

The results set forth herein are provided by SGS North America Inc.

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Automated Report

Technical Report for

Hydro-Environmental Technology, Inc.

8060.00 Indigo-Desoto Parish, LA

SGS Job Number: LA47396X

Sampling Dates: 09/04/18 - 09/05/18

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: 250



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)

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Test results relate only to samples analyzed.

Table of Contents

-1-

Section 1: Sample Summary	3
Section 2: Subcontract Lab Data	4
Section 3: Misc. Forms	247
3.1: Chain of Custody	248



Sample Summary

Hydro-Environmental Technology, Inc.

Job No: LA47396X

8060.00 Indigo-Desoto Parish, LA

Sample Number	Collected		Matrix Code	Type	Client Sample ID
	Date	Time By			
LA47396-1	09/04/18	10:45 KC/LV09/06/18	AQ	Water	HANSON RELIEF WELL
LA47396-2	09/04/18	11:40 KC/LV09/06/18	AQ	Water	BILLINGSLEY RELIEF WELL
LA47396-3	09/04/18	14:50 KC/LV09/06/18	AQ	Water	DAVID MASON RELIEF WELL
LA47396-4	09/04/18	16:30 KC/LV09/06/18	AQ	Water	DENNISON RIG SUPPLY WELL
LA47396-5	09/04/18	16:45 KC/LV09/06/18	AQ	Water	GAMBLE RIG SUPPLY WELL
LA47396-6	09/04/18	16:35 KC/LV09/06/18	AQ	Water	FIELD DUPLICATE
LA47396-7	09/05/18	11:45 KC/LV09/06/18	AQ	Water	BRYANT POND 2'
LA47396-8	09/05/18	11:15 KC/LV09/06/18	AQ	Water	BRYANT POND 7'
LA47396-9	09/05/18	10:45 KC/LV09/06/18	AQ	Water	BRYANT POND 12'
LA47396-10	09/04/18	10:40 KC/LV09/06/18	AQ	Equipment Blank	EQUIPMENT BLANK

Subcontract Lab Data

Report of Analysis

SGS NORTH AMERICA INC.

LA47396X

**STANDARD LEVEL IV
REPORT OF ANALYSIS**

WORK ORDER #18-09016-OR

October 17, 2018

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

0001

TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
I	Chain of Custody & pH Check	0004
II	Sample Acknowledgement	0012
III	Case Narrative	0015
IV	Analytical Results Summary	0018
V	Analytical Standard	0021
VI	Quality Control Sample Results Summary	0030
VII	Laboratory Technician's Notes	0035
VIII	Analytical Data (Radium-226)	0049
IX	Analytical Data (Radium-228)	0128
X	Barium-133 Analytical Tracer Data	0144
XI	Analytical Data (Total Dissolved Solids)	0240
	Last Page Number	0242

0002




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


Eberline Services Work Order # 18 09016

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

Date for Partial	Initials	Date	Initials	Checklist Items
		9/7/18	AS	Sample Log-In
		9-20-18	JL	Data Compilation
		9-24-18	MLT	First Technical Data Review
		9/27/18	ESJ	Second Technical Data Review
		10/16/18	J	Data Entry/Electronic Deliverable
		10/16/18	J	Case Narrative
		10/17/18	ESJ	Electronic Deliverable Proof
		10/17/18	ESJ	Samples Analyzed within Holding Time Yes? <input checked="" type="checkbox"/> No? <input type="checkbox"/>
		10/17/18	ESJ	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: 10/17/18

Copy No. _____

Radiochemistry Services

0003

SECTION I
CHAIN OF CUSTODY
& pH CHECK

0004

18-09016



500 Ambassador Caffery Parkway, Scott, LA 70583
 Phone: 800-304-5227 Fax: 337-237-7838

FED-EX Tracking #
 SCS Quote # LA47396X

Client / Reporting Information		Project Information		Requested Analysis (see TEST CODE sheet)		Matrix Codes	
Company Name: SGS North America Inc.		Project Name: 8060.00 Indigo-Desoto Parish, LA		REC'D SEP 07 2018		DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SO - Soil SL - Sludge SED - Sediment OI - Oil LIQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FE-Equipment Blank EE-Equipment Blank RB- Rinse Blank TB-Trip Blank	
Street Address: 500 Ambassador Caffery Parkway City: Scott State: LA Zip: 70583		Billing Information (if different from Report to) Company Name: Street Address: City: State: Zip:		Matrix Codes		LAB USE ONLY	
Project Contact: ralph.frye@sgs.com		Project #: Client Purchase Order #		Matrix # of bottles		NaOH HCl H2SO4 HNO3 NONE DI Water MEQH ENCORE	
Phone #: 800-304-5227		Attention:		RA-226, RA-228, TDS		Matrix	
Sample(s) Name(s): KCLV		Project Manager:		Date		Time	
SCS Sample #		MECH/ID Vial #		Date		Time	
1	HANSON RELIEF WELL	9/4/18	10:45:00 AM	KC/LV	AQ		
2	BILLINGSLEY RELIEF WELL	9/4/18	11:40:00 AM	KC/LV	AQ		
3	DAVID MASON RELIEF WELL	9/4/18	2:50:00 PM	KC/LV	AQ		
4	DENNISON RIG SUPPLY WELL	9/4/18	4:30:00 PM	KC/LV	AQ		
5	GAMBLE RIG SUPPLY WELL	9/4/18	4:45:00 PM	KC/LV	AQ		
6	FIELD DUPLICATE	9/4/18	4:35:00 PM	KC/LV	AQ		
7	BRYANT POND 2'	9/5/18	11:45:00 AM	KC/LV	AQ		
8	BRYANT POND 7'	9/5/18	11:15:00 AM	KC/LV	AQ		
9	BRYANT POND 12'	9/5/18	10:45:00 AM	KC/LV	AQ		
10	EQUIPMENT BLANK	9/4/18	10:40:00 AM	KC/LV	AQ		
11							
12							
13							

Turnaround Time (Business days)		Data Deliverable Information	
<input type="checkbox"/> Std. 10 Business Days <input type="checkbox"/> 5 Day RUSH <input type="checkbox"/> 3 Day EMERGENCY <input type="checkbox"/> 2 Day EMERGENCY <input type="checkbox"/> 1 Day EMERGENCY <input checked="" type="checkbox"/> other Due 10/11/2018 Emergency & Rush T/A data available VIA Lablink	Approved By (SGS PM): / Date:	<input type="checkbox"/> Commercial "A" (Level 1) <input type="checkbox"/> Commercial "B" (Level 2) <input type="checkbox"/> FULLT1 (Level 3+4) <input type="checkbox"/> REDT1 (Level 3+4) <input type="checkbox"/> Commercial "C" Commercial "A" = Results Only Commercial "B" = Results + QC Summary	<input type="checkbox"/> TRRP <input type="checkbox"/> EDD Format <input type="checkbox"/> Other
Relinquished by Sampler: Date Time:	Relinquished By: Date Time:	Relinquished by Sampler: Date Time:	Relinquished By: Date Time:
Relinquished by Sampler: Date Time:	Relinquished By: Date Time:	Relinquished by Sampler: Date Time:	Relinquished By: Date Time:
Relinquished by Sampler: Date Time:	Relinquished By: Date Time:	Relinquished by Sampler: Date Time:	Relinquished By: Date Time:

Sample Custody must be documented below each time samples change possession, including courier delivery.

Received By: *[Signature]* Date Time: 9-7-18
 Relinquished By: *[Signature]* Date Time: 9-7-18
 Received By: *[Signature]* Date Time: 9-7-18
 Relinquished By: *[Signature]* Date Time: 9-7-18

On Ice Cooler Temp.

Date / Time: 9/6/2018 1:21:50 PM

CSR: ralph

Job #: LA47396X

Client Project: 8060.00 Indigo-Desoto Parish, LA

Deliverable: COMMB

TAT: Due 10/11/2018

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 07 2018

18 09 016

SGS Sample #	Client Sample Description	Analysis	Location	Sampled By	Date Sampled	Time Sampled	Aliquot
LA47396-1	HANSON RELIEF WELL	RA-226 .RA-228 .TDS.	OL	KC/LV	9/4/2018	10:45:00 AM	
LA47396-2	BILLINGSLEY RELIEF WELL	RA-226 .RA-228 .TDS.	OL	KC/LV	9/4/2018	11:40:00 AM	
LA47396-3	DAVID MASON RELIEF WELL	RA-226 .RA-228 .TDS.	OL	KC/LV	9/4/2018	2:50:00 PM	
LA47396-4	DENNISON RIG SUPPLY WELL	RA-226 .RA-228 .TDS.	OL	KC/LV	9/4/2018	4:30:00 PM	
LA47396-5	GAMBLE RIG SUPPLY WELL	RA-226 .RA-228 .TDS.	OL	KC/LV	9/4/2018	4:45:00 PM	
LA47396-6	FIELD DUPLICATE	RA-226 .RA-228 .TDS.	OL	KC/LV	9/4/2018	4:35:00 PM	
LA47396-7	BRYANT POND 2'	RA-226 .RA-228 .TDS.	OL	KC/LV	9/5/2018	11:45:00 AM	
LA47396-8	BRYANT POND 7'	RA-226 .RA-228 .TDS.	OL	KC/LV	9/5/2018	11:15:00 AM	
LA47396-9	BRYANT POND 12'	RA-226 .RA-228 .TDS.	OL	KC/LV	9/5/2018	10:45:00 AM	
LA47396-10	EQUIPMENT BLANK	RA-226 .RA-228 .TDS.	OL	KC/LV	9/4/2018	10:40:00 AM	

20 3002 (NWS)
10 2500 (RP)

REC AS 9-7-18
9:30

0006

REC'D SEP 07 2018

18 09 016

Comments:


Joseph Spencer
9:30

Date:

9-7-18


Sample Management Receipt:

0007

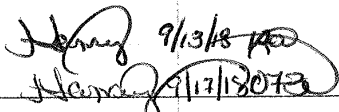
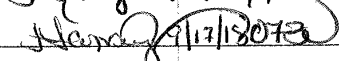
 EBERLINE SERVICES Oak Ridge Laboratory	<h1>Internal Chain of Custody</h1>	Work Order #	18-09016
		Lab Deadline	9/26/2018
		Analysis	Ra226 - Level 4
		Sample Matrix	Water


Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
	04	43	EE1.4
	05	44	EE1.4
	06	36	EE1.4
	07	36	EE1.4
	08	37	EE1.4
	09	41	EE1.4
	10	43	EE1.4
	11	40	EE1.4
	12	43	EE1.4
	13	38	EE1.4
Use container #3 for TDS			

	Location (circle one)					Initials	Date
	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	<u>Sample Storage</u>						
Relinquished by	Sample Storage		<u>Prep</u>			<i>[Signature]</i>	9/13/18 1000
Received by	Sample Storage						
Relinquished by	Sample Storage					<i>[Signature]</i>	9/17/18 0730
Received by	Sample Storage						
Relinquished by	Sample Storage					<i>[Signature]</i>	9/17/18 0800
Received by	Sample Storage						
Relinquished by	Sample Storage					<i>[Signature]</i>	9/18/18 1000
Received by	Sample Storage						
Relinquished by	Sample Storage					<i>[Signature]</i>	9/18/18 1000
Received by	<u>Sample Storage</u>						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						
Received by	Sample Storage						
Relinquished by	Sample Storage						

 EBERLINE SERVICES Oak Ridge Laboratory	<h1>Internal Chain of Custody</h1>	Work Order #	18-09016
		Lab Deadline	9/26/2018
		Analysis	Ra228 - Level 4
		Sample Matrix	Water


Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location	
<p>Use container #3 for TDS</p>	04	43	EE1.4	
	05	44	EE1.4	
	06	36	EE1.4	
	07	36	EE1.4	
	08	37	EE1.4	
	09	41	EE1.4	
	10	43	EE1.4	
	11	40	EE1.4	
	12	43	EE1.4	
	13	38	EE1.4	

	Location (circle one)					Initials	Date
	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	 9/13/18 1000	 9/17/18 0730
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JS 9/19/18 0800 JS 9/18/18 1000	JS 9/19/18 0800 JS 9/19/18 1400
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB 9/19/18 1000 KB 9/19/18 1530	KB 9/19/18 1401 KB 9/19/18 1406
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		

 EBERLINE SERVICES Oak Ridge Laboratory	<h1>Internal Chain of Custody</h1>	Work Order #	18-09016
		Lab Deadline	9/11/2018
		Analysis	TDS - Level 4
		Sample Matrix	Water

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location	
Use container #3 for TDS	04	43	EE1.4	
	05	44	EE1.4	
	06	36	EE1.4	
	07	36	EE1.4	
	08	37	EE1.4	
	09	41	EE1.4	
	10	43	EE1.4	
	11	40	EE1.4	
	12	43	EE1.4	
	13	38	EE1.4	

	Location (circle one)						Initials	Date
	Sample Storage	Rough Prep	Prep	Separations	Count Room			
Received by	Sample Storage						M4	8/5/18
Relinquished by	Sample Storage						M4	8/5/18 0540
Received by	Sample Storage							
Relinquished by	Sample Storage							
Received by	Sample Storage							
Relinquished by	Sample Storage							
Received by	Sample Storage							
Relinquished by	Sample Storage							
Received by	Sample Storage							
Relinquished by	Sample Storage							
Received by	Sample Storage							
Relinquished by	Sample Storage							

	Sample Receiving Report (Volumes, pH, & CPM)	Internal Work Order 18-09016
		Received By
		RSPENCER

FR	ClientID	# Btls	Comments	Matrix	Storage	Rec Vol Ttl	CPM Max
01	LCS	0		WA	EE1.4		
02	BLANK	0		WA	EE1.4		
03	DUP	0		WA	EE1.4		
04	1-HANSON RELIEF WELL	3		WA	EE1.4	2.03	43
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	32
			2	<2	<2	1.0000	43
			3	7	7	0.0250	30
05	2-BILLINGSLEY RELIEF WELL	3		WA	EE1.4	2.25	44
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	44
			2	<2	<2	1.0000	39
			3	7	7	0.2500	24
06	3-DAVID MASON RELIEF WELL	3		WA	EE1.4	2.25	36
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	35
			2	<2	<2	1.0000	36
			3	7	7	0.2500	27
07	4-DENNISON RIG SUPPLY WELL	3		WA	EE1.4	3.00	36
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	35
			2	<2	<2	1.0000	36
			3	7	7	1.0000	30
08	5-GAMBLE RIG SUPPLY WELL	3		WA	EE1.4	2.25	37
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	22
			2	<2	<2	1.0000	37
			3	7	7	0.2500	29
09	6-FIELD DUPLICATE	3		WA	EE1.4	2.25	41
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	41
			2	<2	<2	1.0000	38
			3	7	7	0.2500	30
10	7-BRYANT POND 2	3		WA	EE1.4	2.25	43
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	35
			2	<2	<2	1.0000	43
			3	7	7	0.2500	28
11	8-BRYANT POND 7	3		WA	EE1.4	2.25	40
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	22
			2	<2	<2	1.0000	40
			3	7	7	0.2500	28
12	9-BRYANT POND 12	3		WA	EE1.4	2.25	43
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	35
			2	<2	<2	1.0000	43
			3	7	7	0.2500	26
13	10-EQUIPMENT BLANK	3		WA	EE1.4	2.25	38
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	37
			2	<2	<2	1.0000	38
			3	7	7	0.2500	24

Received by: *R. Spencer*

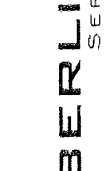
Date: 9-7-18

MP-001, Rev 5
Effective: 11/22/02
0011

SECTION II
SAMPLE ACKNOWLEDGEMENT

0012

Client Name SGS North America Inc.		Contract/PO ENV		Project Type Environmental		Date Received 09/07/2018		Required Turnaround Days 28		Eberline Services Work Order 18-09016		
Project Name ENV		Client WO LA47396X		Sample Disp W		Lab Deadline 09/26/2018		Internal Deadline 10/05/2018		Client Deadline 10/05/2018		
Internal ID	Client ID	Sample Date	Matrix	Storage	Ra226	TDS						
01	LCS	09/07/18	WA	EE1.4	X	X					DL	
02	BLANK	09/07/18	WA	EE1.4	X	X					3	
03	DUP	09/07/18	WA	EE1.4	X	X					3	
04	HANSON RELIEF WELL	09/04/18 10:45	WA	EE1.4	X	X					3	
05	BILLINGSLEY RELIEF WELL	09/04/18 11:40	WA	EE1.4	X	X					3	
06	DAVID MASON RELIEF WELL	09/04/18 14:50	WA	EE1.4	X	X					3	
07	DENNISSON RIG SUPPLY WELL	09/04/18 16:30	WA	EE1.4	X	X					3	
08	GAMBLE RIG SUPPLY WELL	09/04/18 16:45	WA	EE1.4	X	X					3	
09	FIELD DUPLICATE	09/04/18 16:35	WA	EE1.4	X	X					3	
10	BRYANT POND 2	09/05/18 11:45	WA	EE1.4	X	X					3	
11	BRYANT POND 7	09/05/18 11:15	WA	EE1.4	X	X					3	
12	BRYANT POND 12	09/05/18 10:45	WA	EE1.4	X	X					3	
13	EQUIPMENT BLANK	09/04/18 10:40	WA	EE1.4	X	X					0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
											0	
Totals Per Analysis (non QA samples)					10	10	10	0	0	0	0	0



EBERLINE SERVICES
Sample Log In Report

Oak Ridge Laboratory
601 Scarboro Rd.
Oak Ridge, TN 37830

Voice: (865) 481-0683
Fax: (865) 483-4621

Invoice

Account Payable
SGS North America Inc.
500 Ambassador Caffery Pkwy
Scott, LA 70583

Invoice
800-304-5227
337-237-7638

Contact
Ralph Frye
800-304-5227
337-237-7638

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

Voice: 800-304-5227
Fax: 337-237-7638

0013



Eberline Services - Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST
MP-001-2

WORK ORDER # 18 09016

SAMPLE MATRIX/MATRICES:

(CIRCLE ONE OR BOTH)

AQUEOUS NON-AQUEOUS

WERE SAMPLES:

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

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

WERE CHAIN OF CUSTODY SEALS:

Present on outside of package?	<input checked="" type="radio"/> Y	N	
Unbroken on outside of package?	<input checked="" type="radio"/> Y	N	
Present on samples?	<input checked="" type="radio"/> Y	N	
Unbroken on samples?	<input checked="" type="radio"/> Y	N	
Was chain of custody present upon sample receipt?	<input checked="" type="radio"/> Y	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: 9-7-18

Copy No. _____

Radiochemistry Services

0014

SECTION III
CASE NARRATIVE

0015



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

2

EBS-OR-44476

October 17, 2018

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

CASE NARRATIVE
 LA Certificate #05005
 Work Order # 18-09016-OR

SAMPLE RECEIPT

This work order contains ten water samples received 09/07/2018. 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>
HANSON RELIEF WELL	18-09016-04	FIELD DUPLICATE	18-09016-09
BILLINGSLEY RELIEF WELL	18-09016-05	BRYANT POND 2	18-09016-10
DAVID MASON RELIEF WELL	18-09016-06	BRYANT POND 7	18-09016-11
DENNISON RIG SUPPLY WELL	18-09016-07	BRYANT POND 12	18-09016-12
GAMBLE RIG SUPPLY WELL	18-09016-08	EQUIPMENT BLANK	18-09016-13

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.

ANALYTICAL RESULTS CONTINUED

RADIUM-226 CONTINUED

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

RADIUM-228

Following alpha spectroscopy analysis of Radium-226, Barium/Radium Sulfate precipitates were redissolved and allowed for sufficient ingrowth of the Actinium-228 daughter. After ingrowth, Actinium-228 was selectively precipitated. Precipitates were filtered and beta emissions for Actinium-228 were 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 a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Radium-228 laboratory control sample demonstrated an acceptable percent recovery.

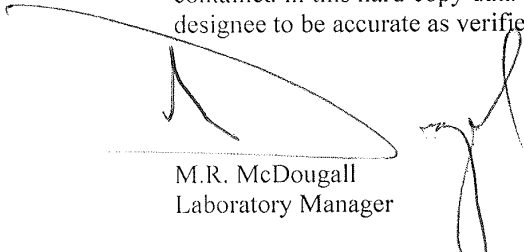
TOTAL DISSOLVED SOLIDS (TDS)

A volumetric aliquot of each sample was filtered through 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 contents that ranged from 6.0 to 834.0 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: 10/17/2018

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

0018

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
<p>Report To: Ralph Frye SGS North America Inc 500 Amb. Caffery Pkwy Scott, LA 70583</p> <p>Work Order Details: SDG: 18-09016 Project: LA47396X Analysis Category: ENVIRONMENTAL Sample Matrix: WA</p>														
18-09016-01	LCS	KNOWN		09/07/18 00:00	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	1.01E+01	4.65E-01			pCi/l
18-09016-02	LCS	SPIKE		09/07/18 00:00	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	9.99E+00	1.37E+00	2.52E+00	3.60E-01	pCi/l
18-09016-01	MBL	BLANK		09/07/18 00:00	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	1.02E-01	2.28E-01	2.29E-01	4.34E-01	pCi/l
18-09016-03	DUP	EQUIPMENT BLANK		09/04/18 10:40	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	-2.66E-02	6.57E-02	6.60E-02	1.88E-01	pCi/l
18-09016-04	TRG	HANSON RELIEF WELL		09/04/18 10:45	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	2.75E+00	7.21E-01	9.26E-01	3.78E-01	pCi/l
18-09016-05	TRG	BILLINGSLEY RELIEF WELL		09/04/18 11:40	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	1.43E-01	1.46E-01	1.49E-01	1.86E-01	pCi/l
18-09016-06	TRG	DAVID MASON RELIEF WELL		09/04/18 14:50	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	2.61E+00	5.97E-01	8.13E-01	1.81E-01	pCi/l
18-09016-07	TRG	DENNISON RIG SUPPLY WELL		09/04/18 16:30	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	2.38E-01	2.13E-01	2.19E-01	2.77E-01	pCi/l
18-09016-08	TRG	GAMBLE RIG SUPPLY WELL		09/04/18 16:45	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	3.17E-01	2.30E-01	2.40E-01	2.52E-01	pCi/l
18-09016-09	TRG	FIELD DUPLICATE		09/04/18 16:35	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	2.12E-01	1.81E-01	1.87E-01	1.79E-01	pCi/l
18-09016-10	TRG	BRYANT POND 2		09/05/18 11:45	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	4.32E-01	2.90E-01	3.04E-01	3.40E-01	pCi/l
18-09016-11	TRG	BRYANT POND 7		09/05/18 11:15	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	2.58E-01	2.57E-01	2.63E-01	3.57E-01	pCi/l
18-09016-12	TRG	BRYANT POND 12		09/05/18 10:45	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	8.13E-02	1.55E-01	1.56E-01	2.86E-01	pCi/l
18-09016-13	DO	EQUIPMENT BLANK		09/04/18 10:40	9/7/2018	9/18/2018	18-09016	Radium-226	EPA 903.0 Modified	1.20E-01	1.72E-01	1.73E-01	2.81E-01	pCi/l
18-09016-01	LCS	KNOWN		09/07/18 00:00	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	9.01E+00	4.60E-01			pCi/l
18-09016-01	LCS	SPIKE		09/07/18 00:00	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	1.02E+01	7.95E-01	2.45E+00	9.43E-01	pCi/l
18-09016-02	MBL	BLANK		09/07/18 00:00	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	3.22E-01	3.33E-01	3.41E-01	6.75E-01	pCi/l
18-09016-03	DUP	EQUIPMENT BLANK		09/04/18 10:40	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	2.68E-01	3.48E-01	3.53E-01	7.15E-01	pCi/l
18-09016-04	TRG	HANSON RELIEF WELL		09/04/18 10:45	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	2.10E+00	4.23E-01	6.37E-01	6.69E-01	pCi/l
18-09016-05	TRG	BILLINGSLEY RELIEF WELL		09/04/18 11:40	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	2.90E-01	3.69E-01	3.75E-01	7.58E-01	pCi/l
18-09016-06	TRG	DAVID MASON RELIEF WELL		09/04/18 14:50	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	3.83E+00	5.44E-01	1.02E+00	8.08E-01	pCi/l
18-09016-07	TRG	DENNISON RIG SUPPLY WELL		09/04/18 16:30	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	1.47E+00	4.45E-01	5.56E-01	8.02E-01	pCi/l
18-09016-08	TRG	GAMBLE RIG SUPPLY WELL		09/04/18 16:45	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	3.36E-01	3.84E-01	3.91E-01	7.83E-01	pCi/l
18-09016-09	TRG	FIELD DUPLICATE		09/04/18 16:35	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	4.85E-01	3.96E-01	4.11E-01	7.94E-01	pCi/l
18-09016-10	TRG	BRYANT POND 2		09/05/18 11:45	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	-1.18E-01	4.36E-01	4.37E-01	9.41E-01	pCi/l
18-09016-11	TRG	BRYANT POND 7		09/05/18 11:15	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	2.29E-01	4.23E-01	4.26E-01	7.89E-01	pCi/l
18-09016-12	TRG	BRYANT POND 12		09/05/18 10:45	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	2.48E-01	3.82E-01	3.86E-01	7.89E-01	pCi/l
18-09016-13	DO	EQUIPMENT BLANK		09/04/18 10:40	9/7/2018	9/19/2018	18-09016	Radium-228	EPA 904.0	1.13E+00	4.23E-01	4.94E-01	7.81E-01	pCi/l

0019

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

Eberline Analytical Final Report of Analysis		Report To:				Work Order Details:									
Ralph Frye SGS North America Inc 500 Amb. Caffery Pkwy Scott, LA 70583		SDG: 18-09016 Project: LA47396X Analysis Category: ENVIRONMENTAL Sample Matrix: WVA		Method		Result		CU		CSU		MDA		Report Units	
Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units		
18-09016-04	TRG	HANSON RELIEF WELL	09/04/18 10:45	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	7.02E+02				mg/l		
18-09016-05	TRG	BILLINGSLEY RELIEF WELL	09/04/18 11:40	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	5.57E+02				mg/l		
18-09016-06	TRG	DAVID MASON RELIEF WELL	09/04/18 14:50	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	7.76E+02				mg/l		
18-09016-07	TRG	DENNISON RIG SUPPLY WELL	09/04/18 16:30	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	8.31E+02				mg/l		
18-09016-08	TRG	GAMBLE RIG SUPPLY WELL	09/04/18 16:45	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	8.26E+02				mg/l		
18-09016-09	TRG	FIELD DUPLICATE	09/04/18 16:35	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	8.34E+02				mg/l		
18-09016-10	TRG	BRYANT POND 2	09/05/18 11:45	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	2.22E+02				mg/l		
18-09016-11	TRG	BRYANT POND 7	09/05/18 11:15	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	2.75E+02				mg/l		
18-09016-12	TRG	BRYANT POND 12	09/05/18 10:45	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	3.01E+02				mg/l		
18-09016-13	TRG	EQUIPMENT BLANK	09/04/18 10:40	9/7/2018	9/8/2018	18-09016	TDS	SM2540C	6.00E+00				mg/l		

0020

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



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SECTION V
ANALYTICAL STANDARD

0021



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.

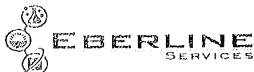
Preparation

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 ¹³³Barium Half Life, Years 1.048E+01 Half Life, Days 3.828E+03

Radionuclide ¹³³Barium Reference Date 9/1/1993 0:00
Certified Activity μ Ci
Certified Concentration 1.318E+01 μ 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 μ Ci

Chemical Composition of Standard Solution
¹³³BaCl₂ in 1M HCl

Dilution Instructions: Dilution Solvent Used 1M HCl

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 66.5577 μ 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

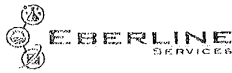
Verified & Approved By [Signature]

Date: 5/5/18

QC Approval [Signature]

Date: 5/8/18

0023



QUALITY CONTROL PROGRAM
QCP-009

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

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

Solution Reference # QCP-009-1-A Date 5/5/18
NIST SRM4251C Solution # Ba-6a

Principal Radionuclide ¹³³Ba Half Life, Years 1.048E+01 Half Life, Days 3.828E+03

Radionuclide of Interest ¹³³Ba Reference Date 9/1/1993 0:00
Parent Solution Conc. 1.48E+05 dpm/ml

Chemical Composition of Standard Solution
¹³³BaCl₂ 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 Activity Concentration: 3.6950E+03 dpm/ml
Final Volume: 1000.00 ml

NOTES:

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

Expiration Date: April 26, 2019

Verified & Approved By [Signature]

Date: 5/5/18

QC Approval [Signature]

Date: 5/5/18

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

Ra-5
 NA/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(NO3)2 in 1 N HNO3
c. Carrier content:	None added
d. Density:	1.0318 g/ml @ 20°C.

Radioimpurities None detected (other than daughters)

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

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

Method of Calibration

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

Uncertainty of Measurement

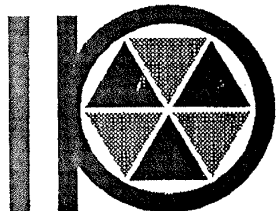
a. Systematic uncertainty in instrument calibration:	±3.4%
b. Random uncertainty in assay:	±3.1%
c. Random uncertainty in weighing(s):	±0.2%
d. Total uncertainty at the 99% confidence level:	±4.6%

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

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

Notes

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



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

Ana H. Kuan
 QUALITY CONTROL
Feb. 3, 1994
 Date Signed



QUALITY CONTROL PROGRAM
MP 009

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

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

SOLUTION REFERENCE # IPL 453-26 CURRENT DATE 9/17/2018 0:00
SOLUTION # Ra-5

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

Radionuclide ²²⁶Radium Reference Date 2/1/1994 0:00
Certified Activity 1.001E+00 μ Ci
Certified Concentration μ Ci per gram

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

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

Dilution Instructions: Dilution Solvent Used 1M HNO₃

Dilute to a volume of 1000.00 milliliters

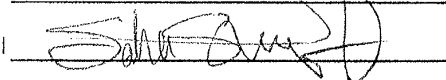
Certified Total Activity of 1.0010 μ Ci Which Equals 2.222E+06 dpm at the date listed above

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.

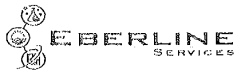
Expiration Date: September 10, 2019

Verified & Approved By 

Date: 9/17/2018

QC Approval 

Date: 9/18/18



QUALITY CONTROL PROGRAM

MP 009

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

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

Solution Reference # MP 009
IPL-453-26

Date 9/17/2018 0:00
Solution # Ra-5b

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

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

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

Dilution Instructions: Dilution Solvent Used 1M HNO₃

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution:	<u>20.0000</u> ml
Total Activity:	<u>4.4440E+04</u> dpm
Final Volume:	<u>1000.00</u> 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:

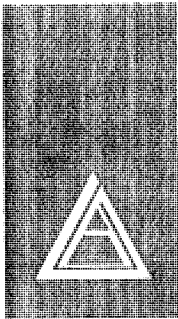
Expiration Date: 10-Sep-19

Verified & Approved By [Signature]

QC Approval [Signature]

Date: 9/17/2018 0:00

Date: 9/18/18



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

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

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

2

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

72325-207

Ra²²⁸

Ra-228 5 mL Liquid in Flame Sealed Vial

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

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

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

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

Impurities: γ -impurities <0.1%

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

P O NUMBER 00003181, Item 1

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

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

0028



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 ²²⁸Ra Half Life, Years 5.750E+00 Half Life, Days 2.100E+03

Radionuclide ²²⁸Ra Reference Date 2/10/2006 0:00
Certified Activity 1.087E-01 μ Ci
Certified Concentration μ 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 μ Ci

Chemical Composition of Standard Solution
²²⁸Ra(NO₃)₂ in 0.5 M HCl


Dilution Instructions: Dilution Solvent Used 0.5 M HCl

Dilute to a volume of 991.00 Kg

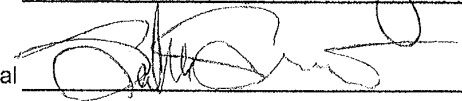
Certified Total Activity of 0.1087 μ Ci Which Equals 2.413E+05 dpm at the date listed above

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

Expiration Date: February 12, 2019

Recertified By 

Date: 2/12/18

QC Approval 

Date: 2/13/18

SECTION VI
QUALITY CONTROL SAMPLE RESULTS SUMMARY

0030

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
18-09016	Ra226	1	pCi	I	SGS North America Inc.

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	98.76%	25.18%	100.00%	4.60%	1.01E+01	4.65E-01	9.99E+00	2.52E+00	Ra-5b	4.40E+01	4.60E+00	5.11E-01

Matrix Spike

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

Duplicate Results

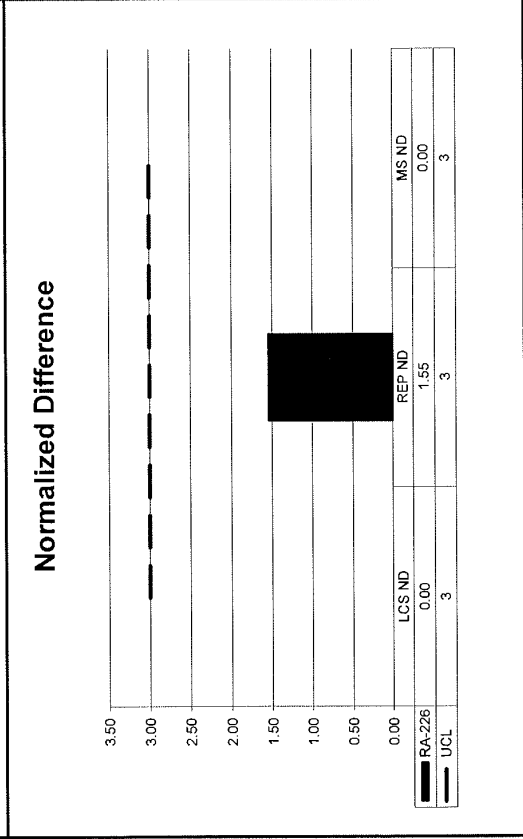
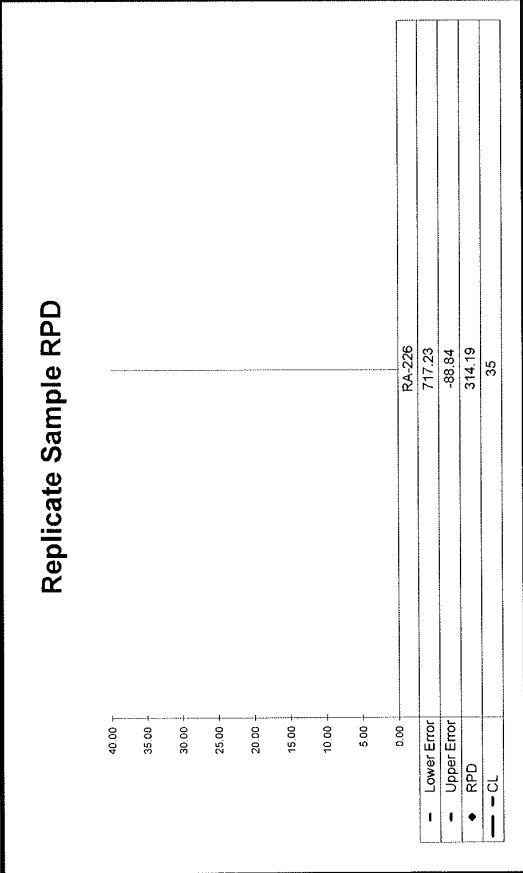
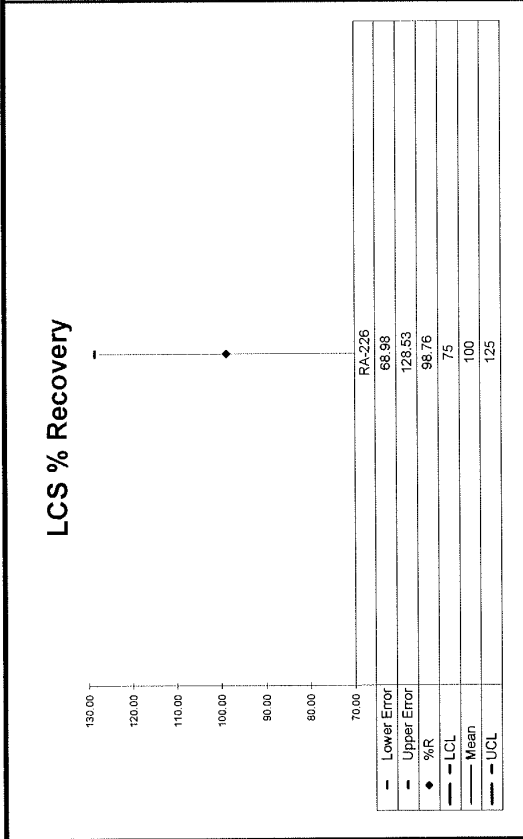
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-226	1.55	314.19	1.20E-01	1.73E-01	-2.66E-02	6.60E-02	0.99	OK	NA		NA	OK

QC Summary

Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-226	1.55	314.19	1.20E-01	1.73E-01	-2.66E-02	6.60E-02	0.99	OK	NA		NA	OK

0031

WO	Analysis	Activity Units	Aliquot Units	Client Name
18-09016	Ra226	pCi	I	SGS North America Inc.
Run	1			



No Matrix Spike

0032

Version

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
18-09016	Ra228	1	pCi	I	SGS North America Inc.

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	113.37%	23.94%	100.00%	5.10%	9.01E+00	4.60E-01	1.02E+01	2.45E+00	Ra-12	5.33E+01	5.10E+00	3.75E-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

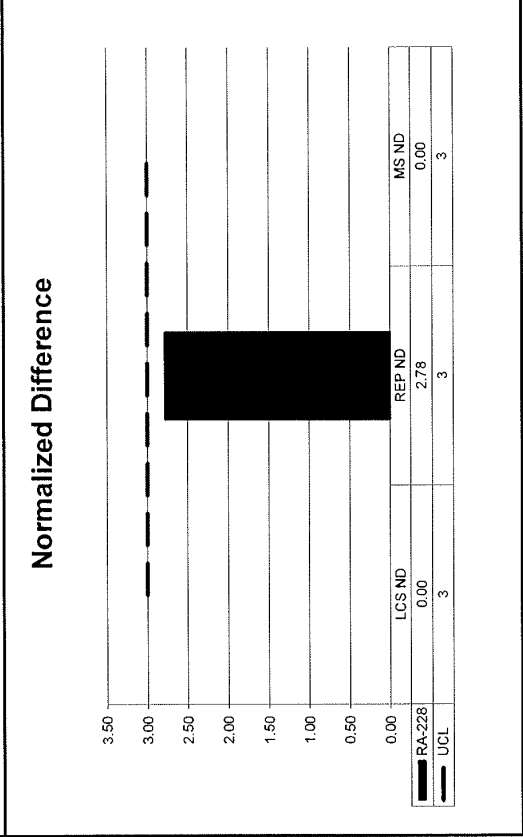
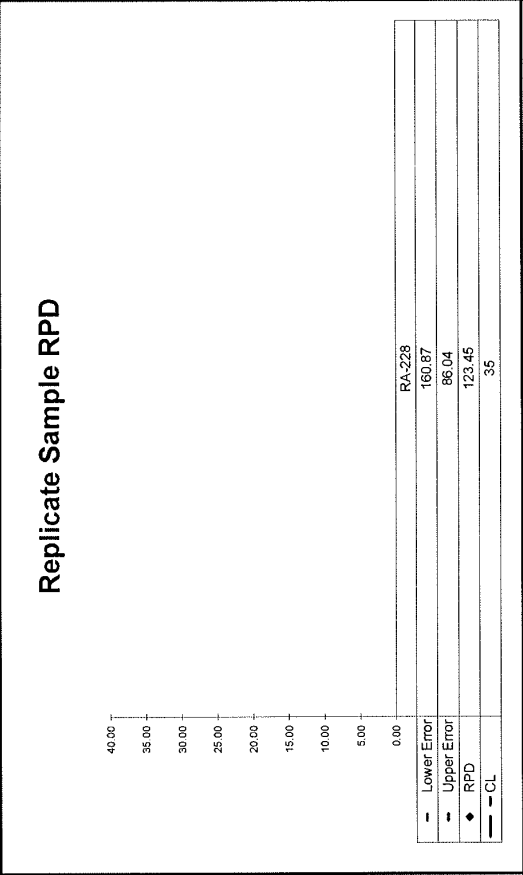
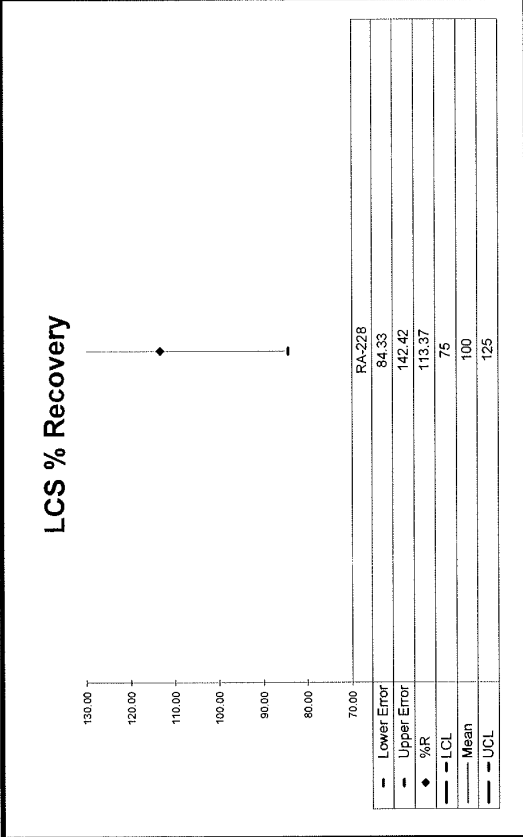
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Duplicate Result	Duplicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
RA-228	2.78	123.45	1.13E+00	4.94E-01	2.68E-01	3.53E-01	1.13	OK			NA	OK

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	2.78	123.45	1.13E+00	4.94E-01	2.68E-01	3.53E-01	1.13	OK			NA	OK

0033

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
18-09016	Ra228	1	pCi	I	SGS North America Inc.



No Matrix Spike


0034

SECTION VII
LABORATORY TECHNICIAN'S NOTES

0035

RA-226 NOTES

0036

 EBERLINE SERVICES Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com		Internal Work Order	18-09016
			Analysis Code	Ra226
			Run Number	1

2

#	Date	Dept	User	Notes
1	09/13/18 12:36	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

J Harvey
9/13/18

0037


 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com		Internal Work Order	18-09016
			Analysis Code	Ra226
			Run Number	1

2

#	Date	Dept	User	Notes
1	09/13/18 12:36	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	09/18/18 09:58	CHEM	JBAILEY	ADDED EDTA TO SAMPLES AND LET SIT. ADDED AMMONIUM SULFATE AND ACETIC ACID TO SAMPLES. FILTERED ONTO TARED FILTER PAPERS, LET DRY UNDER HEAT LAMP, REWEIGHED, AND SUBMITTED TO COUNT.

JBA
 9/18/18

0038

 Reagents Used in an Analysis		Internal Work Order		
		18-09016		
		Analysis Code		Run
		Ra226		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/13/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/13/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/13/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/13/2018
020000P	Nitric Acid	Reagent Grade	JHARVEY	9/13/2018
019210P	Acetic Acid	Reagent Grade	JBAILEY	9/18/2018
019733D02	Ammonium Sulfate	200 mg/ml	JBAILEY	9/18/2018
020249S	EDTA	0.25M	JBAILEY	9/18/2018

0039

Alpha 3

25

Date	Sample #	Client	Load time	Count time	Analysis	Tech
9/18/18	1809042A (1,2)	TN Dept of H.	0818	2 hrs 50 min	UU	KP
9/18/18	1809043A (1-8)	TN Dept. of H.	0819	1 hr 5	UU	KP
9/18/18	1809057A (3-4)	Bungess Niple	1112	2 hrs 0 =	UU	KB
9/19/18	1809066A (1-4)	Smoky mtn.	1112	2 hrs 50 =	UU	KB
9/19/18	1809066A (1-13)	323 N. America	1200	2 hrs 50 =	Rob	KB

0040

RA-228 NOTES

0041


 EBERLINE SERVICES Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09016
		Analysis Code	Ra228
		Run Number	1

2

#	Date	Dept	User	Notes
1	09/13/18 12:36	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

J. Harvey
9/13/18

0042


 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com		Internal Work Order	18-09016
			Analysis Code	Ra228
			Run Number	1

2

#	Date	Dept	User	Notes
1	09/13/18 12:36	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	09/19/18 13:55	CHEM	JBAILEY	ADDED FILTER PAPERS FROM COUNT ROOM TO LABELED C-TUBES, FILLED WITH EDTA SOLUTION AND LET SIT OVERNIGHT. REMOVED FILTER FROM EDTA-ADDED 2MLS YTTRIUM 9MG/ML CARRIER ADDED 18N NAOH TO SAMPLES AND RECORDED T1. HOT BATHED FOR 15 MIN, CENTRIFUGED AND DISCARDED SUPERNANT. ADDED 6N HNO3, DI WATER, AND 10N NAOH. HOT BATHED FOR 15 MIN, CENTRIFUGED AND DISCARDED SUPERNANT. ADDED 1N HNO3, DI WATER, AND AMMONIUM OXALATE. FILTERED ONTO TARED FILTER PAPERS. LET DRY UNDER HEAT LAMP, REWEIGHED AND SUBMITTED TO COUNT.

