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*e-Hardcopy 2.0*  
*Automated Report*

## Technical Report for

**Hydro-Environmental Technology, Inc.**

**8060.00 (RL) Indigo-Desoto Parish, LA**

**SGS Job Number: LA47470X**

**Sampling Date: 09/06/18**

### Report to:

**Hydro-Environmental Technology  
P.O. BOX 60295  
Lafayette, LA 70596  
labdata@hetinc.us**

**ATTN: Stewart L Stover, Jr.**

**Total number of pages in report: 174**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

*Ron Benjamin*  
**Ron Benjamin**  
**Lab Director**

**Client Service contact: Ralph Frye 337-237-4775**

Certifications: LDEQ(2048), LDHH(LA150012), AR(14-045-04), AZ(AZ0805), FL(E87657), IL(200082), KY(#31), NC(487), SC(73004001), NJ(LA007), TX(T104704186-15-7), WV(257)

This report shall not be reproduced, except in its entirety, without the written approval of SGS.  
Test results relate only to samples analyzed.

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### Sample Summary

Hydro-Environmental Technology, Inc.  
8060.00 (RL) Indigo-Desoto Parish, LA

Job No: LA47470X

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
LA47470-1	09/06/18	10:20	KC/LV09/07/18	AQ	Water	HALEY POND 6'
LA47470-2	09/06/18	10:50	KC/LV09/07/18	AQ	Water	HALEY POND 2'
LA47470-3	09/06/18	16:10	KC/LV09/07/18	AQ	Water	LONG 1&2 RIG SUPPLY
LA47470-4	09/06/18	16:20	KC/LV09/07/18	AQ	Water	LONG 3&4 RIG SUPPLY

**Subcontract Lab Data**

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**Report of Analysis**

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**SGS NORTH AMERICA INC.**

**LA47470X**

**STANDARD LEVEL IV  
REPORT OF ANALYSIS**

**WORK ORDER #18-09034-OR**

**October 26, 2018**

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

0001

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0002



Eberline Services – Oak Ridge Laboratory  
LABORATORY DATA SUPPORT CHECKLIST

MP-001-3

18-09034

Eberline Services Work Order # \_\_\_\_\_

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

Date for Partial	Initials	Date	Initials	Checklist Items
		9/11/18	AS	Sample Log-In
		9-26-18	JH	Data Compilation
		9-27-18	MLT	First Technical Data Review
		10/2/18	JES	Second Technical Data Review
		10/23/18	G	Data Entry/Electronic Deliverable
		10/23/18	CS	Case Narrative
		10/25/18	ELT	Electronic Deliverable Proof
		10/25/18	JES	Samples Analyzed within Holding Time Yes? <input checked="" type="checkbox"/> No? <input type="checkbox"/>
		10/25/18	JES	QA/QC Review
				Client in Possession of Data Electronic or Hard Copy
				Invoiced by Laboratory

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

Date package approved by:

\_\_\_\_\_  
Laboratory Manager

\_\_\_\_\_  
Date

Copy No. \_\_\_\_\_

Radiochemistry Services

0003

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

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0004





Date / Time: 9/10/2018 11:04:46 AM

CSR: ralph

Job #: LA47470X

Client Project: 8060.00 Indigo-Desoto Parish, LA

Deliverable: COMMB

TAT: Due 10/12/2018

Sub Lab: Eberline Analytical  
Address: 601 Scarboro Road  
City: Oak Ridge

State: TN Zip: 37830

Contact: Kathy Shaulis

Phone: (865) 483-4621

REC'D SEP 11 2018

18-09034

SGS Sample #	Client Sample Description	Analysis	Location	Sampled By	Date Sampled	Time Sampled	Aliquot
4	HALEY POND 6'	RA-226 ,RA-228 ,IDS .	OL .	KC/LV	9/6/2018	10:20:00 AM	
5	HALEY POND 2'	RA-226 ,RA-228 ,IDS .	OL .	KC/LV	9/6/2018	10:50:00 AM	
6	LONG 1&2 RIG SUPPLY	RA-226 ,RA-228 ,IDS .	OL .	KC/LV	9/6/2018	4:10:00 PM	
7	LONG 3&4 RIG SUPPLY	RA-226 ,RA-228 ,IDS .	OL .	KC/LV	9/6/2018	4:20:00 PM	

Comments:

*Ronald Spencer*


Sample Management Receipt:

0857

Date: 9-11-18 0857


(8) 32oz (1103) 0910 B  
(4) 25oz (1103)

0006

	<h1>Internal Chain of Custody</h1>	Work Order #	18-09034
		Lab Deadline	10/1/2018
		Analysis	Ra226 - Level 4
		Sample Matrix	Water


Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Use container #3 for TDS	04	43	EE1.3
	05	38	EE1.3
	06	41	EE1.3
	07	35	EE1.3

	Location (circle one)						Initials	Date
	Sample Storage	Rough Prep	Prep	Separations	Count Room			
Received by	Sample Storage							
Relinquished by	Sample Storage		Prep			J. Long	9/18/18 0900	
Received by	Sample Storage		Prep	Separations				
Relinquished by	Sample Storage		Prep	Separations			JB 9/19/18 0800 JB 9/20/18 1040	
Received by	Sample Storage		Prep	Separations	Count Room			
Relinquished by	Sample Storage		Prep	Separations	Count Room		KP 9/20/18 1045 KB 9/20/18 1045	
Received by	Sample Storage		Prep	Separations	Count Room			
Relinquished by	Sample Storage		Prep	Separations	Count Room			
Received by	Sample Storage		Prep	Separations	Count Room			
Relinquished by	Sample Storage		Prep	Separations	Count Room			
Received by	Sample Storage		Prep	Separations	Count Room			
Relinquished by	Sample Storage		Prep	Separations	Count Room			

 <b>EBERLINE SERVICES</b> Oak Ridge Laboratory	<h1>Internal Chain of Custody</h1>	Work Order #	<b>18-09034</b>
		Lab Deadline	<b>10/1/2018</b>
		Analysis	<b>Ra228 - Level 4</b>
		Sample Matrix	<b>Water</b>


Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
<p><b>Use container #3 for TDS</b></p>	<b>04</b>	43	EE1.3
	<b>05</b>	38	EE1.3
	<b>06</b>	41	EE1.3
	<b>07</b>	35	EE1.3

	Location (circle one)						Initials	Date
	Sample Storage	Rough Prep	Prep	Separations	Count Room			
Received by	Sample Storage							<i>[Signature]</i> 9/18/18
Relinquished by	Sample Storage		Prep					<i>[Signature]</i> 9/18/18
Received by	Sample Storage			Prep				JS 9/19/18 0800
Relinquished by	Sample Storage			Prep				JS 9/20/18 1040
Received by	Sample Storage				Count Room			KP 9/20/18 1045
Relinquished by	Sample Storage				Count Room			KB 9/20/18 1454
Received by	Sample Storage							JS 9/24/18 0800
Relinquished by	Sample Storage							JS 9/25/18 1410
Received by	Sample Storage				Count Room			ICB 9/25/18 1411
Relinquished by	Sample Storage				Count Room			ICB 9/25/18 1618
Received by	Sample Storage							
Relinquished by	Sample Storage							
Received by	Sample Storage							
Relinquished by	Sample Storage							

 <b>EBERLINE</b> SERVICES Oak Ridge Laboratory	<h1>Internal Chain of Custody</h1>	Work Order #	<b>18-09034</b>
		Lab Deadline	<b>9/13/2018</b>
		Analysis	<b>TDS - Level 4</b>
		Sample Matrix	<b>Water</b>

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Use container #3 for TDS	04	43	EE1.3
	05	38	EE1.3
	06	41	EE1.3
	07	35	EE1.3

Location (circle one)						Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	<i>Mu</i>	<i>12 SEP 18</i>
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	<i>Mu</i>	<i>12 SEP 18 0530</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		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		

 <b>EBERLINE</b> SERVICES	<b>Sample Receiving Report</b> (Volumes, pH, & CPM)	Internal Work Order <b>18-09034</b>
		Received By <b>RSPENCER</b>

FR	ClientID	# Btls	Comments	Matrix	Storage	Rec Vol Ttl	CPM Max
01	LCS	0		WA	EE1.3		
02	BLANK	0		WA	EE1.3		
03	DUP	0		WA	EE1.3		
04	HALEY POND 6	3		WA	EE1.3	2.00	43
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	43
			2	<2	<2	1.0000	29
			3	7	7	0.25	41
05	HALEY POND 2	3		WA	EE1.3	2.25	38
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	33
			2	<2	<2	1.0000	38
			3	7	7	0.2500	29
06	LONG 1 AND 2 RIG SUPPLY	3		WA	EE1.3	2.25	41
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	31
			2	<2	<2	1.0000	41
			3	7	7	0.2500	19
07	LONG 3 AND 4 RIG SUPPLY	3		WA	EE1.3	2.25	35
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	33
			2	<2	<2	1.0000	27
			3	7	7	0.2500	35

*167  
9/11/18*

Received by: *Randall Spencer* Date: *9-11-18*

MP-001, Rev 5  
Effective: 11/22/02  
**0010**



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

0011







STANDARD OPERATING PROCEDURE

Sample Receiving

MP-001, Rev. 19  
Effective 2/11/18  
Page 13 of 15

2

Eberline Services - Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST  
MP-001-2

WORK ORDER # 18-09034

SAMPLE MATRIX/MATRICES:

(CIRCLE ONE OR BOTH)

AQUEOUS NON-AQUEOUS

WERE SAMPLES:

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

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: 9-11-18

Copy No. \_\_\_\_\_

Radiochemistry Services

0013



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

---

0014



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

2

EBS-OR-44500

October 25, 2018

Ralph Frye  
 SGS North America Inc.  
 500 Ambassador Caffery Parkway  
 Scott, LA 70583

CASE NARRATIVE  
 LA Certificate #05005  
 Work Order # 18-09034-OR

SAMPLE RECEIPT

This work order contains four water samples received 09/11/2018. 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>
HALEY POND 6	18-09034-04	LONG 1 AND 2 RIG SUPPLY	18-09034-06
HALEY POND 2	18-09034-05	LONG 3 AND 4 RIG SUPPLY	18-09034-07

ANALYTICAL METHODS

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

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

RADIUM-226

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

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

ANALYTICAL RESULTS CONTINUED

RADIUM-226 CONTINUED

within acceptable limits for the analytical technique. Results for the Radium-226 laboratory control sample demonstrated an acceptable percent recovery.

RADIUM-228

Following alpha spectroscopy analysis of Radium-226, Barium/Radium Sulfate precipitates were redissolved and allowed for sufficient ingrowth of the Actinium-228 daughter. After ingrowth, Actinium-228 was selectively precipitated. Precipitates were filtered and beta emissions for Actinium-228 were 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 samples. The Radium-228 method blank demonstrated an acceptable result. Results for the Radium-228 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Radium-228 laboratory control sample demonstrated an acceptable percent recovery.

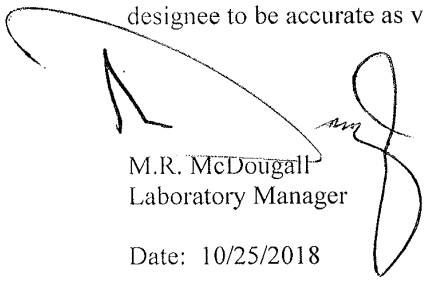
TOTAL DISSOLVED SOLIDS (TDS)

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

Samples demonstrated Total Dissolved Solids content that ranged from 412.0 to 751.0 mg/L.

CERTIFICATION OF ACCURACY

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

  
M.R. McDougall  
Laboratory Manager  
Date: 10/25/2018

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**

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0017

# Eberline Analytical

## Final Report of Analysis

Lab ID		Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
18-09034-01	LCS	KNOWN		09/11/18 00:00	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	1.01E+01	4.65E-01			pCi/l
18-09034-01	LCS	SPIKE		09/11/18 00:00	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	1.04E+01	1.40E+00	2.61E+00	2.18E-01	pCi/l
18-09034-02	MBL	BLANK		09/11/18 00:00	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	-1.31E-01	1.08E-01	1.12E-01	3.95E-01	pCi/l
18-09034-03	DUP	HALEY POND 6		09/06/18 10:20	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	3.01E-01	2.70E-01	2.77E-01	3.51E-01	pCi/l
18-09034-04	DO	HALEY POND 6		09/06/18 10:20	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	5.51E-01	3.62E-01	3.80E-01	3.05E-01	pCi/l
18-09034-05	TRG	HALEY POND 2		09/06/18 10:50	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	4.28E-01	3.26E-01	3.38E-01	3.61E-01	pCi/l
18-09034-06	TRG	LONG 1 AND 2 RIG SUPPLY		09/06/18 16:10	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	3.40E-01	2.97E-01	3.05E-01	4.01E-01	pCi/l
18-09034-07	TRG	LONG 3 AND 4 RIG SUPPLY		09/06/18 16:20	9/11/2018	9/20/2018	18-09034	Radium-226	EPA 903.0 Modified	5.28E-01	3.68E-01	3.85E-01	4.47E-01	pCi/l
18-09034-01	LCS	KNOWN		09/11/18 00:00	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	9.18E+00	4.68E-01			pCi/l
18-09034-01	LCS	SPIKE		09/11/18 00:00	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	8.26E+00	6.86E-01	1.98E+00	7.74E-01	pCi/l
18-09034-02	MBL	BLANK		09/11/18 00:00	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	2.69E-01	3.75E-01	3.80E-01	7.73E-01	pCi/l
18-09034-03	DUP	HALEY POND 6		09/06/18 10:20	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	2.70E-01	4.30E-01	4.35E-01	8.90E-01	pCi/l
18-09034-04	DO	HALEY POND 6		09/06/18 10:20	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	3.20E-01	4.09E-01	4.16E-01	8.39E-01	pCi/l
18-09034-05	TRG	HALEY POND 2		09/06/18 10:50	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	8.00E-01	4.12E-01	4.50E-01	7.95E-01	pCi/l
18-09034-06	TRG	LONG 1 AND 2 RIG SUPPLY		09/06/18 16:10	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	2.30E-01	4.50E-01	4.53E-01	9.34E-01	pCi/l
18-09034-07	TRG	LONG 3 AND 4 RIG SUPPLY		09/06/18 16:20	9/11/2018	9/25/2018	18-09034	Radium-228	EPA 904.0	4.17E+00	6.46E-01	1.14E+00	1.00E+00	pCi/l
18-09034-04	TRG	HALEY POND 6		09/06/18 10:20	9/11/2018	9/12/2018	18-09034	TDS	SM2540C	7.51E+02				mg/l
18-09034-05	TRG	HALEY POND 2		09/06/18 10:50	9/11/2018	9/12/2018	18-09034	TDS	SM2540C	4.21E+02				mg/l
18-09034-06	TRG	LONG 1 AND 2 RIG SUPPLY		09/06/18 16:10	9/11/2018	9/12/2018	18-09034	TDS	SM2540C	4.49E+02				mg/l
18-09034-07	TRG	LONG 3 AND 4 RIG SUPPLY		09/06/18 16:20	9/11/2018	9/12/2018	18-09034	TDS	SM2540C	4.12E+02				mg/l

Work Order Details:

SDG: **18-09034**  
 Project: **LA47470X**  
 Analysis Category: **ENVIRONMENTAL**  
 Sample Matrix: **WA**

Report To:

Ralph Frye  
 SGS North America Inc  
 500 Amb. Caffery Pkwy  
 Scott, LA 70583

0018

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 STANDARD**

---

0019



Ba-6  
(#6a)

# National Institute of Standards & Technology Certificate

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

ORIGINAL

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

### Radiological Hazard

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

### Chemical Hazard

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

### Storage and Handling

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

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

### Preparation

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

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

Gaithersburg, Maryland 20899  
October 1994

Thomas E. Gills, Chief  
Standard Reference Materials Program





QUALITY CONTROL PROGRAM  
QCP-009

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

EBERLINE SERVICES - OAK RIDGE LABORATORY  
RADIOACTIVE REFERENCE SOLUTIONS  
PRIMARY DILUTION RECERTIFICATION  
QCP 009-1

SOLUTION REFERENCE # NIST SRM4251C CURRENT DATE 5/5/2018 0:00  
SOLUTION # Ba-6

Principal Radionuclide <sup>133</sup>Barium Half Life, Years 1.048E+01 Half Life, Days 3.828E+03

Radionuclide <sup>133</sup>Barium Reference Date 9/1/1993 0:00  
Certified Activity                       $\mu$ Ci  
Certified Concentration 1.318E+01  $\mu$ Ci per gram

Ampoule /Solution Gross 9.3081 Weight, Grams  
Empty Ampoule 4.2582 Weight, Grams  
Solution Net 5.0499 Weight, Grams  
Total Activity in Ampoule 66.5577  $\mu$ Ci

Chemical Composition of Standard Solution  
<sup>133</sup>BaCl<sub>2</sub> in 1M HCl

Dilution Instructions: Dilution Solvent Used 1M HCl

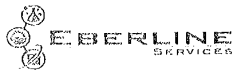
Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 66.5577  $\mu$ Ci Which Equals 1.478E+08 dpm at the date listed above

And after dilution the activity of this solution is 1.478E+05 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: April 26, 2019

Verified & Approved By [Signature] Date: 5/5/18  
QC Approval [Signature] Date: 5/5/18



QUALITY CONTROL PROGRAM  
QCP-009

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

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

Solution Reference # QCP-009-1-A  
NIST SRM4251C

Date 5/5/18  
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  
Parent Solution Conc. 1.48E+05 dpm/ml

Reference Date 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  
Total Activity: 3.6950E+06 dpm  
Final Volume: 1000.00 ml

Final Activity Concentration: 3.6950E+03 dpm/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

# CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

*Ra-5*  
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).

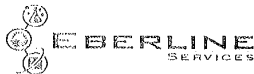


ISOTOPE PRODUCTS LABORATORIES  
1800 North Keystone Street  
Burbank, California 91504  
(818) 843 - 7000

*Anna U. Kuan*  
QUALITY CONTROL

*Feb. 3, 1994*  
Date Signed

0023



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]

Date: 9/17/2018

QC Approval [Signature]

Date: 9/18/18

0024



QUALITY CONTROL PROGRAM

MP 009

Rev.0: 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

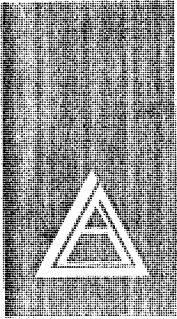
Verified & Approved By [Signature]

Date: 9/17/2018 0:00

QC Approval [Signature]

Date: 9/18/18

0025



ANALYTICS #411 Rec'd 2/15/06 R. Taskaeva

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

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

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# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

*Ra 228*

72325-207

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%

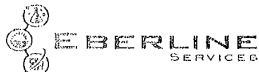
5.10721 grams 0.1M HCl solution with 50  $\mu$ g/g Ba carrier.

P O NUMBER 00003181, Item 1

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

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

0026



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  $\mu$ Ci  
Certified Concentration                       $\mu$ 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  $\mu$ 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  $\mu$ 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 [Signature] Date: 2/12/18

QC Approval [Signature] Date: 2/13/18

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

0028



WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09034</b>	<b>Ra226</b>	<b>1</b>	<b>pCi</b>	<b>I</b>	<b>SGS North America 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	103.15%	25.03%	100.00%	4.60%	1.01E+01	4.65E-01	1.04E+01	2.61E+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**

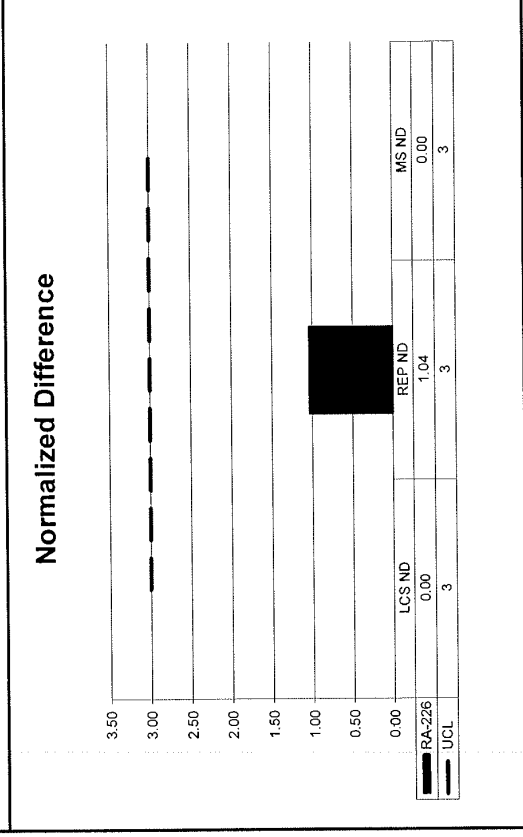
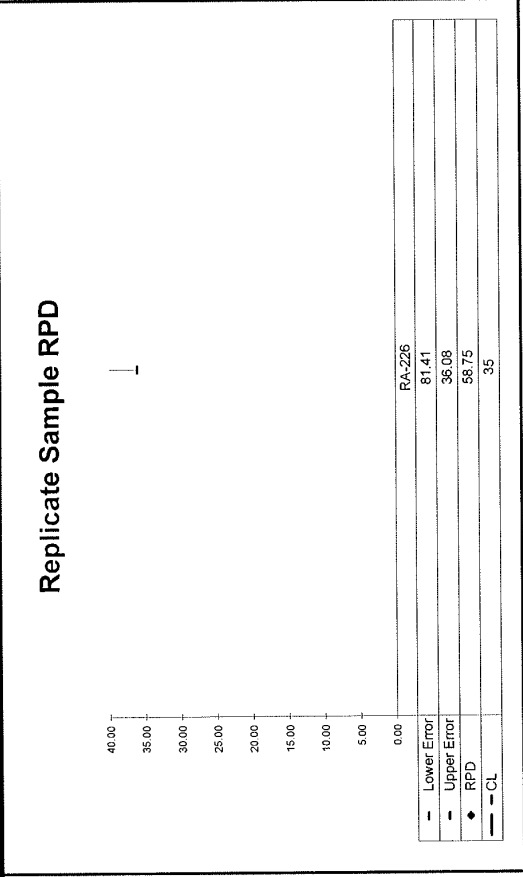
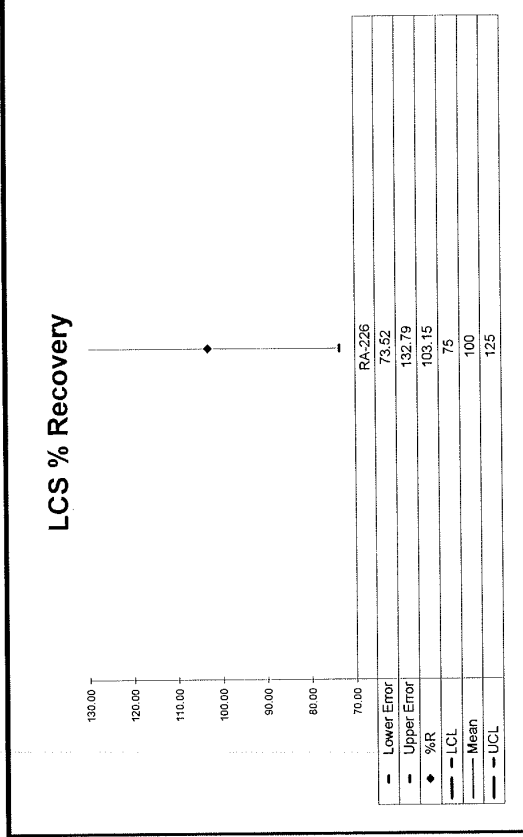
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS MD	Rep RPD	Rep MD
RA-226	1.04	58.75	5.51E-01	3.80E-01	3.01E-01	2.77E-01	1.03	OK			NA	OK

**QC Summary**

Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS MD	Rep RPD	Rep MD
RA-226	1.04	58.75	5.51E-01	3.80E-01	3.01E-01	2.77E-01	1.03	OK			NA	OK

0029

WO	Analysis	Activity Units	Aliquot Units	Client Name
<b>18-09034</b>	<b>Ra226</b>	<b>1</b>	<b>I</b>	<b>SGS North America Inc.</b>



No Matrix Spike

0030

Version

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09034</b>	<b>Ra228</b>	<b>1</b>	<b>pCi</b>	<b>I</b>	<b>SGS North America 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	90.05%	24.11%	100.00%	5.10%	9.18E+00	4.68E-01	8.26E+00	1.99E+00	Ra-12	5.32E+01	5.10E+00	3.83E-01

**Matrix Spike**

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

**Duplicate Results**

Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-228	0.16	17.05	3.20E-01	4.16E-01	2.70E-01	4.35E-01	0.90	OK			NA	OK

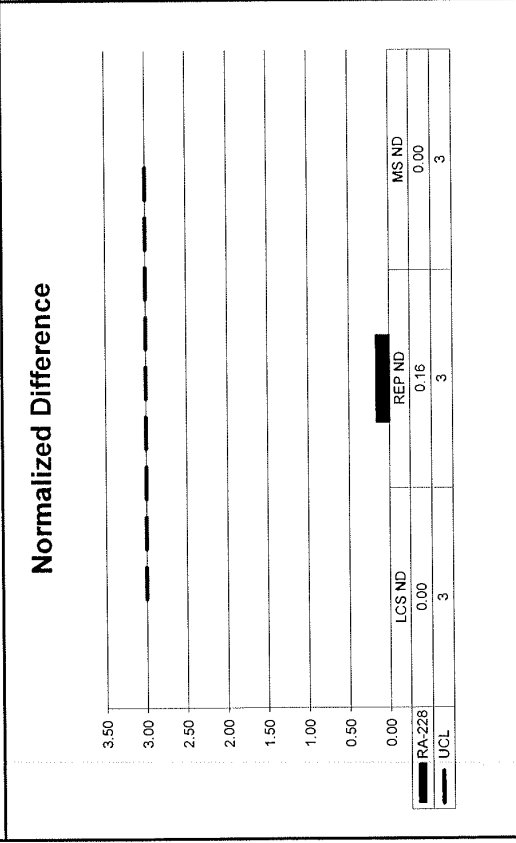
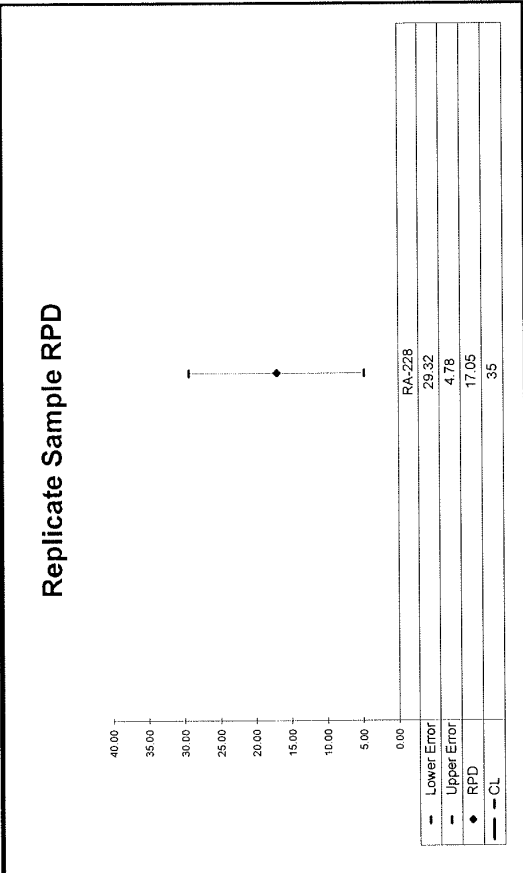
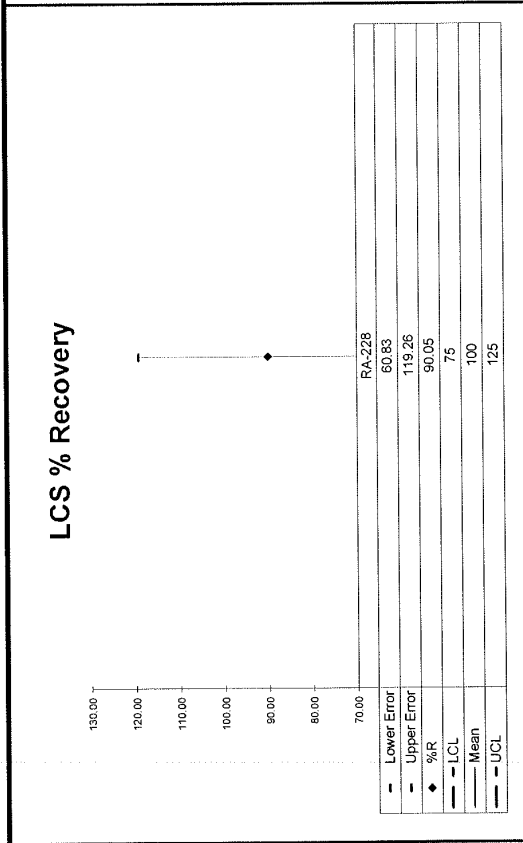
**QC Summary**

