17157E-01	11.50	
	26	468.22	1.70139E-02	50.40	
	27	610.14	1.20320E-02	48.33	

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

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Analysis Report for 1809025-14

BC-6

## NUCLIDE MDA REPORT

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

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	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.93E+01	2.93E+01	7.51E+00	1.37E+01
	136.48	10.60	2.89E+02		9.79E+01	1.35E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.74E+02	2.74E+02	-3.50E+01	1.28E+02
+ SN-113	255.12	1.93	1.14E+03	1.79E+01	-5.84E+02	5.09E+02
	391.69	*	61.90	1.79E+01	3.19E+01	8.13E+00
SN-119M	23.87	16.10	1.78E-03	1.78E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	*	6.49	5.45E+00	2.27E+01	2.67E+00
I-129	29.78	57.00	2.35E-01	2.35E-01	8.41E-01	1.16E-01
	33.60	13.20	1.87E+00		8.11E-02	9.21E-01
	39.58	7.52	2.04E+00		-3.41E+00	9.31E-01
BA-133	30.80	97.60	2.16E-01	2.16E-01	2.32E+00	1.07E-01
	302.84	17.80	2.73E+02		7.75E+02	1.31E+02
	356.01	60.00	1.06E+02		6.13E+02	5.21E+01
CE-139	165.85	80.35	4.27E+01	4.27E+01	-9.78E+00	1.98E+01
CE-144	133.54	10.80	2.72E+02	2.72E+02	6.83E+00	1.27E+02
HG-203	279.19	77.30	3.72E+01	3.72E+01	-2.77E+01	1.72E+01
PB-210	46.50	4.25	1.10E+01	1.10E+01	3.30E+00	5.08E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.26E+03		8.00E+02	5.69E+02
	302.67	*	2.30	1.22E+03	5.96E+03	5.72E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.65E+02		8.41E+02	1.78E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.27E-01		-1.50E+00	3.42E-01
	131.42	20.40	1.31E+02		0.00E+00	6.11E+01
+ TH-234	63.29	*	3.80	1.52E+02	4.23E+02	7.36E+01
NP-237	29.37	14.00	3.09E-01	3.09E-01	-8.82E+00	1.49E-01
	86.50	12.60	8.12E+01		-1.74E+01	3.80E+01
U-237	97.08	16.30	9.37E+01	6.34E+01	-1.89E+00	4.39E+01
	101.07	26.30	6.34E+01		1.93E+01	2.97E+01
	114.00	12.30	3.58E+02		3.85E+02	1.73E+02
	208.01	22.00	1.66E+02		-5.06E+01	7.66E+01
AM-241	59.54	35.90	7.68E+00	7.68E+00	-5.37E+01	3.65E+00
AM-243	74.67	66.00	9.31E+00	9.31E+00	-2.20E+00	4.36E+00



Analysis Report for 1809025-14

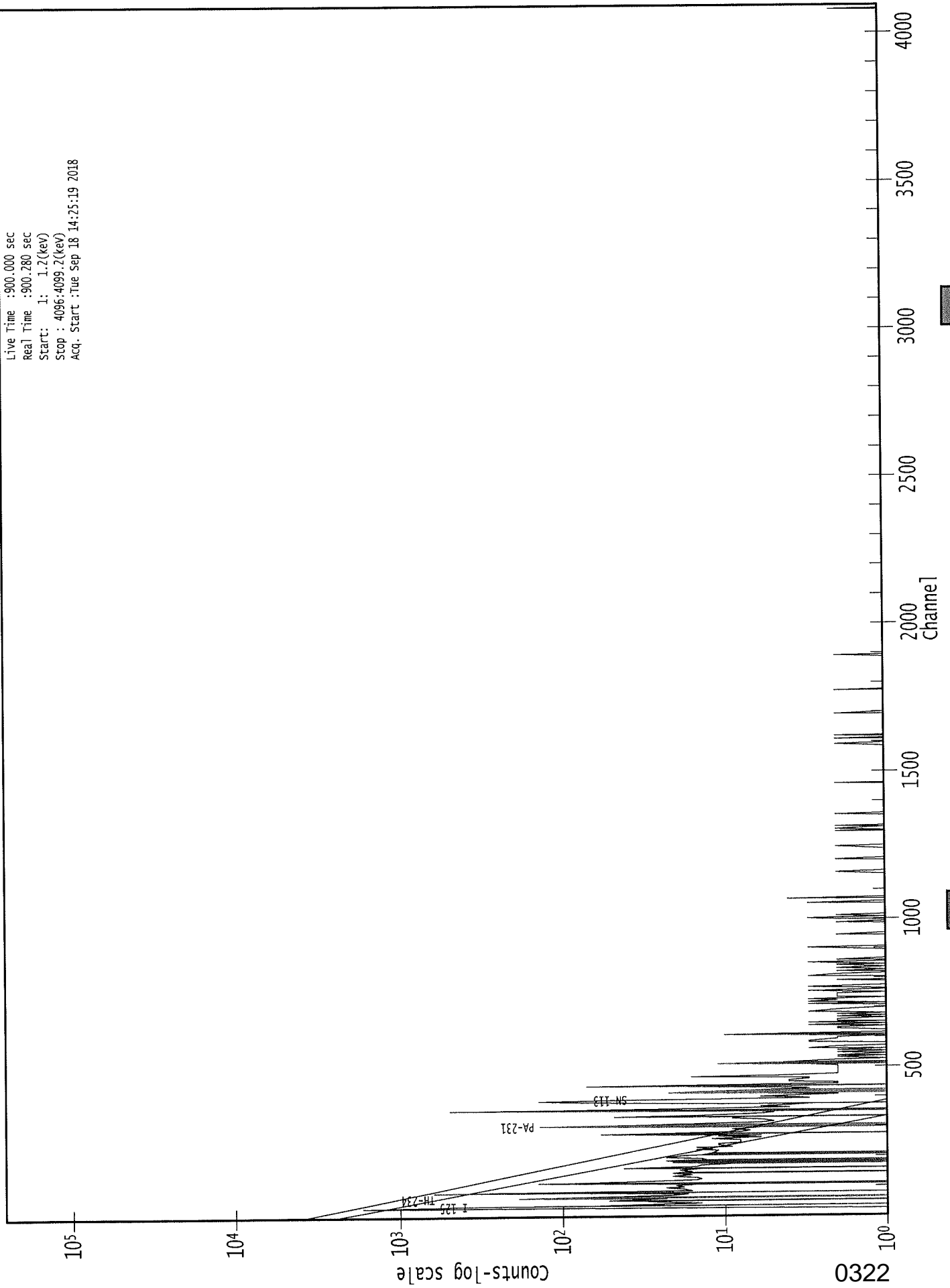
BC-6

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- + = 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
-

# 0000071969.CNF

Live Time : 900.000 sec  
Real Time : 900.280 sec  
Start : 1: 1.2(keV)  
Stop : 4096:4099.2(keV)  
Acq. Start : Tue Sep 18 14:25:19 2018



Analysis Report for 1809025-15  
BC-7B

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-15  
 Sample Description : BC-7B  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 10:01:28AM  
 Acquisition Started : 9/18/2018 2:25:27PM  
  
 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) : 9 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 71970

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:40:38PM  
 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 1809025-15

BC-7B

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
M	1	21.22	18 -	41	21.59	1.25E+02	42.05	2.18E+02	2.39
m	2	31.06	18 -	41	31.42	2.22E+03	100.54	1.93E+02	2.04
m	3	35.22	18 -	41	35.58	5.72E+02	89.09	2.35E+02	2.43
M	4	61.98	49 -	70	62.33	2.92E+02	48.53	2.12E+02	2.48
m	5	66.29	49 -	70	66.63	1.24E+02	46.47	2.29E+02	2.49
	6	81.31	77 -	88	81.65	9.75E+02	82.34	3.60E+02	2.29
M	7	112.12	106 -	122	112.45	2.94E+02	46.43	1.52E+02	2.56
m	8	116.49	106 -	122	116.82	6.67E+01	41.76	1.52E+02	2.57
	9	145.32	140 -	150	145.63	4.33E+01	39.12	1.79E+02	4.67
	10	186.78	184 -	190	187.07	3.30E+01	28.87	1.24E+02	4.01
M	11	252.07	251 -	265	252.33	1.76E+01	8.12	1.40E+01	2.73
m	12	256.48	251 -	265	256.75	1.74E+01	21.90	6.30E+01	3.01
m	13	261.88	251 -	265	262.15	1.73E+01	20.00	5.60E+01	3.31
	14	276.85	273 -	280	277.10	5.21E+01	27.50	9.78E+01	2.46
M	15	303.14	298 -	314	303.39	1.40E+02	29.59	5.16E+01	2.36
m	16	308.01	298 -	314	308.25	3.84E+01	30.39	7.02E+01	2.90
m	17	311.93	298 -	314	312.18	1.36E+01	15.16	3.98E+01	2.22
M	18	334.30	328 -	341	334.54	7.41E+01	28.33	5.40E+01	3.54
m	19	338.64	328 -	341	338.88	1.79E+01	21.32	4.01E+01	2.34
	20	356.30	350 -	361	356.52	4.81E+02	51.42	8.96E+01	2.22
M	21	384.53	380 -	396	384.75	1.19E+02	38.25	4.46E+01	3.42
m	22	387.39	380 -	396	387.60	1.67E+02	33.45	1.80E+01	2.04
m	23	391.23	380 -	396	391.44	6.74E+01	36.82	2.02E+01	3.79
M	24	414.97	410 -	424	415.17	3.78E+01	19.29	3.48E+01	2.60
m	25	420.04	410 -	424	420.24	2.32E+01	18.87	2.78E+01	2.61
	26	437.56	433 -	440	437.76	1.05E+02	23.92	2.73E+01	2.88
	27	468.58	464 -	475	468.76	3.33E+01	18.11	2.53E+01	2.29
m	28	516.03	505 -	521	516.20	7.49E+00	9.80	0.00E+00	3.23

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 : 9/18/2018 2:40:38PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070289.CNF

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	21.22	1.25E+02	42.05			1.25E+02	4.21E+01

Analysis Report for 1809025-15

BC-7B

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	2	31.06	2.22E+03	100.54			2.22E+03	1.01E+02
m	3	35.22	5.72E+02	89.09			5.72E+02	8.91E+01
M	4	61.98	2.92E+02	48.53	1.31E+01	8.56E-01	2.79E+02	4.85E+01
m	5	66.29	1.24E+02	46.47			1.24E+02	4.65E+01
	6	81.31	9.75E+02	82.34			9.75E+02	8.23E+01
M	7	112.12	2.94E+02	46.43			2.94E+02	4.64E+01
m	8	116.49	6.67E+01	41.76			6.67E+01	4.18E+01
	9	145.32	4.33E+01	39.12			4.33E+01	3.91E+01
	10	186.78	3.30E+01	28.87	7.85E+00	1.75E+00	2.52E+01	2.89E+01
M	11	252.07	1.76E+01	8.12			1.76E+01	8.12E+00
m	12	256.48	1.74E+01	21.90			1.74E+01	2.19E+01
m	13	261.88	1.73E+01	20.00			1.73E+01	2.00E+01
	14	276.85	5.21E+01	27.50			5.21E+01	2.75E+01
M	15	303.14	1.40E+02	29.59			1.40E+02	2.96E+01
m	16	308.01	3.84E+01	30.39			3.84E+01	3.04E+01
m	17	311.93	1.36E+01	15.16			1.36E+01	1.52E+01
M	18	334.30	7.41E+01	28.33			7.41E+01	2.83E+01
m	19	338.64	1.79E+01	21.32			1.79E+01	2.13E+01
	20	356.30	4.81E+02	51.42			4.81E+02	5.14E+01
M	21	384.53	1.19E+02	38.25			1.19E+02	3.82E+01
m	22	387.39	1.67E+02	33.45			1.67E+02	3.35E+01
m	23	391.23	6.74E+01	36.82			6.74E+01	3.68E+01
M	24	414.97	3.78E+01	19.29			3.78E+01	1.93E+01
m	25	420.04	2.32E+01	18.87			2.32E+01	1.89E+01
	26	437.56	1.05E+02	23.92			1.05E+02	2.39E+01
	27	468.58	3.33E+01	18.11			3.33E+01	1.81E+01
m	28	516.03	7.49E+00	9.80			7.49E+00	9.80E+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	7.11E+02	9.45E+02
		391.69 *	61.90	4.70E+01	2.61E+01

Analysis Report for 1809025-15  
BC-7B

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
I-125	0.99	35.49 *		6.49	2.65E+01	4.13E+00
BA-133	0.99	30.80 *		97.60	3.01E+00	1.36E-01
		302.84 *		17.80	5.25E+02	2.21E+02
		356.01 *		60.00	4.17E+02	6.51E+01
		63.29 *		3.80	4.41E+02	7.81E+01
TH-234	0.97					

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.995	4.75E+01	2.61E+01	
I-125	0.999	2.65E+01	4.13E+00	
X I-129	0.901			
BA-133	0.999	3.01E+00	1.36E-01	
TH-234	0.970	4.41E+02	7.81E+01	
X NP-237	0.884			

? = 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

Analysis Report for 1809025-15

BC-7B

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:40:38PM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M 1	21.22	1.39277E-01	16.77	Tol.	PA-234M
m 5	66.29	1.37794E-01	18.73	Sum	
6	81.31	1.08333E+00	4.22		
M 7	112.12	3.26223E-01	7.91	Tol.	U-237
m 8	116.49	7.41105E-02	31.31		
9	145.32	4.80618E-02	45.22		
10	186.78	2.79677E-02	57.45		
M 11	252.07	1.95077E-02	23.14		
m 13	261.88	1.91892E-02	57.90		
14	276.85	5.79025E-02	26.38		
m 16	308.01	4.27069E-02	39.54		
m 17	311.93	1.50693E-02	55.88		
M 18	334.30	8.23111E-02	19.12	Sum	
m 19	338.64	1.99174E-02	59.47	Sum	
M 21	384.53	1.31782E-01	16.12		
m 22	387.39	1.85711E-01	10.01	Sum	
M 24	414.97	4.20327E-02	25.49		
m 25	420.04	2.57433E-02	40.72	Sum	
26	437.56	1.17068E-01	11.35		
27	468.58	3.70290E-02	27.17		
m 28	516.03	8.31834E-03	65.44		