JBA
 9/19/18

0043

 Reagents Used in an Analysis		Internal Work Order		
		18-09016		
		Analysis Code		Run
		Ra228		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/13/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/13/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/13/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/13/2018
020000P	Nitric Acid	Reagent Grade	JHARVEY	9/13/2018
018297D01	Ammonium Oxalate	5%	JBAILEY	9/19/2018
018971D06	Nitric Acid	1N	JBAILEY	9/19/2018
019673D02	Nitric Acid	6N	JBAILEY	9/19/2018
018699D10	Sodium Hydroxide	10M	JBAILEY	9/19/2018
019344D01	Sodium Hydroxide	18M	JBAILEY	9/19/2018
019519S	Yttrium Carrier	9 mg/ml	JBAILEY	9/19/2018

0044

Aqua LBC1110

85

Date	Sample #	Client	Lead time	Counttime	Analysis	Tech
9/14/18	1808137AB(1)	AMO	0851	30min	αβ	KP
9/14/18	1809054AB(1-35)	CG Services	0916	15min	αβ	KP
9/14/18	1809054AB(4)	CG Services	0938	15min	αβ	KP
9/14/18	1809022RA(1-4)	USA	1124	2hrs	Raw	KB
9/14/18	1809030RA(1-4)	USA	1124	2hrs	Raw	KB
9/14/18	1809137RA(1)	AMO	1124	1hr	Raw	KB
9/14/18	1809137RA(5)	AMO	1125	2hr	Raw	KB
9/14/18	1808156C(1-35)	UCOR	1329	30min	CI	KP
9/5/18	Weekly Bkgd	Lab	0935	12 hr	αβ	AG
9/7/18	Daily Bkgd/QC	Lab	0508/0613	1hr/30min	αβ	KP
9/7/18	Cross Talk	Lab	0648	5min	αβ	KP
9/7/18	Cross Talk	Lab	0657	5min	αβ	KP
9/7/18	1809069AB(1-3/3/4)	UCOR	0705	30min	αβ	KP
9/7/18	1809004RA(1-6)	SoS N. America	1422	2hrs	Raw	KB
9/7/18	1809005RA(1-6)	SoS N. America	1422	2hrs	Raw	KB
9/18/18	Daily Bkgd/QC	Lab	0504/0607	1hr/30min	αβ	KP
9/18/18	Cross Talk	Lab	0641	5min	αβ	KP
9/18/18	Cross Talk	Lab	0650	5min	αβ	KP
9/19/18	U-10A Recents(1-5)	Lab	1237	15mins	αβ	KB
9/19/18	1809057RA(1-4)	Burgess N. Am	1449	2hrs	Raw	KB
9/19/18	1809058RA(1-4)	USA	1450	2hrs	Raw	KB
9/19/18	Daily Bkgd/QC	Lab	0508/0611	1hr/30min	αβ	KP
9/19/18	Cross Talk	Lab	0647	5min	αβ	KP
9/19/18	Cross Talk	Lab	0655	5min	αβ	KP
9/19/18	1809058AB(1)	USA	0704	30min	αβ	KP
9/19/18	1809058AB(2-5)	USA	0704	2hrs	αβ	KP
9/19/18	1809016RA(7-13)	SoS N. America	1405	2hr	Raw	KB
9/19/18	1809070AB(1-5)	Auxier	1406	2hr	αβ	KB

0045

Red LBH10

101

Date	Sample #	Client	Load Time	Count Time	Analysis	Tech
9/18/18	Daily Bkgd/OC	Lab	0535/0503	1hr/30min	α/β	KP
9/18/18	Cross Talk	Lab	0640	5 min	α/β	KP
9/18/18	Cross Talk	Lab	0649	5 min	α/β	KP
9/18/18	1809077AB(135)	UCON	1550	30mins	α/β	KB
9/19/18	Daily Bkgd/OC	Lab	0540/0507	1hr/30min	α/β	KP
9/19/18	Cross Talk	Lab	0646	5 min	α/β	KP
9/19/18	Cross Talk	Lab	0654	5 min	α/β	KP
9/19/18	180901URACI-W	San America	1405	2 hrs	Raw	KB

0046

TDS NOTES

0047

2

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	18-09016
		Analysis Code	TDS
		Run Number	1

#	Date	Dept	User	Notes
1	09/08/18 03:57	PREP	MHIGHTOWER	Filtered sample into tared beaker, dried, re-weighed

MH 9/8/18

0048

SECTION VIII
ANALYTICAL DATA (RADIUM-226)

0049

Work Order	18-09016
Analysis Code	Ra226
Run	1
Date Received	9/7/2018
Lab Deadline	9/26/2018
Client	SGS North America Inc.
Project	ENV
Report Level	4
Activity Units	pCi
Aliquot Units	1
Matrix	WA
Method	EPA 903.0 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	Ba-133
Radiometric Sol#	Ba-6a
Tracer Act (dpm/g)	474.7
Carrier	
Carrier Conc (mg/ml)	

0050

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/07/18 00:00	1.0000E+00
02	MBL	BLANK		09/07/18 00:00	1.0000E+00
03	DUP	EQUIPMENT BLANK	38	09/04/18 10:40	1.0000E+00
04	TRG	HANSON RELIEF WELL	43	09/04/18 10:45	1.0000E+00
05	TRG	BILLINGSLEY RELIEF WELL	44	09/04/18 11:40	1.0000E+00
06	TRG	DAVID MASON RELIEF WELL	36	09/04/18 14:50	1.0000E+00
07	TRG	DENNISON RIG SUPPLY WELL	36	09/04/18 16:30	1.0000E+00
08	TRG	GAMBLE RIG SUPPLY WELL	37	09/04/18 16:45	1.0000E+00
09	TRG	FIELD DUPLICATE	41	09/04/18 16:35	1.0000E+00
10	TRG	BRYANT POND 2	43	09/05/18 11:45	1.0000E+00
11	TRG	BRYANT POND 7	40	09/05/18 11:15	1.0000E+00
12	TRG	BRYANT POND 12	43	09/05/18 10:45	1.0000E+00
13	DO	EQUIPMENT BLANK	38	09/04/18 10:40	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	2.0393	968.1	666.0	152.73		0.0210	0.0303	0.0093		110.00	3.00^	1.00
02	MBL	2.0323	964.7	594.0	136.69		0.0220	0.0312	0.0092		110.00	3.00^	1.00
03	DUP	2.0324	964.8	488.0	112.29		0.0219	0.0281	0.0062		110.00	2.23	1.00
04	TRG	2.0288	963.1	594.0	136.92		0.0209	0.0302	0.0093		110.00	3.00^	1.00
05	TRG	2.0306	963.9	652.0	150.16		0.0220	0.0286	0.0066		110.00	2.37	1.00
06	TRG	2.0281	962.7	583.0	134.44		0.0221	0.0288	0.0067		110.00	2.40	1.00
07	TRG	2.0254	961.5	950.0	219.35		0.0219	0.0288	0.0069		110.00	2.47	1.00
08	TRG	2.0244	961.0	585.0	135.14		0.0219	0.0288	0.0069		110.00	2.47	1.00
09	TRG	2.0217	959.7	543.0	125.61		0.0218	0.0287	0.0069		110.00	2.47	1.00
10	TRG	2.0194	958.6	850.0	196.85		0.0218	0.0291	0.0073		110.00	2.58	1.00
11	TRG	2.0196	958.7	521.0	120.64		0.0217	0.0301	0.0084		110.00	2.87	1.00
12	TRG	2.0185	958.2	545.0	126.27		0.0218	0.0300	0.0082		110.00	2.82	1.00
13	DO	2.0204	959.1	762.0	176.38		0.0219	0.0284	0.0065		110.00	2.34	1.00

0051

* 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			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
02	MBL			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
03	DUP			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
04	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
05	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
06	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
07	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
08	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
09	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
10	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
11	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
12	TRG			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		
13	DO			09/13/18 12:26	JHARVEY	09/18/18 09:00	JBAILEY		

0052



* 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.

	Client	SGS North America Inc.
	Eberline Analytical Work Order	18-09016
Analysis Code	Ra226	
Run	1	

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	RA-226	LCS	LCS	pCi/l	9.99E+00	1.37E+00	3.60E-01	1.01E+01	98.76	OK		OK	
02	RA-226	MBL	BLANK	pCi/l	1.02E-01	2.28E-01	4.34E-01					OK	OK
03	RA-226	DUP	EQUIPMENT BLANK	pCi/l	-2.66E-02	6.57E-02	1.88E-01				NA	OK	
04	RA-226	TRG	HANSON RELIEF WELL	pCi/l	2.75E+00	7.21E-01	3.78E-01					OK	
05	RA-226	TRG	BILLINGSLEY RELIEF WELL	pCi/l	1.43E-01	1.46E-01	1.86E-01					OK	
06	RA-226	TRG	DAVID MASON RELIEF WELL	pCi/l	2.61E+00	5.97E-01	1.81E-01					OK	
07	RA-226	TRG	DENNISON RIG SUPPLY WELL	pCi/l	2.38E-01	2.13E-01	2.77E-01					OK	
08	RA-226	TRG	GAMBLE RIG SUPPLY WELL	pCi/l	3.17E-01	2.30E-01	2.52E-01					OK	
09	RA-226	TRG	FIELD DUPLICATE	pCi/l	2.12E-01	1.81E-01	1.79E-01					OK	
10	RA-226	TRG	BRYANT POND 2	pCi/l	4.32E-01	2.90E-01	3.40E-01					OK	
11	RA-226	TRG	BRYANT POND 7	pCi/l	2.58E-01	2.57E-01	3.57E-01					OK	
12	RA-226	TRG	BRYANT POND 12	pCi/l	8.13E-02	1.55E-01	2.86E-01					OK	
13	RA-226	DO	EQUIPMENT BLANK	pCi/l	1.20E-01	1.72E-01	2.81E-01					OK	

	Run 1
Eberline Analytical Work Order	18-09016
Analysis Code	Ra226
Client	SGS North America Inc.

0054

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	09/07/18 00:00	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
02	RA-226	MBL	09/07/18 00:00	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
03	RA-226	DUP	09/04/18 10:40	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
04	RA-226	TRG	09/04/18 10:45	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
05	RA-226	TRG	09/04/18 11:40	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
06	RA-226	TRG	09/04/18 14:50	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
07	RA-226	TRG	09/04/18 16:30	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
08	RA-226	TRG	09/04/18 16:45	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
09	RA-226	TRG	09/04/18 16:35	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
10	RA-226	TRG	09/05/18 11:45	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
11	RA-226	TRG	09/05/18 11:15	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
12	RA-226	TRG	09/05/18 10:45	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	
13	RA-226	DO	09/04/18 10:40	1.00E+00	100.00	0.00	110.00		9/18/2018 9:00	

	Run	1	Ra226	18-09016	Eberline Analytical Work Order	Client	SGS North America Inc.	5500
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Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Half-life (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-226	LCS	09/18/18 11:59		A_Spec	Alpha_039	170	2.22 E+02	1.30 E-02	17.6
02	RA-226	MBL	09/18/18 11:59		A_Spec	Alpha_040	170	2.26 E+00	2.20 E-02	17.6
03	RA-226	DUP	09/18/18 11:59		A_Spec	Alpha_041	170	-8.50 E-01	5.00 E-03	18.8
04	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_042	170	5.96 E+01	1.40 E-02	17.2
05	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_043	170	4.32 E+00	4.00 E-03	19
06	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_044	170	7.55 E+01	3.00 E-03	18.4
07	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_045	170	6.30 E+00	1.00 E-02	17.4
08	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_046	170	8.64 E+00	8.00 E-03	17.8
09	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_047	170	5.66 E+00	2.00 E-03	17.4
10	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_048	170	1.11 E+01	1.70 E-02	17.6
11	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_049	170	5.30 E+00	1.00 E-02	15.6
12	RA-226	TRG	09/18/18 11:59		A_Spec	Alpha_050	170	1.49 E+00	3.00 E-03	13.7
13	RA-226	DO	09/18/18 11:59		A_Spec	Alpha_051	170	2.81 E+00	7.00 E-03	14.5

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	09/07/18 00:00	1.0000	2.0393	968.0557	666.0000	152.73	3.00^	1.00
02	MBL	BLANK	09/07/18 00:00	1.0000	2.0323	964.7328	594.0000	136.69	3.00^	1.00
03	DUP	EQUIPMENT BLANK	09/04/18 10:40	1.0000	2.0324	964.7803	488.0000	112.29	2.23	1.00
04	TRG	HANSON RELIEF WELL	09/04/18 10:45	1.0000	2.0288	963.0714	594.0000	136.92	3.00^	1.00
05	TRG	BILLINGSLEY RELIEF WELL	09/04/18 11:40	1.0000	2.0306	963.9258	652.0000	150.16	2.37	1.00
06	TRG	DAVID MASON RELIEF WELL	09/04/18 14:50	1.0000	2.0281	962.7391	583.0000	134.44	2.40	1.00
07	TRG	JENNISON RIG SUPPLY WEL	09/04/18 16:30	1.0000	2.0254	961.4574	950.0000	219.35	2.47	1.00
08	TRG	GAMBLE RIG SUPPLY WELL	09/04/18 16:45	1.0000	2.0244	960.9827	585.0000	135.14	2.47	1.00
09	TRG	FIELD DUPLICATE	09/04/18 16:35	1.0000	2.0217	959.7010	543.0000	125.61	2.47	1.00
10	TRG	BRYANT POND 2	09/05/18 11:45	1.0000	2.0194	958.6092	850.0000	196.85	2.58	1.00
11	TRG	BRYANT POND 7	09/05/18 11:15	1.0000	2.0196	958.7041	521.0000	120.64	2.87	1.00
12	TRG	BRYANT POND 12	09/05/18 10:45	1.0000	2.0185	958.1820	545.0000	126.27	2.82	1.00
13	DO	EQUIPMENT BLANK	09/04/18 10:40	1.0000	2.0204	959.0839	762.0000	176.38	2.34	1.00

Spike and Tracer Worksheet

Internal Work Order		Run	Analysis Code		Date	Technician		Technician Initials		Witness Initials			
18-09016		1	Ra226		9/13/2018 12:19	JHARVEY							
LCS & Matrix Spikes													
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	LCS Volume Used (g)	MS Volume Used (g)	LCS Volume Used (g)	MSD Volume Used (g)	LCS Known pCi	MS Added pCi	MSD Error Estimate	MSD Added pCi	MSD Error Estimate
Ra-226	Ra-5b	43.970	9/13/2018	0.500	0.5107		10.12		0.465	0.00	0.000	0.00	0.000

Tracers													
fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition	Tracer						LCS
01	Ba-133	Ba-6a	474.700	9/13/2018	2.0393	2.1300							
02	Ba-133	Ba-6a	474.700	9/13/2018	2.0323	2.1300							
03	Ba-133	Ba-6a	474.700	9/13/2018	2.0324	2.1300							
04	Ba-133	Ba-6a	474.700	9/13/2018	2.0288	2.1300							
05	Ba-133	Ba-6a	474.700	9/13/2018	2.0306	2.1300							
06	Ba-133	Ba-6a	474.700	9/13/2018	2.0281	2.1300							
07	Ba-133	Ba-6a	474.700	9/13/2018	2.0254	2.1300							
08	Ba-133	Ba-6a	474.700	9/13/2018	2.0244	2.1300							
09	Ba-133	Ba-6a	474.700	9/13/2018	2.0217	2.1300							
10	Ba-133	Ba-6a	474.700	9/13/2018	2.0194	2.1300							
11	Ba-133	Ba-6a	474.700	9/13/2018	2.0196	2.1300							
12	Ba-133	Ba-6a	474.700	9/13/2018	2.0185	2.1300							
13	Ba-133	Ba-6a	474.700	9/13/2018	2.0204	2.1300							
Matrix Spike													

0057

Aliquot Worksheet

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
18-09016	1	Ra226	liters	9/26/2018	JHARVEY

Lab Fraction	Client ID	Sample Type	Muffle Data		Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
			Ratio Post/Pre	No of Dils	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq	
01	LCS	LCS						1.0000E+00	1.0000E+00				
02	BLANK	MBL						1.0000E+00	1.0000E+00				
03	EQUIPMENT BLANK	DUP						1.0000E+00	1.0000E+00				
04	HANSON RELIEF WELL	TRG						1.0000E+00	1.0000E+00				
05	BILLINGSLEY RELIEF WELL	TRG						1.0000E+00	1.0000E+00				
06	DAVID MASON RELIEF WELL	TRG						1.0000E+00	1.0000E+00				
07	DENNISON RIG SUPPLY WELL	TRG						1.0000E+00	1.0000E+00				
08	GAMBLE RIG SUPPLY WELL	TRG						1.0000E+00	1.0000E+00				
09	FIELD DUPLICATE	TRG						1.0000E+00	1.0000E+00				
10	BRYANT POND 2	TRG						1.0000E+00	1.0000E+00				
11	BRYANT POND 7	TRG						1.0000E+00	1.0000E+00				
12	BRYANT POND 12	TRG						1.0000E+00	1.0000E+00				
13	EQUIPMENT BLANK	DO						1.0000E+00	1.0000E+00				

Comments

0058



Technician:  Date: 9/13/18

Gravimetric Worksheet

Work Order		Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
18-09016		1	Ra226			JBAILEY

TRetec Fraction	Sample		Carrier Added (ml)	Filter Data			Gravimetric % Recovery
	Client ID	Type		Filter Tare (g)	Filter Final (g)	Filter Net (g)	
01	LCS	LCS		0.0210	0.0303	0.0093	
02	BLANK	MBL		0.0220	0.0312	0.0092	
03	DUP	DUP		0.0219	0.0281	0.0062	
04	HANSON RELIEF WELL	TRG		0.0209	0.0302	0.0093	
05	BILLINGSLEY RELIEF WELL	TRG		0.0220	0.0286	0.0066	
06	DAVID MASON RELIEF WELL	TRG		0.0221	0.0288	0.0067	
07	DENNISON RIG SUPPLY WELL	TRG		0.0219	0.0288	0.0069	
08	GAMBLE RIG SUPPLY WELL	TRG		0.0219	0.0288	0.0069	
09	FIELD DUPLICATE	TRG		0.0218	0.0287	0.0069	
10	BRYANT POND 2	TRG		0.0218	0.0291	0.0073	
11	BRYANT POND 7	TRG		0.0217	0.0301	0.0084	
12	BRYANT POND 12	TRG		0.0218	0.0300	0.0082	
13	EQUIPMENT BLANK	DO		0.0219	0.0284	0.0065	

0059

Technician:  Date: 9/18/18

KS
9/18/18

Sample Description: SPIKE
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 01
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_039
 Chamber Serial Number: 06027396A
 Detector Serial Number: 83109
 Env. Background: System Bkgd 225250
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/18/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:07 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1765 +/- 0.0031 on 2/16/2018 9:34:28 AM
 Effective Efficiency: 0.1765 +/- 0.0031

Control Certificate Name: Ra226_Ra-5b
 Chem. Recov. of Control: RA-226 0.329187 +/- 0.025005
 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	5.502	8.47	74.12	1.53	0.00E+000	3.0
RA-226	4.567	221.79	13.24	2.21	0.00E+000	3.7

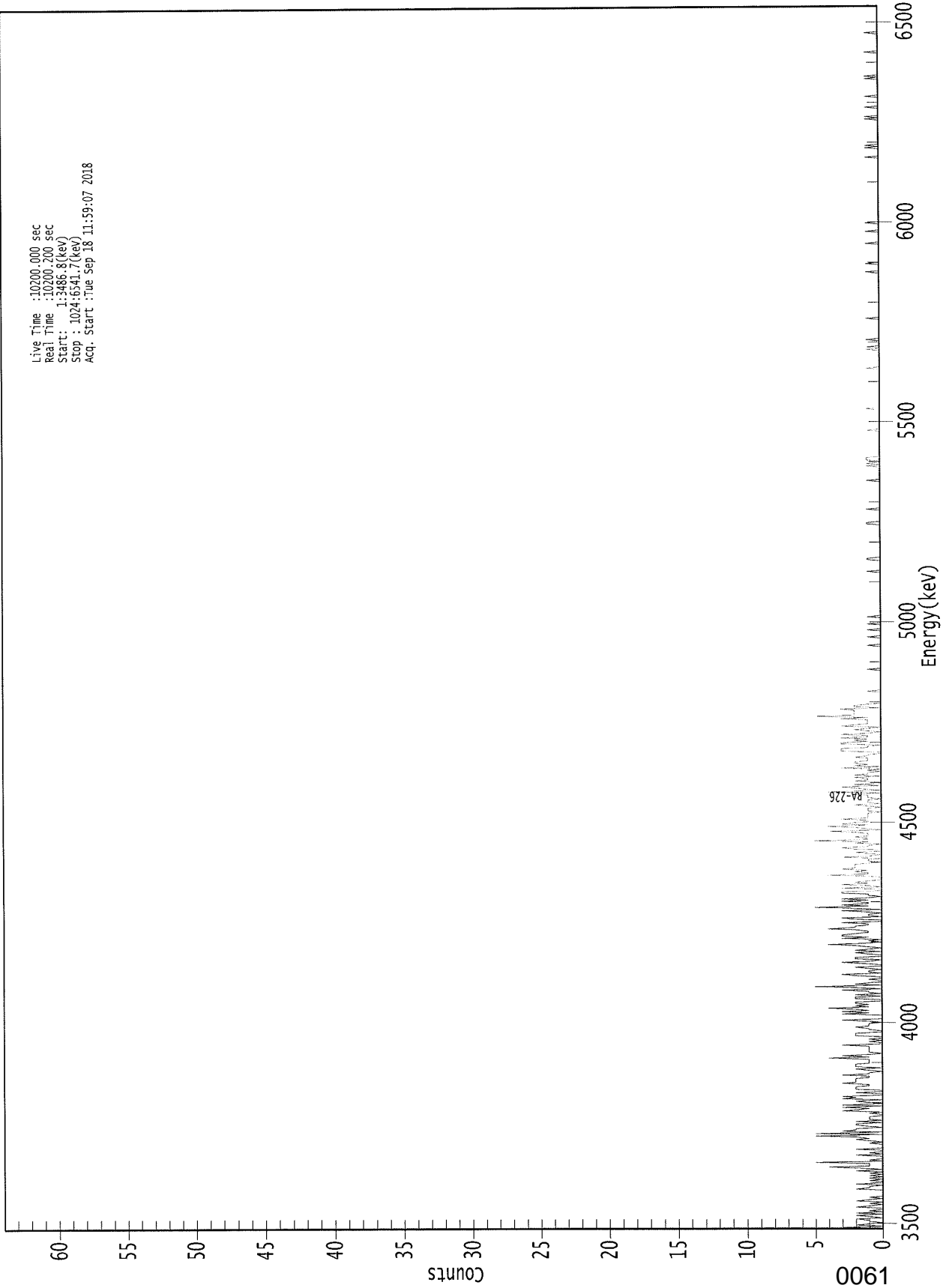
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.957	5685.50*	4.01E-001 +/- 2.98E-001	3.37E-001 +/- 1.16E-002
RA-226	0.940	4785.00*	9.99E+000 +/- 1.37E+000	3.60E-001 +/- 1.24E-002

AG
9/19/18

0000222534.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:3486.8(keV)
Stop : 1024:6541.7(keV)
Acq. Start :Tue Sep 18 11:59:07 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:	0	3	0	2	1	0	1	1
9:	2	0	1	2	0	2	0	1
17:	0	0	2	1	0	1	0	2
25:	1	0	1	0	0	0	0	0
33:	0	2	1	1	0	2	0	0
41:	1	0	1	0	1	0	1	0
49:	2	0	1	4	1	1	1	5
57:	0	1	0	0	0	2	0	1
65:	0	0	2	0	0	0	0	1
73:	0	1	2	1	2	5	0	5
81:	0	3	2	2	0	1	2	2
89:	0	2	0	1	1	1	0	0
97:	1	0	3	2	1	3	0	3
105:	0	1	2	0	3	2	3	0
113:	0	2	0	0	2	2	2	1
121:	1	3	2	2	2	2	1	1
129:	3	1	1	0	1	2	0	2
137:	2	2	1	1	1	1	4	1
145:	3	1	0	1	1	1	1	1
153:	1	3	0	0	1	0	1	0
161:	0	2	2	2	0	0	1	1
169:	2	1	1	1	0	1	3	0
177:	0	0	0	3	1	3	1	2
185:	4	1	2	1	2	2	0	0
193:	2	2	0	2	0	1	1	3
201:	0	2	5	0	2	1	0	0
209:	1	0	0	2	3	0	1	1
217:	0	1	2	0	0	1	3	1
225:	0	2	2	0	0	1	2	0
233:	2	1	0	1	2	4	1	0
241:	1	0	3	1	3	3	2	1
249:	1	2	4	2	2	1	1	3
257:	0	0	2	3	0	1	1	0
265:	1	3	0	2	5	1	3	1
273:	1	3	1	3	1	0	1	1
281:	3	3	0	0	3	0	1	3
289:	1	2	1	0	0	0	1	4
297:	1	1	2	1	3	2	2	2
305:	2	1	0	1	1	0	3	1
313:	0	1	2	0	0	2	3	1
321:	1	0	2	1	5	1	1	2
329:	1	1	1	2	4	0	1	2
337:	4	1	3	2	1	1	3	1
345:	1	1	1	1	0	1	1	1
353:	0	1	2	0	1	1	1	0
361:	1	1	1	2	0	4	0	1

0062



369: 2 3 0 2 0 0 2 1

Sample Title: 01

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

0063

2

801: 1 0 0 0 0 0 0 0 1

Sample Title: 01

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	1	0	0	0	0	0	0	0
833:	0	0	1	0	0	0	0	0
841:	0	1	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:	1	0	0	0	0	0	0	0
905:	1	0	1	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	1	0	0	0	0	0
937:	0	0	1	0	0	0	0	0
945:	0	0	0	1	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	1	0	1	0	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	1	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	1	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0

2

0064

*KS
9/18/18*

Sample Description: BLANK
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 02
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_040
 Chamber Serial Number: 06027396B
 Detector Serial Number: 91135
 Env. Background: System Bkgd 225251
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/18/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:09 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1757 +/- 0.0031 on 2/16/2018 9:34:27 AM
 Effective Efficiency: 0.1757 +/- 0.0031

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.529	-2.38	97.60	2.38	0.00E+000	0.0
RA-226	4.608	2.26	223.41	3.74	0.00E+000	3.0

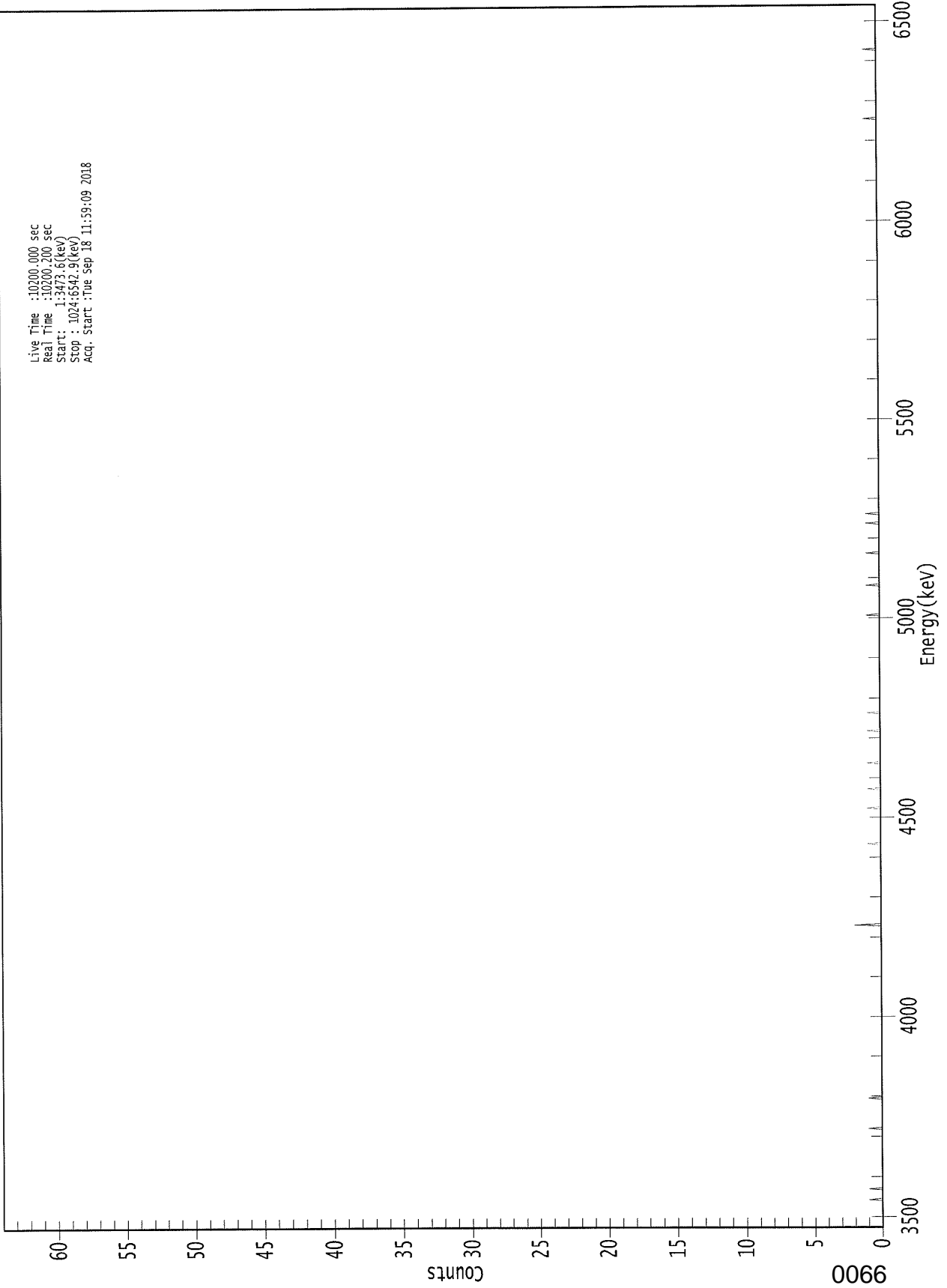
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.968	5685.50*	-1.13E-001 +/- 1.11E-001	3.90E-001 +/- 1.34E-002
RA-226	0.960	4785.00*	1.02E-001 +/- 2.28E-001	4.34E-001 +/- 1.49E-002

*AG
9/19/18*

0000222526.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:3473.6(keV)
Stop : 1024:6542.9(keV)
Acq. Start :Tue Sep 18 11:59:09 2018



ROI Type: 1

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

Sample Title: 02

Elapsed Live time: 10200

Elapsed Real Time: 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	1
25:	0	0	0	0	0	0	0	0
33:	1	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	1	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	1	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	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	2	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0
321:	1	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	1	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	1	0

0067



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	1	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	1
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	1	0
433:	0	0	0	0	0	0	0	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	1
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	1	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	1	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	1	0	0	0
593:	0	0	0	0	1	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

0068

2

801: 0 0 0 0 0 0 0 0

Sample Title: 02

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

0069

108
9/19/18

Sample Description: EQUIPMENT BLANK DUP
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 03
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_041
 Chamber Serial Number: 05026930A
 Detector Serial Number: 91087
 Env. Background: System Bkgd 225252
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.230E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:10 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

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

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.529	-0.17	1169.4	0.17	0.00E+000	0.0
RA-226	4.601	-0.85	246.69	0.85	0.00E+000	0.0

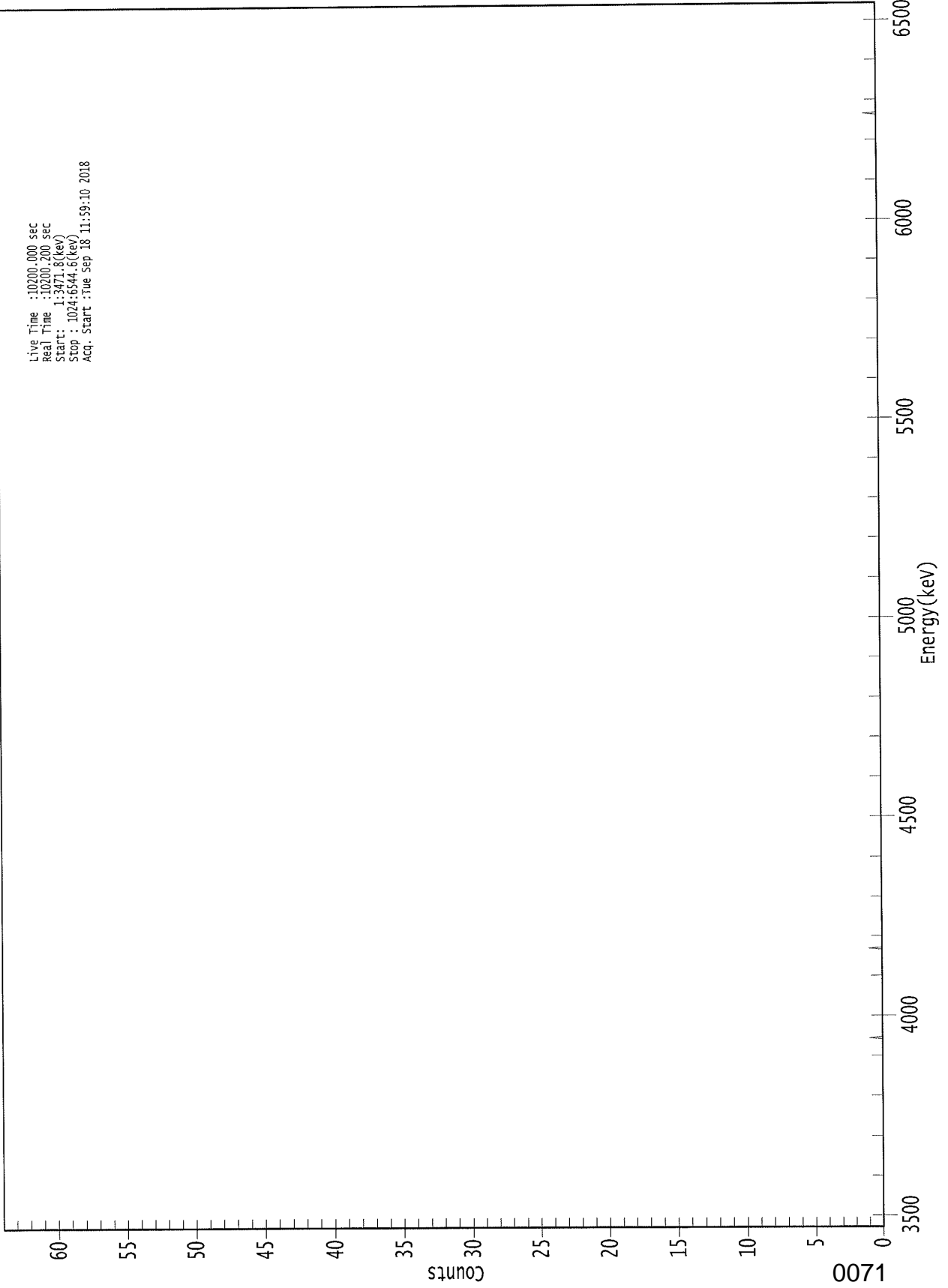
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.969	5685.50*	-5.63E-003 +/- 6.58E-002	1.38E-001 +/- 4.71E-003
RA-226	0.957	4785.00*	-2.66E-002 +/- 6.57E-002	1.88E-001 +/- 6.39E-003

AG
9/19/18

0000222527.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:3471.8(kev)
Stop : 1024:6544.6(kev)
Acq. Start :Tue Sep 18 11:59:10 2018



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

Sample Title: 03

Elapsed Live time: 10200
 Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----	-----
1:	0	0	0	0	0	0	0	0	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	0	0	0	0	0
129:	0	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	1	0	0	0
161:	0	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0	0
233:	1	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0	0

0072



369: 0 0 0 0 0 0 0 0

Sample Title: 03

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	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

0073



801: 0 0 0 0 0 0 0 0 0

Sample Title: 03

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

2

0074

KB
9/19/18

Sample Description: HANSON RELIEF WELL
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 04
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_042
 Chamber Serial Number: 05026930B
 Detector Serial Number: 84185
 Env. Background: System Bkgd 225253
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:12 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1722 +/- 0.0030 on 2/16/2018 9:34:23 AM
 Effective Efficiency: 0.1722 +/- 0.0030

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.518	42.60	31.40	3.40	0.00E+000	3.0
RA-226	4.597	59.62	25.97	2.38	0.00E+000	3.7

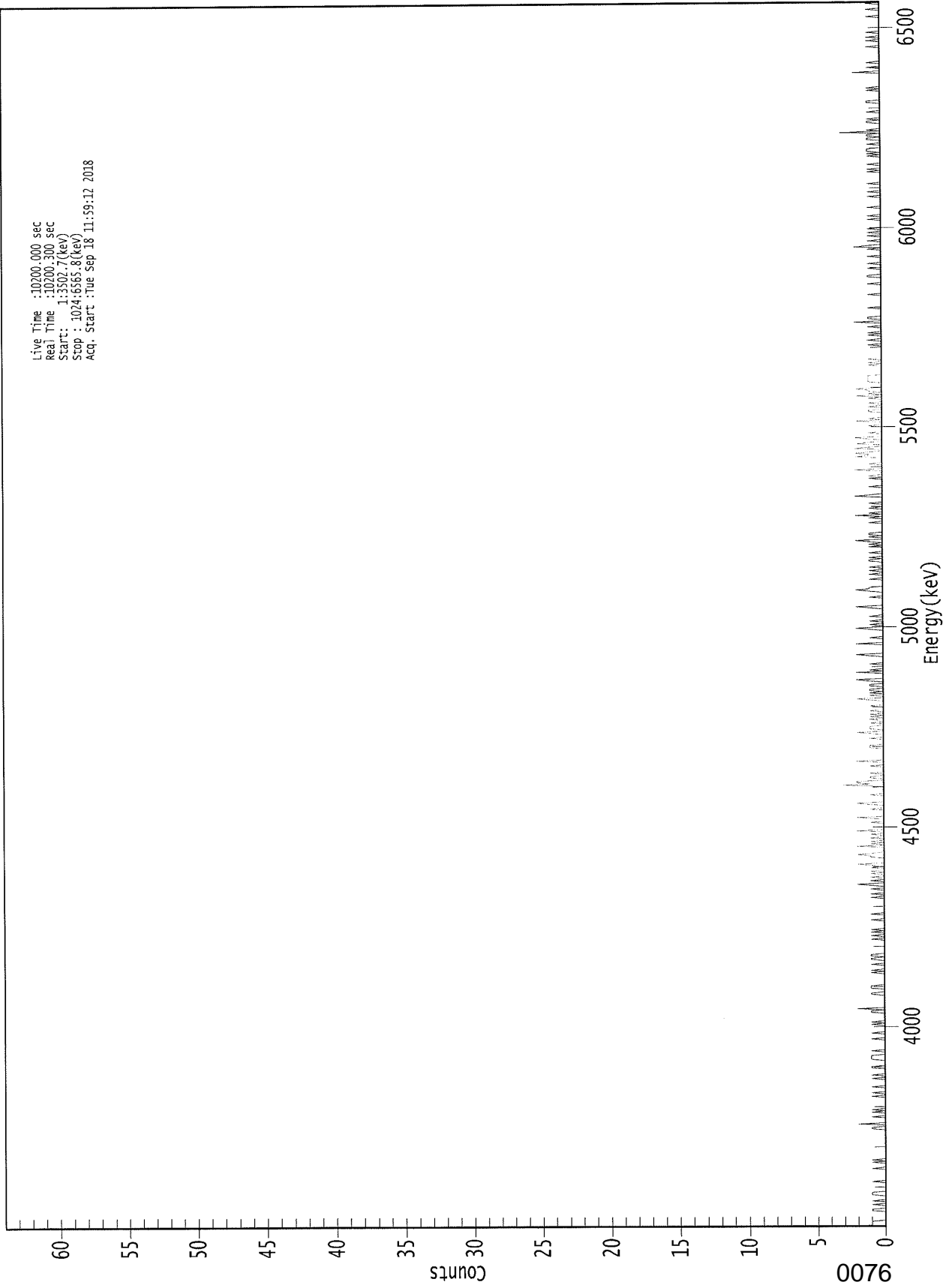
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.964	5685.50*	2.08E+000 +/- 6.56E-001	4.52E-001 +/- 1.56E-002
RA-226	0.955	4785.00*	2.75E+000 +/- 7.21E-001	3.78E-001 +/- 1.30E-002

AG
9/19/18

0000222521.CNF

Live Time :10200.000 sec
Real Time :10200.300 sec
Start : 1:3502.7(keV)
Stop : 1024:6565.8(keV)
Acq. Start :Tue Sep 18 11:59:12 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:	2	1	1	1	1	0	0	0	
9:	0	0	0	0	0	1	1	0	
17:	0	0	1	0	0	1	0	0	
25:	0	0	1	1	1	0	0	0	
33:	0	0	0	0	0	1	0	0	
41:	0	0	0	0	0	0	0	0	
49:	1	0	0	0	0	1	0	1	
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	1	0	0	2	0	0	
89:	0	0	0	1	0	0	0	1	
97:	0	1	0	0	0	0	0	0	
105:	0	0	0	0	1	0	0	1	
113:	0	0	0	0	1	0	0	0	
121:	0	0	0	1	0	0	1	0	
129:	0	0	0	0	1	1	0	0	
137:	0	0	0	1	1	1	1	0	
145:	0	0	1	0	0	0	0	0	
153:	0	0	0	0	1	0	0	0	
161:	0	1	0	0	0	0	0	0	
169:	1	0	1	0	0	0	0	0	
177:	0	0	1	1	0	2	0	0	
185:	0	0	0	0	0	0	0	0	
193:	0	1	1	0	0	0	1	1	
201:	1	0	0	0	0	0	0	0	
209:	0	0	0	1	0	1	0	0	
217:	0	0	1	0	0	0	1	1	
225:	0	1	1	0	0	0	0	0	
233:	0	0	0	0	0	0	0	1	
241:	0	0	1	0	0	1	0	1	
249:	0	0	0	0	0	0	0	1	
257:	0	0	0	0	1	0	0	0	
265:	0	0	0	0	0	0	0	0	
273:	0	0	1	0	0	1	0	0	
281:	0	1	0	0	1	2	0	0	
289:	1	0	0	1	0	0	1	0	
297:	1	0	0	1	0	1	2	0	
305:	0	0	0	0	1	1	2	1	
313:	0	0	0	0	0	2	0	1	
321:	0	1	0	0	1	0	0	1	
329:	0	0	2	0	0	0	0	0	
337:	0	1	0	0	0	2	0	0	
345:	0	0	0	0	1	0	0	0	
353:	1	2	0	0	0	0	0	0	
361:	1	0	0	0	0	0	0	0	

0077



369: 3 1 2 2 0 0 1 1

Sample Title: 04

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

0078



801: 1 0 0 0 1 0 0 0

Sample Title: 04

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

2

0079



VCB
9/19/18

2

Sample Description: BILLINGSLEY RELIEF WELL
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 05
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_043
 Chamber Serial Number: 04026481A
 Detector Serial Number: 91088
 Env. Background: System Bkgd 225254
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.370E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:14 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

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

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.588	3.66	107.87	0.34	0.00E+000	3.0
RA-226	4.566	4.32	102.62	0.68	0.00E+000	3.0