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-228	0.16	17.05	3.20E-01	4.16E-01	2.70E-01	4.35E-01	0.90	OK			NA	OK

0031

Version

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
<b>18-09034</b>	<b>Ra228</b>	<b>1</b>	<b>pCi</b>	<b>I</b>	<b>SGS North America Inc.</b>



No Matrix Spike

0032

Version

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

0033

RA-226 NOTES

0034

 <b>EBERLINE</b> SERVICES <b>Work Order Analysis Notes</b>	<b>Oak Ridge Laboratory</b>	Internal Work Order	18-09034
	601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Analysis Code	Ra226
		Run Number	1

#	Date	Dept	User	Notes
1	09/18/18 10:42	PREP	JHARVEY	ALIUQUOTED AND 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*  
9/18/18

0035

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	18-09034
			Analysis Code	Ra226
			Run Number	1


2

#	Date	Dept	User	Notes
1	09/18/18 10:42	PREP	JHARVEY	ALIQUOTED AND 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	09/20/18 10:39	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*  
9/20/18

0036



 <b>Reagents Used in an Analysis</b>		Internal Work Order		
		18-09034		
		Analysis Code		Run
		Ra226		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/18/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/18/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/18/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/18/2018
020000P	Nitric Acid	Reagent Grade	JHARVEY	9/18/2018
019210P	Acetic Acid	Reagent Grade	JBAILEY	9/20/2018
019733D02	Ammonium Sulfate	200 mg/ml	JBAILEY	9/20/2018
020249S	EDTA	0.25M	JBAILEY	9/20/2018

0037

Alpha 3

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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	2hrs0-	UU	KB
9/19/18	1809066A (1-4)	Smoky mtn	1112	2hrs0-	UU	KB
9/19/18	1809016A (1-13)	sec N. America	1200	2hrs0-	Rate	KB
9/19/18	1809025A (1-12)	MPA	1624	2hrs0-	Rate	KB
9/19/18	Daily Pulser	Lab	0500	10min	Na	KP
9/19/18	1809058A (1-4)	USA	0802	2hrs50min	UU	KP
9/19/18	1809046A (1-3,18)	TDX Assoc.	0802	2hrs50min	UU	KP
9/19/18	1809057A (1-4)	Bungess	0803	2hrs50min	Th	KP
9/19/18	1809046A (1-3,18)	TDX Assoc.	0804	2hrs50min	Th	KP
9/19/18	1809044A (1-7)	USA	1207	2hrs0-	Rate	KB
9/20/18	Daily Pulser	Lab	0513	10min	Na	KP
9/20/18	1809076A (1-4)	USA	0825	2hrs50min	UU	KP
9/20/18	1809076A (1-4)	USA	0826	2hrs50min	Th	KP
9/20/18	1809046A (1-3,18)	TDX Assoc.	0827	2hrs50min	Am <sup>241</sup>	KP
9/20/18	1809046A (1-3,18)	TDX Assoc.	0828	2hrs50min	Pu	KP
9/20/18	1809045A (1-10)	TN Dept of H.	0829	2hrs50min	UU	KP
9/20/19	1809045A (11)	TN Dept of H.	1127	2hrs0-	UU	KB
9/20/18	1809052A (1-5)	MPA	1128	2hrs0-	Rate	KB
9/20/18	1809018A (1-4)	Quest	1125	5hr35min	Pu	KB
9/20/18	1809033A (1-5)	MPA	1129	2hrs0-	Rate	KB
9/20/18	1809034A (1-7)	sec N. America	1159	2hrs0-	Rate	KB

0038

RA-228 NOTES

0039


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	18-09034
		Analysis Code	Ra228
		Run Number	1

#	Date	Dept	User	Notes
1	09/18/18 10:42	PREP	JHARVEY	ALIUQUOTED AND 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*  
 9/18/18

0040


 <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	18-09034
		Analysis Code	Ra228
		Run Number	1

#	Date	Dept	User	Notes
1	09/18/18 10:42	PREP	JHARVEY	ALIUQUOTED AND 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	09/25/18 13:58	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.

*JBAILEY*  
 9/25/18

0041

2

 <b>EBERLINE</b> SERVICES  Reagents Used in an Analysis		Internal Work Order		
		18-09034		
		Analysis Code		Run
		Ra228		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/18/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/18/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/18/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/18/2018
020000P	Nitric Acid	Reagent Grade	JHARVEY	9/18/2018
018297D01	Ammonium Oxalate	5%	JBAILEY	9/25/2018
018971D06	Nitric Acid	1N	JBAILEY	9/25/2018
019673D02	Nitric Acid	6N	JBAILEY	9/25/2018
018699D10	Sodium Hydroxide	10M	JBAILEY	9/25/2018
019344D01	Sodium Hydroxide	18M	JBAILEY	9/25/2018
019519S	Yttrium Carrier	9 mg/ml	JBAILEY	9/25/2018

0042

Aqua LB4110

87

Date	Sample #	Client	Load time	Count time	Analysis	Tech
9/20/18	1809071A(1-13)	Auxier	1345	2 hrs	αβ	KB
9/21/18	Daily Bkgd/QC	Lab	0526/0628	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)	CA Energy	1128	2 hrs	Raw	KB
9/21/18	1809044RA(1-7)	USA	1129	2 hr	Raw	KB
9/21/18	1809025RA(1-4)	MPA	1426	2 hrs	Raw	KB
9/22/18	Weekly Bkgd	Lab	0839	12 hr	αβ	KB
9/24/18	Daily Bkgd/QC	Lab	0505/0608	1hr/30min	αβ	KP
9/24/18	Cross Talk	Lab	0641	5 min	αβ	KP
9/24/18	Cross Talk	Lab	0650	5 min	αβ	KP
9/24/18	18090465(1-3,18)	TPX Assoc.	0657	1 hr	Tot Sr	KP
9/24/18	1809033RA(1)	MPA	1112	1 hr	Raw	KB
9/24/18	1809033RA(2-5)	MPA	1113	2 hrs	Raw	KB
9/24/18	1809052RA(1)	MPA	1113	1 hr	Raw	KB
9/24/18	1809052RA(2-5)	MPA	1114	2 hr	Raw	KB
9/25/18	Daily Bkgd/QC	Lab	0515/0618	1hr/30min	αβ	KP
9/25/18	Cross Talk	Lab	0654	5 min	αβ	KP
9/25/18	Cross Talk	Lab	0703	5 min	αβ	KP
9/25/18	1809034RA(1-7)	ss N. America	1415	2 hrs	Raw	KB
9/25/18	1809036RA(1-7)	ss N. America	1416	2 hr	Raw	KB

0043

**TDS NOTES**

0044



 <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	18-09034
		Analysis Code	TDS
		Run Number	1

#	Date	Dept	User	Notes
1	09/12/18 05:07	PREP	MHIGHTOWER	Filtered sample into tared beaker, dried, re-weighed

Mh 12 SEP 18

0045

2

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

0046

<b>Work Order</b>	<b>18-09034</b>
<b>Analysis Code</b>	<b>Ra226</b>
<b>Run</b>	<b>1</b>
<b>Date Received</b>	<b>9/11/2018</b>
<b>Lab Deadline</b>	<b>10/1/2018</b>
<b>Client</b>	SGS North America Inc.
<b>Project</b>	ENV
<b>Report Level</b>	4
<b>Activity Units</b>	pCi
<b>Aliquot Units</b>	1
<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>	474.27
<b>Carrier</b>	
<b>Carrier Conc (mg/ml)</b>	

0047

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/11/18 00:00	1.0000E+00
02	MBL	BLANK		09/11/18 00:00	1.0000E+00
03	DUP	HALEY POND 6	43	09/06/18 10:20	1.0000E+00
04	DO	HALEY POND 6	43	09/06/18 10:20	1.0000E+00
05	TRG	HALEY POND 2	38	09/06/18 10:50	1.0000E+00
06	TRG	LONG 1 AND 2 RIG SUPPLY	41	09/06/18 16:10	1.0000E+00
07	TRG	LONG 3 AND 4 RIG SUPPLY	35	09/06/18 16:20	1.0000E+00

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



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	2.2010	1043.9	722.0	153.55		0.0209	0.0312	0.0103		110.00	3.00 <sup>^</sup>	1.00
02	MBL	2.2025	1044.6	701.0	148.98		0.0215	0.0313	0.0098		110.00	3.00 <sup>^</sup>	1.00
03	DUP	2.1995	1043.2	616.0	131.09		0.0207	0.0289	0.0082		110.00	2.82	1.00
04	DO	2.1994	1043.1	969.0	206.23		0.0211	0.0304	0.0093		110.00	3.00 <sup>^</sup>	1.00
05	TRG	2.1976	1042.3	669.0	142.50		0.0211	0.0301	0.0090		110.00	3.00 <sup>^</sup>	1.00
06	TRG	2.1943	1040.7	630.0	134.39		0.0216	0.0311	0.0095		110.00	3.00 <sup>^</sup>	1.00
07	TRG	2.1973	1042.1	974.0	207.49		0.0211	0.0294	0.0083		110.00	2.84	1.00

0048

\* 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			09/18/18 09:31	JHARVEY	09/20/18 10:07	JBAILEY		
02	MBL			09/18/18 09:31	JHARVEY	09/20/18 10:07	JBAILEY		
03	DUP			09/18/18 09:31	JHARVEY	09/20/18 10:07	JBAILEY		
04	DO			09/18/18 09:31	JHARVEY	09/20/18 10:07	JBAILEY		
05	TRG			09/18/18 09:31	JHARVEY	09/20/18 10:07	JBAILEY		
06	TRG			09/18/18 09:31	JHARVEY	09/20/18 10:07	JBAILEY		
07	TRG			09/18/18 09:31	JHARVEY	09/20/18 10:07	JBAILEY		

0049

\* 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.

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	1.04E+01	1.40E+00	2.18E-01	1.01E+01	103.15	OK		OK	
02	RA-226	MBL	BLANK	pCi/l	-1.31E-01	1.08E-01	3.95E-01					OK	OK
03	RA-226	DUP	HALEY POND 6	pCi/l	3.01E-01	2.70E-01	3.51E-01				NA	OK	
04	RA-226	DO	HALEY POND 6	pCi/l	5.51E-01	3.62E-01	3.05E-01					OK	
05	RA-226	TRG	HALEY POND 2	pCi/l	4.28E-01	3.26E-01	3.61E-01					OK	
06	RA-226	TRG	LONG 1 AND 2 RIG SUPPLY	pCi/l	3.40E-01	2.97E-01	4.01E-01					OK	
07	RA-226	TRG	LONG 3 AND 4 RIG SUPPLY	pCi/l	5.29E-01	3.68E-01	4.47E-01					OK	

0500

 1 Run	Analysis Code <b>Ra226</b>	Eberline Analytical Work Order <b>18-09034</b>	Client <b>SGS North America Inc.</b>
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 <p><b>Run 1</b></p>	<p><b>18-09034</b> <b>Ra226</b></p> <p>Analysis Code</p>	<p><b>SGS North America Inc.</b></p> <p>Client</p>
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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-226	LCS	09/11/18 00:00	1.00E+00	100.00	0.00	110.00		9/20/2018 10:07	
02	RA-226	MBL	09/11/18 00:00	1.00E+00	100.00	0.00	110.00		9/20/2018 10:07	
03	RA-226	DUP	09/06/18 10:20	1.00E+00	100.00	0.00	110.00		9/20/2018 10:07	
04	RA-226	DO	09/06/18 10:20	1.00E+00	100.00	0.00	110.00		9/20/2018 10:07	
05	RA-226	TRG	09/06/18 10:50	1.00E+00	100.00	0.00	110.00		9/20/2018 10:07	
06	RA-226	TRG	09/06/18 16:10	1.00E+00	100.00	0.00	110.00		9/20/2018 10:07	
07	RA-226	TRG	09/06/18 16:20	1.00E+00	100.00	0.00	110.00		9/20/2018 10:07	

Preliminary Data Report & Analytical Calculations  
**Work Order: 18-09034-Ra226-1**


0052

Client: **SGS North America Inc.**

Eberline Analytical Work Order: **18-09034**

Analysis Code: **Ra226**

Run: **1**



Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Half-life (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-226	LCS	09/20/18 11:57		A_Spec	Alpha_047	170	2.29 E+02	2.00 E-03	17.4
02	RA-226	MBL	09/20/18 11:57		A_Spec	Alpha_048	170	-2.89 E+00	1.70 E-02	17.6
03	RA-226	DUP	09/20/18 11:58		A_Spec	Alpha_049	170	6.30 E+00	1.00 E-02	15.6
04	RA-226	DO	09/20/18 11:58		A_Spec	Alpha_050	170	9.49 E+00	3.00 E-03	13.7
05	RA-226	TRG	09/20/18 11:58		A_Spec	Alpha_051	170	7.81 E+00	7.00 E-03	14.5
06	RA-226	TRG	09/20/18 11:58		A_Spec	Alpha_052	170	7.28 E+00	1.60 E-02	17
07	RA-226	TRG	09/20/18 11:58		A_Spec	Alpha_053	170	1.08 E+01	1.90 E-02	15.3



18-09034-Ra226-1 (pCi/l) in WA  
Tracer ID: Ba-6a

Count Room Report  
Client: SGS North America Inc.

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	09/11/18 00:00	1.0000	2.2010	1043.8683	722.0000	153.55	3.00^	1.00
02	MBL	BLANK	09/11/18 00:00	1.0000	2.2025	1044.5797	701.0000	148.98	3.00^	1.00
03	DUP	HALEY POND 6	09/06/18 10:20	1.0000	2.1995	1043.1569	616.0000	131.09	2.82	1.00
04	DO	HALEY POND 6	09/06/18 10:20	1.0000	2.1994	1043.1094	969.0000	206.23	3.00^	1.00
05	TRG	HALEY POND 2	09/06/18 10:50	1.0000	2.1976	1042.2558	669.0000	142.50	3.00^	1.00
06	TRG	LONG 1 AND 2 RIG SUPPLY	09/06/18 16:10	1.0000	2.1943	1040.6907	630.0000	134.39	3.00^	1.00
07	TRG	LONG 3 AND 4 RIG SUPPLY	09/06/18 16:20	1.0000	2.1973	1042.1135	974.0000	207.49	2.84	1.00

0053



# Aliquot Worksheet

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
<b>18-09034</b>	<b>1</b>	<b>Ra226</b>	<b>liters</b>	<b>10/1/2018</b>	<b>JHARVEY</b>

Lab Fraction	Sample		Muffle Data		Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
	Client ID	Type	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	HALEY POND 6	DUP					1.0000E+00	1.0000E+00					
04	HALEY POND 6	DO					1.0000E+00	1.0000E+00					
05	HALEY POND 2	TRG					1.0000E+00	1.0000E+00					
06	LONG 1 AND 2 RIG SUPPLY	TRG					1.0000E+00	1.0000E+00					
07	LONG 3 AND 4 RIG SUPPLY	TRG					1.0000E+00	1.0000E+00					

Comments
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0055

Technician: J Harvey Date: 9/18/18





# Apex-Alpha™

CS  
9/20/18

2

Sample Description: SPIKE  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002227  
 Batch Identification: 1809034A-RA  
 Sample Identification: 01  
 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: 3.000E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 9/20/2018 10:49:32 AM  
 Acquisition Date/Time: 9/20/2018 11:57:50 AM  
 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

Control Certificate Name: Ra226\_Ra-5b  
 Chem. Recov. of Control: RA-226 0.343844 +/- 0.025683  
 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	5.504	3.81	117.34	1.19	0.00E+000	3.0
RA-226	4.582	228.66	12.97	0.34	0.00E+000	3.7

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

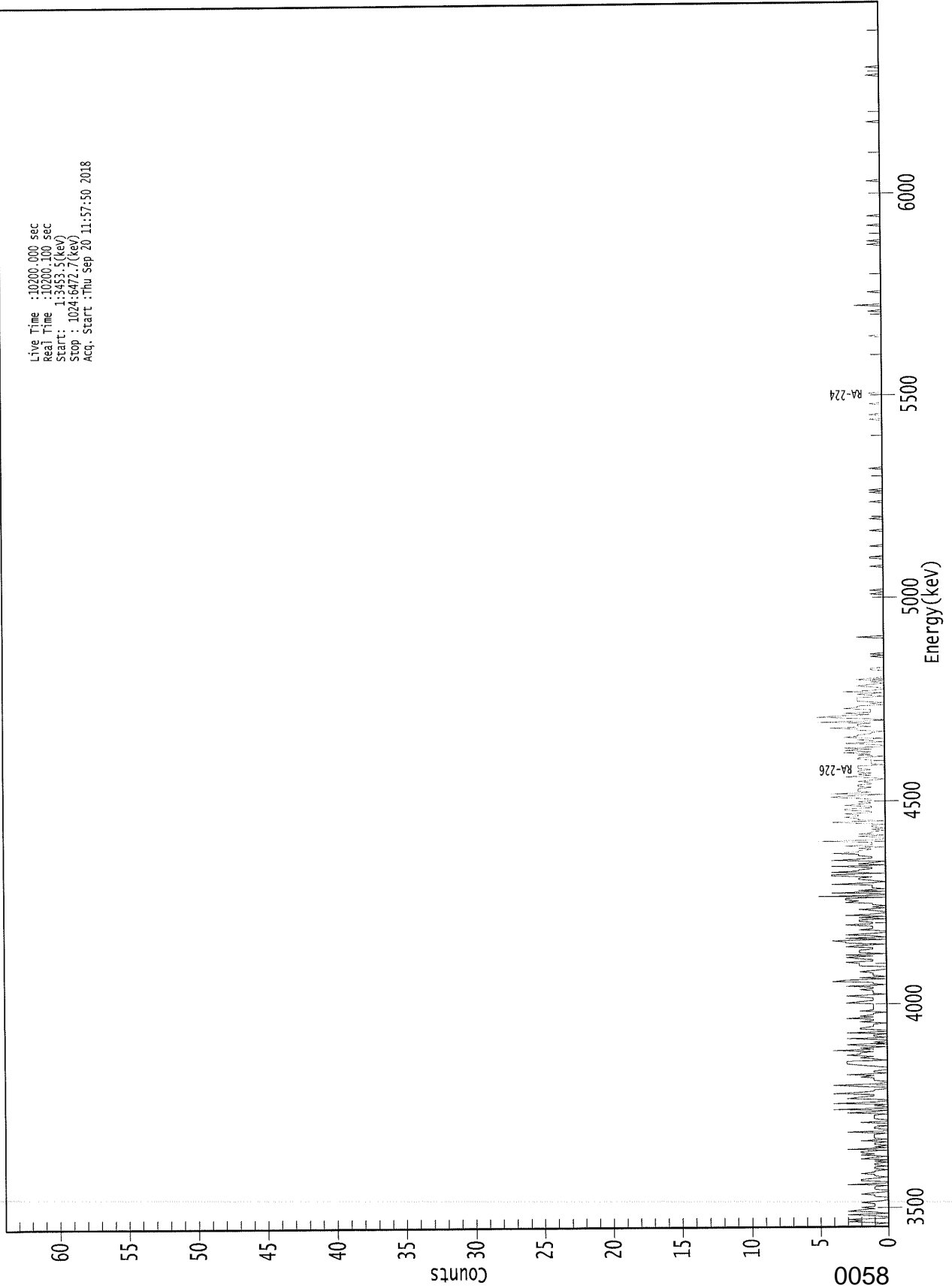
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.958	5685.50*	1.83E-001 +/- 2.14E-001	3.16E-001 +/- 1.07E-002
RA-226	0.948	4785.00*	1.04E+001 +/- 1.40E+000	2.18E-001 +/- 7.38E-003

AG  
9/21/18

0057

0000222720.CNF

Live Time : 10200.000 sec  
Real Time : 10200.100 sec  
Start : 1:3453.5(keV)  
Stop : 1024:6472.7(keV)  
Acq. Start : Thu Sep 20 11:57:50 2018



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

Sample Title: 01

Elapsed Live time: 10200

Elapsed Real Time: 10200

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

0059

369: 2 1 1 2 1 0 1 3

Sample Title: 01

Channel	1	2	1	2	1	0	1	3
377:	1	2	1	2	2	1	2	2
385:	2	0	1	1	1	1	2	2
393:	0	2	1	3	1	3	1	3
401:	0	0	1	3	0	1	2	0
409:	3	2	2	1	1	0	2	2
417:	4	1	2	2	1	5	0	0
425:	3	5	3	1	3	1	1	1
433:	3	2	2	0	1	0	2	2
441:	2	2	0	1	2	0	3	1
449:	0	0	1	2	1	0	1	0
457:	2	1	0	0	0	0	0	0
465:	1	1	0	0	0	0	0	0
473:	0	0	0	1	0	1	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	0	2	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	1
529:	0	0	1	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	1	0
553:	0	0	0	0	0	1	1	0
561:	0	0	0	0	0	0	0	1
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	1	0	0	0
585:	0	0	0	0	0	0	1	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	1	0	0	0
609:	0	0	0	0	1	0	1	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	1	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	1	0	0	0	1	0	0
681:	0	0	0	0	0	0	1	0
689:	0	0	0	0	0	0	0	1
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	1
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	2	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

0060

2



801: 0 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	1	0	0	1
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	1	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	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	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	1	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	1	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

2

0061

VB  
9/20/18

Sample Description: BLANK  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002227  
 Batch Identification: 1809034A-RA  
 Sample Identification: 02  
 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: 3.000E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 9/20/2018 10:49:32 AM  
 Acquisition Date/Time: 9/20/2018 11:57:51 AM  
 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  
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Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.484	-0.87	258.63	1.87	0.00E+000	3.0
RA-226	4.601	-2.89	82.82	2.89	0.00E+000	0.0

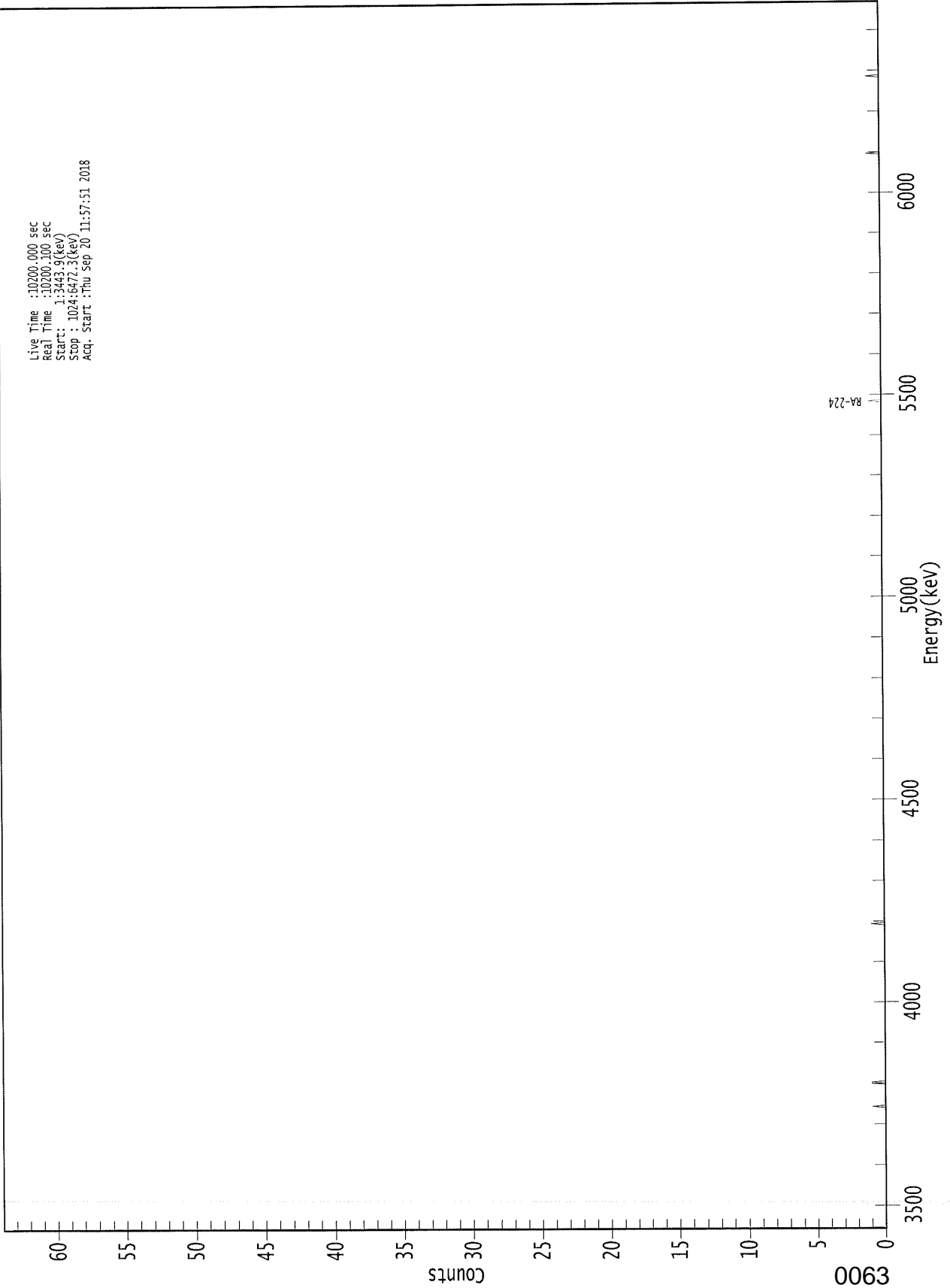
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.948	5685.50*	-4.13E-002 +/- 1.07E-001	3.60E-001 +/- 1.22E-002
RA-226	0.957	4785.00*	-1.31E-001 +/- 1.08E-001	3.95E-001 +/- 1.34E-002

AG  
9/21/18

0000222719.CNF

Live Time : 10200.000 sec  
Real Time : 10200.100 sec  
Start : 1:34:43.9(keV)  
Stop : 1024:6472.3(keV)  
Acq. Start : Thu Sep 20 11:57:51 2018



ROI Type: 1

\*\*\*\*\*  
 \*\*\*\*\* S P E C T R A L D A T A R E P O R T \*\*\*\*\*  
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Sample Title: 02

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

0064



369: 0 0 0 0 0 0 0 0 0

Sample Title: 02

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	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	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	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	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

0065



801: 0 0 0 0 0 0 0 0 0

Sample Title: 02

Channel									
809:	0	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0	0
833:	0	0	0	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:	1	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0	0
921:	0	0	0	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	0	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	0	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	0	0
1001:	0	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0	0

2

YB  
9/20/18

Sample Description: HALEY POND 6 DUP  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002227  
 Batch Identification: 1809034A-RA  
 Sample Identification: 03  
 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: 2.820E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 9/6/2018 10:49:32 AM  
 Acquisition Date/Time: 9/20/2018 11:58:09 AM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1565 +/- 0.0028 on 2/16/2018 12:37:01 PM  
 Effective Efficiency: 0.1565 +/- 0.0028

