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

e-Hardcopy 2.0
Automated Report

Technical Report for

Hydro-Environmental Technology, Inc.

8060.00 (RL) Indigo-Desoto Parish, LA

SGS Job Number: LA47640X

Sampling Date: 09/11/18

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: **163**

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
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)

Sections: 1 2 3

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SGS North America Inc.

Sample Summary

Hydro-Environmental Technology, Inc.

8060.00 (RL) Indigo-Desoto Parish, LA

Job No: LA47640X

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
LA47640-1	09/11/18	11:50	KC/WP	09/12/18	AQ	Water	BAGLEY RIG SUPPLY WELL
LA47640-2	09/11/18	14:55	KC/WP	09/12/18	AQ	Water	ROM RIG SUPPLY WELL
LA47640-3	09/11/18	16:00	KC/WP	09/12/18	AQ	Water	DERBONNE RELIEF WELL

Subcontract Lab Data

Report of Analysis

SGS NORTH AMERICA INC.

LA47640X

STANDARD LEVEL IV
REPORT OF ANALYSIS

WORK ORDER #18-09064-OR

October 26, 2018

EBERLINE ANALYTICAL/OAK RIDGE LABORATORY
OAK RIDGE, TN

0001

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Eberline Services – Oak Ridge Laboratory

LABORATORY DATA SUPPORT CHECKLIST

MP-001-3

Eberline Services Work Order # 18 09064

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

Date for Partial	Initials	Date	Initials	Checklist Items
		9/14/18	BS	Sample Log-In
		9-27-18		Data Compilation
		9-28-18	MLT	First Technical Data Review
		9/28/18		Second Technical Data Review
		10/23/18		Data Entry/Electronic Deliverable
		10/23/18		Case Narrative
		10/25/18	EMT	Electronic Deliverable Proof
		10/26/18		Samples Analyzed within Holding Time Yes? [X] No? [ ]
		10/26/18		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: _____ 10/26/18

Laboratory Manager Date

Copy No _____

Radiochemistry Services

0003

SECTION I

CHAIN OF CUSTODY
& pH CHECK

CHAIN OF CUSTODY

SGS

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

FED-EX Tracking # | Bottle Order Control #

SGS Quote # | SGS Job # LA47640X

Client / Reporting Information

Company Name: SGS North America Inc.

Street Address: 500 Ambassador Caffery Parkway

City: Scott State: LA Zip: 70583

Project Contact: ralph.frye@sgs.com E-mail

Phone #: 800-304-5227 Fax #

Sampler(s) Name(s): KC/WP Phone

Project Information

Project Name: 8060.00 Indigo-Desoto Parish, LA

Street

City State

Project #

Client Purchase Order #

Project Manager

Billing Information (if different from Report to)

Company Name

Street Address

City State Zip

Attention:

Requested Analysis (see TEST CODE sheet)

Matrix Codes: 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; FB-Field Blank; EB-Equipment Blank; RB- Rinse Blank; TB-Trip Blank

18 09064

REC'D SEP 14 2018

SGS Sample #	Field ID / Point of Collection	MEOH/DI Vial #	Collection Date	Collection Time	Sampled by	Matrix	# of bottles	Number of preserved Bottles: HCl	NaOH	HNO3	H2SO4	NONE	DI Water	MEOH	ENCORE	RA-226, RA-228, TDS	LAB USE ONLY
1	BAGLEY RIG SUPPLY WELL		9/11/18	11:50:00 AM	KC/WP	AQ										X	
2	ROM RIG SUPPLY WELL		9/11/18	2:55:00 PM	KC/WP	AQ										X	
3	DERBONNE RELIEF WELL		9/11/18	4:00:00 PM	KC/WP	AQ										X	

4 5 4

Turnaround Time (Business days)

Approved By (SGS PM): / Date:

- ☐ Std. 10 Business Days
- ☐ 5 Day RUSH
- ☐ 3 Day EMERGENCY
- ☐ 2 Day EMERGENCY
- ☐ 1 Day EMERGENCY
- ☒ other Due 10/17/2018

Emergency & Rush T/A data available VIA Lablink

Data Deliverable Information

- ☐ Commercial "A" (Level 1)
- ☐ Commercial "B" (Level 2)
- ☐ FULLT1 (Level 3+4)
- ☐ REDT1 (Level 3+4)
- ☐ Commercial "C" X COMMB
- ☐ TRRP
- ☐ EDD Format
- ☐ Other

Commercial "A" = Results Only

Commercial "B" = Results + QC Summary

Comments / Special Instructions

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

Relinquished by Sampler: 1	Date Time: 9-13-18	Received By: 1 Randolph Spencer	9-14-18 9:15	Relinquished By: 2	Date Time:	Received By: 2
Relinquished by Sampler: 3	Date Time:	Received By: 3		Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5		Custody Seal #	☐ Intact ☐ Not intact	Preserved where applicable ☐	On Ice ☐	Cooler Temp.

0005

REC'D SEP 14 2018

18 09064

Date / Time: 9/13/2018 11:49:59 AM
CSR: ralphf
Job #: LA47640X
Client Project: 8060.00 Indigo-Desoto Parish, LA
Deliverable: COMMB
TAT: Due 10/17/2018

Sub Lab: Eberline Analytical
Address: 601 Scarboro Road
City: Oak Ridge
State: TN
Zip: 37830
Contact: Kathy Shaulis
Phone: (865) 483-4621

SGS Sample #	Client Sample Description	Analysis	Location	Sampled By	Date Sampled	Time Sampled	Aliquot
4 LA47640-1 ✓	BAGLEY RIG SUPPLY WELL	RA-226 ,RA-228 ,TDS , 3	OL ,	KC/WP	9/11/2018	11:50:00 AM	
5 LA47640-2 ✓	ROM RIG SUPPLY WELL	RA-226 ,RA-228 ,TDS , 3	OL ,	KC/WP	9/11/2018	2:55:00 PM	
6 LA47640-3 ✓	DERBONNE RELIEF WELL	RA-226 ,RA-228 ,TDS , 3	OL ,	KC/WP	9/11/2018	4:00:00 PM	

Comments:

Sample Management Receipt: Randolph Spencer

Date: 9-14-18 @ 9:18

6-32oz HNO3
3-250mL unp

9000

EBERLINE SERVICES

Oak Ridge Laboratory

Internal Chain of Custody

Work Order #	18-09064
Lab Deadline	10/4/2018
Analysis	Ra226 - Level 4
Sample Matrix	Water

Comments

Use container #3 for TDS.

Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
04	36	I11,3
05	37	I11,3
06	33	I11,3

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JHarvey	9/20/18 0800
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JHarvey	9/21/18 0810
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	9/21/18 0950
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	9/24/18 1445
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	9/24/18 1447
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KP	9/25/18 0554
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		

EBERLINE SERVICES
Oak Ridge Laboratory

Internal Chain of Custody

Work Order #	18-09064
Lab Deadline	10/4/2018
Analysis	Ra228 - Level 4
Sample Matrix	Water

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Use container #3 for TDS.	04	36	III.3
	05	37	III.3
	06	33	III.3

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	9/21/18 0750
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	9/24/18 1445
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	9/24/18 1447
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KP	9/25/18 0554
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	9/25/18 0810
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	9/26/18 1400
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	9/26/18 1400
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	9/26/18 1602
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		

Printed: 9/27/2018 8:47 AM

2

EBERLINE SERVICES
Oak Ridge Laboratory

Internal Chain of Custody

Work Order #	18-09064
Lab Deadline	9/18/2018
Analysis	TDS - Level 4
Sample Matrix	Water

Comments

Use container #3 for TDS.

Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
04	36	I11.3
05	37	I11.3
06	33	I11.3

	Location (circle one)					Initials	Date
Received by	(Sample Storage)	Rough Prep	Prep	Separations	Count Room	1300 [signature]	9-17-18
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	MU	18SEP18 0200
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		

EBERLINE SERVICES

Sample Receiving Report
(Volumes, pH, & CPM)

Internal Work Order
18-09064
Received By
RSPENCER

FR	ClientID	# Btls	Comments	Matrix	Storage	Rec Vol Ttl	CPM Max
01	LCS	0		WA	II1.3		
02	BLANK	0		WA	II1.3		
03	DUP	0		WA	II1.3		
04	BAGLEY RIG SUPPLY WELL	3		WA	II1.3	2.25	36
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	27
			2	<2	<2	1.0000	30
			3	7	7	0.2500	36
05	ROM RIG SUPPLY WELL	3		WA	II1.3	2.25	37
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	37
			2	<2	<2	1.0000	36
			3	7	7	0.2500	34
06	DERBONNE RELIEF WELL	3		WA	II1.3	2.25	33
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	<2	<2	1.0000	28
			2	<2	<2	1.0000	33
			3	7	7	0.2500	30

VEyT 9/17/18

Received by: Randolph Spencer Date: 9-14-18

SECTION II

SAMPLE ACKNOWLEDGEMENT

Client Name	Contract/PO	Project Type	Date Received	Required Turnaround Days	Eberline Services Work Order
SGS North America Inc.	ENV	Environmental	09/14/2018	28	18-09064
Project Name	**Client WO**	**Sample Disp**	**Lab Deadline**	**Internal Deadline**	**Client Deadline**
ENV	LA47640X	W	10/04/2018	10/11/2018	10/12/2018

Internal ID	Client ID	Sample Date	Matrix	Storage	Ra226	Ra228	TDS	TI
01	LCS	09/17/18	WA	II1.3	X	X	X	3
02	BLANK	09/17/18	WA	II1.3	X	X	X	3
03	DUP	09/17/18	WA	II1.3	X	X	X	3
04	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	WA	II1.3	X	X	X	3
05	ROM RIG SUPPLY WELL	09/11/18 14:55	WA	II1.3	X	X	X	3
06	DERBONNE RELIEF WELL	09/11/18 15:00	WA	II1.3	X	X	X	3
								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
								0
	Totals Per Analysis (non QA samples)				3	3	3	0

0012

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		Report Data	
	Accounts Payable		Ralph Frye
	SGS North America Inc.		SGS North America Inc
	500 Ambassador Caffery Pkwy		500 Amb. Caffery Pkwy
	Scott, LA 70583		Scott, LA 70583
Voice	800-304-5227	*Voice*	800-304-5227
Fax	337-237-7838	*Fax*	337-237-7838
Contact	Ralph Frye		
Voice	800-304-5227		
Fax	337-237-7838		

2

Eberline Services - Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST
MP-001-2

WORK ORDER # 18-09064

SAMPLE MATRIX/MATRICES:

(CIRCLE ONE OR BOTH)

(AQUEOUS) NON-AQUEOUS

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

WERE SAMPLES:

Received in good condition?	(Y)	N	
If aqueous, properly preserved	(Y)	N	N/A

WERE CHAIN OF CUSTODY SEALS:

Present on outside of package?	(Y)	N
Unbroken on outside of package?	(Y)	N
Present on samples?	(Y)	N
Unbroken on samples?	(Y)	N
Was chain of custody present upon sample receipt?	(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: 9-14-18