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

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**NUCLIDE MDA REPORT**


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

0327

Analysis Report for 1809025-15

BC-7B

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	4.26E-09	4.26E-09	-1.71E-08	1.35E-09
CO-57	122.06	85.51	2.53E+01	2.53E+01	-2.61E+00	1.18E+01
	136.48	10.60	2.38E+02		-1.99E+01	1.11E+02
NI-59	6.92	29.80	9.86E-08	9.86E-08	-7.01E-09	4.46E-08
MO-93	16.59	52.90	1.12E-03	1.12E-03	1.48E-05	5.33E-04
	18.60	10.00	1.97E-02		1.71E-03	9.48E-03
NB-93M	16.57	9.43	6.19E-03	6.19E-03	8.21E-05	2.96E-03
CD-109	88.03	3.72	2.79E+02	2.79E+02	-1.86E+02	1.31E+02
+ SN-113	255.12 *	1.93	2.14E+03	2.87E+01	7.11E+02	1.01E+03
	391.69 *	61.90	2.87E+01		4.70E+01	1.34E+01
SN-119M	23.87	16.10	9.38E-02	9.21E-02	-9.39E-02	4.52E-02
	25.10	22.70	9.21E-02		-8.30E-01	4.43E-02
+ I-125	35.49 *	6.49	7.69E+00	7.69E+00	2.65E+01	3.78E+00
I-129	29.78 *	57.00	3.83E-01	3.83E-01	5.15E+00	1.89E-01
	33.60 *	13.20	3.77E+00		1.30E+01	1.85E+00
	39.58	7.52	5.76E+00		3.25E-01	2.77E+00
+ BA-133	30.80 *	97.60	2.24E-01	2.24E-01	3.01E+00	1.10E-01
	302.84 *	17.80	2.23E+02		5.25E+02	1.06E+02
	356.01 *	60.00	4.06E+01		4.17E+02	1.91E+01
CE-139	165.85	80.35	4.72E+01	4.72E+01	1.27E+01	2.23E+01
CE-144	133.54	10.80	2.47E+02	2.47E+02	7.43E+01	1.16E+02
HG-203	279.19	77.30	4.55E+01	4.55E+01	-9.51E-01	2.15E+01
PB-210	46.50	4.25	1.74E+01	1.74E+01	9.54E-01	8.20E+00
PA-231	9.28	42.00	3.78E-06	3.78E-06	4.33E-06	1.79E-06
	10.11	20.20	1.99E-05		2.28E-05	9.43E-06
	283.67	1.60	1.42E+03		1.35E+02	6.47E+02
	302.67	2.30	1.86E+03		2.95E+03	8.91E+02
TH-231	25.64	14.70	1.70E-01	1.70E-01	-4.40E+00	8.21E-02
	84.21	6.40	3.62E+02		1.25E+03	1.77E+02
PA-234M	9.89	89.00	3.56E-06	3.56E-06	4.08E-06	1.69E-06
	21.72	64.90	1.10E-02		1.04E-02	5.32E-03
	37.93	23.75	2.43E+00		7.25E+00	1.19E+00
	131.42	20.40	1.27E+02		2.33E+01	5.95E+01
+ TH-234	63.29 *	3.80	2.33E+02	2.33E+02	4.41E+02	1.14E+02
NP-237	29.37 *	14.00	1.56E+00	1.56E+00	2.10E+01	7.68E-01
	86.50	12.60	8.70E+01		-1.56E+01	4.13E+01
U-237	97.08	16.30	9.50E+01	6.21E+01	9.00E+00	4.50E+01
	101.07	26.30	6.21E+01		3.03E+01	2.94E+01
	114.00	12.30	3.38E+02		9.30E+02	1.64E+02
	208.01	22.00	1.77E+02		7.93E+01	8.31E+01
AM-241	59.54	35.90	1.28E+01	1.28E+01	2.38E+01	6.21E+00
AM-243	74.67	66.00	1.03E+01	1.03E+01	5.72E-01	4.90E+00

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

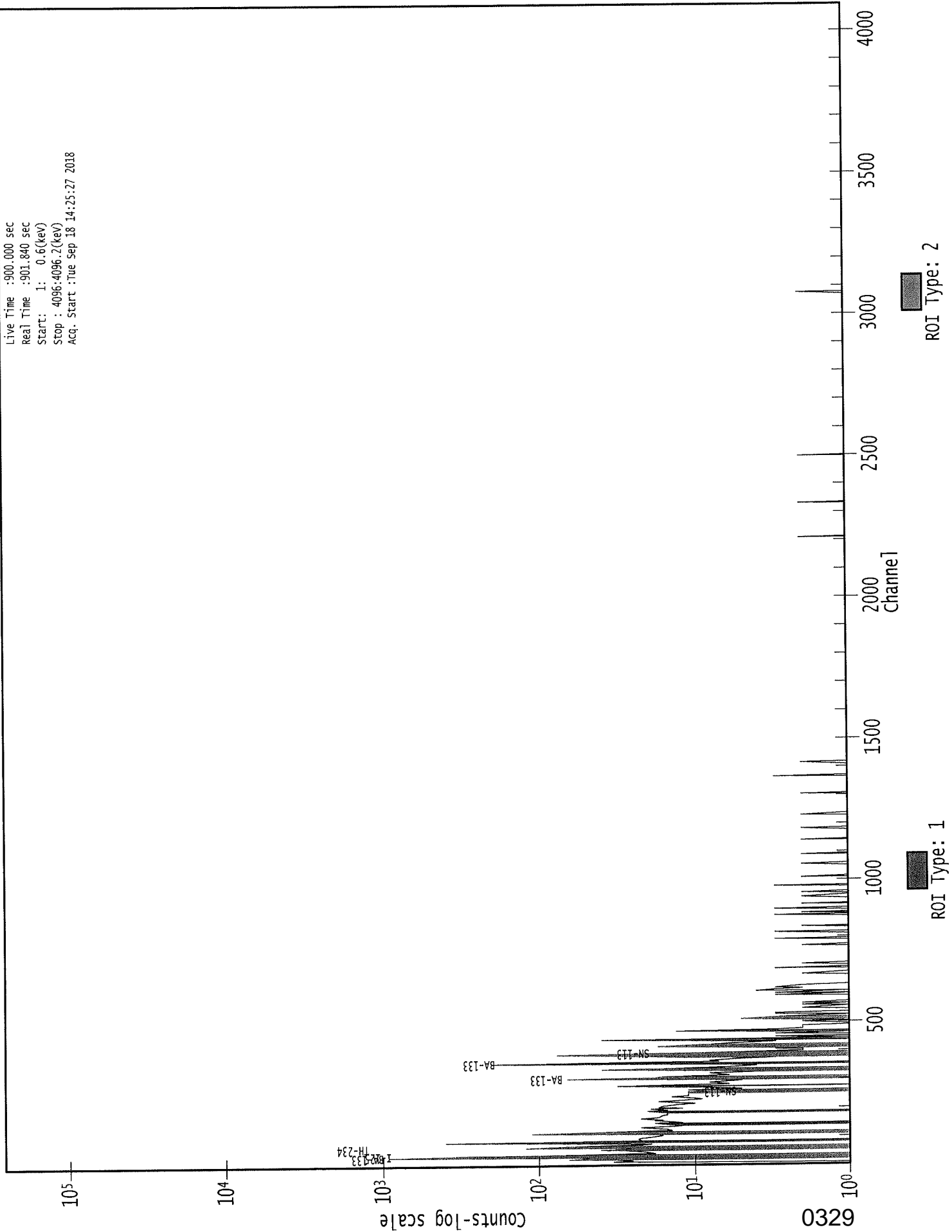
&gt; = MDA value not calculated

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



# 0000071970.CNF

Live Time : 900.000 sec  
Real Time : 901.840 sec  
Start: 1: 0.6 (keV)  
Stop : 4096: 4096.2 (keV)  
Acq. Start : Tue Sep 18 14:25:27 2018



*WZ  
9/18/18*

Analysis Report for 1809025-16  
BC-7A

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 1809025-16  
 Sample Description : BC-7A  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/18/2018 10:01:39AM  
 Acquisition Started : 9/18/2018 2:29:46PM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 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) : 9 - 4096  
 Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Used Done On : 11/9/2014  
 Efficiency Calibration Description :

Sample Number : 71971

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/18/2018 2:44:50PM  
 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 1809025-16

BC-7A

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.19	16 -	23	20.24	3.49E+01	38.99	2.18E+02	3.06
M	2	31.49	25 -	40	30.55	1.07E+03	71.17	1.31E+02	2.30
m	3	35.75	25 -	40	34.81	2.33E+02	47.09	1.21E+02	2.18
	4	53.69	48 -	57	52.77	3.47E+01	31.30	1.21E+02	1.78
M	5	62.19	58 -	72	61.27	1.27E+02	31.60	9.31E+01	2.39
m	6	66.65	58 -	72	65.74	5.87E+01	38.04	1.23E+02	3.08
	7	81.53	75 -	86	80.63	4.03E+02	46.60	1.05E+02	2.22
M	8	112.59	105 -	119	111.71	9.36E+01	34.16	1.24E+02	2.87
m	9	116.69	105 -	119	115.82	2.73E+01	34.16	1.08E+02	2.88
	10	241.97	237 -	245	241.20	2.61E+01	20.66	4.98E+01	1.83
	11	276.74	271 -	281	275.99	3.82E+01	22.81	4.77E+01	2.32
	12	303.20	297 -	305	302.47	4.70E+01	23.82	5.81E+01	2.04
	13	334.23	328 -	336	333.53	1.30E+01	16.91	3.60E+01	2.08
	14	356.83	352 -	362	356.15	1.94E+02	37.42	7.00E+01	2.33
	15	376.62	373 -	379	375.96	1.25E+01	9.41	7.00E+00	1.76
M	16	386.47	381 -	394	385.81	8.53E+01	22.61	1.47E+01	4.16
m	17	391.75	381 -	394	391.10	1.08E+01	18.99	1.68E+01	3.09
	18	420.77	418 -	422	420.15	8.10E+00	7.25	3.80E+00	1.05
	19	430.13	425 -	432	429.51	7.96E+00	10.20	1.21E+01	2.88
	20	437.73	433 -	440	437.12	3.30E+01	13.42	8.00E+00	3.49
M	21	464.18	461 -	470	463.59	7.90E+00	7.12	9.00E+00	2.89
m	22	468.39	461 -	470	467.81	1.27E+01	9.11	7.68E+00	2.57
	23	484.94	481 -	487	484.38	8.00E+00	5.66	0.00E+00	2.14
	24	696.47	691 -	701	696.10	1.24E+01	11.34	9.18E+00	5.52
	25	867.35	863 -	870	867.14	7.00E+00	5.29	0.00E+00	1.12

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 : 9/18/2018 2:44:50PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000071072.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	21.19	3.49E+01	38.99			3.49E+01	3.90E+01
M	2	31.49	1.07E+03	71.17			1.07E+03	7.12E+01
m	3	35.75	2.33E+02	47.09			2.33E+02	4.71E+01
	4	53.69	3.47E+01	31.30			3.47E+01	3.13E+01

0331

Analysis Report for 1809025-16

BC-7A

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	5	62.19	1.27E+02	31.60	1.33E+01	2.31E+00	1.14E+02	3.17E+01
m	6	66.65	5.87E+01	38.04			5.87E+01	3.80E+01
m	7	81.53	4.03E+02	46.60			4.03E+02	4.66E+01
M	8	112.59	9.36E+01	34.16			9.36E+01	3.42E+01
m	9	116.69	2.73E+01	34.16			2.73E+01	3.42E+01
	10	241.97	2.61E+01	20.66			2.61E+01	2.07E+01
	11	276.74	3.82E+01	22.81			3.82E+01	2.28E+01
	12	303.20	4.70E+01	23.82			4.70E+01	2.38E+01
	13	334.23	1.30E+01	16.91			1.30E+01	1.69E+01
	14	356.83	1.94E+02	37.42			1.94E+02	3.74E+01
	15	376.62	1.25E+01	9.41			1.25E+01	9.41E+00
M	16	386.47	8.53E+01	22.61			8.53E+01	2.26E+01
m	17	391.75	1.08E+01	18.99			1.08E+01	1.90E+01
	18	420.77	8.10E+00	7.25			8.10E+00	7.25E+00
	19	430.13	7.96E+00	10.20			7.96E+00	1.02E+01
	20	437.73	3.30E+01	13.42			3.30E+01	1.34E+01
M	21	464.18	7.90E+00	7.12			7.90E+00	7.12E+00
m	22	468.39	1.27E+01	9.11			1.27E+01	9.11E+00
	23	484.94	8.00E+00	5.66			8.00E+00	5.66E+00
	24	696.47	1.24E+01	11.34			1.24E+01	1.13E+01
	25	867.35	7.00E+00	5.29			7.00E+00	5.29E+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	1.70E+01	3.00E+01
I-125	0.99	35.49 *	6.49	2.14E+02	4.36E+01
		30.80 *	97.60	5.04E+01	3.49E+00
BA-133	0.99	302.84 *	17.80	2.31E+02	1.37E+02
		356.01 *	60.00	3.05E+02	7.10E+01
		63.29 *	3.80	4.87E+02	1.40E+02
TH-234	0.97				

0332

Analysis Report for 1809025-16

BC-7A

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

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## INTERFERENCE CORRECTED REPORT

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<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	0.947	1.70E+01	3.00E+01	
I-125	0.999	2.14E+02	4.36E+01	
X I-129	0.588			
BA-133	0.990	5.11E+01	3.48E+00	
TH-234	0.977	4.87E+02	1.40E+02	

? = 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 1809025-16

BC-7A

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:44:50PM  
 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	21.19	3.87847E-02	55.85	Tol.	PA-234M
4	53.69	3.85146E-02	45.16		
m 6	66.65	6.52367E-02	32.39	Sum	
m 7	81.53	4.48064E-01	5.78		
M 8	112.59	1.04051E-01	18.24	Tol.	U-237
m 9	116.69	3.03292E-02	62.57		
10	241.97	2.89869E-02	39.59		
11	276.74	4.24104E-02	29.88		
13	334.23	1.44265E-02	65.13	Sum	
15	376.62	1.38889E-02	37.63		
M 16	386.47	9.48304E-02	13.24	Sum	
18	420.77	9.00000E-03	44.73	Sum	
19	430.13	8.84921E-03	64.02		
20	437.73	3.66667E-02	20.33		
M 21	464.18	8.77248E-03	45.12		
m 22	468.39	1.41613E-02	35.74		
23	484.94	8.88889E-03	35.36		
24	696.47	1.37908E-02	45.67	Sum	
25	867.35	7.77778E-03	37.80		