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	5.556	5.26	115.67	3.74	0.00E+000	3.0
RA-226	4.584	6.30	89.57	1.70	0.00E+000	3.0

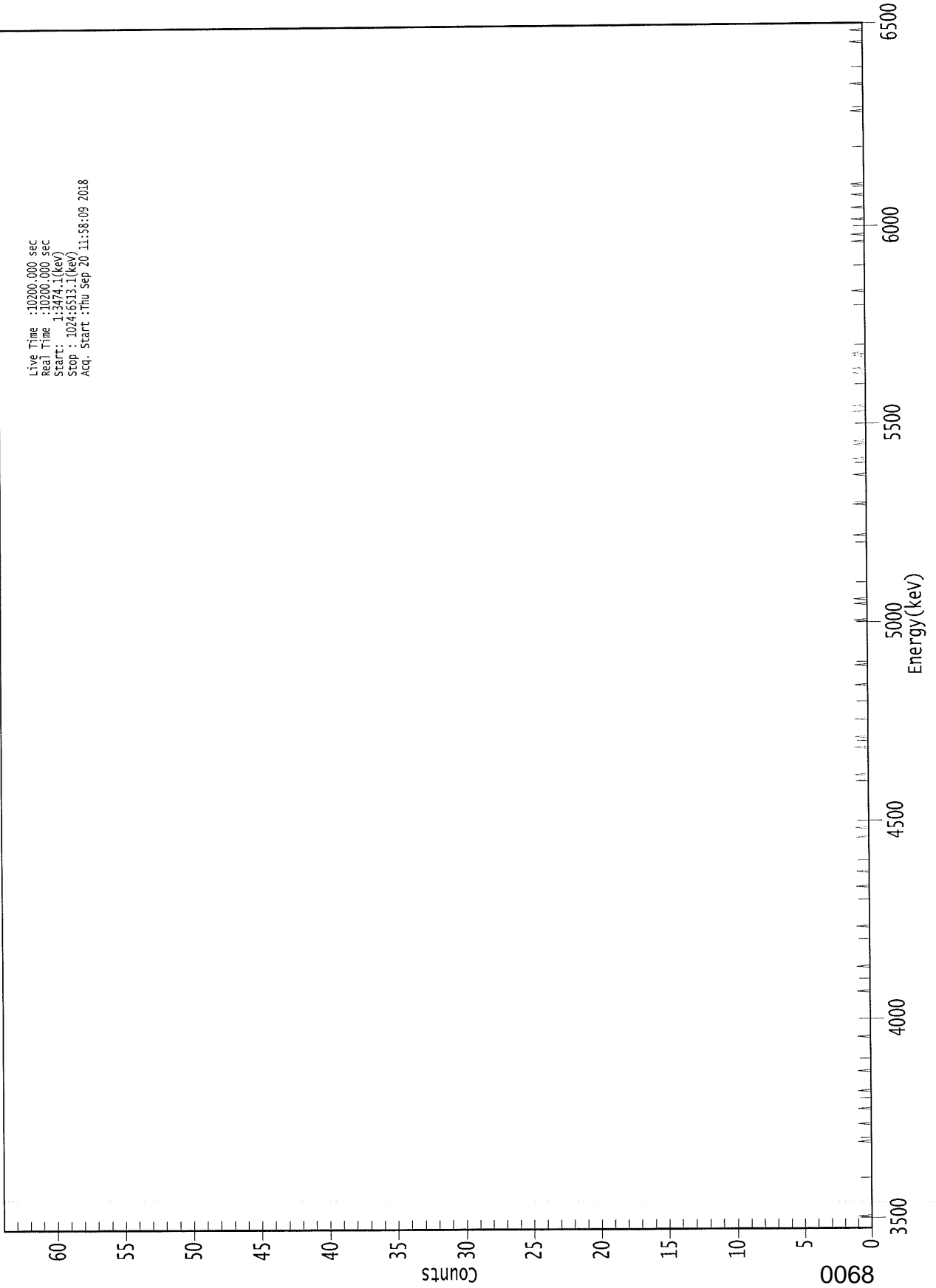
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.978	5685.50*	2.65E-001 +/- 3.07E-001	4.84E-001 +/- 1.70E-002
RA-226	0.949	4785.00*	3.01E-001 +/- 2.70E-001	3.51E-001 +/- 1.23E-002

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9/20/18

0000222723.CNF

Live Time :10200.000 sec  
Real Time :10200.000 sec  
Start : 1:3474.1(keV)  
Stop : 1024:6513.1(keV)  
Acq. Start :Thu Sep 20 11:58:09 2018



ROI Type: 1



\*\*\*\*\*  
 \*\*\*\*\* S P E C T R A L D A T A R E P O R T \*\*\*\*\*  
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Sample Title: 03

Elapsed Live time: 10200  
 Elapsed Real Time: 10200

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

0069



369: 0 0 0 0 0 0 0 0 0

Sample Title: 03

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	1	0	0	0	0
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	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	0	0	1
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	1	0	0	0
465:	0	0	0	0	0	0	0	0
473:	0	0	0	0	0	1	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	1	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	1	0	0	0	1	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	1	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	1	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	1	0	0	0
657:	0	0	0	0	0	0	0	0
665:	1	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	1	0	0	0
697:	0	1	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	1	0	0
729:	0	1	0	0	0	0	0	0
737:	0	0	0	0	1	0	1	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	1	0	0	0	0

0070



801: 0 0 0 0 0 0 0 0 0

Sample Title: 03

Channel									
809:	0	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	1	0	0	0
841:	0	0	0	1	0	0	0	0	0
849:	0	0	0	0	0	0	0	0	0
857:	1	0	0	0	0	0	0	0	0
865:	0	0	1	0	0	0	0	0	0
873:	0	0	0	0	0	1	0	0	0
881:	0	0	0	0	0	0	1	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:	0	0	0	0	0	0	0	0	0
921:	0	0	0	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	1	0	0	0	0
953:	0	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0	0
969:	0	0	0	1	0	0	0	0	0
977:	0	0	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	0	0
1001:	0	0	0	0	0	0	1	0	0
1009:	0	0	0	0	0	0	0	0	0
1017:	1	0	0	0	0	0	0	0	0

2



KS  
9/20/18

2

Sample Description: HALEY POND 6  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002227  
 Batch Identification: 1809034A-RA  
 Sample Identification: 04  
 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: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 9/6/2018 10:49:32 AM  
 Acquisition Date/Time: 9/20/2018 11:58:11 AM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1369 +/- 0.0025 on 2/16/2018 12:37:00 PM  
 Effective Efficiency: 0.1369 +/- 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	5.525	7.32	76.28	0.68	0.00E+000	3.0
RA-226	4.639	9.49	65.59	0.51	0.00E+000	4.4

-----  
 NUCLIDE ANALYSIS RESULTS  
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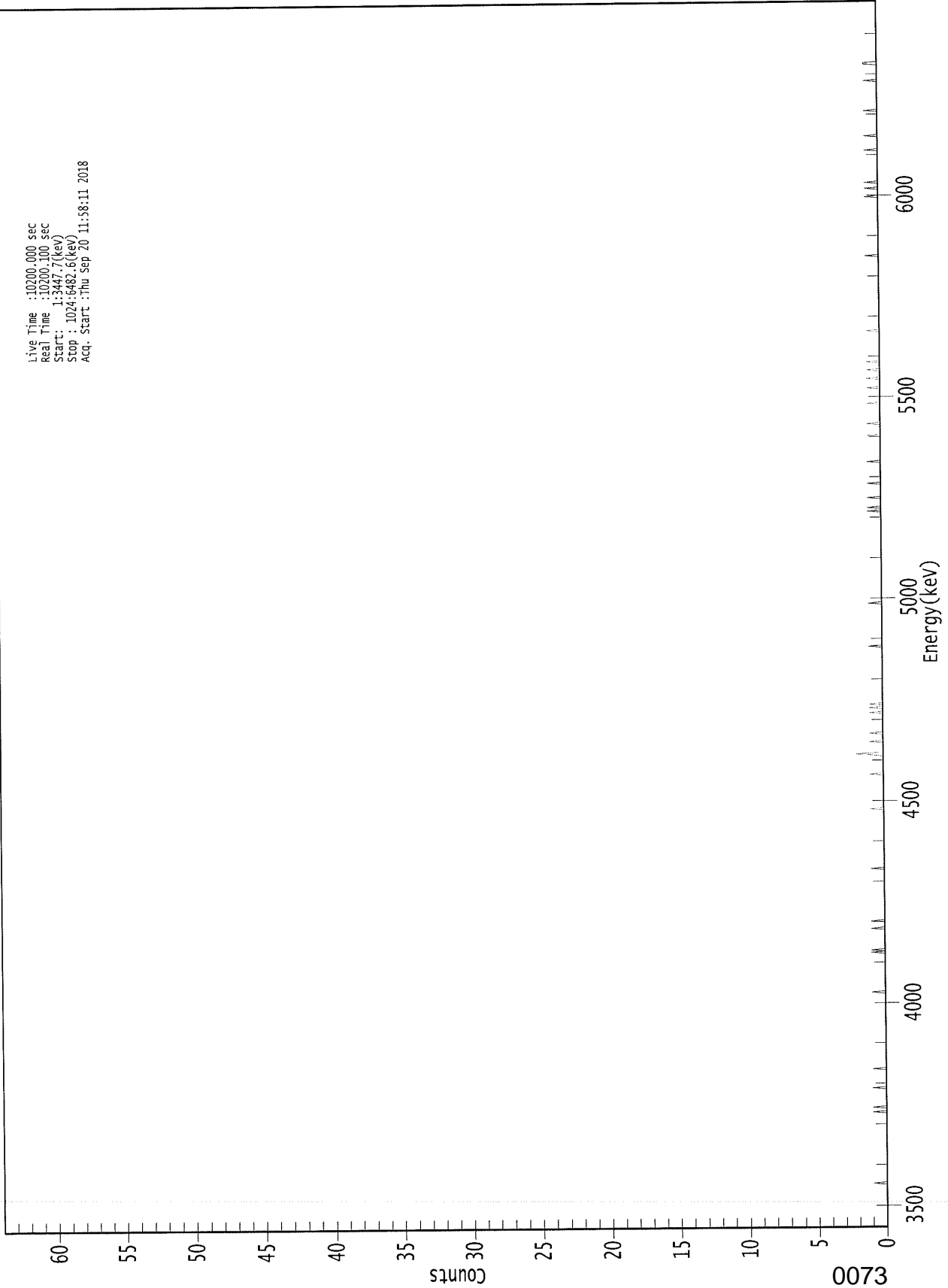
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.967	5685.50*	4.49E-001 +/- 3.43E-001	3.46E-001 +/- 1.23E-002
RA-226	0.973	4785.00*	5.51E-001 +/- 3.62E-001	3.05E-001 +/- 1.09E-002

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9/21/18

0072

0000222724.CNF

Live Time : 10200.000 sec  
Real Time : 10200.100 sec  
Start : 1:3447.7(keV)  
Stop : 1024:6482.6(keV)  
Acq. Start : Thu Sep 20 11:58:11 2018



ROI Type: 1

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

Sample Title: 04

Elapsed Live time: 10200

Elapsed Real Time: 10200

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	1	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	1
97:	0	0	0	1	0	0	0	0	0
105:	0	0	0	0	0	0	0	0	0
113:	0	0	0	1	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	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	1	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	1	0	1	0	0
233:	0	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0	0
249:	1	0	0	0	0	0	1	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	1	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	1	0	0	0	0
353:	0	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0	0

0074



369: 0 0 0 0 0 0 0 0 0

Sample Title: 04

Channel	1	2	3	4	5	6	7	8	9
377:	0	1	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0	0
393:	0	1	2	0	0	0	0	0	0
401:	0	0	0	0	1	0	0	0	0
409:	0	0	0	1	0	0	0	0	0
417:	0	0	0	0	0	0	0	0	0
425:	0	0	0	0	1	0	0	0	0
433:	1	0	0	1	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	1	0	0	0	0	0
489:	0	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0	1
521:	0	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0	0
593:	0	0	0	0	1	0	0	0	1
601:	0	0	0	0	0	0	0	0	1
609:	0	0	0	0	0	0	0	0	0
617:	0	0	0	1	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	0
657:	0	0	0	1	0	0	0	0	0
665:	0	0	0	0	0	1	0	0	0
673:	0	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	1	0	0
689:	0	0	0	0	0	0	0	0	0
697:	0	0	0	1	0	0	0	0	0
705:	0	0	0	1	0	0	0	0	0
713:	0	0	1	0	0	0	0	0	0
721:	0	1	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:	0	0	0	1	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	0
785:	0	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0	0

0075

801: 0 0 0 0 0 0 0 0 0

Sample Title: 04

Channel	1	2	3	4	5	6	7	8	9
809:	0	0	1	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0	0
833:	0	0	0	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	1	0	0	0	0	0
865:	0	0	1	0	0	0	0	0	1
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	1	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	1	0
913:	0	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0	0
929:	0	0	0	1	0	0	0	0	0
937:	0	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0	0
953:	0	0	0	0	1	0	0	0	0
961:	0	0	0	0	0	0	0	0	0
969:	0	0	1	1	0	0	0	0	0
977:	0	0	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	0	0
1001:	0	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0	1

2



KB  
9/20/18

Sample Description: HALEY POND 2  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002227  
 Batch Identification: 1809034A-RA  
 Sample Identification: 05  
 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: 9/6/2018 10:49:32 AM  
 Acquisition Date/Time: 9/20/2018 11:58:13 AM  
 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	5.508	5.79	97.97	2.21	0.00E+000	3.0
RA-226	4.585	7.81	76.13	1.19	0.00E+000	3.0

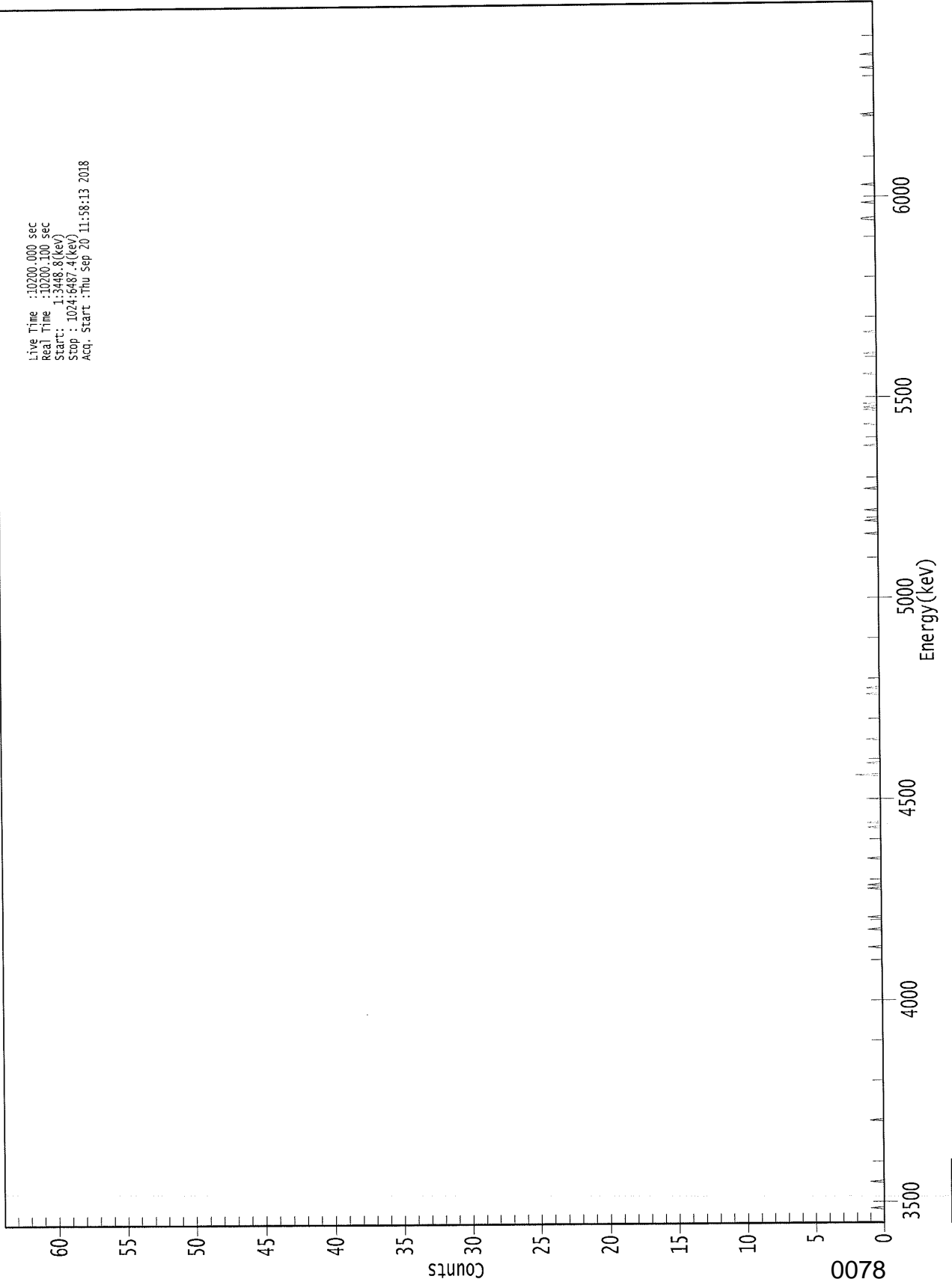
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.960	5685.50*	3.35E-001 +/- 3.28E-001	4.62E-001 +/- 1.64E-002
RA-226	0.949	4785.00*	4.28E-001 +/- 3.26E-001	3.61E-001 +/- 1.28E-002

AG  
9/21/18

0000222725.CNF

Live Time :10200.000 sec  
Real Time :10200.100 sec  
Start : 1:34:48.8(keV)  
Stop : 1024:6487.4(keV)  
Acq. Start :Thu Sep 20 11:58:13 2018



ROI Type: 1

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

Sample Title: 05

Elapsed Live time: 10200

Elapsed Real Time: 10200

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

0079



369: 0 0 0 0 0 0 0 2 0

Sample Title: 05

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	0
385:	1	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	1	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	0	0	0	0	0
441:	0	0	1	0	0	0	0	1
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:	1	0	0	0	0	0	0	0
585:	0	0	0	1	0	0	0	0
593:	0	0	0	0	1	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	1	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	1	0	0	0	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:	1	0	1	0	0	1	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	1	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	1
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:	0	0	0	0	0	0	0	0

0080



801: 0 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	0
833:	0	0	0	0	0	0	0	0
841:	1	1	0	0	0	0	0	0
849:	0	0	0	0	0	0	1	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	1	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:	1	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	1
969:	0	0	0	0	0	0	0	0
977:	0	0	1	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

2

0081

V.B.  
9/20/18

Sample Description: LONG 1 AND 2 RIG SUPPLY  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002227  
 Batch Identification: 1809034A-RA  
 Sample Identification: 06  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_052  
 Chamber Serial Number: 10006123B  
 Detector Serial Number: 52  
 Env. Background: System Bkgd 225263  
 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: 9/6/2018 10:49:32 AM  
 Acquisition Date/Time: 9/20/2018 11:58:14 AM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1700 +/- 0.0030 on 2/16/2018 12:36:57 PM  
 Effective Efficiency: 0.1700 +/- 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	5.531	-0.53	415.13	1.53	0.00E+000	3.0
RA-226	4.610	7.28	87.08	2.72	0.00E+000	3.0

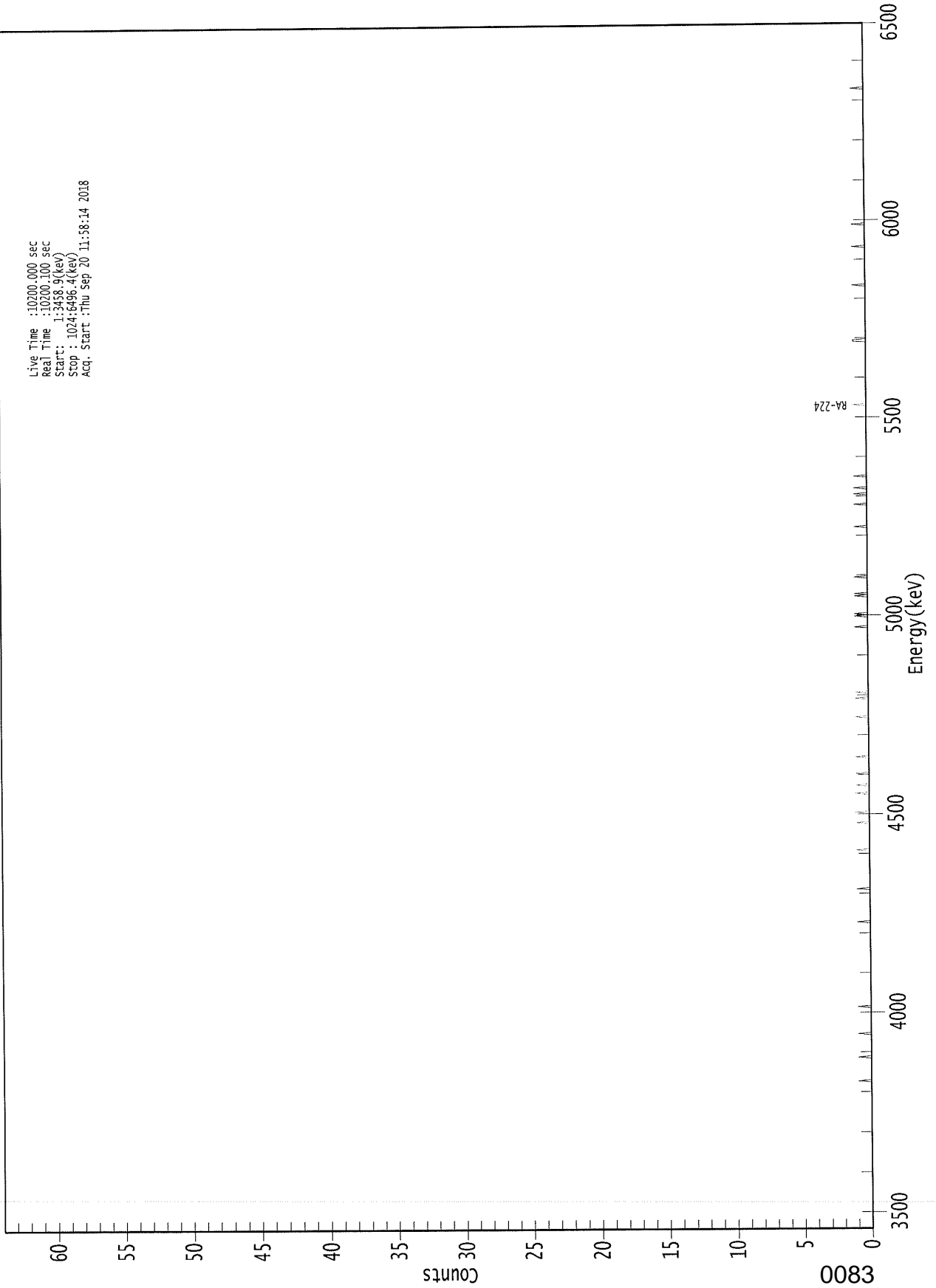
-----  
 NUCLIDE ANALYSIS RESULTS  
 -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.969	5685.50*	-2.62E-002 +/- 1.09E-001	3.51E-001 +/- 1.22E-002
RA-226	0.961	4785.00*	3.40E-001 +/- 2.97E-001	4.01E-001 +/- 1.39E-002

AG  
9/21/18

0000222722.CNF

Live Time :10200.000 sec  
Real Time :10200.100 sec  
Start : 1:34:58.9(kev)  
Stop : 1024:6496.4(kev)  
Acq. Start :Thu Sep 20 11:58:14 2018



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

Sample Title: 06

Elapsed Live time: 10200

Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----	-----
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	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	1	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:	1	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0	0
161:	0	0	0	0	1	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	1	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	1	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	1
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:	1	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	0	0	0	0	0	0
353:	1	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0	0

0084





369: 1 0 0 0 0 0 0 0 1

Sample Title: 06

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	0	0	0	0
385:	0	1	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0	1
401:	0	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0	0
433:	0	1	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0	0
449:	0	1	0	0	0	0	0	1	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	0	0	0	0	0	0
505:	0	0	0	0	0	0	1	0	0
513:	0	0	0	0	0	0	0	1	0
521:	1	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0	1
537:	0	1	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0	1
553:	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0	0
593:	0	0	1	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	1	0	0
617:	0	0	0	0	0	0	0	1	0
625:	0	0	0	1	0	0	0	0	0
633:	0	0	0	0	0	0	1	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	1	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:	0	0	0	0	0	0	0	0	0
753:	1	1	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	0
785:	0	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0	0

0085

2

801: 1 0 0 0 0 0 0 0 0

Sample Title: 06

Channel	1	2	3	4	5	6	7	8	9
809:	0	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0	0
833:	0	1	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0	0
849:	0	0	0	0	1	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:	0	0	0	0	0	0	0	0	0
921:	0	0	0	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	0	0	0	0
953:	0	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0	1
969:	0	0	0	0	0	0	0	0	0
977:	0	0	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	0	0
1001:	0	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0	0

2

12/5  
9/20/18

# Apex-Alpha™

2

Sample Description: LONG 3 AND 4 RIG SUPPLY  
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002227  
 Batch Identification: 1809034A-RA  
 Sample Identification: 07  
 Sample Geometry: Shelf 2  
 Procedure Description: Ra

Detector Name: Alpha\_053  
 Chamber Serial Number: 10006122A  
 Detector Serial Number: 53  
 Env. Background: System Bkgd 225264  
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter  
 Generic Mult. Factor: 2.840E+000 Generic Div. Factor: 1.000E+000  
 Sample Date/Time: 9/6/2018 10:49:32 AM  
 Acquisition Date/Time: 9/20/2018 11:58:16 AM  
 Acquisition Live Time: 170.0 minutes  
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000  
 Counting Efficiency: 0.1531 +/- 0.0027 on 2/16/2018 12:36:55 PM  
 Effective Efficiency: 0.1531 +/- 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	5.406	1.32	215.97	0.68	0.00E+000	5.9
RA-226	4.609	10.77	69.42	3.23	0.00E+000	3.0