 NUCLIDE ANALYSIS RESULTS

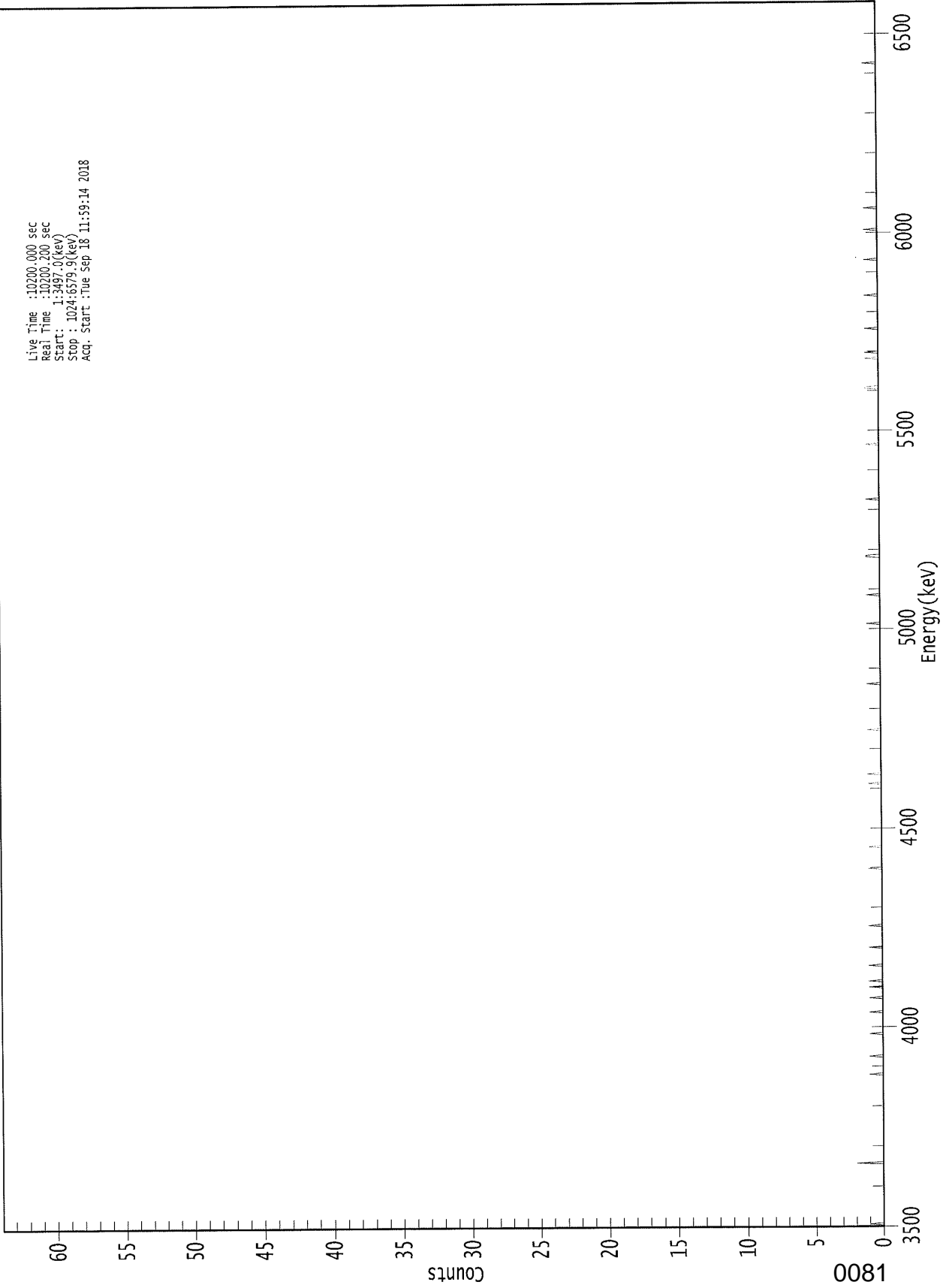
Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.988	5685.50*	1.28E-001 +/- 1.38E-001	1.67E-001 +/- 5.69E-003
RA-226	0.939	4785.00*	1.43E-001 +/- 1.46E-001	1.86E-001 +/- 6.35E-003

AG
9/19/18

0080

0000222528.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:349.0(kev)
Stop : 1024:6579.9(kev)
Acq. Start :Tue Sep 18 11:59:14 2018



 ***** 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	1	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	2	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	1	0
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	1	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	1	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	1	0	0	0	0	0
185:	0	0	0	0	0	0	1	0
193:	0	0	0	0	0	0	0	1
201:	0	0	0	0	1	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	1	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	1	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	1	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	1	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	1	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

0082



369: 0 1 0 0 0 0 0 0 0

Sample Title: 05

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	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	1	0
417:	0	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0	0
449:	0	0	0	0	1	0	0	0	0
457:	0	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0	0
473:	0	0	0	0	0	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	1	0
505:	0	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	1	0
529:	0	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	1	1
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	0	0	0	0	0
601:	0	0	0	0	0	0	0	1	0
609:	0	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0	0
649:	0	0	0	0	1	0	0	0	0
657:	0	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0	0
697:	0	0	0	1	1	0	0	0	0
705:	0	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0	0
721:	0	0	0	0	1	0	0	0	0
729:	0	1	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	1	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	1	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

0083



801: 0 0 0 0 0 0 0 0 1

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:	1	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	1	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	0	1	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

0084

*KS
9/18/18*

Sample Description: DAVID MASON RELIEF WELL
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 06
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_044
 Chamber Serial Number: 04026481B
 Detector Serial Number: 84168
 Env. Background: System Bkgd 225255
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.400E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:16 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

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

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.546	50.15	27.95	0.85	0.00E+000	4.5
RA-226	4.600	75.49	22.65	0.51	0.00E+000	4.0

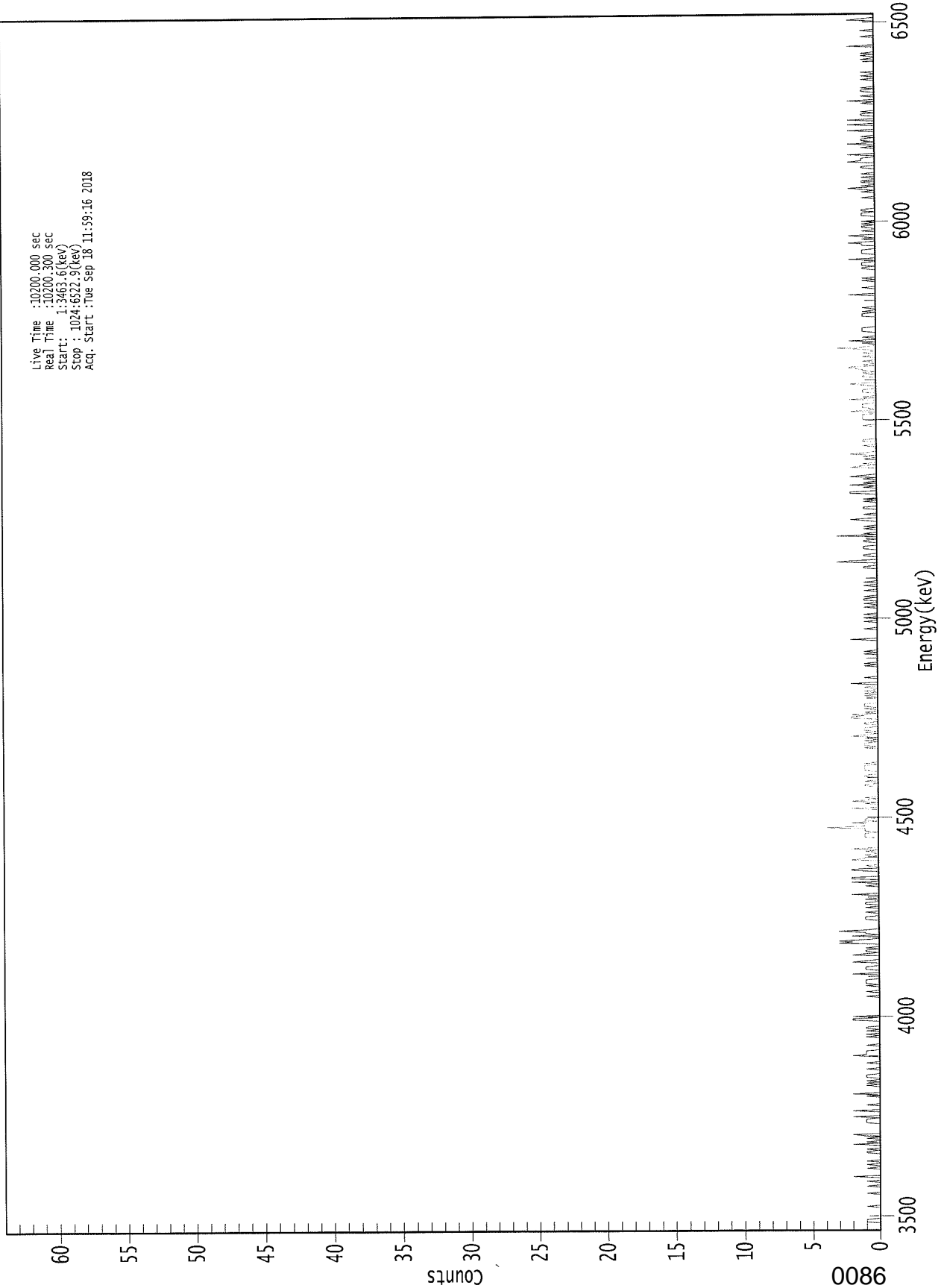
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.975	5685.50*	1.83E+000 +/- 5.16E-001	2.19E-001 +/- 7.50E-003
RA-226	0.956	4785.00*	2.61E+000 +/- 5.97E-001	1.81E-001 +/- 6.22E-003

*AG
9/19/18*

0000222531.CNF

Live Time : 10200.000 sec
Real Time : 10200.300 sec
Start : 1:34:63.6(kev)
Stop : 1024:6522.9(kev)
Acq. Start : Tue Sep 18 11:59:16 2018



ROI Type: 1

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

Sample Title: 06

Elapsed Live time: 10200

Elapsed Real Time: 10200

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

0087



369: 0 0 0 0 0 1 1 0

Sample Title: 06

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

0088



801: 1 0 0 0 0 0 0 0 0

Sample Title: 06

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

2

0089

KB
9/19/18

Sample Description: DENNISON RIG SUPPLY WELL
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 07
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_045
 Chamber Serial Number: 04026482A
 Detector Serial Number: 91131
 Env. Background: System Bkgd 225256
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.470E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:18 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1735 +/- 0.0031 on 2/16/2018 9:34:18 AM
 Effective Efficiency: 0.1735 +/- 0.0031

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.400	0.49	416.98	0.51	0.00E+000	3.0
RA-226	4.583	6.30	89.57	1.70	0.00E+000	3.0

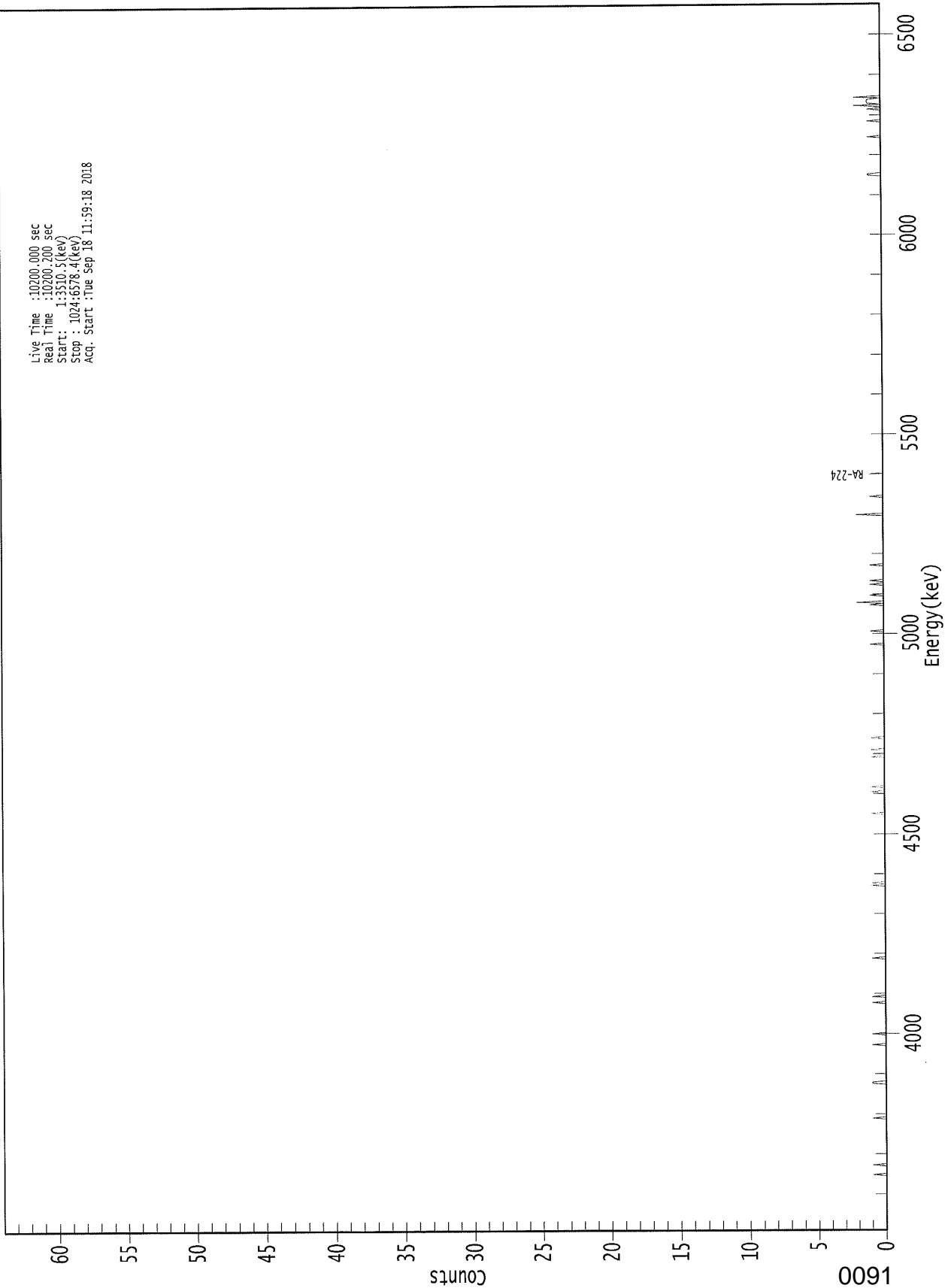
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.899	5685.50*	1.95E-002 +/- 8.14E-002	2.09E-001 +/- 7.23E-003
RA-226	0.948	4785.00*	2.38E-001 +/- 2.13E-001	2.77E-001 +/- 9.57E-003

AG
9/19/18

0000222524.CNF

Live Time : 10200.000 sec
Real Time : 10200.200 sec
Start : 1:33:10.5(keV)
Stop : 1024:6578.4(keV)
Acq. Start : Tue Sep 18 11:59:18 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	0	0	0	0
9:	0	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	1	0	0
49:	0	0	0	0	0	0	1	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	1	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	1	1	0	0	0	0	0
129:	0	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0	0
153:	0	0	1	0	0	0	0	0	0
161:	0	0	0	1	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	1	0	0	0
193:	0	0	1	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	1	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0	1
289:	0	1	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0	0
345:	0	0	0	1	0	0	0	0	0
353:	0	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	1	0	0	0

0092

369: 0 1 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	0
393:	0	0	1	0	0	0	0	0
401:	1	0	0	0	0	0	0	0
409:	0	0	1	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:	1	0	0	0	0	0	0	0
497:	0	0	0	1	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	1	0	2	0	0	0	0
529:	0	1	0	0	0	0	0	0
537:	0	0	1	0	0	1	0	0
545:	0	0	0	0	0	0	0	0
553:	0	0	1	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	2	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	1	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	1	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

0093



801: 0 0 0 0 0 0 0 0 0

Sample Title: 07

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

2

0094

LB
9/18/18

Sample Description: GAMBLE RIG SUPPLY WELL
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 08
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_046
 Chamber Serial Number: 04026482B
 Detector Serial Number: 58762
 Env. Background: System Bkgd 225257
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.470E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:19 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
 Counting Efficiency: 0.1783 +/- 0.0031 on 2/16/2018 9:34:16 AM
 Effective Efficiency: 0.1783 +/- 0.0031

Peak Match Tolerance: 0.350 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.644	3.32	119.77	0.68	0.00E+000	3.0
RA-226	4.594	8.64	72.56	1.36	0.00E+000	3.0

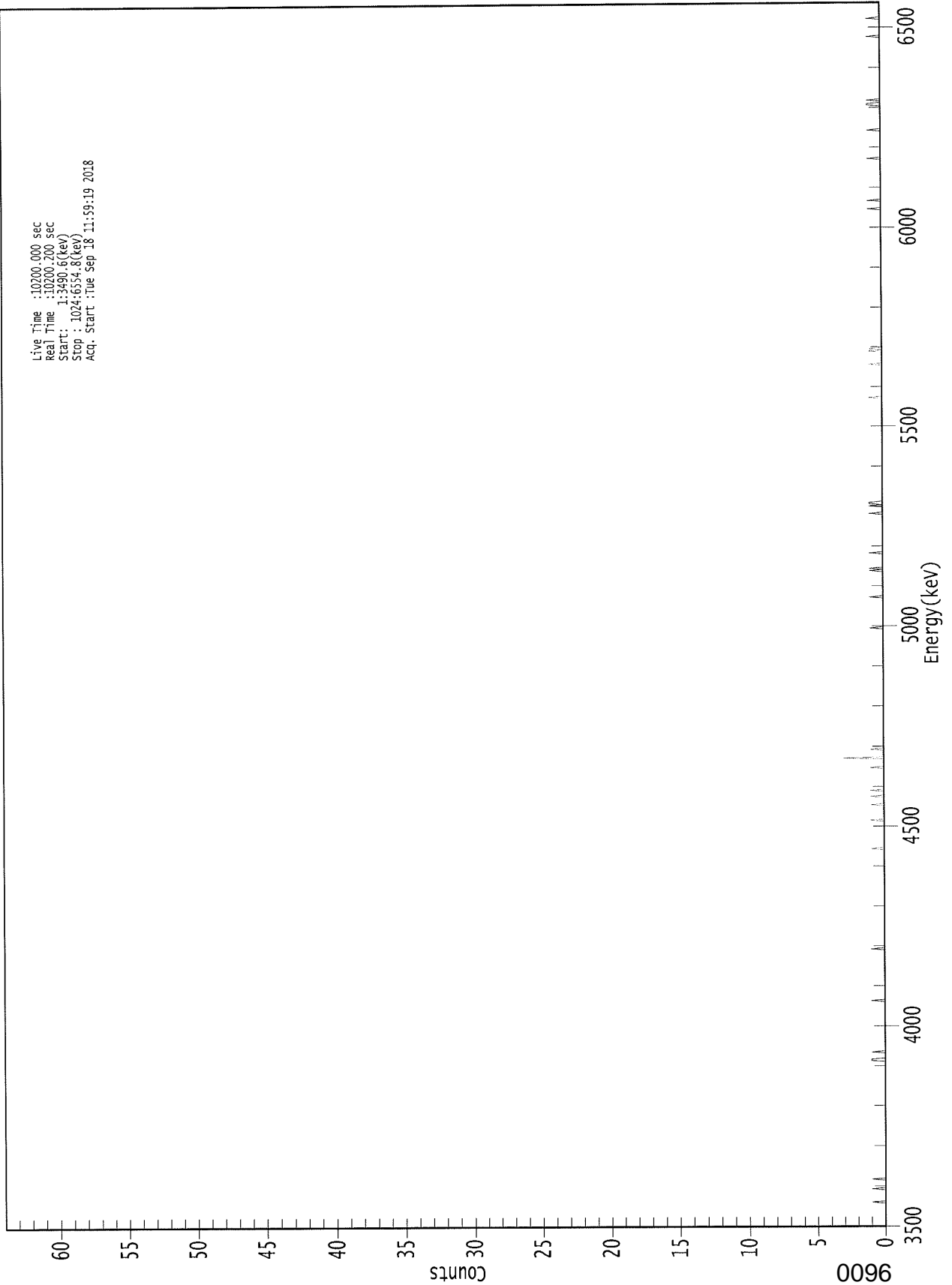
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.998	5685.50*	1.29E-001 +/- 1.54E-001	2.19E-001 +/- 7.54E-003
RA-226	0.953	4785.00*	3.17E-001 +/- 2.30E-001	2.52E-001 +/- 8.67E-003

AG
9/18/18

0000222532.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:3490.6(kev)
Stop : 1024:6534.8(kev)
Acq. Start : Tue Sep 18 11:59:19 2018



ROI Type: 1

369: 0 0 0 0 0 0 0 0 0

Sample Title: 08

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	1
385:	0	0	0	0	0	0	0	3
393:	0	0	0	0	0	0	1	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	1	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	1	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	1	0	1	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	1	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	1	0	0	0	0
601:	0	1	0	1	1	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	1	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:	1	0	0	0	0	0	0	0
729:	0	0	0	1	0	1	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

0098

2

801: 0 0 0 0 0 0 0 0 0

Sample Title: 08

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

2

0099

LCB
9/19/18

Sample Description: FIELD DUPLICATE
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 09
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_047
 Chamber Serial Number: 10006125A
 Detector Serial Number: 91086
 Env. Background: System Bkgd 225258
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.470E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:21 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

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	5.528	-1.19	180.60	1.19	0.00E+000	0.0
RA-226	4.522	5.66	85.23	0.34	0.00E+000	3.0

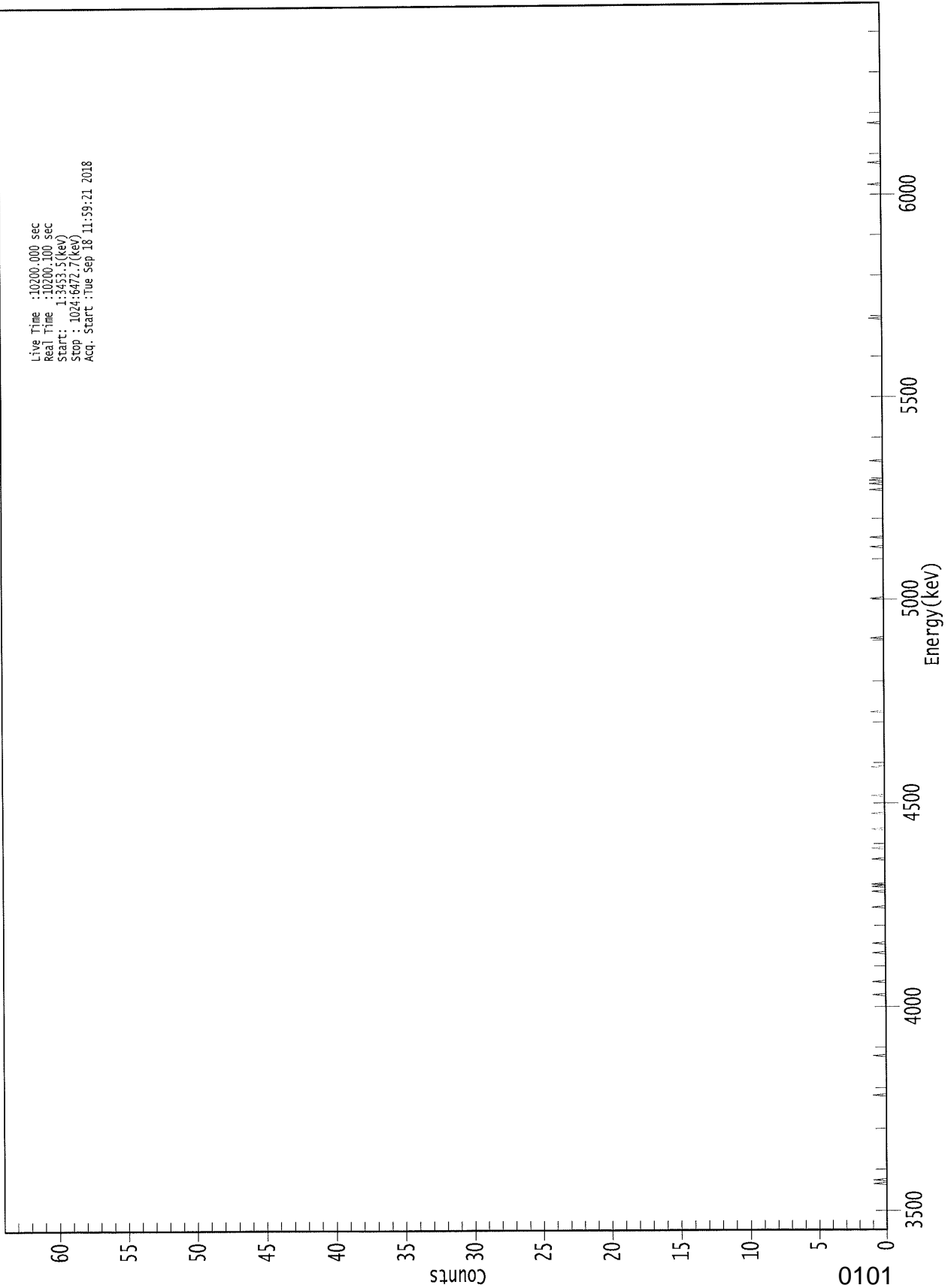
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.968	5685.50*	-4.72E-002 +/- 8.52E-002	2.61E-001 +/- 8.85E-003
RA-226	0.914	4785.00*	2.12E-001 +/- 1.81E-001	1.79E-001 +/- 6.07E-003

AG
9/19/18

0000222530.CNF

Live Time :10200.000 sec
Real Time :10200.100 sec
Start : 1:3433.5(kev)
Stop : 1024:6472.7(kev)
Acq. Start : Tue Sep 18 11:59:21 2018



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

Sample Title: 09

Elapsed Live time: 10200
 Elapsed Real Time: 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	1	0	0
41:	0	1	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0	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	1
113:	0	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0	0
145:	1	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	1	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	1	0	0
233:	0	0	0	0	0	0	1	0	0
241:	0	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0	0
265:	0	0	0	0	1	0	0	0	0
273:	0	0	0	0	0	0	0	0	0
281:	0	1	0	0	0	1	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	1	0	0	0	0
313:	0	0	0	0	0	1	0	0	0
321:	0	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	1	0	0	0
337:	0	0	0	0	0	0	0	0	0
345:	0	0	1	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0	0
361:	0	1	0	0	0	0	0	0	0

0102

2

369: 0 0 0 0 0 0 0 0 0

Sample Title: 09

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	0
385:	0	1	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	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	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	1	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	1	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:	1	0	0	0	0	0	0	0
577:	1	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:	1	0	0	0	0	1	0	0
625:	1	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	1	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	1
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

0103

2

801: 0 0 0 0 0 0 0 0 0

Sample Title: 09

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	1
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	1	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	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

0104

CS
9/19/18

Sample Description: BRYANT POND 2
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 10
 Sample Geometry: Shelf 2
 Procedure Description: Ra

Detector Name: Alpha_048
 Chamber Serial Number: 10006125B
 Detector Serial Number: 83111
 Env. Background: System Bkgd 225259
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Generic Mult. Factor: 2.580E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/5/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:23 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

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.562	1.13	315.94	1.87	0.00E+000	3.0
RA-226	4.600	11.11	67.16	2.89	0.00E+000	3.0

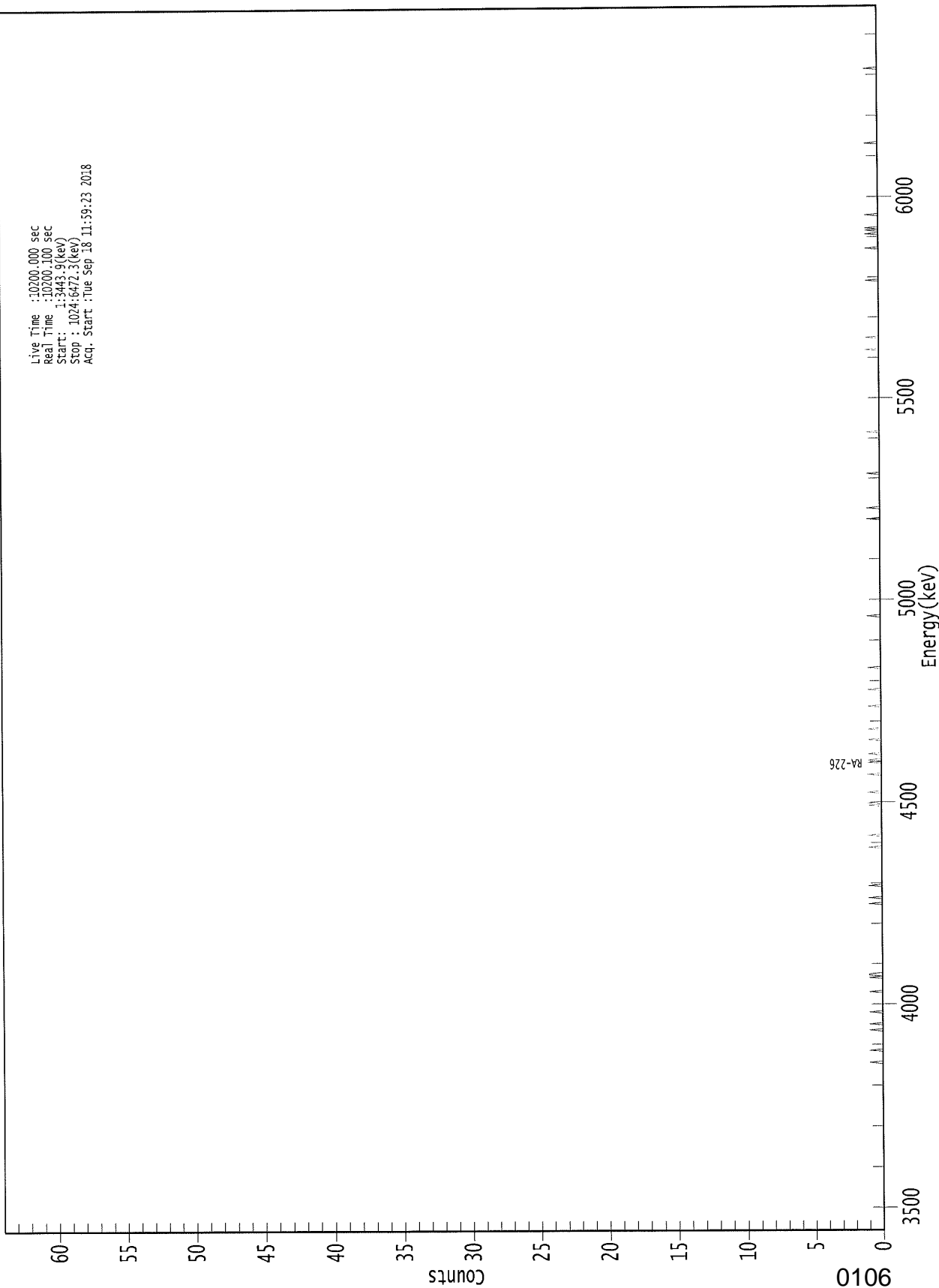
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.980	5685.50*	4.64E-002 +/- 1.46E-001	3.11E-001 +/- 1.05E-002
RA-226	0.956	4785.00*	4.32E-001 +/- 2.90E-001	3.40E-001 +/- 1.15E-002

AG
9/19/18

0000222533.CNF

Live Time : 10200.000 sec
Real Time : 10200.100 Sec
Start : 1:3443.9 (keV)
Stop : 1024:6472.3 (keV)
Acq. Start : Tue Sep 18 11:59:23 2018



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

Sample Title: 10

Elapsed Live time: 10200

Elapsed Real Time: 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	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	1	0	0	0	0
145:	0	0	0	0	0	1	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	1	0
169:	0	0	0	1	0	0	0	0
177:	0	0	0	0	0	1	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	1	0
201:	0	0	0	0	0	0	0	0
209:	0	0	1	0	1	1	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	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	1	0	0	0	0	1	0	0
281:	0	0	0	0	0	0	0	1
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	1
321:	0	0	0	0	0	0	0	0
329:	0	1	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	1	0	1	0	0	0
361:	0	0	0	0	0	1	0	0

0107

369: 0 0 0 0 0 0 0 0 0

Sample Title: 10

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	1	0	0	0
385:	0	0	0	0	0	0	1	0
393:	1	0	0	0	0	1	0	0
401:	0	0	0	0	0	0	0	0
409:	0	1	0	0	0	0	0	0
417:	0	0	1	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	1	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	0	1	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	1	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:	1	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	1	0	0	0	0	0	0
601:	0	0	1	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	1
633:	0	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	1	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	1
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	1	0	0	0	0	0	0

0108

2

801: 0 0 0 0 0 0 0 0 0

Sample Title: 10

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

108
9/19/18

Sample Description: BRYANT POND 7
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 11
 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: 2.870E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/5/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:25 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	5.479	-0.74	505.04	3.74	0.00E+000	3.0
RA-226	4.601	5.30	99.84	1.70	0.00E+000	3.0

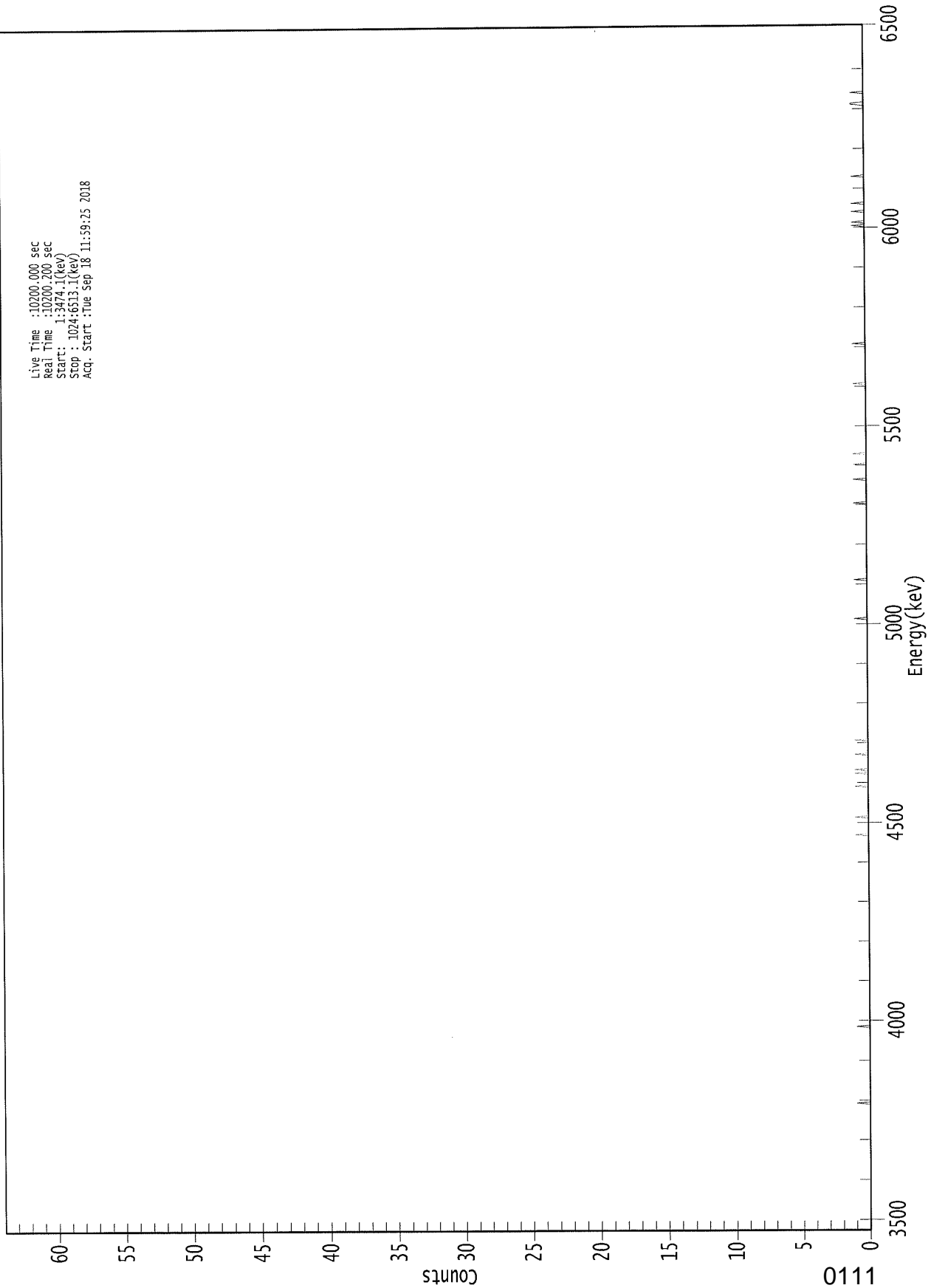
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.946	5685.50*	-3.80E-002 +/- 1.92E-001	4.92E-001 +/- 1.73E-002
RA-226	0.957	4785.00*	2.58E-001 +/- 2.57E-001	3.57E-001 +/- 1.26E-002

AG
9/19/18

0000222529.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:3474.1(keV)
Stop : 1024:6513.1(keV)
Acq. Start :Tue Sep 18 11:59:25 2018



ROI Type: 1

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

Sample Title: 11

Elapsed Live time: 10200
 Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----	-----
1:	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	1	0	0	0	0	0
113:	0	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0	0
169:	0	0	0	0	1	0	0	0	0
177:	0	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0	1
337:	0	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	1	0	0
353:	0	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0	0

0112

2

369: 0 0 0 0 0 0 0 0 0

Sample Title: 11

Channel	1	0	0	0	0	0	0	0
377:	1	0	0	0	0	0	0	0
385:	0	0	0	1	0	0	1	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	1	0	0	0	0
409:	0	0	0	0	0	0	0	1
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	1	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	1
553:	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	1	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	1	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	1	0	0	0	0	0	0
657:	0	0	1	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	1	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	1	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

0113



801: 0 0 0 0 0 0 0 0

Sample Title: 11

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

2

0114

KS
9/19/18

Apex-Alpha™

2

Sample Description: BRYANT POND 12
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 12
 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: 2.820E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/5/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:27 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	5.558	2.32	149.12	0.68	0.00E+000	3.0
RA-226	4.651	1.49	190.02	0.51	0.00E+000	3.0

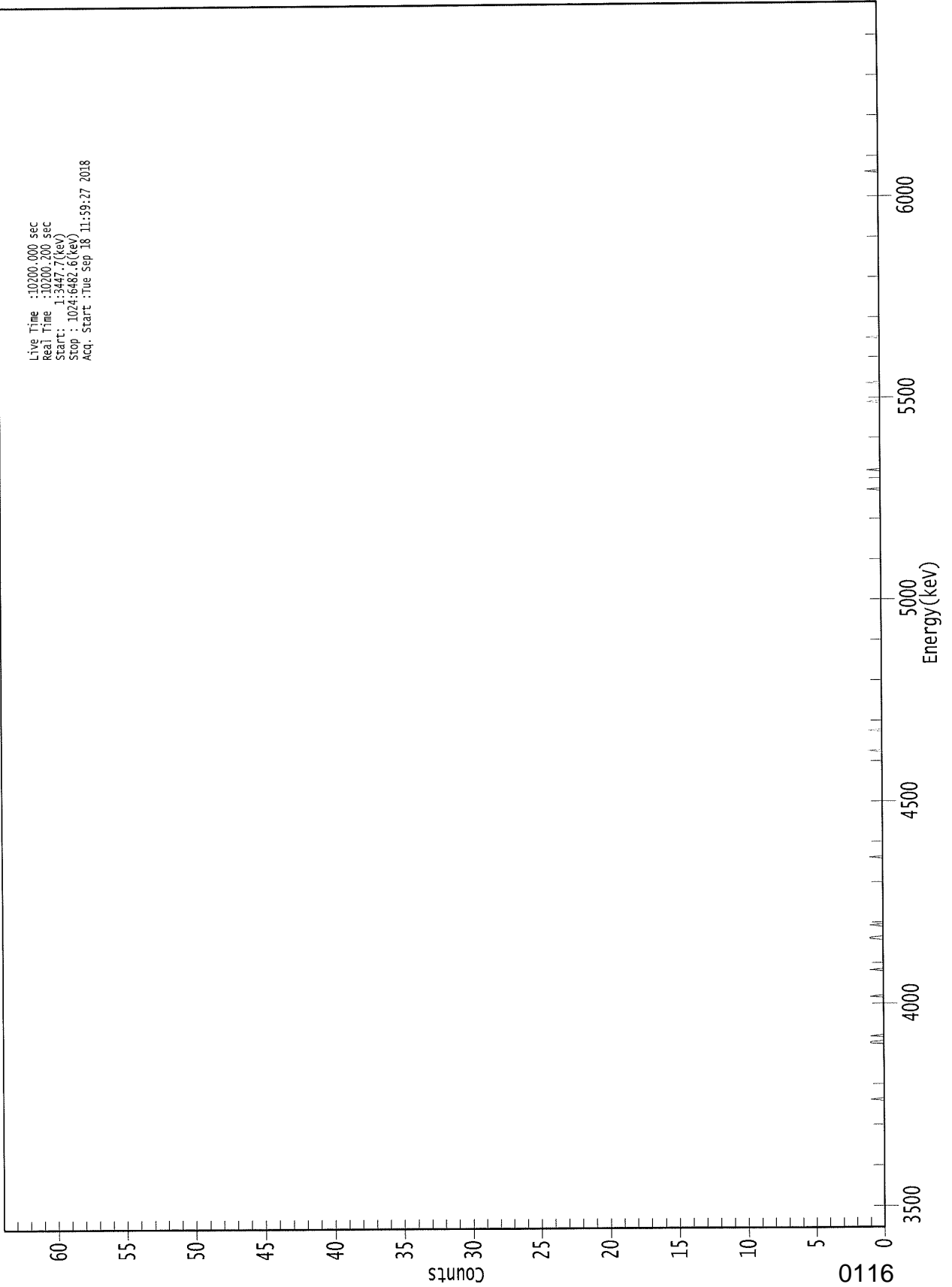
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.979	5685.50*	1.34E-001 +/- 1.99E-001	3.25E-001 +/- 1.16E-002
RA-226	0.977	4785.00*	8.13E-002 +/- 1.55E-001	2.86E-001 +/- 1.02E-002

AG
 9/19/18

0000222523.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:3447.7(kev)
Stop : 1024:0482.6(kev)
Acq. Start :Tue Sep 18 11:59:27 2018



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

Sample Title: 12

Elapsed Live time: 10200

Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	1	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	1	1	0	0	0	0	1
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:	1	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	1	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:	1	1	0	0	0	0	0	0
249:	0	0	0	1	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	1	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

0117



369: 0 0 0 0 0 0 0 0 0

Sample Title: 12

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	1	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	1	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	1
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	1
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	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:	1	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	1	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	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	0	0	0	0	0

0118



801: 0 0 0 0 0 0 0 0

Sample Title: 12

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

2

KCS
9/19/18

Sample Description: EQUIPMENT BLANK
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002225
 Batch Identification: 1809016A-RA
 Sample Identification: 13
 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: 2.340E+000 Generic Div. Factor: 1.000E+000
 Sample Date/Time: 9/4/2018 10:02:31 AM
 Acquisition Date/Time: 9/18/2018 11:59:28 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	5.531	-2.21	104.02	2.21	0.00E+000	0.0
RA-226	4.644	2.81	142.99	1.19	0.00E+000	3.0

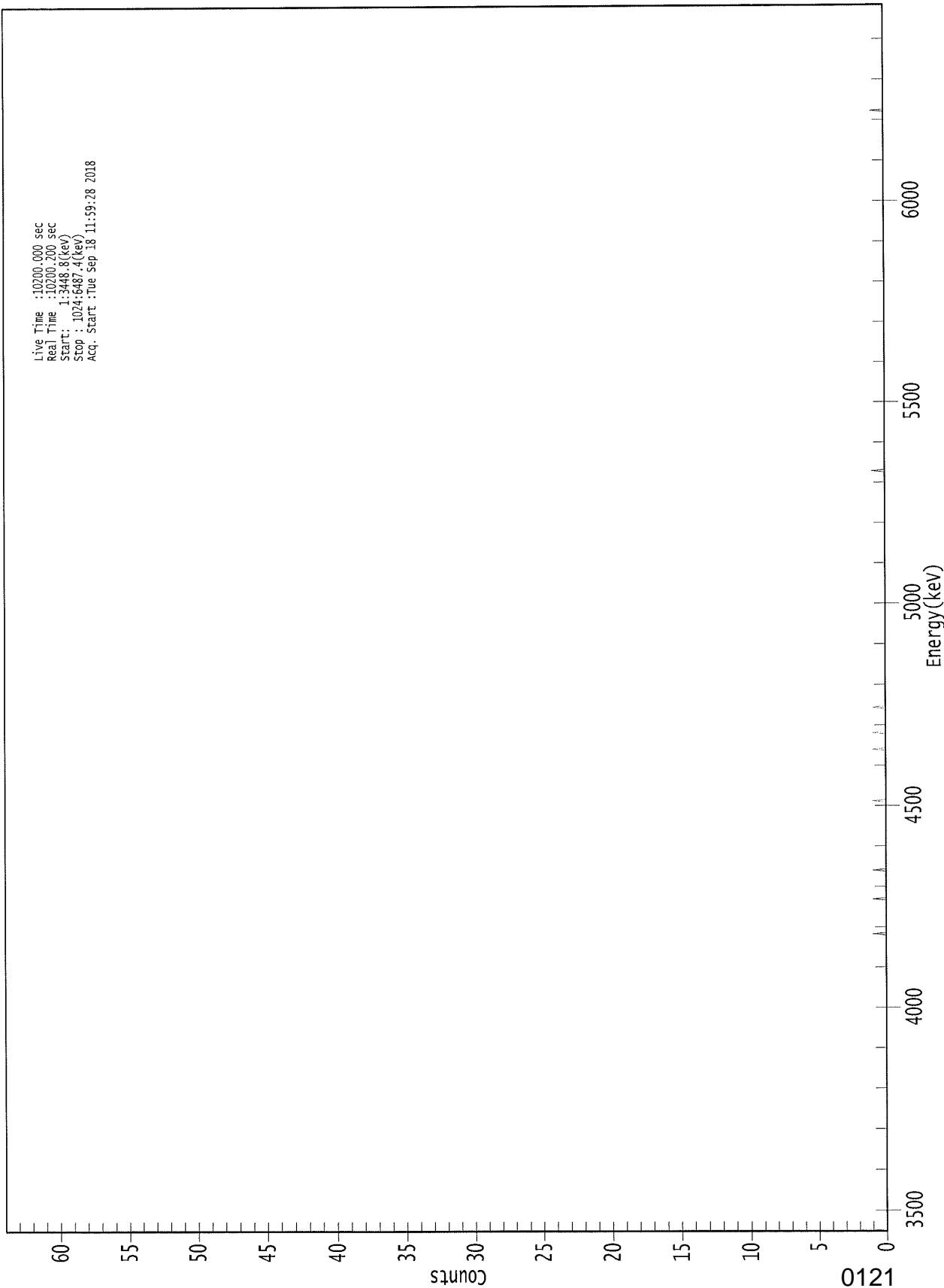
 ----- NUCLIDE ANALYSIS RESULTS -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.969	5685.50*	-9.97E-002 +/- 1.04E-001	3.61E-001 +/- 1.28E-002
RA-226	0.974	4785.00*	1.20E-001 +/- 1.72E-001	2.81E-001 +/- 9.97E-003