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

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**NUCLIDE MDA REPORT**


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

0334

Analysis Report for 1809025-16

BC-7A

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	1.63E+01	1.63E+01	-1.43E+00	7.50E+00
	136.48	10.60	1.36E+02		-6.77E+01	6.19E+01
NI-59	6.92	29.80	4.85E-02	4.85E-02	-3.62E-02	2.05E-02
MO-93	16.59	52.90	1.14E+00	1.14E+00	3.85E-01	5.43E-01
	18.60	10.00	8.03E+00		3.17E+00	3.83E+00
NB-93M	16.57	9.43	6.36E+00	6.36E+00	2.15E+00	3.03E+00
CD-109	88.03	3.72	2.84E+02	2.84E+02	1.67E+01	1.32E+02
+ SN-113	255.12	1.93	1.16E+03	3.91E+01	2.98E+02	5.26E+02
	391.69	* 61.90	3.91E+01		1.70E+01	1.74E+01
SN-119M	23.87	16.10	7.67E+00	5.63E+00	-8.23E+00	3.63E+00
	25.10	22.70	5.63E+00		-4.00E+01	2.65E+00
+ I-125	35.49	* 6.49	7.97E+01	7.97E+01	2.14E+02	3.86E+01
I-129	29.78	* 57.00	7.00E+00	7.00E+00	8.62E+01	3.39E+00
	33.60	13.20	6.57E+01		4.13E+02	3.23E+01
	39.58	7.52	4.65E+01		-2.11E+00	2.20E+01
+ BA-133	30.80	* 97.60	4.09E+00	4.09E+00	5.04E+01	1.98E+00
	302.84	* 17.80	1.71E+02		2.31E+02	7.89E+01
	356.01	* 60.00	6.88E+01		3.05E+02	3.23E+01
CE-139	165.85	80.35	2.31E+01	2.31E+01	-4.06E+00	1.06E+01
CE-144	133.54	10.80	1.33E+02	1.33E+02	-2.25E+01	6.10E+01
HG-203	279.19	77.30	3.88E+01	3.88E+01	3.25E+01	1.79E+01
PB-210	46.50	4.25	8.35E+01	8.35E+01	4.65E+00	3.86E+01
PA-231	9.28	42.00	1.83E-01	1.83E-01	3.76E-02	8.49E-02
	10.11	20.20	5.99E-01		4.02E-01	2.82E-01
	283.67	1.60	1.16E+03		7.53E+01	5.08E+02
	302.67	2.30	1.60E+03		1.54E+03	7.47E+02
TH-231	25.64	14.70	9.66E+00	9.66E+00	-1.64E+02	4.56E+00
	84.21	6.40	3.96E+02		1.40E+03	1.93E+02
PA-234M	9.89	89.00	1.27E-01	1.27E-01	8.55E-02	5.99E-02
	21.72	64.90	1.67E+00		1.26E+00	7.95E-01
	37.93	23.75	2.24E+01		3.02E+01	1.08E+01
	131.42	20.40	6.94E+01		2.21E+01	3.17E+01
+ TH-234	63.29	* 3.80	3.08E+02	3.08E+02	4.87E+02	1.48E+02
NP-237	29.37	14.00	4.20E+01	4.20E+01	2.17E+02	2.06E+01
	86.50	12.60	8.69E+01		1.62E+01	4.05E+01
U-237	97.08	16.30	7.24E+01	4.16E+01	3.88E+01	3.35E+01
	101.07	26.30	4.16E+01		-9.92E+00	1.91E+01
	114.00	12.30	1.91E+02		3.34E+02	9.14E+01
	208.01	22.00	9.03E+01		5.45E+00	4.08E+01
AM-241	59.54	35.90	2.54E+01	2.54E+01	3.28E+01	1.21E+01
AM-243	74.67	66.00	1.34E+01	1.34E+01	-1.85E+00	6.26E+00

+ = Nuclide identified during the nuclide identification

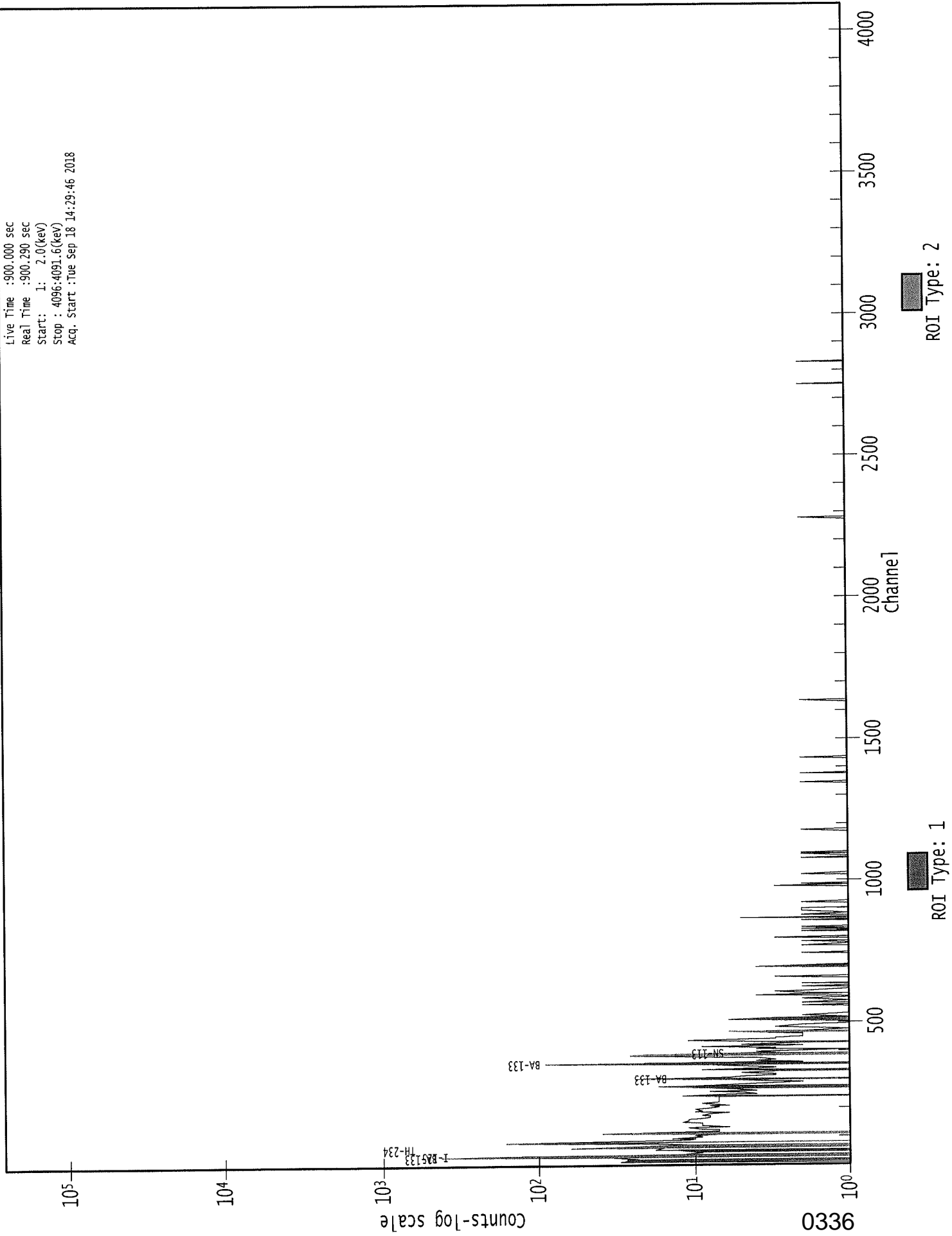
\* = Energy line found in the spectrum

&gt; = MDA value not calculated

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

# 0000071971.CNF

Live Time : 900.000 sec  
Real Time : 900.290 sec  
Start : 1: 2.0(keV)  
Stop : 4096:4091.6(keV)  
Acq. Start : Tue Sep 18 14:29:46 2018





*KB  
9/18/18*

Analysis Report for 1809025-17  
BC-8B

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-17  
 Sample Description : BC-8B  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/18/2018 10:01:51AM  
 Acquisition Started : 9/18/2018 2:41:11PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE2  
 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) : 28 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 71974

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 2:56:13PM  
 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 1809025-17

BC-8B

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	36.00	35 -	39	35.78	5.44E+02	70.90	3.44E+02	2.62
2	54.26	49 -	58	54.03	9.85E+01	45.07	2.31E+02	5.25
3	62.09	59 -	65	61.86	1.21E+02	56.84	5.16E+02	1.28
4	66.62	65 -	69	66.38	1.07E+02	38.02	2.13E+02	1.62
5	81.59	77 -	85	81.35	1.03E+03	77.54	2.92E+02	1.82
M 6	112.32	107 -	129	112.07	2.07E+02	37.48	1.30E+02	1.60
m 7	116.48	107 -	129	116.22	5.05E+01	31.58	1.30E+02	1.83
8	192.31	189 -	195	192.02	4.42E+01	27.85	1.10E+02	3.69
9	200.44	197 -	203	200.15	2.86E+01	30.10	1.45E+02	4.82
M 10	270.78	269 -	281	270.45	1.35E+01	10.26	1.07E+01	1.80
m 11	276.74	269 -	281	276.41	5.64E+01	21.38	3.59E+01	1.81
M 12	303.23	299 -	322	302.88	1.81E+02	29.45	3.31E+01	1.51
m 13	307.41	299 -	322	307.06	2.87E+01	17.76	4.34E+01	1.54
M 14	323.49	322 -	343	323.14	1.25E+01	7.87	9.25E+00	1.55
m 15	334.40	322 -	343	334.04	5.81E+01	20.35	2.04E+01	1.57
16	356.34	352 -	360	355.97	6.63E+02	56.11	7.60E+01	1.43
M 17	381.53	380 -	394	381.15	6.95E+00	8.15	1.50E+01	1.62
m 18	384.53	380 -	394	384.15	1.66E+02	31.66	2.50E+01	1.62
m 19	391.39	380 -	394	391.00	3.85E+01	16.25	2.00E+01	1.48
M 20	415.10	409 -	424	414.70	3.00E+01	18.71	2.80E+01	2.20
m 21	418.59	409 -	424	418.19	2.46E+01	20.05	2.80E+01	2.21
22	437.19	434 -	440	436.78	1.15E+02	21.91	4.21E+00	1.78
23	467.64	464 -	470	467.21	1.07E+01	13.33	2.47E+01	1.14
24	478.79	474 -	481	478.36	9.31E+00	9.17	7.38E+00	1.35
25	511.21	507 -	516	510.76	3.00E+01	12.53	6.09E+00	2.54
26	653.32	650 -	654	652.80	5.00E+00	4.47	0.00E+00	1.16
27	1217.35	1213 -	1219	1216.50	8.00E+00	5.66	0.00E+00	3.88
28	1321.51	1317 -	1323	1320.60	5.00E+00	4.47	0.00E+00	1.24

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 : 9/18/2018 2:56:13PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000070288.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
1	36.00	5.44E+02	70.90			5.44E+02	7.09E+01

Analysis Report for 1809025-17

BC-8B

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	2	54.26	9.85E+01	45.07		9.85E+01	4.51E+01
	3	62.09	1.21E+02	56.84		1.21E+02	5.68E+01
	4	66.62	1.07E+02	38.02	3.70E+00	1.03E+02	3.80E+01
	5	81.59	1.03E+03	77.54		1.03E+03	7.75E+01
M	6	112.32	2.07E+02	37.48		2.07E+02	3.75E+01
m	7	116.48	5.05E+01	31.58		5.05E+01	3.16E+01
	8	192.31	4.42E+01	27.85		4.42E+01	2.79E+01
	9	200.44	2.86E+01	30.10		2.86E+01	3.01E+01
M	10	270.78	1.35E+01	10.26		1.35E+01	1.03E+01
m	11	276.74	5.64E+01	21.38		5.64E+01	2.14E+01
M	12	303.23	1.81E+02	29.45		1.81E+02	2.95E+01
m	13	307.41	2.87E+01	17.76		2.87E+01	1.78E+01
M	14	323.49	1.25E+01	7.87		1.25E+01	7.87E+00
m	15	334.40	5.81E+01	20.35		5.81E+01	2.03E+01
	16	356.34	6.63E+02	56.11		6.63E+02	5.61E+01
M	17	381.53	6.95E+00	8.15		6.95E+00	8.15E+00
m	18	384.53	1.66E+02	31.66		1.66E+02	3.17E+01
m	19	391.39	3.85E+01	16.25		3.85E+01	1.62E+01
M	20	415.10	3.00E+01	18.71		3.00E+01	1.87E+01
m	21	418.59	2.46E+01	20.05		2.46E+01	2.00E+01
	22	437.19	1.15E+02	21.91		1.15E+02	2.19E+01
	23	467.64	1.07E+01	13.33	0.00E+00	0.00E+00	1.07E+01
	24	478.79	9.31E+00	9.17		9.31E+00	9.17E+00
	25	511.21	3.00E+01	12.53	1.78E+01	1.21E+01	1.26E+01
	26	653.32	5.00E+00	4.47		5.00E+00	4.47E+00
	27	1217.35	8.00E+00	5.66		8.00E+00	5.66E+00
	28	1321.51	5.00E+00	4.47		5.00E+00	4.47E+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	0.96	255.12	1.93		
		391.69 *	61.90	2.36E+01	1.01E+01

Analysis Report for 1809025-17

BC-8B

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
I-125	0.99	35.49 *	6.49	2.19E+01	2.85E+00
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	5.33E+03	1.83E+03

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
SN-113	0.965	2.36E+01	1.01E+01	
I-125	0.993	2.19E+01	2.85E+00	
PA-231	1.000	5.33E+03	1.83E+03	

? = 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

Analysis Report for 1809025-17

BC-8B

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/18/2018 2:56:13PM  
 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	54.26	1.09395E-01	22.89	
	3	62.09	1.34311E-01	23.51	
	4	66.62	1.14463E-01	18.47	
	5	81.59	1.14206E+00	3.77	
M	6	112.32	2.29784E-01	9.06	Tol. U-237
m	7	116.48	5.60678E-02	31.29	
	8	192.31	4.91246E-02	31.50	
	9	200.44	3.17492E-02	52.68	
M	10	270.78	1.50126E-02	37.96	
m	11	276.74	6.27108E-02	18.94	
m	13	307.41	3.19265E-02	30.91	
M	14	323.49	1.39000E-02	31.47	
m	15	334.40	6.45179E-02	17.52	
	16	356.34	7.36671E-01	4.23	Tol. BA-133
M	17	381.53	7.71990E-03	58.68	
m	18	384.53	1.84834E-01	9.52	
M	20	415.10	3.33417E-02	31.17	
m	21	418.59	2.72822E-02	40.83	
	22	437.19	1.27664E-01	9.54	
	23	467.64	1.18599E-02	62.45	
	24	478.79	1.03419E-02	49.23	
	25	511.21	1.34802E-02	51.88	
	26	653.32	5.55556E-03	44.72	
	27	1217.35	8.88889E-03	35.36	
	28	1321.51	5.55556E-03	44.72	