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

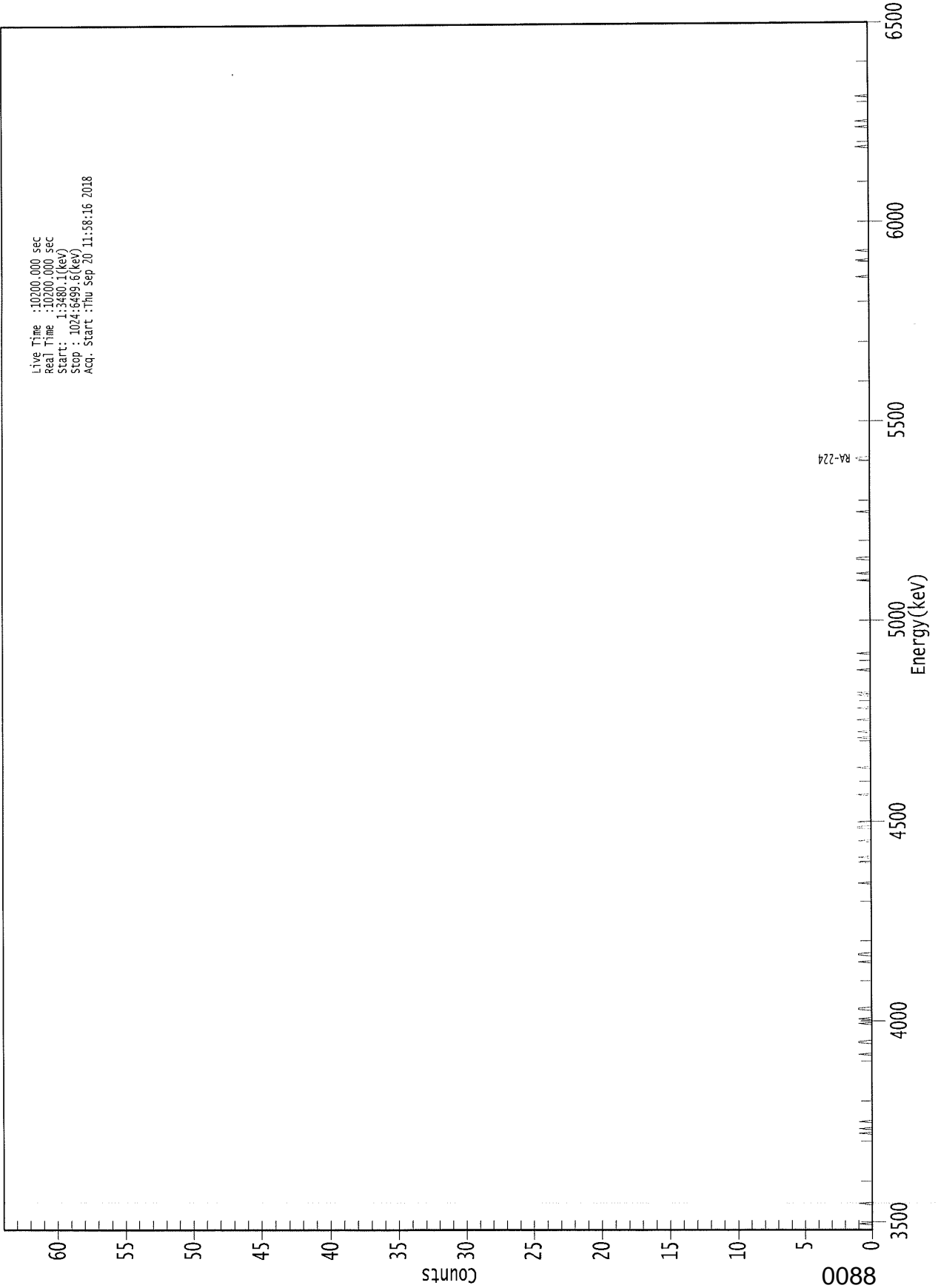
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.903	5685.50*	6.85E-002 +/- 1.48E-001	2.93E-001 +/- 1.03E-002
RA-226	0.960	4785.00*	5.29E-001 +/- 3.68E-001	4.47E-001 +/- 1.57E-002

AG  
9/21/18

0087

0000222721.CNF

Live Time :10200.000 sec  
Real Time :10200.000 sec  
Start: 1:3480.1(kev)  
Stop : 1024:6499.6(kev)  
Acq. Start :Thu Sep 20 11:58:16 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: 10200

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

0089



369: 1 0 0 0 0 0 0 0 0

Sample Title: 07

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	1
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:	1	0	0	0	0	1	0	0
425:	0	0	0	0	0	0	0	1
433:	0	0	0	0	0	0	0	0
441:	0	1	0	0	0	0	0	0
449:	0	0	0	0	1	0	1	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	1
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	1	0	0
553:	0	0	0	1	0	0	0	0
561:	0	0	0	0	0	0	0	1
569:	1	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	1
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	1	1	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

0090

2

801: 0 0 0 0 0 0 0 0 1

Sample Title: 07

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	1	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	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	1	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	1	0
937:	0	0	0	1	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	1	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

2

0091



QA SUMMARY REPORT  
Review Of QA Results - Pulser Check

Date : 9/20/2018  
Time : 5:33:26 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	9/20/2018 5:12:02 AM
Alpha 004	21f	ALL	Passed	9/20/2018 5:12:03 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	9/20/2018 5:12:04 AM
Alpha 012	21f	ALL	Passed	9/20/2018 5:12:04 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	9/20/2018 5:12:05 AM
Alpha 015	21f	Peak Energy	Action	9/20/2018 5:12:06 AM
Alpha 015	21f	Peak FWHM	Action	9/20/2018 5:12:06 AM
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	Peak Energy	Action	9/20/2018 5:12:07 AM
Alpha 034	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:09 AM
Alpha 035	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:10 AM
Alpha 036	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:12 AM
Alpha 037	Alpha Analyst100DC	ALL	Not Done	
Alpha 038	Alpha Analyst100DC	ALL	Not Done	
Alpha 039	Alpha Analyst100DC	Peak FWHM	Action	9/20/2018 5:12:13 AM
Alpha 040	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:15 AM
Alpha 041	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:17 AM
Alpha 042	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:19 AM
Alpha 043	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:21 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:23 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:26 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:29 AM
Alpha 047	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:31 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:34 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:36 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:39 AM
Alpha 051	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:41 AM
Alpha 052	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:44 AM
Alpha 053	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:46 AM
Alpha 054	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:49 AM
Alpha 055	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:52 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:55 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:12:57 AM

0092



CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 058	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:13:00 AM
Alpha 059	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:13:02 AM
Alpha 060	Alpha Analyst100DC	ALL	Passed	9/20/2018 5:13:05 AM

2

APPROVED BY: KP

APPROVAL DATE: 9/20/18

0093

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

0094



**SECTION IX**  
**ANALYTICAL DATA (RADIUM-228)**

0095

<b>Work Order</b>	<b>18-09034</b>
<b>Analysis Code</b>	<b>Ra228</b>
<b>Run</b>	<b>1</b>
<b>Date Received</b>	<b>9/11/2018</b>
<b>Lab Deadline</b>	<b>10/1/2018</b>
<b>Client</b>	SGS North America Inc.
<b>Project</b>	ENV
<b>Report Level</b>	4
<b>Activity Units</b>	pCi
<b>Aliquot Units</b>	l
<b>Matrix</b>	WA
<b>Method</b>	EPA 904.0
<b>Instrument Type</b>	Alpha/Beta GPC
<b>Radiometric Tracer</b>	Ba-133
<b>Radiometric Sol#</b>	Ba-6a
<b>Tracer Act (dpm/g)</b>	473.67
<b>Carrier</b>	Yttrium
<b>Carrier Conc (mg/ml)</b>	30.05

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/11/18 00:00	1.0000E+00
02	MBL	BLANK		09/11/18 00:00	1.0000E+00
03	DUP	HALEY POND 6	43	09/06/18 10:20	1.0000E+00
04	DO	HALEY POND 6	43	09/06/18 10:20	1.0000E+00
05	TRG	HALEY POND 2	38	09/06/18 10:50	1.0000E+00
06	TRG	LONG 1 AND 2 RIG SUPPLY	41	09/06/18 16:10	1.0000E+00
07	TRG	LONG 3 AND 4 RIG SUPPLY	35	09/06/18 16:20	1.0000E+00

0096

\* 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.

18-09034  
Ra228  
Run 1

Eberline Analytical  
Oak Ridge Laboratory  
Analysis Sheet

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	2.2010	1042.5	722.0	153.74	2.000	0.0843	0.1427	0.0584	97.17	106.89	1.00	1.00
02	MBL	2.2025	1043.3	701.0	149.17	2.000	0.0838	0.1412	0.0574	95.51	105.06	1.00	1.00
03	DUP	2.1995	1041.8	616.0	131.26	2.000	0.0834	0.1385	0.0551	91.68	100.85	1.00	1.00
04	DO	2.1994	1041.8	969.0	206.49	2.000	0.0833	0.1392	0.0559	93.01	102.31	1.00	1.00
05	TRG	2.1976	1040.9	669.0	142.68	2.050	0.0829	0.1444	0.0615	99.83	109.82	1.00	1.00
06	TRG	2.1943	1039.4	630.0	134.56	2.000	0.0835	0.1408	0.0573	95.34	104.88	1.00	1.00
07	TRG	2.1973	1040.8	974.0	207.75	2.000	0.0838	0.1351	0.0513	85.36	93.89	1.00	1.00

0097

\* 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			09/25/18 12:16	JBAILEY	09/20/18 10:07	JBAILEY	09/25/18 12:29	JBAILEY
02	MBL			09/25/18 12:16	JBAILEY	09/20/18 10:07	JBAILEY	09/25/18 12:29	JBAILEY
03	DUP			09/25/18 12:16	JBAILEY	09/20/18 10:07	JBAILEY	09/25/18 12:29	JBAILEY
04	DO			09/25/18 12:16	JBAILEY	09/20/18 10:07	JBAILEY	09/25/18 12:29	JBAILEY
05	TRG			09/25/18 12:16	JBAILEY	09/20/18 10:07	JBAILEY	09/25/18 12:29	JBAILEY
06	TRG			09/25/18 12:16	JBAILEY	09/20/18 10:07	JBAILEY	09/25/18 12:29	JBAILEY
07	TRG			09/25/18 12:16	JBAILEY	09/20/18 10:07	JBAILEY	09/25/18 12:29	JBAILEY

0098

\* 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.

6600	Client	<b>SGS North America Inc.</b>	
Run	<b>1</b>	Analysis Code	<b>Ra228</b>
		Eberline Analytical Work Order	<b>18-09034</b>

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	8.26E+00	6.86E-01	7.74E-01	9.18E+00	90.05	OK		OK	
02	RA-228	MBL	BLANK	pCi/l	2.69E-01	3.75E-01	7.73E-01					OK	OK
03	RA-228	DUP	HALEY POND 6	pCi/l	2.70E-01	4.30E-01	8.90E-01				NA	OK	
04	RA-228	DO	HALEY POND 6	pCi/l	3.20E-01	4.09E-01	8.39E-01					OK	
05	RA-228	TRG	HALEY POND 2	pCi/l	8.00E-01	4.12E-01	7.95E-01					OK	
06	RA-228	TRG	LONG 1 AND 2 RIG SUPPLY	pCi/l	2.30E-01	4.50E-01	9.34E-01					OK	
07	RA-228	TRG	LONG 3 AND 4 RIG SUPPLY	pCi/l	4.17E+00	6.46E-01	1.00E+00					OK	

Run	1
Analysis Code	Ra228
Eberline Analytical Work Order	18-09034
Client	SGS North America Inc.
0100	

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	09/11/18 00:00	1.00E+00	153.74	97.17	106.89	1.00	9/20/2018 10:07	9/25/2018 12:29
02	RA-228	MBL	09/11/18 00:00	1.00E+00	149.17	95.51	105.06	1.00	9/20/2018 10:07	9/25/2018 12:29
03	RA-228	DUP	09/06/18 10:20	1.00E+00	131.26	91.68	100.85	1.00	9/20/2018 10:07	9/25/2018 12:29
04	RA-228	DO	09/06/18 10:20	1.00E+00	206.49	93.01	102.31	1.00	9/20/2018 10:07	9/25/2018 12:29
05	RA-228	TRG	09/06/18 10:50	1.00E+00	142.68	99.83	109.82	1.00	9/20/2018 10:07	9/25/2018 12:29
06	RA-228	TRG	09/06/18 16:10	1.00E+00	134.56	95.34	104.88	1.00	9/20/2018 10:07	9/25/2018 12:29
07	RA-228	TRG	09/06/18 16:20	1.00E+00	207.75	85.36	93.89	1.00	9/20/2018 10:07	9/25/2018 12:29







# Spike and Tracer Worksheet

Internal Work Order		Run	Analysis Code		Date	Technician		Technician Initials		Witness Initials						
<b>18-09034</b>		<b>1</b>	<b>Ra228</b>		<b>9/25/2018 12:16</b>	<b>JBAILEY</b>		<b>JB</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	Error Estimate	MS Added pCi	Error Estimate	LCS Known pCi	Error Estimate	MSD Added pCi	Error Estimate
Ra-228	Ra-12	53.180	9/25/2018	0.380	0.3831		9.18	0.468	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000

Tracers																
fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition										
01	Ba-133	Ba-6a	473.670	9/25/2018	2.2010	2.1400										
02	Ba-133	Ba-6a	473.670	9/25/2018	2.2025	2.1400										
03	Ba-133	Ba-6a	473.670	9/25/2018	2.1995	2.1400										
04	Ba-133	Ba-6a	473.670	9/25/2018	2.1994	2.1400										
05	Ba-133	Ba-6a	473.670	9/25/2018	2.1976	2.1400										
06	Ba-133	Ba-6a	473.670	9/25/2018	2.1943	2.1400										
07	Ba-133	Ba-6a	473.670	9/25/2018	2.1973	2.1400										
							Tracer					LCS				
Balance Printer Tapes																
Matrix Spike																

0103




# Gravimetric Worksheet

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
<b>18-09034</b>	<b>1</b>	<b>Ra228</b>	<b>Yttrium</b>	<b>30.0500</b>	<b>JBAILEY</b>

TRetec Fraction	SGS North America Inc. Client ID	Sample Type	Carrier Data		Filter Data			Gravimetric % Recovery
			Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)	Recovery	
01	LCS	LCS	2.0000	0.0843	0.1427	0.0584	97.17	
02	BLANK	MBL	2.0000	0.0838	0.1412	0.0574	95.51	
03	DUP	DUP	2.0000	0.0834	0.1385	0.0551	91.68	
04	HALEY POND 6	DO	2.0000	0.0833	0.1392	0.0559	93.01	
05	HALEY POND 2	TRG	2.0500	0.0829	0.1444	0.0615	99.83	
06	LONG 1 AND 2 RIG SUPPLY	TRG	2.0000	0.0835	0.1408	0.0573	95.34	
07	LONG 3 AND 4 RIG SUPPLY	TRG	2.0000	0.0838	0.1351	0.0513	85.36	

0105

Technician:  Date: 9/25/18

4B  
9/25/18

Detector ID	Sample ID	Alpha	Beta	Count Time	Voltage	TOD
A1	1809034-01	37	920	120	1410	9/25/2018 2:15:46 PM
A2	1809034-02	14	184	120	1410	9/25/2018 2:15:46 PM
A3	1809034-03	13	219	120	1410	9/25/2018 2:15:46 PM
A4	1809034-04	14	193	120	1410	9/25/2018 2:15:46 PM
B1	1809034-05	24	255	120	1410	9/25/2018 2:15:46 PM
B2	1809034-06	22	252	120	1410	9/25/2018 2:15:46 PM
B3	1809034-07	47	536	120	1410	9/25/2018 2:15:46 PM

0106

GPC Detector Report  
(ALL Backgrounds)

JP  
9/25/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	9/25/2018	8.33E-02	P	-3.48E-02	9.20E-02	2.19E-01
LB4110A - A2	Alpha	11/2/2017	9/25/2018	1.00E-01	P	-5.04E-02	9.62E-02	2.43E-01
LB4110A - A3	Alpha	11/2/2017	9/25/2018	1.83E-01	P	-3.26E-02	1.04E-01	2.41E-01
LB4110A - A4	Alpha	11/2/2017	9/25/2018	8.33E-02	P	-3.10E-02	9.17E-02	2.15E-01
LB4110A - B1	Alpha	11/2/2017	9/25/2018	1.00E-01	P	-3.40E-02	1.12E-01	2.57E-01
LB4110A - B2	Alpha	11/2/2017	9/25/2018	1.33E-01	P	-1.75E-02	1.17E-01	2.52E-01
LB4110A - B3	Alpha	11/2/2017	9/25/2018	1.00E-01	P	-5.52E-02	7.99E-02	2.15E-01
LB4110A - B4	Alpha	11/2/2017	9/25/2018	8.33E-02	P	-3.93E-02	7.95E-02	1.98E-01
LB4110A - C1	Alpha	11/2/2017	9/25/2018	1.50E-01	P	-2.38E-02	8.78E-02	1.99E-01
LB4110A - C2	Alpha	11/2/2017	9/25/2018	6.67E-02	P	-3.91E-02	5.94E-02	1.58E-01
LB4110A - C3	Alpha	11/2/2017	9/25/2018	5.00E-02	P	-5.51E-02	6.77E-02	1.90E-01
LB4110A - C4	Alpha	11/2/2017	9/25/2018	1.17E-01	P	-3.05E-02	8.07E-02	1.92E-01
LB4110A - D1	Alpha	11/2/2017	9/25/2018	1.83E-01	P	-3.27E-02	1.36E-01	3.05E-01
LB4110A - D2	Alpha	11/2/2017	9/25/2018	3.33E-02	P	-1.83E-02	1.24E-01	2.67E-01
LB4110A - D3	Alpha	11/2/2017	9/25/2018	1.33E-01	P	-4.42E-02	1.06E-01	2.56E-01
LB4110A - D4	Alpha	11/2/2017	9/25/2018	6.67E-02	P	-2.10E-02	1.46E-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	9/25/2018	1.00E-01	P	-4.10E-02	7.53E-02	1.92E-01
LB4110A - F2	Alpha	11/2/2017	9/25/2018	5.00E-02	P	-3.17E-02	5.14E-02	1.34E-01
LB4110A - F3	Alpha	11/2/2017	9/25/2018	6.67E-02	P	-4.78E-02	6.14E-02	1.71E-01
LB4110A - F4	Alpha	11/2/2017	9/25/2018	6.67E-02	P	-2.25E-02	7.19E-02	1.66E-01
LB4110A - G1	Alpha	11/2/2017	9/25/2018	8.33E-02	P	-4.58E-02	6.08E-02	1.67E-01
LB4110A - G2	Alpha	11/2/2017	9/25/2018	3.33E-02	P	-4.27E-02	7.60E-02	1.95E-01
LB4110A - G3	Alpha	11/2/2017	9/25/2018	1.00E-01	P	-4.52E-02	8.28E-02	2.11E-01
LB4110A - G4	Alpha	11/2/2017	9/25/2018	1.33E-01	P	-3.02E-02	8.11E-02	1.92E-01

0107

GPC Detector Report  
(ALL Backgrounds)

RP  
9/25/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	9/25/2018	1.23E+00	P	8.47E-01	1.37E+00	1.89E+00
LB4110A - A2	Beta	11/2/2017	9/25/2018	1.32E+00	P	9.15E-01	1.51E+00	2.11E+00
LB4110A - A3	Beta	11/2/2017	9/25/2018	1.62E+00	P	1.02E+00	1.51E+00	2.00E+00
LB4110A - A4	Beta	11/2/2017	9/25/2018	1.37E+00	P	9.47E-01	1.41E+00	1.87E+00
LB4110A - B1	Beta	11/2/2017	9/25/2018	1.47E+00	P	1.05E+00	1.54E+00	2.03E+00
LB4110A - B2	Beta	11/2/2017	9/25/2018	1.92E+00	P	6.69E-01	1.52E+00	2.37E+00
LB4110A - B3	Beta	11/2/2017	9/25/2018	1.62E+00	P	9.17E-01	1.37E+00	1.81E+00
LB4110A - B4	Beta	11/2/2017	9/25/2018	1.00E+00	P	7.33E-01	1.37E+00	2.01E+00
LB4110A - C1	Beta	11/2/2017	9/25/2018	1.13E+00	P	8.21E-01	1.26E+00	1.69E+00
LB4110A - C2	Beta	11/2/2017	9/25/2018	1.13E+00	P	-3.93E-01	1.26E+00	2.92E+00
LB4110A - C3	Beta	11/2/2017	9/25/2018	1.82E+00	P	9.68E-01	1.80E+00	2.63E+00
LB4110A - C4	Beta	11/2/2017	9/25/2018	1.20E+00	P	7.91E-01	1.22E+00	1.66E+00
LB4110A - D1	Beta	11/2/2017	9/25/2018	1.30E+00	P	8.62E-01	1.32E+00	1.79E+00
LB4110A - D2	Beta	11/2/2017	9/25/2018	1.52E+00	P	-2.34E-01	1.63E+00	3.49E+00
LB4110A - D3	Beta	11/2/2017	9/25/2018	1.28E+00	P	7.64E-01	1.27E+00	1.78E+00
LB4110A - D4	Beta	11/2/2017	9/25/2018	1.40E+00	P	9.49E-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	9/25/2018	1.62E+00	P	8.75E-01	1.36E+00	1.84E+00
LB4110A - F2	Beta	11/2/2017	9/25/2018	8.67E-01	P	5.24E-01	8.98E-01	1.27E+00
LB4110A - F3	Beta	11/2/2017	9/25/2018	1.10E+00	P	3.88E-02	1.23E+00	2.43E+00
LB4110A - F4	Beta	11/2/2017	9/25/2018	1.17E+00	P	6.90E-01	1.15E+00	1.61E+00
LB4110A - G1	Beta	11/2/2017	9/25/2018	1.02E+00	P	6.88E-01	1.37E+00	2.05E+00
LB4110A - G2	Beta	11/2/2017	9/25/2018	1.62E+00	P	1.06E+00	1.81E+00	2.56E+00
LB4110A - G3	Beta	11/2/2017	9/25/2018	1.28E+00	P	7.60E-01	1.50E+00	2.23E+00
LB4110A - G4	Beta	11/2/2017	9/25/2018	1.03E+00	P	5.58E-01	1.46E+00	2.37E+00

0108



GPC Detector Report  
(ALL Efficiencies)

XP  
9/25/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	9/25/2018	0.2224	P	0.2137	0.2252	0.2367
LB4110A - A2	Alpha	11/2/2017	9/25/2018	0.2110	P	0.1969	0.2115	0.2260
LB4110A - A3	Alpha	11/2/2017	9/25/2018	0.2029	P	0.1837	0.1997	0.2157
LB4110A - A4	Alpha	11/2/2017	9/25/2018	0.2273	P	0.2061	0.2260	0.2459
LB4110A - B1	Alpha	11/2/2017	9/25/2018	0.2315	P	0.2037	0.2230	0.2423
LB4110A - B2	Alpha	11/2/2017	9/25/2018	0.1956	P	0.1833	0.2006	0.2179
LB4110A - B3	Alpha	11/2/2017	9/25/2018	0.2272	P	0.2176	0.2345	0.2515
LB4110A - B4	Alpha	11/2/2017	9/25/2018	0.2255	P	0.2035	0.2212	0.2388
LB4110A - C1	Alpha	11/2/2017	9/25/2018	0.2064	P	0.1948	0.2073	0.2198
LB4110A - C2	Alpha	11/2/2017	9/25/2018	0.2170	P	-0.0991	0.2241	0.5472
LB4110A - C3	Alpha	11/2/2017	9/25/2018	0.2442	P	0.2295	0.2423	0.2551
LB4110A - C4	Alpha	11/2/2017	9/25/2018	0.2163	P	0.1984	0.2147	0.2310
LB4110A - D1	Alpha	11/2/2017	9/25/2018	0.2139	P	0.2102	0.2218	0.2335
LB4110A - D2	Alpha	11/2/2017	9/25/2018	0.2503	P	0.2319	0.2508	0.2698
LB4110A - D3	Alpha	11/2/2017	9/25/2018	0.2516	P	0.2341	0.2496	0.2651
LB4110A - D4	Alpha	11/2/2017	9/25/2018	0.1936	P	0.1763	0.1958	0.2152
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	9/25/2018	0.2128	P	0.1616	0.2123	0.2630
LB4110A - F2	Alpha	11/2/2017	9/25/2018	0.1865	P	0.1710	0.1830	0.1950
LB4110A - F3	Alpha	11/2/2017	9/25/2018	0.2420	P	0.2216	0.2368	0.2519
LB4110A - F4	Alpha	11/2/2017	9/25/2018	0.2080	P	0.1930	0.2095	0.2260
LB4110A - G1	Alpha	11/2/2017	9/25/2018	0.1849	F	0.1850	0.1982	0.2114
LB4110A - G2	Alpha	11/2/2017	9/25/2018	0.1965	P	0.1917	0.2017	0.2117
LB4110A - G3	Alpha	11/2/2017	9/25/2018	0.2143	P	0.2103	0.2238	0.2373
LB4110A - G4	Alpha	11/2/2017	9/25/2018	0.1795	F	0.1833	0.1983	0.2133

0109

GPC Detector Report  
(ALL Efficiencies)

FP  
9/25/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	9/25/2018	0.5406	P	0.5099	0.5372	0.5645
LB4110A - A2	Beta	11/2/2017	9/25/2018	0.4606	P	0.4160	0.4643	0.5125
LB4110A - A3	Beta	11/2/2017	9/25/2018	0.4765	P	0.4361	0.4790	0.5218
LB4110A - A4	Beta	11/2/2017	9/25/2018	0.5437	P	0.4985	0.5409	0.5833
LB4110A - B1	Beta	11/2/2017	9/25/2018	0.5526	P	0.4988	0.5394	0.5801
LB4110A - B2	Beta	11/2/2017	9/25/2018	0.5030	P	0.4623	0.4994	0.5366
LB4110A - B3	Beta	11/2/2017	9/25/2018	0.5837	P	0.5443	0.5823	0.6202
LB4110A - B4	Beta	11/2/2017	9/25/2018	0.5522	P	0.5006	0.5431	0.5855
LB4110A - C1	Beta	11/2/2017	9/25/2018	0.4737	P	0.4435	0.4794	0.5153
LB4110A - C2	Beta	11/2/2017	9/25/2018	0.5192	P	0.4904	0.5180	0.5457
LB4110A - C3	Beta	11/2/2017	9/25/2018	0.6078	P	0.5675	0.5996	0.6317
LB4110A - C4	Beta	11/2/2017	9/25/2018	0.5217	P	0.4812	0.5236	0.5660
LB4110A - D1	Beta	11/2/2017	9/25/2018	0.6400	P	0.6151	0.6405	0.6660
LB4110A - D2	Beta	11/2/2017	9/25/2018	0.6395	P	0.5879	0.6423	0.6967
LB4110A - D3	Beta	11/2/2017	9/25/2018	0.6450	P	0.5997	0.6407	0.6817
LB4110A - D4	Beta	11/2/2017	9/25/2018	0.5030	P	0.4637	0.5038	0.5439
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	9/25/2018	0.5259	P	0.4028	0.5278	0.6527
LB4110A - F2	Beta	11/2/2017	9/25/2018	0.4563	P	0.4291	0.4575	0.4860
LB4110A - F3	Beta	11/2/2017	9/25/2018	0.6169	P	0.5704	0.6105	0.6507
LB4110A - F4	Beta	11/2/2017	9/25/2018	0.5210	P	0.4886	0.5296	0.5707
LB4110A - G1	Beta	11/2/2017	9/25/2018	0.4583	P	0.4334	0.4569	0.4804
LB4110A - G2	Beta	11/2/2017	9/25/2018	0.4702	W	0.4664	0.4852	0.5041
LB4110A - G3	Beta	11/2/2017	9/25/2018	0.5051	F	0.5084	0.5410	0.5737
LB4110A - G4	Beta	11/2/2017	9/25/2018	0.4409	F	0.4455	0.4836	0.5217

0110

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

0111

KS  
9/20/18

2

Analysis Report for 1809034-01  
SPIKE

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 1809034-01  
 Sample Description : SPIKE  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/19/2018 9:47:50AM  
 Acquisition Started : 9/20/2018 11:01:44AM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE3  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 902.2 seconds

Dead Time : 0.24 %

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 : 72127

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/20/2018 11:16:58AM

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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0112