AG
9/19/18

0000222522.CNF

Live Time :10200.000 sec
Real Time :10200.200 Sec
Start: 1:348.8(keV)
Stop : 1024:6487.4(keV)
Acq. Start :Tue Sep 18 11:59:28 2018



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

Sample Title: 13

Elapsed Live time: 10200

Elapsed Real Time: 10200

Channel	-----	-----	-----	-----	-----	-----	-----	-----
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	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	1
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	1	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	1	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	1	0
361:	0	0	0	0	0	0	0	0

0122



369: 0 0 0 0 0 0 0 0

Sample Title: 13

Channel	-----	-----	-----	-----	-----	-----	-----	-----
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	1	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	1
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	0	1	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	1	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

0123

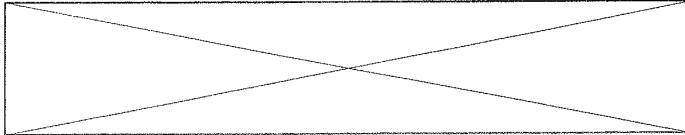


801: 0 0 0 0 0 0 0 0 0

Sample Title: 13

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

2



QA SUMMARY REPORT

Review Of QA Results - Pulser Check

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

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	9/18/2018 4:54:15 AM
Alpha 004	21f	ALL	Passed	9/18/2018 4:54:15 AM
Alpha 005	21f	ALL	Not Done	
Alpha 006	21f	ALL	Not Done	
Alpha 007	21f	ALL	Not Done	
Alpha 008	21f	ALL	Not Done	
Alpha 009	21f	ALL	Not Done	
Alpha 010	21f	ALL	Not Done	
Alpha 011	21f	ALL	Passed	9/18/2018 4:54:16 AM
Alpha 012	21f	ALL	Passed	9/18/2018 4:54:17 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	9/18/2018 4:54:18 AM
Alpha 015	21f	Peak Energy	Action	9/17/2018 5:01:16 AM
Alpha 015	21f	Peak FWHM	Action	9/17/2018 5:01:16 AM
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	Peak Energy	Action	9/14/2018 5:06:36 AM
Alpha 034	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:22 AM
Alpha 035	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:23 AM
Alpha 036	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:25 AM
Alpha 037	Alpha Analyst100DC	ALL	Not Done	
Alpha 038	Alpha Analyst100DC	ALL	Not Done	
Alpha 039	Alpha Analyst100DC	Peak FWHM	Action	9/18/2018 4:54:27 AM
Alpha 040	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:28 AM
Alpha 041	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:30 AM
Alpha 042	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:32 AM
Alpha 043	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:34 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:36 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:39 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:41 AM
Alpha 047	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:43 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:46 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:48 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:50 AM
Alpha 051	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:53 AM
Alpha 052	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:55 AM
Alpha 053	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:54:58 AM
Alpha 054	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:00 AM
Alpha 055	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:03 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:05 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	9/18/2018 4:55:08 AM

0125

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

2

APPROVED BY: KP

APPROVAL DATE: 9/18/18

0126

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*****
***** LIBRARY LISTING REPORT *****
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Nuclide Library Title: Radium

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

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

* = key line

TOTALS: 3 Nuclides 3 Energy Lines



SECTION IX
ANALYTICAL DATA (RADIUM-228)

0128

Work Order	18-09016
Analysis Code	Ra228
Run	1
Date Received	9/7/2018
Lab Deadline	9/26/2018
Client	SGS North America Inc.
Project	ENV
Report Level	4
Activity Units	pCi
Aliquot Units	I
Matrix	WA
Method	EPA 904.0
Instrument Type	Alpha/Beta GPC
Radiometric Tracer	Ba-133
Radiometric Sol#	Ba-6a
Tracer Act (dpm/g)	474.18
Carrier	Yttrium
Carrier Conc (mg/ml)	30.05

0129

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/07/18 00:00	1.0000E+00
02	MBL	BLANK		09/07/18 00:00	1.0000E+00
03	DUP	EQUIPMENT BLANK	38	09/04/18 10:40	1.0000E+00
04	TRG	HANSON RELIEF WELL	43	09/04/18 10:45	1.0000E+00
05	TRG	BILLINGSLEY RELIEF WELL	44	09/04/18 11:40	1.0000E+00
06	TRG	DAVID MASON RELIEF WELL	36	09/04/18 14:50	1.0000E+00
07	TRG	DENNISON RIG SUPPLY WELL	36	09/04/18 16:30	1.0000E+00
08	TRG	GAMBLE RIG SUPPLY WELL	37	09/04/18 16:45	1.0000E+00
09	TRG	FIELD DUPLICATE	41	09/04/18 16:35	1.0000E+00
10	TRG	BRYANT POND 2	43	09/05/18 11:45	1.0000E+00
11	TRG	BRYANT POND 7	40	09/05/18 11:15	1.0000E+00
12	TRG	BRYANT POND 12	43	09/05/18 10:45	1.0000E+00
13	DO	EQUIPMENT BLANK	38	09/04/18 10:40	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	2.0393	967.0	666.0	152.90	2.100	0.0819	0.1440	0.0621	98.41	108.25	1.00	1.00
02	MBL	2.0323	963.7	594.0	136.84	2.000	0.0817	0.1413	0.0596	99.17	109.08	1.00	1.00
03	DUP	2.0324	963.7	488.0	112.41	2.150	0.0780	0.1420	0.0640	99.06	108.97	1.00	1.00
04	TRG	2.0288	962.0	594.0	137.07	2.050	0.0818	0.1420	0.0602	97.72	107.50	1.00	1.00
05	TRG	2.0306	962.9	652.0	150.33	2.150	0.0780	0.1418	0.0638	98.75	108.63	1.00	1.00
06	TRG	2.0281	961.7	583.0	134.58	2.000	0.0820	0.1414	0.0594	98.84	108.72	1.00	1.00
07	TRG	2.0254	960.4	950.0	219.60	2.050	0.0818	0.1422	0.0604	98.05	107.85	1.00	1.00
08	TRG	2.0244	959.9	585.0	135.29	2.150	0.0781	0.1426	0.0645	99.83	109.82	1.00	1.00
09	TRG	2.0217	958.6	543.0	125.75	2.100	0.0815	0.1437	0.0622	98.57	108.42	1.00	1.00
10	TRG	2.0194	957.6	850.0	197.06	2.100	0.0780	0.1403	0.0623	98.72	108.60	1.00	1.00
11	TRG	2.0196	957.7	521.0	120.78	2.000	0.0817	0.1417	0.0600	99.83	109.82	1.00	1.00
12	TRG	2.0185	957.1	545.0	126.41	2.150	0.0804	0.1450	0.0646	99.99	109.99	1.00	1.00
13	DO	2.0204	958.0	762.0	176.57	2.100	0.0810	0.1437	0.0627	99.36	109.29	1.00	1.00

0130

* 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			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
02	MBL			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
03	DUP			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
04	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
05	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
06	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
07	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
08	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
09	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
10	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
11	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
12	TRG			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY
13	DO			09/19/18 11:50	JBAILEY	09/18/18 09:00	JBAILEY	09/19/18 12:28	JBAILEY

0131

* 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.

	1 Run	Ra228 Analysis Code	18-09016 Eberline Analytical Work Order	SGS North America Inc. Client	0132
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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	1.02E+01	7.95E-01	9.43E-01	9.01E+00	113.37	OK		OK	
02	RA-228	MBL	BLANK	pCi/l	3.22E-01	3.33E-01	6.75E-01					OK	OK
03	RA-228	DUP	EQUIPMENT BLANK	pCi/l	2.68E-01	3.48E-01	7.15E-01				NA	OK	OK
04	RA-228	TRG	HANSON RELIEF WELL	pCi/l	2.10E+00	4.23E-01	6.69E-01					OK	OK
05	RA-228	TRG	BILLINGSLEY RELIEF WELL	pCi/l	2.90E-01	3.69E-01	7.58E-01					OK	OK
06	RA-228	TRG	DAVID MASON RELIEF WELL	pCi/l	3.83E+00	5.44E-01	8.08E-01					OK	OK
07	RA-228	TRG	DENNISON RIG SUPPLY WELL	pCi/l	1.47E+00	4.45E-01	8.02E-01					OK	OK
08	RA-228	TRG	GAMBLE RIG SUPPLY WELL	pCi/l	3.36E-01	3.84E-01	7.83E-01					OK	OK
09	RA-228	TRG	FIELD DUPLICATE	pCi/l	4.85E-01	3.96E-01	7.94E-01					OK	OK
10	RA-228	TRG	BRYANT POND 2	pCi/l	-1.18E-01	4.36E-01	9.41E-01					OK	OK
11	RA-228	TRG	BRYANT POND 7	pCi/l	2.29E-01	4.23E-01	8.78E-01					OK	OK
12	RA-228	TRG	BRYANT POND 12	pCi/l	2.46E-01	3.82E-01	7.89E-01					OK	OK
13	RA-228	DO	EQUIPMENT BLANK	pCi/l	1.13E+00	4.23E-01	7.81E-01					OK	OK

		Client SGS North America Inc.	Eberline Analytical Work Order 18-09016	Analysis Code Ra228	Run 1
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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-228	LCS	09/07/18 00:00	1.00E+00	152.90	98.41	108.25	1.00	9/18/2018 9:00	9/19/2018 12:28
02	RA-228	MBL	09/07/18 00:00	1.00E+00	136.84	99.17	109.08	1.00	9/18/2018 9:00	9/19/2018 12:28
03	RA-228	DUP	09/04/18 10:40	1.00E+00	112.41	99.06	108.97	1.00	9/18/2018 9:00	9/19/2018 12:28
04	RA-228	TRG	09/04/18 10:45	1.00E+00	137.07	97.72	107.50	1.00	9/18/2018 9:00	9/19/2018 12:28
05	RA-228	TRG	09/04/18 11:40	1.00E+00	150.33	98.75	108.63	1.00	9/18/2018 9:00	9/19/2018 12:28
06	RA-228	TRG	09/04/18 14:50	1.00E+00	134.58	98.84	108.72	1.00	9/18/2018 9:00	9/19/2018 12:28
07	RA-228	TRG	09/04/18 16:30	1.00E+00	219.60	98.05	107.85	1.00	9/18/2018 9:00	9/19/2018 12:28
08	RA-228	TRG	09/04/18 16:45	1.00E+00	135.29	99.83	109.82	1.00	9/18/2018 9:00	9/19/2018 12:28
09	RA-228	TRG	09/04/18 16:35	1.00E+00	125.75	98.57	108.42	1.00	9/18/2018 9:00	9/19/2018 12:28
10	RA-228	TRG	09/05/18 11:45	1.00E+00	197.06	98.72	108.60	1.00	9/18/2018 9:00	9/19/2018 12:28
11	RA-228	TRG	09/05/18 11:15	1.00E+00	120.78	99.83	109.82	1.00	9/18/2018 9:00	9/19/2018 12:28
12	RA-228	TRG	09/05/18 10:45	1.00E+00	126.41	99.99	109.99	1.00	9/18/2018 9:00	9/19/2018 12:28
13	RA-228	DO	09/04/18 10:40	1.00E+00	176.57	99.36	109.29	1.00	9/18/2018 9:00	9/19/2018 12:28

	Run	1
	Analysis Code	Ra228
	Eberline Analytical Work Order	18-09016
Client	SGS North America Inc.	
0134		

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Half-life (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-228	LCS	09/19/18 14:05		LB4110A	F1	120	1125	1.716666667	0.4754
02	RA-228	MBL	09/19/18 14:05		LB4110A	F2	120	149	0.983333333	0.4658
03	RA-228	DUP	09/19/18 14:05		LB4110A	F3	120	162	1.133333333	0.4713
04	RA-228	TRG	09/19/18 14:05		LB4110A	F4	120	322	0.983333333	0.4773
05	RA-228	TRG	09/19/18 14:05		LB4110A	G1	120	180	1.266666667	0.4705
06	RA-228	TRG	09/19/18 14:05		LB4110A	G2	120	540	1.433333333	0.4676
07	RA-228	TRG	09/19/18 14:05		LB4110A	A1	120	320	1.466666667	0.4803
08	RA-228	TRG	09/19/18 14:05		LB4110A	A2	120	201	1.4	0.4724
09	RA-228	TRG	09/19/18 14:05		LB4110A	A3	120	215	1.4	0.4719
10	RA-228	TRG	09/19/18 14:05		LB4110A	A4	120	211	1.85	0.4548
11	RA-228	TRG	09/19/18 14:05		LB4110A	B1	120	226	1.7	0.4626
12	RA-228	TRG	09/19/18 14:05		LB4110A	B3	120	177	1.283333333	0.449
13	RA-228	DO	09/19/18 14:05		LB4110A	B4	120	266	1.316666667	0.4619

Count Room Report
Client: SGS North America Inc.

18-09016-Ra228-1 (pCi/l) in WA
Tracer ID: Ba-6a

Internal Fraction	Sample Desc	Client ID	Sample Date	Sample Aliquot	Tracer Aliquot (g)	Tracer ACT (dpm)	Radiometric Tracer (pCi)	Radiometric % Rec	SAF 1*	SAF 2*
01	LCS	LCS	09/07/18 00:00	1.0000	2.0393	966.9953	666.0000	152.90	1.00	1.00
02	MBL	BLANK	09/07/18 00:00	1.0000	2.0323	963.6760	594.0000	136.84	1.00	1.00
03	DUP	EQUIPMENT BLANK	09/04/18 10:40	1.0000	2.0324	963.7234	488.0000	112.41	1.00	1.00
04	TRG	HANSON RELIEF WELL	09/04/18 10:45	1.0000	2.0288	962.0164	594.0000	137.07	1.00	1.00
05	TRG	BILLINGSLEY RELIEF WELL	09/04/18 11:40	1.0000	2.0306	962.8699	652.0000	150.33	1.00	1.00
06	TRG	DAVID MASON RELIEF WELL	09/04/18 14:50	1.0000	2.0281	961.6845	583.0000	134.58	1.00	1.00
07	TRG	JENNISON RIG SUPPLY WELL	09/04/18 16:30	1.0000	2.0254	960.4042	950.0000	219.60	1.00	1.00
08	TRG	GAMBLE RIG SUPPLY WELL	09/04/18 16:45	1.0000	2.0244	959.9300	585.0000	135.29	1.00	1.00
09	TRG	FIELD DUPLICATE	09/04/18 16:35	1.0000	2.0217	958.6497	543.0000	125.75	1.00	1.00
10	TRG	BRYANT POND 2	09/05/18 11:45	1.0000	2.0194	957.5591	850.0000	197.06	1.00	1.00
11	TRG	BRYANT POND 7	09/05/18 11:15	1.0000	2.0196	957.6539	521.0000	120.78	1.00	1.00
12	TRG	BRYANT POND 12	09/05/18 10:45	1.0000	2.0185	957.1323	545.0000	126.41	1.00	1.00
13	DO	EQUIPMENT BLANK	09/04/18 10:40	1.0000	2.0204	958.0333	762.0000	176.57	1.00	1.00

0135

Aliquot Worksheet

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
18-09016	1	Ra228	liters	9/26/2018	JHARVEY

Lab Fraction	Sample		Muffle Data		Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
	Client ID	Type	Ratio Post/Pre	No of Dils	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq	
01	LCS	LCS					1.0000E+00	1.0000E+00					
02	BLANK	MBL					1.0000E+00	1.0000E+00					
03	EQUIPMENT BLANK	DUP					1.0000E+00	1.0000E+00					
04	HANSON RELIEF WELL	TRG					1.0000E+00	1.0000E+00					
05	BILLINGSLEY RELIEF WELL	TRG					1.0000E+00	1.0000E+00					
06	DAVID MASON RELIEF WELL	TRG					1.0000E+00	1.0000E+00					
07	DENNISON RIG SUPPLY WELL	TRG					1.0000E+00	1.0000E+00					
08	GAMBLE RIG SUPPLY WELL	TRG					1.0000E+00	1.0000E+00					
09	FIELD DUPLICATE	TRG					1.0000E+00	1.0000E+00					
10	BRYANT POND 2	TRG					1.0000E+00	1.0000E+00					
11	BRYANT POND 7	TRG					1.0000E+00	1.0000E+00					
12	BRYANT POND 12	TRG					1.0000E+00	1.0000E+00					
13	EQUIPMENT BLANK	DO					1.0000E+00	1.0000E+00					

Comments

0137


Technician: J Harvey Date: 9/13/18

Gravimetric Worksheet

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
18-09016	1	Ra228	Yttrium	30.0500	JBAILEY

TRetec Fraction	Sample		Carrier Data		Filter Data			Gravimetric % Recovery
	Client ID	Type	Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)		
01	LCS	LCS	2.1000	0.0819	0.1440	0.0621	98.41	
02	BLANK	MBL	2.0000	0.0817	0.1413	0.0596	99.17	
03	DUP	DUP	2.1500	0.0780	0.1420	0.0640	99.06	
04	HANSON RELIEF WELL	TRG	2.0500	0.0818	0.1420	0.0602	97.72	
05	BILLINGSLEY RELIEF WELL	TRG	2.1500	0.0780	0.1418	0.0638	98.75	
06	DAVID MASON RELIEF WELL	TRG	2.0000	0.0820	0.1414	0.0594	98.84	
07	DENNISON RIG SUPPLY WELL	TRG	2.0500	0.0818	0.1422	0.0604	98.05	
08	GAMBLE RIG SUPPLY WELL	TRG	2.1500	0.0781	0.1426	0.0645	99.83	
09	FIELD DUPLICATE	TRG	2.1000	0.0815	0.1437	0.0622	98.57	
10	BRYANT POND 2	TRG	2.1000	0.0780	0.1403	0.0623	98.72	
11	BRYANT POND 7	TRG	2.0000	0.0817	0.1417	0.0600	99.83	
12	BRYANT POND 12	TRG	2.1500	0.0804	0.1450	0.0646	99.99	
13	EQUIPMENT BLANK	DO	2.1000	0.0810	0.1437	0.0627	99.36	

0138

Technician:  Date: 9/19/18

RB
9/19/18

Detector ID	Sample ID	Alpha	Beta	Count Time	Voltage	TOD
F1	1809016-01	38	1125	120	1410	9/19/2018 2:05:05 PM
F2	1809016-02	7	149	120	1410	9/19/2018 2:05:05 PM
F3	1809016-03	10	162	120	1410	9/19/2018 2:05:05 PM
F4	1809016-04	10	322	120	1410	9/19/2018 2:05:05 PM
G1	1809016-05	18	180	120	1410	9/19/2018 2:05:06 PM
G2	1809016-06	8	540	120	1410	9/19/2018 2:05:06 PM
A1	1809016-07	21	320	120	1410	9/19/2018 2:05:04 PM
A2	1809016-08	11	201	120	1410	9/19/2018 2:05:04 PM
A3	1809016-09	18	215	120	1410	9/19/2018 2:05:05 PM
A4	1809016-10	20	211	120	1410	9/19/2018 2:05:05 PM
B1	1809016-11	17	226	120	1410	9/19/2018 2:05:05 PM
B3	1809016-12	19	177	120	1410	9/19/2018 2:05:05 PM
B4	1809016-13	7	266	120	1410	9/19/2018 2:05:05 PM

0139

GPC Detector Report
(ALL Backgrounds)

RP
9/19/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
.B4110A - A1	Alpha	11/2/2017	9/19/2018	1.00E-01	P	-3.57E-02	9.18E-02	2.19E-01
.B4110A - A2	Alpha	11/2/2017	9/19/2018	3.33E-02	P	-5.10E-02	9.55E-02	2.42E-01
.B4110A - A3	Alpha	11/2/2017	9/19/2018	1.33E-01	P	-3.28E-02	1.03E-01	2.39E-01
.B4110A - A4	Alpha	11/2/2017	9/19/2018	1.17E-01	P	-3.02E-02	9.15E-02	2.13E-01
.B4110A - B1	Alpha	11/2/2017	9/19/2018	1.67E-01	P	-3.49E-02	1.12E-01	2.58E-01
.B4110A - B2	Alpha	11/2/2017	9/19/2018	2.33E-01	P	-1.56E-02	1.16E-01	2.48E-01
.B4110A - B3	Alpha	11/2/2017	9/19/2018	6.67E-02	P	-5.62E-02	7.97E-02	2.16E-01
.B4110A - B4	Alpha	11/2/2017	9/19/2018	1.67E-02	P	-3.89E-02	7.95E-02	1.98E-01
.B4110A - C1	Alpha	11/2/2017	9/19/2018	1.00E-01	P	-2.36E-02	8.75E-02	1.99E-01
.B4110A - C2	Alpha	11/2/2017	9/19/2018	1.00E-01	P	-3.89E-02	5.92E-02	1.57E-01
.B4110A - C3	Alpha	11/2/2017	9/19/2018	8.33E-02	P	-5.54E-02	6.80E-02	1.91E-01
.B4110A - C4	Alpha	11/2/2017	9/19/2018	1.67E-01	P	-3.04E-02	8.09E-02	1.92E-01
.B4110A - D1	Alpha	11/2/2017	9/19/2018	4.00E-01	F	-3.42E-02	1.36E-01	3.06E-01
.B4110A - D2	Alpha	11/2/2017	9/19/2018	3.17E-01	F	-1.75E-02	1.25E-01	2.67E-01
.B4110A - D3	Alpha	11/2/2017	9/19/2018	1.00E-01	P	-4.46E-02	1.05E-01	2.55E-01
.B4110A - D4	Alpha	11/2/2017	9/19/2018	1.00E-01	P	-2.10E-02	1.46E-01	3.13E-01
.B4110A - E1	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-4.29E-02	1.10E-01	2.62E-01
.B4110A - E2	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-3.09E-02	6.37E-02	1.58E-01
.B4110A - E3	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-8.81E-02	9.11E-02	2.70E-01
.B4110A - E4	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-4.55E-02	7.04E-02	1.86E-01
.B4110A - F1	Alpha	11/2/2017	9/19/2018	2.00E-01	P	-4.02E-02	7.40E-02	1.88E-01
.B4110A - F2	Alpha	11/2/2017	9/19/2018	1.83E-01	P	-3.30E-02	5.11E-02	1.35E-01
.B4110A - F3	Alpha	11/2/2017	9/19/2018	1.00E-01	P	-4.80E-02	6.15E-02	1.71E-01
.B4110A - F4	Alpha	11/2/2017	9/19/2018	6.67E-02	P	-2.23E-02	7.21E-02	1.67E-01
.B4110A - G1	Alpha	11/2/2017	9/19/2018	1.50E-01	P	-4.61E-02	6.03E-02	1.67E-01
.B4110A - G2	Alpha	11/2/2017	9/19/2018	1.00E-01	P	-4.26E-02	7.57E-02	1.94E-01
.B4110A - G3	Alpha	11/2/2017	9/19/2018	2.00E-01	P	-4.60E-02	8.24E-02	2.11E-01
.B4110A - G4	Alpha	11/2/2017	9/19/2018	8.33E-02	P	-3.06E-02	8.09E-02	1.92E-01

0140

GPC Detector Report
(ALL Backgrounds)

VP
9/19/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	9/19/2018	1.47E+00	P	8.44E-01	1.37E+00	1.90E+00
LB4110A - A2	Beta	11/2/2017	9/19/2018	1.40E+00	P	9.16E-01	1.51E+00	2.10E+00
LB4110A - A3	Beta	11/2/2017	9/19/2018	1.40E+00	P	1.02E+00	1.51E+00	2.00E+00
LB4110A - A4	Beta	11/2/2017	9/19/2018	1.85E+00	P	9.43E-01	1.41E+00	1.88E+00
LB4110A - B1	Beta	11/2/2017	9/19/2018	1.70E+00	P	1.06E+00	1.55E+00	2.04E+00
LB4110A - B2	Beta	11/2/2017	9/19/2018	1.82E+00	P	6.65E-01	1.52E+00	2.37E+00
LB4110A - B3	Beta	11/2/2017	9/19/2018	1.28E+00	P	9.18E-01	1.36E+00	1.81E+00
LB4110A - B4	Beta	11/2/2017	9/19/2018	1.32E+00	P	7.34E-01	1.37E+00	2.01E+00
LB4110A - C1	Beta	11/2/2017	9/19/2018	1.43E+00	P	8.19E-01	1.26E+00	1.70E+00
LB4110A - C2	Beta	11/2/2017	9/19/2018	1.32E+00	P	-4.06E-01	1.26E+00	2.93E+00
LB4110A - C3	Beta	11/2/2017	9/19/2018	2.17E+00	F	9.63E-01	1.80E+00	2.64E+00
LB4110A - C4	Beta	11/2/2017	9/19/2018	1.33E+00	P	7.89E-01	1.22E+00	1.66E+00
LB4110A - D1	Beta	11/2/2017	9/19/2018	1.52E+00	P	8.59E-01	1.33E+00	1.79E+00
LB4110A - D2	Beta	11/2/2017	9/19/2018	1.58E+00	P	-2.46E-01	1.63E+00	3.51E+00
LB4110A - D3	Beta	11/2/2017	9/19/2018	1.15E+00	P	7.65E-01	1.27E+00	1.78E+00
LB4110A - D4	Beta	11/2/2017	9/19/2018	1.75E+00	P	9.46E-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	9/19/2018	1.72E+00	P	8.79E-01	1.35E+00	1.83E+00
LB4110A - F2	Beta	11/2/2017	9/19/2018	9.83E-01	P	5.23E-01	8.97E-01	1.27E+00
LB4110A - F3	Beta	11/2/2017	9/19/2018	1.13E+00	P	2.92E-02	1.24E+00	2.44E+00
LB4110A - F4	Beta	11/2/2017	9/19/2018	9.83E-01	P	6.83E-01	1.15E+00	1.61E+00
LB4110A - G1	Beta	11/2/2017	9/19/2018	1.27E+00	P	6.89E-01	1.37E+00	2.06E+00
LB4110A - G2	Beta	11/2/2017	9/19/2018	1.43E+00	P	1.07E+00	1.82E+00	2.57E+00
LB4110A - G3	Beta	11/2/2017	9/19/2018	1.40E+00	P	7.61E-01	1.50E+00	2.24E+00
LB4110A - G4	Beta	11/2/2017	9/19/2018	1.30E+00	P	5.56E-01	1.47E+00	2.38E+00

0141

GPC Detector Report
(ALL Efficiencies)

kp
9/19/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	9/19/2018	0.2246	P	0.2137	0.2252	0.2368
LB4110A - A2	Alpha	11/2/2017	9/19/2018	0.2107	P	0.1968	0.2115	0.2262
LB4110A - A3	Alpha	11/2/2017	9/19/2018	0.1958	P	0.1837	0.1997	0.2158
LB4110A - A4	Alpha	11/2/2017	9/19/2018	0.2256	P	0.2059	0.2260	0.2461
LB4110A - B1	Alpha	11/2/2017	9/19/2018	0.2227	P	0.2035	0.2229	0.2423
LB4110A - B2	Alpha	11/2/2017	9/19/2018	0.2026	P	0.1833	0.2006	0.2180
LB4110A - B3	Alpha	11/2/2017	9/19/2018	0.2378	P	0.2176	0.2346	0.2516
LB4110A - B4	Alpha	11/2/2017	9/19/2018	0.2246	P	0.2034	0.2211	0.2388
LB4110A - C1	Alpha	11/2/2017	9/19/2018	0.2051	P	0.1948	0.2074	0.2199
LB4110A - C2	Alpha	11/2/2017	9/19/2018	0.2207	P	-0.1017	0.2241	0.5500
LB4110A - C3	Alpha	11/2/2017	9/19/2018	0.2444	P	0.2294	0.2423	0.2552
LB4110A - C4	Alpha	11/2/2017	9/19/2018	0.2105	P	0.1982	0.2147	0.2311
LB4110A - D1	Alpha	11/2/2017	9/19/2018	0.2195	P	0.2103	0.2219	0.2335
LB4110A - D2	Alpha	11/2/2017	9/19/2018	0.2495	P	0.2318	0.2509	0.2699
LB4110A - D3	Alpha	11/2/2017	9/19/2018	0.2484	P	0.2340	0.2496	0.2652
LB4110A - D4	Alpha	11/2/2017	9/19/2018	0.1950	P	0.1762	0.1958	0.2154
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	9/19/2018	0.2138	P	0.1608	0.2122	0.2636
LB4110A - F2	Alpha	11/2/2017	9/19/2018	0.1815	P	0.1709	0.1830	0.1951
LB4110A - F3	Alpha	11/2/2017	9/19/2018	0.2378	P	0.2214	0.2367	0.2521
LB4110A - F4	Alpha	11/2/2017	9/19/2018	0.2117	P	0.1928	0.2095	0.2262
LB4110A - G1	Alpha	11/2/2017	9/19/2018	0.1927	P	0.1856	0.1984	0.2111
LB4110A - G2	Alpha	11/2/2017	9/19/2018	0.1979	P	0.1919	0.2018	0.2117
LB4110A - G3	Alpha	11/2/2017	9/19/2018	0.2148	P	0.2106	0.2239	0.2372
LB4110A - G4	Alpha	11/2/2017	9/19/2018	0.1795	F	0.1847	0.1986	0.2125

0142

GPC Detector Report
(ALL Efficiencies)

JP
9/19/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	9/19/2018	0.5385	P	0.5097	0.5371	0.5644
LB4110A - A2	Beta	11/2/2017	9/19/2018	0.4637	P	0.4157	0.4643	0.5129
LB4110A - A3	Beta	11/2/2017	9/19/2018	0.4704	P	0.4359	0.4790	0.5221
LB4110A - A4	Beta	11/2/2017	9/19/2018	0.5416	P	0.4981	0.5408	0.5836
LB4110A - B1	Beta	11/2/2017	9/19/2018	0.5455	P	0.4985	0.5392	0.5799
LB4110A - B2	Beta	11/2/2017	9/19/2018	0.4970	P	0.4620	0.4994	0.5367
LB4110A - B3	Beta	11/2/2017	9/19/2018	0.5857	P	0.5442	0.5823	0.6205
LB4110A - B4	Beta	11/2/2017	9/19/2018	0.5682	P	0.5003	0.5429	0.5855
LB4110A - C1	Beta	11/2/2017	9/19/2018	0.4779	P	0.4433	0.4795	0.5156
LB4110A - C2	Beta	11/2/2017	9/19/2018	0.5254	P	0.4901	0.5180	0.5459
LB4110A - C3	Beta	11/2/2017	9/19/2018	0.6004	P	0.5672	0.5995	0.6318
LB4110A - C4	Beta	11/2/2017	9/19/2018	0.5178	P	0.4809	0.5237	0.5664
LB4110A - D1	Beta	11/2/2017	9/19/2018	0.6425	P	0.6150	0.6405	0.6661
LB4110A - D2	Beta	11/2/2017	9/19/2018	0.6392	P	0.5875	0.6423	0.6972
LB4110A - D3	Beta	11/2/2017	9/19/2018	0.6425	P	0.5993	0.6407	0.6820
LB4110A - D4	Beta	11/2/2017	9/19/2018	0.5000	P	0.4634	0.5038	0.5443
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	9/19/2018	0.5275	P	0.4008	0.5276	0.6545
LB4110A - F2	Beta	11/2/2017	9/19/2018	0.4504	P	0.4288	0.4576	0.4865
LB4110A - F3	Beta	11/2/2017	9/19/2018	0.6018	P	0.5698	0.6105	0.6512
LB4110A - F4	Beta	11/2/2017	9/19/2018	0.5286	P	0.4884	0.5299	0.5713
LB4110A - G1	Beta	11/2/2017	9/19/2018	0.4508	P	0.4334	0.4570	0.4806
LB4110A - G2	Beta	11/2/2017	9/19/2018	0.4682	W	0.4672	0.4855	0.5037
LB4110A - G3	Beta	11/2/2017	9/19/2018	0.5061	F	0.5101	0.5415	0.5729
LB4110A - G4	Beta	11/2/2017	9/19/2018	0.4293	F	0.4487	0.4843	0.5199

0143

SECTION X
BARIUM-133 ANALYTICAL TRACER DATA

0144

AP
9/18/18

2

Analysis Report for 1809016-01
SPIKE

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-01
 Sample Description : SPIKE
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:54:50AM
 Acquisition Started : 9/18/2018 10:32:22AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.3 seconds

Dead Time : 0.03 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 28 - 4096
 Identification Energy Tolerance : 1.000FWHM

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

Sample Number : 71934

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 10:47:26AM
 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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0145

Analysis Report for 1809016-01

SPIKE

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.89	35 -	41	35.67	5.86E+02	90.29	4.59E+02	2.53
	2	53.44	50 -	57	53.21	1.29E+02	42.14	2.15E+02	2.11
M	3	62.28	58 -	69	62.05	3.09E+02	42.52	1.46E+02	1.47
m	4	66.33	58 -	69	66.10	1.35E+02	37.62	2.07E+02	1.65
	5	81.52	77 -	85	81.29	1.17E+03	84.34	3.75E+02	1.67
M	6	112.27	107 -	121	112.02	2.15E+02	39.81	1.26E+02	1.50
m	7	116.41	107 -	121	116.15	6.34E+01	29.81	1.19E+02	1.51
	8	160.93	159 -	162	160.65	2.31E+01	22.98	1.10E+02	1.43
	9	223.85	220 -	226	223.54	2.34E+01	29.97	1.45E+02	1.88
	10	276.60	272 -	280	276.27	8.70E+01	27.92	6.39E+01	1.72
	11	290.38	282 -	297	290.04	4.08E+01	31.05	8.05E+01	11.64
M	12	303.20	299 -	313	302.85	2.21E+02	31.50	3.08E+01	1.48
m	13	307.43	299 -	313	307.09	4.94E+01	21.86	2.07E+01	2.04
	14	324.34	320 -	327	323.99	1.71E+01	13.71	1.99E+01	3.87
M	15	333.92	328 -	344	333.56	9.35E+01	23.43	1.39E+01	2.09
m	16	337.97	328 -	344	337.60	3.30E+01	21.93	1.65E+01	2.09
m	17	356.29	351 -	362	355.92	8.21E+02	58.90	3.69E+01	1.53
	18	364.67	362 -	366	364.30	1.07E+01	12.99	2.86E+01	1.74
M	19	384.09	374 -	393	383.71	1.88E+02	32.76	1.92E+01	1.97
m	20	387.17	374 -	393	386.79	2.25E+02	37.67	1.13E+01	1.54
m	21	391.03	374 -	393	390.64	9.31E+01	32.51	8.16E+00	2.10
M	22	414.45	411 -	421	414.05	3.63E+01	17.18	3.00E+01	1.65
m	23	417.55	411 -	421	417.15	2.21E+01	17.86	3.00E+01	1.66
	24	437.07	432 -	440	436.66	9.74E+01	21.18	9.12E+00	2.09
	25	467.63	464 -	469	467.21	3.06E+01	12.92	8.83E+00	2.00
	26	562.93	559 -	567	562.45	1.10E+01	6.63	0.00E+00	2.38
	27	609.08	605 -	612	608.58	1.38E+01	8.94	4.31E+00	1.81
	28	760.01	756 -	762	759.43	7.00E+00	5.29	0.00E+00	1.98
	29	1030.13	1026 -	1031	1029.40	5.00E+00	4.47	0.00E+00	1.70

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 10:47:26AM

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

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
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0146

Analysis Report for 1809016-01

SPIKE

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	35.89	5.86E+02	90.29		5.86E+02	9.03E+01
	2	53.44	1.29E+02	42.14		1.29E+02	4.21E+01
M	3	62.28	3.09E+02	42.52		3.09E+02	4.25E+01
m	4	66.33	1.35E+02	37.62	3.70E+00	1.31E+02	3.76E+01
	5	81.52	1.17E+03	84.34		1.17E+03	8.43E+01
M	6	112.27	2.15E+02	39.81		2.15E+02	3.98E+01
m	7	116.41	6.34E+01	29.81		6.34E+01	2.98E+01
	8	160.93	2.31E+01	22.98		2.31E+01	2.30E+01
	9	223.85	2.34E+01	29.97		2.34E+01	3.00E+01
	10	276.60	8.70E+01	27.92		8.70E+01	2.79E+01
	11	290.38	4.08E+01	31.05		4.08E+01	3.10E+01
M	12	303.20	2.21E+02	31.50		2.21E+02	3.15E+01
m	13	307.43	4.94E+01	21.86		4.94E+01	2.19E+01
	14	324.34	1.71E+01	13.71		1.71E+01	1.37E+01
M	15	333.92	9.35E+01	23.43		9.35E+01	2.34E+01
m	16	337.97	3.30E+01	21.93	1.24E+00	3.17E+01	2.20E+01
m	17	356.29	8.21E+02	58.90		8.21E+02	5.89E+01
	18	364.67	1.07E+01	12.99		1.07E+01	1.30E+01
M	19	384.09	1.88E+02	32.76		1.88E+02	3.28E+01
m	20	387.17	2.25E+02	37.67		2.25E+02	3.77E+01
m	21	391.03	9.31E+01	32.51		9.31E+01	3.25E+01
M	22	414.45	3.63E+01	17.18		3.63E+01	1.72E+01
m	23	417.55	2.21E+01	17.86		2.21E+01	1.79E+01
	24	437.07	9.74E+01	21.18		9.74E+01	2.12E+01
	25	467.63	3.06E+01	12.92	0.00E+00	3.06E+01	1.29E+01
	26	562.93	1.10E+01	6.63		1.10E+01	6.63E+00
	27	609.08	1.38E+01	8.94	2.25E+00	1.16E+01	8.99E+00
	28	760.01	7.00E+00	5.29		7.00E+00	5.29E+00
	29	1030.13	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
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0147

Analysis Report for 1809016-01

SPIKE

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.95	255.12	1.93		
		391.69 *	61.90	5.72E+01	2.04E+01
I-125	0.99	35.49 *	6.49	2.31E+01	3.55E+00
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	6.51E+03	2.18E+03
TH-234	0.97	63.29 *	3.80	5.21E+02	7.32E+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
SN-113	0.957	5.72E+01	2.04E+01	
I-125	0.996	2.31E+01	3.55E+00	
PA-231	1.000	6.51E+03	2.18E+03	
TH-234	0.973	5.21E+02	7.32E+01	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 2.000sigma

0148

Analysis Report for 1809016-01

SPIKE

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 10:47:26AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	2	53.44	1.42976E-01		
m	4	66.33	1.45594E-01		
	5	81.52	1.30046E+00		
M	6	112.27	2.39322E-01		
m	7	116.41	7.04912E-02		
	8	160.93	2.56410E-02		
	9	223.85	2.60417E-02		
	10	276.60	9.66993E-02		
	11	290.38	4.52812E-02		
m	13	307.43	5.49229E-02		
	14	324.34	1.89712E-02		
M	15	333.92	1.03902E-01		
m	16	337.97	3.52759E-02	Sum	
m	17	356.29	9.11705E-01	Tol.	BA-133
	18	364.67	1.18667E-02	Sum	
M	19	384.09	2.09282E-01		
m	20	387.17	2.50195E-01		
M	22	414.45	4.03175E-02		
m	23	417.55	2.45867E-02		
	24	437.07	1.08268E-01		
	25	467.63	3.39841E-02		
	26	562.93	1.22222E-02		
	27	609.08	1.28770E-02		
	28	760.01	7.77778E-03		
	29	1030.13	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

0149

Analysis Report for 1809016-01

SPIKE

NUCLIDE MDA REPORT

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

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.61E+01	2.61E+01	-9.29E+00	1.21E+01
	136.48	10.60	3.32E+02		1.32E+01	1.57E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	3.01E+02	3.01E+02	-2.20E+02	1.41E+02
+ SN-113	255.12	1.93	1.40E+03	2.46E+01	3.57E+02	6.39E+02
	391.69	* 61.90	2.46E+01		5.72E+01	1.15E+01
SN-119M	23.87	16.10	1.77E-03	1.77E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	5.04E+00	5.04E+00	2.31E+01	2.46E+00
I-129	29.78	57.00	2.49E-01	2.49E-01	1.08E+00	1.23E-01
	33.60	13.20	1.91E+00		-1.06E+00	9.37E-01
	39.58	7.52	2.23E+00		-1.13E+00	1.03E+00
BA-133	30.80	97.60	2.25E-01	2.25E-01	2.51E+00	1.12E-01
	302.84	17.80	2.84E+02		8.09E+02	1.37E+02
	356.01	60.00	1.11E+02		6.66E+02	5.46E+01
CE-139	165.85	80.35	4.90E+01	4.90E+01	-1.16E+01	2.29E+01
CE-144	133.54	10.80	2.99E+02	2.99E+02	2.01E+02	1.40E+02
HG-203	279.19	77.30	3.28E+01	3.28E+01	-1.95E+00	1.50E+01
PB-210	46.50	4.25	1.10E+01	1.10E+01	-2.23E+00	5.08E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.11E+03		-4.40E+02	4.90E+02
	302.67	* 2.30	1.49E+03		6.51E+03	7.05E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.72E+02		5.58E+02	1.81E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.23E-01		-2.55E+00	3.40E-01
	131.42	20.40	1.33E+02		-1.39E+02	6.21E+01
+ TH-234	63.29	* 3.80	1.57E+02	1.57E+02	5.21E+02	7.63E+01
NP-237	29.37	14.00	3.40E-01	3.40E-01	-1.00E+01	1.64E-01
	86.50	12.60	9.69E+01		-1.73E+01	4.59E+01
U-237	97.08	16.30	8.69E+01	6.98E+01	-2.83E+01	4.05E+01
	101.07	26.30	6.98E+01		3.28E+01	3.29E+01
	114.00	12.30	3.71E+02		6.72E+02	1.80E+02
	208.01	22.00	1.74E+02		7.40E+01	8.09E+01
AM-241	59.54	35.90	8.10E+00	8.10E+00	-6.65E+01	3.85E+00
AM-243	74.67	66.00	1.02E+01	1.02E+01	-3.86E+00	4.82E+00

0150

Analysis Report for 1809016-01

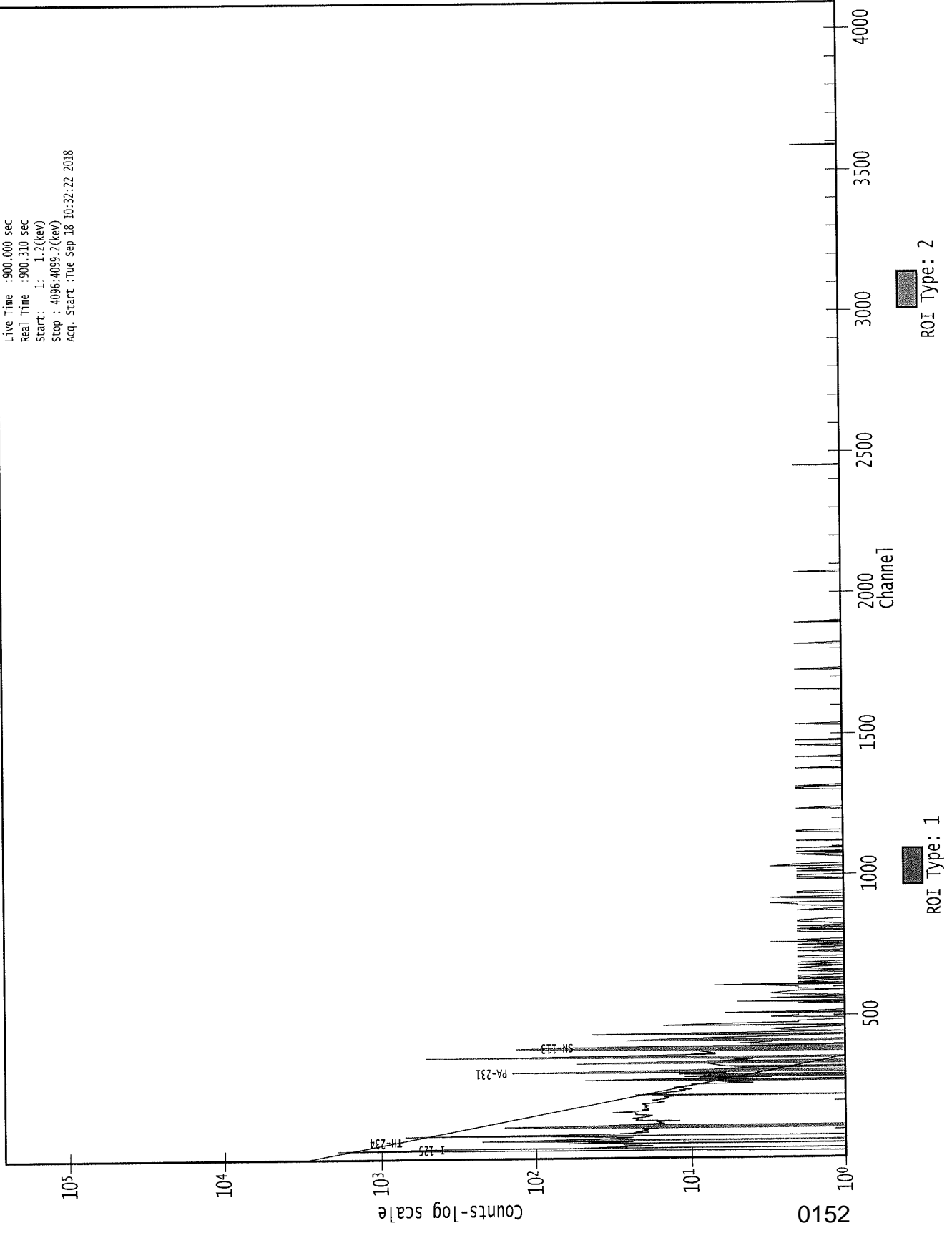
SPIKE

- + = 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

0151

0000071934.CNF



KP
9/18/18

2

Analysis Report for 1809016-02
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GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-02
 Sample Description : BLANK
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:55:09AM
 Acquisition Started : 9/18/2018 10:32:31AM