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

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Analysis Report for 1809025-17

BC-8B

## NUCLIDE MDA REPORT

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

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	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.70E+01	2.70E+01	-8.56E+00	1.25E+01
	136.48	10.60	2.67E+02		3.93E+01	1.24E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.80E+02	2.80E+02	-2.30E+00	1.31E+02
+ SN-113	255.12	1.93	1.37E+03	2.64E+01	-4.34E+01	6.23E+02
	391.69	* 61.90	2.64E+01		2.36E+01	1.24E+01
SN-119M	23.87	16.10	1.78E-03	1.78E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	3.64E+00	3.64E+00	2.19E+01	1.77E+00
I-129	29.78	57.00	2.27E-01	2.27E-01	7.03E-01	1.12E-01
	33.60	13.20	1.89E+00		9.04E-01	9.26E-01
	39.58	7.52	2.01E+00		-5.02E+00	9.18E-01
BA-133	30.80	97.60	2.10E-01	2.10E-01	2.16E+00	1.04E-01
	302.84	17.80	2.57E+02		6.68E+02	1.23E+02
	356.01	60.00	1.01E+02		5.44E+02	4.94E+01
CE-139	165.85	80.35	4.38E+01	4.38E+01	-3.10E+01	2.03E+01
CE-144	133.54	10.80	2.72E+02	2.72E+02	9.21E+01	1.27E+02
HG-203	279.19	77.30	3.69E+01	3.69E+01	-6.96E+00	1.71E+01
PB-210	46.50	4.25	9.88E+00	9.88E+00	-2.32E+00	4.51E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.22E+03		3.56E+02	5.47E+02
	302.67	* 2.30	2.29E+03		5.33E+03	1.10E+03
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.64E+02		7.92E+02	1.77E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.76E-01		-6.00E-01	3.67E-01
	131.42	20.40	1.41E+02		3.85E+01	6.61E+01
TH-234	63.29	3.80	1.62E+02	1.62E+02	3.78E+02	7.83E+01
NP-237	29.37	14.00	3.09E-01	3.09E-01	-8.52E+00	1.49E-01
	86.50	12.60	8.82E+01		-2.56E+01	4.15E+01
U-237	97.08	16.30	8.96E+01	6.22E+01	2.33E+01	4.19E+01
	101.07	26.30	6.22E+01		8.85E+00	2.91E+01
	114.00	12.30	3.48E+02		4.34E+02	1.68E+02
	208.01	22.00	1.49E+02		-3.88E+00	6.83E+01
AM-241	59.54	35.90	7.49E+00	7.49E+00	-4.81E+01	3.55E+00
AM-243	74.67	66.00	9.42E+00	9.42E+00	-2.35E+00	4.42E+00

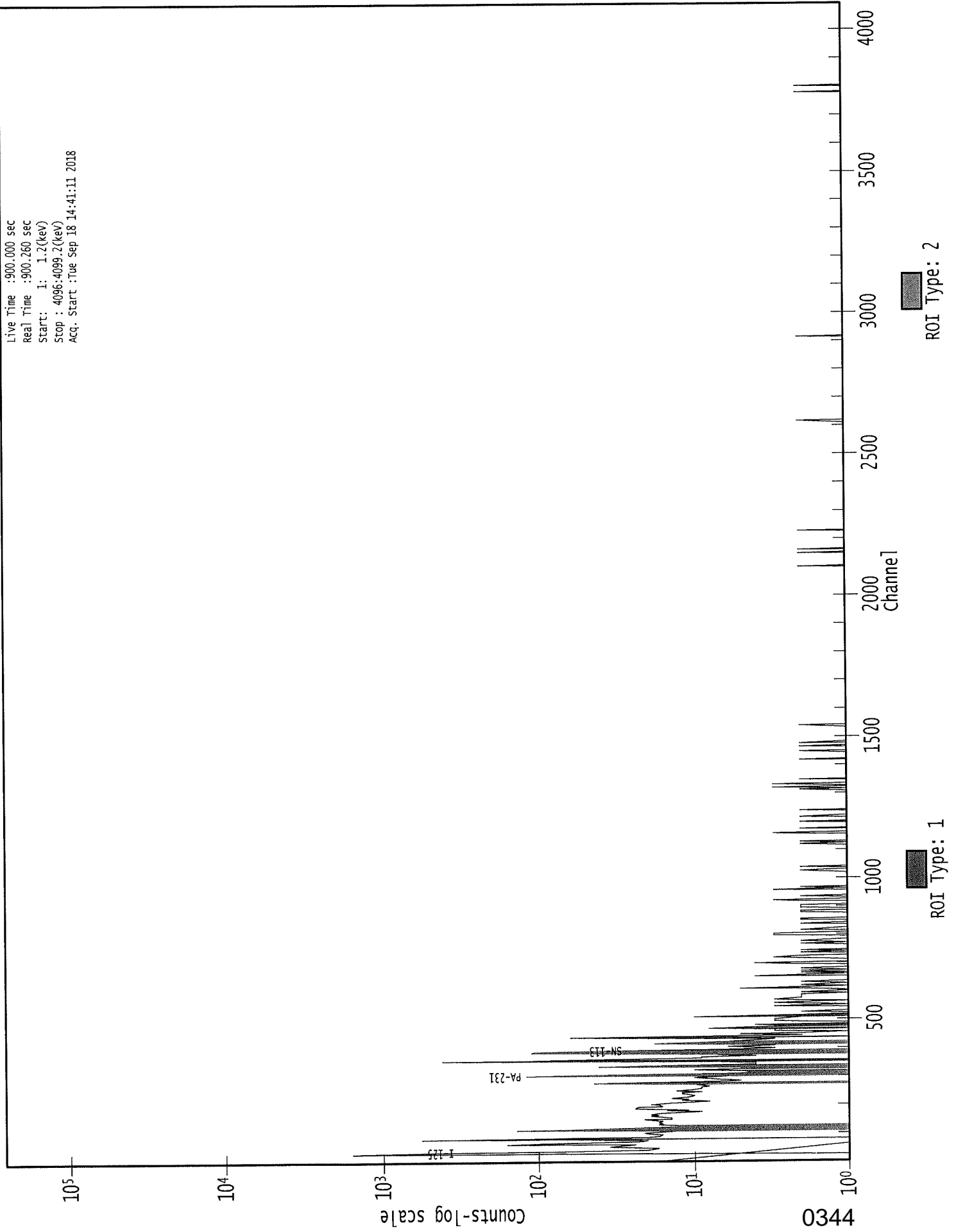
Analysis Report for 1809025-17  
BC-8B

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- + = 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
-

0000071974.CNF

Live Time :900.000 sec  
Real Time :900.260 sec  
Start: I: 1.2(keV)  
Stop : 4096:4099.2(keV)  
Acq. Start :Tue Sep 18 14:41:11 2018





**RUN 2**

KP  
9/24/18

Analysis Report for 1809025-01  
SPIKE

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-01  
 Sample Description : SPIKE  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/24/2018 12:55:46PM  
 Acquisition Started : 9/24/2018 12:57:13PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE1  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.4 seconds  
  
 Dead Time : 0.04 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 19 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 6/16/2018  
 Efficiency Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 72238

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 1:12:16PM  
 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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Analysis Report for 1809025-01

## SPIKE

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
M	1	30.81	26 -	41	31.18	2.97E+03	119.16	4.82E+02	1.84
m	2	35.12	26 -	41	35.49	7.52E+02	75.80	3.02E+02	1.97
m	3	38.13	26 -	41	38.51	1.14E+02	61.92	2.66E+02	1.98
	4	52.61	49 -	56	52.98	9.67E+01	42.76	2.41E+02	3.07
M	5	61.82	58 -	70	62.18	3.33E+02	51.54	2.56E+02	2.12
m	6	66.08	58 -	70	66.45	1.62E+02	45.39	2.79E+02	1.89
M	7	76.64	76 -	86	77.00	2.26E+01	24.66	1.63E+02	1.54
m	8	81.17	76 -	86	81.54	1.16E+03	77.59	2.80E+02	1.99
M	9	111.83	106 -	122	112.19	2.69E+02	44.79	1.46E+02	2.31
m	10	116.26	106 -	122	116.62	6.91E+01	39.43	1.51E+02	2.32
	11	142.71	139 -	147	143.06	4.16E+01	35.80	1.73E+02	2.63
	12	209.53	207 -	213	209.86	2.41E+01	30.38	1.50E+02	1.72
M	13	254.85	254 -	266	255.17	1.44E+01	9.33	1.98E+01	1.86
m	14	258.73	254 -	266	259.05	2.72E+01	18.63	5.74E+01	1.87
	15	276.45	272 -	281	276.77	8.93E+01	33.56	1.09E+02	1.44
M	16	296.65	293 -	317	296.96	2.74E+01	19.68	4.25E+01	3.05
m	17	302.93	293 -	317	303.23	2.45E+02	34.66	3.85E+01	1.94
m	18	307.54	293 -	317	307.85	5.44E+01	31.74	6.16E+01	2.86
	19	334.21	331 -	339	334.51	7.55E+01	34.92	1.45E+02	1.61
	20	356.15	353 -	361	356.44	7.31E+02	66.76	2.29E+02	2.10
	21	363.44	361 -	367	363.73	4.07E+01	23.09	5.67E+01	3.40
M	22	383.85	381 -	393	384.14	1.44E+02	32.59	5.83E+01	1.95
m	23	386.89	381 -	393	387.18	2.25E+02	42.45	6.74E+01	1.95
M	24	414.54	411 -	430	414.82	3.84E+01	16.91	1.80E+01	1.96
m	25	417.90	411 -	430	418.18	2.53E+01	18.28	1.80E+01	1.97
	26	437.03	433 -	440	437.31	1.36E+02	26.68	2.83E+01	2.22
M	27	464.92	464 -	471	465.19	6.77E+00	6.58	8.50E+00	2.19
m	28	467.75	464 -	471	468.02	2.24E+01	13.76	1.65E+01	2.19
	29	473.71	471 -	477	473.98	9.69E+00	10.63	1.26E+01	2.09
	30	597.97	594 -	603	598.21	1.40E+01	7.48	0.00E+00	1.96
	31	608.81	604 -	612	609.05	1.90E+01	8.72	0.00E+00	2.25
	32	655.64	653 -	659	655.88	8.00E+00	5.66	0.00E+00	1.47
	33	698.63	696 -	702	698.86	7.00E+00	5.29	0.00E+00	1.16
	34	839.75	837 -	843	839.95	5.07E+00	6.34	3.86E+00	1.89

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 : 9/24/2018 1:12:16PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000072210.CNF

0347

Analysis Report for 1809025-01

SPIKE

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	30.81	2.97E+03	119.16			2.97E+03	1.19E+02
m	2	35.12	7.52E+02	75.80			7.52E+02	7.58E+01
m	3	38.13	1.14E+02	61.92			1.14E+02	6.19E+01
	4	52.61	9.67E+01	42.76			9.67E+01	4.28E+01
M	5	61.82	3.33E+02	51.54			3.33E+02	5.15E+01
m	6	66.08	1.62E+02	45.39			1.62E+02	4.54E+01
M	7	76.64	2.26E+01	24.66			2.26E+01	2.47E+01
m	8	81.17	1.16E+03	77.59			1.16E+03	7.76E+01
M	9	111.83	2.69E+02	44.79			2.69E+02	4.48E+01
m	10	116.26	6.91E+01	39.43			6.91E+01	3.94E+01
	11	142.71	4.16E+01	35.80	2.47E+00	1.13E+00	3.91E+01	3.58E+01
	12	209.53	2.41E+01	30.38			2.41E+01	3.04E+01
M	13	254.85	1.44E+01	9.33			1.44E+01	9.33E+00
m	14	258.73	2.72E+01	18.63			2.72E+01	1.86E+01
	15	276.45	8.93E+01	33.56			8.93E+01	3.36E+01
M	16	296.65	2.74E+01	19.68			2.74E+01	1.97E+01
m	17	302.93	2.45E+02	34.66			2.45E+02	3.47E+01
m	18	307.54	5.44E+01	31.74			5.44E+01	3.17E+01
	19	334.21	7.55E+01	34.92			7.55E+01	3.49E+01
	20	356.15	7.31E+02	66.76			7.31E+02	6.68E+01
	21	363.44	4.07E+01	23.09			4.07E+01	2.31E+01
M	22	383.85	1.44E+02	32.59			1.44E+02	3.26E+01
m	23	386.89	2.25E+02	42.45			2.25E+02	4.24E+01
M	24	414.54	3.84E+01	16.91			3.84E+01	1.69E+01
m	25	417.90	2.53E+01	18.28			2.53E+01	1.83E+01
	26	437.03	1.36E+02	26.68			1.36E+02	2.67E+01
M	27	464.92	6.77E+00	6.58			6.77E+00	6.58E+00
m	28	467.75	2.24E+01	13.76			2.24E+01	1.38E+01
	29	473.71	9.69E+00	10.63			9.69E+00	1.06E+01
	30	597.97	1.40E+01	7.48			1.40E+01	7.48E+00
	31	608.81	1.90E+01	8.72	2.15E+00	1.11E+00	1.68E+01	8.79E+00
	32	655.64	8.00E+00	5.66			8.00E+00	5.66E+00
	33	698.63	7.00E+00	5.29			7.00E+00	5.29E+00
	34	839.75	5.07E+00	6.34			5.07E+00	6.34E+00

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

Analysis Report for 1809025-01

SPIKE

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## NUCLIDE IDENTIFICATION REPORT

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

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### IDENTIFIED NUCLIDES

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<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
I-125	0.99	35.49	*	6.49	7.11E+00	7.16E-01
BA-133	1.00	30.80	*	97.60	5.53E-01	2.22E-02
		302.84	*	17.80	1.08E+03	5.00E+02
		356.01	*	60.00	6.17E+02	8.78E+01
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	8.39E+03	3.87E+03
PA-234M	0.99	9.89		89.00		
		21.72		64.90		
		37.93	*	23.75	6.07E-01	3.28E-01
		131.42		20.40		
TH-234	0.93	63.29	*	3.80	3.68E+02	5.74E+01