Analysis Report for 1809034-01

SPIKE

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	21.28	17 -	41	21.65	1.60E+02	58.00	5.17E+02	2.63
m	2	31.02	17 -	41	31.39	3.54E+03	126.97	3.28E+02	2.12
m	3	35.25	17 -	41	35.61	9.22E+02	109.35	2.95E+02	2.49
	4	52.48	47 -	56	52.84	7.46E+01	55.34	3.95E+02	2.98
m	5	62.05	57 -	74	62.40	4.74E+02	62.29	3.22E+02	2.20
m	6	66.22	57 -	74	66.57	2.16E+02	60.33	3.58E+02	2.49
M	7	79.13	76 -	87	79.47	1.23E+02	85.90	4.55E+02	3.06
m	8	81.34	76 -	87	81.68	1.30E+03	86.16	3.66E+02	1.99
M	9	112.23	107 -	122	112.55	4.32E+02	58.10	2.45E+02	2.57
m	10	116.32	107 -	122	116.64	8.71E+01	52.04	2.36E+02	2.57
	11	276.73	271 -	281	276.98	6.22E+01	42.13	2.04E+02	1.84
	12	283.14	281 -	286	283.40	2.01E+01	21.19	7.19E+01	2.87
	13	294.59	289 -	299	294.84	6.00E+01	31.98	1.04E+02	2.65
	14	302.97	300 -	307	303.22	1.69E+02	42.76	2.00E+02	2.00
	15	334.69	330 -	342	334.93	1.87E+02	41.11	1.12E+02	2.67
M	16	351.97	349 -	363	352.20	6.30E+01	23.87	5.94E+01	2.82
m	17	356.30	349 -	363	356.52	8.33E+02	61.09	7.07E+01	2.56
M	18	383.95	380 -	397	384.16	1.83E+02	39.38	4.25E+01	2.32
m	19	387.25	380 -	397	387.46	3.04E+02	44.70	3.32E+01	2.26
m	20	391.85	380 -	397	392.06	7.36E+01	34.33	3.01E+01	2.85
	21	415.29	410 -	422	415.49	7.83E+01	36.12	1.15E+02	3.86
	22	437.17	431 -	442	437.37	1.56E+02	27.71	1.83E+01	2.21
M	23	467.93	464 -	476	468.11	4.42E+01	15.64	1.03E+01	3.51
m	24	472.97	464 -	476	473.15	1.46E+01	10.98	1.48E+00	3.02
	25	609.65	606 -	613	609.78	1.89E+01	12.17	1.22E+01	2.44
	26	1185.05	1181 -	1187	1185.00	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 : 9/20/2018 11:16:58AM

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.
M	1	21.28	1.60E+02	58.00			1.60E+02	5.80E+01
m	2	31.02	3.54E+03	126.97			3.54E+03	1.27E+02
m	3	35.25	9.22E+02	109.35			9.22E+02	1.09E+02

0113

Analysis Report for 1809034-01

SPIKE

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.	
	4	52.48	7.46E+01	55.34	2.82E-01	5.14E-01	7.43E+01	5.53E+01
m	5	62.05	4.74E+02	62.29	1.31E+01	8.56E-01	4.60E+02	6.23E+01
m	6	66.22	2.16E+02	60.33			2.16E+02	6.03E+01
M	7	79.13	1.23E+02	85.90			1.23E+02	8.59E+01
m	8	81.34	1.30E+03	86.16			1.30E+03	8.62E+01
M	9	112.23	4.32E+02	58.10			4.32E+02	5.81E+01
m	10	116.32	8.71E+01	52.04			8.71E+01	5.20E+01
	11	276.73	6.22E+01	42.13			6.22E+01	4.21E+01
	12	283.14	2.01E+01	21.19			2.01E+01	2.12E+01
	13	294.59	6.00E+01	31.98			6.00E+01	3.20E+01
	14	302.97	1.69E+02	42.76			1.69E+02	4.28E+01
	15	334.69	1.87E+02	41.11			1.87E+02	4.11E+01
M	16	351.97	6.30E+01	23.87	1.68E+00	1.20E+00	6.13E+01	2.39E+01
m	17	356.30	8.33E+02	61.09			8.33E+02	6.11E+01
M	18	383.95	1.83E+02	39.38			1.83E+02	3.94E+01
m	19	387.25	3.04E+02	44.70			3.04E+02	4.47E+01
m	20	391.85	7.36E+01	34.33			7.36E+01	3.43E+01
	21	415.29	7.83E+01	36.12			7.83E+01	3.61E+01
	22	437.17	1.56E+02	27.71			1.56E+02	2.77E+01
M	23	467.93	4.42E+01	15.64			4.42E+01	1.56E+01
m	24	472.97	1.46E+01	10.98			1.46E+01	1.10E+01
	25	609.65	1.89E+01	12.17	1.01E+00	8.23E-01	1.79E+01	1.22E+01
	26	1185.05	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	5.14E+01	2.45E+01
I-125	0.99	35.49 *	6.49	4.34E+01	5.15E+00
BA-133	0.99	30.80 *	97.60	4.77E+00	1.71E-01
		302.84 *	17.80	6.34E+02	2.81E+02
		356.01 *	60.00	7.22E+02	9.78E+01

0114

Analysis Report for 1809034-01  
SPIKE

2

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/units)</b>	<b>Activity Uncertainty</b>
TH-234	0.97	63.29 *	3.80	7.31E+02	1.02E+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	5.14E+01	2.45E+01	
	I-125	4.34E+01	5.15E+00	
X	I-129	0.901		
	BA-133	4.77E+00	1.71E-01	
	TH-234	7.31E+02	1.02E+02	
X	NP-237	0.885		

? = 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

0115

Analysis Report for 1809034-01

SPIKE

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/20/2018 11:16:58AM  
 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	21.28	1.78148E-01	18.09	Tol.	PA-234M
4	52.48	8.25559E-02	37.25		
m 6	66.22	2.40429E-01	13.94	Sum	
M 7	79.13	1.36150E-01	35.05		
m 8	81.34	1.44502E+00	3.31		
M 9	112.23	4.80288E-01	6.72	Tol.	U-237
m 10	116.32	9.68199E-02	29.86		
11	276.73	6.91396E-02	33.86		
12	283.14	2.22917E-02	52.81	Tol.	PA-231
13	294.59	6.66567E-02	26.65		
15	334.69	2.07892E-01	10.99	Sum	
M 16	351.97	6.81091E-02	19.50		
M 18	383.95	2.03395E-01	10.76		
m 19	387.25	3.37376E-01	7.36	Sum	
21	415.29	8.70262E-02	23.06		
22	437.17	1.73192E-01	8.89		
M 23	467.93	4.91189E-02	17.69		
m 24	472.97	1.61963E-02	37.65		
25	609.65	1.98812E-02	34.07		
26	1185.05	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

NUCLIDE MDA REPORT

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

0116



Analysis Report for 1809034-01  
SPIKE

2

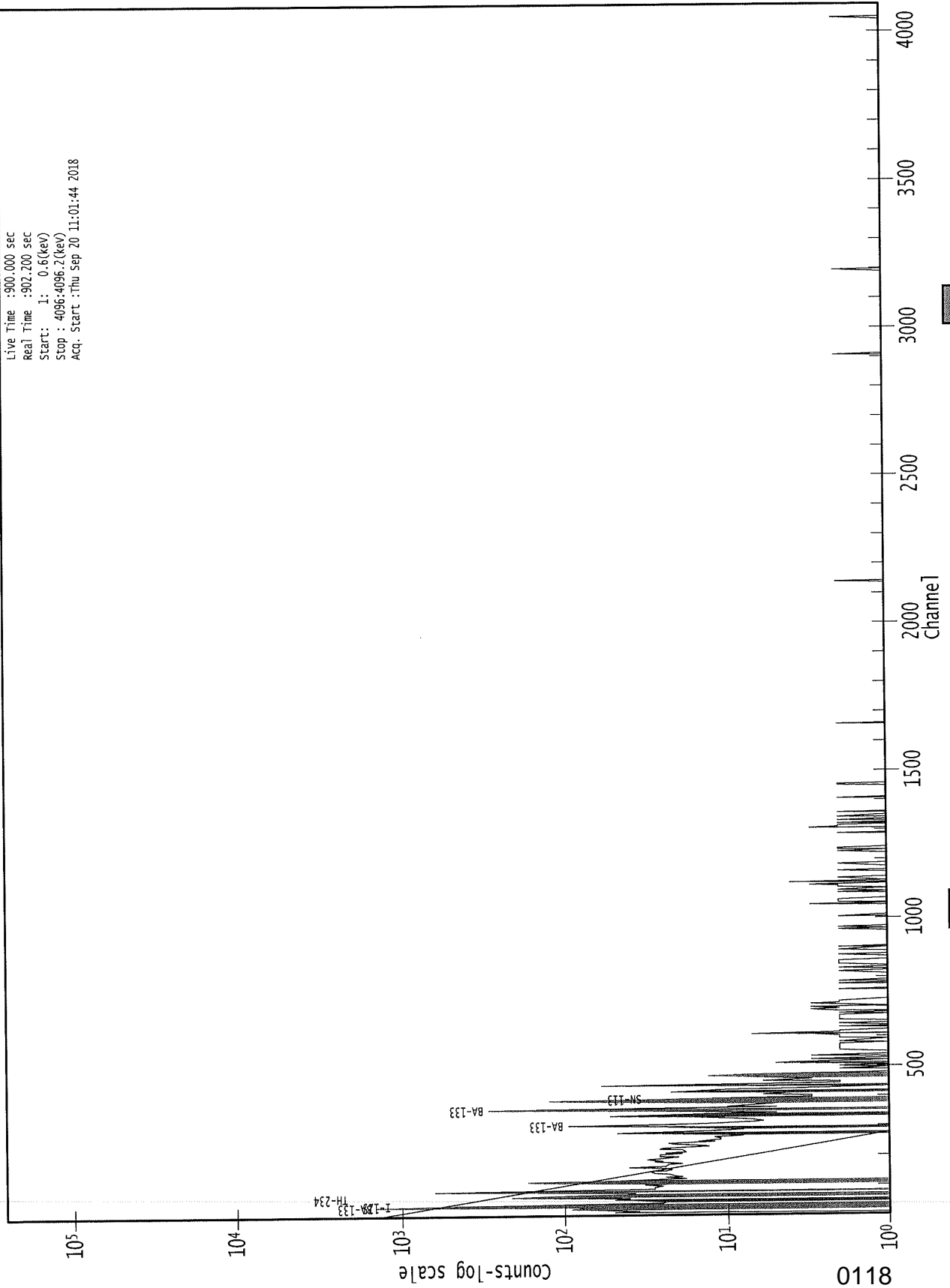
Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	1.57E-09	1.57E-09	0.00E+00	0.00E+00
CO-57	122.06	85.51	3.07E+01	3.07E+01	3.23E+00	1.46E+01
	136.48	10.60	2.99E+02		-2.59E+02	1.42E+02
NI-59	6.92	29.80	1.09E-07	1.09E-07	-1.72E-08	5.01E-08
MO-93	16.59	52.90	1.41E-03	1.41E-03	-1.19E-04	6.82E-04
	18.60	10.00	2.43E-02		3.53E-02	1.18E-02
NB-93M	16.57	9.43	7.85E-03	7.85E-03	-6.62E-04	3.79E-03
CD-109	88.03	3.72	3.81E+02	3.81E+02	7.69E+01	1.83E+02
+ SN-113	255.12	1.93	1.57E+03	3.58E+01	-5.22E+01	7.30E+02
	391.69	* 61.90	3.58E+01		5.14E+01	1.70E+01
SN-119M	23.87	16.10	1.16E-01	1.16E-01	-2.20E-01	5.65E-02
	25.10	22.70	1.17E-01		-1.57E+00	5.69E-02
+ I-125	35.49	* 6.49	1.02E+01	1.02E+01	4.34E+01	5.05E+00
I-129	29.78	* 57.00	5.02E-01	5.02E-01	8.16E+00	2.48E-01
	33.60	* 13.20	4.97E+00		2.11E+01	2.45E+00
	39.58	* 7.52	6.83E+00		4.16E-02	3.31E+00
+ BA-133	30.80	* 97.60	2.93E-01	2.93E-01	4.77E+00	1.45E-01
	302.84	* 17.80	2.20E+02		6.34E+02	1.05E+02
	356.01	* 60.00	5.08E+01		7.22E+02	2.42E+01
CE-139	165.85	80.35	5.56E+01	5.56E+01	-3.00E+01	2.65E+01
CE-144	133.54	10.80	2.73E+02	2.73E+02	-1.09E+02	1.29E+02
HG-203	279.19	77.30	5.51E+01	5.51E+01	5.77E+01	2.62E+01
PB-210	46.50	4.25	2.03E+01	2.03E+01	4.76E+00	9.65E+00
PA-231	9.28	42.00	4.35E-06	4.35E-06	5.59E-06	2.08E-06
	10.11	20.20	2.29E-05		2.94E-05	1.09E-05
	283.67	1.60	1.73E+03		5.21E+02	8.06E+02
	302.67	2.30	2.24E+03		5.06E+03	1.08E+03
TH-231	25.64	14.70	2.23E-01	2.23E-01	-7.01E+00	1.09E-01
	84.21	6.40	4.41E+02		1.70E+03	2.16E+02
PA-234M	9.89	89.00	4.10E-06	4.10E-06	5.27E-06	1.96E-06
	21.72	64.90	1.38E-02		1.55E-02	6.71E-03
	37.93	23.75	2.89E+00		1.05E+01	1.42E+00
	131.42	20.40	1.37E+02		-6.84E+01	6.46E+01
+ TH-234	63.29	* 3.80	2.45E+02	2.45E+02	7.31E+02	1.20E+02
NP-237	29.37	* 14.00	2.04E+00	2.04E+00	3.32E+01	1.01E+00
	86.50	12.60	1.13E+02		2.10E+01	5.43E+01
U-237	97.08	16.30	1.23E+02	8.40E+01	7.83E+00	5.86E+01
	101.07	26.30	8.40E+01		3.59E+01	4.01E+01
	114.00	12.30	4.54E+02		1.63E+03	2.22E+02
	208.01	22.00	2.32E+02		-9.67E+01	1.10E+02
AM-241	59.54	35.90	1.64E+01	1.64E+01	4.78E+01	8.02E+00
AM-243	74.67	66.00	1.39E+01	1.39E+01	-4.70E+01	6.70E+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

0117

0000072127.CNF

Live Time :900.000 sec  
Real Time :902.200 sec  
Start: 1: 0.6(kev)  
Stop : 4096:4096.2(kev)  
Acq. Start :Thu Sep 20 11:01:44 2018



Analysis Report for 1809034-02  
BLANK

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 1809034-02  
 Sample Description : BLANK  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/19/2018 9:48:00AM  
 Acquisition Started : 9/20/2018 11:17:54AM

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 : 72128

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/20/2018 11:32:57AM  
 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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0119

Analysis Report for 1809034-02

BLANK

2

	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 -	45	31.20	3.23E+03	119.22	2.46E+02	1.95
m	2	35.43	25 -	45	35.81	8.00E+02	99.22	2.66E+02	2.63
	3	53.55	50 -	58	53.92	1.00E+02	49.74	3.18E+02	1.93
M	4	61.83	58 -	73	62.20	2.84E+02	50.49	2.73E+02	2.03
m	5	66.37	58 -	73	66.73	1.45E+02	44.87	2.61E+02	2.04
	6	81.14	77 -	86	81.51	1.21E+03	97.29	6.51E+02	2.02
	7	88.16	87 -	91	88.52	4.74E+01	35.33	2.29E+02	2.63
M	8	111.98	108 -	122	112.34	2.53E+02	45.11	1.93E+02	1.85
m	9	116.21	108 -	122	116.56	7.01E+01	46.60	2.10E+02	2.55
	10	276.42	273 -	280	276.74	7.84E+01	32.86	1.27E+02	1.29
	11	295.36	292 -	300	295.67	2.18E+01	28.04	1.06E+02	1.96
	12	302.95	300 -	306	303.26	2.31E+02	38.04	9.70E+01	2.04
M	13	333.71	329 -	342	334.01	8.05E+01	23.32	3.71E+01	2.11
m	14	337.72	329 -	342	338.02	2.61E+01	19.29	3.21E+01	2.11
M	15	351.99	350 -	361	352.29	6.61E+01	22.93	2.39E+01	1.83
m	16	356.12	350 -	361	356.42	8.31E+02	61.64	6.92E+01	1.97
	17	363.82	362 -	368	364.11	2.19E+01	24.88	8.82E+01	1.49
M	18	384.01	380 -	397	384.30	2.12E+02	42.66	6.63E+01	2.56
m	19	386.94	380 -	397	387.23	2.33E+02	42.93	4.39E+01	1.85
m	20	391.56	380 -	397	391.85	8.04E+01	39.29	5.71E+01	2.98
M	21	414.92	411 -	421	415.21	3.02E+01	19.03	4.40E+01	2.16
m	22	418.49	411 -	421	418.77	2.63E+01	19.13	3.85E+01	2.16
	23	437.18	432 -	440	437.46	1.23E+02	24.76	2.08E+01	2.12
	24	467.04	463 -	470	467.32	1.70E+01	14.56	2.40E+01	2.17
	25	569.50	567 -	573	569.75	7.13E+00	9.21	9.75E+00	3.18
	26	583.42	581 -	586	583.67	6.75E+00	6.40	2.50E+00	1.54
	27	608.88	605 -	612	609.12	3.51E+01	16.12	1.98E+01	1.33
	28	665.56	663 -	669	665.79	6.69E+00	6.65	2.63E+00	1.85
	29	687.77	685 -	692	688.00	7.00E+00	8.72	8.00E+00	1.13
	30	731.38	728 -	734	731.60	5.29E+00	6.34	3.43E+00	2.72
	31	762.18	759 -	766	762.39	8.77E+00	7.75	4.45E+00	4.80
	32	791.48	789 -	794	791.69	4.67E+00	5.74	2.67E+00	1.89
	33	999.97	997 -	1003	1000.14	7.00E+00	5.29	0.00E+00	1.98
	34	1120.40	1116 -	1125	1120.55	1.10E+01	6.63	0.00E+00	3.22
	35	1414.89	1411 -	1417	1415.00	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 : 9/20/2018 11:32:57AM

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

0120

Analysis Report for 1809034-02

BLANK

2

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	30.83	3.23E+03	119.22			3.23E+03	1.19E+02
m	2	35.43	8.00E+02	99.22			8.00E+02	9.92E+01
	3	53.55	1.00E+02	49.74			1.00E+02	4.97E+01
M	4	61.83	2.84E+02	50.49			2.84E+02	5.05E+01
m	5	66.37	1.45E+02	44.87			1.45E+02	4.49E+01
	6	81.14	1.21E+03	97.29			1.21E+03	9.73E+01
	7	88.16	4.74E+01	35.33			4.74E+01	3.53E+01
M	8	111.98	2.53E+02	45.11			2.53E+02	4.51E+01
m	9	116.21	7.01E+01	46.60			7.01E+01	4.66E+01
	10	276.42	7.84E+01	32.86			7.84E+01	3.29E+01
	11	295.36	2.18E+01	28.04			2.18E+01	2.80E+01
	12	302.95	2.31E+02	38.04			2.31E+02	3.80E+01
M	13	333.71	8.05E+01	23.32			8.05E+01	2.33E+01
m	14	337.72	2.61E+01	19.29	6.20E-01	1.14E+00	2.54E+01	1.93E+01
M	15	351.99	6.61E+01	22.93			6.61E+01	2.29E+01
m	16	356.12	8.31E+02	61.64			8.31E+02	6.16E+01
	17	363.82	2.19E+01	24.88			2.19E+01	2.49E+01
M	18	384.01	2.12E+02	42.66			2.12E+02	4.27E+01
m	19	386.94	2.33E+02	42.93			2.33E+02	4.29E+01
m	20	391.56	8.04E+01	39.29			8.04E+01	3.93E+01
M	21	414.92	3.02E+01	19.03			3.02E+01	1.90E+01
m	22	418.49	2.63E+01	19.13			2.63E+01	1.91E+01
	23	437.18	1.23E+02	24.76			1.23E+02	2.48E+01
	24	467.04	1.70E+01	14.56			1.70E+01	1.46E+01
	25	569.50	7.13E+00	9.21			7.13E+00	9.21E+00
	26	583.42	6.75E+00	6.40			6.75E+00	6.40E+00
	27	608.88	3.51E+01	16.12	1.92E+00	1.08E+00	3.32E+01	1.62E+01
	28	665.56	6.69E+00	6.65			6.69E+00	6.65E+00
	29	687.77	7.00E+00	8.72			7.00E+00	8.72E+00
	30	731.38	5.29E+00	6.34			5.29E+00	6.34E+00
	31	762.18	8.77E+00	7.75			8.77E+00	7.75E+00
	32	791.48	4.67E+00	5.74			4.67E+00	5.74E+00
	33	999.97	7.00E+00	5.29	1.38E+00	7.03E-01	5.62E+00	5.34E+00
	34	1120.40	1.10E+01	6.63	3.30E-01	6.26E-01	1.07E+01	6.66E+00
	35	1414.89	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

0121

Analysis Report for 1809034-02  
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## NUCLIDE IDENTIFICATION REPORT

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

### IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
CD-109	0.99	88.03	*	3.72	3.23E+02	2.45E+02
SN-113	0.97	255.12		1.93		
		391.69	*	61.90	4.80E+01	2.37E+01
I-125	1.00	35.49	*	6.49	8.29E+00	1.03E+00
BA-133	1.00	30.80	*	97.60	6.05E-01	2.23E-02
		302.84	*	17.80	1.02E+03	4.78E+02
		356.01	*	60.00	7.01E+02	9.26E+01
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	7.89E+03	3.70E+03
TH-234	0.93	63.29	*	3.80	3.14E+02	5.62E+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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
CD-109	0.999	3.23E+02	2.45E+02	
SN-113	0.971	4.80E+01	2.37E+01	
I-125	1.000	8.29E+00	1.03E+00	
X I-129	0.747			

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Analysis Report for 1809034-02  
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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>
BA-133	1.000	6.05E-01	2.23E-02	
PA-231	1.000	7.88E+03	3.70E+03	
TH-234	0.938	3.14E+02	5.62E+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 1809034-02

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 9/20/2018 11:32:57AM  
 Peak Locate From Channel : 1  
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	3	53.55	1.11208E-01	24.85	
m	5	66.37	1.60938E-01	15.49	Sum
	6	81.14	1.34376E+00	4.02	
M	8	111.98	2.80955E-01	8.92	
m	9	116.21	7.78775E-02	33.25	
	10	276.42	8.70735E-02	20.97	
	11	295.36	2.42741E-02	64.16	
M	13	333.71	8.94490E-02	14.49	Sum
m	14	337.72	2.82724E-02	37.97	Sum
M	15	351.99	7.34663E-02	17.34	
	17	363.82	2.43519E-02	56.77	Sum
M	18	384.01	2.35289E-01	10.07	
m	19	386.94	2.59381E-01	9.19	Sum
M	21	414.92	3.35343E-02	31.52	
m	22	418.49	2.91772E-02	36.43	Sum
	23	437.18	1.36199E-01	10.10	
	24	467.04	1.88889E-02	42.82	
	25	569.50	7.91667E-03	64.60	
	26	583.42	7.50000E-03	47.43	
	27	608.88	3.68426E-02	24.37	
	28	665.56	7.43056E-03	49.74	
	29	687.77	7.77778E-03	62.27	
	30	731.38	5.87302E-03	60.01	
	31	762.18	9.74747E-03	44.15	
	32	791.48	5.18519E-03	61.55	
	33	999.97	6.24461E-03	47.49	
	34	1120.40	1.18551E-02	31.22	
	35	1414.89	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 1809034-02  
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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	1.90E-13	1.90E-13	0.00E+00	0.00E+00
CO-57	122.06	85.51	3.56E+01	3.56E+01	3.31E+00	1.66E+01
	136.48	10.60	3.96E+02		-4.28E+00	1.86E+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	7.83E-06	7.83E-06	-1.34E-05	3.47E-06
	18.60	10.00	4.61E-04		4.47E-04	2.21E-04
NB-93M	16.57	9.43	4.32E-05	4.32E-05	-7.38E-05	1.92E-05
+ CD-109	88.03	*	3.72	3.84E+02	3.23E+02	1.83E+02
+ SN-113	255.12	1.93	1.93E+03	3.74E+01	1.91E+02	8.91E+02
	391.69	*	61.90	3.74E+01	4.80E+01	1.79E+01
SN-119M	23.87	16.10	5.43E-03	5.43E-03	-7.22E-04	2.60E-03
	25.10	22.70	6.18E-03		-2.94E-03	2.95E-03
+ I-125	35.49	*	6.49	1.66E+00	8.29E+00	8.14E-01
I-129	29.78	*	57.00	5.12E-02	1.04E+00	2.52E-02
	33.60	13.20	6.35E-01		-2.76E+00	3.13E-01
	39.58	7.52	1.59E+00		-1.92E+00	7.62E-01
+ BA-133	30.80	*	97.60	2.99E-02	6.05E-01	1.47E-02
	302.84	*	17.80	1.79E+02	1.02E+03	8.33E+01
	356.01	*	60.00	4.62E+01	7.01E+02	2.20E+01
CE-139	165.85	80.35	6.78E+01	6.78E+01	1.07E+00	3.18E+01
CE-144	133.54	10.80	3.44E+02	3.44E+02	-5.10E+01	1.61E+02
HG-203	279.19	77.30	6.45E+01	6.45E+01	6.39E-01	3.06E+01
PB-210	46.50	4.25	6.96E+00	6.96E+00	1.38E+00	3.29E+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	2.05E+03		7.98E+02	9.49E+02
	302.67	*	2.30	1.38E+03	7.89E+03	6.45E+02
TH-231	25.64	14.70	1.36E-02	1.36E-02	-2.60E-02	6.53E-03
	84.21	6.40	2.39E+02		-2.00E+03	1.15E+02
PA-234M	9.89	89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
	21.72	64.90	5.49E-04		8.85E-04	2.65E-04
	37.93	23.75	6.12E-01		1.53E+00	2.99E-01
	131.42	20.40	1.72E+02		-1.95E+01	8.03E+01
+ TH-234	63.29	*	3.80	1.47E+02	3.14E+02	7.18E+01
NP-237	29.37	*	14.00	2.08E-01	4.21E+00	1.02E-01
	86.50	12.60	1.16E+02		-1.20E+02	5.55E+01
U-237	97.08	16.30	1.08E+02	8.53E+01	-1.25E+02	5.05E+01
	101.07	26.30	8.53E+01		3.07E+01	4.02E+01
	114.00	12.30	4.88E+02		8.80E+02	2.36E+02
	208.01	22.00	2.88E+02		7.66E+01	1.35E+02
AM-241	59.54	35.90	7.79E+00	7.79E+00	8.41E+00	3.77E+00
AM-243	74.67	66.00	1.08E+01	1.08E+01	-2.43E+00	5.15E+00

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Analysis Report for 1809034-02