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

Dead Time : 0.22 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 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 : 71935

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 10:47:42AM
 Peak Analysis From Channel : 1
 Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
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0153

Analysis Report for 1809016-02

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2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.85	18 -	24	21.21	1.50E+02	49.19	3.33E+02	2.12
M	2	30.97	25 -	40	31.33	3.38E+03	123.43	2.72E+02	2.41
m	3	35.26	25 -	40	35.62	7.78E+02	100.41	1.73E+02	2.42
	4	53.33	49 -	57	53.68	1.10E+02	52.46	3.55E+02	2.75
M	5	62.01	58 -	70	62.36	3.65E+02	56.47	2.91E+02	2.48
m	6	66.22	58 -	70	66.57	1.52E+02	54.23	3.11E+02	2.49
	7	81.19	75 -	87	81.53	1.47E+03	95.24	3.77E+02	2.31
M	8	111.92	107 -	122	112.25	3.32E+02	51.46	2.12E+02	2.71
m	9	116.69	107 -	122	117.02	8.49E+01	38.85	1.98E+02	2.33
	10	205.18	202 -	209	205.47	3.40E+01	33.11	1.60E+02	4.14
	11	261.21	258 -	265	261.48	2.00E+01	23.66	8.00E+01	2.95
	12	276.64	273 -	282	276.90	7.70E+01	28.60	8.00E+01	2.57
M	13	303.22	298 -	314	303.46	2.08E+02	36.06	7.73E+01	2.50
m	14	307.45	298 -	314	307.69	3.68E+01	31.11	6.28E+01	2.66
M	15	333.91	328 -	347	334.15	1.04E+02	26.15	4.19E+01	2.51
m	16	339.00	328 -	347	339.23	2.39E+01	21.35	3.54E+01	2.55
	17	356.29	350 -	360	356.52	6.85E+02	56.61	6.50E+01	2.47
	18	364.72	362 -	368	364.94	1.66E+01	14.90	2.88E+01	1.11
	19	376.79	373 -	380	377.01	2.82E+01	18.11	3.57E+01	1.76
M	20	384.02	380 -	395	384.24	1.58E+02	37.58	5.09E+01	2.71
m	21	387.24	380 -	395	387.45	2.44E+02	41.31	3.67E+01	2.22
m	22	391.53	380 -	395	391.74	5.85E+01	37.19	3.89E+01	2.85
M	23	414.24	410 -	429	414.44	6.40E+01	21.94	3.19E+01	3.81
m	24	417.70	410 -	429	417.90	4.17E+01	24.60	2.13E+01	3.47
m	25	422.30	410 -	429	422.50	2.10E+01	18.03	6.61E+00	2.87
	26	437.27	434 -	441	437.47	1.31E+02	22.89	0.00E+00	2.50
	27	468.99	462 -	475	469.17	3.01E+01	19.29	2.77E+01	2.25

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 10:47:42AM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.85	1.50E+02	49.19			1.50E+02	4.92E+01
M	2	30.97	3.38E+03	123.43			3.38E+03	1.23E+02

0154

Analysis Report for 1809016-02

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2

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	3	35.26	7.78E+02	100.41			7.78E+02	1.00E+02
	4	53.33	1.10E+02	52.46	2.82E-01	5.14E-01	1.10E+02	5.25E+01
M	5	62.01	3.65E+02	56.47	1.31E+01	8.56E-01	3.51E+02	5.65E+01
m	6	66.22	1.52E+02	54.23			1.52E+02	5.42E+01
	7	81.19	1.47E+03	95.24			1.47E+03	9.52E+01
M	8	111.92	3.32E+02	51.46			3.32E+02	5.15E+01
m	9	116.69	8.49E+01	38.85			8.49E+01	3.89E+01
	10	205.18	3.40E+01	33.11			3.40E+01	3.31E+01
	11	261.21	2.00E+01	23.66			2.00E+01	2.37E+01
	12	276.64	7.70E+01	28.60			7.70E+01	2.86E+01
M	13	303.22	2.08E+02	36.06			2.08E+02	3.61E+01
m	14	307.45	3.68E+01	31.11			3.68E+01	3.11E+01
M	15	333.91	1.04E+02	26.15			1.04E+02	2.62E+01
m	16	339.00	2.39E+01	21.35			2.39E+01	2.14E+01
	17	356.29	6.85E+02	56.61			6.85E+02	5.66E+01
	18	364.72	1.66E+01	14.90			1.66E+01	1.49E+01
	19	376.79	2.82E+01	18.11			2.82E+01	1.81E+01
M	20	384.02	1.58E+02	37.58			1.58E+02	3.76E+01
m	21	387.24	2.44E+02	41.31			2.44E+02	4.13E+01
m	22	391.53	5.85E+01	37.19			5.85E+01	3.72E+01
M	23	414.24	6.40E+01	21.94			6.40E+01	2.19E+01
m	24	417.70	4.17E+01	24.60			4.17E+01	2.46E+01
m	25	422.30	2.10E+01	18.03			2.10E+01	1.80E+01
	26	437.27	1.31E+02	22.89			1.31E+02	2.29E+01
	27	468.99	3.01E+01	19.29			3.01E+01	1.93E+01

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.96	255.12	1.93		
		391.69 *	61.90	4.07E+01	2.62E+01
I-125	0.99	35.49 *	6.49	3.63E+01	4.68E+00
BA-133	0.99	30.80 *	97.60	4.49E+00	1.64E-01

0155

Analysis Report for 1809016-02

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Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
BA-133	0.99	302.84 *	17.80	7.80E+02	3.13E+02
		356.01 *	60.00	5.94E+02	8.36E+01
TH-234	0.97	63.29 *	3.80	5.56E+02	9.13E+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
SN-113	0.964	4.07E+01	2.62E+01	
I-125	0.999	3.63E+01	4.68E+00	
X I-129	0.903			
BA-133	0.999	4.49E+00	1.64E-01	
TH-234	0.971	5.56E+02	9.13E+01	
X NP-237	0.887			

? = 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

0156

Analysis Report for 1809016-02

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2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 10:47:42AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide	
	1	20.85	1.67142E-01	16.35	Tol.	PA-234M
	4	53.33	1.22288E-01	23.83		
m	6	66.22	1.69408E-01	17.79	Sum	
	7	81.19	1.62967E+00	3.25		
M	8	111.92	3.68585E-01	7.76		
m	9	116.69	9.43645E-02	22.87		
	10	205.18	3.77778E-02	48.69		
	11	261.21	2.22222E-02	59.16		
	12	276.64	8.55556E-02	18.57		
m	14	307.45	4.09000E-02	42.26		
M	15	333.91	1.15550E-01	12.57	Sum	
m	16	339.00	2.65591E-02	44.67	Sum	
	18	364.72	1.84409E-02	44.89	Sum	
	19	376.79	3.12923E-02	32.15		
M	20	384.02	1.75207E-01	11.92		
m	21	387.24	2.71232E-01	8.46	Sum	
M	23	414.24	7.11256E-02	17.14		
m	24	417.70	4.62926E-02	29.52	Sum	
m	25	422.30	2.33279E-02	42.95	Sum	
	26	437.27	1.45556E-01	8.74		
	27	468.99	3.34848E-02	32.00		

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

0157

Analysis Report for 1809016-02
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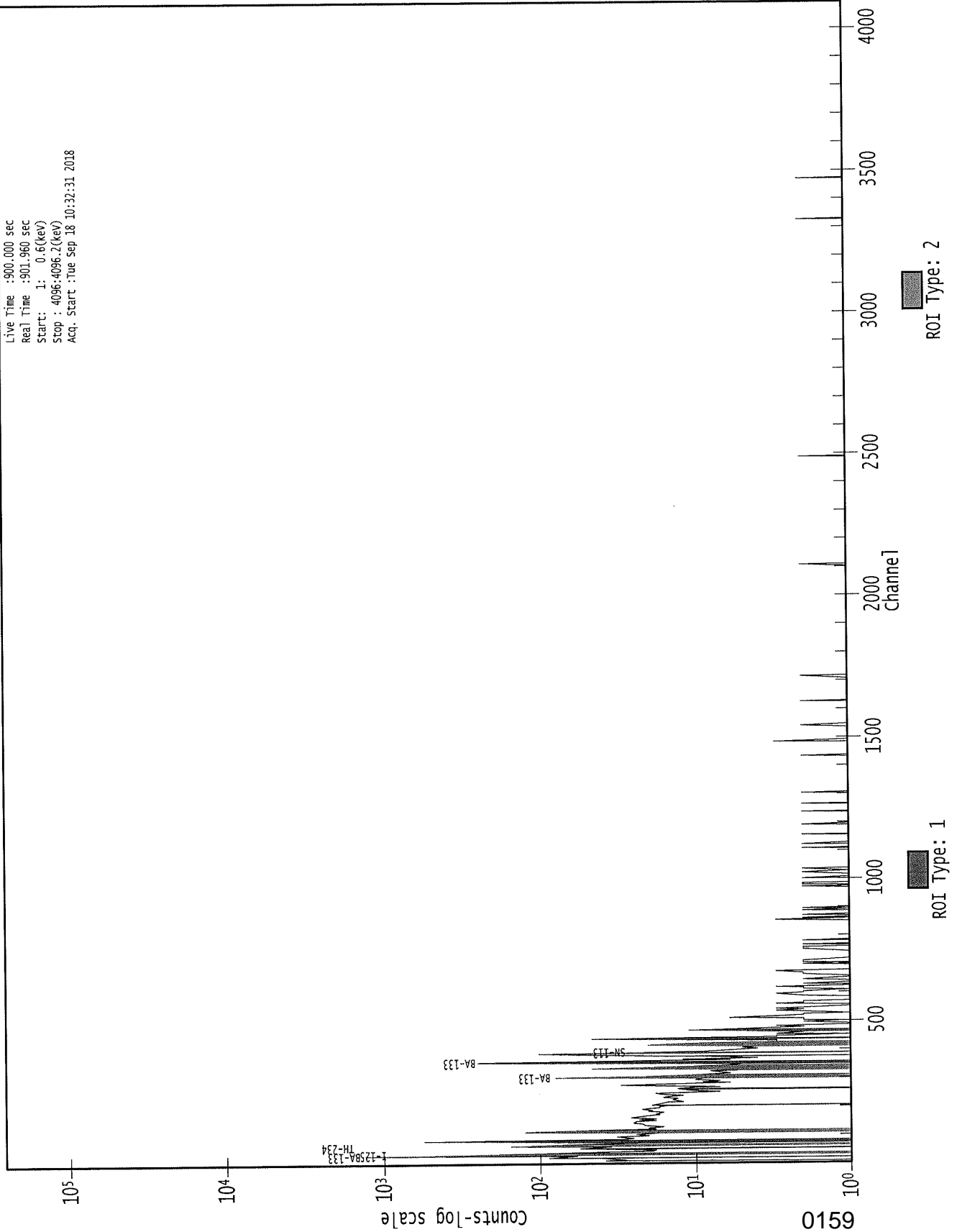
2

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	5.37E-09	5.37E-09	-1.97E-08	1.90E-09
CO-57	122.06	85.51	2.91E+01	2.91E+01	2.64E+00	1.38E+01
	136.48	10.60	2.85E+02		-3.94E+01	1.35E+02
NI-59	6.92	29.80	1.06E-07	1.06E-07	-8.71E-09	4.81E-08
MO-93	16.59	52.90	1.21E-03	1.21E-03	-2.96E-04	5.81E-04
	18.60	10.00	2.23E-02		-2.18E-03	1.08E-02
NB-93M	16.57	9.43	6.72E-03	6.72E-03	-1.64E-03	3.22E-03
CD-109	88.03	3.72	3.27E+02	3.27E+02	-8.27E+01	1.56E+02
+ SN-113	255.12	1.93	1.44E+03	3.39E+01	7.30E+02	6.67E+02
	391.69	* 61.90	3.39E+01		4.07E+01	1.60E+01
SN-119M	23.87	16.10	1.06E-01	1.04E-01	-1.97E-01	5.11E-02
	25.10	22.70	1.04E-01		-1.63E+00	5.04E-02
+ I-125	35.49	* 6.49	5.59E+00	5.59E+00	3.63E+01	2.73E+00
I-129	29.78	* 57.00	2.78E-01	2.78E-01	7.69E+00	1.36E-01
	33.60	* 13.20	2.75E+00		1.78E+01	1.34E+00
	39.58	7.52	5.90E+00		-2.26E-02	2.84E+00
+ BA-133	30.80	* 97.60	1.62E-01	1.62E-01	4.49E+00	7.94E-02
	302.84	* 17.80	2.52E+02		7.80E+02	1.21E+02
	356.01	* 60.00	3.30E+01		5.94E+02	1.53E+01
CE-139	165.85	80.35	4.91E+01	4.91E+01	-2.43E+01	2.33E+01
CE-144	133.54	10.80	2.59E+02	2.59E+02	-1.90E+01	1.22E+02
HG-203	279.19	77.30	4.65E+01	4.65E+01	5.86E+01	2.20E+01
PB-210	46.50	4.25	1.92E+01	1.92E+01	-4.77E+00	9.14E+00
PA-231	9.28	42.00	4.07E-06	4.07E-06	5.02E-06	1.94E-06
	10.11	20.20	2.14E-05		2.64E-05	1.02E-05
	283.67	1.60	1.45E+03		3.62E+02	6.64E+02
	302.67	2.30	2.13E+03		3.87E+03	1.02E+03
TH-231	25.64	14.70	1.94E-01	1.94E-01	-6.62E+00	9.40E-02
	84.21	6.40	4.13E+02		1.52E+03	2.03E+02
PA-234M	9.89	89.00	3.84E-06	3.84E-06	4.73E-06	1.83E-06
	21.72	64.90	1.27E-02		2.16E-02	6.17E-03
	37.93	23.75	2.63E+00		8.52E+00	1.29E+00
	131.42	20.40	1.39E+02		3.58E+01	6.59E+01
+ TH-234	63.29	* 3.80	1.74E+02	1.74E+02	5.56E+02	8.46E+01
NP-237	29.37	* 14.00	1.13E+00	1.13E+00	3.13E+01	5.54E-01
	86.50	12.60	9.92E+01		8.23E-01	4.74E+01
U-237	97.08	16.30	1.01E+02	6.89E+01	-1.91E+01	4.82E+01
	101.07	26.30	6.89E+01		4.51E+01	3.28E+01
	114.00	12.30	3.62E+02		1.05E+03	1.76E+02
	208.01	22.00	1.83E+02		-3.37E+01	8.65E+01
AM-241	59.54	35.90	1.44E+01	1.44E+01	2.52E+01	7.03E+00
AM-243	74.67	66.00	1.12E+01	1.12E+01	1.36E+00	5.35E+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

0000071935.CNF

Live Time : 900.000 sec
Real Time : 901.960 sec
Start : 1: 0.6(kev)
Stop : 4096.4096.2(kev)
Acq. Start : Tue Sep 18 10:32:31 2018



Analysis Report for 1809016-03
EQUIPMENT BLANK

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-03
 Sample Description : EQUIPMENT BLANK
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:55:41AM
 Acquisition Started : 9/18/2018 10:47:54AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.3 seconds

Dead Time : 0.03 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 28 - 4096
 Identification Energy Tolerance : 1.000FWHM

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

Sample Number : 71937

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:02:58AM
 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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0160

Analysis Report for 1809016-03

EQUIPMENT BLANK

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.98	35 - 41	35.76	4.83E+02	80.36	3.46E+02	2.59
	2	53.06	49 - 56	52.83	7.80E+01	36.99	1.76E+02	2.58
M	3	62.33	58 - 70	62.10	1.59E+02	30.80	8.75E+01	1.13
m	4	66.13	58 - 70	65.90	7.78E+01	25.93	1.07E+02	1.14
	5	81.61	79 - 85	81.37	8.77E+02	70.57	2.58E+02	1.75
	6	112.24	108 - 114	111.99	1.85E+02	40.99	1.69E+02	1.37
	7	122.15	120 - 124	121.89	2.37E+01	21.84	7.86E+01	2.28
	8	276.99	272 - 281	276.66	8.95E+01	29.09	6.91E+01	1.98
	9	295.92	293 - 299	295.58	2.97E+01	15.41	2.25E+01	1.28
M	10	303.20	299 - 309	302.86	1.73E+02	29.27	2.77E+01	1.53
m	11	307.22	299 - 309	306.87	3.08E+01	15.77	2.96E+01	1.54
	12	312.10	310 - 315	311.75	1.31E+01	15.78	3.98E+01	1.39
	13	325.13	322 - 327	324.78	1.15E+01	11.58	1.70E+01	3.12
	14	333.43	328 - 337	333.07	5.58E+01	29.65	9.04E+01	2.03
	15	356.35	354 - 359	355.98	6.11E+02	51.74	3.96E+01	1.42
	16	376.67	372 - 379	376.29	1.81E+01	17.66	3.98E+01	1.20
M	17	384.53	380 - 395	384.15	1.20E+02	29.29	2.41E+01	1.62
m	18	391.24	380 - 395	390.85	4.19E+01	18.06	1.17E+01	1.63
	19	417.24	411 - 424	416.84	8.11E+01	22.61	1.99E+01	4.39
	20	437.10	433 - 440	436.69	8.82E+01	20.59	1.17E+01	1.72
	21	469.47	464 - 474	469.05	2.42E+01	13.29	9.59E+00	2.25
	22	609.35	606 - 613	608.85	2.86E+01	14.70	1.87E+01	1.50
	23	768.10	765 - 770	767.52	7.78E+00	6.71	2.44E+00	3.41
	24	980.51	977 - 982	979.80	5.00E+00	4.47	0.00E+00	2.41
	25	1120.21	1116 - 1121	1119.42	8.40E+00	7.00	3.20E+00	1.19

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:02:58AM

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

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	4.83E+02	80.36			4.83E+02	8.04E+01
	2	7.80E+01	36.99			7.80E+01	3.70E+01
M	3	1.59E+02	30.80			1.59E+02	3.08E+01
m	4	7.78E+01	25.93	3.70E+00	1.42E+00	7.41E+01	2.60E+01

0161

Analysis Report for 1809016-03

EQUIPMENT BLANK

2

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	5	81.61	8.77E+02	70.57		8.77E+02	7.06E+01
	6	112.24	1.85E+02	40.99		1.85E+02	4.10E+01
	7	122.15	2.37E+01	21.84		2.37E+01	2.18E+01
	8	276.99	8.95E+01	29.09		8.95E+01	2.91E+01
	9	295.92	2.97E+01	15.41	2.67E+00	2.71E+01	1.55E+01
M	10	303.20	1.73E+02	29.27		1.73E+02	2.93E+01
m	11	307.22	3.08E+01	15.77		3.08E+01	1.58E+01
	12	312.10	1.31E+01	15.78		1.31E+01	1.58E+01
	13	325.13	1.15E+01	11.58		1.15E+01	1.16E+01
	14	333.43	5.58E+01	29.65		5.58E+01	2.96E+01
	15	356.35	6.11E+02	51.74		6.11E+02	5.17E+01
	16	376.67	1.81E+01	17.66		1.81E+01	1.77E+01
M	17	384.53	1.20E+02	29.29		1.20E+02	2.93E+01
m	18	391.24	4.19E+01	18.06		4.19E+01	1.81E+01
	19	417.24	8.11E+01	22.61		8.11E+01	2.26E+01
	20	437.10	8.82E+01	20.59		8.82E+01	2.06E+01
	21	469.47	2.42E+01	13.29	0.00E+00	2.42E+01	1.33E+01
	22	609.35	2.86E+01	14.70	2.25E+00	2.64E+01	1.47E+01
	23	768.10	7.78E+00	6.71	8.95E-01	7.78E+00	6.71E+00
	24	980.51	5.00E+00	4.47		5.00E+00	4.47E+00
	25	1120.21	8.40E+00	7.00		8.40E+00	7.00E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
CO-57	0.83	122.06 *	85.51	1.69E+01	1.63E+01
		136.48	10.60		
SN-113	0.96	255.12	1.93		
		391.69 *	61.90	2.57E+01	1.12E+01
I-125	0.99	35.49 *	6.49	1.93E+01	3.21E+00
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		

0162

Analysis Report for 1809016-03
EQUIPMENT BLANK

2

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
PA-231	1.00	302.67 *		2.30	5.10E+03	1.77E+03
TH-234	0.97	63.29 *		3.80	2.68E+02	5.27E+01

* = Energy line found in the spectrum.
 - = Manually added nuclide.
 ? = Manually edited nuclide.
 @ = Energy line not used for Weighted Mean Activity
 Energy Tolerance : 2.000FWHM
 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
CO-57	0.838	1.69E+01	1.63E+01	
SN-113	0.962	2.57E+01	1.12E+01	
I-125	0.994	1.93E+01	3.21E+00	
PA-231	1.000	5.10E+03	1.77E+03	
TH-234	0.976	2.68E+02	5.27E+01	

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

Errors quoted at 2.000sigma

0163

Analysis Report for 1809016-03

EQUIPMENT BLANK

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:02:58AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	2	53.06	8.66667E-02		
m	4	66.13	8.23105E-02		
	5	81.61	9.74523E-01		
	6	112.24	2.06037E-01	Tol.	U-237
	8	276.99	9.94086E-02		
	9	295.92	3.00706E-02		
m	11	307.22	3.41907E-02		
	12	312.10	1.45286E-02		
	13	325.13	1.27778E-02		
	14	333.43	6.20022E-02		
	15	356.35	6.79102E-01	Tol.	BA-133
	16	376.67	2.01170E-02		
M	17	384.53	1.33004E-01		
	19	417.24	9.00733E-02		
	20	437.10	9.79669E-02		
	21	469.47	2.68966E-02		
	22	609.35	2.93079E-02		
	23	768.10	8.64198E-03		
	24	980.51	5.55556E-03		
	25	1120.21	9.33333E-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

0164

Analysis Report for 1809016-03
EQUIPMENT BLANK

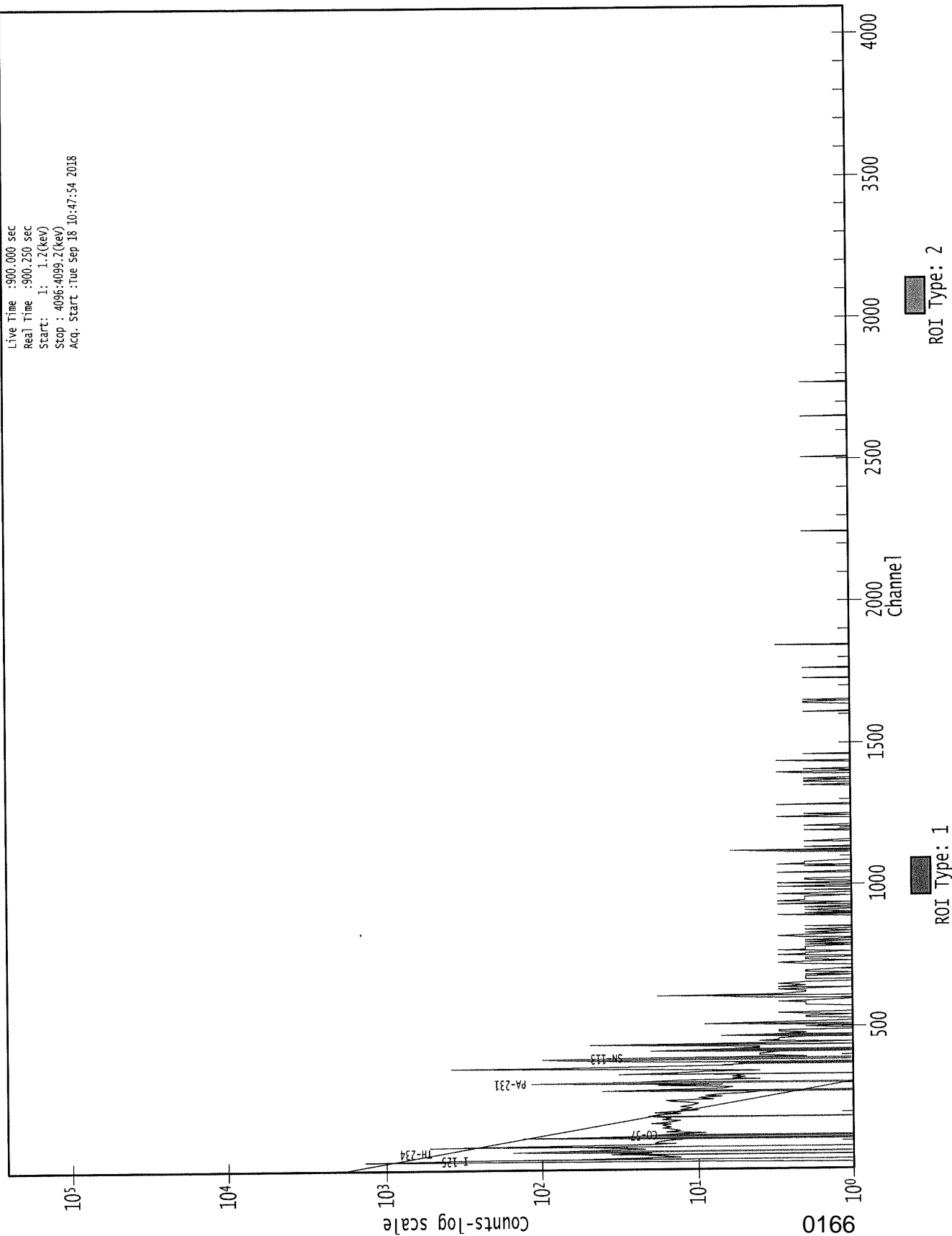
2

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	1.20E-10	1.20E-10	0.00E+00	0.00E+00
+ CO-57	122.06 *	85.51	2.49E+01	2.49E+01	1.69E+01	1.15E+01
	136.48	10.60	2.46E+02		9.78E+01	1.14E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.82E+02	2.82E+02	-1.19E+02	1.32E+02
+ SN-113	255.12	1.93	1.26E+03	2.50E+01	-5.35E+01	5.68E+02
	391.69 *	61.90	2.50E+01		2.57E+01	1.17E+01
SN-119M	23.87	16.10	1.77E-03	1.77E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49 *	6.49	4.53E+00	4.53E+00	1.93E+01	2.21E+00
I-129	29.78	57.00	2.14E-01	2.14E-01	6.68E-01	1.05E-01
	33.60	13.20	1.73E+00		-3.69E-01	8.51E-01
	39.58	7.52	2.04E+00		-2.17E+00	9.31E-01
BA-133	30.80	97.60	1.97E-01	1.97E-01	1.89E+00	9.71E-02
	302.84	17.80	2.58E+02		6.89E+02	1.24E+02
	356.01	60.00	9.64E+01		4.88E+02	4.71E+01
CE-139	165.85	80.35	4.71E+01	4.71E+01	1.06E+00	2.20E+01
CE-144	133.54	10.80	2.27E+02	2.27E+02	-1.26E+02	1.05E+02
HG-203	279.19	77.30	3.80E+01	3.80E+01	4.33E+00	1.77E+01
PB-210	46.50	4.25	1.00E+01	1.00E+01	2.83E+00	4.57E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.18E+03		1.51E+02	5.25E+02
	302.67 *	2.30	1.03E+03		5.10E+03	4.77E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.37E+02		5.95E+02	1.64E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.23E-01		-1.03E+00	3.40E-01
	131.42	20.40	1.26E+02		4.11E+01	5.84E+01
+ TH-234	63.29 *	3.80	1.56E+02	1.56E+02	2.68E+02	7.58E+01
NP-237	29.37	14.00	3.08E-01	3.08E-01	-6.69E+00	1.48E-01
	86.50	12.60	8.63E+01		-1.13E+01	4.05E+01
U-237	97.08	16.30	8.32E+01	5.87E+01	-3.01E+00	3.87E+01
	101.07	26.30	5.87E+01		1.08E+01	2.73E+01
	114.00	12.30	3.26E+02		4.24E+01	1.57E+02
	208.01	22.00	1.59E+02		5.63E+01	7.33E+01
AM-241	59.54	35.90	6.80E+00	6.80E+00	-4.75E+01	3.21E+00
AM-243	74.67	66.00	9.86E+00	9.86E+00	-1.71E+01	4.64E+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

0000071937.CNF

Live Time : 900.000 sec
Real Time : 900.250 sec
Start : 1: 1.2 (keV)
Stop : 4096.4099.2 (keV)
Acq. Start : Tue Sep 18 10:47:54 2018



105
9/18/18

2

Analysis Report for 1809016-04
HANSON RELIEF WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-04
 Sample Description : HANSON RELIEF WELL
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:55:56AM
 Acquisition Started : 9/18/2018 10:48:03AM

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

Dead Time : 0.21 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 10 - 4096
 Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 7/21/2018
 Efficiency Calibration Used Done On : 7/21/2018
 Efficiency Calibration Description :

Sample Number : 71938

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:03:14AM
 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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0167

Analysis Report for 1809016-04

HANSON RELIEF WELL

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.84	18 -	25	21.20	1.24E+02	54.52	4.22E+02	2.36
M	2	26.03	25 -	40	26.39	4.17E+01	19.54	1.15E+02	2.01
m	3	30.99	25 -	40	31.35	3.05E+03	120.36	3.26E+02	2.19
m	4	35.22	25 -	40	35.58	7.27E+02	99.71	2.46E+02	2.43
	5	46.32	44 -	49	46.68	4.38E+01	30.50	1.52E+02	3.66
	6	52.65	50 -	56	53.01	1.09E+02	42.83	2.58E+02	2.83
M	7	61.92	58 -	69	62.27	3.70E+02	58.96	3.51E+02	2.29
m	8	66.15	58 -	69	66.50	1.80E+02	55.10	3.16E+02	2.19
	9	81.19	77 -	87	81.53	1.22E+03	87.64	3.76E+02	2.40
M	10	112.00	107 -	122	112.33	3.45E+02	48.99	1.82E+02	2.47
m	11	116.55	107 -	122	116.88	1.14E+02	46.95	1.75E+02	2.72
	12	161.38	157 -	167	161.69	7.62E+01	47.43	2.62E+02	2.77
	13	258.02	253 -	263	258.28	3.91E+01	33.79	1.30E+02	5.14
m	14	281.27	266 -	286	281.52	2.24E+01	27.42	5.73E+01	2.76
M	15	303.00	298 -	314	303.25	1.89E+02	33.23	6.04E+01	2.28
m	16	307.41	298 -	314	307.66	5.53E+01	38.90	8.23E+01	3.36
	17	333.77	330 -	337	334.00	1.12E+02	34.76	1.33E+02	1.73
	18	339.33	338 -	345	339.56	2.60E+01	26.98	8.80E+01	2.18
	19	356.19	349 -	361	356.41	6.85E+02	56.41	5.20E+01	2.49
	20	364.71	362 -	368	364.93	2.22E+01	17.97	4.36E+01	1.85
M	21	383.83	380 -	398	384.04	1.55E+02	36.58	2.96E+01	2.33
m	22	387.22	380 -	398	387.44	2.75E+02	42.36	3.19E+01	2.22
m	23	391.34	380 -	398	391.55	6.79E+01	37.74	3.88E+01	2.74
	24	417.76	408 -	425	417.97	1.16E+02	32.53	5.40E+01	9.78
	25	437.23	432 -	443	437.43	1.46E+02	29.53	3.60E+01	2.39
	26	444.99	443 -	447	445.18	6.55E+00	7.66	6.90E+00	2.01
M	27	468.64	464 -	474	468.82	2.71E+01	12.97	4.87E+00	2.90
m	28	472.13	464 -	474	472.31	6.44E+00	7.37	3.16E-01	2.35
M	29	506.14	505 -	516	506.30	6.46E+00	4.95	5.25E+00	3.01
	30	609.01	605 -	612	609.14	8.58E+00	8.94	6.83E+00	1.84

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:03:14AM

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

0168

Analysis Report for 1809016-04

HANSON RELIEF WELL

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.84	1.24E+02	54.52			1.24E+02	5.45E+01
M	2	26.03	4.17E+01	19.54			4.17E+01	1.95E+01
m	3	30.99	3.05E+03	120.36			3.05E+03	1.20E+02
m	4	35.22	7.27E+02	99.71			7.27E+02	9.97E+01
	5	46.32	4.38E+01	30.50	1.01E+01	7.65E-01	3.38E+01	3.05E+01
	6	52.65	1.09E+02	42.83	2.82E-01	5.14E-01	1.09E+02	4.28E+01
M	7	61.92	3.70E+02	58.96	1.31E+01	8.56E-01	3.57E+02	5.90E+01
m	8	66.15	1.80E+02	55.10			1.80E+02	5.51E+01
	9	81.19	1.22E+03	87.64			1.22E+03	8.76E+01
M	10	112.00	3.45E+02	48.99			3.45E+02	4.90E+01
m	11	116.55	1.14E+02	46.95			1.14E+02	4.69E+01
	12	161.38	7.62E+01	47.43			7.62E+01	4.74E+01
	13	258.02	3.91E+01	33.79			3.91E+01	3.38E+01
m	14	281.27	2.24E+01	27.42			2.24E+01	2.74E+01
M	15	303.00	1.89E+02	33.23			1.89E+02	3.32E+01
m	16	307.41	5.53E+01	38.90			5.53E+01	3.89E+01
	17	333.77	1.12E+02	34.76			1.12E+02	3.48E+01
	18	339.33	2.60E+01	26.98			2.60E+01	2.70E+01
	19	356.19	6.85E+02	56.41			6.85E+02	5.64E+01
	20	364.71	2.22E+01	17.97			2.22E+01	1.80E+01
M	21	383.83	1.55E+02	36.58			1.55E+02	3.66E+01
m	22	387.22	2.75E+02	42.36			2.75E+02	4.24E+01
m	23	391.34	6.79E+01	37.74			6.79E+01	3.77E+01
	24	417.76	1.16E+02	32.53			1.16E+02	3.25E+01
	25	437.23	1.46E+02	29.53			1.46E+02	2.95E+01
	26	444.99	6.55E+00	7.66			6.55E+00	7.66E+00
M	27	468.64	2.71E+01	12.97			2.71E+01	1.30E+01
m	28	472.13	6.44E+00	7.37			6.44E+00	7.37E+00
M	29	506.14	6.46E+00	4.95			6.46E+00	4.95E+00
	30	609.01	8.58E+00	8.94	1.01E+00	8.23E-01	7.58E+00	8.98E+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

0169

Analysis Report for 1809016-04

HANSON RELIEF WELL

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.96	255.12 391.69 *	1.93 61.90	4.73E+01	2.67E+01
I-125	0.99	35.49 *	6.49	3.36E+01	4.61E+00
BA-133	0.99	30.80 * 302.84 * 356.01 *	97.60 17.80 60.00	4.07E+00 7.09E+02 5.94E+02	1.61E-01 2.87E+02 8.35E+01
HG-203	0.92	279.19 *	77.30	2.11E+01	2.72E+01
PB-210	0.99	46.50 *	4.25	1.17E+01	1.06E+01
TH-231	0.96	25.64 * 84.21	14.70 6.40	1.08E-01	5.07E-02
TH-234	0.96	63.29 *	3.80	5.62E+02	9.47E+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
SN-113	0.962	4.73E+01	2.67E+01	
I-125	0.999	3.36E+01	4.61E+00	
X I-129	0.903			
BA-133	0.999	4.07E+00	1.61E-01	
HG-203	0.926	2.11E+01	2.72E+01	
PB-210	0.999	1.17E+01	1.06E+01	
TH-231	0.969	1.08E-01	5.07E-02	
TH-234	0.967	5.62E+02	9.47E+01	
X NP-237	0.886			

? = 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

0170

Analysis Report for 1809016-04

HANSON RELIEF WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:03:14AM
 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	20.84	1.37675E-01	22.00	To1.	PA-234M
	6	52.65	1.20695E-01	19.71	Sum	
m	8	66.15	2.00230E-01	15.29	Sum	
	9	81.19	1.35343E+00	3.60	Sum	
M	10	112.00	3.83438E-01	7.10	To1.	U-237
m	11	116.55	1.27136E-01	20.51		
	12	161.38	8.46699E-02	31.12		
	13	258.02	4.34402E-02	43.22		
m	16	307.41	6.13902E-02	35.20	Sum	
	17	333.77	1.24120E-01	15.56	Sum	
	18	339.33	2.88889E-02	51.89	Sum	
	20	364.71	2.46465E-02	40.51	Sum	
M	21	383.83	1.72570E-01	11.78	Sum	
m	22	387.22	3.05144E-01	7.71	Sum	
	24	417.76	1.28889E-01	14.02	Sum	
	25	437.23	1.62222E-01	10.11	Sum	
	26	444.99	7.27778E-03	58.51		
M	27	468.64	3.00676E-02	23.97		
m	28	472.13	7.15113E-03	57.22		
M	29	506.14	7.18325E-03	38.28		
	30	609.01	8.41824E-03	59.28		

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

0171

Analysis Report for 1809016-04

HANSON RELIEF WELL

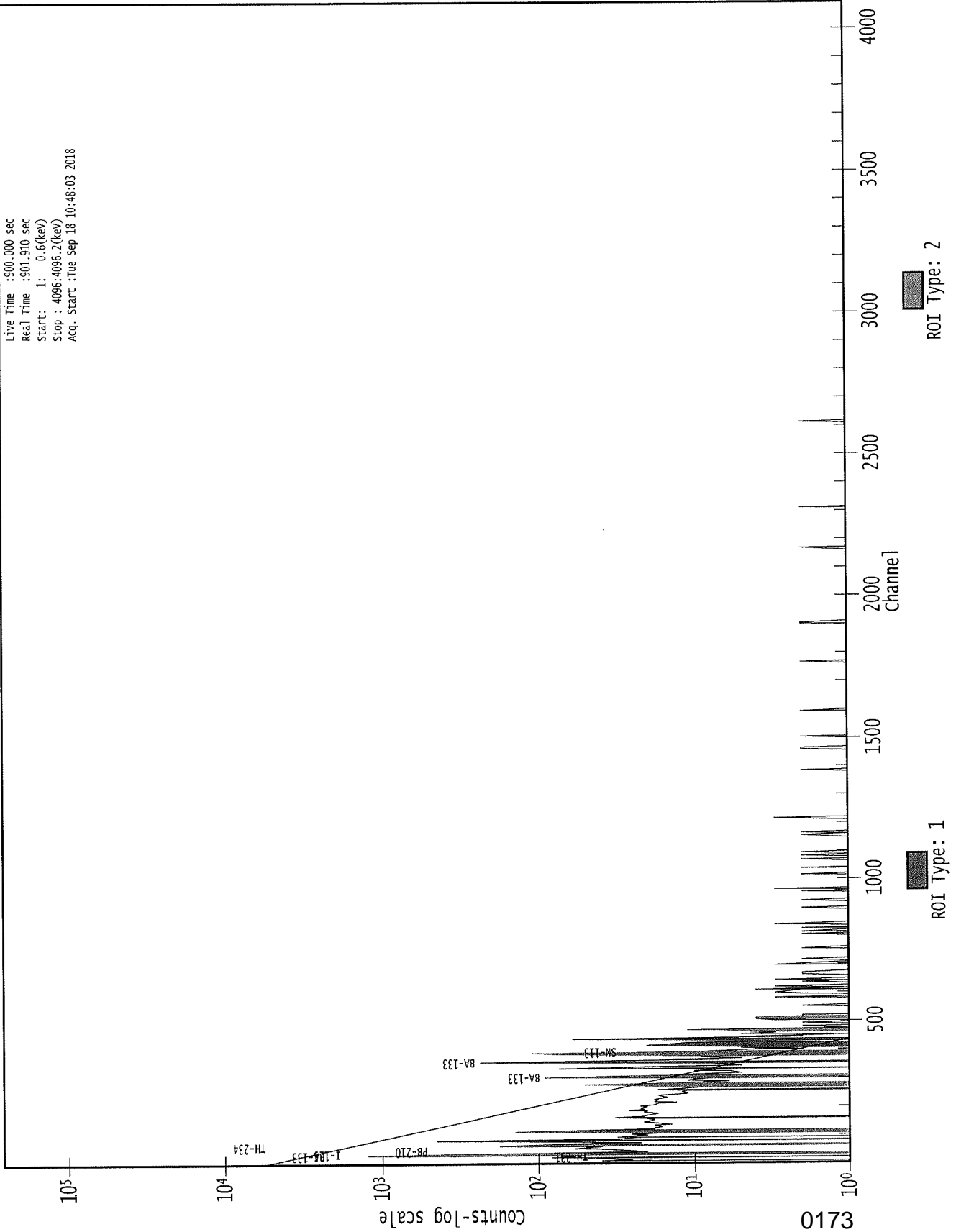
Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	1.57E-09	1.57E-09	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.80E+01	2.80E+01	1.52E+00	1.32E+01
	136.48	10.60	2.69E+02		-5.89E+01	1.27E+02
NI-59	6.92	29.80	1.09E-07	1.09E-07	1.38E-08	5.01E-08
MO-93	16.59	52.90	1.14E-03	1.14E-03	-1.15E-04	5.46E-04
	18.60	10.00	2.11E-02		-5.65E-04	1.02E-02
NB-93M	16.57	9.43	6.34E-03	6.34E-03	-6.36E-04	3.03E-03
CD-109	88.03	3.72	3.26E+02	3.26E+02	-1.20E+02	1.55E+02
+ SN-113	255.12	1.93	1.61E+03	3.61E+01	-3.99E+02	7.50E+02
	391.69	* 61.90	3.61E+01		4.73E+01	1.71E+01
SN-119M	23.87	16.10	1.08E-01	1.08E-01	-1.25E-01	5.24E-02
	25.10	22.70	1.08E-01		-1.45E+00	5.21E-02
+ I-125	35.49	* 6.49	6.14E+00	6.14E+00	3.36E+01	3.01E+00
I-129	29.78	* 57.00	3.07E-01	3.07E-01	6.97E+00	1.51E-01
	33.60	* 13.20	3.02E+00		1.65E+01	1.48E+00
	39.58	7.52	5.93E+00		-3.27E-01	2.85E+00
+ BA-133	30.80	* 97.60	1.80E-01	1.80E-01	4.07E+00	8.80E-02
	302.84	* 17.80	2.37E+02		7.09E+02	1.14E+02
	356.01	* 60.00	3.23E+01		5.94E+02	1.50E+01
CE-139	165.85	80.35	5.17E+01	5.17E+01	5.26E+00	2.46E+01
CE-144	133.54	10.80	2.64E+02	2.64E+02	1.16E+02	1.25E+02
+ HG-203	279.19	* 77.30	6.77E+01	6.77E+01	2.11E+01	3.26E+01
+ PB-210	46.50	* 4.25	1.71E+01	1.71E+01	1.17E+01	8.06E+00
PA-231	9.28	42.00	4.03E-06	4.03E-06	5.13E-06	1.92E-06
	10.11	20.20	2.12E-05		2.69E-05	1.01E-05
	283.67	1.60	1.53E+03		-1.05E+02	7.04E+02
	302.67	2.30	2.11E+03		3.73E+03	1.01E+03
+ TH-231	25.64	* 14.70	3.37E-01	3.37E-01	1.08E-01	1.65E-01
	84.21	6.40	3.88E+02		1.25E+03	1.90E+02
PA-234M	9.89	89.00	3.80E-06	3.80E-06	4.83E-06	1.81E-06
	21.72	64.90	1.26E-02		1.89E-02	6.10E-03
	37.93	23.75	2.67E+00		9.40E+00	1.31E+00
	131.42	20.40	1.33E+02		1.75E+01	6.26E+01
+ TH-234	63.29	* 3.80	1.74E+02	1.74E+02	5.62E+02	8.47E+01
NP-237	29.37	* 14.00	1.25E+00	1.25E+00	2.84E+01	6.13E-01
	86.50	12.60	9.95E+01		-3.45E+00	4.75E+01
U-237	97.08	16.30	9.77E+01	6.90E+01	-9.72E+01	4.64E+01
	101.07	26.30	6.90E+01		1.87E+01	3.28E+01
	114.00	12.30	3.74E+02		1.14E+03	1.82E+02
	208.01	22.00	1.89E+02		4.88E+01	8.93E+01
AM-241	59.54	35.90	1.52E+01	1.52E+01	3.70E+01	7.40E+00
AM-243	74.67	66.00	1.18E+01	1.18E+01	9.16E-01	5.65E+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