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

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## INTERFERENCE CORRECTED REPORT

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	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	I-125	0.996	7.11E+00	7.16E-01	
X	I-129	0.792			
	BA-133	1.000	5.53E-01	2.22E-02	

0349

Analysis Report for 1809025-01

SPIKE

<i><b>Nuclide Name</b></i>	<i><b>Nuclide Id Confidence</b></i>	<i><b>Wt mean Activity (pCi/units)</b></i>	<i><b>Wt mean Activity Uncertainty</b></i>	<i><b>Comments</b></i>
PA-231	1.000	8.38E+03	3.87E+03	
PA-234M	0.994	6.07E-01	3.28E-01	
TH-234	0.937	3.68E+02	5.74E+01	
X NP-237	0.937			

? = 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

Analysis Report for 1809025-01

SPIKE

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 UNIDENTIFIED PEAKS
 

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Peak Locate Performed on : 9/24/2018 1:12:16PM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	4	52.61	1.07465E-01	22.10	
m	6	66.08	1.80291E-01	13.99	Sum
M	7	76.64	2.51665E-02	54.43	Sum
m	8	81.17	1.29012E+00	3.34	
M	9	111.83	2.98826E-01	8.33	
m	10	116.26	7.67590E-02	28.54	
	11	142.71	4.34835E-02	45.76	
	12	209.53	2.67284E-02	63.14	Tol. U-237
M	13	254.85	1.59783E-02	32.43	Tol. SN-113
m	14	258.73	3.02004E-02	34.27	
	15	276.45	9.92670E-02	18.78	
M	16	296.65	3.04275E-02	35.93	
m	18	307.54	6.04455E-02	29.17	
	19	334.21	8.39302E-02	23.12	Sum
	21	363.44	4.51932E-02	28.39	Sum
M	22	383.85	1.59468E-01	11.35	
m	23	386.89	2.50077E-01	9.43	Sum
M	24	414.54	4.26713E-02	22.02	
m	25	417.90	2.80618E-02	36.18	Sum
	26	437.03	1.50967E-01	9.82	
M	27	464.92	7.51787E-03	48.60	
m	28	467.75	2.48816E-02	30.72	
	29	473.71	1.07639E-02	54.87	
	30	597.97	1.55556E-02	26.73	
	31	608.81	1.87222E-02	26.08	
	32	655.64	8.88889E-03	35.36	
	33	698.63	7.77778E-03	37.80	
	34	839.75	5.63492E-03	62.55	

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

Analysis Report for 1809025-01

SPIKE

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## NUCLIDE MDA REPORT

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

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	1.90E-13	1.90E-13	0.00E+00	0.00E+00	
CO-57	122.06	85.51	3.69E+01	3.69E+01	3.43E+00	1.73E+01	
	136.48	10.60	3.07E+02		-3.94E+01	1.41E+02	
NI-59	6.92	29.80	2.77E-12	2.77E-12	0.00E+00	0.00E+00	
MO-93	16.59	52.90	8.15E-06	8.15E-06	-1.79E-05	3.63E-06	
	18.60	10.00	5.24E-04		5.65E-04	2.52E-04	
NB-93M	16.57	9.43	4.50E-05	4.50E-05	-9.90E-05	2.01E-05	
CD-109	88.03	3.72	3.77E+02	3.77E+02	2.03E+02	1.80E+02	
SN-113	255.12	1.93	1.86E+03	2.96E+01	-1.98E+02	8.56E+02	
	391.69	61.90	2.96E+01		1.17E+00	1.40E+01	
SN-119M	23.87	16.10	6.67E-03	6.67E-03	-1.52E-03	3.22E-03	
	25.10	22.70	7.42E-03		-2.44E-03	3.57E-03	
+ I-125	35.49	*	6.49	1.58E+00	1.58E+00	7.11E+00	7.75E-01
I-129	29.78	*	57.00	5.41E-02	5.41E-02	9.47E-01	2.66E-02
	33.60		13.20	6.18E-01		-3.58E+00	3.05E-01
	39.58	*	7.52	2.78E+00		1.92E+00	1.37E+00
+ BA-133	30.80	*	97.60	3.16E-02	3.16E-02	5.53E-01	1.55E-02
	302.84	*	17.80	3.46E+02		1.08E+03	1.67E+02
	356.01	*	60.00	5.66E+01		6.17E+02	2.72E+01
CE-139	165.85		80.35	7.28E+01	7.28E+01	2.08E+01	3.43E+01
CE-144	133.54		10.80	3.28E+02	3.28E+02	9.44E+01	1.53E+02
HG-203	279.19		77.30	6.09E+01	6.09E+01	-7.25E-01	2.88E+01
PB-210	46.50		4.25	6.53E+00	6.53E+00	-3.17E+00	3.07E+00
+ PA-231	9.28		42.00	2.61E-10	2.61E-10	0.00E+00	0.00E+00
	10.11		20.20	2.08E-09		0.00E+00	0.00E+00
	283.67		1.60	1.84E+03		-1.81E+02	8.43E+02
	302.67	*	2.30	2.68E+03		8.39E+03	1.29E+03
TH-231	25.64		14.70	1.48E-02	1.48E-02	6.13E-03	7.15E-03
	84.21		6.40	2.26E+02		-1.69E+03	1.08E+02
+ PA-234M	9.89		89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
	21.72		64.90	6.62E-04		9.36E-04	3.21E-04
	37.93	*	23.75	8.81E-01		6.07E-01	4.34E-01
	131.42		20.40	1.67E+02		-1.36E+01	7.78E+01
+ TH-234	63.29	*	3.80	1.21E+02	1.21E+02	3.68E+02	5.90E+01
NP-237	29.37	*	14.00	2.20E-01	2.20E-01	3.86E+00	1.08E-01
	86.50		12.60	1.07E+02		5.20E+01	5.09E+01
U-237	97.08		16.30	1.05E+02	7.45E+01	-7.65E+01	4.94E+01
	101.07		26.30	7.45E+01		2.16E+01	3.51E+01
	114.00		12.30	4.27E+02		7.72E+02	2.07E+02
	208.01		22.00	2.58E+02		1.12E+02	1.21E+02
AM-241	59.54		35.90	8.11E+00	8.11E+00	1.21E+01	3.93E+00
AM-243	74.67		66.00	1.04E+01	1.04E+01	-5.34E+00	4.94E+00

0352



Analysis Report for 1809025-01

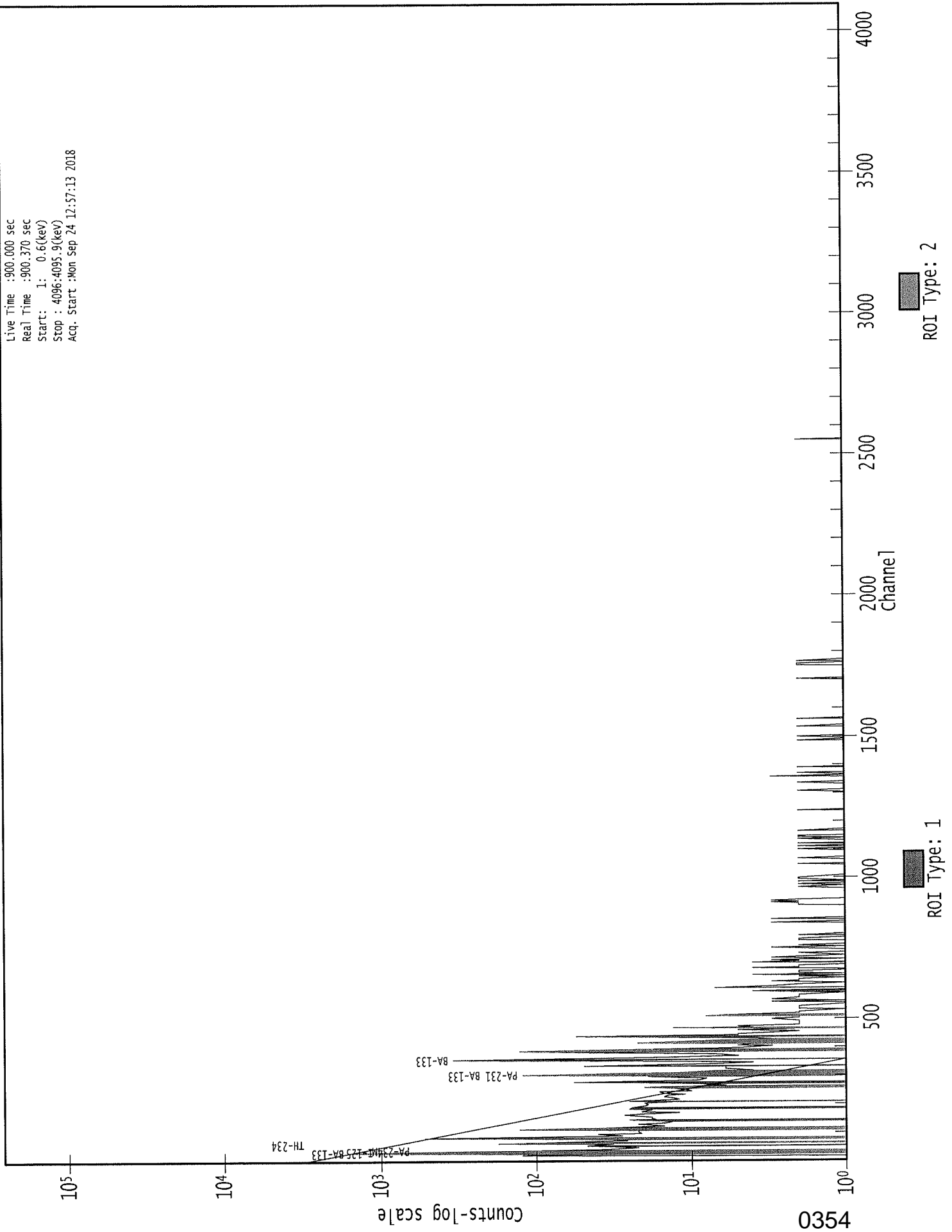
SPIKE

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- + = 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
-

# 0000072238.CNF

Live Time : 900.000 sec  
Real Time : 900.370 sec  
Start : 1: 0.6(keV)  
Stop : 4096.4095.9(keV)  
Acq. Start : Mon Sep 24 12:57:13 2018



KP  
9/24/18

Analysis Report for 1809025-02  
BLANK

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-02  
 Sample Description : BLANK  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/24/2018 12:55:53PM  
 Acquisition Started : 9/24/2018 12:57:19PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE2  
 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) : 28 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 2/17/2018  
 Efficiency Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 72239

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 1:12:33PM  
 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 1809025-02

BLANK

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.81	35 - 40	35.59	6.47E+02	89.38	3.96E+02	2.53
	2	53.77	50 - 57	53.55	9.12E+01	41.38	2.26E+02	2.08
M	3	62.19	58 - 70	61.96	1.99E+02	39.14	1.45E+02	1.37
m	4	66.41	58 - 70	66.18	1.15E+02	34.06	1.76E+02	1.38
	5	81.37	77 - 84	81.13	1.15E+03	80.22	3.08E+02	1.32
M	6	112.17	108 - 119	111.92	1.98E+02	37.50	1.26E+02	1.65
m	7	116.29	108 - 119	116.04	4.58E+01	27.39	1.13E+02	1.66
	8	141.73	139 - 144	141.47	2.96E+01	26.34	1.17E+02	3.76
	9	188.41	181 - 195	188.13	6.25E+01	56.34	3.09E+02	7.16
	10	276.41	272 - 280	276.08	8.05E+01	28.64	7.70E+01	1.83
M	11	303.10	299 - 313	302.75	2.25E+02	31.05	2.80E+01	1.50
m	12	307.40	299 - 313	307.05	3.08E+01	19.03	4.20E+01	1.86
M	13	333.89	329 - 341	333.53	7.94E+01	23.69	2.74E+01	1.90
m	14	338.28	329 - 341	337.92	2.78E+01	15.65	2.00E+01	1.90
M	15	356.16	351 - 372	355.79	8.09E+02	57.60	1.78E+01	1.53
m	16	365.42	351 - 372	365.04	9.97E+00	15.87	1.70E+01	2.58
	17	376.46	373 - 379	376.08	1.61E+01	12.70	1.78E+01	1.63
M	18	384.53	380 - 395	384.15	1.20E+02	31.92	1.04E+01	1.62
m	19	391.24	380 - 395	390.85	4.66E+01	17.97	1.18E+00	1.63
M	20	414.82	411 - 421	414.42	3.93E+01	17.03	1.53E+01	2.00
m	21	418.34	411 - 421	417.94	2.03E+01	17.15	2.14E+01	2.01
	22	436.99	432 - 440	436.58	1.08E+02	22.10	8.77E+00	1.85
	23	467.73	463 - 470	467.30	1.04E+01	13.56	2.33E+01	1.31
	24	593.39	591 - 595	592.90	4.17E+00	6.04	3.67E+00	2.71
	25	654.13	650 - 656	653.61	6.31E+00	6.65	3.38E+00	3.02

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 : 9/24/2018 1:12:33PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000072211.CNF

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	6.47E+02	89.38			6.47E+02	8.94E+01
	2	9.12E+01	41.38			9.12E+01	4.14E+01
M	3	1.99E+02	39.14			1.99E+02	3.91E+01
m	4	1.15E+02	34.06			1.15E+02	3.41E+01

Analysis Report for 1809025-02

BLANK

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	5	81.37	1.15E+03	80.22			1.15E+03	8.02E+01
M	6	112.17	1.98E+02	37.50	0.00E+00	0.00E+00	1.98E+02	3.75E+01
m	7	116.29	4.58E+01	27.39			4.58E+01	2.74E+01
	8	141.73	2.96E+01	26.34			2.96E+01	2.63E+01
	9	188.41	6.25E+01	56.34			6.25E+01	5.63E+01
	10	276.41	8.05E+01	28.64			8.05E+01	2.86E+01
M	11	303.10	2.25E+02	31.05			2.25E+02	3.10E+01
m	12	307.40	3.08E+01	19.03			3.08E+01	1.90E+01
M	13	333.89	7.94E+01	23.69			7.94E+01	2.37E+01
m	14	338.28	2.78E+01	15.65			2.78E+01	1.57E+01
M	15	356.16	8.09E+02	57.60			8.09E+02	5.76E+01
m	16	365.42	9.97E+00	15.87			9.97E+00	1.59E+01
	17	376.46	1.61E+01	12.70			1.61E+01	1.27E+01
M	18	384.53	1.20E+02	31.92			1.20E+02	3.19E+01
m	19	391.24	4.66E+01	17.97			4.66E+01	1.80E+01
M	20	414.82	3.93E+01	17.03			3.93E+01	1.70E+01
m	21	418.34	2.03E+01	17.15			2.03E+01	1.71E+01
	22	436.99	1.08E+02	22.10			1.08E+02	2.21E+01
	23	467.73	1.04E+01	13.56			1.04E+01	1.36E+01
	24	593.39	4.17E+00	6.04			4.17E+00	6.04E+00
	25	654.13	6.31E+00	6.65			6.31E+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	0.96	255.12	1.93		
		391.69 *	61.90	2.86E+01	1.12E+01
I-125	0.99	35.49 *	6.49	2.50E+01	3.46E+00
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	6.61E+03	2.21E+03