SECTION III

CASE NARRATIVE

EBERLINE ANALYTICAL

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

EBS-OR-44506

October 26, 2018

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

CASE NARRATIVE
LA Certificate #05005
Work Order # 18-09064-OR

SAMPLE RECEIPT

This work order contains three water samples received 09/14/2018. Samples were analyzed for Radium-226/228 and Total Dissolved Solids.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
BAGLEY RIG SUPPLY WELL	18-09064-04	DERBONNE RELIEF WELL	18-09064-06
ROM RIG SUPPLY WELL	18-09064-05		

ANALYTICAL METHODS

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

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

RADIUM-226

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

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

ANALYTICAL RESULTS CONTINUED

RADIUM-226 CONTINUED

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

RADIUM-228

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

Samples demonstrated acceptable results for all Radium-228 analyses. Chemical recovery was acceptable for all samples. The Radium-228 method blank demonstrated an acceptable result. Results for the Radium-228 duplicate demonstrated 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 content that ranged from 336.0 to 561.0 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: 10/26/2018

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

SECTION IV

ANALYTICAL RESULTS SUMMARY

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 18-09064
Project: LA47640X
Analysis Category: ENVIRONMENTAL
Sample Matrix: WA

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
18-09064-01	LCS	KNOWN	09/17/18 00:00	9/14/2018	9/24/2018	18-09064	Radium-226	EPA 903.0 Modified	1.02E+01	4.69E-01			pCi/l
18-09064-01	LCS	SPIKE	09/17/18 00:00	9/14/2018	9/24/2018	18-09064	Radium-226	EPA 903.0 Modified	1.14E+01	1.59E+00	2.89E+00	4.61E-01	pCi/l
18-09064-02	MBL	BLANK	09/17/18 00:00	9/14/2018	9/24/2018	18-09064	Radium-226	EPA 903.0 Modified	8.14E-02	1.86E-01	1.87E-01	3.64E-01	pCi/l
18-09064-03	DUP	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	9/14/2018	9/24/2018	18-09064	Radium-226	EPA 903.0 Modified	2.10E-01	1.99E-01	2.03E-01	2.44E-01	pCi/l
18-09064-04	DO	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	9/14/2018	9/24/2018	18-09064	Radium-226	EPA 903.0 Modified	4.30E-01	2.85E-01	2.99E-01	3.27E-01	pCi/l
18-09064-05	TRG	ROM RIG SUPPLY WELL	09/11/18 14:55	9/14/2018	9/24/2018	18-09064	Radium-226	EPA 903.0 Modified	3.31E-01	2.41E-01	2.51E-01	2.43E-01	pCi/l
18-09064-06	TRG	DERBONNE RELIEF WELL	09/11/18 16:00	9/14/2018	9/24/2018	18-09064	Radium-226	EPA 903.0 Modified	6.97E-01	3.90E-01	4.17E-01	4.04E-01	pCi/l
18-09064-01	LCS	KNOWN	09/17/18 00:00	9/14/2018	9/26/2018	18-09064	Radium-228	EPA 904.0	9.22E+00	4.70E-01			pCi/l
18-09064-01	LCS	SPIKE	09/17/18 00:00	9/14/2018	9/26/2018	18-09064	Radium-228	EPA 904.0	8.45E+00	7.11E-01	2.04E+00	8.58E-01	pCi/l
18-09064-02	MBL	BLANK	09/17/18 00:00	9/14/2018	9/26/2018	18-09064	Radium-228	EPA 904.0	-7.86E-02	2.91E-01	2.91E-01	6.38E-01	pCi/l
18-09064-03	DUP	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	9/14/2018	9/26/2018	18-09064	Radium-228	EPA 904.0	4.13E-01	3.21E-01	3.34E-01	6.38E-01	pCi/l
18-09064-04	DO	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	9/14/2018	9/26/2018	18-09064	Radium-228	EPA 904.0	1.94E-02	3.29E-01	3.29E-01	7.03E-01	pCi/l
18-09064-05	TRG	ROM RIG SUPPLY WELL	09/11/18 14:55	9/14/2018	9/26/2018	18-09064	Radium-228	EPA 904.0	3.51E-01	3.34E-01	3.43E-01	6.73E-01	pCi/l
18-09064-06	TRG	DERBONNE RELIEF WELL	09/11/18 16:00	9/14/2018	9/26/2018	18-09064	Radium-228	EPA 904.0	4.33E-01	3.80E-01	3.92E-01	7.65E-01	pCi/l
18-09064-04	TRG	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	9/14/2018	9/18/2018	18-09064	TDS	SM2540C	3.36E+02				mg/l
18-09064-05	TRG	ROM RIG SUPPLY WELL	09/11/18 14:55	9/14/2018	9/18/2018	18-09064	TDS	SM2540C	5.11E+02				mg/l
18-09064-06	TRG	DERBONNE RELIEF WELL	09/11/18 16:00	9/14/2018	9/18/2018	18-09064	TDS	SM2540C	5.61E+02				mg/l

0018

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

SECTION V

ANALYTICAL STANDARD

13a-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

*Notes and references are on pages 5 and 6.

0020

EBERLINE SERVICES

QUALITY CONTROL PROGRAM
QCP-009

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

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

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

Principal Radionuclide	Half Life, Years	Half Life, Days
^{133}Barium	1.048E+01	3.828E+03

Radionuclide: ^{133}Barium
Reference Date: 9/1/1993 0:00
Certified Activity: µCi
Certified Concentration: 1.318E+01 µCi 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	µCi

Chemical Composition of Standard Solution
$^{133}BaCl_2$ in 1M HCl

Dilution Instructions:
Dilution Solvent Used: 1M HCl

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 66.5577 µCi 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 _____ Date: 5/5/18

QC Approval _____ Date: 5/8/18

0021

EBERLINE SERVICES

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

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

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

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

Chemical Composition of Standard Solution
$^{133}BaCl_2$ in 1M HCl

Dilution Instructions: Dilution Solvent Used: 1M HCl

SECONDARY VOLUMETRIC DILUTION

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

Final Activity Concentration: 3.6950E+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.

NOTES:

Expiration Date: April 26, 2019

Verified & Approved By _____ Date: 5/5/18

QC Approval _____ Date: 5/5/18

0022

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

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

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

Description of Solution

a. Mass of solution:	5.1864 g (in a 5 ml Flame Sealed Ampoule)	
b. Chemical form:	$Ra(NO_3)_2$ in 1 N HNO_3	
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).

Ana U. Kuen
QUALITY CONTROL

Feb. 3, 1994
Date Signed

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

0023

EBERLINE SERVICES

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

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

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

Radionuclide	^{226}Radium	
Certified Activity	1.001E+00	µCi
Certified Concentration		µCi per gram

Reference Date 2/1/1994 0:00

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

Chemical Composition of Standard Solution
$^{226}Ra(NO_3)_2$ in 1M HNO_3

Dilution Instructions:

Dilution Solvent Used: 1M HNO_3

Dilute to a volume of 1000.00 milliliters

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

And after dilution the activity of this solution is 2.222E+03 dpm/ml

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

Expiration Date: September 10, 2019

Verified & Approved By _____ Date: 9/17/2018

QC Approval _____ Date: 9/18/18

0024

EBERLINE SERVICES

QUALITY CONTROL PROGRAM

MP 009

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

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

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

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

Radionuclide of Interest: ^{226}Radium
Parent Solution Conc.: 2.22E+03 dpm/ml

Reference Date: 2/1/1994 0:00

Chemical Composition of Standard Solution
$^{226}Ra(NO_3)_2$ in 1M HNO_3

Dilution Instructions:

Dilution Solvent Used: 1M HNO_3

SECONDARY VOLUMETRIC DILUTION

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

Final Activity Concentration: 4.4440E+01 dpm/ml

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

NOTES:

Expiration Date: 10-Sep-19

Verified & Approved By _____ Date: 9/17/2018 0:00

QC Approval _____ Date: 9/18/18

0025

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

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

Ra^{228}

72325-207

Ra-228 5 mL Liquid in Flame Sealed Vial

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

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

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

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

Impurities: γ-impurities <0.1%

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

P O NUMBER 00003181, Item 1

SOURCE PREPARED BY: M Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: M. Mitchell 2-13-06

0026

EBERLINE SERVICES

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

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

Principal Radionuclide	Half Life, Years	Half Life, Days
^{228}Ra	5.750E+00	2.100E+03

Radionuclide	^{228}Ra	Reference Date	2/10/2006 0:00
Certified Activity	1.087E-01	µCi	
Certified Concentration		µCi 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	µCi

Chemical Composition of Standard Solution
$^{228}Ra(NO_3)_2$ in 0.5 M HCl

Dilution Instructions: Dilution Solvent Used: 0.5 M HCl

Dilute to a volume of 991.00 Kg

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

And after dilution the activity of this solution is 2.435E+02 dpm/ml

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

Expiration Date: February 12, 2019

Recertified By _____ Date: 2/12/18

QC Approval _____ Date: 2/13/18

0027

SECTION VI

QUALITY CONTROL SAMPLE RESULTS SUMMARY

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
18-09064	Ra226	1	pCi	l	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		112.14%	25.28%	100.00%	4.60%	1.02E+01	4.69E-01	1.14E+01	2.89E+00	Ra-5b	4.40E+01	4.60E+00	5.15E-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*
RA-226	1.19	68.69	4.30E-01	2.99E-01	2.10E-01	2.03E-01

QC Summary

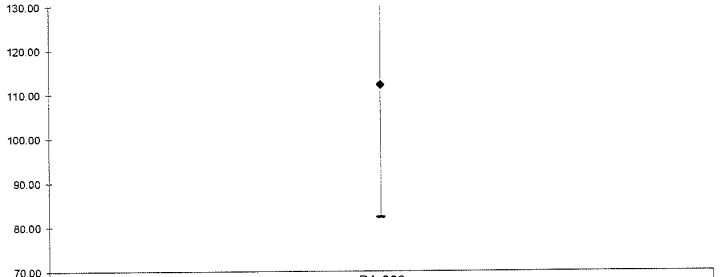
LCS Relative Bias	*LCS % R*		*MS % R*	*MS ND*	*Rep RPD*	*Rep ND*
1.12	OK				NA	OK

0029

Version

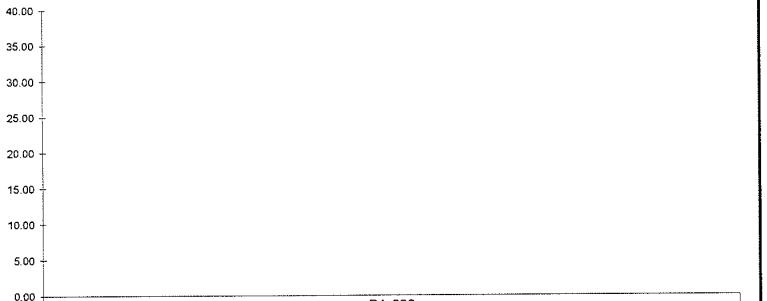
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
18-09064	Ra226	1	pCi	I	SGS North America Inc.