0172

0000071938.CNF

Live Time : 900.000 sec
Real Time : 901.910 sec
Start: 1: 0.6(keV)
Stop : 4096:4096.2(keV)
Acq. Start : Tue Sep 18 10:48:03 2018



YB
9/18/18

2

Analysis Report for 1809016-05
BILLINGSLEY RELIEF WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-05
 Sample Description : BILLINGSLEY RELIEF WELL
 Sample Type : RA RECOVERY

 Sample Size : 1.000E+00 units
 Facility : Countroom

 Sample Taken On : 9/18/2018 9:56:16AM
 Acquisition Started : 9/18/2018 11:03:15AM

 Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.3 seconds

 Dead Time : 0.03 %

 Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 28 - 4096
 Identification Energy Tolerance : 1.000FWHM

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

 Sample Number : 71939

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:18:18AM
 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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0174

Analysis Report for 1809016-05

BILLINGSLEY RELIEF WELL

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.86	35 -	38	35.64	5.34E+02	68.09	4.46E+02	2.53
	2	52.72	49 -	55	52.49	6.66E+01	36.19	1.91E+02	2.49
M	3	62.41	59 -	74	62.18	2.42E+02	41.62	1.81E+02	1.37
m	4	66.41	59 -	74	66.18	1.16E+02	35.10	1.59E+02	1.38
	5	81.56	78 -	85	81.32	1.13E+03	79.67	3.10E+02	1.77
M	6	112.21	107 -	119	111.96	2.72E+02	39.64	9.32E+01	1.50
m	7	116.42	107 -	119	116.16	5.89E+01	27.48	7.94E+01	1.51
	8	134.20	130 -	137	133.94	4.05E+01	33.70	1.59E+02	3.56
	9	160.98	158 -	163	160.70	4.17E+01	28.11	1.23E+02	1.44
	10	241.41	236 -	247	241.09	3.13E+01	30.66	1.01E+02	5.68
	11	251.38	248 -	254	251.06	2.31E+01	20.99	6.38E+01	2.82
	12	276.82	273 -	281	276.49	8.96E+01	29.33	7.87E+01	1.91
M	13	303.23	300 -	310	302.89	1.99E+02	30.20	3.23E+01	1.44
m	14	307.49	300 -	310	307.14	3.18E+01	19.14	5.22E+01	1.54
	15	323.27	320 -	327	322.92	1.30E+01	14.97	3.00E+01	1.80
	16	333.70	330 -	336	333.34	9.55E+01	28.09	7.50E+01	1.91
	17	338.40	337 -	342	338.04	1.86E+01	19.97	5.88E+01	3.14
	18	356.32	352 -	359	355.95	8.09E+02	59.57	5.11E+01	1.39
M	19	384.53	380 -	395	384.15	1.51E+02	32.62	2.28E+01	1.62
m	20	391.32	380 -	395	390.93	4.57E+01	20.59	7.15E+00	1.63
M	21	412.40	411 -	425	412.00	5.54E+00	5.17	3.09E+00	1.50
m	22	417.81	411 -	425	417.41	3.20E+01	19.60	1.22E+01	2.67
m	23	422.25	411 -	425	421.85	1.66E+01	14.56	1.52E+01	2.68
	24	437.15	431 -	439	436.74	1.29E+02	26.41	2.91E+01	2.02
	25	468.05	463 -	470	467.62	2.18E+01	16.00	2.83E+01	1.76
	26	495.26	492 -	498	494.82	6.00E+00	6.65	4.00E+00	1.11
	27	568.81	565 -	570	568.33	6.00E+00	4.90	0.00E+00	1.92
	28	609.02	605 -	611	608.52	1.05E+01	8.97	7.00E+00	1.45
	29	630.01	627 -	632	629.50	8.00E+00	5.66	0.00E+00	2.38
	30	662.78	659 -	665	662.25	8.00E+00	5.66	0.00E+00	1.16
	31	1014.53	1011 -	1016	1013.80	5.00E+00	4.47	0.00E+00	2.41

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:18:18AM

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

0175

Analysis Report for 1809016-05

BILLINGSLEY RELIEF WELL

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	35.86	5.34E+02	68.09		5.34E+02	6.81E+01
	2	52.72	6.66E+01	36.19		6.66E+01	3.62E+01
M	3	62.41	2.42E+02	41.62		2.42E+02	4.16E+01
m	4	66.41	1.16E+02	35.10	3.70E+00	1.12E+02	3.51E+01
	5	81.56	1.13E+03	79.67		1.13E+03	7.97E+01
M	6	112.21	2.72E+02	39.64		2.72E+02	3.96E+01
m	7	116.42	5.89E+01	27.48		5.89E+01	2.75E+01
	8	134.20	4.05E+01	33.70		4.05E+01	3.37E+01
	9	160.98	4.17E+01	28.11		4.17E+01	2.81E+01
	10	241.41	3.13E+01	30.66		3.13E+01	3.07E+01
	11	251.38	2.31E+01	20.99		2.31E+01	2.10E+01
	12	276.82	8.96E+01	29.33		8.96E+01	2.93E+01
M	13	303.23	1.99E+02	30.20		1.99E+02	3.02E+01
m	14	307.49	3.18E+01	19.14		3.18E+01	1.91E+01
	15	323.27	1.30E+01	14.97		1.30E+01	1.50E+01
	16	333.70	9.55E+01	28.09		9.55E+01	2.81E+01
	17	338.40	1.86E+01	19.97	1.24E+00	1.74E+01	2.00E+01
	18	356.32	8.09E+02	59.57	1.28E+00	8.09E+02	5.96E+01
M	19	384.53	1.51E+02	32.62		1.51E+02	3.26E+01
m	20	391.32	4.57E+01	20.59		4.57E+01	2.06E+01
M	21	412.40	5.54E+00	5.17		5.54E+00	5.17E+00
m	22	417.81	3.20E+01	19.60		3.20E+01	1.96E+01
m	23	422.25	1.66E+01	14.56		1.66E+01	1.46E+01
	24	437.15	1.29E+02	26.41		1.29E+02	2.64E+01
	25	468.05	2.18E+01	16.00	0.00E+00	2.18E+01	1.60E+01
	26	495.26	6.00E+00	6.65		6.00E+00	6.65E+00
	27	568.81	6.00E+00	4.90	0.00E+00	6.00E+00	4.90E+00
	28	609.02	1.05E+01	8.97	2.25E+00	8.25E+00	9.02E+00
	29	630.01	8.00E+00	5.66		8.00E+00	5.66E+00
	30	662.78	8.00E+00	5.66	1.03E+00	6.97E+00	5.72E+00
	31	1014.53	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

0176

Analysis Report for 1809016-05

BILLINGSLEY RELIEF WELL

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.96	255.12	1.93		
		391.69 *	61.90	2.80E+01	1.28E+01
I-125	0.99	35.49 *	6.49	2.09E+01	2.66E+00
CE-144	0.98	133.54 *	10.80	2.71E+02	2.41E+02
PA-231	1.00	9.28	42.00		
		10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	5.85E+03	1.98E+03
TH-234	0.98	63.29 *	3.80	4.11E+02	7.18E+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
SN-113	0.964	2.80E+01	1.28E+01	
I-125	0.996	2.09E+01	2.66E+00	
CE-144	0.988	2.71E+02	2.41E+02	
PA-231	1.000	5.85E+03	1.98E+03	
TH-234	0.980	4.11E+02	7.18E+01	

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

Errors quoted at 2.000sigma

0177

Analysis Report for 1809016-05

BILLINGSLEY RELIEF WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:18:18AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	2	52.72	7.40123E-02		
m	4	66.41	1.24461E-01		
	5	81.56	1.25315E+00		
M	6	112.21	3.01927E-01	Tol.	U-237
m	7	116.42	6.54475E-02		
	9	160.98	4.63862E-02		
	10	241.41	3.48306E-02		
	11	251.38	2.56768E-02		
	12	276.82	9.95995E-02		
m	14	307.49	3.53486E-02		
	15	323.27	1.44246E-02		
	16	333.70	1.06136E-01		
	17	338.40	1.92884E-02	Sum	
	18	356.32	8.99398E-01	Tol.	BA-133
M	19	384.53	1.68242E-01		
M	21	412.40	6.15585E-03		
m	22	417.81	3.55519E-02		
m	23	422.25	1.84528E-02		
	24	437.15	1.43819E-01	Sum	
	25	468.05	2.42593E-02		
	26	495.26	6.66667E-03		
	27	568.81	6.66667E-03		
	28	609.02	9.16167E-03		
	29	630.01	8.88889E-03		
	30	662.78	7.74624E-03		
	31	1014.53	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

0178

Analysis Report for 1809016-05

BILLINGSLEY RELIEF WELL

NUCLIDE MDA REPORT

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

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	3.03E+01	3.03E+01	1.41E+01	1.42E+01
	136.48	10.60	2.87E+02		-1.89E+01	1.34E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.68E+02	2.68E+02	-3.92E+02	1.25E+02
+ SN-113	255.12	1.93	1.28E+03	2.34E+01	-8.21E+01	5.77E+02
	391.69	* 61.90	2.34E+01		2.80E+01	1.08E+01
SN-119M	23.87	16.10	1.77E-03	1.77E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	6.80E+00	6.80E+00	2.09E+01	3.35E+00
I-129	29.78	57.00	2.49E-01	2.49E-01	1.17E+00	1.23E-01
	33.60	13.20	1.87E+00		-1.46E+00	9.20E-01
	39.58	7.52	2.11E+00		4.65E-01	9.68E-01
BA-133	30.80	97.60	2.24E-01	2.24E-01	2.52E+00	1.11E-01
	302.84	17.80	2.70E+02		7.49E+02	1.30E+02
	356.01	60.00	1.10E+02		6.52E+02	5.39E+01
CE-139	165.85	80.35	4.30E+01	4.30E+01	-1.12E+01	2.00E+01
+ CE-144	133.54	* 10.80	3.61E+02	3.61E+02	2.71E+02	1.71E+02
HG-203	279.19	77.30	4.01E+01	4.01E+01	3.76E+00	1.87E+01
PB-210	46.50	4.25	1.19E+01	1.19E+01	1.01E+01	5.50E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.29E+03		1.24E+02	5.79E+02
	302.67	* 2.30	1.24E+03		5.85E+03	5.82E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.80E+02		8.30E+02	1.85E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.31E-01		-1.64E+00	3.44E-01
	131.42	20.40	1.44E+02		-5.82E+01	6.75E+01
+ TH-234	63.29	* 3.80	2.17E+02	2.17E+02	4.11E+02	1.06E+02
NP-237	29.37	14.00	3.20E-01	3.20E-01	-9.58E+00	1.54E-01
	86.50	12.60	8.82E+01		1.16E+01	4.15E+01
U-237	97.08	16.30	9.53E+01	7.07E+01	1.75E+00	4.47E+01
	101.07	26.30	7.07E+01		1.39E+01	3.33E+01
	114.00	12.30	3.82E+02		7.49E+02	1.85E+02
	208.01	22.00	1.81E+02		2.42E+01	8.43E+01
AM-241	59.54	35.90	8.04E+00	8.04E+00	2.75E-01	3.83E+00
AM-243	74.67	66.00	9.91E+00	9.91E+00	2.00E+00	4.67E+00

0179

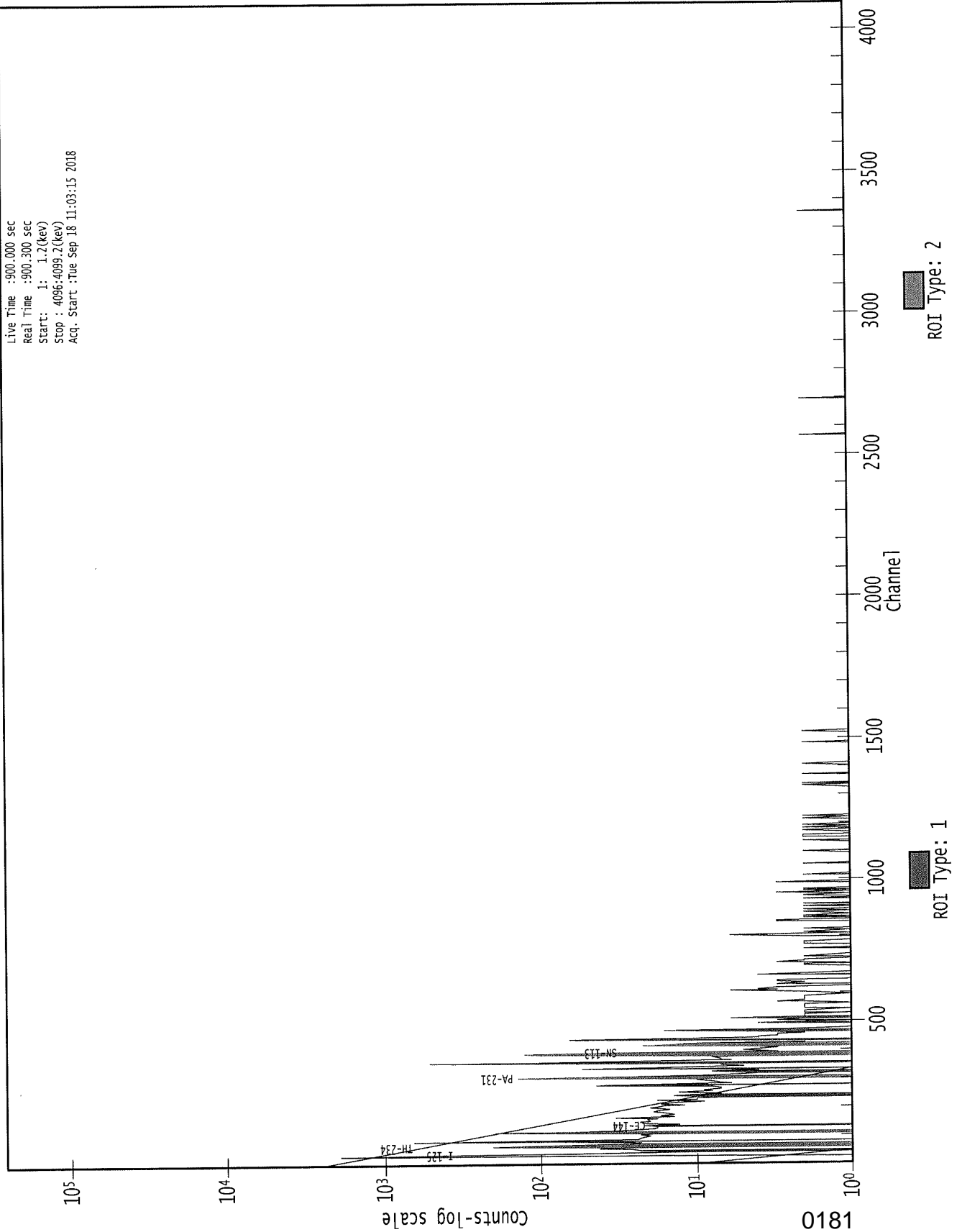
Analysis Report for 1809016-05

BILLINGSLEY RELIEF WELL

- + = 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
-

0180

0000071939.CNF



ICB
9/18/18

2

Analysis Report for 1809016-06
DAVID MASON RELIEF WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-06
 Sample Description : DAVID MASON RELIEF WELL
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:56:31AM
 Acquisition Started : 9/18/2018 11:03:26AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE3
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 902.1 seconds

Dead Time : 0.23 %

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 : 71940

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:18:34AM
 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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0182

Analysis Report for 1809016-06

DAVID MASON RELIEF WELL

2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.87	17 -	25	21.24	1.35E+02	60.15	4.76E+02	2.13
M	2	30.98	26 -	41	31.34	2.93E+03	115.05	3.07E+02	2.16
m	3	35.23	26 -	41	35.59	6.81E+02	97.55	2.73E+02	2.18
	4	52.53	49 -	56	52.88	1.07E+02	45.69	2.78E+02	2.96
M	5	61.95	57 -	70	62.30	3.77E+02	56.50	2.76E+02	2.48
m	6	66.22	57 -	70	66.57	1.73E+02	53.85	2.79E+02	2.49
	7	81.26	76 -	88	81.60	1.19E+03	95.27	5.04E+02	2.22
	8	101.02	99 -	104	101.35	4.35E+01	31.40	1.63E+02	3.55
	9	112.54	107 -	119	112.87	4.89E+02	70.60	3.51E+02	2.55
	10	197.80	194 -	202	198.09	5.07E+01	41.09	2.27E+02	5.01
	11	243.88	241 -	249	244.15	2.94E+01	29.02	1.09E+02	5.15
M	12	265.21	264 -	286	265.48	2.26E+01	9.64	2.15E+01	2.71
m	13	269.22	264 -	286	269.48	2.13E+01	23.07	7.99E+01	2.74
m	14	276.89	264 -	286	277.15	7.60E+01	26.98	6.49E+01	2.75
	15	303.08	290 -	310	303.32	2.55E+02	60.47	2.17E+02	2.15
M	16	333.86	329 -	343	334.10	1.26E+02	28.00	4.80E+01	2.57
m	17	338.11	329 -	343	338.35	4.70E+01	28.28	4.80E+01	2.61
	18	356.17	350 -	362	356.39	6.72E+02	57.38	7.05E+01	2.48
M	19	384.02	380 -	397	384.23	1.51E+02	36.88	2.52E+01	2.58
m	20	387.02	380 -	397	387.23	2.60E+02	42.24	1.53E+01	2.59
m	21	391.55	380 -	397	391.76	6.03E+01	27.71	2.53E+00	2.59
	22	417.23	409 -	427	417.44	1.05E+02	34.41	6.54E+01	6.49
M	23	432.90	433 -	443	433.10	8.17E+00	0.71	0.00E+00	3.83
m	24	437.26	433 -	443	437.45	1.31E+02	24.51	8.86E+00	2.89
	25	468.93	465 -	474	469.11	3.01E+01	16.00	1.78E+01	3.44
	26	609.59	606 -	614	609.72	1.55E+01	9.60	5.00E+00	2.86

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:18:34AM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.87	1.35E+02	60.15			1.35E+02	6.02E+01
M	2	30.98	2.93E+03	115.05			2.93E+03	1.15E+02
m	3	35.23	6.81E+02	97.55			6.81E+02	9.75E+01

0183

Analysis Report for 1809016-06

DAVID MASON RELIEF WELL

2

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.	
M	4	52.53	1.07E+02	45.69	2.82E-01	5.14E-01	1.07E+02	4.57E+01
m	5	61.95	3.77E+02	56.50	1.31E+01	8.56E-01	3.63E+02	5.65E+01
m	6	66.22	1.73E+02	53.85			1.73E+02	5.38E+01
	7	81.26	1.19E+03	95.27			1.19E+03	9.53E+01
	8	101.02	4.35E+01	31.40			4.35E+01	3.14E+01
	9	112.54	4.89E+02	70.60			4.89E+02	7.06E+01
	10	197.80	5.07E+01	41.09	9.62E-01	1.83E+00	4.98E+01	4.11E+01
	11	243.88	2.94E+01	29.02			2.94E+01	2.90E+01
M	12	265.21	2.26E+01	9.64			2.26E+01	9.64E+00
m	13	269.22	2.13E+01	23.07			2.13E+01	2.31E+01
m	14	276.89	7.60E+01	26.98			7.60E+01	2.70E+01
	15	303.08	2.55E+02	60.47			2.55E+02	6.05E+01
M	16	333.86	1.26E+02	28.00			1.26E+02	2.80E+01
m	17	338.11	4.70E+01	28.28			4.70E+01	2.83E+01
	18	356.17	6.72E+02	57.38			6.72E+02	5.74E+01
M	19	384.02	1.51E+02	36.88			1.51E+02	3.69E+01
m	20	387.02	2.60E+02	42.24			2.60E+02	4.22E+01
m	21	391.55	6.03E+01	27.71			6.03E+01	2.77E+01
	22	417.23	1.05E+02	34.41			1.05E+02	3.44E+01
M	23	432.90	8.17E+00	0.71			8.17E+00	7.07E-01
m	24	437.26	1.31E+02	24.51			1.31E+02	2.45E+01
	25	468.93	3.01E+01	16.00			3.01E+01	1.60E+01
	26	609.59	1.55E+01	9.60	1.01E+00	8.23E-01	1.45E+01	9.64E+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	4.20E+01	1.97E+01
I-125	0.99	35.49 *	6.49	3.16E+01	4.52E+00
BA-133	0.99	30.80 *	97.60	3.91E+00	1.53E-01
		302.84 *	17.80	9.57E+02	4.15E+02
		356.01 *	60.00	5.83E+02	8.30E+01

0184

Analysis Report for 1809016-06

DAVID MASON RELIEF WELL

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
TH-234	0.96	63.29 *	3.80	5.73E+02	9.11E+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
	SN-113	0.964	4.20E+01	1.97E+01
	I-125	0.999	3.16E+01	4.52E+00
X	I-129	0.903		
	BA-133	0.999	3.91E+00	1.53E-01
	TH-234	0.968	5.73E+02	9.11E+01
X	NP-237	0.886		

? = 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

0185

Analysis Report for 1809016-06

DAVID MASON RELIEF WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:18:34AM
 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	20.87	1.50034E-01	22.27		
4	52.53	1.18426E-01	21.44		
m 6	66.22	1.91937E-01	15.59	Sum	
7	81.26	1.32583E+00	3.99		
8	101.02	4.83289E-02	36.10		
9	112.54	5.43680E-01	7.21		
10	197.80	5.53131E-02	41.32		
11	243.88	3.26389E-02	49.40		
M 12	265.21	2.51372E-02	21.31	Sum	
m 13	269.22	2.37179E-02	54.03	Sum	
m 14	276.89	8.44659E-02	17.75		
M 16	333.86	1.40345E-01	11.08	Sum	
m 17	338.11	5.22147E-02	30.09	Sum	
M 19	384.02	1.67665E-01	12.22		
m 20	387.02	2.89309E-01	8.11	Sum	
22	417.23	1.17001E-01	16.34	Sum	
M 23	432.90	9.07256E-03	4.33		
m 24	437.26	1.45102E-01	9.38		
25	468.93	3.34188E-02	26.60		
26	609.59	1.61034E-02	33.26		

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

0186



Analysis Report for 1809016-06

DAVID MASON RELIEF WELL

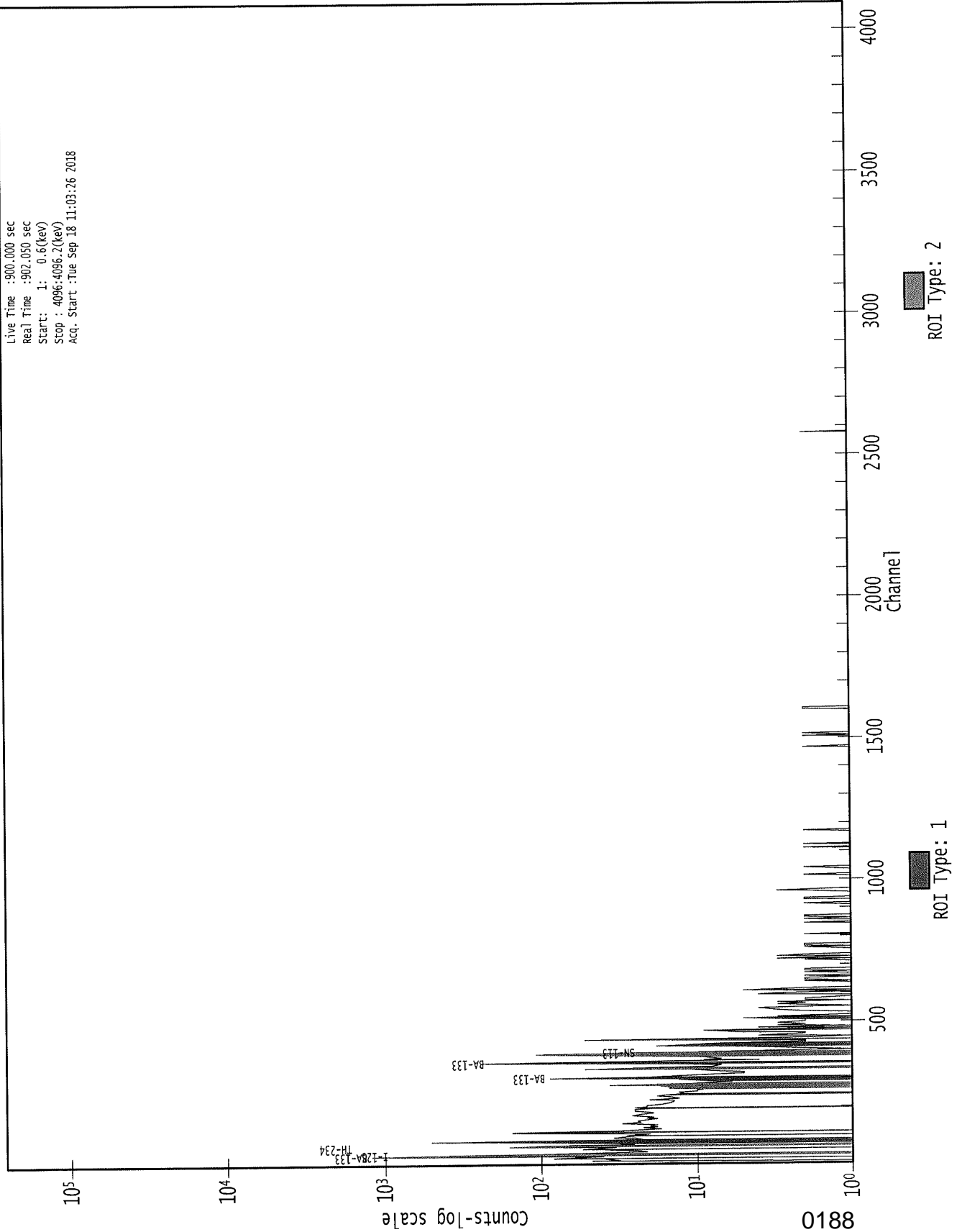
2

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	4.26E-09	4.26E-09	-1.74E-08	1.35E-09
CO-57	122.06	85.51	2.69E+01	2.69E+01	-1.43E+01	1.27E+01
	136.48	10.60	2.94E+02		1.46E+01	1.39E+02
NI-59	6.92	29.80	1.00E-07	1.00E-07	-2.83E-08	4.54E-08
MO-93	16.59	52.90	1.18E-03	1.18E-03	-4.45E-04	5.66E-04
	18.60	10.00	2.18E-02		3.03E-02	1.06E-02
NB-93M	16.57	9.43	6.56E-03	6.56E-03	-2.47E-03	3.14E-03
CD-109	88.03	3.72	3.38E+02	3.38E+02	-4.43E+01	1.61E+02
+ SN-113	255.12	1.93	1.57E+03	2.26E+01	4.36E+02	7.32E+02
	391.69	* 61.90	2.26E+01		4.20E+01	1.04E+01
SN-119M	23.87	16.10	1.06E-01	1.02E-01	-7.69E-02	5.12E-02
	25.10	22.70	1.02E-01		-1.41E+00	4.94E-02
+ I-125	35.49	* 6.49	6.36E+00	6.36E+00	3.16E+01	3.12E+00
I-129	29.78	* 57.00	3.15E-01	3.15E-01	6.69E+00	1.54E-01
	33.60	* 13.20	3.13E+00		1.55E+01	1.53E+00
	39.58	7.52	5.94E+00		2.94E-01	2.86E+00
+ BA-133	30.80	* 97.60	1.84E-01	1.84E-01	3.91E+00	9.02E-02
	302.84	* 17.80	3.28E+02		9.57E+02	1.59E+02
	356.01	* 60.00	3.75E+01		5.83E+02	1.76E+01
CE-139	165.85	80.35	4.69E+01	4.69E+01	-2.39E+01	2.22E+01
CE-144	133.54	10.80	2.77E+02	2.77E+02	2.09E+01	1.31E+02
HG-203	279.19	77.30	4.83E+01	4.83E+01	4.65E+01	2.28E+01
PB-210	46.50	4.25	1.86E+01	1.86E+01	-1.97E+00	8.84E+00
PA-231	9.28	42.00	4.13E-06	4.13E-06	6.45E-06	1.97E-06
	10.11	20.20	2.17E-05		3.39E-05	1.03E-05
	283.67	1.60	1.50E+03		8.81E+01	6.88E+02
	302.67	2.30	2.16E+03		4.25E+03	1.04E+03
TH-231	25.64	14.70	1.88E-01	1.88E-01	-6.63E+00	9.07E-02
	84.21	6.40	3.98E+02		1.34E+03	1.95E+02
PA-234M	9.89	89.00	3.89E-06	3.89E-06	6.08E-06	1.86E-06
	21.72	64.90	1.27E-02		2.03E-02	6.17E-03
	37.93	23.75	2.58E+00		8.09E+00	1.26E+00
	131.42	20.40	1.42E+02		-2.92E+01	6.71E+01
+ TH-234	63.29	* 3.80	1.78E+02	1.78E+02	5.73E+02	8.67E+01
NP-237	29.37	* 14.00	1.28E+00	1.28E+00	2.72E+01	6.29E-01
	86.50	12.60	1.03E+02		-2.53E+00	4.91E+01
U-237	97.08	16.30	1.03E+02	7.13E+01	-1.68E+01	4.92E+01
	101.07	26.30	7.13E+01		2.09E+01	3.40E+01
	114.00	12.30	3.89E+02		1.32E+03	1.89E+02
	208.01	22.00	1.92E+02		2.20E+01	9.07E+01
AM-241	59.54	35.90	1.49E+01	1.49E+01	3.44E+01	7.24E+00
AM-243	74.67	66.00	1.14E+01	1.14E+01	6.61E-01	5.42E+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

0187

0000071940.CNF



*KS
9/18/18*

2

Analysis Report for 1809016-07
DENNISON RIG SUPPLY WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-07
 Sample Description : DENNISON RIG SUPPLY WELL
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:56:47AM
 Acquisition Started : 9/18/2018 11:03:33AM

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 : 71941

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:18:47AM

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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0189

Analysis Report for 1809016-07

DENNISON RIG SUPPLY WELL

2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.25	16 -	24	20.30	1.16E+02	58.66	4.57E+02	2.15
M	2	31.41	25 -	44	30.47	2.93E+03	116.41	2.88E+02	2.24
m	3	35.68	25 -	44	34.75	7.10E+02	73.53	1.98E+02	2.02
	4	53.25	48 -	55	52.33	5.54E+01	42.80	2.69E+02	2.28
M	5	62.29	56 -	69	61.38	3.12E+02	57.86	3.26E+02	2.60
m	6	66.53	56 -	69	65.62	1.20E+02	55.39	3.73E+02	2.61
	7	81.56	75 -	85	80.66	1.14E+03	83.69	3.25E+02	2.23
M	8	112.17	105 -	120	111.29	2.90E+02	51.19	2.22E+02	2.83
m	9	116.87	105 -	120	116.00	7.65E+01	32.45	1.41E+02	2.16
	10	162.47	158 -	166	161.64	3.88E+01	41.25	2.36E+02	1.14
	11	277.35	273 -	282	276.61	7.65E+01	27.44	6.11E+01	2.43
M	12	303.37	298 -	316	302.65	1.91E+02	32.86	5.75E+01	2.66
m	13	308.43	298 -	316	307.71	2.99E+01	24.16	5.89E+01	2.22
	14	334.99	329 -	342	334.29	1.05E+02	35.23	9.23E+01	3.09
	15	356.60	350 -	360	355.92	6.05E+02	52.48	4.59E+01	2.18
M	16	377.99	374 -	395	377.33	1.43E+01	11.14	1.20E+01	4.15
m	17	386.47	374 -	395	385.81	2.75E+02	38.47	2.40E+01	4.16
	18	415.73	409 -	422	415.10	4.45E+01	26.15	5.70E+01	2.81
	19	437.62	432 -	440	437.01	1.05E+02	21.92	9.85E+00	1.73
	20	445.03	442 -	446	444.43	7.00E+00	5.29	0.00E+00	1.47
	21	459.40	455 -	463	458.81	9.06E+00	11.17	1.39E+01	1.62
	22	468.61	463 -	472	468.03	1.85E+01	15.78	2.49E+01	1.68
	23	609.27	605 -	612	608.81	1.39E+01	8.94	4.13E+00	5.43

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:18:47AM

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	21.25	1.16E+02	58.66			1.16E+02	5.87E+01
M	2	31.41	2.93E+03	116.41			2.93E+03	1.16E+02
m	3	35.68	7.10E+02	73.53			7.10E+02	7.35E+01
	4	53.25	5.54E+01	42.80			5.54E+01	4.28E+01
M	5	62.29	3.12E+02	57.86	1.33E+01	2.31E+00	2.99E+02	5.79E+01
m	6	66.53	1.20E+02	55.39			1.20E+02	5.54E+01

0190

Analysis Report for 1809016-07

DENNISON RIG SUPPLY WELL

2

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	7	81.56	1.14E+03	83.69		1.14E+03	8.37E+01
M	8	112.17	2.90E+02	51.19		2.90E+02	5.12E+01
m	9	116.87	7.65E+01	32.45		7.65E+01	3.24E+01
	10	162.47	3.88E+01	41.25		3.88E+01	4.12E+01
	11	277.35	7.65E+01	27.44		7.65E+01	2.74E+01
M	12	303.37	1.91E+02	32.86		1.91E+02	3.29E+01
m	13	308.43	2.99E+01	24.16		2.99E+01	2.42E+01
	14	334.99	1.05E+02	35.23		1.05E+02	3.52E+01
	15	356.60	6.05E+02	52.48		6.05E+02	5.25E+01
M	16	377.99	1.43E+01	11.14		1.43E+01	1.11E+01
m	17	386.47	2.75E+02	38.47		2.75E+02	3.85E+01
	18	415.73	4.45E+01	26.15		4.45E+01	2.62E+01
	19	437.62	1.05E+02	21.92		1.05E+02	2.19E+01
	20	445.03	7.00E+00	5.29		7.00E+00	5.29E+00
	21	459.40	9.06E+00	11.17		9.06E+00	1.12E+01
	22	468.61	1.85E+01	15.78		1.85E+01	1.58E+01
	23	609.27	1.39E+01	8.94	1.31E+00 1.33E+00	1.26E+01	9.04E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
I-125	0.99	35.49 *	6.49	6.49E+02	6.92E+01
BA-133	0.99	30.80 *	97.60	1.37E+02	6.06E+00
		302.84 *	17.80	9.41E+02	3.31E+02
		356.01 *	60.00	9.50E+02	1.49E+02
HG-203	0.93	279.19 *	77.30	8.28E+01	3.89E+01
TH-234	0.98	63.29 *	3.80	1.29E+03	2.65E+02

0191

Analysis Report for 1809016-07

DENNISON RIG SUPPLY WELL

* = 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
	I-125	0.999	6.49E+02	6.92E+01	
X	I-129	0.592			
	BA-133	0.993	1.38E+02	6.06E+00	
	HG-203	0.937	8.28E+01	3.89E+01	
	TH-234	0.981	1.29E+03	2.65E+02	
X	NP-237	0.548			

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

Errors quoted at 2.000sigma

0192

Analysis Report for 1809016-07

DENNISON RIG SUPPLY WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:18:47AM
 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	21.25	1.28550E-01	25.35	Tol.	PA-234M
4	53.25	6.16082E-02	38.60		
m 6	66.53	1.33830E-01	22.99	Sum	
7	81.56	1.26964E+00	3.66		
M 8	112.17	3.22159E-01	8.83	Tol.	U-237
m 9	116.87	8.50513E-02	21.20		
10	162.47	4.31387E-02	53.12		
m 13	308.43	3.32448E-02	40.38	Sum	
14	334.99	1.16483E-01	16.80	Sum	
M 16	377.99	1.59064E-02	38.89		
m 17	386.47	3.06037E-01	6.98	Sum	
18	415.73	4.94673E-02	29.37		
19	437.62	1.16747E-01	10.43		
20	445.03	7.77778E-03	37.80		
21	459.40	1.00694E-02	61.62		
22	468.61	2.06093E-02	42.54		
23	609.27	1.40350E-02	35.80		

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

0193

Analysis Report for 1809016-07

DENNISON RIG SUPPLY WELL

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.09E+01	2.09E+01	-3.84E+00	9.78E+00
	136.48	10.60	2.13E+02		-3.92E+01	1.00E+02
NI-59	6.92	29.80	5.05E-02	5.05E-02	-5.84E-02	2.15E-02
MO-93	16.59	52.90	1.31E+00	1.31E+00	2.71E-01	6.29E-01
	18.60	10.00	1.11E+01		1.21E+01	5.39E+00
NB-93M	16.57	9.43	7.33E+00	7.33E+00	1.52E+00	5.52E+00
CD-109	88.03	3.72	3.89E+02	3.89E+02	-1.39E+02	1.84E+02
SN-113	255.12	1.93	1.33E+03	9.97E+01	-5.16E+02	6.07E+02
	391.69	61.90	9.97E+01		1.42E+02	4.77E+01
SN-119M	23.87	16.10	1.24E+01	9.20E+00	-1.53E+01	6.00E+00
	25.10	22.70	9.20E+00		-1.13E+02	4.44E+00
+ I-125	35.49	* 6.49	1.39E+02	1.39E+02	6.49E+02	6.85E+01
I-129	29.78	* 57.00	1.23E+01	1.23E+01	2.34E+02	6.05E+00
	33.60	13.20	1.08E+02		1.14E+03	5.35E+01
	39.58	7.52	7.21E+01		-2.98E+02	3.47E+01
+ BA-133	30.80	* 97.60	7.19E+00	7.19E+00	1.37E+02	3.53E+00
	302.84	* 17.80	3.24E+02		9.41E+02	1.55E+02
	356.01	* 60.00	5.14E+01		9.50E+02	2.36E+01
CE-139	165.85	80.35	3.56E+01	3.56E+01	-3.79E+00	1.68E+01
CE-144	133.54	10.80	1.95E+02	1.95E+02	-5.10E+01	9.17E+01
+ HG-203	279.19	* 77.30	4.06E+01	4.06E+01	8.28E+01	1.88E+01
PB-210	46.50	4.25	1.21E+02	1.21E+02	-9.21E+00	5.74E+01
PA-231	9.28	42.00	2.10E-01	2.10E-01	1.92E-01	9.83E-02
	10.11	20.20	6.15E-01		2.39E-01	2.90E-01
	283.67	1.60	1.45E+03		3.88E+02	6.52E+02
	302.67	2.30	2.63E+03		5.62E+03	1.27E+03
TH-231	25.64	14.70	1.53E+01	1.53E+01	-4.83E+02	7.38E+00
	84.21	6.40	6.47E+02		3.97E+03	3.18E+02
PA-234M	9.89	89.00	1.31E-01	1.31E-01	5.10E-02	6.17E-02
	21.72	64.90	2.54E+00		3.94E+00	1.23E+00
	37.93	23.75	3.75E+01		1.20E+02	1.84E+01
	131.42	20.40	9.91E+01		-4.57E+01	4.66E+01
+ TH-234	63.29	* 3.80	5.06E+02	5.06E+02	1.29E+03	2.47E+02
NP-237	29.37	* 14.00	5.02E+01	5.02E+01	9.54E+02	2.46E+01
	86.50	12.60	1.21E+02		2.32E+01	5.78E+01
U-237	97.08	16.30	9.52E+01	6.69E+01	-7.19E+01	4.50E+01
	101.07	26.30	6.69E+01		3.90E+01	3.18E+01
	114.00	12.30	2.95E+02		8.25E+02	1.43E+02
	208.01	22.00	1.49E+02		2.86E+01	7.05E+01
AM-241	59.54	35.90	4.20E+01	4.20E+01	9.39E+01	2.04E+01
AM-243	74.67	66.00	1.91E+01	1.91E+01	-4.53E-01	9.11E+00

+ = Nuclide identified during the nuclide identification

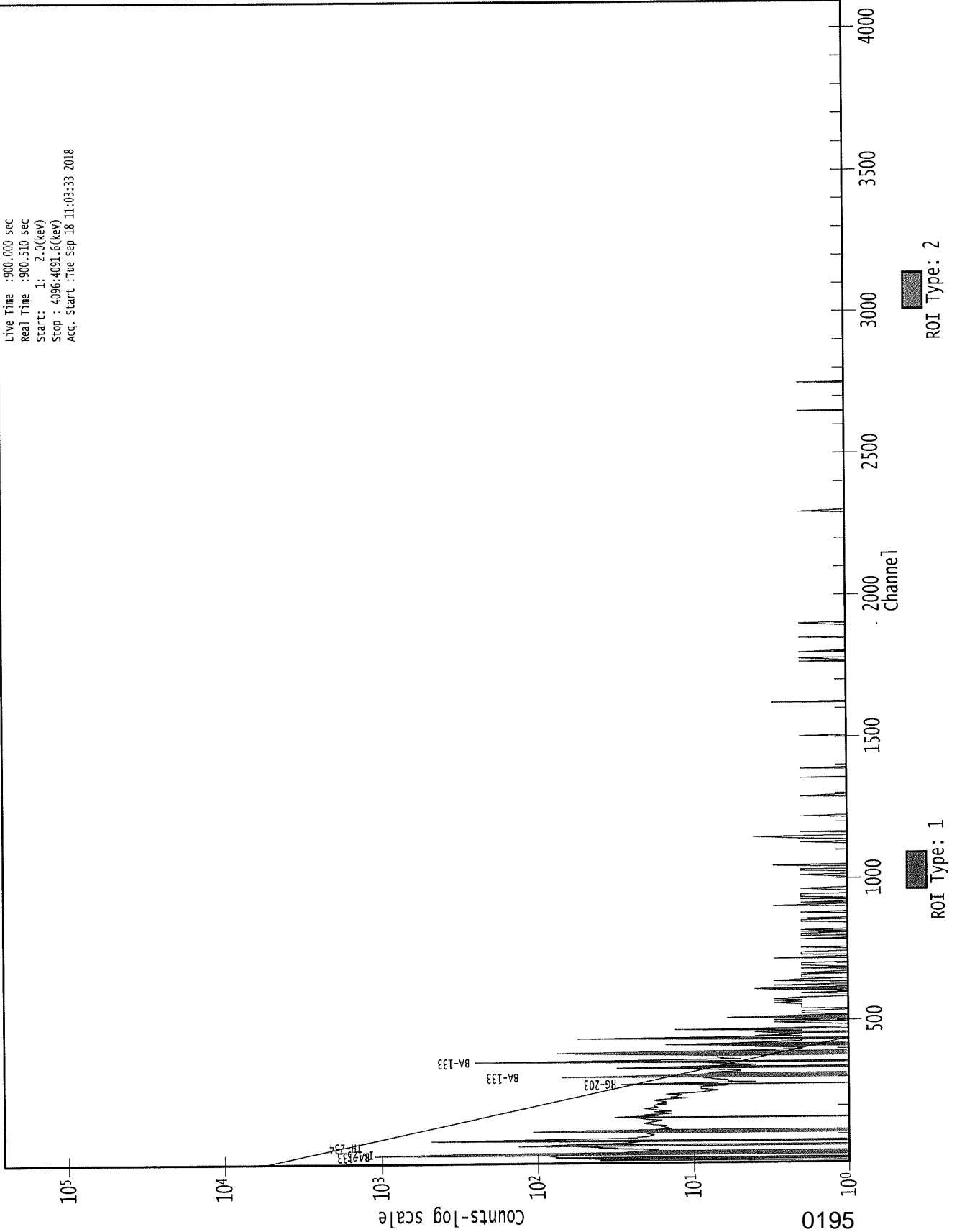
* = Energy line found in the spectrum

> = MDA value not calculated

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

0194

0000071941.CNF



*Sub
alpha*

2

Analysis Report for 1809016-08
GAMBLE RIG SUPPLY WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-08
 Sample Description : GAMBLE RIG SUPPLY WELL
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:57:04AM
 Acquisition Started : 9/18/2018 11:20:56AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.3 seconds

Dead Time : 0.03 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 28 - 4096
 Identification Energy Tolerance : 1.000FWHM

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

Sample Number : 71943

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:36:00AM
 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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0196