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Analysis Report for 1809025-02

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

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## INTERFERENCE CORRECTED REPORT

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<i><b>Nuclide Name</b></i>	<i><b>Nuclide Id Confidence</b></i>	<i><b>Wt mean Activity (pCi/units)</b></i>	<i><b>Wt mean Activity Uncertainty</b></i>	<i><b>Comments</b></i>
SN-113	0.962	2.86E+01	1.12E+01	
I-125	0.997	2.50E+01	3.46E+00	
PA-231	1.000	6.61E+03	2.21E+03	

? = 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

Analysis Report for 1809025-02

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/24/2018 1:12:33PM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

<i>Peak No.</i>	<i>Energy (keV)</i>	<i>Peak Size (CPS)</i>	<i>Peak CPS (%) Uncertainty</i>	<i>Peak Type</i>	<i>Tolerance Nuclide</i>
	2	53.77	1.01296E-01	22.69	
M	3	62.19	2.21428E-01	9.82	
m	4	66.41	1.27834E-01	14.80	
	5	81.37	1.27442E+00	3.50	
M	6	112.17	2.20320E-01	9.46	Tol. U-237
m	7	116.29	5.08552E-02	29.92	
	8	141.73	3.29293E-02	44.45	
	9	188.41	6.94777E-02	45.05	
	10	276.41	8.94678E-02	17.78	
m	12	307.40	3.42264E-02	30.88	
M	13	333.89	8.82331E-02	14.91	
m	14	338.28	3.08540E-02	28.18	Sum
M	15	356.16	8.98909E-01	3.56	
m	16	365.42	1.10761E-02	79.62	
	17	376.46	1.78667E-02	39.49	
M	18	384.53	1.32833E-01	13.35	
M	20	414.82	4.37139E-02	21.64	
m	21	418.34	2.26106E-02	42.13	
	22	436.99	1.19573E-01	10.27	
	23	467.73	1.15152E-02	65.44	
	24	593.39	4.62963E-03	72.50	
	25	654.13	7.01389E-03	52.69	

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

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Analysis Report for 1809025-02

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## NUCLIDE MDA REPORT

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

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	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.63E+01	2.63E+01	1.44E+01	1.22E+01
	136.48	10.60	2.99E+02		2.29E+02	1.40E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	3.01E+02	3.01E+02	1.39E+02	1.41E+02
+ SN-113	255.12	1.93	1.42E+03	1.57E+01	-4.06E+02	6.48E+02
	391.69	* 61.90	1.57E+01		2.86E+01	7.03E+00
SN-119M	23.87	16.10	1.77E-03	1.77E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	4.78E+00	4.78E+00	2.50E+01	2.34E+00
I-129	29.78	57.00	2.66E-01	2.66E-01	1.81E+00	1.32E-01
	33.60	13.20	1.64E+00		-9.89E+00	8.03E-01
	39.58	7.52	1.88E+00		-1.74E+00	8.52E-01
BA-133	30.80	97.60	2.26E-01	2.26E-01	2.56E+00	1.12E-01
	302.84	17.80	2.79E+02		8.09E+02	1.34E+02
	356.01	60.00	1.10E+02		6.55E+02	5.37E+01
CE-139	165.85	80.35	4.80E+01	4.80E+01	1.52E+01	2.25E+01
CE-144	133.54	10.80	2.87E+02	2.87E+02	-8.35E+01	1.34E+02
HG-203	279.19	77.30	3.61E+01	3.61E+01	-9.31E+00	1.67E+01
PB-210	46.50	4.25	1.10E+01	1.10E+01	-3.19E+00	5.08E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.20E+03		2.71E+02	5.36E+02
	302.67	* 2.30	1.49E+03		6.61E+03	7.03E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.09E+02		-2.20E+01	1.50E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	6.66E-01		-1.85E+00	3.12E-01
	131.42	20.40	1.39E+02		-5.75E+01	6.51E+01
TH-234	63.29	3.80	1.58E+02	1.58E+02	-1.86E+02	7.66E+01
NP-237	29.37	14.00	3.79E-01	3.79E-01	-1.07E+01	1.84E-01
	86.50	12.60	9.06E+01		1.44E+01	4.27E+01
U-237	97.08	16.30	8.73E+01	6.70E+01	-1.14E+01	4.07E+01
	101.07	26.30	6.70E+01		-2.53E+01	3.15E+01
	114.00	12.30	3.33E+02		4.40E+02	1.61E+02
	208.01	22.00	1.61E+02		-8.75E+01	7.45E+01
AM-241	59.54	35.90	8.13E+00	8.13E+00	-4.15E+01	3.87E+00
AM-243	74.67	66.00	9.13E+00	9.13E+00	-9.69E+00	4.28E+00



Analysis Report for 1809025-02

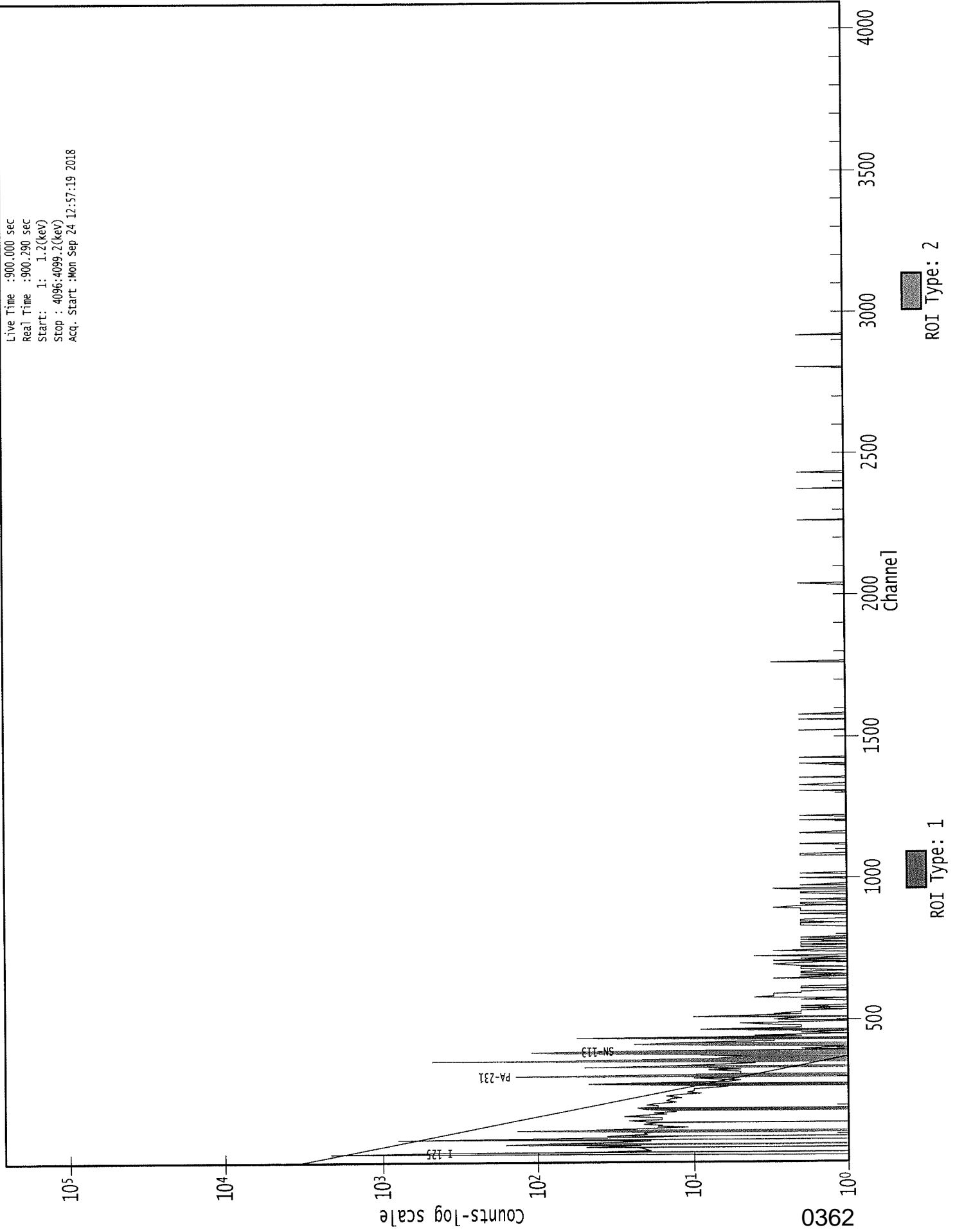
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- + = Nuclide identified during the nuclide identification
  - \* = Energy line found in the spectrum
  - > = MDA value not calculated
  - @ = Half-life too short to be able to perform the decay correction
-

# 0000072239.CNF

Live Time : 900.000 sec  
Real Time : 900.290 sec  
Start : 1: 1.2(keV)  
Stop : 4096: 4099.2(keV)  
Acq. Start : Mon Sep 24 12:57:19 2018



LB  
9/25/18Analysis Report for 1809025-03  
BC-8A

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**GAMMA SPECTRUM ANALYSIS**

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Sample Identification : 1809025-03  
Sample Description : BC-8A  
Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
Facility : Countroom

Sample Taken On : 9/25/2018 2:54:39PM  
Acquisition Started : 9/25/2018 3:02:27PM

Procedure : BAFIL  
Operator : Administrator  
Detector Name : GE4  
Geometry : BAFIL  
Live Time : 900.0 seconds  
Real Time : 900.4 seconds

Dead Time : 0.04 %

Peak Locate Threshold : 2.50  
Peak Locate Range (in channels) : 1 - 4096  
Peak Area Range (in channels) : 8 - 4096  
Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 2/24/2018  
Efficiency Calibration Used Done On : 11/9/2014  
Efficiency Calibration Description :

Sample Number : 72323

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**PEAK ANALYSIS REPORT**

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Peak Analysis Performed on : 9/25/2018 3:17:29PM  
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 1809025-03  
BC-8A

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	31.31	25 -	39	30.37	1.66E+03	87.54	1.65E+02	2.22
m	2	35.73	25 -	39	34.80	4.11E+02	72.44	9.07E+01	2.50
	3	52.94	47 -	56	52.01	6.70E+01	37.26	1.60E+02	2.61
	4	63.57	57 -	70	62.65	2.08E+02	57.47	2.79E+02	2.80
	5	81.58	75 -	87	80.67	6.37E+02	70.86	2.86E+02	2.20
	6	112.41	106 -	117	111.53	1.36E+02	46.17	2.00E+02	1.99
	7	188.83	181 -	199	188.02	5.21E+01	53.27	2.32E+02	12.20
	8	276.88	271 -	280	276.13	3.61E+01	23.66	5.78E+01	2.12
	9	296.08	293 -	298	295.35	9.00E+00	11.22	1.80E+01	2.64
	10	303.72	299 -	310	302.99	8.71E+01	31.50	8.77E+01	2.25
M	11	334.19	327 -	342	333.49	4.37E+01	20.49	3.47E+01	2.81
m	12	338.60	327 -	342	337.90	2.33E+01	20.00	3.84E+01	2.55
	13	356.40	350 -	359	355.72	2.94E+02	34.83	5.70E+00	2.27
M	14	384.15	380 -	396	383.49	6.89E+01	20.60	5.48E+00	2.84
m	15	387.16	380 -	396	386.51	8.10E+01	24.82	3.24E+00	2.51
m	16	391.14	380 -	396	390.49	2.27E+01	20.89	1.30E+00	2.84
	17	437.35	431 -	442	436.74	5.29E+01	20.10	2.41E+01	1.84
	18	468.26	465 -	469	467.68	5.38E+00	6.67	5.25E+00	1.42
M	19	509.04	506 -	517	508.49	7.30E+00	7.40	1.21E+01	2.92
	20	609.46	605 -	611	609.00	5.00E+00	4.47	0.00E+00	1.00

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 : 9/25/2018 3:17:29PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000072213.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	31.31	1.66E+03	87.54			1.66E+03	8.75E+01
m	2	35.73	4.11E+02	72.44			4.11E+02	7.24E+01
	3	52.94	6.70E+01	37.26			6.70E+01	3.73E+01
	4	63.57	2.08E+02	57.47	1.08E+01	1.04E+00	1.98E+02	5.75E+01
	5	81.58	6.37E+02	70.86			6.37E+02	7.09E+01
	6	112.41	1.36E+02	46.17	1.93E+00	1.85E+00	1.34E+02	4.62E+01
	7	188.83	5.21E+01	53.27			5.21E+01	5.33E+01
	8	276.88	3.61E+01	23.66			3.61E+01	2.37E+01
	9	296.08	9.00E+00	11.22			9.00E+00	1.12E+01

Analysis Report for 1809025-03

BC-8A

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	10	303.72	8.71E+01	31.50			8.71E+01	3.15E+01
M	11	334.19	4.37E+01	20.49			4.37E+01	2.05E+01
m	12	338.60	2.33E+01	20.00			2.33E+01	2.00E+01
	13	356.40	2.94E+02	34.83			2.94E+02	3.48E+01
M	14	384.15	6.89E+01	20.60			6.89E+01	2.06E+01
m	15	387.16	8.10E+01	24.82			8.10E+01	2.48E+01
m	16	391.14	2.27E+01	20.89			2.27E+01	2.09E+01
	17	437.35	5.29E+01	20.10			5.29E+01	2.01E+01
	18	468.26	5.38E+00	6.67			5.38E+00	6.67E+00
M	19	509.04	7.30E+00	7.40			7.30E+00	7.40E+00
	20	609.46	5.00E+00	4.47			5.00E+00	4.47E+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	3.57E+01	3.32E+01
I-125	0.99	35.49 *	6.49	3.77E+02	6.71E+01
BA-133	0.99	30.80 *	97.60	7.71E+01	4.33E+00
		302.84 *	17.80	4.30E+02	2.04E+02
		356.01 *	60.00	4.62E+02	8.14E+01
TH-234	0.99	63.29 *	3.80	8.79E+02	2.64E+02