LCS % Recovery



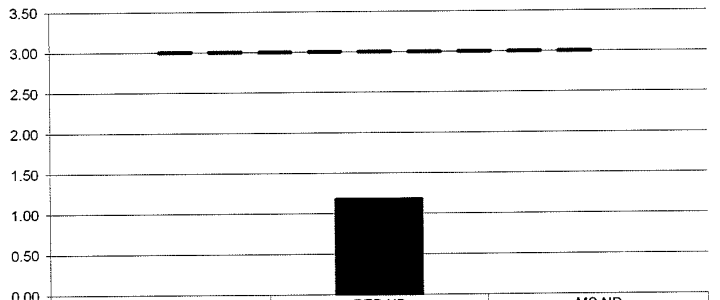
	RA-226
Lower Error	82.26
Upper Error	142.02
%R	112.14
LCL	75
Mean	100
UCL	125

Replicate Sample RPD



	RA-226
Lower Error	95.62
Upper Error	41.75
RPD	68.69
CL	35

Normalized Difference



	LCS ND	REP ND	MS ND
RA-226	0.00	1.19	0.00
UCL	3	3	3

No Matrix Spike

0030

Version

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
18-09064	Ra228	1	pCi	l	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		91.67%	24.15%	100.00%	5.10%	9.22E+00	4.70E-01	8.45E+00	2.04E+00	Ra-12	5.32E+01	5.10E+00	3.85E-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
RA-228	1.64	182.00	1.94E-02	3.29E-01	4.13E-01	3.34E-01

QC Summary

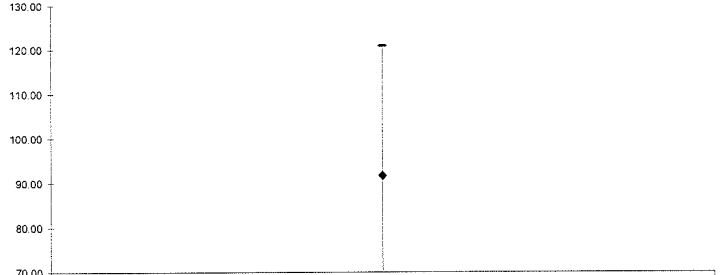
LCS Relative Bias	LCS % R		MS % R	MS ND	Rep RPD	Rep ND
0.92	OK				NA	OK

0031

Version

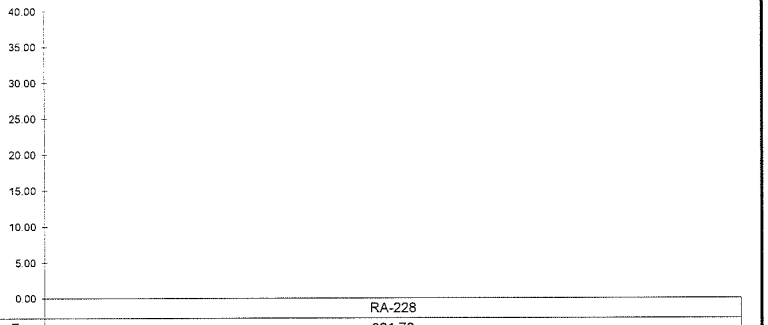
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
18-09064	Ra228	1	pCi	l	SGS North America Inc.

LCS % Recovery



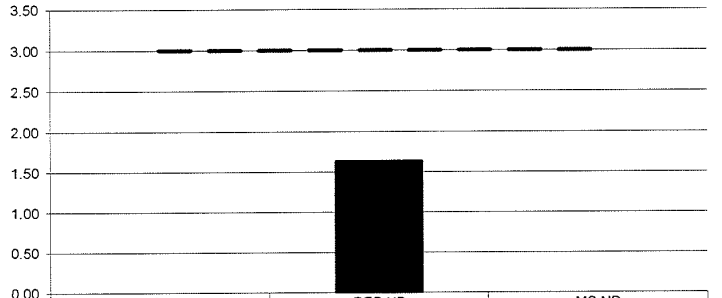
	RA-228
Lower Error	62.41
Upper Error	120.92
%R	91.67
LCL	75
Mean	100
UCL	125

Replicate Sample RPD



	RA-228
Lower Error	321.70
Upper Error	42.31
RPD	182.00
CL	35

Normalized Difference



	LCS ND	REP ND	MS ND
RA-228	0.00	1.64	0.00
UCL	3	3	3

No Matrix Spike

0032

Version

SECTION VII

LABORATORY TECHNICIAN'S NOTES

RA-226 NOTES

2

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	18-09064
Analysis Code	Ra226
Run Number	1

#	Date	Dept	User	Notes
1	09/20/18 09:58	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 PREIP TO SEPARATIONS

JHarvey
9/20/18

0035

2

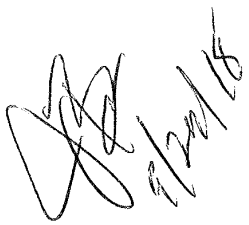
EBERLINE SERVICES

Work Order Analysis Notes

Oak Ridge Laboratory
601 Scarboro Rd.
Oak Ridge, TN 37830
Voice: 865.481.0683
www.eberlineservices.com

Internal Work Order	18-09064
Analysis Code	Ra226
Run Number	1

#	Date	Dept	User	Notes
1	09/20/18 09:58	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 PREIP TO SEPARATIONS
2	09/24/18 14:41	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.



0036

2

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
18-09064	
Analysis Code	Run
Ra226	1

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

Alpha 3

Date	Sample #	Client ~~Lab~~	Load time	Count time	Analysis	Tech
9/24/18	180904 9A (9)	DOE	0818	5hr 35 min	Am241	ICP
9/24/18	180904 9A (1-5,8,9)	DOE	0819	5hr 35 min	Pu	ICP
9/24/18	180906 3A (1-5,7)	DOE	0820	5hr 35 min	Pu	ICP
9/24/18	180904 9A (1-5,8,9)	DOE	0821	5hr 35 min	UU	ICP
9/24/18	180906 3A (1-5)	DOE	0822	5hr 35 min	UU	ICP
9/24/18	180906 3A (7)	DOE	1407	5hr 35 min	UU	ICP
9/24/18	180902 5B (1-3,18)	MPA	1409	2hr 50 min	Rad	ICP
9/24/18	180904 6A (1-4)	Indust. Env.	1411	2hr 50 min	Rad	ICP
9/24/18	180908 3A (1-4)	UCOR	1432	2hr 50 min	Rad	ICP
9/24/18	180906 4A (1-6)	SGS N. America	1725	2hr 50 min	Rad	ICP
9/24/18	180907 5A (1-5)	SGS N. America	1726	2hr 50 min	Rad	ICP

RA-228 NOTES

2

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	18-09064
Analysis Code	Ra228
Run Number	1

#	Date	Dept	User	Notes
1	09/20/18 09:58	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 PREIP TO SEPARATIONS

Harvey 9/20/18

0040

2

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	18-09064
Analysis Code	Ra228
Run Number	1

#	Date	Dept	User	Notes
1	09/20/18 09:58	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 PREIP TO SEPARATIONS
2	09/26/18 13:47	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.

9/26/18

0041

2

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
18-09064	
Analysis Code	Run
Ra228	1

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
019782P	Ammonium Hydroxide	Reagent Grade	JHARVEY	9/20/2018
020136D02	Ammonium Sulfate	200 mg/ml	JHARVEY	9/20/2018
019792D06	Barium Carrier	1 mg/ml	JHARVEY	9/20/2018
019767D01	Lead Carrier	166 mg/ml	JHARVEY	9/20/2018
020283P	Nitric Acid	Reagent Grade	JHARVEY	9/20/2018
018297D01	Ammonium Oxalate	5%	JBAILEY	9/26/2018
018971D06	Nitric Acid	1N	JBAILEY	9/26/2018
019673D02	Nitric Acid	6N	JBAILEY	9/26/2018
018699D10	Sodium Hydroxide	10M	JBAILEY	9/26/2018
019344D01	Sodium Hydroxide	18M	JBAILEY	9/26/2018
019519S	Yttrium Carrier	9 mg/ml	JBAILEY	9/26/2018

0042

Red LB4110

Date	Sample #	Client	Loadtime	Counttime	Analysis	Tech
9/18/18	Daily Blkd/QC	Lab	0535/0503	1hr/30min	αβ	ICP
9/18/18	Cross Talk	Lab	0640	5 min	αβ	ICP
9/18/18	Cross Talk	Lab	0649	5 min	αβ	ICP
9/18/18	1809077AB(1-3,5)	UCOR	1650	30mins	αβ	ICP
9/19/18	Daily Blkd/QC	Lab	0540/0508	1hr/30min	αβ	ICP
9/19/18	Cross Talk	Lab	0646	5min	αβ	ICP
9/19/18	Cross Talk	Lab	0654	5 min	αβ	ICP
9/19/18	1809016RA(1-6)	Sees N. America	1405	2hrs	Ra	ICP
9/19/18	1809088AB(1-3,5)	UCOR	1727	30mins	αβ	ICP
9/19/18	1809089AB(1-2)	UCOR	1729	30mins	αβ	ICP
9/20/18	Daily Blkd/QC	Lab	0524/0520	1hr/30min	αβ	ICP
9/20/18	Cross Talk	Lab	0658	5 min	αβ	ICP
9/20/18	Cross Talk	Lab	0707	5 min	αβ	ICP
9/21/18	Daily Blkd/QC	Lab	0605/0525	1hr/30min	αβ	ICP
9/21/18	Cross Talk	Lab	0707	5 min	αβ	ICP
9/21/18	Cross Talk	Lab	0715	5 min	αβ	ICP
9/21/18	1809025RA(15-18)	MPA	1426	2hr	Ra	ICP
9/22/18	Weekly Blkd	Lab	0939	12hrs	αβ	ICP
9/24/18	Daily Blkd/QC	Lab	0537/0524	1hr/30min	αβ	ICP
9/24/18	Cross Talk	Lab	0640	5 min	αβ	ICP
9/24/18	Cross Talk	Lab	0649	5 min	αβ	ICP
9/24/18	1809078RA(1-4)	USA	1112	2hrs	Ra	ICP
9/25/18	Daily Blkd/QC	Lab	0550/0514	1hr/30min	αβ	ICP
9/25/18	Cross Talk	Lab	0653	5 min	αβ	ICP
9/25/18	Cross Talk	Lab	0702	5 min	αβ	ICP
9/25/18	1809086RA(1-4)	Industr. + Env.	1416	2hr	Ra	ICP
9/26/18	Daily Blkd/QC	Lab	0613/0534	1hr/30min	αβ	ICP
9/26/18	Cross Talk	Lab	0716	5min	αβ	ICP
9/26/18	Cross Talk	Lab	0724	5 min	αβ	ICP
9/26/18	1809046AB(17,18)	TDX Assoc.	0746	1 hr	αβ	ICP
9/26/18	1809083Np(1-3)	UCOR	0755	10 min	Np	ICP
9/26/18	1809083Np(4)	UCOR	0808	10min	Np	ICP
9/26/18	1809067RA(1-6)	Sees N. American	1401	2hrs	Ra	ICP

TDS NOTES

2

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	18-09064
Analysis Code	TDS
Run Number	1

#	Date	Dept	User	Notes
1	09/18/18 01:38	PREP	MHIGHTOWER	Filtered sample into tared beaker, dried, re-weighed

MH 18 SEP18

SECTION VIII

ANALYTICAL DATA (RADIUM-226)