Analysis Report for 1809016-08

GAMBLE RIG SUPPLY WELL

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.88	35 -	40	35.66	5.56E+02	80.89	4.00E+02	2.55
	2	52.98	49 -	55	52.76	9.06E+01	38.19	1.99E+02	2.61
M	3	62.30	58 -	69	62.07	3.20E+02	44.93	1.44E+02	1.65
m	4	66.45	58 -	69	66.22	1.43E+02	37.03	1.69E+02	1.67
	5	81.62	79 -	85	81.38	1.10E+03	76.04	2.37E+02	1.74
M	6	112.33	99 -	119	112.08	2.42E+02	38.97	1.22E+02	1.67
m	7	116.66	99 -	119	116.41	6.47E+01	35.09	1.28E+02	2.01
	8	191.30	188 -	193	191.01	2.54E+01	27.95	1.37E+02	2.66
	9	276.62	273 -	280	276.29	8.80E+01	30.00	8.99E+01	1.70
M	10	303.20	299 -	309	302.86	1.95E+02	30.72	5.17E+01	1.48
m	11	307.37	299 -	309	307.03	3.55E+01	19.60	3.93E+01	1.54
M	12	334.22	330 -	345	333.86	9.31E+01	21.44	1.84E+01	1.78
m	13	338.35	330 -	345	337.98	2.52E+01	16.34	1.93E+01	1.90
M	14	352.51	351 -	361	352.14	2.98E+01	12.54	2.09E+01	1.59
m	15	356.31	351 -	361	355.94	7.27E+02	54.70	2.59E+01	1.49
M	16	384.33	380 -	396	383.95	1.43E+02	25.80	2.16E+01	1.79
m	17	387.25	380 -	396	386.86	1.86E+02	35.18	1.40E+01	1.79
m	18	391.47	380 -	396	391.08	6.37E+01	20.72	7.33E+00	1.79
M	19	412.40	411 -	428	412.00	5.72E+00	5.55	8.60E+00	1.50
m	20	418.90	411 -	428	418.50	2.36E+01	16.22	7.32E+00	2.01
	21	437.34	433 -	441	436.93	9.75E+01	23.18	2.30E+01	1.43
	22	454.59	451 -	458	454.17	1.20E+01	12.00	1.60E+01	1.70
M	23	468.27	463 -	474	467.84	2.85E+01	13.17	1.50E+01	1.71
m	24	471.58	463 -	474	471.16	7.34E+00	10.07	1.50E+01	1.71
	25	522.30	517 -	525	521.84	1.17E+01	8.73	4.57E+00	4.38
	26	559.87	556 -	563	559.40	1.00E+01	6.32	0.00E+00	2.92
	27	609.10	605 -	611	608.60	1.48E+01	10.81	1.05E+01	1.43
	28	615.40	613 -	618	614.90	8.06E+00	6.71	1.89E+00	1.05
	29	654.77	651 -	656	654.24	6.50E+00	6.40	3.00E+00	1.37

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:36:00AM

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

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
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0197

Analysis Report for 1809016-08

GAMBLE RIG SUPPLY WELL

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	35.88	5.56E+02	80.89		5.56E+02	8.09E+01
	2	52.98	9.06E+01	38.19		9.06E+01	3.82E+01
M	3	62.30	3.20E+02	44.93		3.20E+02	4.49E+01
m	4	66.45	1.43E+02	37.03	3.70E+00	1.39E+02	3.71E+01
	5	81.62	1.10E+03	76.04		1.10E+03	7.60E+01
M	6	112.33	2.42E+02	38.97		2.42E+02	3.90E+01
m	7	116.66	6.47E+01	35.09		6.47E+01	3.51E+01
	8	191.30	2.54E+01	27.95		2.54E+01	2.79E+01
	9	276.62	8.80E+01	30.00		8.80E+01	3.00E+01
M	10	303.20	1.95E+02	30.72		1.95E+02	3.07E+01
m	11	307.37	3.55E+01	19.60		3.55E+01	1.96E+01
M	12	334.22	9.31E+01	21.44		9.31E+01	2.14E+01
m	13	338.35	2.52E+01	16.34	1.24E+00	2.39E+01	1.64E+01
M	14	352.51	2.98E+01	12.54	2.64E+00	2.72E+01	1.26E+01
m	15	356.31	7.27E+02	54.70		7.27E+02	5.47E+01
M	16	384.33	1.43E+02	25.80		1.43E+02	2.58E+01
m	17	387.25	1.86E+02	35.18		1.86E+02	3.52E+01
m	18	391.47	6.37E+01	20.72		6.37E+01	2.07E+01
M	19	412.40	5.72E+00	5.55		5.72E+00	5.55E+00
m	20	418.90	2.36E+01	16.22		2.36E+01	1.62E+01
	21	437.34	9.75E+01	23.18		9.75E+01	2.32E+01
	22	454.59	1.20E+01	12.00		1.20E+01	1.20E+01
M	23	468.27	2.85E+01	13.17	0.00E+00	2.85E+01	1.32E+01
m	24	471.58	7.34E+00	10.07		7.34E+00	1.01E+01
	25	522.30	1.17E+01	8.73		1.17E+01	8.73E+00
	26	559.87	1.00E+01	6.32		1.00E+01	6.32E+00
	27	609.10	1.48E+01	10.81	2.25E+00	1.25E+01	1.08E+01
	28	615.40	8.06E+00	6.71	8.95E-01	8.06E+00	6.71E+00
	29	654.77	6.50E+00	6.40		6.50E+00	6.40E+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
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0198

Analysis Report for 1809016-08

GAMBLE RIG SUPPLY WELL

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.96	255.12 391.69 *	1.93 61.90	3.90E+01	1.30E+01
I-125	0.99	35.49 *	6.49	2.18E+01	3.18E+00
PA-231	1.00	9.28 10.11 283.67	42.00 20.20 1.60		
TH-234	0.97	302.67 * 63.29 *	2.30 3.80	5.73E+03 5.41E+02	1.96E+03 7.74E+01

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
SN-113	0.966	3.90E+01	1.30E+01	
I-125	0.996	2.18E+01	3.18E+00	
PA-231	1.000	5.73E+03	1.96E+03	
TH-234	0.974	5.41E+02	7.74E+01	

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

Errors quoted at 2.000sigma

Analysis Report for 1809016-08

GAMBLE RIG SUPPLY WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:36:00AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	2	52.98	1.00620E-01		
m	4	66.45	1.54937E-01		
	5	81.62	1.22624E+00		
M	6	112.33	2.69219E-01	Tol.	U-237
m	7	116.66	7.19260E-02		
	8	191.30	2.81678E-02		
	9	276.62	9.78070E-02		
m	11	307.37	3.94048E-02		
M	12	334.22	1.03428E-01		
m	13	338.35	2.65898E-02	Sum	
M	14	352.51	3.02253E-02		
m	15	356.31	8.07363E-01	Tol.	BA-133
M	16	384.33	1.59135E-01		
m	17	387.25	2.06785E-01		
M	19	412.40	6.35194E-03		
m	20	418.90	2.61886E-02		
	21	437.34	1.08323E-01		
	22	454.59	1.33333E-02	Sum	
M	23	468.27	3.16824E-02		
m	24	471.58	8.15984E-03		
	25	522.30	1.30159E-02		
	26	559.87	1.11111E-02		
	27	609.10	1.38839E-02		
	28	615.40	8.95062E-03		
	29	654.77	7.22222E-03		

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

0200

Analysis Report for 1809016-08

GAMBLE RIG SUPPLY WELL

NUCLIDE MDA REPORT

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

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.67E+01	2.67E+01	-5.86E+00	1.24E+01
	136.48	10.60	2.87E+02		-9.88E+01	1.34E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.93E+02	2.93E+02	1.54E+01	1.37E+02
+ SN-113	255.12	1.93	1.54E+03	2.30E+01	6.74E+02	7.11E+02
	391.69	* 61.90	2.30E+01		3.90E+01	1.07E+01
SN-119M	23.87	16.10	1.77E-03	1.77E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	6.14E+00	6.14E+00	2.18E+01	3.02E+00
I-129	29.78	57.00	2.30E-01	2.30E-01	7.92E-01	1.14E-01
	33.60	13.20	1.89E+00		-9.19E-01	9.27E-01
	39.58	7.52	1.96E+00		-3.01E+00	8.93E-01
BA-133	30.80	97.60	2.13E-01	2.13E-01	2.21E+00	1.05E-01
	302.84	17.80	2.69E+02		6.66E+02	1.29E+02
	356.01	60.00	1.05E+02		5.85E+02	5.13E+01
CE-139	165.85	80.35	4.84E+01	4.84E+01	9.52E+00	2.26E+01
CE-144	133.54	10.80	2.78E+02	2.78E+02	3.88E+01	1.30E+02
HG-203	279.19	77.30	3.86E+01	3.86E+01	-8.56E+00	1.80E+01
PB-210	46.50	4.25	1.07E+01	1.07E+01	6.37E-01	4.92E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.31E+03		5.68E+02	5.90E+02
	302.67	* 2.30	1.50E+03		5.73E+03	7.09E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.67E+02		8.96E+02	1.79E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.07E-01		-1.36E+00	3.33E-01
	131.42	20.40	1.30E+02		-7.52E+01	6.06E+01
+ TH-234	63.29	* 3.80	1.42E+02	1.42E+02	5.41E+02	6.87E+01
NP-237	29.37	14.00	3.13E-01	3.13E-01	-7.90E+00	1.51E-01
	86.50	12.60	8.27E+01		-4.09E+01	3.88E+01
U-237	97.08	16.30	9.08E+01	6.74E+01	2.22E+01	4.25E+01
	101.07	26.30	6.74E+01		1.16E+01	3.17E+01
	114.00	12.30	3.57E+02		5.05E+02	1.73E+02
	208.01	22.00	1.76E+02		-4.19E+01	8.18E+01
AM-241	59.54	35.90	7.92E+00	7.92E+00	-5.65E+01	3.77E+00
AM-243	74.67	66.00	1.05E+01	1.05E+01	-7.89E+00	4.97E+00

0201

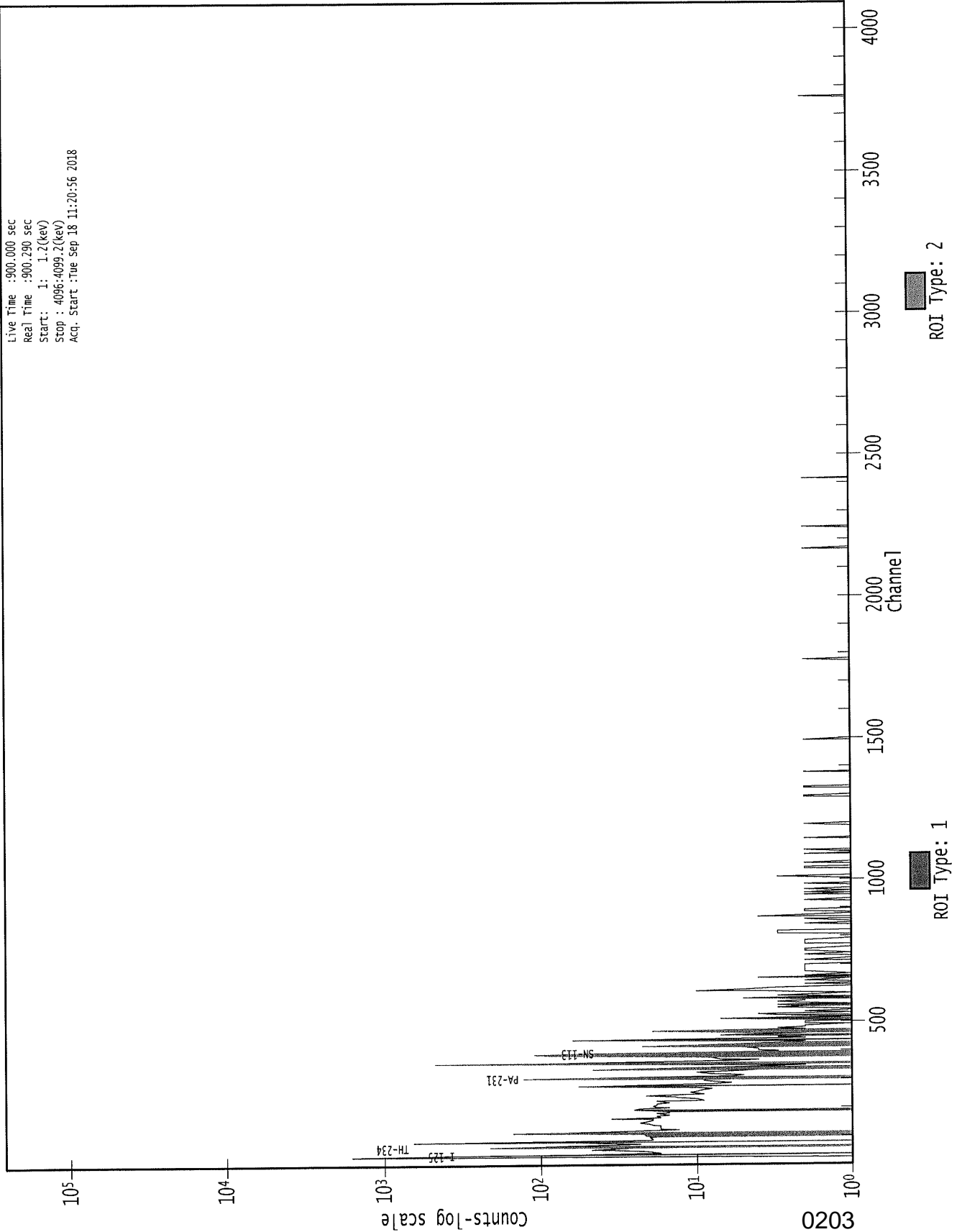
Analysis Report for 1809016-08

GAMBLE RIG SUPPLY WELL

- + = 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
-

0202

0000071943.CNF



*RB
9/18/18*

2

Analysis Report for 1809016-09
FIELD DUPLICATE

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-09
 Sample Description : FIELD DUPLICATE
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:57:16AM
 Acquisition Started : 9/18/2018 11:21:05AM

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

Dead Time : 0.22 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 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 : 71944

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:36:15AM

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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0204

Analysis Report for 1809016-09

FIELD DUPLICATE

2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	21.19	17 -	40	21.56	1.58E+02	48.12	2.93E+02	2.63
m	2	31.04	17 -	40	31.40	2.85E+03	112.38	2.02E+02	2.16
m	3	35.20	17 -	40	35.56	7.24E+02	96.46	2.09E+02	2.48
	4	52.89	49 -	57	53.25	9.54E+01	49.82	3.21E+02	2.38
M	5	61.99	58 -	71	62.33	3.38E+02	54.83	2.85E+02	2.48
m	6	66.32	58 -	71	66.67	1.45E+02	53.57	3.46E+02	2.46
	7	81.28	78 -	88	81.62	1.16E+03	89.93	4.58E+02	2.31
	8	102.14	98 -	106	102.47	5.87E+01	40.35	2.11E+02	5.14
M	9	111.92	107 -	120	112.25	2.92E+02	49.56	1.68E+02	2.57
m	10	116.23	107 -	120	116.55	9.67E+01	44.36	1.86E+02	2.57
	11	276.40	271 -	281	276.66	7.12E+01	33.30	1.10E+02	2.45
M	12	303.20	297 -	316	303.45	2.22E+02	38.24	9.24E+01	3.43
m	13	307.38	297 -	316	307.62	3.79E+01	37.12	8.40E+01	3.38
M	14	333.82	319 -	343	334.06	1.05E+02	25.38	3.59E+01	2.76
m	15	338.45	319 -	343	338.68	3.59E+01	22.36	3.30E+01	2.59
M	16	356.27	351 -	368	356.50	6.26E+02	51.68	3.12E+01	2.13
m	17	364.52	351 -	368	364.74	2.77E+01	19.87	6.22E+01	3.11
M	18	383.98	380 -	397	384.20	1.39E+02	36.91	3.53E+01	2.30
m	19	387.02	380 -	397	387.23	2.58E+02	44.65	3.34E+01	2.84
M	20	414.69	411 -	425	414.90	4.17E+01	22.58	3.27E+01	2.85
m	21	418.40	411 -	425	418.60	3.47E+01	22.09	3.43E+01	2.59
m	22	422.41	411 -	425	422.61	1.16E+01	16.55	3.36E+01	3.03
	23	437.35	430 -	441	437.54	1.40E+02	27.57	2.87E+01	2.77
	24	457.39	453 -	461	457.57	9.50E+00	9.82	9.00E+00	2.66
	25	469.79	464 -	478	469.97	3.50E+01	11.83	0.00E+00	3.11
	26	511.53	506 -	518	511.70	3.42E+01	17.17	1.56E+01	2.46
	27	597.74	594 -	601	597.87	6.13E+00	6.93	3.75E+00	4.55
	28	1119.23	1115 -	1121	1119.20	5.00E+00	4.47	0.00E+00	2.31

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:36:15AM

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	21.19	1.58E+02	48.12			1.58E+02	4.81E+01

0205

Analysis Report for 1809016-09

FIELD DUPLICATE

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	2	31.04	2.85E+03	112.38			2.85E+03	1.12E+02
m	3	35.20	7.24E+02	96.46			7.24E+02	9.65E+01
	4	52.89	9.54E+01	49.82	2.82E-01	5.14E-01	9.51E+01	4.98E+01
M	5	61.99	3.38E+02	54.83	1.31E+01	8.56E-01	3.25E+02	5.48E+01
m	6	66.32	1.45E+02	53.57			1.45E+02	5.36E+01
	7	81.28	1.16E+03	89.93			1.16E+03	8.99E+01
	8	102.14	5.87E+01	40.35			5.87E+01	4.03E+01
M	9	111.92	2.92E+02	49.56			2.92E+02	4.96E+01
m	10	116.23	9.67E+01	44.36			9.67E+01	4.44E+01
	11	276.40	7.12E+01	33.30			7.12E+01	3.33E+01
M	12	303.20	2.22E+02	38.24			2.22E+02	3.82E+01
m	13	307.38	3.79E+01	37.12			3.79E+01	3.71E+01
M	14	333.82	1.05E+02	25.38			1.05E+02	2.54E+01
m	15	338.45	3.59E+01	22.36			3.59E+01	2.24E+01
M	16	356.27	6.26E+02	51.68			6.26E+02	5.17E+01
m	17	364.52	2.77E+01	19.87			2.77E+01	1.99E+01
M	18	383.98	1.39E+02	36.91			1.39E+02	3.69E+01
m	19	387.02	2.58E+02	44.65			2.58E+02	4.47E+01
M	20	414.69	4.17E+01	22.58			4.17E+01	2.26E+01
m	21	418.40	3.47E+01	22.09			3.47E+01	2.21E+01
m	22	422.41	1.16E+01	16.55			1.16E+01	1.66E+01
	23	437.35	1.40E+02	27.57			1.40E+02	2.76E+01
	24	457.39	9.50E+00	9.82			9.50E+00	9.82E+00
	25	469.79	3.50E+01	11.83			3.50E+01	1.18E+01
	26	511.53	3.42E+01	17.17	1.42E+01	1.38E+00	2.00E+01	1.72E+01
	27	597.74	6.13E+00	6.93	6.85E-02	1.03E+00	6.06E+00	7.00E+00
	28	1119.23	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
I-125	0.99	35.49 *	6.49	3.34E+01	4.45E+00
BA-133	0.99	30.80 *	97.60	3.85E+00	1.52E-01

0206

Analysis Report for 1809016-09

FIELD DUPLICATE

2

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
BA-133	0.99	302.84 *		17.80	8.34E+02	3.35E+02
		356.01 *		60.00	5.43E+02	7.64E+01
TH-234	0.97	63.29 *		3.80	5.14E+02	8.84E+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
	I-125	0.998	3.34E+01	4.45E+00	
X	I-129	0.902			
	BA-133	0.999	3.85E+00	1.52E-01	
	TH-234	0.970	5.14E+02	8.84E+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

0207

Analysis Report for 1809016-09

FIELD DUPLICATE

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:36:15AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

	<i>Peak No.</i>	<i>Energy (keV)</i>	<i>Peak Size (CPS)</i>	<i>Peak CPS (%) Uncertainty</i>	<i>Peak Type</i>	<i>Tolerance Nuclide</i>
M	1	21.19	1.75107E-01	15.27	Tol.	PA-234M
	4	52.89	1.05706E-01	26.18		
m	6	66.32	1.61486E-01	18.43	Sum	
	7	81.28	1.29436E+00	3.86		
	8	102.14	6.52371E-02	34.36	Tol.	U-237
M	9	111.92	3.24808E-01	8.48		
m	10	116.23	1.07467E-01	22.93		
	11	276.40	7.90741E-02	23.40		
m	13	307.38	4.20960E-02	48.99		
M	14	333.82	1.16799E-01	12.07	Sum	
m	15	338.45	3.98967E-02	31.14	Sum	
m	17	364.52	3.07433E-02	35.90	Sum	
M	18	383.98	1.54614E-01	13.26		
m	19	387.02	2.86480E-01	8.66	Sum	
M	20	414.69	4.62798E-02	27.11		
m	21	418.40	3.85134E-02	31.87	Sum	
m	22	422.41	1.29017E-02	71.28		
	23	437.35	1.55152E-01	9.87		
	24	457.39	1.05556E-02	51.70		
	25	469.79	3.88889E-02	16.90		
	26	511.53	2.22573E-02	42.99		
	27	597.74	6.72943E-03	57.82		
	28	1119.23	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

0208

Analysis Report for 1809016-09
FIELD DUPLICATE

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	-1.88E-08	1.35E-09
CO-57	122.06	85.51	2.83E+01	2.83E+01	1.02E+01	1.34E+01
	136.48	10.60	2.96E+02		-1.21E+01	1.40E+02
NI-59	6.92	29.80	9.86E-08	9.86E-08	-1.06E-08	4.46E-08
MO-93	16.59	52.90	1.18E-03	1.18E-03	1.10E-04	5.65E-04
	18.60	10.00	2.13E-02		3.19E-02	1.03E-02
NB-93M	16.57	9.43	6.54E-03	6.54E-03	6.09E-04	3.13E-03
CD-109	88.03	3.72	3.38E+02	3.38E+02	-1.29E+02	1.61E+02
SN-113	255.12	1.93	1.36E+03	4.57E+01	-4.99E+02	6.25E+02
	391.69	61.90	4.57E+01		3.75E+01	2.19E+01
SN-119M	23.87	16.10	1.03E-01	1.01E-01	-1.23E-01	4.96E-02
	25.10	22.70	1.01E-01		-1.21E+00	4.89E-02
+ I-125	35.49	*	6.49	7.68E+00	3.34E+01	3.78E+00
I-129	29.78	*	57.00	3.85E-01	6.59E+00	1.89E-01
	33.60	*	13.20	3.78E+00	1.64E+01	1.86E+00
	39.58		7.52	5.99E+00	7.87E-01	2.89E+00
+ BA-133	30.80	*	97.60	2.25E-01	3.85E+00	1.11E-01
	302.84	*	17.80	2.85E+02	8.34E+02	1.38E+02
	356.01	*	60.00	4.64E+01	5.43E+02	2.20E+01
CE-139	165.85	80.35	4.85E+01	4.85E+01	-2.93E+01	2.29E+01
CE-144	133.54	10.80	2.81E+02	2.81E+02	1.26E+02	1.33E+02
HG-203	279.19	77.30	4.68E+01	4.68E+01	6.87E+01	2.21E+01
PB-210	46.50	4.25	1.95E+01	1.95E+01	-1.57E+00	9.29E+00
PA-231	9.28	42.00	3.86E-06	3.86E-06	4.41E-06	1.83E-06
	10.11	20.20	2.03E-05		2.32E-05	9.63E-06
	283.67	1.60	1.43E+03		4.76E+02	6.55E+02
	302.67	2.30	2.12E+03		3.91E+03	1.02E+03
TH-231	25.64	14.70	1.86E-01	1.86E-01	-5.67E+00	9.01E-02
	84.21	6.40	3.98E+02		1.39E+03	1.95E+02
PA-234M	9.89	89.00	3.63E-06	3.63E-06	4.16E-06	1.73E-06
	21.72	64.90	1.22E-02		1.43E-02	5.91E-03
	37.93	23.75	2.55E+00		7.60E+00	1.25E+00
	131.42	20.40	1.39E+02		1.83E+01	6.59E+01
+ TH-234	63.29	*	3.80	1.87E+02	5.14E+02	9.13E+01
NP-237	29.37	*	14.00	1.57E+00	2.68E+01	7.70E-01
	86.50		12.60	1.00E+02	-9.98E+00	4.78E+01
U-237	97.08	16.30	9.61E+01	7.14E+01	2.11E+01	4.56E+01
	101.07	26.30	7.14E+01		5.97E+01	3.40E+01
	114.00	12.30	3.67E+02		1.23E+03	1.79E+02
	208.01	22.00	1.88E+02		3.41E+01	8.86E+01
AM-241	59.54	35.90	1.37E+01	1.37E+01	2.79E+01	6.68E+00
AM-243	74.67	66.00	1.18E+01	1.18E+01	-6.94E+00	5.63E+00

0209

Analysis Report for 1809016-09

FIELD DUPLICATE

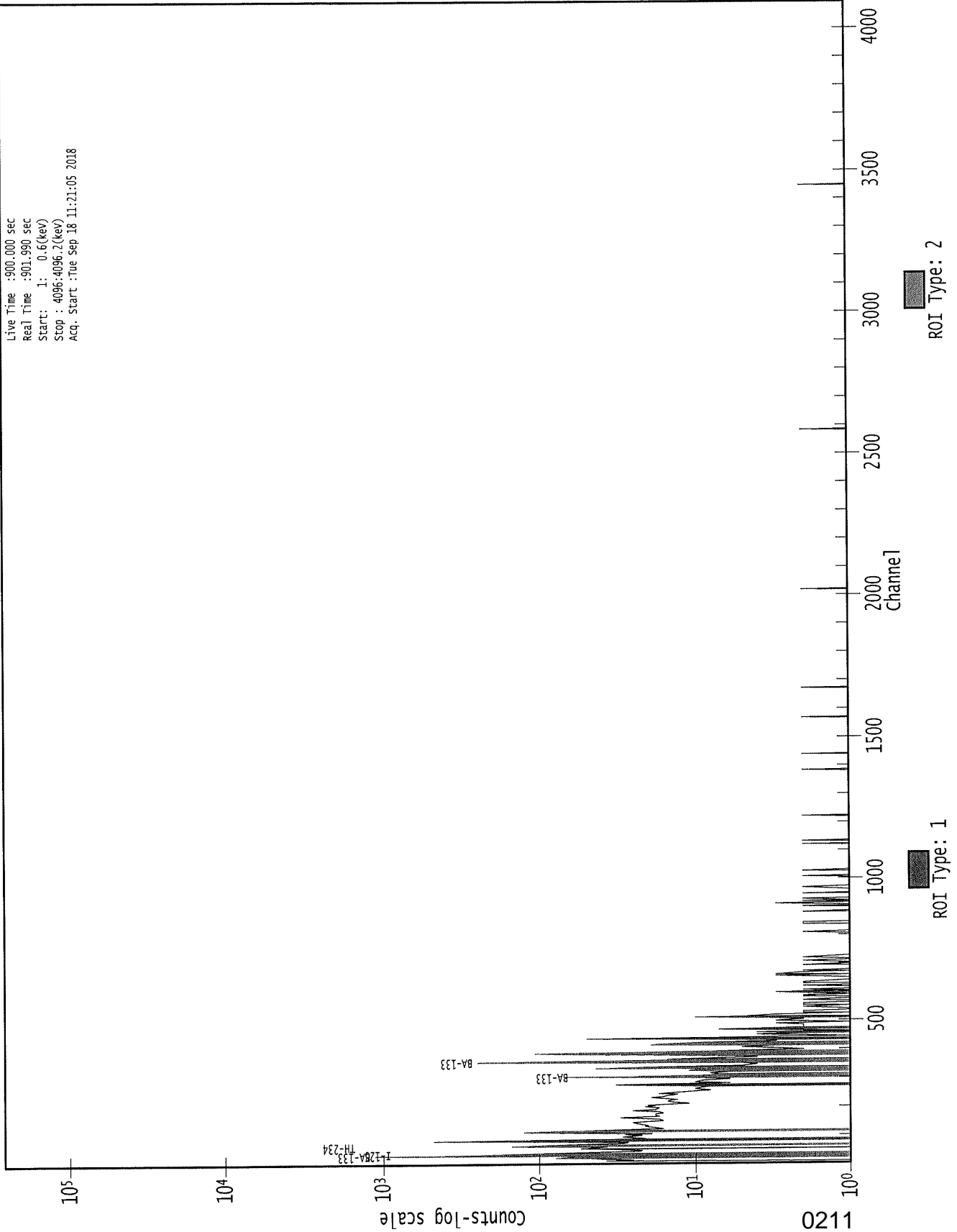
- + = Nuclide identified during the nuclide identification
 - * = Energy line found in the spectrum
 - > = MDA value not calculated
 - @ = Half-life too short to be able to perform the decay correction
-

2

0210

0000071944.CNF

Live Time : 900.000 sec
Real Time : 901.990 sec
Start: 1: 0.6(keV)
Stop : 4096:4096.2(keV)
Acq. Start : Tue Sep 18 11:21:05 2018



*WJB
9/18/18*

2

Analysis Report for 1809016-10
BRYANT POND 2

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-10
 Sample Description : BRYANT POND 2
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:57:30AM
 Acquisition Started : 9/18/2018 11:21:12AM

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

Dead Time : 0.05 %

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

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

Sample Number : 71945

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:36:28AM
 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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0212

Analysis Report for 1809016-10

BRYANT POND 2

2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	21.06	15 -	23	20.11	6.95E+01	53.12	3.91E+02	2.10
M	2	31.37	26 -	39	30.43	2.59E+03	107.21	2.36E+02	2.14
m	3	35.62	26 -	39	34.69	6.03E+02	92.62	1.77E+02	2.30
	4	53.01	49 -	55	52.08	7.50E+01	34.52	1.64E+02	1.94
M	5	62.13	57 -	68	61.22	2.30E+02	50.00	2.40E+02	2.54
m	6	66.20	57 -	68	65.29	9.84E+01	51.54	2.70E+02	2.55
	7	81.47	75 -	87	80.57	1.01E+03	82.87	3.36E+02	2.36
M	8	112.18	106 -	121	111.30	1.96E+02	42.94	1.71E+02	2.61
m	9	116.33	106 -	121	115.45	4.91E+01	38.99	1.46E+02	2.62
	10	192.11	189 -	193	191.29	2.10E+01	21.31	8.21E+01	1.20
	11	277.56	273 -	280	276.82	6.11E+01	23.83	4.98E+01	2.38
	12	303.66	298 -	309	302.94	1.58E+02	40.60	1.30E+02	2.20
	13	334.01	330 -	338	333.31	4.85E+01	28.16	9.70E+01	2.18
	14	356.62	350 -	362	355.94	5.41E+02	48.88	2.71E+01	2.27
M	15	386.47	380 -	395	385.81	2.46E+02	36.72	3.76E+01	4.16
m	16	391.77	380 -	395	391.12	3.64E+01	30.50	1.50E+01	3.19
	17	407.64	403 -	410	407.00	1.60E+01	8.00	0.00E+00	3.74
	18	417.32	411 -	424	416.70	7.09E+01	18.68	8.17E+00	5.11
	19	437.50	432 -	441	436.89	6.75E+01	21.10	2.51E+01	2.75
	20	468.52	463 -	474	467.94	1.70E+01	16.12	2.40E+01	2.53
	21	511.37	504 -	518	510.82	2.58E+01	13.12	6.45E+00	4.24
	22	533.86	530 -	535	533.33	6.00E+00	4.90	0.00E+00	1.92
	23	595.93	592 -	598	595.46	8.35E+00	7.23	3.30E+00	3.62
	24	712.75	708 -	715	712.39	7.22E+00	7.21	3.56E+00	2.04

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:36:28AM

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	21.06	6.95E+01	53.12			6.95E+01	5.31E+01
M	2	31.37	2.59E+03	107.21			2.59E+03	1.07E+02
m	3	35.62	6.03E+02	92.62			6.03E+02	9.26E+01
	4	53.01	7.50E+01	34.52			7.50E+01	3.45E+01
M	5	62.13	2.30E+02	50.00	1.33E+01	2.31E+00	2.16E+02	5.01E+01

0213

Analysis Report for 1809016-10

BRYANT POND 2

2

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	6	66.20	9.84E+01	51.54			9.84E+01	5.15E+01
	7	81.47	1.01E+03	82.87			1.01E+03	8.29E+01
M	8	112.18	1.96E+02	42.94			1.96E+02	4.29E+01
m	9	116.33	4.91E+01	38.99			4.91E+01	3.90E+01
	10	192.11	2.10E+01	21.31			2.10E+01	2.13E+01
	11	277.56	6.11E+01	23.83			6.11E+01	2.38E+01
	12	303.66	1.58E+02	40.60			1.58E+02	4.06E+01
	13	334.01	4.85E+01	28.16			4.85E+01	2.82E+01
	14	356.62	5.41E+02	48.88			5.41E+02	4.89E+01
M	15	386.47	2.46E+02	36.72			2.46E+02	3.67E+01
m	16	391.77	3.64E+01	30.50			3.64E+01	3.05E+01
	17	407.64	1.60E+01	8.00			1.60E+01	8.00E+00
	18	417.32	7.09E+01	18.68			7.09E+01	1.87E+01
	19	437.50	6.75E+01	21.10			6.75E+01	2.11E+01
	20	468.52	1.70E+01	16.12			1.70E+01	1.61E+01
	21	511.37	2.58E+01	13.12	1.30E+01	1.48E+00	1.27E+01	1.32E+01
	22	533.86	6.00E+00	4.90			6.00E+00	4.90E+00
	23	595.93	8.35E+00	7.23			8.35E+00	7.23E+00
	24	712.75	7.22E+00	7.21			7.22E+00	7.21E+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	5.72E+01	4.86E+01
I-125	1.00	35.49 *	6.49	5.49E+02	8.55E+01
BA-133	0.99	30.80 *	97.60	1.20E+02	5.52E+00
		302.84 *	17.80	7.80E+02	3.12E+02
		356.01 *	60.00	8.50E+02	1.35E+02
HG-203	0.95	279.19 *	77.30	6.62E+01	3.27E+01
TH-234	0.97	63.29 *	3.80	9.27E+02	2.24E+02

0214

Analysis Report for 1809016-10

BRYANT POND 2

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

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
	SN-113	0.947	5.72E+01	4.86E+01	
	I-125	1.000	5.49E+02	8.55E+01	
X	I-129	0.831			
	BA-133	0.993	1.22E+02	5.52E+00	
	HG-203	0.950	6.62E+01	3.27E+01	
	TH-234	0.975	9.27E+02	2.24E+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

0215

Analysis Report for 1809016-10
 BRYANT POND 2

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:36:28AM
 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	21.06	7.72579E-02	38.20	Tol.	PA-234M
4	53.01	8.32873E-02	23.02		
m 6	66.20	1.09302E-01	26.19	Sum	
7	81.47	1.12234E+00	4.10		
M 8	112.18	2.17458E-01	10.97	Tol.	U-237
m 9	116.33	5.45267E-02	39.72		
10	192.11	2.32885E-02	50.84		
13	334.01	5.39118E-02	29.02	Sum	
M 15	386.47	2.73458E-01	7.46	Sum	
17	407.64	1.77778E-02	25.00		
18	417.32	7.87926E-02	13.17	Sum	
19	437.50	7.49583E-02	15.63		
20	468.52	1.88889E-02	47.43		
21	511.37	1.41461E-02	51.87		
22	533.86	6.66667E-03	40.82		
23	595.93	9.27778E-03	43.28		
24	712.75	8.02469E-03	49.92	Sum	

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

NUCLIDE MDA REPORT

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

0216

Analysis Report for 1809016-10
BRYANT POND 2

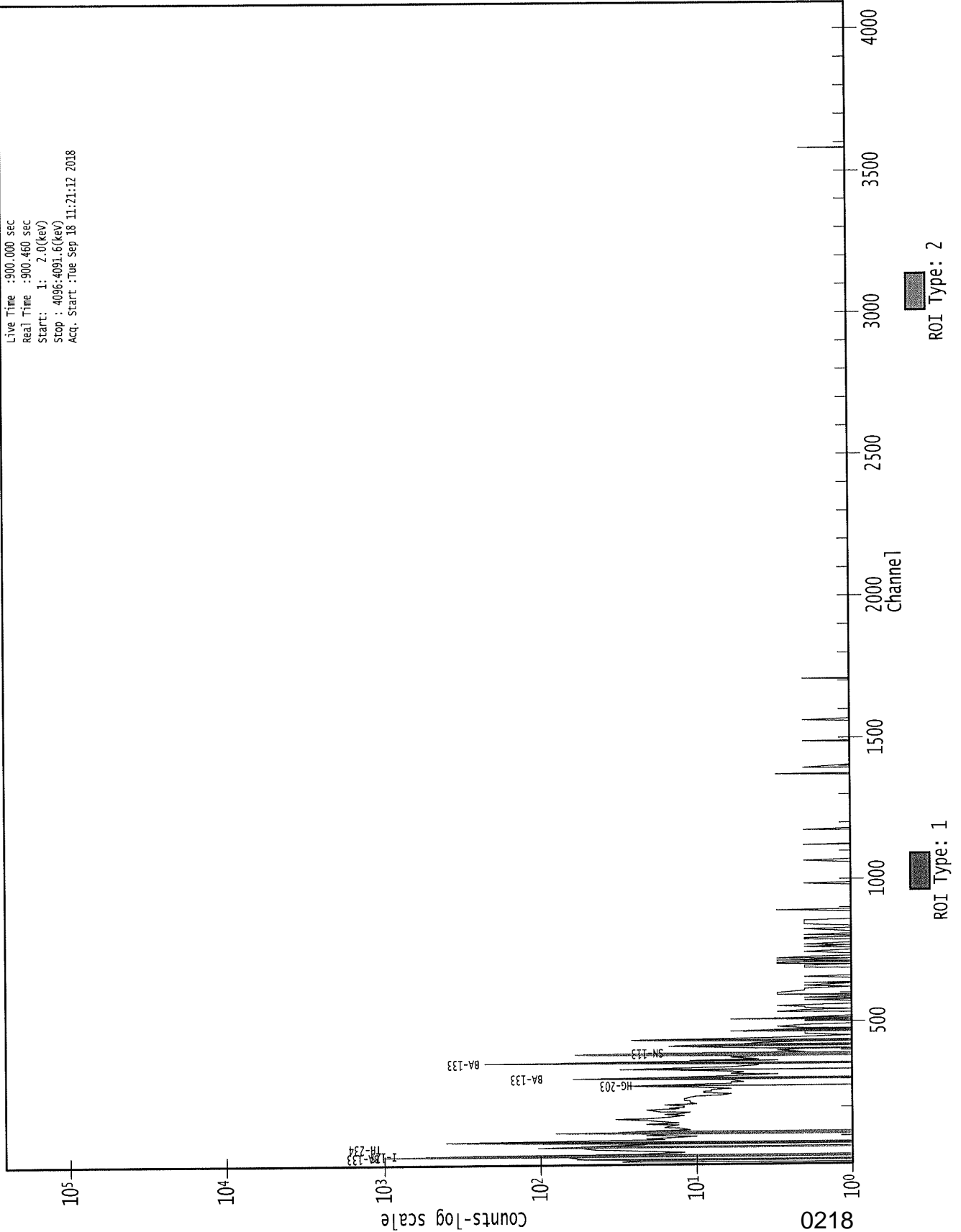
2

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	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	1.91E+01	1.91E+01	-4.30E-01	8.89E+00
	136.48	10.60	1.86E+02		-5.02E+01	8.69E+01
NI-59	6.92	29.80	3.65E-02	3.65E-02	-6.40E-02	1.45E-02
MO-93	16.59	52.90	1.16E+00	1.16E+00	1.10E-01	5.54E-01
	18.60	10.00	9.81E+00		8.55E+00	4.72E+00
NB-93M	16.57	9.43	6.49E+00	6.49E+00	6.17E-01	3.10E+00
CD-109	88.03	3.72	3.52E+02	3.52E+02	-9.85E+00	1.66E+02
+ SN-113	255.12	1.93	1.44E+03	5.69E+01	8.60E+02	6.65E+02
	391.69	* 61.90	5.69E+01		5.72E+01	2.63E+01
SN-119M	23.87	16.10	1.15E+01	8.85E+00	-2.69E-01	5.56E+00
	25.10	22.70	8.85E+00		-2.14E-01	4.26E+00
+ I-125	35.49	* 6.49	9.52E+01	9.52E+01	5.49E+02	4.64E+01
I-129	29.78	* 57.00	8.46E+00	8.46E+00	2.06E+02	4.12E+00
	33.60	* 13.20	4.68E+01		2.70E+02	2.28E+01
	39.58	7.52	6.44E+01		6.10E+00	3.09E+01
+ BA-133	30.80	* 97.60	4.94E+00	4.94E+00	1.20E+02	2.41E+00
	302.84	* 17.80	2.72E+02		7.80E+02	1.29E+02
	356.01	* 60.00	4.28E+01		8.50E+02	1.93E+01
CE-139	165.85	80.35	3.22E+01	3.22E+01	-3.01E+01	1.51E+01
CE-144	133.54	10.80	1.82E+02	1.82E+02	-1.53E+01	8.50E+01
+ HG-203	279.19	* 77.30	3.50E+01	3.50E+01	6.62E+01	1.60E+01
PB-210	46.50	4.25	1.06E+02	1.06E+02	-2.70E+01	4.98E+01
PA-231	9.28	42.00	1.90E-01	1.90E-01	1.50E-01	8.86E-02
	10.11	20.20	5.68E-01		3.41E-01	2.66E-01
	283.67	1.60	1.27E+03		9.79E+01	5.64E+02
	302.67	2.30	2.49E+03		4.84E+03	1.19E+03
TH-231	25.64	14.70	1.47E+01	1.47E+01	-3.46E-01	7.08E+00
	84.21	6.40	6.00E+02		3.34E+03	2.94E+02
PA-234M	9.89	89.00	1.21E-01	1.21E-01	7.27E-02	5.67E-02
	21.72	64.90	2.31E+00		2.67E+00	1.12E+00
	37.93	23.75	3.34E+01		1.00E+02	1.63E+01
	131.42	20.40	9.68E+01		2.38E+01	4.54E+01
+ TH-234	63.29	* 3.80	3.85E+02	3.85E+02	9.27E+02	1.87E+02
NP-237	29.37	* 14.00	3.44E+01	3.44E+01	8.39E+02	1.68E+01
	86.50	12.60	1.09E+02		1.60E+01	5.17E+01
U-237	97.08	16.30	8.92E+01	5.95E+01	-2.88E+01	4.20E+01
	101.07	26.30	5.95E+01		-6.69E+00	2.80E+01
	114.00	12.30	2.62E+02		5.63E+02	1.27E+02
	208.01	22.00	1.40E+02		6.17E+01	6.58E+01
AM-241	59.54	35.90	3.56E+01	3.56E+01	5.83E+01	1.72E+01
AM-243	74.67	66.00	1.72E+01	1.72E+01	3.19E-01	8.13E+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

0000071945.CNF

Live Time :900.000 sec
Real Time :900.460 sec
Start: 1: 2.0(kev)
Stop : 4096:4091.6(kev)
Acq. Start :Tue Sep 18 11:21:12 2018



Handwritten initials

2

Analysis Report for 1809016-11
BRYANT POND 7

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-11
 Sample Description : BRYANT POND 7
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:57:41AM
 Acquisition Started : 9/18/2018 11:37:19AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE2
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 900.3 seconds

Dead Time : 0.03 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 28 - 4096
 Identification Energy Tolerance : 1.000FWHM

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

Sample Number : 71948

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:52:23AM

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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0219

Analysis Report for 1809016-11

BRYANT POND 7

2

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.93	35 - 39	35.71	4.74E+02	68.93	3.56E+02	2.61
	2	53.85	50 - 57	53.62	8.54E+01	36.22	1.57E+02	1.91
M	3	62.25	58 - 69	62.02	1.78E+02	36.09	9.78E+01	1.50
m	4	66.43	58 - 69	66.19	8.51E+01	31.02	1.24E+02	1.52
	5	81.58	77 - 85	81.34	9.41E+02	73.88	2.60E+02	1.76
M	6	112.28	108 - 119	112.03	1.72E+02	34.82	1.03E+02	1.50
m	7	116.59	108 - 119	116.34	2.77E+01	24.66	9.31E+01	1.51
	8	160.68	156 - 163	160.40	4.98E+01	32.56	1.42E+02	1.30
	9	276.87	273 - 282	276.54	5.10E+01	30.68	1.06E+02	1.97
M	10	303.29	299 - 309	302.95	1.81E+02	29.09	2.54E+01	1.53
m	11	307.21	299 - 309	306.86	2.05E+01	14.37	2.95E+01	1.54
M	12	334.06	330 - 340	333.70	3.80E+01	17.56	2.19E+01	1.72
	13	356.32	351 - 360	355.95	6.44E+02	53.75	4.48E+01	1.51
	14	376.73	372 - 379	376.35	1.44E+01	12.33	1.52E+01	1.46
M	15	384.53	380 - 394	384.15	1.06E+02	28.27	1.35E+01	1.62
m	16	391.24	380 - 394	390.85	3.30E+01	17.41	1.04E+01	1.63
M	17	415.13	410 - 428	414.74	2.74E+01	13.87	1.01E+01	2.42
m	18	418.94	410 - 428	418.54	1.50E+01	14.16	4.78E+00	2.43
m	19	423.40	410 - 428	423.00	6.30E+00	7.78	8.33E-01	1.51
	20	437.30	433 - 442	436.89	7.51E+01	21.07	2.19E+01	1.89
	21	467.85	465 - 469	467.43	1.34E+01	8.75	5.13E+00	1.14
	22	536.24	533 - 538	535.78	5.71E+00	6.08	2.57E+00	1.27

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:52:23AM

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

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	4.74E+02	68.93			4.74E+02	6.89E+01
	2	8.54E+01	36.22			8.54E+01	3.62E+01
M	3	1.78E+02	36.09			1.78E+02	3.61E+01
m	4	8.51E+01	31.02	3.70E+00	1.42E+00	8.14E+01	3.11E+01
	5	9.41E+02	73.88			9.41E+02	7.39E+01
M	6	1.72E+02	34.82			1.72E+02	3.48E+01
m	7	2.77E+01	24.66			2.77E+01	2.47E+01