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Analysis Report for 1809025-03  
BC-8A

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## INTERFERENCE CORRECTED REPORT

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	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	SN-113	0.941	3.57E+01	3.32E+01	
	I-125	0.999	3.77E+02	6.71E+01	
X	I-129	0.596			
	BA-133	0.995	7.83E+01	4.32E+00	
	TH-234	0.998	8.79E+02	2.64E+02	
X	NP-237	0.552			

- ? = 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 1809025-03

BC-8A

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/25/2018 3:17:29PM  
 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	52.94	7.44444E-02	27.80		
5	81.58	7.07517E-01	5.56		
6	112.41	1.49020E-01	17.23	Tol.	U-237
7	188.83	5.78704E-02	51.14		
8	276.88	4.01197E-02	32.77		
9	296.08	1.00000E-02	62.36		
M 11	334.19	4.85409E-02	23.46	Sum	
m 12	338.60	2.59107E-02	42.88	Sum	
M 14	384.15	7.65999E-02	14.94		
m 15	387.16	8.99734E-02	15.33	Sum	
17	437.35	5.88205E-02	18.98		
18	468.26	5.97222E-03	62.05		
M 19	509.04	8.11103E-03	50.68		
20	609.46	5.55556E-03	44.72		

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

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**NUCLIDE MDA REPORT**


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

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	1.48E-02	1.48E-02	-8.63E-02	4.67E-03
CO-57	122.06	85.51	1.66E+01	1.66E+01	-1.09E+01	7.66E+00

0367

Analysis Report for 1809025-03

BC-8A

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
CO-57	136.48	10.60	1.56E+02	1.66E+01	-3.42E+01	7.22E+01
NI-59	6.92	29.80	8.30E-02	8.30E-02	-5.44E-02	3.78E-02
MO-93	16.59	52.90	1.07E+00	1.07E+00	-3.05E+00	5.10E-01
	18.60	10.00	8.88E+00		9.16E+00	4.26E+00
NB-93M	16.57	9.43	5.99E+00	5.99E+00	-1.71E+01	2.85E+00
CD-109	88.03	3.72	3.08E+02	3.08E+02	-6.04E+01	1.44E+02
+ SN-113	255.12	1.93	1.31E+03	2.66E+01	3.09E+02	5.99E+02
	391.69	*	61.90		3.57E+01	1.12E+01
SN-119M	23.87	16.10	9.75E+00	7.28E+00	7.66E+00	4.67E+00
	25.10	22.70	7.28E+00		2.38E+00	3.48E+00
+ I-125	35.49	*	6.49	8.02E+01	3.77E+02	3.88E+01
I-129	29.78	*	57.00	7.13E+00	1.32E+02	3.46E+00
	33.60	13.20	8.03E+01		6.09E+02	3.96E+01
	39.58	7.52	5.44E+01		-1.40E+01	2.59E+01
+ BA-133	30.80	*	97.60	4.17E+00	7.71E+01	2.02E+00
	302.84	*	17.80	2.19E+02	4.30E+02	1.03E+02
	356.01	*	60.00	1.98E+01	4.62E+02	7.79E+00
CE-139	165.85	80.35	2.48E+01	2.48E+01	-1.13E+01	1.14E+01
CE-144	133.54	10.80	1.57E+02	1.57E+02	3.78E+00	7.26E+01
HG-203	279.19	77.30	3.94E+01	3.94E+01	2.61E+01	1.82E+01
PB-210	46.50	4.25	9.41E+01	9.41E+01	1.92E+01	4.39E+01
PA-231	9.28	42.00	2.80E-01	2.80E-01	4.28E-01	1.33E-01
	10.11	20.20	8.27E-01		1.71E+00	3.96E-01
	283.67	1.60	1.27E+03		4.24E+02	5.64E+02
	302.67	2.30	1.91E+03		2.84E+03	9.04E+02
TH-231	25.64	14.70	1.22E+01	1.22E+01	-4.43E+00	5.82E+00
	84.21	6.40	4.84E+02		2.12E+03	2.36E+02
PA-234M	9.89	89.00	1.76E-01	1.76E-01	3.63E-01	8.43E-02
	21.72	64.90	1.97E+00		1.71E+00	9.42E-01
	37.93	23.75	2.73E+01		6.97E+01	1.33E+01
	131.42	20.40	8.50E+01		4.08E+01	3.95E+01
+ TH-234	63.29	*	3.80	3.79E+02	8.79E+02	1.83E+02
NP-237	29.37	*	14.00	2.90E+01	5.37E+02	1.41E+01
	86.50	12.60	9.38E+01		-1.51E+01	4.40E+01
U-237	97.08	16.30	7.04E+01	3.95E+01	6.16E+00	3.26E+01
	101.07	26.30	3.95E+01		-3.34E+01	1.80E+01
	114.00	12.30	2.03E+02		3.29E+02	9.74E+01
	208.01	22.00	1.11E+02		-5.87E+00	5.12E+01
AM-241	59.54	35.90	2.79E+01	2.79E+01	2.07E+01	1.34E+01
AM-243	74.67	66.00	1.58E+01	1.58E+01	7.29E-01	7.46E+00

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

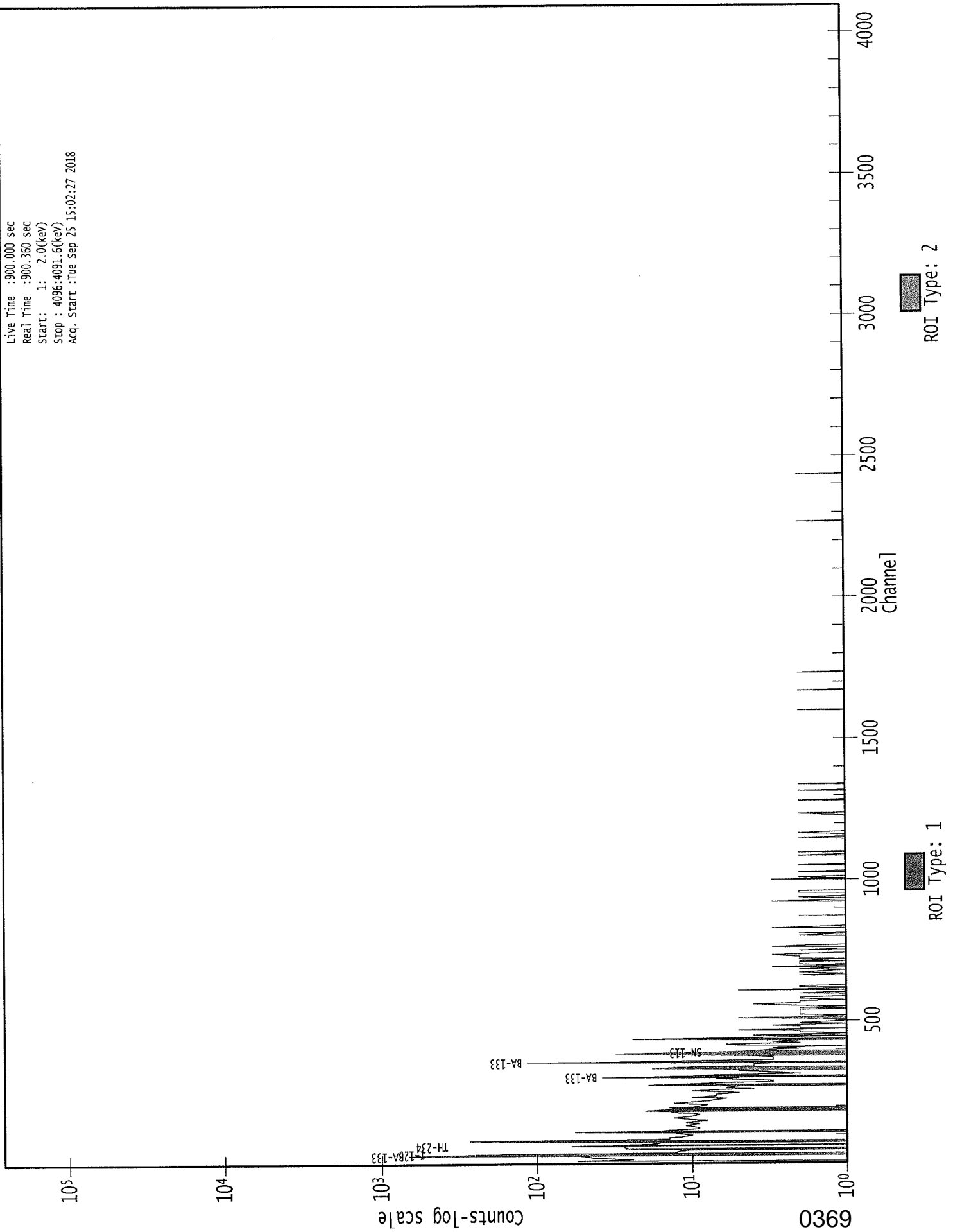
&gt; = MDA value not calculated

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



0000072323.CNF

Live Time : 900.000 sec  
Real Time : 900.360 sec  
Start : 1: 2.0(keV)  
Stop : 4096:4091.6(keV)  
Acq. Start : Tue Sep 25 15:02:27 2018



*KS  
9/25/18*

Analysis Report for 1809025-18  
BC-8A

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809025-18  
 Sample Description : BC-8A  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/25/2018 2:54:52PM  
 Acquisition Started : 9/25/2018 3:18:31PM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.3 seconds  
  
 Dead Time : 0.04 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 9 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 2/24/2018  
 Efficiency Calibration Used Done On : 11/9/2014  
 Efficiency Calibration Description :  
  
 Sample Number : 72324

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2018 3:33:35PM  
 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 1809025-18

BC-8A

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>ROI start</b>	<b>ROI end</b>	<b>Peak Centroid</b>	<b>Net Peak Area</b>	<b>Net Area Uncertainty</b>	<b>Continuum Counts</b>	<b>FWHM (keV)</b>
M	1	26.36	24 -	39	25.41	3.45E+01	15.80	5.38E+01	2.31
m	2	31.28	24 -	39	30.34	1.56E+03	84.57	1.11E+02	2.17
m	3	35.50	24 -	39	34.57	3.71E+02	68.70	9.52E+01	2.50
	4	53.62	50 -	56	52.69	2.88E+01	29.83	1.42E+02	2.00
M	5	62.17	56 -	70	61.25	1.17E+02	43.58	2.06E+02	3.08
m	6	66.36	56 -	70	65.44	4.67E+01	38.05	1.68E+02	2.55
	7	81.58	76 -	87	80.68	5.60E+02	64.56	2.26E+02	2.33
M	8	112.31	106 -	118	111.43	1.25E+02	33.17	1.04E+02	2.68
m	9	116.56	106 -	118	115.68	3.57E+01	26.53	4.70E+01	2.16
	10	135.70	130 -	139	134.84	2.46E+01	27.62	9.49E+01	4.05
	11	167.46	163 -	170	166.62	2.13E+01	27.42	1.09E+02	4.02
M	12	261.25	257 -	269	260.50	1.42E+01	13.48	2.77E+01	3.03
m	13	267.71	257 -	269	266.95	1.15E+01	12.24	1.79E+01	3.03
	14	276.36	270 -	282	275.62	4.10E+01	25.77	6.00E+01	2.45
M	15	303.49	299 -	309	302.77	7.00E+01	22.63	3.20E+01	2.53
m	16	306.95	299 -	309	306.23	1.63E+01	22.27	3.20E+01	2.53
	17	333.99	328 -	338	333.29	2.96E+01	20.09	3.68E+01	3.12
	18	356.47	348 -	360	355.79	2.72E+02	38.47	4.87E+01	2.65
M	19	384.05	379 -	394	383.39	5.97E+01	20.78	2.40E+01	2.74
m	20	387.08	379 -	394	386.42	6.78E+01	27.71	3.60E+01	4.08
M	21	412.63	410 -	428	412.00	1.03E+01	5.34	5.72E+00	2.36
m	22	421.52	410 -	428	420.90	1.34E+01	12.57	5.44E+00	3.47
	23	437.72	432 -	441	437.11	4.05E+01	16.34	1.50E+01	1.62
	24	452.10	449 -	453	451.50	8.00E+00	5.66	0.00E+00	1.87
	25	482.28	479 -	484	481.71	7.00E+00	5.29	0.00E+00	3.31
	26	495.62	491 -	498	495.06	6.13E+00	6.93	3.75E+00	1.89
	27	583.05	579 -	585	582.57	7.00E+00	5.29	0.00E+00	2.87

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 : 9/25/2018 3:33:35PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000072213.CNF

	<b>Peak No.</b>	<b>Energy (keV)</b>	<b>Original Area</b>	<b>Orig. Area Uncertainty</b>	<b>Ambient Background</b>	<b>Backgr. Uncert.</b>	<b>Subtracted Area</b>	<b>Subtracted Uncert.</b>
M	1	26.36	3.45E+01	15.80			3.45E+01	1.58E+01
m	2	31.28	1.56E+03	84.57			1.56E+03	8.46E+01