Work Order	18-09064
Analysis Code	Ra226
Run	1
Date Received	9/14/2018
Lab Deadline	10/4/2018
Client	SGS North America Inc.
Project	ENV
Report Level	4
Activity Units	pCi
Aliquot Units	l
Matrix	WA
Method	EPA 903.0 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	Ba-133
Radiometric Sol#	Ba-6a
Tracer Act (dpm/g)	474.1
Carrier	
Carrier Conc (mg/ml)	

0047

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/17/18 00:00	1.0000E+00
02	MBL	BLANK		09/17/18 00:00	1.0000E+00
03	DUP	BAGLEY RIG SUPPLY WELL	36	09/11/18 11:50	1.0000E+00
04	DO	BAGLEY RIG SUPPLY WELL	36	09/11/18 11:50	1.0000E+00
05	TRG	ROM RIG SUPPLY WELL	37	09/11/18 14:55	1.0000E+00
06	TRG	DERBONNE RELIEF WELL	33	09/11/18 16:00	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	2.0460	970.0	673.0	154.03		0.0208	0.0295	0.0087		110.00	2.94	1.00
02	MBL	2.0405	967.4	603.0	138.38		0.0203	0.0303	0.0100		110.00	3.00^	1.00
03	DUP	2.0377	966.1	544.0	125.01		0.0208	0.0286	0.0078		110.00	2.72	1.00
04	DO	2.0352	964.9	799.0	183.83		0.0207	0.0278	0.0071		110.00	2.53	1.00
05	TRG	2.0317	963.2	606.0	139.67		0.0207	0.0292	0.0085		110.00	2.89	1.00
06	TRG	2.0301	962.5	569.0	131.24		0.0207	0.0310	0.0103		110.00	3.00^	1.00

0048

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

18-09064
Ra226
Run 1

Internal Fraction	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep t0 Date/Time	Sep t0 By	Sep t1 Date/Time	Sep t1 By
01	LCS			09/20/18 09:19	JHARVEY	09/24/18 13:55	JBAILEY		
02	MBL			09/20/18 09:19	JHARVEY	09/24/18 13:55	JBAILEY		
03	DUP			09/20/18 09:19	JHARVEY	09/24/18 13:55	JBAILEY		
04	DO			09/20/18 09:19	JHARVEY	09/24/18 13:55	JBAILEY		
05	TRG			09/20/18 09:19	JHARVEY	09/24/18 13:55	JBAILEY		
06	TRG			09/20/18 09:19	JHARVEY	09/24/18 13:55	JBAILEY		

0049

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

Client: SGS North America Inc.
Eberline Analytical Work Order: 18-09064
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	1.14E+01	1.59E+00	4.61E-01	1.02E+01	112.14	OK		OK	
02	RA-226	MBL	BLANK	pCi/l	8.14E-02	1.86E-01	3.64E-01					OK	OK
03	RA-226	DUP	BAGLEY RIG SUPPLY WELL	pCi/l	2.10E-01	1.99E-01	2.44E-01				NA	OK	
04	RA-226	DO	BAGLEY RIG SUPPLY WELL	pCi/l	4.30E-01	2.85E-01	3.27E-01					OK	
05	RA-226	TRG	ROM RIG SUPPLY WELL	pCi/l	3.31E-01	2.41E-01	2.43E-01					OK	
06	RA-226	TRG	DERBONNE RELIEF WELL	pCi/l	6.97E-01	3.90E-01	4.04E-01					OK	

Client: SGS North America Inc.
Eberline Analytical Work Order: 18-09064
Analysis Code: Ra226
Run: 1

Lab Fraction	Nuclide	Sample Desc	Sample Date	Sample Aliquot	Radiometric % Rec	Grav % Rec	Mean % Rec	SAF	Sep t0 Date/Time	Sep t1 Date/Time
01	RA-226	LCS	09/17/18 00:00	1.00E+00	100.00	0.00	110.00		9/24/2018 13:55	
02	RA-226	MBL	09/17/18 00:00	1.00E+00	100.00	0.00	110.00		9/24/2018 13:55	
03	RA-226	DUP	09/11/18 11:50	1.00E+00	100.00	0.00	110.00		9/24/2018 13:55	
04	RA-226	DO	09/11/18 11:50	1.00E+00	100.00	0.00	110.00		9/24/2018 13:55	
05	RA-226	TRG	09/11/18 14:55	1.00E+00	100.00	0.00	110.00		9/24/2018 13:55	
06	RA-226	TRG	09/11/18 16:00	1.00E+00	100.00	0.00	110.00		9/24/2018 13:55	

0054

Client: SGS North America Inc.
Eberline Analytical Work Order: 18-09064
Analysis Code: Ra226
Run: 1

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-226	LCS	09/24/18 17:25		A_Spec	Alpha_035	170	2.17 E+02	1.70 E-02	14.8
02	RA-226	MBL	09/24/18 17:25		A_Spec	Alpha_036	170	1.79 E+00	1.30 E-02	17.5
03	RA-226	DUP	09/24/18 17:25		A_Spec	Alpha_039	170	5.15 E+00	5.00 E-03	17.6
04	RA-226	DO	09/24/18 17:25		A_Spec	Alpha_040	170	1.13 E+01	1.60 E-02	17.6
05	RA-226	TRG	09/24/18 17:25		A_Spec	Alpha_041	170	8.15 E+00	5.00 E-03	18.8
06	RA-226	TRG	09/24/18 17:25		A_Spec	Alpha_042	170	1.51 E+01	1.70 E-02	17.2

0052

Count Room Report
Client: SGS North America Inc.

18-09064-Ra226-1 (pCi/l) in WA
Tracer ID: Ba-6a

#33_42

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	09/17/18 00:00	1.0000	2.0460	970.0086	673.0000	154.03	2.94	1.00
02	MBL	BLANK	09/17/18 00:00	1.0000	2.0405	967.4011	603.0000	138.38	3.00^	1.00
03	DUP	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	1.0000	2.0377	966.0736	544.0000	125.01	2.72	1.00
04	DO	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	1.0000	2.0352	964.8883	799.0000	183.83	2.53	1.00
05	TRG	ROM RIG SUPPLY WELL	09/11/18 14:55	1.0000	2.0317	963.2290	606.0000	139.67	2.89	1.00
06	TRG	DERBONNE RELIEF WELL	09/11/18 16:00	1.0000	2.0301	962.4704	569.0000	131.24	3.00^	1.00

0053

Eberline Analytical
Oak Ridge Laboratory

Spike and Tracer Worksheet

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
18-09064	1	Ra226	9/20/2018 9:15	JHARVEY		

LCS & Matrix Spikes					LCS	MS	LCSD	MSD	LCS		MS		LCSD		MSD	
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Known pCi	Error Estimate	Added pCi	Error Estimate	Known pCi	Error Estimate	Added pCi	Error Estimate
Ra-226	Ra-5b	43.970	9/20/2018	0.500	0.5149				10.20	0.469	0.00	0.000	0.00	0.000	0.00	0.000

Tracers

fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition
01	Ba-133	Ba-6a	474.100	9/20/2018	2.0460	2.1400
02	Ba-133	Ba-6a	474.100	9/20/2018	2.0405	2.1400
03	Ba-133	Ba-6a	474.100	9/20/2018	2.0377	2.1400
04	Ba-133	Ba-6a	474.100	9/20/2018	2.0352	2.1400
05	Ba-133	Ba-6a	474.100	9/20/2018	2.0317	2.1400
06	Ba-133	Ba-6a	474.100	9/20/2018	2.0301	2.1400

Balance Printer Tapes

Tracer

LCS

Matrix Spike

0054

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Printed: 9/20/2018 9:50 AM

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
18-09064	1	Ra226	liters	10/4/2018	JHARVEY

Lab Fraction	SGS North America Inc. Client ID	Sample Type	Muffle Data Ratio Post/Pre	Dilution Data No of Dils	Dil Factor	Ratio	Aliquot Data Aliquot	Net Equiv	MS Aliquot Data Aliquot	Net Equiv	H-3 Solids Only 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	BAGLEY RIG SUPPLY WELL	DUP					1.0000E+00	1.0000E+00				
04	BAGLEY RIG SUPPLY WELL	DO					1.0000E+00	1.0000E+00				
05	ROM RIG SUPPLY WELL	TRG					1.0000E+00	1.0000E+00				
06	DERBONNE RELIEF WELL	TRG					1.0000E+00	1.0000E+00				

Comments	

0055

Technician: _____ Date: 9/20/18

Eberline Analytical - Oak Ridge
Version 1.1 10/2015

Gravimetric Worksheet

Printed: 9/24/2018 2:40 PM

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
18-09064	1	Ra226			JBAILEY

TRetec Fraction	SGS North America Inc. Client ID	Sample Type	Carrier Data	Filter Data			Gravimetric
			Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)	% Recovery
01	LCS	LCS		0.0208	0.0295	**0.0087**	
02	BLANK	MBL		0.0203	0.0303	**0.0100**	
03	DUP	DUP		0.0208	0.0286	**0.0078**	
04	BAGLEY RIG SUPPLY WELL	DO		0.0207	0.0278	**0.0071**	
05	ROM RIG SUPPLY WELL	TRG		0.0207	0.0292	**0.0085**	
06	DERBONNE RELIEF WELL	TRG		0.0207	0.0310	**0.0103**	

0056

Technician: JB Date: 9/24/18

KP
9/25/18

2

Apex-Alpha™

Sample Description: SPIKE
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229
Batch Identification: 1809064A-RA
Sample Identification: 01
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_035
Chamber Serial Number: 04026477A
Detector Serial Number: 58771
Env. Background: System Bkgd 225702
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.940E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 9/24/2018 2:48:40 PM
Acquisition Date/Time: 9/24/2018 5:25:03 PM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

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

Control Certificate Name: Ra226_Ra-5b
Chem. Recov. of Control: RA-226 0.381422 +/- 0.029303
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	5.500	10.47	65.55	1.53	0.00E+000	3.0
RA-226	4.582	217.11	13.41	2.89	0.00E+000	3.3