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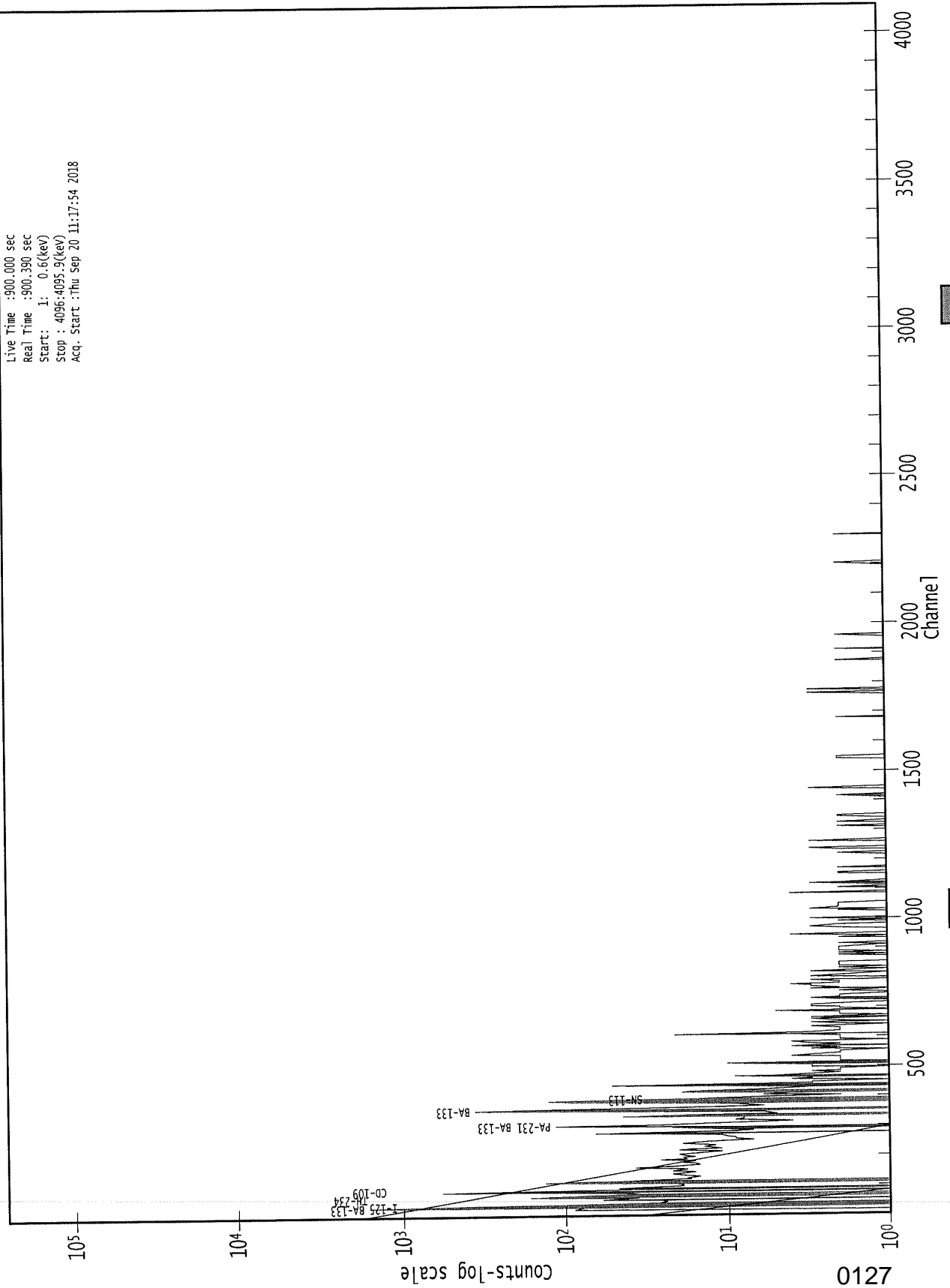
- 
- + = Nuclide identified during the nuclide identification
  - \* = Energy line found in the spectrum
  - > = MDA value not calculated
  - @ = Half-life too short to be able to perform the decay correction
- 

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0126

# 0000072128.CNF

Live Time : 900.000 sec  
Real Time : 900.390 sec  
Start: 1: 0.6(kev)  
Stop : 4096:4095.9(kev)  
Acq. Start :Thu Sep 20 11:17:54 2018



Analysis Report for 1809034-03  
HALEY POND 6

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809034-03  
 Sample Description : HALEY POND 6  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/19/2018 9:48:12AM  
 Acquisition Started : 9/20/2018 11:18:02AM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE3  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 901.8 seconds  
  
 Dead Time : 0.20 %  
  
 Peak Locate Threshold : 2.50  
 Peak Locate Range (in channels) : 1 - 4096  
 Peak Area Range (in channels) : 10 - 4096  
 Identification Energy Tolerance : 1.000FWHM  
  
 Energy Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Used Done On : 7/21/2018  
 Efficiency Calibration Description :  
  
 Sample Number : 72129

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/20/2018 11:33:14AM  
 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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0128

Analysis Report for 1809034-03  
HALEY POND 6

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	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.07	18 -	24	21.43	1.51E+02	50.69	3.58E+02	2.27
M	2	31.03	26 -	40	31.39	3.30E+03	120.98	2.91E+02	2.14
m	3	35.31	26 -	40	35.67	8.37E+02	104.80	2.35E+02	2.37
	4	53.00	50 -	56	53.36	7.97E+01	42.27	2.69E+02	3.01
M	5	62.22	57 -	73	62.57	4.37E+02	58.96	2.89E+02	2.49
m	6	66.09	57 -	73	66.43	2.07E+02	57.14	2.84E+02	2.49
	7	81.25	75 -	87	81.59	1.39E+03	96.78	4.48E+02	2.29
	8	111.90	106 -	117	112.23	3.11E+02	78.87	6.17E+02	2.25
	9	160.46	157 -	165	160.76	5.53E+01	42.40	2.41E+02	4.32
	10	276.66	272 -	281	276.92	5.67E+01	33.73	1.31E+02	1.46
M	11	303.11	299 -	315	303.36	2.31E+02	34.63	5.29E+01	2.30
m	12	307.28	299 -	315	307.53	4.21E+01	28.77	3.55E+01	2.32
m	13	312.07	299 -	315	312.32	1.64E+01	17.99	2.98E+01	3.06
M	14	334.05	329 -	345	334.29	1.10E+02	29.05	6.11E+01	2.56
m	15	338.28	329 -	345	338.51	4.87E+01	29.80	4.86E+01	2.81
	16	356.37	350 -	362	356.60	7.11E+02	59.22	7.81E+01	2.31
M	17	384.45	380 -	401	384.67	1.92E+02	41.67	1.57E+01	3.13
m	18	387.40	380 -	401	387.61	2.42E+02	41.02	9.01E+00	2.10
m	19	391.37	380 -	401	391.58	8.98E+01	37.10	1.03E+01	3.13
	20	415.65	412 -	420	415.85	5.71E+01	30.10	1.06E+02	1.47
	21	437.32	432 -	444	437.51	1.34E+02	30.39	4.64E+01	2.50
	22	468.60	464 -	474	468.78	4.49E+01	14.91	6.13E+00	2.16
	23	494.58	492 -	497	494.75	5.00E+00	7.07	6.00E+00	2.25
	24	1047.01	1042 -	1049	1047.00	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 : 9/20/2018 11:33:14AM

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	21.07	1.51E+02	50.69			1.51E+02	5.07E+01
M	2	31.03	3.30E+03	120.98			3.30E+03	1.21E+02
m	3	35.31	8.37E+02	104.80			8.37E+02	1.05E+02
	4	53.00	7.97E+01	42.27	2.82E-01	5.14E-01	7.94E+01	4.23E+01
M	5	62.22	4.37E+02	58.96	1.31E+01	8.56E-01	4.24E+02	5.90E+01

0129

Analysis Report for 1809034-03

HALEY POND 6

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	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	6	66.09	2.07E+02	57.14			2.07E+02	5.71E+01
	7	81.25	1.39E+03	96.78			1.39E+03	9.68E+01
	8	111.90	3.11E+02	78.87			3.11E+02	7.89E+01
	9	160.46	5.53E+01	42.40			5.53E+01	4.24E+01
	10	276.66	5.67E+01	33.73			5.67E+01	3.37E+01
M	11	303.11	2.31E+02	34.63			2.31E+02	3.46E+01
m	12	307.28	4.21E+01	28.77			4.21E+01	2.88E+01
m	13	312.07	1.64E+01	17.99			1.64E+01	1.80E+01
M	14	334.05	1.10E+02	29.05			1.10E+02	2.91E+01
m	15	338.28	4.87E+01	29.80			4.87E+01	2.98E+01
	16	356.37	7.11E+02	59.22			7.11E+02	5.92E+01
M	17	384.45	1.92E+02	41.67			1.92E+02	4.17E+01
m	18	387.40	2.42E+02	41.02			2.42E+02	4.10E+01
m	19	391.37	8.98E+01	37.10			8.98E+01	3.71E+01
	20	415.65	5.71E+01	30.10			5.71E+01	3.01E+01
	21	437.32	1.34E+02	30.39			1.34E+02	3.04E+01
	22	468.60	4.49E+01	14.91			4.49E+01	1.49E+01
	23	494.58	5.00E+00	7.07			5.00E+00	7.07E+00
	24	1047.01	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	6.29E+01	2.67E+01
I-125	0.99	35.49 *	6.49	3.98E+01	4.99E+00
BA-133	0.99	30.80 *	97.60	4.45E+00	1.63E-01
		302.84 *	17.80	8.69E+02	3.41E+02
		356.01 *	60.00	6.16E+02	8.69E+01
TH-234	0.98	63.29 *	3.80	6.81E+02	9.75E+01

0130

Analysis Report for 1809034-03  
HALEY POND 6

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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

## INTERFERENCE CORRECTED REPORT

<i>Nuclide Name</i>	<i>Nuclide Id Confidence</i>	<i>Wt mean Activity (pCi/units)</i>	<i>Wt mean Activity Uncertainty</i>	<i>Comments</i>
	SN-113	0.962	6.29E+01	2.67E+01
	I-125	0.999	3.98E+01	4.99E+00
X	I-129	0.901		
	BA-133	0.999	4.45E+00	1.63E-01
	TH-234	0.980	6.81E+02	9.75E+01
X	NP-237	0.885		

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

Errors quoted at 2.000sigma

0131

Analysis Report for 1809034-03  
HALEY POND 6

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UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/20/2018 11:33:14AM  
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	21.07	1.67734E-01	16.79	Tol.	PA-234M
4	53.00	8.82116E-02	26.63		
m 6	66.09	2.30166E-01	13.79	Sum	
7	81.25	1.54328E+00	3.48		
8	111.90	3.45218E-01	12.69		
9	160.46	6.13952E-02	38.36		
10	276.66	6.29690E-02	29.76		
m 12	307.28	4.67483E-02	34.19		
m 13	312.07	1.82540E-02	54.74		
M 14	334.05	1.21794E-01	13.25	Sum	
m 15	338.28	5.41174E-02	30.59	Sum	
M 17	384.45	2.12925E-01	10.87		
m 18	387.40	2.68339E-01	8.49	Sum	
20	415.65	6.34495E-02	26.35		
21	437.32	1.48694E-01	11.36		
22	468.60	4.99306E-02	16.59		
23	494.58	5.55556E-03	70.71		
24	1047.01	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

NUCLIDE MDA REPORT

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

0132



Analysis Report for 1809034-03  
HALEY POND 6

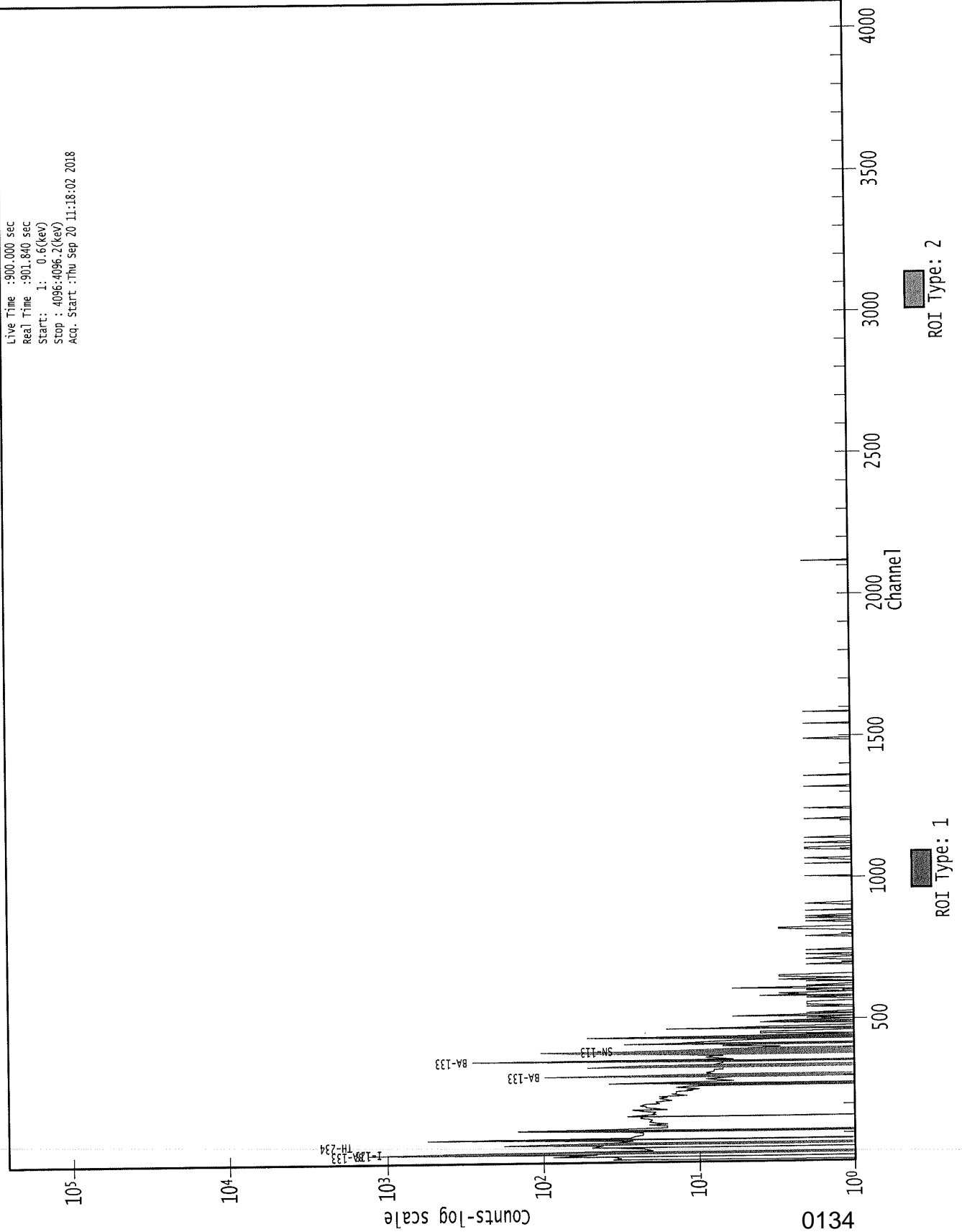
2

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	2.56E+01	2.56E+01	-4.06E+01	1.20E+01
	136.48	10.60	2.67E+02		-2.28E+02	1.26E+02
NI-59	6.92	29.80	1.06E-07	1.06E-07	1.21E-08	4.81E-08
MO-93	16.59	52.90	1.27E-03	1.27E-03	5.57E-05	6.08E-04
	18.60	10.00	2.24E-02		-1.20E-03	1.08E-02
NB-93M	16.57	9.43	7.03E-03	7.03E-03	3.09E-04	3.38E-03
CD-109	88.03	3.72	3.31E+02	3.31E+02	-9.10E+01	1.58E+02
+ SN-113	255.12	1.93	1.62E+03	2.45E+01	8.64E+01	7.54E+02
	391.69	* 61.90	2.45E+01		6.29E+01	1.13E+01
SN-119M	23.87	16.10	1.07E-01	1.04E-01	-1.20E-01	5.19E-02
	25.10	22.70	1.04E-01		-1.42E+00	5.04E-02
+ I-125	35.49	* 6.49	5.92E+00	5.92E+00	3.98E+01	2.90E+00
I-129	29.78	* 57.00	2.90E-01	2.90E-01	7.62E+00	1.42E-01
	33.60	* 13.20	2.88E+00		1.93E+01	1.41E+00
	39.58	7.52	6.40E+00		1.28E+00	3.09E+00
+ BA-133	30.80	* 97.60	1.70E-01	1.70E-01	4.45E+00	8.29E-02
	302.84	* 17.80	2.17E+02		8.69E+02	1.03E+02
	356.01	* 60.00	3.91E+01		6.16E+02	1.84E+01
CE-139	165.85	80.35	4.89E+01	4.89E+01	1.95E+01	2.32E+01
CE-144	133.54	10.80	2.63E+02	2.63E+02	-4.87E+01	1.24E+02
HG-203	279.19	77.30	4.83E+01	4.83E+01	4.86E+01	2.29E+01
PB-210	46.50	4.25	1.84E+01	1.84E+01	4.41E-01	8.73E+00
PA-231	9.28	42.00	3.76E-06	3.76E-06	2.57E-06	1.79E-06
	10.11	20.20	1.98E-05		1.35E-05	9.39E-06
	283.67	1.60	1.53E+03		3.10E+02	7.04E+02
	302.67	2.30	2.25E+03		4.93E+03	1.09E+03
TH-231	25.64	14.70	1.93E-01	1.93E-01	-7.01E+00	9.34E-02
	84.21	6.40	4.19E+02		1.66E+03	2.06E+02
PA-234M	9.89	89.00	3.55E-06	3.55E-06	2.42E-06	1.68E-06
	21.72	64.90	1.30E-02		2.28E-02	6.29E-03
	37.93	23.75	2.77E+00		1.06E+01	1.36E+00
	131.42	20.40	1.37E+02		9.96E+00	6.49E+01
+ TH-234	63.29	* 3.80	2.18E+02	2.18E+02	6.81E+02	1.07E+02
NP-237	29.37	* 14.00	1.18E+00	1.18E+00	3.10E+01	5.78E-01
	86.50	12.60	1.00E+02		-2.37E+01	4.80E+01
U-237	97.08	16.30	1.13E+02	7.72E+01	-3.27E+01	5.40E+01
	101.07	26.30	7.72E+01		-5.86E+00	3.67E+01
	114.00	12.30	4.18E+02		1.25E+03	2.04E+02
	208.01	22.00	2.21E+02		4.51E+00	1.05E+02
AM-241	59.54	35.90	1.57E+01	1.57E+01	4.21E+01	7.68E+00
AM-243	74.67	66.00	1.20E+01	1.20E+01	-5.70E+01	5.75E+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

# 0000072129.CNF

Live Time : 900.000 sec  
Real Time : 901.840 sec  
Start : 1: 0.6(kev)  
Stop : 4096.4096.2(kev)  
Acq. Start : Thu Sep 20 11:18:02 2018



LP  
9/20/18

2

Analysis Report for 1809034-04  
HALEY POND 6

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809034-04  
 Sample Description : HALEY POND 6  
 Sample Type : RA RECOVERY  
  
 Sample Size : 1.000E+00 units  
 Facility : Countroom  
  
 Sample Taken On : 9/19/2018 9:48:27AM  
 Acquisition Started : 9/20/2018 11:18:08AM  
  
 Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 900.5 seconds  
  
 Dead Time : 0.06 %  
  
 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 : 72130

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/20/2018 11:33:26AM  
 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 1809034-04

HALEY POND 6

2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.30	16 -	23	20.35	1.44E+02	53.89	3.88E+02	2.22
M	2	31.35	26 -	40	30.41	3.15E+03	120.09	2.70E+02	2.23
m	3	35.63	26 -	40	34.69	7.48E+02	100.77	1.85E+02	2.30
	4	53.14	47 -	56	52.22	8.08E+01	48.86	2.94E+02	2.42
M	5	62.24	57 -	72	61.32	3.48E+02	55.93	2.40E+02	2.54
m	6	66.47	57 -	72	65.56	1.38E+02	51.96	2.54E+02	2.55
	7	81.52	75 -	86	80.62	1.21E+03	88.97	3.81E+02	2.18
	8	103.30	100 -	106	102.42	4.09E+01	30.16	1.34E+02	2.23
M	9	112.25	107 -	124	111.38	2.86E+02	44.02	1.36E+02	2.39
m	10	116.69	107 -	124	115.82	6.22E+01	39.82	1.47E+02	2.38
	11	162.92	157 -	166	162.08	4.23E+01	43.61	2.41E+02	5.35
	12	277.04	270 -	280	276.29	6.81E+01	31.88	9.99E+01	2.02
	13	303.42	298 -	305	302.70	1.46E+02	34.41	9.96E+01	2.00
	14	333.81	328 -	337	333.11	5.35E+01	30.74	1.03E+02	2.13
	15	356.62	350 -	361	355.95	6.17E+02	54.30	5.98E+01	2.05
M	16	386.65	379 -	395	386.00	3.32E+02	40.64	3.65E+01	5.03
m	17	392.32	379 -	395	391.67	4.85E+01	22.45	2.69E+00	2.76
	18	416.65	410 -	423	416.02	5.83E+01	24.78	4.33E+01	6.05
M	19	433.85	432 -	441	433.24	7.45E+00	3.46	0.00E+00	2.61
m	20	437.37	432 -	441	436.76	8.42E+01	18.97	0.00E+00	2.61
	21	445.94	443 -	447	445.33	9.00E+00	6.00	0.00E+00	1.32
	22	601.04	597 -	603	600.57	7.00E+00	5.29	0.00E+00	3.00
	23	609.21	606 -	611	608.75	1.20E+01	6.93	0.00E+00	1.24
	24	737.77	733 -	740	737.43	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 2.000sigma

## BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/20/2018 11:33:26AM

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	1.44E+02	53.89			1.44E+02	5.39E+01
M	2	31.35	3.15E+03	120.09			3.15E+03	1.20E+02
m	3	35.63	7.48E+02	100.77			7.48E+02	1.01E+02
	4	53.14	8.08E+01	48.86			8.08E+01	4.89E+01
M	5	62.24	3.48E+02	55.93	1.33E+01	2.31E+00	3.34E+02	5.60E+01

0136

Analysis Report for 1809034-04  
HALEY POND 6

2

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m 6	66.47	1.38E+02	51.96			1.38E+02	5.20E+01
7	81.52	1.21E+03	88.97			1.21E+03	8.90E+01
8	103.30	4.09E+01	30.16			4.09E+01	3.02E+01
M 9	112.25	2.86E+02	44.02			2.86E+02	4.40E+01
m 10	116.69	6.22E+01	39.82			6.22E+01	3.98E+01
11	162.92	4.23E+01	43.61			4.23E+01	4.36E+01
12	277.04	6.81E+01	31.88			6.81E+01	3.19E+01
13	303.42	1.46E+02	34.41			1.46E+02	3.44E+01
14	333.81	5.35E+01	30.74			5.35E+01	3.07E+01
15	356.62	6.17E+02	54.30			6.17E+02	5.43E+01
M 16	386.65	3.32E+02	40.64			3.32E+02	4.06E+01
m 17	392.32	4.85E+01	22.45			4.85E+01	2.24E+01
18	416.65	5.83E+01	24.78			5.83E+01	2.48E+01
M 19	433.85	7.45E+00	3.46			7.45E+00	3.46E+00
m 20	437.37	8.42E+01	18.97			8.42E+01	1.90E+01
21	445.94	9.00E+00	6.00			9.00E+00	6.00E+00
22	601.04	7.00E+00	5.29			7.00E+00	5.29E+00
23	609.21	1.20E+01	6.93	1.31E+00	1.33E+00	1.07E+01	7.06E+00
24	737.77	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	0.93	255.12	1.93		
		391.69 *	61.90	7.68E+01	3.70E+01
I-125	1.00	35.49 *	6.49	6.90E+02	9.46E+01
		30.80 *	97.60	1.47E+02	6.28E+00
BA-133	0.99	302.84 *	17.80	7.21E+02	2.79E+02
		356.01 *	60.00	9.69E+02	1.53E+02
		279.19 *	77.30	7.48E+01	4.17E+01
HG-203	0.91	279.19 *	77.30	7.48E+01	4.17E+01
TH-234	0.97	63.29 *	3.80	1.44E+03	2.61E+02

0137

Analysis Report for 1809034-04  
HALEY POND 6

2

\* = 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	0.939	7.68E+01	3.70E+01	
	I-125	1.000	6.90E+02	9.46E+01	
X	I-129	0.832			
	BA-133	0.994	1.48E+02	6.27E+00	
	HG-203	0.915	7.48E+01	4.17E+01	
	TH-234	0.979	1.44E+03	2.61E+02	
X	NP-237	0.550			

? = 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 1809034-04  
HALEY POND 6

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/20/2018 11:33:26AM  
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	1.60095E-01	18.70	Tol.	PA-234M
	4	53.14	8.97880E-02	30.23		
m	6	66.47	1.53770E-01	18.77	Sum	
	7	81.52	1.34697E+00	3.67		
	8	103.30	4.54630E-02	36.86		
M	9	112.25	3.18008E-01	7.69	Tol.	U-237
m	10	116.69	6.90828E-02	32.03		
	11	162.92	4.70484E-02	51.50		
	14	333.81	5.94392E-02	28.73	Sum	
M	16	386.65	3.68665E-01	6.12	Sum	
	18	416.65	6.48194E-02	21.24		
M	19	433.85	8.27285E-03	23.26		
m	20	437.37	9.35237E-02	11.27		
	21	445.94	1.00000E-02	33.33		
	22	601.04	7.77778E-03	37.80		
	23	609.21	1.18822E-02	32.99		
	24	737.77	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

NUCLIDE MDA REPORT

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

0139

Analysis Report for 1809034-04  
HALEY POND 6

2

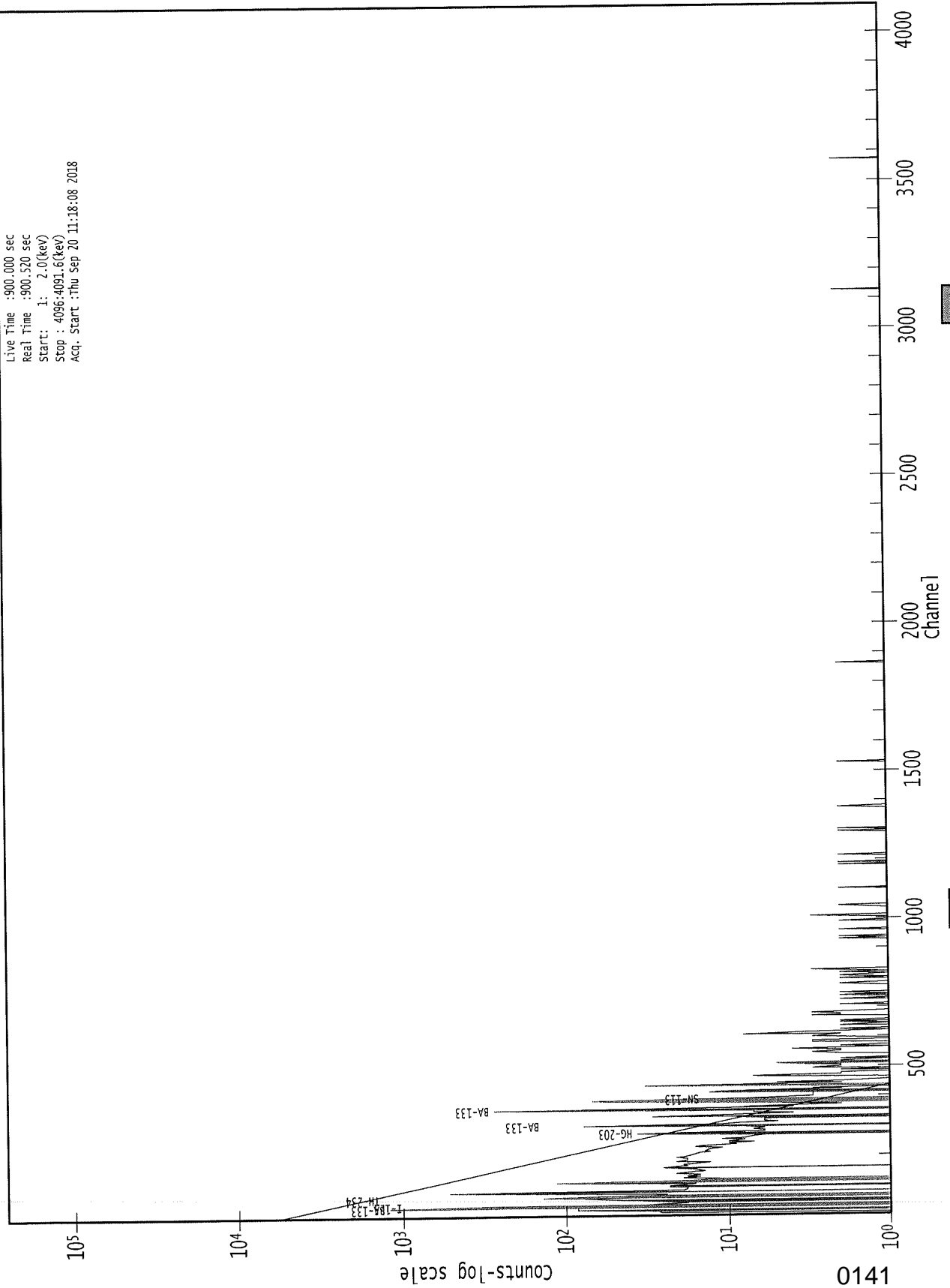
Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	5.44E-03	5.44E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.22E+01	2.22E+01	-1.69E+01	1.04E+01
	136.48	10.60	2.16E+02		4.22E+01	1.02E+02
NI-59	6.92	29.80	5.42E-02	5.42E-02	-3.34E-02	2.33E-02
MO-93	16.59	52.90	1.25E+00	1.25E+00	-1.77E-01	6.01E-01
	18.60	10.00	1.15E+01		2.01E+01	5.56E+00
NB-93M	16.57	9.43	7.02E+00	7.02E+00	-9.89E-01	3.36E+00
CD-109	88.03	3.72	3.92E+02	3.92E+02	-8.63E+01	1.86E+02
+ SN-113	255.12	1.93	1.44E+03	5.42E+01	-3.09E+02	6.62E+02
	391.69	* 61.90	5.42E+01		7.68E+01	2.49E+01
SN-119M	23.87	16.10	1.29E+01	9.59E+00	1.09E+00	6.24E+00
	25.10	22.70	9.59E+00		8.69E-01	4.63E+00
+ I-125	35.49	* 6.49	1.04E+02	1.04E+02	6.90E+02	5.07E+01
I-129	29.78	* 57.00	9.14E+00	9.14E+00	2.51E+02	4.46E+00
	33.60	* 13.20	5.05E+01		3.35E+02	2.46E+01
	39.58	7.52	7.03E+01		-2.27E+00	3.39E+01
+ BA-133	30.80	* 97.60	5.34E+00	5.34E+00	1.47E+02	2.61E+00
	302.84	* 17.80	2.12E+02		7.21E+02	9.93E+01
	356.01	* 60.00	6.08E+01		9.69E+02	2.83E+01
CE-139	165.85	80.35	3.58E+01	3.58E+01	2.16E+00	1.69E+01
CE-144	133.54	10.80	2.02E+02	2.02E+02	-7.57E+00	9.51E+01
+ HG-203	279.19	* 77.30	5.23E+01	5.23E+01	7.48E+01	2.47E+01
PB-210	46.50	4.25	1.18E+02	1.18E+02	1.62E+01	5.59E+01
PA-231	9.28	42.00	1.93E-01	1.93E-01	1.76E-01	9.01E-02
	10.11	20.20	5.58E-01		3.23E-01	2.61E-01
	283.67	1.60	1.49E+03		-1.23E+02	6.75E+02
	302.67	2.30	2.55E+03		5.18E+03	1.22E+03
TH-231	25.64	14.70	1.55E+01	1.55E+01	1.41E+00	7.46E+00
	84.21	6.40	6.59E+02		4.16E+03	3.24E+02
PA-234M	9.89	89.00	1.19E-01	1.19E-01	6.87E-02	5.56E-02
	21.72	64.90	2.62E+00		4.24E+00	1.27E+00
	37.93	23.75	3.71E+01		1.27E+02	1.82E+01
	131.42	20.40	1.01E+02		-3.43E+01	4.77E+01
+ TH-234	63.29	* 3.80	4.83E+02	4.83E+02	1.44E+03	2.36E+02
NP-237	29.37	* 14.00	3.72E+01	3.72E+01	1.02E+03	1.82E+01
	86.50	12.60	1.16E+02		-2.67E+01	5.49E+01
U-237	97.08	16.30	1.10E+02	7.43E+01	-2.67E+01	5.19E+01
	101.07	26.30	7.43E+01		-7.51E+00	3.53E+01
	114.00	12.30	3.32E+02		9.50E+02	1.61E+02
	208.01	22.00	1.58E+02		1.21E+01	7.43E+01
AM-241	59.54	35.90	4.10E+01	4.10E+01	8.65E+01	1.99E+01
AM-243	74.67	66.00	1.79E+01	1.79E+01	3.31E+00	8.52E+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