0220

Analysis Report for 1809016-11

BRYANT POND 7

Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	8	160.68	4.98E+01	32.56		4.98E+01	3.26E+01
	9	276.87	5.10E+01	30.68		5.10E+01	3.07E+01
M	10	303.29	1.81E+02	29.09		1.81E+02	2.91E+01
m	11	307.21	2.05E+01	14.37		2.05E+01	1.44E+01
M	12	334.06	3.80E+01	17.56		3.80E+01	1.76E+01
	13	356.32	6.44E+02	53.75		6.44E+02	5.37E+01
	14	376.73	1.44E+01	12.33		1.44E+01	1.23E+01
M	15	384.53	1.06E+02	28.27		1.06E+02	2.83E+01
m	16	391.24	3.30E+01	17.41		3.30E+01	1.74E+01
M	17	415.13	2.74E+01	13.87		2.74E+01	1.39E+01
m	18	418.94	1.50E+01	14.16		1.50E+01	1.42E+01
m	19	423.40	6.30E+00	7.78		6.30E+00	7.78E+00
	20	437.30	7.51E+01	21.07		7.51E+01	2.11E+01
	21	467.85	1.34E+01	8.75	0.00E+00	1.34E+01	8.75E+00
	22	536.24	5.71E+00	6.08	0.00E+00	5.71E+00	6.08E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.96	255.12	1.93		
		391.69 *	61.90	2.02E+01	1.08E+01
I-125	0.99	35.49 *	6.49	1.88E+01	2.73E+00
		9.28	42.00		
PA-231	1.00	10.11	20.20		
		283.67	1.60		
		302.67 *	2.30	5.33E+03	1.83E+03

0221

Analysis Report for 1809016-11
BRYANT POND 7

* = 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
SN-113	0.962	2.02E+01	1.08E+01	
I-125	0.995	1.88E+01	2.73E+00	
PA-231	1.000	5.33E+03	1.83E+03	

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

Errors quoted at 2.000sigma

0222

Analysis Report for 1809016-11
 BRYANT POND 7

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:52:23AM
 Peak Locate From Channel : 1
 Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	2	53.85	9.49119E-02		
M	3	62.25	1.97754E-01		
m	4	66.43	9.04532E-02		
	5	81.58	1.04546E+00		
M	6	112.28	1.90854E-01		
m	7	116.59	3.08177E-02		
	8	160.68	5.53535E-02		
	9	276.87	5.66827E-02		
m	11	307.21	2.28229E-02		
M	12	334.06	4.21750E-02		
	13	356.32	7.15128E-01		
	14	376.73	1.60101E-02		
M	15	384.53	1.18089E-01		
M	17	415.13	3.04431E-02		
m	18	418.94	1.66355E-02		
m	19	423.40	6.99870E-03		
	20	437.30	8.34109E-02		
	21	467.85	1.49306E-02		
	22	536.24	6.34921E-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

0223

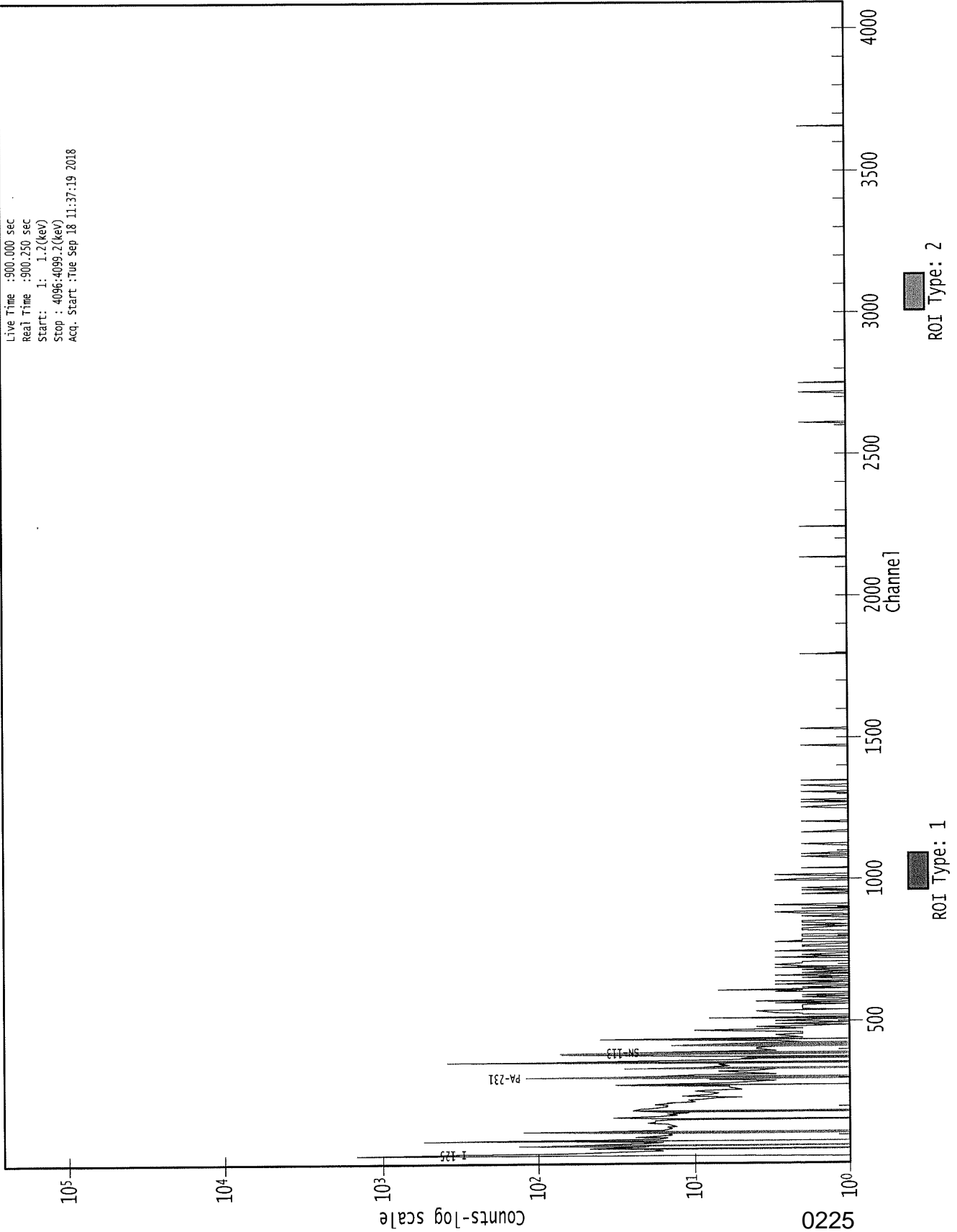
Analysis Report for 1809016-11
BRYANT POND 7

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	1.20E-10	1.20E-10	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.83E+01	2.83E+01	7.05E+00	1.32E+01
	136.48	10.60	2.58E+02		-5.07E+01	1.19E+02
NI-59	6.92	29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
MO-93	16.59	52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
	18.60	10.00	2.91E-04		0.00E+00	0.00E+00
NB-93M	16.57	9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
CD-109	88.03	3.72	2.72E+02	2.72E+02	-1.18E+02	1.27E+02
+ SN-113	255.12	1.93	1.26E+03	1.92E+01	3.60E+02	5.68E+02
	391.69	* 61.90	1.92E+01		2.02E+01	8.77E+00
SN-119M	23.87	16.10	1.77E-03	1.77E-03	0.00E+00	0.00E+00
	25.10	22.70	1.93E-03		0.00E+00	0.00E+00
+ I-125	35.49	* 6.49	5.85E+00	5.85E+00	1.88E+01	2.87E+00
I-129	29.78	57.00	2.19E-01	2.19E-01	7.40E-01	1.08E-01
	33.60	13.20	1.75E+00		-4.67E-01	8.61E-01
	39.58	7.52	2.09E+00		-3.67E+00	9.56E-01
BA-133	30.80	97.60	2.01E-01	2.01E-01	2.02E+00	9.95E-02
	302.84	17.80	2.56E+02		6.41E+02	1.23E+02
	356.01	60.00	9.84E+01		5.21E+02	4.81E+01
CE-139	165.85	80.35	4.41E+01	4.41E+01	-2.57E+01	2.05E+01
CE-144	133.54	10.80	2.36E+02	2.36E+02	-4.42E+01	1.09E+02
HG-203	279.19	77.30	3.71E+01	3.71E+01	7.73E+00	1.72E+01
PB-210	46.50	4.25	1.05E+01	1.05E+01	-1.73E+00	4.80E+00
+ PA-231	9.28	42.00	3.13E-08	3.13E-08	0.00E+00	0.00E+00
	10.11	20.20	1.87E-07		0.00E+00	0.00E+00
	283.67	1.60	1.22E+03		3.29E+02	5.47E+02
	302.67	* 2.30	9.88E+02		5.33E+03	4.54E+02
TH-231	25.64	14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
	84.21	6.40	3.41E+02		6.18E+02	1.66E+02
PA-234M	9.89	89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
	21.72	64.90	1.91E-04		0.00E+00	0.00E+00
	37.93	23.75	7.58E-01		-7.09E-01	3.58E-01
	131.42	20.40	1.15E+02		-4.77E+01	5.27E+01
TH-234	63.29	3.80	1.42E+02	1.42E+02	3.39E+01	6.86E+01
NP-237	29.37	14.00	2.87E-01	2.87E-01	-7.41E+00	1.38E-01
	86.50	12.60	7.85E+01		-3.64E-01	3.66E+01
U-237	97.08	16.30	8.02E+01	5.93E+01	-1.72E+01	3.72E+01
	101.07	26.30	5.93E+01		3.89E+01	2.76E+01
	114.00	12.30	3.15E+02		5.46E+02	1.52E+02
	208.01	22.00	1.65E+02		7.94E+01	7.65E+01
AM-241	59.54	35.90	6.06E+00	6.06E+00	-4.00E+01	2.84E+00
AM-243	74.67	66.00	9.25E+00	9.25E+00	-3.54E+00	4.34E+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

0000071948.CNF



Web @ 11/18/18

2

Analysis Report for 1809016-12
BRYANT POND 12

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-12
 Sample Description : BRYANT POND 12
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:57:55AM
 Acquisition Started : 9/18/2018 11:37:28AM

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

Dead Time : 0.22 %

Peak Locate Threshold : 2.50
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 10 - 4096
 Identification Energy Tolerance : 1.000FWHM

Energy Calibration Used Done On : 7/21/2018
 Efficiency Calibration Used Done On : 7/21/2018
 Efficiency Calibration Description :

Sample Number : 71949

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:52:38AM

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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0226

Analysis Report for 1809016-12

BRYANT POND 12

2

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	21.23	17 -	40	21.59	1.09E+02	44.33	3.54E+02	2.39
m	2	31.06	17 -	40	31.42	2.73E+03	111.09	2.27E+02	2.11
m	3	35.22	17 -	40	35.58	6.95E+02	96.22	1.53E+02	2.43
M	4	52.79	47 -	71	53.15	9.57E+01	40.67	1.98E+02	2.47
m	5	62.04	47 -	71	62.39	3.19E+02	52.17	2.52E+02	2.23
m	6	66.22	47 -	71	66.57	1.51E+02	50.93	2.91E+02	2.48
	7	81.28	76 -	87	81.62	1.22E+03	84.97	2.91E+02	2.16
M	8	111.88	107 -	122	112.21	2.48E+02	44.35	1.63E+02	2.33
m	9	116.68	107 -	122	117.00	1.02E+02	41.12	1.27E+02	2.34
	10	160.23	158 -	164	160.54	2.92E+01	30.50	1.50E+02	3.22
	11	276.48	272 -	281	276.73	7.87E+01	31.29	9.46E+01	2.35
M	12	302.98	298 -	314	303.23	1.78E+02	32.06	4.00E+01	2.52
m	13	307.81	298 -	314	308.05	3.73E+01	26.98	4.00E+01	2.53
	14	323.60	319 -	327	323.84	2.60E+01	18.28	3.40E+01	6.40
	15	333.73	328 -	340	333.96	1.19E+02	33.75	7.84E+01	2.52
	16	356.22	349 -	361	356.44	6.28E+02	53.38	4.24E+01	2.32
	17	364.81	363 -	367	365.04	1.50E+01	11.02	1.20E+01	1.89
M	18	384.36	380 -	396	384.58	1.62E+02	37.63	6.53E+01	2.73
m	19	387.12	380 -	396	387.33	2.05E+02	39.67	4.12E+01	1.96
m	20	390.78	380 -	396	390.99	6.34E+01	43.86	6.41E+01	3.79
M	21	413.80	409 -	430	414.00	2.86E+01	16.79	2.23E+01	2.37
m	22	417.80	409 -	430	418.00	3.11E+01	21.58	3.17E+01	3.15
	23	437.28	432 -	441	437.47	1.22E+02	27.11	3.58E+01	2.30
	24	469.04	465 -	473	469.22	2.05E+01	16.90	3.10E+01	1.89
	25	527.06	524 -	530	527.22	5.43E+00	6.34	3.14E+00	1.06

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:52:38AM

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	21.23	1.09E+02	44.33			1.09E+02	4.43E+01
m	2	31.06	2.73E+03	111.09			2.73E+03	1.11E+02
m	3	35.22	6.95E+02	96.22			6.95E+02	9.62E+01
M	4	52.79	9.57E+01	40.67	2.82E-01	5.14E-01	9.54E+01	4.07E+01

0227

Analysis Report for 1809016-12

BRYANT POND 12

2

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	5	62.04	3.19E+02	52.17	1.31E+01	8.56E-01	3.06E+02	5.22E+01
m	6	66.22	1.51E+02	50.93			1.51E+02	5.09E+01
	7	81.28	1.22E+03	84.97			1.22E+03	8.50E+01
M	8	111.88	2.48E+02	44.35			2.48E+02	4.44E+01
m	9	116.68	1.02E+02	41.12			1.02E+02	4.11E+01
	10	160.23	2.92E+01	30.50			2.92E+01	3.05E+01
	11	276.48	7.87E+01	31.29			7.87E+01	3.13E+01
M	12	302.98	1.78E+02	32.06			1.78E+02	3.21E+01
m	13	307.81	3.73E+01	26.98			3.73E+01	2.70E+01
	14	323.60	2.60E+01	18.28			2.60E+01	1.83E+01
	15	333.73	1.19E+02	33.75			1.19E+02	3.37E+01
	16	356.22	6.28E+02	53.38			6.28E+02	5.34E+01
	17	364.81	1.50E+01	11.02			1.50E+01	1.10E+01
M	18	384.36	1.62E+02	37.63			1.62E+02	3.76E+01
m	19	387.12	2.05E+02	39.67			2.05E+02	3.97E+01
m	20	390.78	6.34E+01	43.86			6.34E+01	4.39E+01
M	21	413.80	2.86E+01	16.79			2.86E+01	1.68E+01
m	22	417.80	3.11E+01	21.58			3.11E+01	2.16E+01
	23	437.28	1.22E+02	27.11			1.22E+02	2.71E+01
	24	469.04	2.05E+01	16.90			2.05E+01	1.69E+01
	25	527.06	5.43E+00	6.34			5.43E+00	6.34E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.95	255.12	1.93		
		391.69 *	61.90	4.43E+01	3.09E+01
I-125	0.99	35.49 *	6.49	3.22E+01	4.45E+00
BA-133	0.99	30.80 *	97.60	3.71E+00	1.51E-01
		302.84 *	17.80	6.68E+02	2.71E+02
		356.01 *	60.00	5.45E+02	7.74E+01
TH-234	0.97	63.29 *	3.80	4.85E+02	8.44E+01

0228

Analysis Report for 1809016-12
BRYANT POND 12

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

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
	SN-113	0.950	4.43E+01	3.09E+01	
	I-125	0.999	3.22E+01	4.45E+00	
X	I-129	0.901			
	BA-133	0.999	3.71E+00	1.51E-01	
	TH-234	0.972	4.85E+02	8.44E+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

0229

Analysis Report for 1809016-12
 BRYANT POND 12

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:52:38AM
 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	21.23	1.21269E-01	20.31	Tol.	PA-234M
M 4	52.79	1.06030E-01	21.31		
m 6	66.22	1.68114E-01	16.83	Sum	
	7	81.28	1.35389E+00	3.49	
M 8	111.88	2.75665E-01	8.94		
m 9	116.68	1.12882E-01	20.24		
	10	160.23	3.24573E-02	52.21	
	11	276.48	8.74339E-02	19.88	
m 13	307.81	4.14914E-02	36.13		
	14	323.60	2.89018E-02	35.13	
	15	333.73	1.31976E-01	14.21	Sum
	17	364.81	1.66402E-02	36.80	Sum
M 18	384.36	1.79709E-01	11.63		
m 19	387.12	2.27606E-01	9.68	Sum	
M 21	413.80	3.17419E-02	29.38		
m 22	417.80	3.45972E-02	34.65	Sum	
	23	437.28	1.35659E-01	11.10	
	24	469.04	2.27932E-02	41.20	
	25	527.06	6.03175E-03	58.43	

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

0230

Analysis Report for 1809016-12
BRYANT POND 12

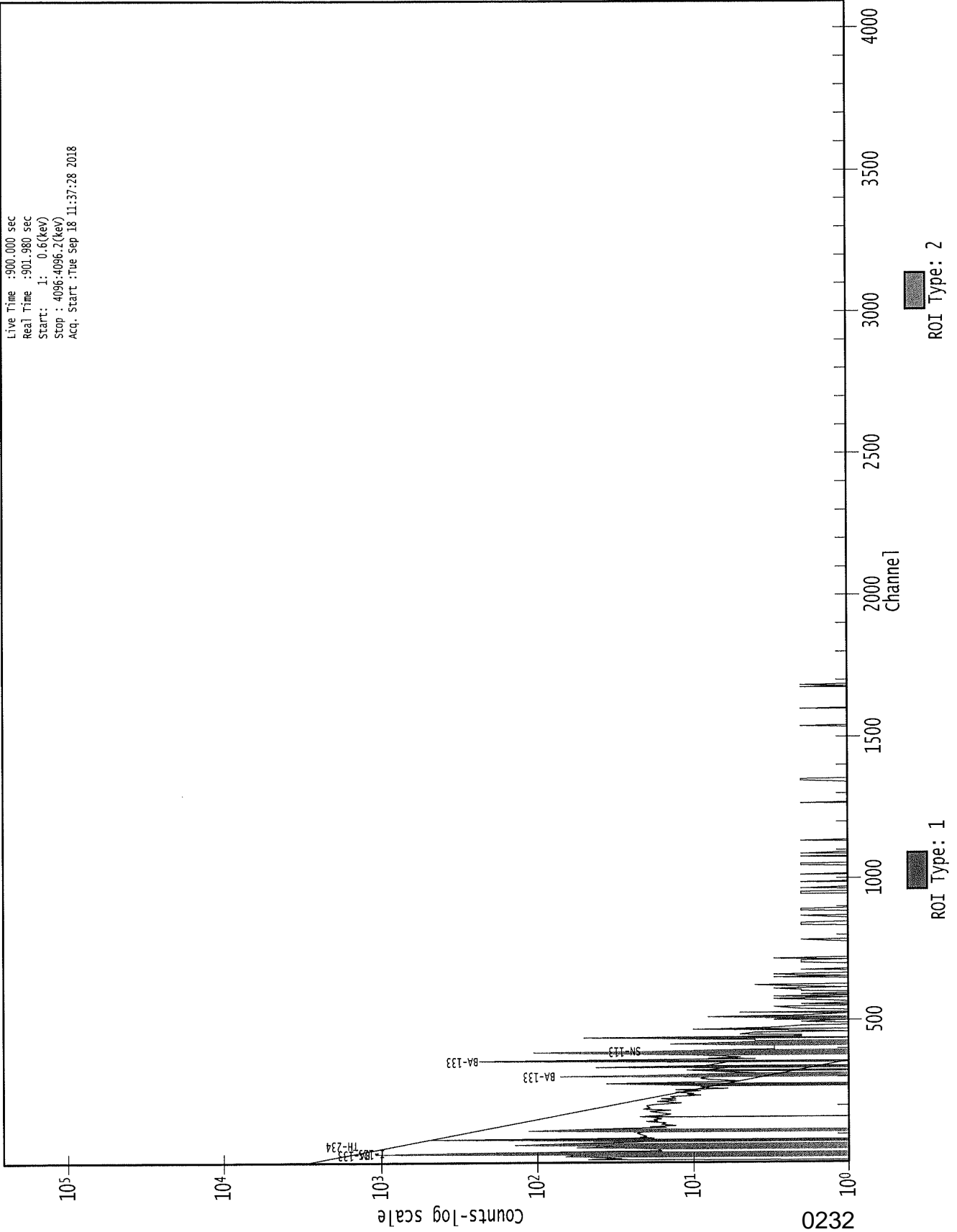
Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	1.57E-09	1.57E-09	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.60E+01	2.60E+01	-3.28E+00	1.22E+01
	136.48	10.60	2.60E+02		4.83E+01	1.22E+02
NI-59	6.92	29.80	1.08E-07	1.08E-07	-3.45E-09	4.94E-08
MO-93	16.59	52.90	1.22E-03	1.22E-03	-4.83E-05	5.85E-04
	18.60	10.00	2.10E-02		2.40E-02	1.01E-02
NB-93M	16.57	9.43	6.77E-03	6.77E-03	-2.68E-04	3.25E-03
CD-109	88.03	3.72	2.93E+02	2.93E+02	-8.32E+01	1.38E+02
+ SN-113	255.12	1.93	1.40E+03	4.07E+01	1.46E+02	6.46E+02
	391.69	* 61.90	4.07E+01		4.43E+01	1.94E+01
SN-119M	23.87	16.10	9.95E-02	9.95E-02	-1.86E-01	4.81E-02
	25.10	22.70	1.01E-01		-1.11E+00	4.90E-02
+ I-125	35.49	* 6.49	7.89E+00	7.89E+00	3.22E+01	3.88E+00
I-129	29.78	* 57.00	3.98E-01	3.98E-01	6.35E+00	1.96E-01
	33.60	* 13.20	3.87E+00		1.58E+01	1.91E+00
	39.58	7.52	5.57E+00		4.13E-01	2.67E+00
+ BA-133	30.80	* 97.60	2.33E-01	2.33E-01	3.71E+00	1.14E-01
	302.84	* 17.80	1.85E+02		6.68E+02	8.76E+01
	356.01	* 60.00	2.86E+01		5.45E+02	1.31E+01
CE-139	165.85	80.35	4.28E+01	4.28E+01	2.58E+00	2.01E+01
CE-144	133.54	10.80	2.40E+02	2.40E+02	-1.66E+00	1.13E+02
HG-203	279.19	77.30	4.74E+01	4.74E+01	6.19E+01	2.24E+01
PB-210	46.50	4.25	1.68E+01	1.68E+01	-1.77E+00	7.91E+00
PA-231	9.28	42.00	4.06E-06	4.06E-06	5.17E-06	1.93E-06
	10.11	20.20	2.13E-05		2.72E-05	1.02E-05
	283.67	1.60	1.25E+03		-5.36E+01	5.65E+02
	302.67	2.30	2.05E+03		4.03E+03	9.84E+02
TH-231	25.64	14.70	1.94E-01	1.94E-01	-5.25E+00	9.37E-02
	84.21	6.40	3.87E+02		1.38E+03	1.89E+02
PA-234M	9.89	89.00	3.83E-06	3.83E-06	4.88E-06	1.82E-06
	21.72	64.90	1.18E-02		1.10E-02	5.71E-03
	37.93	23.75	2.57E+00		9.06E+00	1.26E+00
	131.42	20.40	1.26E+02		9.72E+00	5.92E+01
+ TH-234	63.29	* 3.80	2.86E+02	2.86E+02	4.85E+02	1.41E+02
NP-237	29.37	* 14.00	1.62E+00	1.62E+00	2.58E+01	7.98E-01
	86.50	12.60	9.41E+01		9.68E+00	4.48E+01
U-237	97.08	16.30	9.02E+01	6.74E+01	-4.75E+01	4.27E+01
	101.07	26.30	6.74E+01		2.18E+01	3.20E+01
	114.00	12.30	3.39E+02		8.51E+02	1.65E+02
	208.01	22.00	1.65E+02		-2.00E+01	7.70E+01
AM-241	59.54	35.90	1.36E+01	1.36E+01	2.61E+01	6.61E+00
AM-243	74.67	66.00	1.04E+01	1.04E+01	3.18E+00	4.92E+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

0231

0000071949.CNF

Live Time :900.000 sec
Real Time :901.980 sec
Start: 1: 0.6(kev)
Stop : 4096:4096.2(kev)
Acq. Start :Tue Sep 18 11:37:28 2018



KAR
9/18/18

2

Analysis Report for 1809016-13
EQUIPMENT BLANK

GAMMA SPECTRUM ANALYSIS

Sample Identification : 1809016-13
 Sample Description : EQUIPMENT BLANK
 Sample Type : RA RECOVERY

Sample Size : 1.000E+00 units
 Facility : Countroom

Sample Taken On : 9/18/2018 9:58:10AM
 Acquisition Started : 9/18/2018 11:37:34AM

Procedure : BAFIL
 Operator : Administrator
 Detector Name : GE4
 Geometry : BAFIL
 Live Time : 900.0 seconds
 Real Time : 920.0 seconds

Dead Time : 2.17 %

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

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

Sample Number : 71950

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2018 11:52:56AM

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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0233

Analysis Report for 1809016-13

EQUIPMENT BLANK

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	27.08	24 -	39	26.14	9.43E+01	26.15	1.12E+02	2.75
m	2	31.45	24 -	39	30.51	2.68E+03	107.82	1.55E+02	2.14
m	3	35.67	24 -	39	34.74	6.68E+02	95.02	1.59E+02	2.33
	4	53.46	48 -	56	52.53	7.69E+01	45.33	2.66E+02	2.89
M	5	62.36	57 -	72	61.44	2.64E+02	51.81	2.26E+02	2.54
m	6	66.50	57 -	72	65.59	1.46E+02	50.16	2.52E+02	2.55
	7	81.56	74 -	86	80.65	1.06E+03	83.62	3.25E+02	2.26
M	8	112.24	105 -	119	111.36	2.37E+02	44.99	1.89E+02	2.61
m	9	116.86	105 -	119	115.98	4.92E+01	41.47	1.85E+02	2.55
M	10	157.12	155 -	170	156.28	1.48E+01	11.75	3.80E+01	2.56
m	11	161.53	155 -	170	160.69	4.95E+01	30.62	1.33E+02	2.34
	12	276.97	271 -	280	276.23	7.95E+01	27.80	6.50E+01	1.72
M	13	303.41	298 -	312	302.68	1.50E+02	29.02	5.34E+01	2.01
m	14	308.20	298 -	312	307.48	2.22E+01	29.87	7.73E+01	2.79
	15	335.28	330 -	340	334.58	7.89E+01	29.21	7.22E+01	2.14
	16	356.68	351 -	361	356.00	4.85E+02	49.35	6.60E+01	2.20
M	17	386.47	379 -	395	385.81	2.24E+02	37.52	3.60E+01	4.16
m	18	391.77	379 -	395	391.12	3.51E+01	29.89	2.70E+01	3.13
	19	415.80	408 -	421	415.17	2.94E+01	29.53	8.33E+01	4.57
	20	437.57	432 -	441	436.96	7.05E+01	17.80	4.97E+00	1.51
	21	468.37	464 -	471	467.79	1.10E+01	9.59	8.00E+00	1.78
	22	631.44	628 -	633	631.00	6.00E+00	4.90	0.00E+00	1.33

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/18/2018 11:52:56AM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	27.08	9.43E+01	26.15			9.43E+01	2.62E+01
m	2	31.45	2.68E+03	107.82			2.68E+03	1.08E+02
m	3	35.67	6.68E+02	95.02			6.68E+02	9.50E+01
	4	53.46	7.69E+01	45.33			7.69E+01	4.53E+01
M	5	62.36	2.64E+02	51.81	1.33E+01	2.31E+00	2.50E+02	5.19E+01
m	6	66.50	1.46E+02	50.16			1.46E+02	5.02E+01
	7	81.56	1.06E+03	83.62			1.06E+03	8.36E+01

0234

Analysis Report for 1809016-13

EQUIPMENT BLANK

2

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	8	112.24	2.37E+02	44.99			2.37E+02	4.50E+01
m	9	116.86	4.92E+01	41.47			4.92E+01	4.15E+01
M	10	157.12	1.48E+01	11.75			1.48E+01	1.17E+01
m	11	161.53	4.95E+01	30.62			4.95E+01	3.06E+01
	12	276.97	7.95E+01	27.80			7.95E+01	2.78E+01
M	13	303.41	1.50E+02	29.02			1.50E+02	2.90E+01
m	14	308.20	2.22E+01	29.87			2.22E+01	2.99E+01
	15	335.28	7.89E+01	29.21			7.89E+01	2.92E+01
	16	356.68	4.85E+02	49.35			4.85E+02	4.93E+01
M	17	386.47	2.24E+02	37.52			2.24E+02	3.75E+01
m	18	391.77	3.51E+01	29.89			3.51E+01	2.99E+01
	19	415.80	2.94E+01	29.53			2.94E+01	2.95E+01
	20	437.57	7.05E+01	17.80			7.05E+01	1.78E+01
	21	468.37	1.10E+01	9.59			1.10E+01	9.59E+00
	22	631.44	6.00E+00	4.90			6.00E+00	4.90E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.94	255.12	1.93		
		391.69 *	61.90	5.52E+01	4.76E+01
I-125	0.99	35.49 *	6.49	6.11E+02	8.82E+01
		30.80 *	97.60	1.26E+02	5.62E+00
BA-133	0.99	302.84 *	17.80	7.40E+02	2.69E+02
		356.01 *	60.00	7.62E+02	1.26E+02
		279.19 *	77.30	8.61E+01	3.98E+01
HG-203	0.91	279.19 *	77.30	8.61E+01	3.98E+01
		25.64 *	14.70	2.12E+01	5.89E+00
TH-231	0.76	84.21	6.40		
		63.29 *	3.80	1.08E+03	2.36E+02
TH-234	0.98				

0235

Analysis Report for 1809016-13
EQUIPMENT BLANK

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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
SN-113	0.947	5.52E+01	4.76E+01	
I-125	0.999	6.11E+02	8.82E+01	
X I-129	0.590			
BA-133	0.992	1.27E+02	5.61E+00	
HG-203	0.910	8.61E+01	3.98E+01	
TH-231	0.768	2.12E+01	5.89E+00	
TH-234	0.983	1.08E+03	2.36E+02	

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

Errors quoted at 2.000sigma

0236

Analysis Report for 1809016-13
EQUIPMENT BLANK

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2018 11:52:56AM
Peak Locate From Channel : 1
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide	
	4	53.46	8.54762E-02	29.46	Sum	
m	6	66.50	1.62648E-01	17.13	Sum	
	7	81.56	1.17500E+00	3.95		
M	8	112.24	2.63480E-01	9.49	Tol.	U-237
m	9	116.86	5.46766E-02	42.14		
M	10	157.12	1.64853E-02	39.59		
m	11	161.53	5.49550E-02	30.95		
m	14	308.20	2.46658E-02	67.27	Sum	
	15	335.28	8.76473E-02	18.52	Sum	
M	17	386.47	2.48755E-01	8.38	Sum	
	19	415.80	3.26291E-02	50.28		
	20	437.57	7.83486E-02	12.62		
	21	468.37	1.22222E-02	43.60		
	22	631.44	6.66667E-03	40.82		

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

NUCLIDE MDA REPORT

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

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
FE-55	5.89	24.50	5.43E-03	5.43E-03	0.00E+00	0.00E+00
CO-57	122.06	85.51	2.11E+01	2.11E+01	4.20E+00	9.91E+00

0237

Analysis Report for 1809016-13
EQUIPMENT BLANK

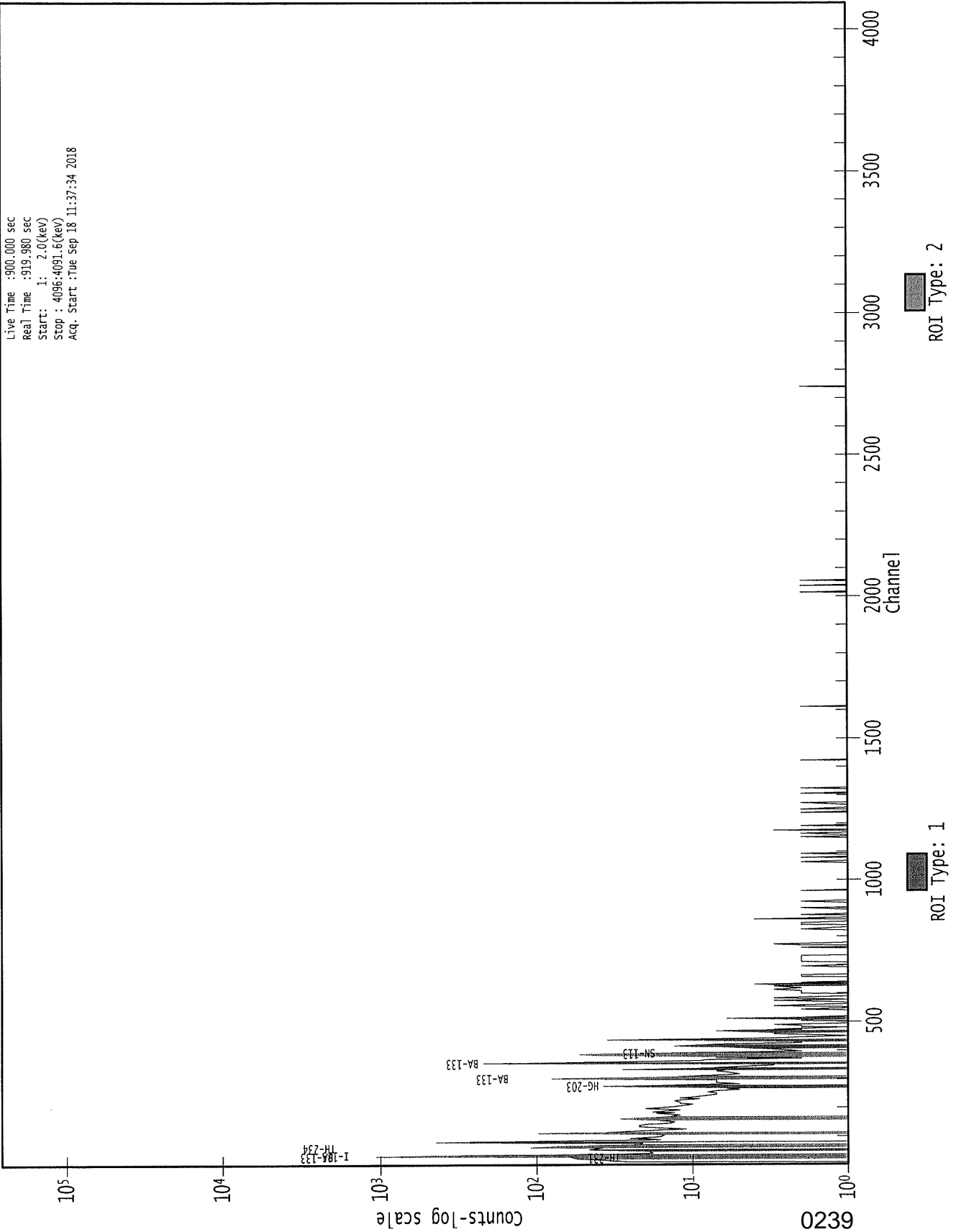
2

Nuclide Name	Energy (keV)	Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
CO-57	136.48	10.60	2.16E+02	2.11E+01	8.26E+01	1.02E+02
NI-59	6.92	29.80	4.18E-02	4.18E-02	-5.15E-02	1.71E-02
MO-93	16.59	52.90	1.26E+00	1.26E+00	-1.91E+00	6.03E-01
	18.60	10.00	1.02E+01		1.18E+01	4.90E+00
NB-93M	16.57	9.43	7.04E+00	7.04E+00	-1.07E+01	3.37E+00
CD-109	88.03	3.72	3.14E+02	3.14E+02	-1.34E+02	1.47E+02
+ SN-113	255.12	1.93	1.34E+03	6.14E+01	4.99E+02	6.15E+02
	391.69	* 61.90	6.14E+01		5.52E+01	2.86E+01
SN-119M	23.87	16.10	1.11E+01	8.71E+00	5.71E+00	5.36E+00
	25.10	22.70	8.71E+00		1.07E+00	4.19E+00
+ I-125	35.49	* 6.49	9.16E+01	9.16E+01	6.11E+02	4.46E+01
I-129	29.78	* 57.00	8.03E+00	8.03E+00	2.15E+02	3.90E+00
	33.60	13.20	1.04E+02		1.06E+03	5.13E+01
	39.58	7.52	6.96E+01		7.75E+00	3.35E+01
+ BA-133	30.80	* 97.60	4.69E+00	4.69E+00	1.26E+02	2.28E+00
	302.84	* 17.80	2.85E+02		7.40E+02	1.36E+02
	356.01	* 60.00	6.17E+01		7.62E+02	2.87E+01
CE-139	165.85	80.35	3.33E+01	3.33E+01	-1.24E+01	1.57E+01
CE-144	133.54	10.80	2.04E+02	2.04E+02	-3.21E+01	9.64E+01
+ HG-203	279.19	* 77.30	4.09E+01	4.09E+01	8.61E+01	1.90E+01
PB-210	46.50	4.25	1.14E+02	1.14E+02	-9.04E+00	5.40E+01
PA-231	9.28	42.00	1.86E-01	1.86E-01	9.53E-02	8.64E-02
	10.11	20.20	5.79E-01		3.66E-01	2.72E-01
	283.67	1.60	1.22E+03		-8.58E+02	5.37E+02
	302.67	2.30	2.46E+03		4.80E+03	1.18E+03
+ TH-231	25.64	* 14.70	2.22E+01	2.22E+01	2.12E+01	1.08E+01
	84.21	6.40	6.13E+02		3.57E+03	3.01E+02
PA-234M	9.89	89.00	1.23E-01	1.23E-01	7.78E-02	5.78E-02
	21.72	64.90	2.20E+00		1.34E+00	1.06E+00
	37.93	23.75	3.51E+01		1.06E+02	1.72E+01
	131.42	20.40	1.08E+02		7.71E+01	5.09E+01
+ TH-234	63.29	* 3.80	4.76E+02	4.76E+02	1.08E+03	2.32E+02
NP-237	29.37	14.00	6.70E+01	6.70E+01	5.93E+02	3.31E+01
	86.50	12.60	1.05E+02		1.92E+00	4.98E+01
U-237	97.08	16.30	9.98E+01	6.11E+01	-5.94E+00	4.73E+01
	101.07	26.30	6.11E+01		6.72E+00	2.88E+01
	114.00	12.30	2.73E+02		6.23E+02	1.32E+02
	208.01	22.00	1.29E+02		7.04E+00	6.03E+01
AM-241	59.54	35.90	3.58E+01	3.58E+01	4.48E+01	1.73E+01
AM-243	74.67	66.00	1.78E+01	1.78E+01	-6.05E+01	8.45E+00

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

0000071950.CNF

Live Time : 900.000 sec
Real Time : 919.980 sec
Start : 1: 2.0(keV)
Stop : 4096.4091.6(keV)
Acq. Start : Tue Sep 18 11:37:34 2018



SECTION XI
ANALYTICAL DATA (TOTAL DISSOLVED SOLIDS)

0240

TDS / TSS Worksheet

Work Order	Run	Analysis Code	Technician
18-09016	1	TDS	MHIGHTOWER

TRetec Fraction	Client ID	Aliquot ml	Filter Data			TDS/TSS (mg/L)	Maximum Aliq (mL)
			Filter Tare (g)	Filter Final (g)	Filter Net (g)		
04	HANSON RELIEF WELL	100.0000	116.3759	116.4461	0.0702	702.0000	142.45
05	BILLINGSLEY RELIEF WELL	100.0000	110.8529	110.9086	0.0557	557.0000	179.53
06	DAVID MASON RELIEF WELL	100.0000	101.9347	102.0123	0.0776	776.0000	128.87
07	DENNISON RIG SUPPLY WELL	100.0000	107.1213	107.2044	0.0831	831.0000	120.34
08	GAMBLE RIG SUPPLY WELL	100.0000	105.2314	105.3140	0.0826	826.0000	121.07
09	FIELD DUPLICATE	100.0000	105.7480	105.8314	0.0834	834.0000	119.90
10	BRYANT POND 2	100.0000	120.9531	120.9753	0.0222	222.0000	450.45
11	BRYANT POND 7	100.0000	104.0737	104.1012	0.0275	275.0000	363.64
12	BRYANT POND 12	100.0000	105.9705	106.0006	0.0301	301.0000	332.23
13	EQUIPMENT BLANK	100.0000	100.5067	100.5073	0.0006	6.0000	16666.67

0241

Technician: MH Date: 9 / 8 / 18

Aliquot Worksheet

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
18-09016	1	TDS	liters	9/26/2018	MHIGHTOWER

Lab Fraction	Sample Client ID	Sample Type	Muffle Data		Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
			Ratio Post/Pre	No of Dilis	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq	
01	LCS	LCS						1.0000E+00	1.0000E+00				
02	BLANK	MBL						1.0000E+00	1.0000E+00				
03	DUP	DUP						1.0000E-01	1.0000E-01				
04	HANSON RELIEF WELL	TRG						1.0000E-01	1.0000E-01				
05	BILLINGSLEY RELIEF WELL	TRG						1.0000E-01	1.0000E-01				
06	DAVID MASON RELIEF WELL	TRG						1.0000E-01	1.0000E-01				
07	DENNISON RIG SUPPLY WELL	TRG						1.0000E-01	1.0000E-01				
08	GAMBLE RIG SUPPLY WELL	TRG						1.0000E-01	1.0000E-01				
09	FIELD DUPLICATE	TRG						1.0000E-01	1.0000E-01				
10	BRYANT POND 2	TRG						1.0000E-01	1.0000E-01				
11	BRYANT POND 7	TRG						1.0000E-01	1.0000E-01				
12	BRYANT POND 12	TRG						1.0000E-01	1.0000E-01				
13	EQUIPMENT BLANK	TRG						1.0000E-01	1.0000E-01				

Comments

0242

Technician: MH Date: 9/8/18

Misc. Forms

Custody Documents and Other Forms

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

LA 47396

SAMPLE CHAIN-OF-CUSTODY RECORD

Project Name: Indigo
 Project Number: 8060.00
 Project Location: DeSoto Parish, Louisiana

Laboratory: Eberline
 Collected By: KC/LV/EM/MJ
 Company: Hydro-Environmental Technology, Inc.
 Date: 9/4/2018

Sample I.D.	Type	Date/Time Sampled	Containers	Analysis Requested/Method	Comments
1 Hanson Relief Well	AQ	9/4/2018 10:45	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
2 Billingsley Relief Well	AQ	9/4/2018 11:40	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
3 David Mason Relief Well	AQ	9/4/2018 14:50	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
4 Dennison Rig Supply Well	AQ	9/4/2018 16:30	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
5 Gamble Rig Supply Well	AQ	9/4/2018 16:45	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C

OL

Max loc
 Temp: 46, 34, 0/434

Relinquished By: *David*
 Date/Time: 9/6/18 12:00
 Relinquished By: *Johnny Helain*
 Date/Time: 9-6-18 12-20
 Analysis Due: Verbal



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LA 47396

SAMPLE CHAIN-OF-CUSTODY RECORD

Project Name: _____ Indigo _____ Laboratory: Eberline _____
 Project Number: 8060.00 Collected By: KC/LV/EM/MLJ _____
 Project Location: DeSoto Parish, Louisiana Company: Hydro-Environmental Technology, Inc. _____
 Date: 9/4/2018

Sample I.D.	Type	Date/Time Sampled	Containers	Analysis Requested/Method	Comments
Field Duplicate	AQ	9/4/2018 16:35	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
Bryant Pond 2'	AQ	9/5/2018 11:45	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C HOLD
Bryant Pond 7'	AQ	9/5/2018 11:15	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C HOLD
Bryant Pond 12'	AQ	9/5/2018 10:45	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C
Equipment Blank	AQ	9/4/2018 10:40	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C

Relinquished By: *Eric Menden* **Sealed**
 Date/Time: *9/6/2018 12:00*
 Relinquished By: *Johnny Helms*
 Date/Time: *9-6-18 12:20*
 Analysis Due: Verbal: *Johnny Helms 12-30*

LA47396X: Chain of Custody
 Page 2 of 3



SGS Sample Receipt Summary

Job Number: LA47396

Client: HYDRO - ENV

Project: INDIGO

Date / Time Received: 9/6/2018 12:20:00 PM

Delivery Method: Accutest Courier

Airbill #'s: _____

Cooler Temps (Initial/Adjusted): #1: (4.6/4.6); #2: (3.4/3.4); DV439

Cooler Security

- | | | | | | |
|---------------------------|--------------------------|-------------------------------------|-----------------------|-------------------------------------|--------------------------|
| | <u>Y or N</u> | | | <u>Y or N</u> | |
| 1. Custody Seals Present: | <input type="checkbox"/> | <input checked="" type="checkbox"/> | 3. COC Present: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Custody Seals Intact: | <input type="checkbox"/> | <input checked="" 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: | <u>DV439;</u> | |
| 3. Cooler media: | <u>Ice (direct contact)</u> | |
| 4. No. Coolers: | <u>2</u> | |

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

LA47396X: Chain of Custody

Page 3 of 3