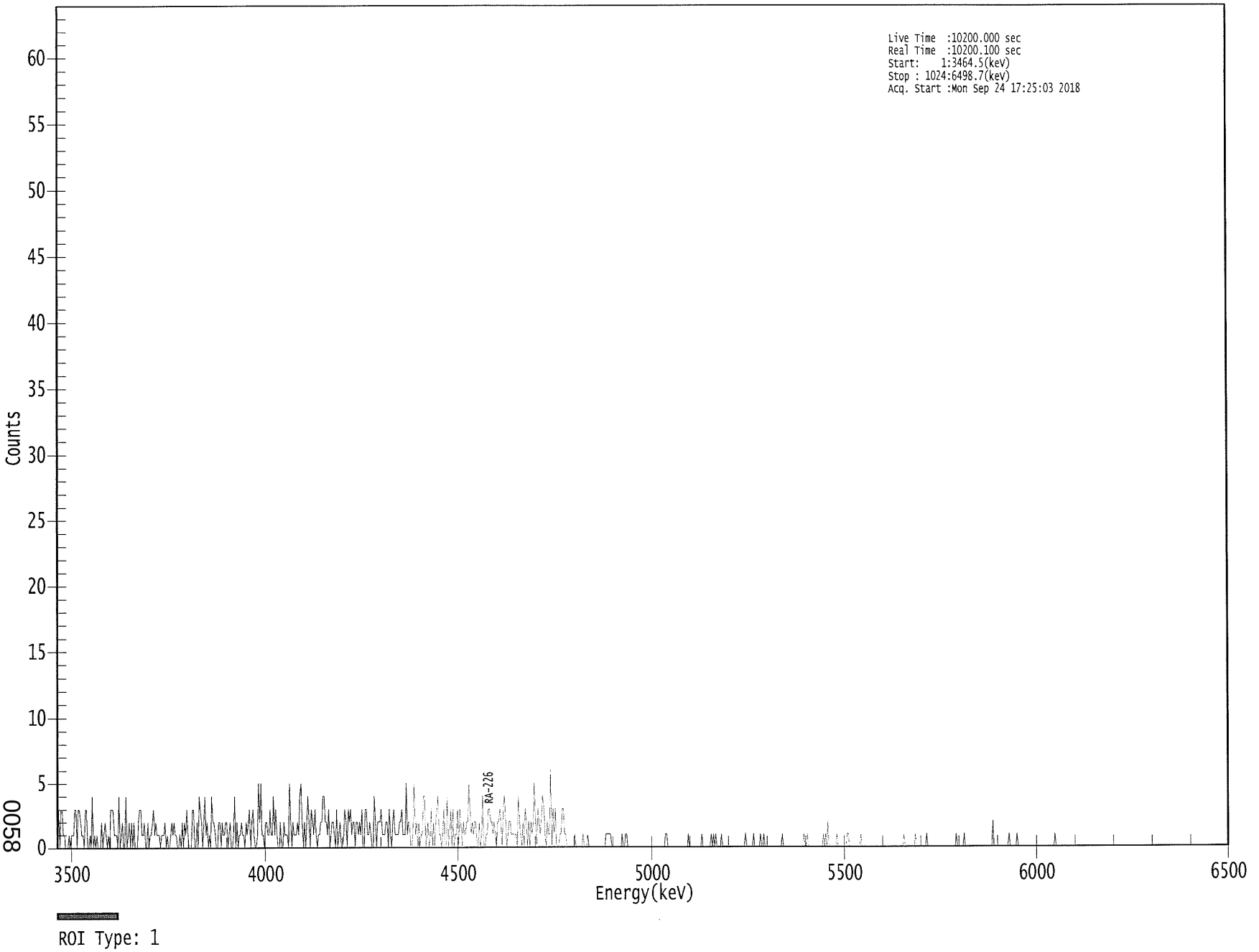
NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.956	5685.50*	5.80E-001 +/- 3.81E-001	3.94E-001 +/- 1.39E-002
RA-226	0.948	4785.00*	1.14E+001 +/- 1.59E+000	4.61E-001 +/- 1.63E-002

AG
9/25/18

0057

0000222968.CNF



2

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

0059

369:	2	0	1	4	0	0	1	1

Sample Title: 01

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

801:	0	0	0	0	0	0	0	0

Sample Title: 01

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	2	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	1
833:	0	0	0	0	0	0	1	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	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	1

0061

Apex-Alpha™

KP
9/25/18

2

Sample Description: BLANK
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229
Batch Identification: 1809064A-RA
Sample Identification: 02
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_036
Chamber Serial Number: 04026477B
Detector Serial Number: 84167
Env. Background: System Bkgd 225703
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 9/24/2018 2:48:40 PM
Acquisition Date/Time: 9/24/2018 5:25:05 PM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
Counting Efficiency: 0.1748 +/- 0.0031 on 2/16/2018 9:34:33 AM
Effective Efficiency: 0.1748 +/- 0.0031

Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.529	-1.02	208.15	1.02	0.00E+000	0.0
RA-226	4.618	1.79	229.05	2.21	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.969	5685.50*	-4.88E-002 +/- 1.02E-001	3.01E-001 +/- 1.04E-002
RA-226	0.964	4785.00*	8.14E-002 +/- 1.86E-001	3.64E-001 +/- 1.25E-002

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9/25/18

0062

Apex-Alpha™

Sample Description: BLANK
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229
Batch Identification: 1809064A-RA
Sample Identification: 02
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_036
Chamber Serial Number: 04026477B
Detector Serial Number: 84167
Env. Background: System Bkgd 225703
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 3.000E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 9/24/2018 2:48:40 PM
Acquisition Date/Time: 9/24/2018 5:25:05 PM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
Counting Efficiency: 0.1748 +/- 0.0031 on 2/16/2018 9:34:33 AM
Effective Efficiency: 0.1748 +/- 0.0031

Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

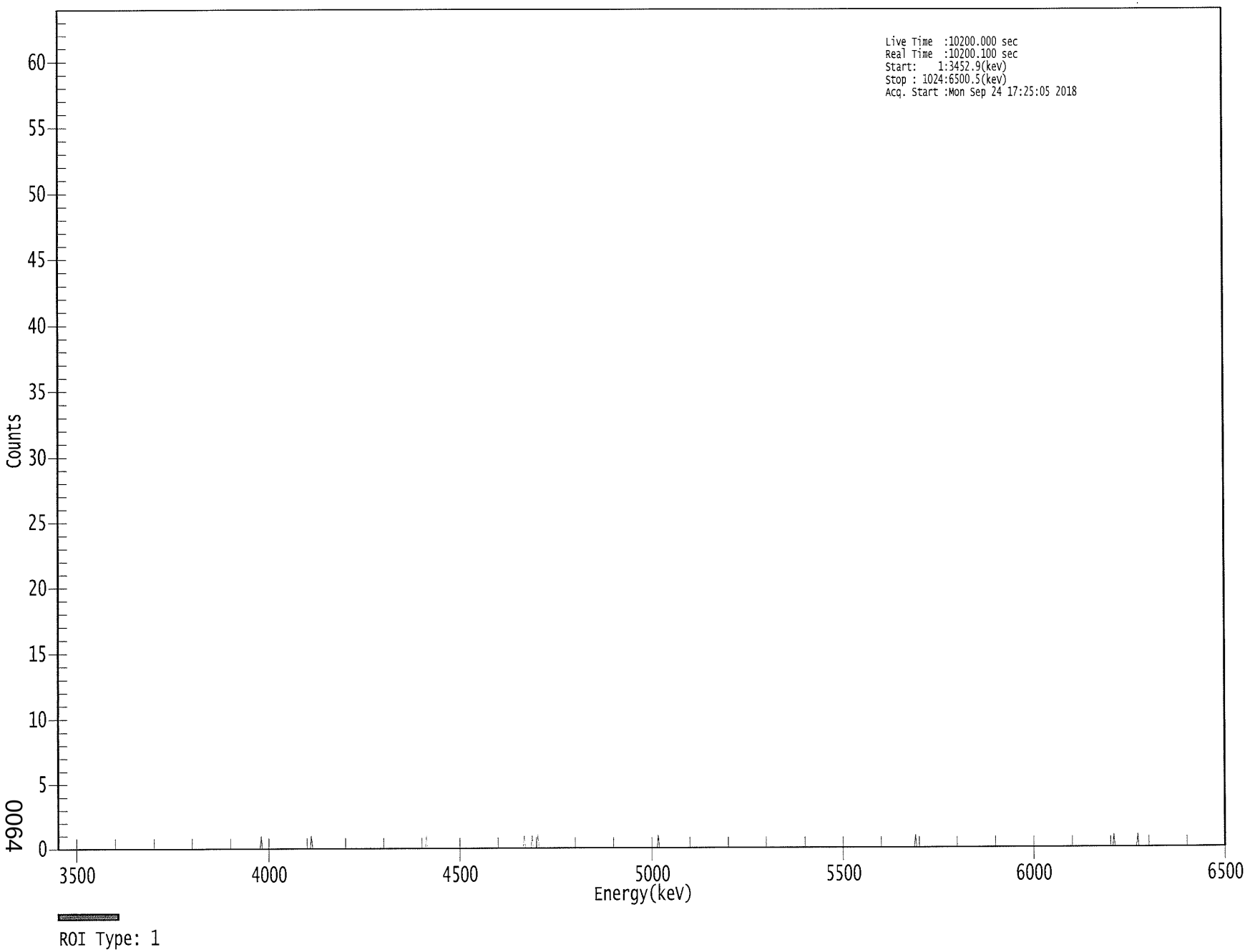
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.529	-1.02	208.15	1.02	0.00E+000	0.0
RA-226	4.618	1.79	229.05	2.21	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.969	5685.50*	-4.88E-002 +/- 1.02E-001	3.01E-001 +/- 1.04E-002
RA-226	0.964	4785.00*	8.14E-002 +/- 1.86E-001	3.64E-001 +/- 1.25E-002

0063

0000222967.CNF



2

****
***** 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	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	1	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	1	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	1	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

0065

369:	0	0	0	0	0	0	0	0

Sample Title: 02

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	1	0	0	0	0	0	0	1
417:	0	0	0	0	1	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	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:	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	1
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 02

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	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	1	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	1	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

Apex-Alpha™

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2

Sample Description: BAGLEY RIG SUPPLY WELL DUP
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229
Batch Identification: 1809064A-RA
Sample Identification: 03
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_039
Chamber Serial Number: 06027396A
Detector Serial Number: 83109
Env. Background: System Bkgd 225704
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.720E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 9/11/2018 2:48:40 PM
Acquisition Date/Time: 9/24/2018 5:25:07 PM
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

Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.511	1.62	253.92	2.38	0.00E+000	3.0
RA-226	4.690	5.15	94.34	0.85	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.961	5685.50*	6.99E-002 +/- 1.77E-001	3.53E-001 +/- 1.22E-002
RA-226	0.988	4785.00*	2.10E-001 +/- 1.99E-001	2.44E-001 +/- 8.42E-003