# 0000072130.CNF

Live Time : 900.000 sec  
Real Time : 900.320 sec  
Start: 1: 2.0(keV)  
Stop : 4096:4091.6(keV)  
Acq. Start :Thu Sep 20 11:18:08 2018



KP  
9/20/18

2

Analysis Report for 1809034-05  
HALEY POND 2

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809034-05  
 Sample Description : HALEY POND 2  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/19/2018 9:48:46AM  
 Acquisition Started : 9/20/2018 11:36:42AM

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 : 72131

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/20/2018 11:51:46AM  
 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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0142

Analysis Report for 1809034-05

HALEY POND 2

	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 -	45	31.20	2.96E+03	114.70	2.59E+02	1.90
m	2	35.42	25 -	45	35.80	7.72E+02	74.19	2.28E+02	2.17
	3	53.14	50 -	57	53.51	6.06E+01	48.00	3.43E+02	1.18
M	4	61.88	58 -	73	62.25	3.99E+02	57.14	2.91E+02	2.35
m	5	65.92	58 -	73	66.29	1.54E+02	52.96	2.89E+02	2.19
	6	81.14	77 -	86	81.51	1.14E+03	90.87	5.27E+02	2.09
	7	88.37	87 -	91	88.73	4.78E+01	31.73	1.70E+02	2.66
M	8	111.88	106 -	121	112.23	3.16E+02	47.75	1.95E+02	2.10
m	9	116.39	106 -	121	116.75	8.63E+01	37.26	1.84E+02	2.11
	10	152.30	150 -	154	152.64	2.47E+01	25.42	1.21E+02	1.09
	11	160.85	157 -	165	161.19	4.45E+01	43.30	2.61E+02	1.79
	12	276.30	273 -	280	276.61	1.08E+02	31.37	9.15E+01	1.70
M	13	303.05	291 -	315	303.36	2.60E+02	35.43	4.23E+01	1.96
m	14	307.05	291 -	315	307.36	4.56E+01	29.92	5.41E+01	2.09
	15	333.58	329 -	337	333.88	9.08E+01	35.89	1.38E+02	1.96
	16	339.37	338 -	343	339.67	2.60E+01	24.64	9.40E+01	1.51
M	17	352.04	350 -	360	352.34	3.71E+01	19.38	4.12E+01	2.30
m	18	356.15	350 -	360	356.45	7.93E+02	58.82	5.86E+01	1.78
	19	363.27	361 -	367	363.57	4.58E+01	25.18	7.83E+01	4.08
M	20	376.43	374 -	400	376.72	1.92E+01	16.12	4.47E+01	2.35
m	21	384.04	374 -	400	384.33	1.74E+02	42.57	5.91E+01	2.36
m	22	386.91	374 -	400	387.20	3.01E+02	44.77	4.75E+01	1.85
m	23	391.30	374 -	400	391.59	7.00E+01	32.25	5.07E+01	2.36
m	24	394.53	374 -	400	394.82	1.21E+01	20.98	4.24E+01	1.95
M	25	414.73	412 -	421	415.01	4.05E+01	21.14	4.49E+01	2.16
m	26	417.74	412 -	421	418.02	2.60E+01	23.56	6.73E+01	2.16
	27	437.05	432 -	441	437.33	1.40E+02	29.61	4.52E+01	2.11
	28	443.15	441 -	447	443.42	1.77E+01	12.85	1.67E+01	1.51
	29	467.44	464 -	471	467.71	2.87E+01	18.22	3.66E+01	1.32
	30	609.30	606 -	612	609.54	2.40E+01	13.15	1.40E+01	2.00
	31	812.40	810 -	816	812.60	6.50E+00	8.03	7.00E+00	1.45
	32	821.05	818 -	823	821.25	4.42E+00	5.74	3.17E+00	2.57
	33	1079.04	1076 -	1081	1079.20	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 : 9/20/2018 11:51:46AM

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

0143

Analysis Report for 1809034-05

HALEY POND 2

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	30.83	2.96E+03	114.70			2.96E+03	1.15E+02
m	2	35.42	7.72E+02	74.19			7.72E+02	7.42E+01
	3	53.14	6.06E+01	48.00			6.06E+01	4.80E+01
M	4	61.88	3.99E+02	57.14			3.99E+02	5.71E+01
m	5	65.92	1.54E+02	52.96			1.54E+02	5.30E+01
	6	81.14	1.14E+03	90.87			1.14E+03	9.09E+01
	7	88.37	4.78E+01	31.73			4.78E+01	3.17E+01
M	8	111.88	3.16E+02	47.75			3.16E+02	4.77E+01
m	9	116.39	8.63E+01	37.26			8.63E+01	3.73E+01
	10	152.30	2.47E+01	25.42			2.47E+01	2.54E+01
	11	160.85	4.45E+01	43.30			4.45E+01	4.33E+01
	12	276.30	1.08E+02	31.37			1.08E+02	3.14E+01
M	13	303.05	2.60E+02	35.43			2.60E+02	3.54E+01
m	14	307.05	4.56E+01	29.92			4.56E+01	2.99E+01
	15	333.58	9.08E+01	35.89			9.08E+01	3.59E+01
	16	339.37	2.60E+01	24.64	6.20E-01	1.14E+00	2.54E+01	2.47E+01
M	17	352.04	3.71E+01	19.38			3.71E+01	1.94E+01
m	18	356.15	7.93E+02	58.82			7.93E+02	5.88E+01
	19	363.27	4.58E+01	25.18			4.58E+01	2.52E+01
M	20	376.43	1.92E+01	16.12			1.92E+01	1.61E+01
m	21	384.04	1.74E+02	42.57			1.74E+02	4.26E+01
m	22	386.91	3.01E+02	44.77			3.01E+02	4.48E+01
m	23	391.30	7.00E+01	32.25			7.00E+01	3.22E+01
m	24	394.53	1.21E+01	20.98			1.21E+01	2.10E+01
M	25	414.73	4.05E+01	21.14			4.05E+01	2.11E+01
m	26	417.74	2.60E+01	23.56			2.60E+01	2.36E+01
	27	437.05	1.40E+02	29.61			1.40E+02	2.96E+01
	28	443.15	1.77E+01	12.85			1.77E+01	1.29E+01
	29	467.44	2.87E+01	18.22			2.87E+01	1.82E+01
	30	609.30	2.40E+01	13.15	1.92E+00	1.08E+00	2.21E+01	1.32E+01
	31	812.40	6.50E+00	8.03			6.50E+00	8.03E+00
	32	821.05	4.42E+00	5.74			4.42E+00	5.74E+00
	33	1079.04	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

0144

Analysis Report for 1809034-05  
HALEY POND 2

2

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
CD-109	0.99	88.03	*	3.72	3.29E+02	2.23E+02
SN-113	0.96	255.12		1.93		
		391.69	*	61.90	4.19E+01	1.96E+01
I-125	1.00	35.49	*	6.49	7.99E+00	7.68E-01
BA-133	1.00	30.80	*	97.60	5.55E-01	2.15E-02
		302.84	*	17.80	1.15E+03	5.27E+02
		356.01	*	60.00	6.69E+02	8.84E+01
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	8.90E+03	4.08E+03
TH-234	0.94	63.29	*	3.80	4.42E+02	6.42E+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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
CD-109	0.997	3.29E+02	2.23E+02	
SN-113	0.967	4.19E+01	1.96E+01	
I-125	1.000	7.99E+00	7.68E-01	
X I-129	0.747			
BA-133	1.000	5.55E-01	2.15E-02	
PA-231	1.000	8.90E+03	4.08E+03	
TH-234	0.942	4.42E+02	6.42E+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

0145

Analysis Report for 1809034-05  
HALEY POND 2

2

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### UNIDENTIFIED PEAKS

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Peak Locate Performed on : 9/20/2018 11:51:46AM  
Peak Locate From Channel : 1  
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	3	53.14	6.72845E-02		
m	5	65.92	1.71160E-01	Sum	
	6	81.14	1.26509E+00		
M	8	111.88	3.50690E-01		
m	9	116.39	9.58609E-02		
	10	152.30	2.74837E-02		
	11	160.85	4.94444E-02		
	12	276.30	1.20253E-01		
m	14	307.05	5.06721E-02		
	15	333.58	1.00840E-01	Sum	
	16	339.37	2.81996E-02	Sum	
M	17	352.04	4.12436E-02		
	19	363.27	5.09346E-02	Sum	
M	20	376.43	2.12807E-02		
m	21	384.04	1.93390E-01		
m	22	386.91	3.34512E-01	Sum	
m	24	394.53	1.34150E-02		
M	25	414.73	4.50097E-02		
m	26	417.74	2.88366E-02	Sum	
	27	437.05	1.56022E-01		
	28	443.15	1.96368E-02	Sum	
	29	467.44	3.18676E-02		
	30	609.30	2.45340E-02		
	31	812.40	7.22222E-03		
	32	821.05	4.90741E-03		
	33	1079.04	5.55556E-03		

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

0146

Analysis Report for 1809034-05  
HALEY POND 2

## 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	3.80E+01	3.80E+01	3.42E+00	1.78E+01
	136.48	10.60	3.65E+02		-6.41E+01	1.71E+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	8.90E-06	8.90E-06	-5.54E-06	4.01E-06
	18.60	10.00	4.73E-04		7.14E-04	2.27E-04
NB-93M	16.57	9.43	4.92E-05	4.92E-05	-3.06E-05	2.22E-05
+ CD-109	88.03	*	3.72	3.42E+02	3.29E+02	1.62E+02
+ SN-113	255.12	1.93	2.17E+03	5.56E+01	1.69E+02	1.01E+03
	391.69	*	61.90	5.56E+01	4.19E+01	2.70E+01
SN-119M	23.87	16.10	5.39E-03	5.39E-03	-3.60E-03	2.58E-03
	25.10	22.70	6.36E-03		-2.09E-03	3.04E-03
+ I-125	35.49	*	6.49	1.68E+00	1.68E+00	7.99E+00
I-129	29.78	*	57.00	5.22E-02	5.22E-02	9.51E-01
	33.60	13.20	6.18E-01		-3.01E+00	3.05E-01
	39.58	7.52	1.51E+00		-1.52E+00	7.23E-01
+ BA-133	30.80	*	97.60	3.05E-02	3.05E-02	5.55E-01
	302.84	*	17.80	3.70E+02	1.15E+03	1.79E+02
	356.01	*	60.00	4.19E+01	6.69E+02	1.98E+01
CE-139	165.85	80.35	6.62E+01	6.62E+01	1.12E+01	3.10E+01
CE-144	133.54	10.80	3.82E+02	3.82E+02	1.41E+02	1.80E+02
HG-203	279.19	77.30	6.46E+01	6.46E+01	7.76E+00	3.06E+01
PB-210	46.50	4.25	6.82E+00	6.82E+00	1.11E+00	3.22E+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	1.98E+03		8.75E+02	9.12E+02
	302.67	*	2.30	2.86E+03	8.90E+03	1.39E+03
TH-231	25.64	14.70	1.31E-02	1.31E-02	-2.67E-02	6.31E-03
	84.21	6.40	2.35E+02		-1.66E+03	1.13E+02
PA-234M	9.89	89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
	21.72	64.90	5.44E-04		7.07E-04	2.63E-04
	37.93	23.75	6.09E-01		1.68E+00	2.98E-01
	131.42	20.40	1.92E+02		2.70E+01	9.02E+01
+ TH-234	63.29	*	3.80	1.43E+02	1.43E+02	4.42E+02
NP-237	29.37	*	14.00	2.13E-01	2.13E-01	3.87E+00
	86.50	12.60	1.09E+02		-1.32E+02	5.18E+01
U-237	97.08	16.30	1.28E+02	9.01E+01	-2.47E+01	6.08E+01
	101.07	26.30	9.01E+01		-1.61E+01	4.26E+01
	114.00	12.30	5.26E+02		9.28E+02	2.55E+02
	208.01	22.00	2.88E+02		9.05E+01	1.35E+02
AM-241	59.54	35.90	8.38E+00	8.38E+00	1.04E+01	4.06E+00
AM-243	74.67	66.00	1.04E+01	1.04E+01	1.87E+00	4.98E+00

0147

Analysis Report for 1809034-05  
HALEY POND 2

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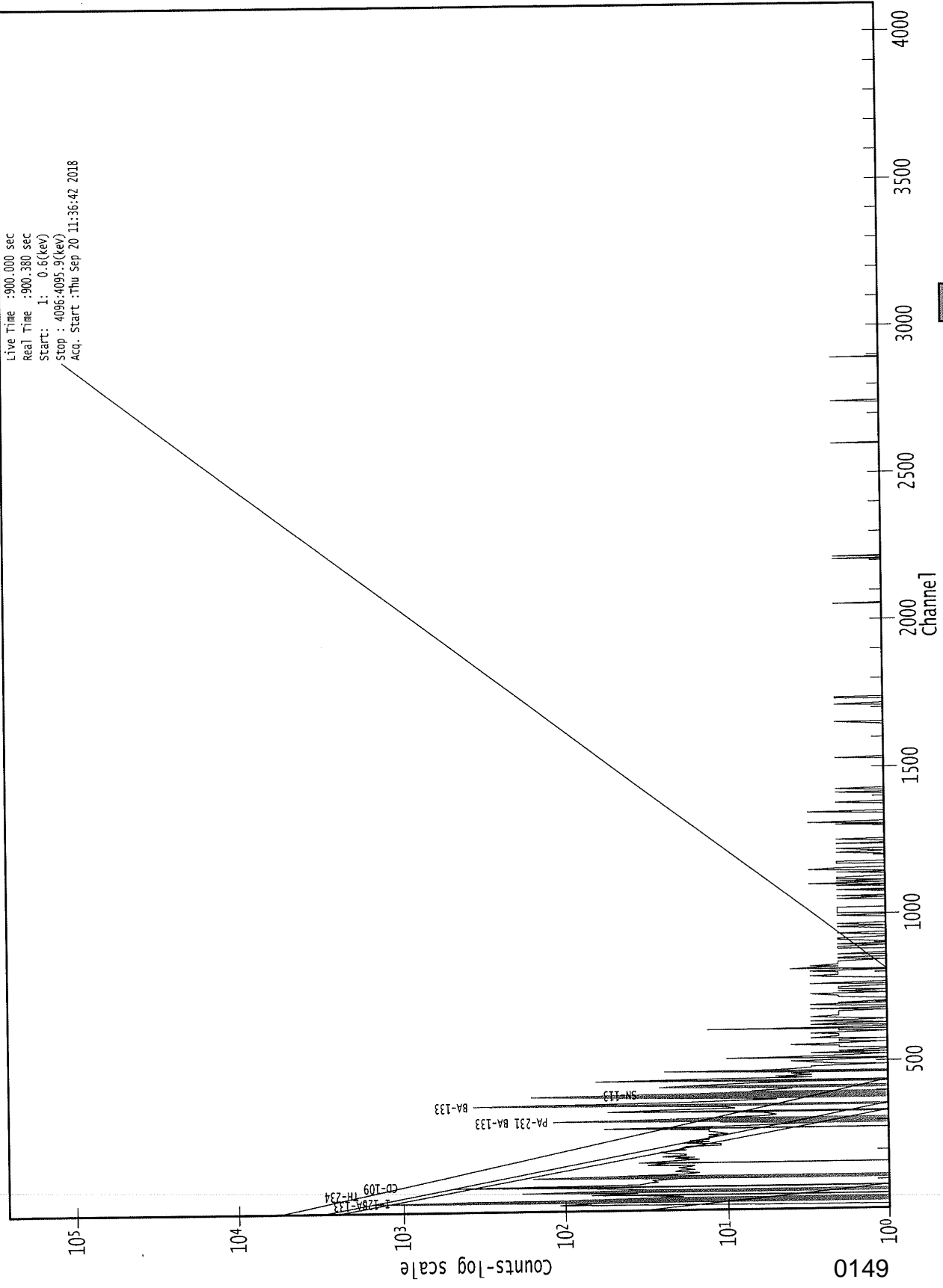
- + = Nuclide identified during the nuclide identification
  - \* = Energy line found in the spectrum
  - > = MDA value not calculated
  - @ = Half-life too short to be able to perform the decay correction
- 

2

0148



0000072131.CNF



RP  
9/20/18

2

Analysis Report for 1809034-06  
LONG 1 AND 2 RIG SUPPLY

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 1809034-06  
 Sample Description : LONG 1 AND 2 RIG SUPPLY  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/19/2018 9:49:01AM  
 Acquisition Started : 9/20/2018 11:36:49AM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE3  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 902.2 seconds

Dead Time : 0.25 %

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 : 72132

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## PEAK ANALYSIS REPORT

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Peak Analysis Performed on : 9/20/2018 11:52:02AM  
 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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0150

Analysis Report for 1809034-06

## LONG 1 AND 2 RIG SUPPLY

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.90	18 -	25	21.27	1.09E+02	55.43	4.45E+02	1.97
M	2	31.05	25 -	40	31.41	3.10E+03	120.69	3.28E+02	2.23
m	3	35.31	25 -	40	35.67	7.93E+02	103.18	2.69E+02	2.26
	4	52.60	49 -	57	52.96	9.14E+01	50.94	3.45E+02	2.84
M	5	62.08	58 -	71	62.43	3.84E+02	59.00	3.39E+02	2.29
m	6	66.49	58 -	71	66.83	1.47E+02	57.32	3.89E+02	2.27
	7	81.24	75 -	87	81.58	1.30E+03	98.38	5.25E+02	2.28
M	8	112.23	108 -	120	112.55	3.63E+02	54.59	2.25E+02	2.57
m	9	116.29	108 -	120	116.62	8.81E+01	49.11	2.53E+02	2.57
	10	148.50	146 -	152	148.81	3.05E+01	34.14	1.85E+02	1.47
	11	161.00	158 -	165	161.30	3.03E+01	38.00	2.21E+02	2.37
	12	276.24	271 -	280	276.49	8.27E+01	33.24	1.25E+02	2.32
M	13	303.13	300 -	311	303.37	2.26E+02	35.45	6.30E+01	2.31
m	14	307.43	300 -	311	307.68	5.46E+01	39.15	8.10E+01	3.06
	15	333.95	330 -	337	334.19	8.73E+01	32.31	1.15E+02	2.21
	16	356.34	351 -	363	356.56	7.26E+02	62.36	1.11E+02	2.22
	17	367.35	363 -	374	367.57	3.20E+01	24.66	6.00E+01	7.04
M	18	384.60	380 -	395	384.81	2.09E+02	45.10	5.09E+01	2.99
m	19	387.29	380 -	395	387.51	2.57E+02	41.39	2.27E+01	1.94
m	20	391.00	380 -	395	391.21	8.06E+01	42.86	2.77E+01	3.18
M	21	413.80	411 -	430	414.00	3.45E+01	14.55	2.33E+01	2.37
m	22	417.01	411 -	430	417.22	4.80E+01	24.12	3.44E+01	3.15
m	23	422.80	411 -	430	423.00	2.22E+01	16.18	1.74E+01	2.37
	24	437.33	432 -	441	437.53	1.60E+02	27.33	1.63E+01	2.13
	25	446.70	444 -	449	446.89	9.00E+00	6.00	0.00E+00	2.32
M	26	467.88	463 -	477	468.06	3.07E+01	15.26	1.09E+01	2.90
m	27	473.06	463 -	477	473.24	9.30E+00	12.96	1.95E+01	2.64
	28	509.97	505 -	514	510.14	2.20E+01	9.38	0.00E+00	3.99
	29	608.97	606 -	612	609.10	9.50E+00	8.75	7.00E+00	1.87
	30	1006.00	1002 -	1008	1006.00	7.00E+00	5.29	0.00E+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 : 9/20/2018 11:52:02AM

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

0151

Analysis Report for 1809034-06

LONG 1 AND 2 RIG SUPPLY

2

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.90	1.09E+02	55.43		1.09E+02	5.54E+01
M	2	31.05	3.10E+03	120.69		3.10E+03	1.21E+02
m	3	35.31	7.93E+02	103.18		7.93E+02	1.03E+02
	4	52.60	9.14E+01	50.94	2.82E-01	9.11E+01	5.09E+01
M	5	62.08	3.84E+02	59.00	1.31E+01	3.71E+02	5.90E+01
m	6	66.49	1.47E+02	57.32		1.47E+02	5.73E+01
	7	81.24	1.30E+03	98.38		1.30E+03	9.84E+01
M	8	112.23	3.63E+02	54.59		3.63E+02	5.46E+01
m	9	116.29	8.81E+01	49.11		8.81E+01	4.91E+01
	10	148.50	3.05E+01	34.14		3.05E+01	3.41E+01
	11	161.00	3.03E+01	38.00		3.03E+01	3.80E+01
	12	276.24	8.27E+01	33.24		8.27E+01	3.32E+01
M	13	303.13	2.26E+02	35.45		2.26E+02	3.54E+01
m	14	307.43	5.46E+01	39.15		5.46E+01	3.91E+01
	15	333.95	8.73E+01	32.31		8.73E+01	3.23E+01
	16	356.34	7.26E+02	62.36		7.26E+02	6.24E+01
	17	367.35	3.20E+01	24.66		3.20E+01	2.47E+01
M	18	384.60	2.09E+02	45.10		2.09E+02	4.51E+01
m	19	387.29	2.57E+02	41.39		2.57E+02	4.14E+01
m	20	391.00	8.06E+01	42.86		8.06E+01	4.29E+01
M	21	413.80	3.45E+01	14.55		3.45E+01	1.46E+01
m	22	417.01	4.80E+01	24.12		4.80E+01	2.41E+01
m	23	422.80	2.22E+01	16.18		2.22E+01	1.62E+01
	24	437.33	1.60E+02	27.33		1.60E+02	2.73E+01
	25	446.70	9.00E+00	6.00		9.00E+00	6.00E+00
M	26	467.88	3.07E+01	15.26		3.07E+01	1.53E+01
m	27	473.06	9.30E+00	12.96		9.30E+00	1.30E+01
	28	509.97	2.20E+01	9.38	1.42E+01	7.82E+00	9.48E+00
	29	608.97	9.50E+00	8.75	1.01E+00	8.49E+00	8.79E+00
	30	1006.00	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

Analysis Report for 1809034-06

LONG 1 AND 2 RIG SUPPLY

<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	0.95	255.12 391.69 *	1.93 61.90	5.66E+01	3.06E+01
I-125	0.99	35.49 *	6.49	3.77E+01	4.91E+00
BA-133	0.99	30.80 * 302.84 * 356.01 *	97.60 17.80 60.00	4.19E+00 8.49E+02 6.30E+02	1.63E-01 3.36E+02 8.98E+01
TH-234	0.97	63.29 *	3.80	<del>5.90E+02</del>	<del>9.60E+01</del>

\* = 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	0.956	5.66E+01	3.06E+01	
I-125	0.999	3.77E+01	4.91E+00	
X I-129	0.900			
BA-133	0.999	4.19E+00	1.63E-01	
TH-234	0.974	5.90E+02	9.60E+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

0153

Analysis Report for 1809034-06

LONG 1 AND 2 RIG SUPPLY

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/20/2018 11:52:02AM  
 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	20.90	1.21479E-01	25.35	Tol.	PA-234M
	4	52.60	1.01269E-01	27.95		
m	6	66.49	1.62786E-01	19.56	Sum	
	7	81.24	1.44590E+00	3.78		
M	8	112.23	4.03502E-01	7.52	Tol.	U-237
m	9	116.29	9.78531E-02	27.88		
	10	148.50	3.39205E-02	55.92		
	11	161.00	3.36643E-02	62.71		
	12	276.24	9.18506E-02	20.11		
m	14	307.43	6.06865E-02	35.84		
	15	333.95	9.69617E-02	18.51	Sum	
	17	367.35	3.55556E-02	38.53		
M	18	384.60	2.32691E-01	10.77		
m	19	387.29	2.85363E-01	8.06	Sum	
M	21	413.80	3.82810E-02	21.12		
m	22	417.01	5.33275E-02	25.13	Sum	
m	23	422.80	2.47151E-02	36.37	Sum	
	24	437.33	1.77629E-01	8.55		
	25	446.70	1.00000E-02	33.33		
M	26	467.88	3.41055E-02	24.85		
m	27	473.06	1.03346E-02	69.68		
	28	509.97	8.68591E-03	60.64		
	29	608.97	9.43676E-03	51.72		
	30	1006.00	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