Analysis Report for 1809025-18

BC-8A

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m 3	35.50	3.71E+02	68.70			3.71E+02	6.87E+01
4	53.62	2.88E+01	29.83			2.88E+01	2.98E+01
M 5	62.17	1.17E+02	43.58	1.08E+01	1.04E+00	1.06E+02	4.36E+01
m 6	66.36	4.67E+01	38.05			4.67E+01	3.81E+01
7	81.58	5.60E+02	64.56			5.60E+02	6.46E+01
M 8	112.31	1.25E+02	33.17	1.93E+00	1.85E+00	1.23E+02	3.32E+01
m 9	116.56	3.57E+01	26.53			3.57E+01	2.65E+01
10	135.70	2.46E+01	27.62			2.46E+01	2.76E+01
11	167.46	2.13E+01	27.42			2.13E+01	2.74E+01
M 12	261.25	1.42E+01	13.48			1.42E+01	1.35E+01
m 13	267.71	1.15E+01	12.24			1.15E+01	1.22E+01
14	276.36	4.10E+01	25.77			4.10E+01	2.58E+01
M 15	303.49	7.00E+01	22.63			7.00E+01	2.26E+01
m 16	306.95	1.63E+01	22.27			1.63E+01	2.23E+01
17	333.99	2.96E+01	20.09			2.96E+01	2.01E+01
18	356.47	2.72E+02	38.47			2.72E+02	3.85E+01
M 19	384.05	5.97E+01	20.78			5.97E+01	2.08E+01
m 20	387.08	6.78E+01	27.71			6.78E+01	2.77E+01
M 21	412.63	1.03E+01	5.34			1.03E+01	5.34E+00
m 22	421.52	1.34E+01	12.57			1.34E+01	1.26E+01
23	437.72	4.05E+01	16.34			4.05E+01	1.63E+01
24	452.10	8.00E+00	5.66			8.00E+00	5.66E+00
25	482.28	7.00E+00	5.29			7.00E+00	5.29E+00
26	495.62	6.13E+00	6.93			6.13E+00	6.93E+00
27	583.05	7.00E+00	5.29	4.35E-01	8.53E-01	6.56E+00	5.36E+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
I-125	1.00	35.49 *	6.49	3.35E+02	6.27E+01
BA-133	0.99	30.80 *	97.60	7.21E+01	4.16E+00
		302.84 *	17.80	3.45E+02	1.54E+02
		356.01 *	60.00	4.26E+02	8.21E+01

Analysis Report for 1809025-18

BC-8A

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
CE-139	0.95	165.85 *		80.35	1.53E+01	2.00E+01
CE-144	0.91	133.54 *		10.80	1.06E+02	1.21E+02
TH-231	0.78	25.64 *		14.70	7.31E+00	3.35E+00
		84.21		6.40		
TH-234	0.97	63.29 *		3.80	4.55E+02	1.90E+02

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

## INTERFERENCE CORRECTED REPORT

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/units)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	I-125	1.000	3.35E+02	6.27E+01	
X	I-129	0.836			
	BA-133	0.995	7.32E+01	4.15E+00	
	CE-139	0.952	1.53E+01	2.00E+01	
	CE-144	0.914	1.06E+02	1.21E+02	
	TH-231	0.789	7.31E+00	3.35E+00	
	TH-234	0.976	4.55E+02	1.90E+02	
X	NP-237	0.553			

? = 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

Analysis Report for 1809025-18  
BC-8A

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## UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/25/2018 3:33:35PM  
Peak Locate From Channel : 1  
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide	
	4	53.62	3.19667E-02	51.85	Sum	
m	6	66.36	5.19069E-02	40.73	Sum	
	7	81.58	6.22045E-01	5.77		
M	8	112.31	1.37118E-01	13.46	Tol.	U-237
m	9	116.56	3.96835E-02	37.15		
M	12	261.25	1.57489E-02	47.56		
m	13	267.71	1.27270E-02	53.42		
	14	276.36	4.55477E-02	31.44		
m	16	306.95	1.81061E-02	68.34		
	17	333.99	3.29167E-02	33.91	Sum	
M	19	384.05	6.63593E-02	17.40	Sum	
m	20	387.08	7.53467E-02	20.43	Sum	
M	21	412.63	1.14721E-02	25.85		
m	22	421.52	1.48368E-02	47.07		
	23	437.72	4.50231E-02	20.16	Sum	
	24	452.10	8.88889E-03	35.36		
	25	482.28	7.77778E-03	37.80		
	26	495.62	6.80556E-03	56.56		
	27	583.05	7.29427E-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

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## NUCLIDE MDA REPORT

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

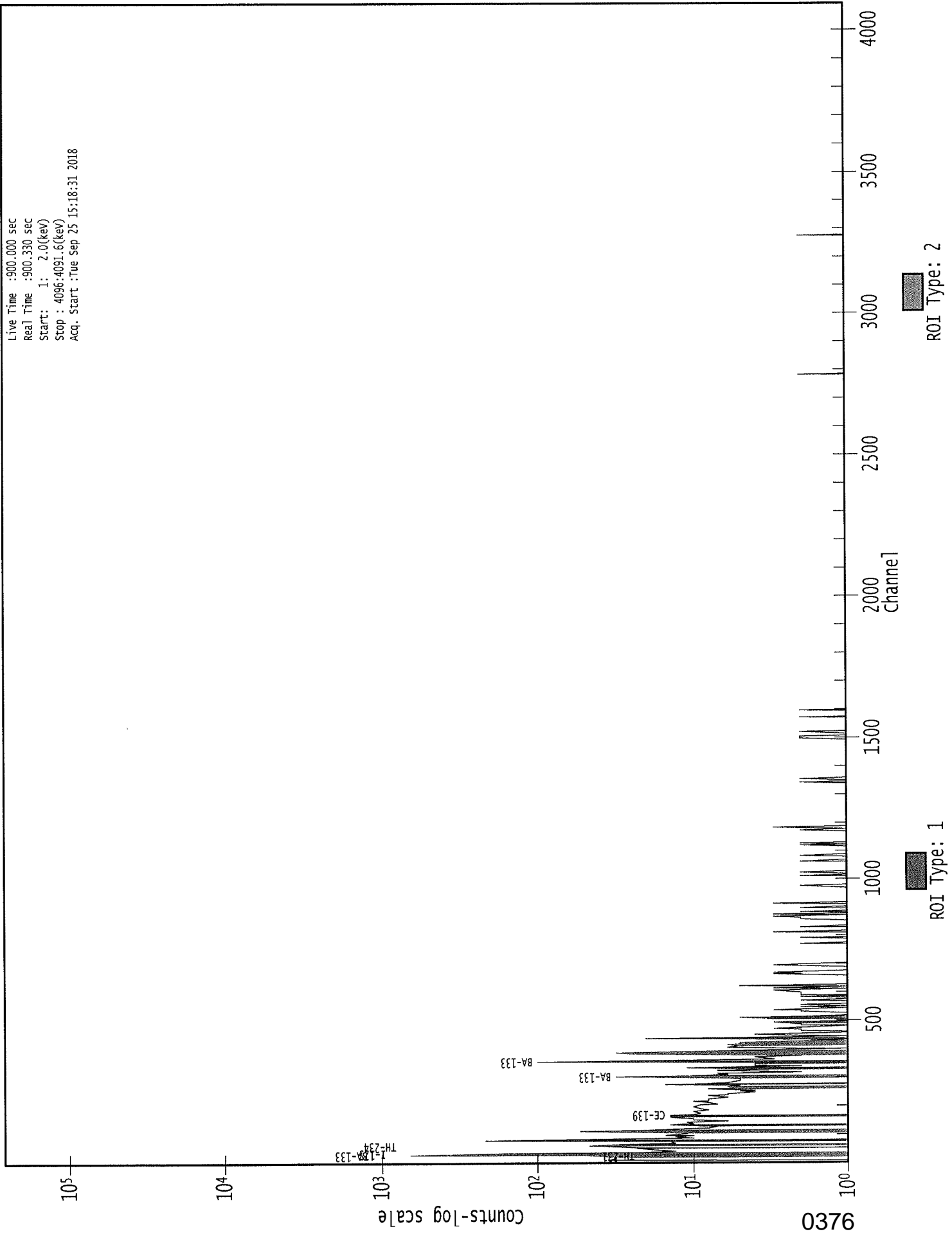
Analysis Report for 1809025-18

BC-8A

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Line MDA (pCi/units)</b>	<b>Nuclide MDA (pCi/units)</b>	<b>Activity (pCi/units)</b>	<b>Dec. Level (pCi/units)</b>
FE-55	5.89	24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	1.54E+01	1.54E+01	2.80E+00	7.05E+00
	136.48	10.60	1.74E+02		7.47E+01	8.12E+01
NI-59	6.92	29.80	3.92E-02	3.92E-02	-6.26E-02	1.59E-02
MO-93	16.59	52.90	1.10E+00	1.10E+00	-1.29E+00	5.22E-01
	18.60	10.00	8.54E+00		9.21E+00	4.09E+00
NB-93M	16.57	9.43	6.13E+00	6.13E+00	-7.22E+00	2.92E+00
CD-109	88.03	3.72	2.70E+02	2.70E+02	-1.06E+02	1.25E+02
SN-113	255.12	1.93	1.01E+03	6.50E+01	2.50E+02	4.50E+02
	391.69	61.90	6.50E+01		3.61E+01	3.04E+01
SN-119M	23.87	16.10	8.67E+00	6.82E+00	2.55E+00	4.13E+00
	25.10	22.70	6.82E+00		-2.53E-01	3.24E+00
+ I-125	35.49	* 6.49	7.18E+01	7.18E+01	3.35E+02	3.47E+01
I-129	29.78	* 57.00	6.33E+00	6.33E+00	1.23E+02	3.06E+00
	33.60	* 13.20	3.53E+01		1.65E+02	1.71E+01
	39.58	7.52	5.30E+01		1.33E+01	2.52E+01
+ BA-133	30.80	* 97.60	3.70E+00	3.70E+00	7.21E+01	1.79E+00
	302.84	* 17.80	1.55E+02		3.45E+02	7.09E+01
	356.01	* 60.00	5.55E+01		4.26E+02	2.56E+01
+ CE-139	165.85	* 80.35	3.24E+01	3.24E+01	1.53E+01	1.52E+01
+ CE-144	133.54	* 10.80	1.95E+02	1.95E+02	1.06E+02	9.17E+01
HG-203	279.19	77.30	3.97E+01	3.97E+01	3.21E+01	1.84E+01
PB-210	46.50	4.25	9.80E+01	9.80E+01	-1.05E+01	4.58E+01
PA-231	9.28	42.00	1.93E-01	1.93E-01	1.83E-01	9.01E-02
	10.11	20.20	5.79E-01		5.97E-01	2.72E-01
	283.67	1.60	1.40E+03		-1.63E+01	6.28E+02
	302.67	2.30	1.76E+03		1.92E+03	8.27E+02
+ TH-231	25.64	* 14.70	1.65E+01	1.65E+01	7.31E+00	7.96E+00
	84.21	6.40	4.55E+02		1.93E+03	2.22E+02
PA-234M	9.89	89.00	1.23E-01	1.23E-01	1.27E-01	5.78E-02
	21.72	64.90	1.77E+00		4.41E-01	8.45E-01
	37.93	23.75	2.66E+01		5.57E+01	1.29E+01
	131.42	20.40	7.80E+01		1.87E+01	3.60E+01
+ TH-234	63.29	* 3.80	3.97E+02	3.97E+02	4.55E+02	1.93E+02
NP-237	29.37	* 14.00	2.58E+01	2.58E+01	5.03E+02	1.25E+01
	86.50	12.60	8.56E+01		-1.04E+01	3.99E+01
U-237	97.08	16.30	8.02E+01	5.10E+01	1.83E+01	3.75E+01
	101.07	26.30	5.10E+01		3.78E+00	2.38E+01
	114.00	12.30	2.07E+02		4.34E+02	9.91E+01
	208.01	22.00	1.01E+02		-3.26E+01	4.63E+01
AM-241	59.54	35.90	2.81E+01	2.81E+01	3.31E+01	1.35E+01
AM-243	74.67	66.00	1.40E+01	1.40E+01	6.15E-01	6.58E+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

0000072324.CNF





**SECTION XI**  
**ANALYTICAL DATA (TOTAL DISSOLVED SOLIDS)**

# TDS / TSS Worksheet

Work Order	Run	Analysis Code	Technician
<b>18-09025</b>	<b>1</b>	<b>TDS</b>	<b>MHIGHTOWER</b>

TRetec Fraction	Client ID	Aliquot ml	Filter Data			TDS/TSS (mg/L)	Maximum Aliq (mL)
			Filter Tare (g)	Filter Final (g)	Filter Net (g)		
04	BC-3A	100.0000	113.2496	115.6817	2.4321	24321.0000	4.11
05	BC-3B	100.0000	115.9365	116.5210	0.5845	5845.0000	17.11
06	BC-2A	100.0000	118.8307	129.9351	11.1044	111044.0000	0.90
07	BC-2D	100.0000	119.8938	121.1779	1.2841	12841.0000	7.79
08	BC-2C	100.0000	119.1677	120.5666	1.3989	13989.0000	7.15
09	BC-5	100.0000	121.8025	122.9628	1.1603	11603.0000	8.62
10	BC-1	100.0000	115.6195	115.9193	0.2998	2998.0000	33.36
11	BC-4C	100.0000	114.1280	116.0686	1.9406	19406.0000	5.15
12	BC-4B	100.0000	116.1467	117.7022	1.5555	15555.0000	6.43
13	BC-4A	100.0000	120.8440	121.0642	0.2202	2202.0000	45.41
14	BC-6	100.0000	116.3227	116.8804	0.5577	5577.0000	17.93
15	BC-7B	100.0000	125.1807	125.5852	0.4045	4045.0000	24.72
16	BC-7A	100.0000	118.4940	127.0367	8.5427	85427.0000	1.17
17	BC-8B	100.0000	122.0775	122.4783	0.4008	4008.0000	24.95
18	BC-8A	100.0000	117.7483	126.8940	9.1457	91457.0000	1.09

Technician: MH Date: 9/11/18

# Aliquot Worksheet

Work Order		Run	Analysis Code	Rpt Units	Lab Deadline	Technician	
<b>18-09025</b>		<b>1</b>	<b>TDS</b>	<b>liters</b>	<b>9/21/2018</b>	<b>MHIGHTOWER</b>	

Lab Fraction	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	DUP	DUP							1.0000E-01	1.0000E-01			
04	BC-3A	TRG							1.0000E-01	1.0000E-01			
05	BC-3B	TRG							1.0000E-01	1.0000E-01			
06	BC-2A	TRG							1.0000E-01	1.0000E-01			
07	BC-2D	TRG							1.0000E-01	1.0000E-01			
08	BC-2C	TRG							1.0000E-01	1.0000E-01			
09	BC-5	TRG							1.0000E-01	1.0000E-01			
10	BC-1	TRG							1.0000E-01	1.0000E-01			
11	BC-4C	TRG							1.0000E-01	1.0000E-01			
12	BC-4B	TRG							1.0000E-01	1.0000E-01			
13	BC-4A	TRG							1.0000E-01	1.0000E-01			
14	BC-6	TRG							1.0000E-01	1.0000E-01			
15	BC-7B	TRG							1.0000E-01	1.0000E-01			
16	BC-7A	TRG							1.0000E-01	1.0000E-01			
17	BC-8B	TRG							1.0000E-01	1.0000E-01			
18	BC-8A	TRG							1.0000E-01	1.0000E-01			

Comments
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Technician: Ma Date: 9/11/18