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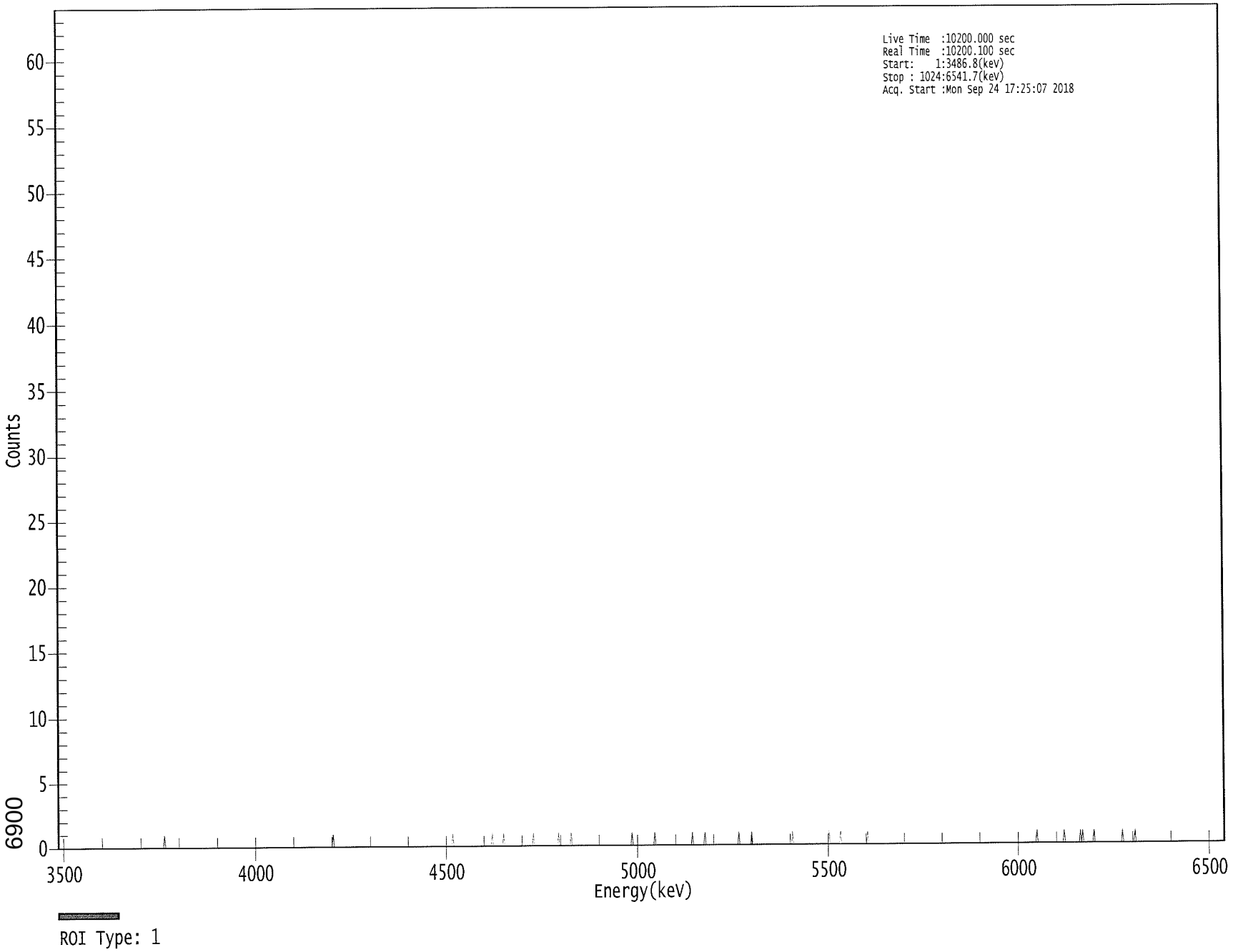
0068

0000222969.CNF



2

****
***** SPECTRAL DATA REPORT *****
****

Sample Title: 03

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	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	1	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:	1	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	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	1	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

0070

369:	0	0	0	0	0	0	0	0

Sample Title: 03

Channel								
377:	0	0	0	0	1	0	0	0
385:	0	0	0	0	0	0	1	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:	1	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	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	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	1	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	1	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	0	0	0	1	0	0	0	0
561:	0	0	0	0	0	0	1	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	0	1	0	0	0
601:	0	0	0	0	0	0	0	1
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	1	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	1	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	1	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 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	1	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	1	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	1	0	1	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	1	0	0
937:	0	0	0	0	0	0	0	0
945:	1	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

Apex-Alpha™

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2

Sample Description: BAGLEY RIG SUPPLY WELL
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229
Batch Identification: 1809064A-RA
Sample Identification: 04
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_040
Chamber Serial Number: 06027396B
Detector Serial Number: 91135
Env. Background: System Bkgd 225705
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.530E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 9/11/2018 2:48:40 PM
Acquisition Date/Time: 9/24/2018 5:25:09 PM
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	5.560	0.47	626.93	1.53	0.00E+000	3.0
RA-226	4.594	11.28	66.08	2.72	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.980	5685.50*	1.89E-002 +/- 1.19E-001	2.86E-001 +/- 9.85E-003
RA-226	0.953	4785.00*	4.30E-001 +/- 2.85E-001	3.27E-001 +/- 1.12E-002

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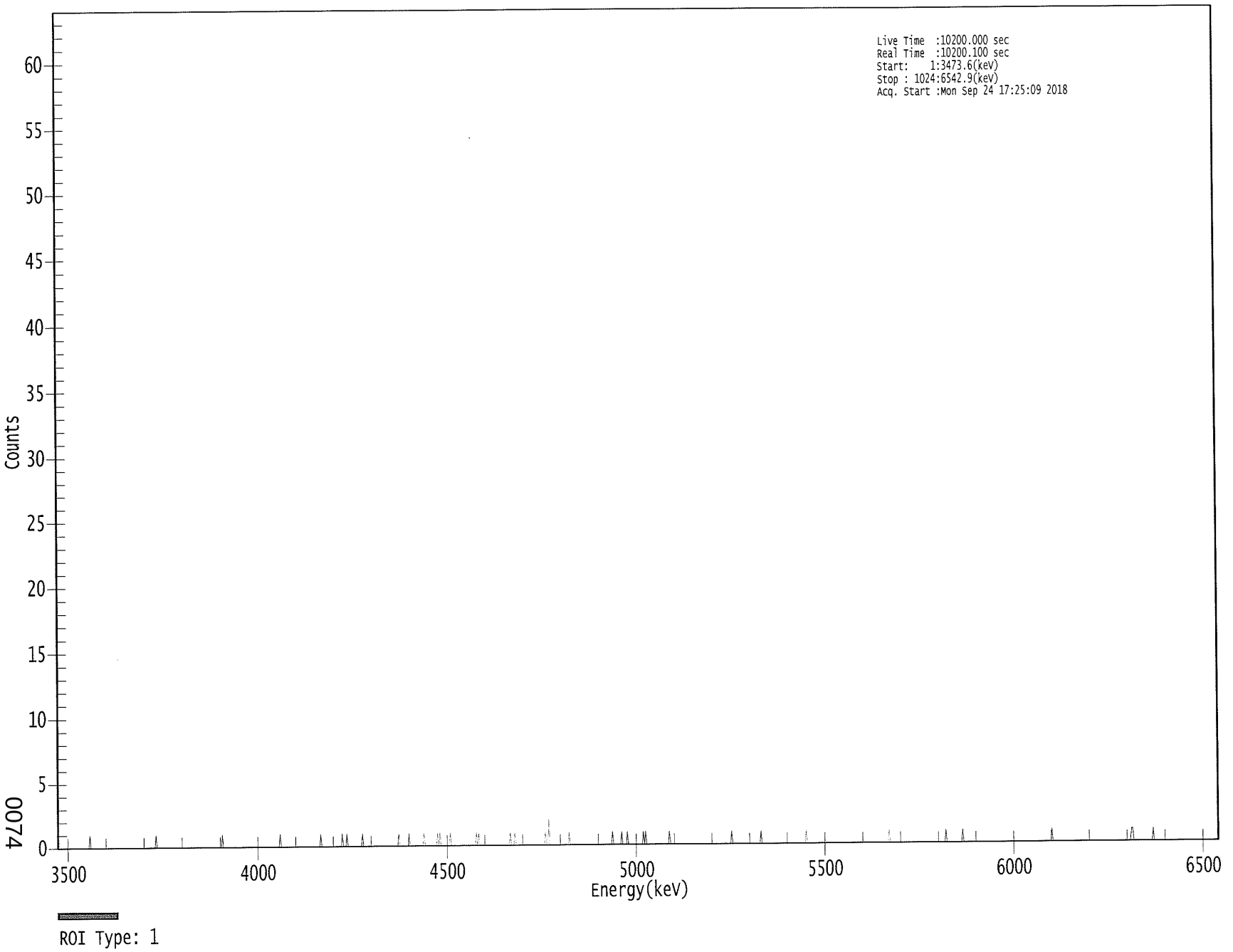
0073

0000222966.CNF



2

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

Sample Title: 04

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	1	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	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	1	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:	1	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	1	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	1
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	1	0	0	0	1	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	1	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	1	0	0	0
305:	0	0	0	0	0	1	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	1	0	0	0	0	0
329:	0	0	0	0	0	0	1	0
337:	1	0	0	0	0	0	0	0
345:	0	1	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

0075

369:	1	0	1	0	0	0	0	0

Sample Title: 04

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	1	0
401:	0	0	1	0	0	0	0	0
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	1	0	0
433:	2	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	1	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:	1	0	0	0	0	1	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	1	0	1	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	1	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	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	1	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	1	0	0	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	1	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	1	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	1	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 04

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

Apex-Alpha™

KP 9/25/18

2

Sample Description: ROM RIG SUPPLY WELL
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229
Batch Identification: 1809064A-RA
Sample Identification: 05
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_041
Chamber Serial Number: 05026930A
Detector Serial Number: 91087
Env. Background: System Bkgd 225706
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.890E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 9/11/2018 2:48:40 PM
Acquisition Date/Time: 9/24/2018 5:25:11 PM
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	5.506	4.98	97.79	1.02	0.00E+000	3.0
RA-226	4.600	8.15	72.72	0.85	0.00E+000	3.0

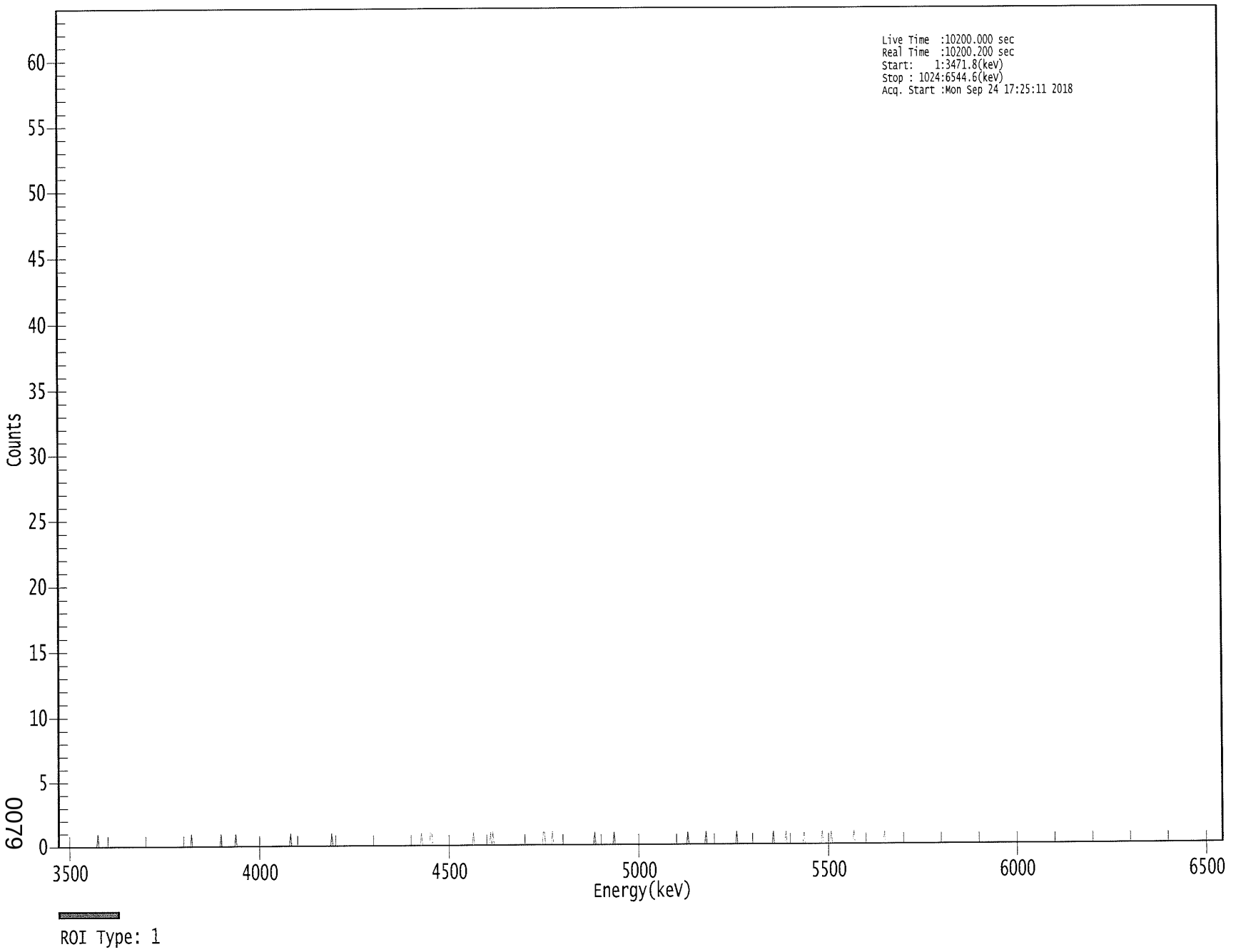
NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.959	5685.50*	2.14E-001 +/- 2.09E-001	2.70E-001 +/- 9.21E-003
RA-226	0.956	4785.00*	3.31E-001 +/- 2.41E-001	2.43E-001 +/- 8.28E-003