Analysis Report for 1809034-06  
LONG 1 AND 2 RIG SUPPLY

2

# 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	4.26E-09	4.26E-09	-2.49E-08	1.35E-09
CO-57	122.06	85.51	3.08E+01	3.08E+01	1.08E+01	1.46E+01
	136.48	10.60	2.78E+02		-1.59E+02	1.31E+02
NI-59	6.92	29.80	1.25E-07	1.25E-07	5.98E-08	5.78E-08
MO-93	16.59	52.90	1.19E-03	1.19E-03	9.60E-05	5.68E-04
	18.60	10.00	2.14E-02		5.29E-04	1.03E-02
NB-93M	16.57	9.43	6.58E-03	6.58E-03	5.33E-04	3.15E-03
CD-109	88.03	3.72	3.38E+02	3.38E+02	-9.71E+01	1.61E+02
+ SN-113	255.12	1.93	1.68E+03	3.09E+01	-4.24E+02	7.84E+02
	391.69	*	61.90	3.09E+01	5.66E+01	1.45E+01
SN-119M	23.87	16.10	1.08E-01	1.04E-01	-6.49E-02	5.21E-02
	25.10	22.70	1.04E-01		-1.37E+00	5.02E-02
+ I-125	35.49	*	6.49	6.37E+00	3.77E+01	3.12E+00
I-129	29.78	*	57.00	3.13E-01	3.13E-01	7.17E+00
	33.60	*	13.20	3.09E+00	1.83E+01	1.52E+00
	39.58		7.52	6.27E+00	-8.50E-01	3.02E+00
+ BA-133	30.80	*	97.60	1.83E-01	4.19E+00	8.96E-02
	302.84	*	17.80	1.82E+02	8.49E+02	8.60E+01
	356.01	*	60.00	4.71E+01	6.30E+02	2.24E+01
CE-139	165.85	80.35	4.78E+01	4.78E+01	-2.45E+00	2.26E+01
CE-144	133.54	10.80	2.86E+02	2.86E+02	2.49E+01	1.36E+02
HG-203	279.19	77.30	5.03E+01	5.03E+01	0.00E+00	2.38E+01
PB-210	46.50	4.25	2.01E+01	2.01E+01	4.28E+00	9.58E+00
PA-231	9.28	42.00	4.15E-06	4.15E-06	5.05E-06	1.98E-06
	10.11	20.20	2.18E-05		2.66E-05	1.04E-05
	283.67	1.60	1.58E+03		2.44E+01	7.27E+02
	302.67	2.30	2.26E+03		4.31E+03	1.09E+03
TH-231	25.64	14.70	1.93E-01	1.93E-01	-6.39E+00	9.34E-02
	84.21	6.40	4.09E+02		1.48E+03	2.01E+02
PA-234M	9.89	89.00	3.91E-06	3.91E-06	4.76E-06	1.86E-06
	21.72	64.90	1.25E-02		1.71E-02	6.07E-03
	37.93	23.75	2.74E+00		9.70E+00	1.34E+00
	131.42	20.40	1.56E+02		1.25E+02	7.42E+01
+ TH-234	63.29	*	3.80	2.02E+02	5.90E+02	9.90E+01
NP-237	29.37	*	14.00	1.28E+00	2.92E+01	6.25E-01
	86.50		12.60	9.77E+01	-6.44E+00	4.66E+01
U-237	97.08	16.30	1.21E+02	7.95E+01	-6.83E+00	5.80E+01
	101.07	26.30	7.95E+01		-4.82E+00	3.79E+01
	114.00	12.30	4.23E+02		1.33E+03	2.06E+02
	208.01	22.00	2.21E+02		-2.90E+01	1.05E+02
AM-241	59.54	35.90	1.50E+01	1.50E+01	3.76E+01	7.29E+00
AM-243	74.67	66.00	1.22E+01	1.22E+01	5.57E-01	5.82E+00

0155

Analysis Report for 1809034-06

LONG 1 AND 2 RIG SUPPLY

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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
- 

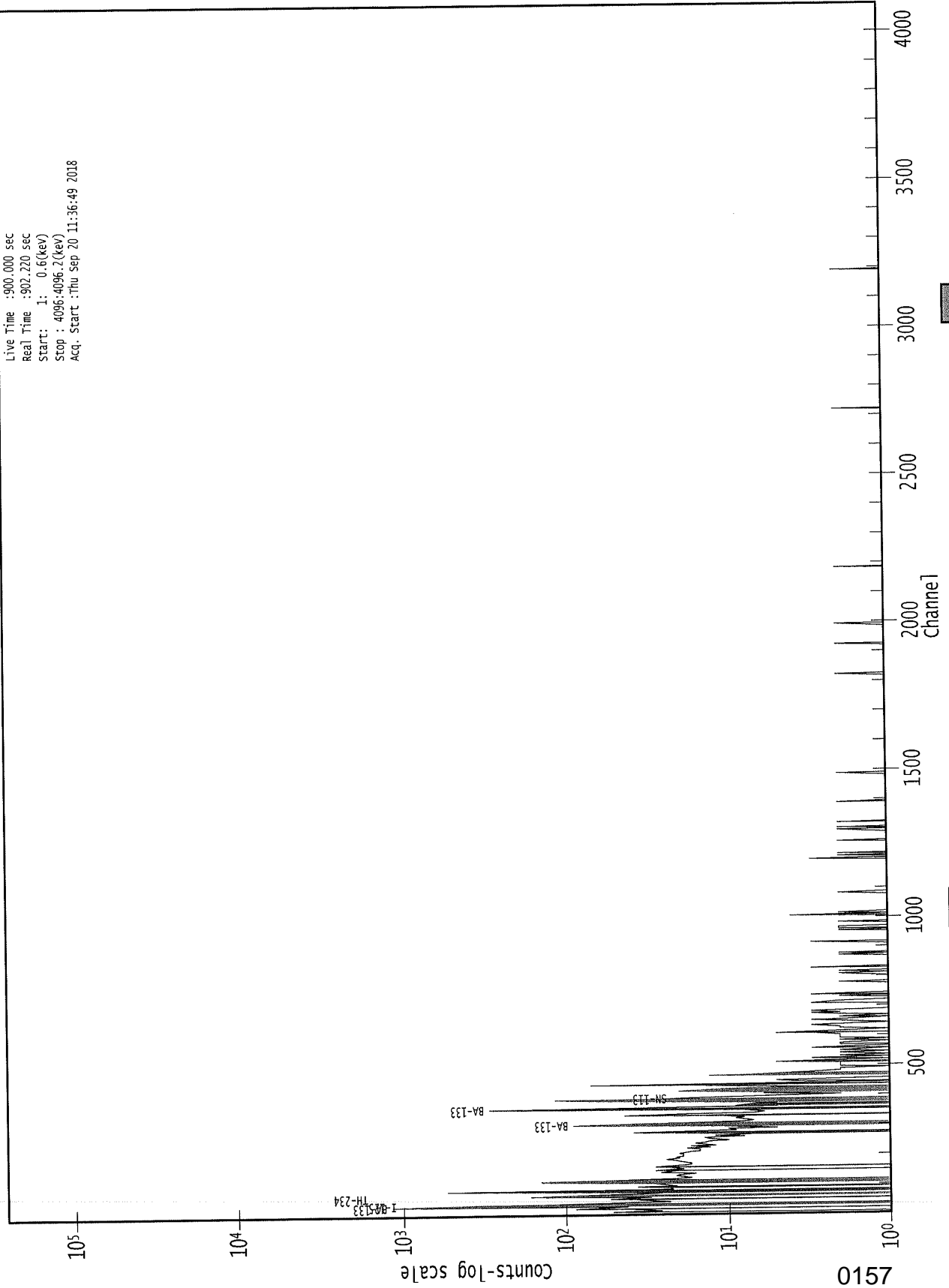
2

0156



# 0000072132.CNF

Live Time : 900.000 sec  
Real Time : 902.220 sec  
Start : 1: 0.6(keV)  
Stop : 4096:4096.2(keV)  
Acq. Start : Thu Sep 20 11:36:49 2018



KP  
9/20/18 2

Analysis Report for 1809034-07  
LONG 3 AND 4 RIG SUPPLY

## GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809034-07  
 Sample Description : LONG 3 AND 4 RIG SUPPLY  
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units  
 Facility : Countroom

Sample Taken On : 9/19/2018 9:49:15AM  
 Acquisition Started : 9/20/2018 11:36:57AM

Procedure : BAFIL  
 Operator : Administrator  
 Detector Name : GE4  
 Geometry : BAFIL  
 Live Time : 900.0 seconds  
 Real Time : 905.1 seconds

Dead Time : 0.56 %

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 : 72133

## PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/20/2018 11:52:15AM  
 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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0158

Analysis Report for 1809034-07

LONG 3 AND 4 RIG SUPPLY

2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.24	17 -	23	20.29	8.91E+01	48.44	3.58E+02	1.43
M	2	31.34	24 -	39	30.40	3.06E+03	118.83	2.88E+02	2.20
m	3	35.63	24 -	39	34.69	7.29E+02	100.54	2.60E+02	2.18
M	4	53.48	48 -	70	52.56	8.79E+01	44.00	2.52E+02	2.53
m	5	62.23	48 -	70	61.32	3.31E+02	51.77	2.28E+02	2.38
m	6	66.70	48 -	70	65.79	1.42E+02	52.35	2.68E+02	2.55
	7	81.52	74 -	86	80.62	1.24E+03	90.99	3.87E+02	2.25
	8	101.44	97 -	104	100.55	3.19E+01	38.63	2.26E+02	1.62
M	9	112.49	105 -	120	111.61	2.77E+02	49.27	2.16E+02	2.59
m	10	117.42	105 -	120	116.55	4.16E+01	40.89	2.16E+02	2.62
	11	134.43	131 -	138	133.57	4.38E+01	32.43	1.50E+02	3.74
	12	161.88	156 -	167	161.04	6.36E+01	48.17	2.59E+02	3.83
	13	276.96	271 -	279	276.21	6.40E+01	29.00	9.00E+01	2.07
M	14	303.47	296 -	314	302.75	1.87E+02	32.77	6.80E+01	2.14
m	15	307.72	296 -	314	307.00	3.77E+01	26.11	6.32E+01	2.30
m	16	311.20	296 -	314	310.48	2.08E+01	25.53	6.86E+01	2.79
	17	334.63	330 -	338	333.94	7.94E+01	32.47	1.15E+02	1.59
	18	356.58	350 -	360	355.90	6.20E+02	54.19	6.15E+01	1.99
M	19	386.47	380 -	396	385.81	3.30E+02	42.33	4.88E+01	4.16
m	20	391.89	380 -	396	391.25	4.41E+01	34.00	2.47E+01	3.44
M	21	415.87	410 -	431	415.24	3.25E+01	19.08	3.56E+01	2.60
m	22	418.86	410 -	431	418.24	2.23E+01	19.80	3.16E+01	2.60
m	23	422.86	410 -	431	422.24	1.58E+01	17.09	2.74E+01	2.60
	24	437.69	433 -	440	437.08	9.51E+01	22.36	1.98E+01	2.06
	25	469.18	464 -	473	468.59	1.90E+01	15.65	2.20E+01	2.02
	26	518.41	515 -	522	517.87	9.54E+00	8.00	4.92E+00	1.92
	27	739.14	736 -	741	738.80	5.00E+00	4.47	0.00E+00	2.40

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 : 9/20/2018 11:52:15AM

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	21.24	8.91E+01	48.44			8.91E+01	4.84E+01
M	2	31.34	3.06E+03	118.83			3.06E+03	1.19E+02

0159

Analysis Report for 1809034-07

LONG 3 AND 4 RIG SUPPLY

2

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	3	35.63	7.29E+02	100.54			7.29E+02	1.01E+02
M	4	53.48	8.79E+01	44.00			8.79E+01	4.40E+01
m	5	62.23	3.31E+02	51.77	1.33E+01	2.31E+00	3.18E+02	5.18E+01
m	6	66.70	1.42E+02	52.35			1.42E+02	5.23E+01
	7	81.52	1.24E+03	90.99			1.24E+03	9.10E+01
	8	101.44	3.19E+01	38.63			3.19E+01	3.86E+01
M	9	112.49	2.77E+02	49.27			2.77E+02	4.93E+01
m	10	117.42	4.16E+01	40.89			4.16E+01	4.09E+01
	11	134.43	4.38E+01	32.43			4.38E+01	3.24E+01
	12	161.88	6.36E+01	48.17			6.36E+01	4.82E+01
	13	276.96	6.40E+01	29.00			6.40E+01	2.90E+01
M	14	303.47	1.87E+02	32.77			1.87E+02	3.28E+01
m	15	307.72	3.77E+01	26.11			3.77E+01	2.61E+01
m	16	311.20	2.08E+01	25.53			2.08E+01	2.55E+01
	17	334.63	7.94E+01	32.47			7.94E+01	3.25E+01
	18	356.58	6.20E+02	54.19			6.20E+02	5.42E+01
M	19	386.47	3.30E+02	42.33			3.30E+02	4.23E+01
m	20	391.89	4.41E+01	34.00			4.41E+01	3.40E+01
M	21	415.87	3.25E+01	19.08			3.25E+01	1.91E+01
m	22	418.86	2.23E+01	19.80			2.23E+01	1.98E+01
m	23	422.86	1.58E+01	17.09			1.58E+01	1.71E+01
	24	437.69	9.51E+01	22.36			9.51E+01	2.24E+01
	25	469.18	1.90E+01	15.65			1.90E+01	1.57E+01
	26	518.41	9.54E+00	8.00			9.54E+00	8.00E+00
	27	739.14	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	6.98E+01	5.46E+01
I-125	1.00	35.49 *	6.49	6.72E+02	9.43E+01
BA-133	0.99	30.80 *	97.60	1.42E+02	6.18E+00

0160

Analysis Report for 1809034-07

LONG 3 AND 4 RIG SUPPLY

<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	9.21E+02	3.25E+02
		356.01 *	60.00	9.74E+02	1.53E+02
CE-144	0.98	133.54 *	10.80	1.88E+02	1.44E+02
HG-203	0.90	279.19 *	77.30	7.03E+01	3.83E+01
TH-234	0.97	63.29 *	3.80	1.37E+03	2.43E+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	0.946	6.98E+01	5.46E+01
	I-125	1.000	6.72E+02	9.43E+01
X	I-129	0.832		
	BA-133	0.994	1.44E+02	6.18E+00
	CE-144	0.985	1.88E+02	1.44E+02
	HG-203	0.909	7.03E+01	3.83E+01
	TH-234	0.979	1.37E+03	2.43E+02
X	NP-237	0.551		

? = 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

0161

Analysis Report for 1809034-07

LONG 3 AND 4 RIG SUPPLY

2

**UNIDENTIFIED PEAKS**

Peak Locate Performed on : 9/20/2018 11:52:15AM  
 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	21.24	9.90091E-02		
M	4	53.48	9.76404E-02		
m	6	66.70	1.57644E-01	Sum	
	7	81.52	1.38047E+00		
	8	101.44	3.54329E-02	Tol.	U-237
M	9	112.49	3.08003E-01	Tol.	U-237
m	10	117.42	4.62546E-02		
	12	161.88	7.07081E-02		
m	15	307.72	4.18634E-02	Sum	
m	16	311.20	2.30730E-02	Sum	
	17	334.63	8.82441E-02	Sum	
M	19	386.47	3.66169E-01	Sum	
M	21	415.87	3.60928E-02		
m	22	418.86	2.47675E-02	Sum	
m	23	422.86	1.75058E-02	Sum	
	24	437.69	1.05667E-01	Sum	
	25	469.18	2.11111E-02		
	26	518.41	1.06019E-02		
	27	739.14	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

**NUCLIDE MDA REPORT**

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

0162

Analysis Report for 1809034-07

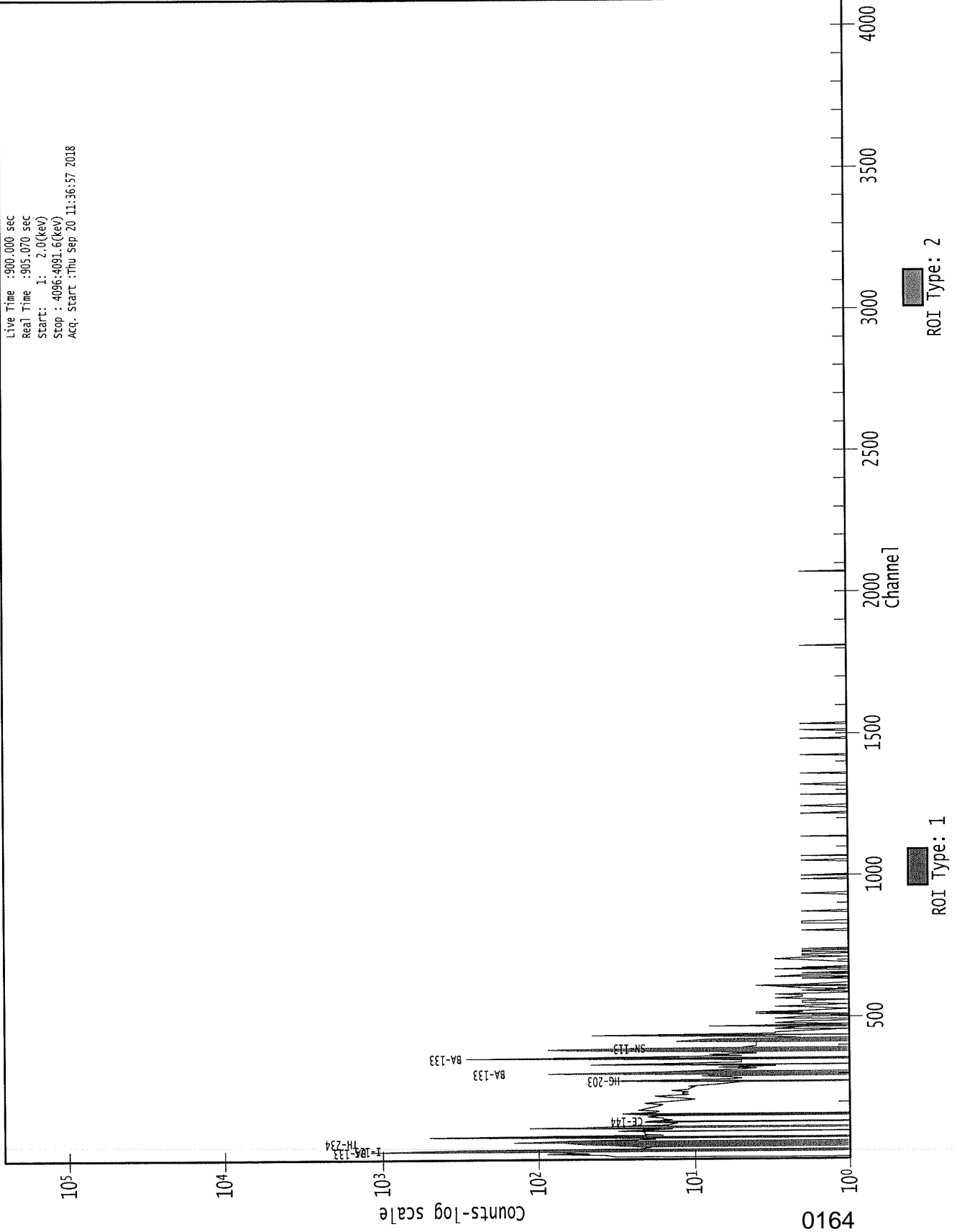
## LONG 3 AND 4 RIG SUPPLY

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	5.44E-03	5.44E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.23E+01	2.23E+01	1.12E+00	1.05E+01
	136.48	10.60	2.25E+02		5.34E+01	1.06E+02
NI-59	6.92	29.80	5.05E-02	5.05E-02	-5.43E-02	2.15E-02
MO-93	16.59	52.90	1.31E+00	1.31E+00	3.16E-01	6.28E-01
	18.60	10.00	1.11E+01		2.53E+00	5.34E+00
NB-93M	16.57	9.43	7.31E+00	7.31E+00	1.77E+00	3.51E+00
CD-109	88.03	3.72	3.66E+02	3.66E+02	7.51E+01	1.73E+02
+ SN-113	255.12	1.93	1.58E+03	6.95E+01	-1.23E+02	7.36E+02
	391.69	* 61.90	6.95E+01		6.98E+01	3.26E+01
SN-119M	23.87	16.10	1.24E+01	8.75E+00	-1.07E+01	5.98E+00
	25.10	22.70	8.75E+00		-1.29E+02	4.21E+00
+ I-125	35.49	* 6.49	1.17E+02	1.17E+02	6.72E+02	5.73E+01
I-129	29.78	* 57.00	1.01E+01	1.01E+01	2.44E+02	4.97E+00
	33.60	* 13.20	5.68E+01		3.27E+02	2.78E+01
	39.58	7.52	7.21E+01		-1.04E+01	3.47E+01
+ BA-133	30.80	* 97.60	5.93E+00	5.93E+00	1.42E+02	2.90E+00
	302.84	* 17.80	3.87E+02		9.21E+02	1.87E+02
	356.01	* 60.00	5.94E+01		9.74E+02	2.76E+01
CE-139	165.85	80.35	3.43E+01	3.43E+01	-3.43E+01	1.62E+01
+ CE-144	133.54	* 10.80	2.21E+02	2.21E+02	1.88E+02	1.05E+02
+ HG-203	279.19	* 77.30	4.67E+01	4.67E+01	7.03E+01	2.19E+01
PB-210	46.50	4.25	1.24E+02	1.24E+02	3.14E+01	5.89E+01
PA-231	9.28	42.00	2.06E-01	2.06E-01	1.68E-01	9.63E-02
	10.11	20.20	6.30E-01		5.29E-01	2.98E-01
	283.67	1.60	1.54E+03		1.42E+02	6.97E+02
	302.67	2.30	2.75E+03		6.01E+03	1.32E+03
TH-231	25.64	14.70	1.54E+01	1.54E+01	-5.21E+02	7.41E+00
	84.21	6.40	6.59E+02		4.17E+03	3.24E+02
PA-234M	9.89	89.00	1.34E-01	1.34E-01	1.13E-01	6.33E-02
	21.72	64.90	2.46E+00		1.94E+00	1.19E+00
	37.93	23.75	3.76E+01		1.37E+02	1.84E+01
	131.42	20.40	1.06E+02		-7.23E+00	4.99E+01
+ TH-234	63.29	* 3.80	6.87E+02	6.87E+02	1.37E+03	3.37E+02
NP-237	29.37	* 14.00	4.13E+01	4.13E+01	9.93E+02	2.02E+01
	86.50	12.60	1.13E+02		2.72E+01	5.36E+01
U-237	97.08	16.30	1.15E+02	7.88E+01	2.20E+01	5.48E+01
	101.07	26.30	7.88E+01		2.91E+01	3.75E+01
	114.00	12.30	3.30E+02		8.33E+02	1.60E+02
	208.01	22.00	1.53E+02		-3.56E+00	7.16E+01
AM-241	59.54	35.90	4.14E+01	4.14E+01	8.60E+01	2.01E+01
AM-243	74.67	66.00	1.91E+01	1.91E+01	-1.22E+00	9.11E+00

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

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0000072133.CNF





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

0165





## Misc. Forms

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### Custody Documents and Other Forms

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**Includes the following where applicable:**

- Chain of Custody



HYDRO-ENVIRONMENTAL TECHNOLOGY, INC.  
 Environmental Consultants  
 P.O. Box 60295  
 Lafayette, LA 70596-0295  
 Phone (337) 261-1963 FAX (337) 261-1953

LA4770

**SAMPLE CHAIN-OF-CUSTODY RECORD**

Project Name: \_\_\_\_\_ Indigo \_\_\_\_\_ Laboratory: Eberline  
 Project Number: 8060.00 Collected By: KC/LV/MJ  
 Project Location: DeSoto Parish, Louisiana Company: Hydro-Environmental Technology, Inc.  
 Date: 9/6/2018

Sample I.D.	Type	Date/Time Sampled	Containers	Analysis Requested/Method	Comments
Haley Pond 6'	AQ	9/6/2018 10:20	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
Haley Pond 2'	AQ	9/6/2018 10:50	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C HOLD
Long 1&2 Rig Supply	AQ	9/6/2018 16:10	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
Long 3&4 Rig Supply	AQ	9/6/2018 16:20	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C

Relinquished By: *[Signature]* Date/Time: *9/24/18 1525*  
 Relinquished By: *[Signature]* Date/Time: *09/17/18*  
 Analysis Due: Verbal: \_\_\_\_\_  
 Written: \_\_\_\_\_

*CSX cond, (24/2018/41) @ Phil, @, dmt16*

# SGS Sample Receipt Summary

Job Number: LA47470

Client: HYDRO

Project: INDIGO

Date / Time Received: 9/7/2018 3:25:00 PM

Delivery Method: Client

Airbill #'s: \_\_\_\_\_

Cooler Temps (Initial/Adjusted): #2: (2.5/2.5); #1: (2.4/2.4);

**Cooler Security**

- |  |   |
|--|---|
| <u>Y or N</u>  | <u>Y or N</u>   |
| 1. Custody Seals Present: <input checked="" type="checkbox"/> <input type="checkbox"/> | 3. COC Present: <input checked="" type="checkbox"/> <input type="checkbox"/>        |
| 2. Custody Seals Intact: <input checked="" type="checkbox"/> <input type="checkbox"/>  | 4. Smpl Dates/Time OK: <input checked="" type="checkbox"/> <input type="checkbox"/> |

**Cooler Temperature**

- |   |                      |
|---|----------------------|
| <u>Y or N</u>   |                      |
| 1. Temp criteria achieved: <input checked="" type="checkbox"/> <input type="checkbox"/> |                      |
| 2. Thermometer ID: _____  | DV441;               |
| 3. Cooler media: _____  | Ice (direct contact) |
| 4. No. Coolers: _____   | 2                    |

**Quality Control Preservation**

- |                                 |                                     |                          |                                     |
|---------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| <u>Y</u>                        | <u>or</u>                           | <u>N</u>                 | <u>N/A</u>                          |
| 1. Trip Blank present / cooler: | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2. Trip Blank listed on COC:    | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3. Samples preserved properly:  | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                                     |
| 4. VOCs headspace free:         | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

**Sample Integrity - Documentation**

- |  |  |
|--|--|
|  | <u>Y or N</u>  |
| 1. Sample labels present on bottles:   | <input checked="" type="checkbox"/> <input type="checkbox"/> |
| 2. Container labeling complete:        | <input checked="" type="checkbox"/> <input type="checkbox"/> |
| 3. Sample container label / COC agree: | <input checked="" type="checkbox"/> <input type="checkbox"/> |

**Sample Integrity - Condition**

- |                                  |  |
|----------------------------------|--|
|                                  | <u>Y or N</u>  |
| 1. Sample recvd within HT:       | <input checked="" type="checkbox"/> <input type="checkbox"/> |
| 2. All containers accounted for: | <input checked="" type="checkbox"/> <input type="checkbox"/> |
| 3. Condition of sample:          | <u>Intact</u>  |

**Sample Integrity - Instructions**

- |  |                                     |           |                                     |                                     |
|--|-------------------------------------|-----------|-------------------------------------|-------------------------------------|
|  | <u>Y</u>                            | <u>or</u> | <u>N</u>                            | <u>N/A</u>                          |
| 1. Analysis requested is clear:            | <input checked="" type="checkbox"/> |           | <input type="checkbox"/>            |                                     |
| 2. Bottles received for unspecified tests: | <input type="checkbox"/>            |           | <input checked="" type="checkbox"/> |                                     |
| 3. Sufficient volume recvd for analysis:   | <input checked="" type="checkbox"/> |           | <input type="checkbox"/>            |                                     |
| 4. Compositing instructions clear:         | <input type="checkbox"/>            |           | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 5. Filtering instructions clear:           | <input type="checkbox"/>            |           | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |

Comments

LA47470X: Chain of Custody

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