AG 9/25/18

0078

0000222963.CNF



0079

2

****
***** SPECTRAL DATA REPORT *****
****

Sample Title: 05

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	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	1	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	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	1	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	1	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	1	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	1	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	1
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	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	1	0
321:	0	0	0	0	0	0	1	1
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	1	0	0	0

0080

369:	0	0	0	0	0	0	0	0

Sample Title: 05

Channel								
377:	0	0	0	1	0	1	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	1	1	0	0	0	0	0
433:	0	1	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	1	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	1
489:	0	0	0	0	0	0	0	0
497:	0	0	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:	1	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:	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	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	1	0	0	0	0
633:	0	0	0	0	0	0	1	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	1	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	1	0
673:	0	0	0	0	0	0	1	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	1	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	1	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 05

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

Apex-Alpha™

KP 9/25/18

2

Sample Description: DERBONNE RELIEF WELL
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00002229
Batch Identification: 1809064A-RA
Sample Identification: 06
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_042
Chamber Serial Number: 05026930B
Detector Serial Number: 84185
Env. Background: System Bkgd 225707
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: 9/11/2018 2:48:40 PM
Acquisition Date/Time: 9/24/2018 5:25:13 PM
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	5.564	9.13	72.22	1.87	0.00E+000	3.0
RA-226	4.622	15.11	55.78	2.89	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.981	5685.50*	4.45E-001 +/- 3.22E-001	3.69E-001 +/- 1.27E-002
RA-226	0.966	4785.00*	6.97E-001 +/- 3.90E-001	4.04E-001 +/- 1.39E-002

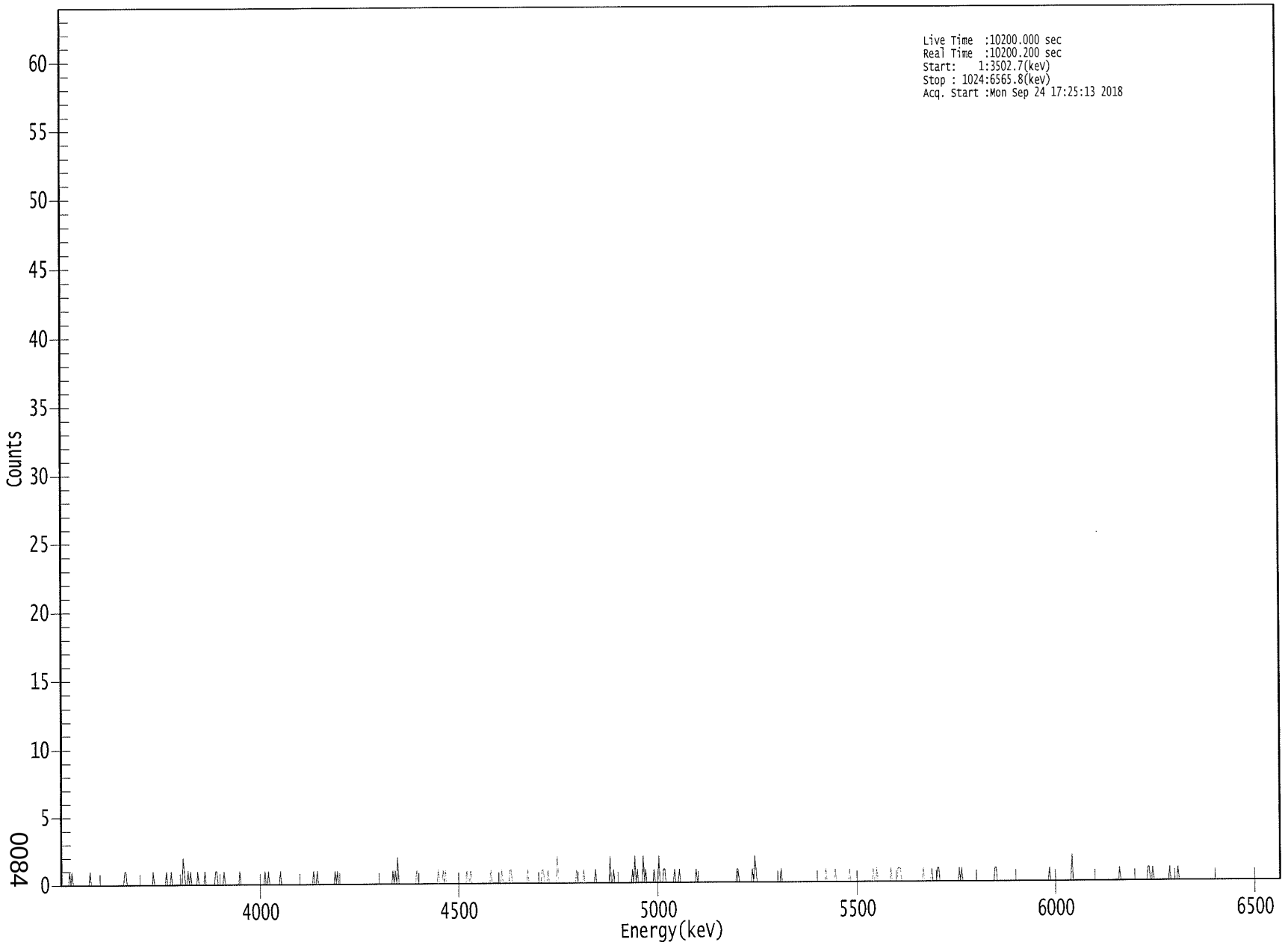
AG 9/25/18

0083

SGS

LA47640X

0000222962.CNF



2

****
***** SPECTRAL DATA REPORT *****
****

Sample Title: 06

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	1
9:	0	1	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	1	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	1	1	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	1	0	0
81:	0	0	0	0	0	0	0	0
89:	1	0	0	0	1	0	0	0
97:	0	0	0	0	0	0	2	1
105:	0	0	1	0	1	0	0	0
113:	0	0	1	0	0	0	0	0
121:	1	0	0	0	0	0	0	0
129:	0	1	1	0	0	0	0	0
137:	1	0	0	0	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	0	0
169:	0	0	1	0	0	1	0	0
177:	0	0	0	0	0	0	0	1
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	1	0	0	1	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	1	0	1
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	1	0
281:	1	0	2	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:	1	0	1	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	1	0	0	1
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	1	0	0	0	0	0	0	0

0085

369:	0	1	0	0	0	0	0	0

Sample Title: 06

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

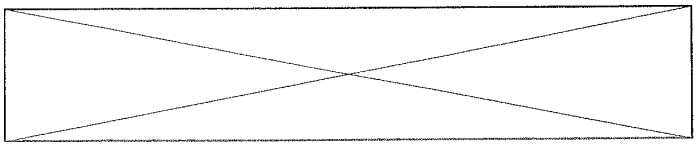
0086

801:	0	0	0	0	0	0	0	0

Sample Title: 06

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	1	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	2	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	1	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	1	1	0	0	1	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	1	0	0	0	0	0
937:	0	1	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

9/24/2018 5:11:31 AM



2

QA SUMMARY REPORT

Review Of QA Results - Pulser Check

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

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_001	21f	ALL	Not Done	
Alpha_002	21f	ALL	Not Done	
Alpha_003	21f	ALL	Passed	9/24/2018 4:58:11 AM
Alpha_004	21f	ALL	Passed	9/24/2018 4:58:12 AM
Alpha_005	21f	ALL	Not Done	
Alpha_006	21f	ALL	Not Done	
Alpha_007	21f	ALL	Not Done	
Alpha_008	21f	ALL	Not Done	
Alpha_009	21f	ALL	Not Done	
Alpha_010	21f	ALL	Not Done	
Alpha_011	21f	ALL	Passed	9/24/2018 4:58:13 AM
Alpha_012	21f	ALL	Passed	9/24/2018 4:58:14 AM
Alpha_013	21f	ALL	Not Done	
Alpha_014	21f	ALL	Passed	9/24/2018 4:58:15 AM
Alpha_015	21f	Peak Energy	Action	9/24/2018 4:58:16 AM
Alpha_016	21f	ALL	Not Done	
Alpha_033	Alpha Analyst100DC	Peak Energy	Action	9/21/2018 5:02:35 AM
Alpha_034	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:19 AM
Alpha_035	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:20 AM
Alpha_036	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:22 AM
Alpha_037	Alpha Analyst100DC	ALL	Not Done	
Alpha_038	Alpha Analyst100DC	ALL	Not Done	
Alpha_039	Alpha Analyst100DC	Peak FWHM	Action	9/24/2018 4:58:24 AM
Alpha_040	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:25 AM
Alpha_041	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:27 AM
Alpha_042	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:28 AM
Alpha_043	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:30 AM
Alpha_044	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:31 AM
Alpha_045	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:33 AM
Alpha_046	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:35 AM
Alpha_047	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:36 AM
Alpha_048	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:38 AM
Alpha_049	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:40 AM
Alpha_050	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:41 AM
Alpha_051	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:43 AM
Alpha_052	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:45 AM
Alpha_053	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:47 AM
Alpha_054	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:49 AM
Alpha_055	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:52 AM
Alpha_056	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:54 AM
Alpha_057	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:56 AM
Alpha_058	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:58 AM

0088

Review of QA Results - Pulser Check

9/24/2018 5:11:31 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_059	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:58:59 AM
Alpha_060	Alpha Analyst100DC	ALL	Passed	9/24/2018 4:59:01 AM

2

APPROVED BY: KP

APPROVAL DATE: 9/24/18

0089

2

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

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

0090

SECTION IX

ANALYTICAL DATA (RADIUM-228)

Work Order	18-09064
Analysis Code	Ra228
Run	1
Date Received	9/14/2018
Lab Deadline	10/4/2018
Client	SGS North America Inc.
Project	ENV
Report Level	4
Activity Units	pCi
Aliquot Units	l
Matrix	WA
Method	EPA 904.0
Instrument Type	Alpha/Beta GPC
Radiometric Tracer	Ba-133
Radiometric Sol#	Ba-6a
Tracer Act (dpm/g)	473.58
Carrier	Yttrium
Carrier Conc (mg/ml)	30.05

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/17/18 00:00	1.0000E+00
02	MBL	BLANK		09/17/18 00:00	1.0000E+00
03	DUP	BAGLEY RIG SUPPLY WELL	36	09/11/18 11:50	1.0000E+00
04	DO	BAGLEY RIG SUPPLY WELL	36	09/11/18 11:50	1.0000E+00
05	TRG	ROM RIG SUPPLY WELL	37	09/11/18 14:55	1.0000E+00
06	TRG	DERBONNE RELIEF WELL	33	09/11/18 16:00	1.0000E+00

0092

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

18-09064
Ra228
Run 1

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	2.0460	968.9	673.0	154.19	2.000	0.0845	0.1446	0.0601	100.00	110.00	1.00	1.00
02	MBL	2.0405	966.3	603.0	138.53	2.000	0.0843	0.1443	0.0600	99.83	109.82	1.00	1.00
03	DUP	2.0377	965.0	544.0	125.15	2.100	0.0838	0.1461	0.0623	98.72	108.60	1.00	1.00
04	DO	2.0352	963.8	799.0	184.03	2.050	0.0836	0.1443	0.0607	98.53	108.39	1.00	1.00
05	TRG	2.0317	962.2	606.0	139.82	2.050	0.0833	0.1446	0.0613	99.51	109.46	1.00	1.00
06	TRG	2.0301	961.4	569.0	131.39	2.050	0.0839	0.1451	0.0612	99.35	109.28	1.00	1.00

0093

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

18-09064
Ra228
Run 1

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			09/26/18 11:59	JBAILEY	09/24/18 13:56	JBAILEY	09/26/18 12:28	JBAILEY
02	MBL			09/26/18 11:59	JBAILEY	09/24/18 13:56	JBAILEY	09/26/18 12:28	JBAILEY
03	DUP			09/26/18 11:59	JBAILEY	09/24/18 13:56	JBAILEY	09/26/18 12:28	JBAILEY
04	DO			09/26/18 11:59	JBAILEY	09/24/18 13:56	JBAILEY	09/26/18 12:28	JBAILEY
05	TRG			09/26/18 11:59	JBAILEY	09/24/18 13:56	JBAILEY	09/26/18 12:28	JBAILEY
06	TRG			09/26/18 11:59	JBAILEY	09/24/18 13:56	JBAILEY	09/26/18 12:28	JBAILEY

0094

* 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: 18-09064
Analysis Code: Ra228
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-228	LCS	LCS	pCi/l	8.45E+00	7.11E-01	8.58E-01	9.22E+00	91.67	OK		OK	
02	RA-228	MBL	BLANK	pCi/l	-7.86E-02	2.91E-01	6.38E-01					OK	OK
03	RA-228	DUP	BAGLEY RIG SUPPLY WELL	pCi/l	4.13E-01	3.21E-01	6.38E-01				NA	OK	
04	RA-228	DO	BAGLEY RIG SUPPLY WELL	pCi/l	1.94E-02	3.29E-01	7.03E-01					OK	
05	RA-228	TRG	ROM RIG SUPPLY WELL	pCi/l	3.51E-01	3.34E-01	6.73E-01					OK	
06	RA-228	TRG	DERBONNE RELIEF WELL	pCi/l	4.33E-01	3.80E-01	7.65E-01					OK	

Run	Analysis Code	Eberline Analytical Work Order	Client
1	Ra228	18-09064	SGS North America Inc.

9600

Lab Fraction	Nuclide	Sample Desc	Sample Date	Sample Aliquot	Radiometric % Rec	Grav % Rec	Mean % Rec	SAF	Sep t0 Date/Time	Sep t1 Date/Time
01	RA-228	LCS	09/17/18 00:00	1.00E+00	154.19	100.00	110.00	1.00	9/24/2018 13:56	9/26/2018 12:28
02	RA-228	MBL	09/17/18 00:00	1.00E+00	138.53	99.83	109.82	1.00	9/24/2018 13:56	9/26/2018 12:28
03	RA-228	DUP	09/11/18 11:50	1.00E+00	125.15	98.72	108.60	1.00	9/24/2018 13:56	9/26/2018 12:28
04	RA-228	DO	09/11/18 11:50	1.00E+00	184.03	98.53	108.39	1.00	9/24/2018 13:56	9/26/2018 12:28
05	RA-228	TRG	09/11/18 14:55	1.00E+00	139.82	99.51	109.46	1.00	9/24/2018 13:56	9/26/2018 12:28
06	RA-228	TRG	09/11/18 16:00	1.00E+00	131.39	99.35	109.28	1.00	9/24/2018 13:56	9/26/2018 12:28

Run: 1
Analysis Code: Ra228
Eberline Analytical Work Order: 18-09064
Client: SGS North America Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-228	LCS	09/26/18 14:00		LB4110A	F1	120	987	1.566666667	0.4754
02	RA-228	MBL	09/26/18 14:00		LB4110A	F2	120	110	0.983333333	0.4658
03	RA-228	DUP	09/26/18 14:00		LB4110A	F3	120	160	0.983333333	0.4713
04	RA-228	DO	09/26/18 14:00		LB4110A	F4	120	150	1.233333333	0.4773
05	RA-228	TRG	09/26/18 14:00		LB4110A	G1	120	170	1.116666667	0.4705
06	RA-228	TRG	09/26/18 14:00		LB4110A	G2	120	216	1.433333333	0.4676

Count Room Report
Client: SGS North America Inc.

18-09064-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	09/17/18 00:00	1.0000	2.0460	968.9447	673.0000	154.19	1.00	1.00
02	MBL	BLANK	09/17/18 00:00	1.0000	2.0405	966.3400	603.0000	138.53	1.00	1.00
03	DUP	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	1.0000	2.0377	965.0140	544.0000	125.15	1.00	1.00
04	DO	BAGLEY RIG SUPPLY WELL	09/11/18 11:50	1.0000	2.0352	963.8300	799.0000	184.03	1.00	1.00
05	TRG	ROM RIG SUPPLY WELL	09/11/18 14:55	1.0000	2.0317	962.1725	606.0000	139.82	1.00	1.00
06	TRG	DERBONNE RELIEF WELL	09/11/18 16:00	1.0000	2.0301	961.4148	569.0000	131.39	1.00	1.00

0098

Eberline Analytical
Oak Ridge Laboratory

Spike and Tracer Worksheet

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
18-09064	1	Ra228	9/26/2018 11:59	JBAILEY	JB	

LCS & Matrix Spikes					LCS	MS	LCSD	MSD	LCS		MS		LCSD		MSD	
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	Volume Used (g)	Volume Used (g)	Volume Used (g)	Volume Used (g)	Known pCi	Error Estimate	Added pCi	Error Estimate	Known pCi	Error Estimate	Added pCi	Error Estimate
Ra-228	Ra-12	53.160	9/26/2018	0.380	0.3850				9.22	0.470	0.00	0.000	0.00	0.000	0.00	0.000

Tracers

fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition
01	Ba-133	Ba-6a	473.580	9/26/2018	2.0460	2.1400
02	Ba-133	Ba-6a	473.580	9/26/2018	2.0405	2.1400
03	Ba-133	Ba-6a	473.580	9/26/2018	2.0377	2.1400
04	Ba-133	Ba-6a	473.580	9/26/2018	2.0352	2.1400
05	Ba-133	Ba-6a	473.580	9/26/2018	2.0317	2.1400
06	Ba-133	Ba-6a	473.580	9/26/2018	2.0301	2.1400

Balance Printer Tapes

Tracer

LCS

Matrix Spike

0099

Version 2.0 08/99

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Printed: 9/20/2018 9:50 AM

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
18-09064	1	Ra228	liters	10/4/2018	JHARVEY

Lab Fraction	SGS North America Inc. Client ID	Sample Type	Muffle Data Ratio Post/Pre	Dilution Data No of Dils	Dil Factor	Ratio	Aliquot Data Aliquot	Net Equiv	MS Aliquot Data Aliquot	Net Equiv	H-3 Solids Only 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	BAGLEY RIG SUPPLY WELL	DUP					1.0000E+00	1.0000E+00				
04	BAGLEY RIG SUPPLY WELL	DO					1.0000E+00	1.0000E+00				
05	ROM RIG SUPPLY WELL	TRG					1.0000E+00	1.0000E+00				
06	DERBONNE RELIEF WELL	TRG					1.0000E+00	1.0000E+00				

Comments	

0100

Technician: _____ Date: 9/20/18

Eberline Analytical - Oak Ridge
Version 1.1 10/2015

Gravimetric Worksheet

Printed: 9/26/2018 1:41 PM

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
18-09064	1	Ra228	Yttrium	30.0500	JBAILEY

TRetec Fraction	SGS North America Inc. Client ID	Sample Type	Carrier Data	Filter Data			Gravimetric
			Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)	% Recovery
01	LCS	LCS	2.0000	0.0845	0.1446	0.0601	100.00
02	BLANK	MBL	2.0000	0.0843	0.1443	0.0600	99.83
03	DUP	DUP	2.1000	0.0838	0.1461	0.0623	98.72
04	BAGLEY RIG SUPPLY WELL	DO	2.0500	0.0836	0.1443	0.0607	98.53
05	ROM RIG SUPPLY WELL	TRG	2.0500	0.0833	0.1446	0.0613	99.51
06	DERBONNE RELIEF WELL	TRG	2.0500	0.0839	0.1451	0.0612	99.35

0101

Technician: _____ Date: 9/26/18

KB 9/26/18

Detector ID	Sample ID	Alpha	Beta	Count Time	Voltage	TOD
F1	1809064-01	28	987	120	1410	9/26/2018 2:00:49 PM
F2	1809064-02	14	110	120	1410	9/26/2018 2:00:50 PM
F3	1809064-03	4	160	120	1410	9/26/2018 2:00:50 PM
F4	1809064-04	8	150	120	1410	9/26/2018 2:00:50 PM
G1	1809064-05	17	170	120	1410	9/26/2018 2:00:50 PM
G2	1809064-06	11	216	120	1410	9/26/2018 2:00:50 PM

0102

GPC Detector Report
(ALL Backgrounds)

KP
9/26/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	9/26/2018	1.33E-01	P	-3.46E-02	9.21E-02	2.19E-01
LB4110A - A2	Alpha	11/2/2017	9/26/2018	3.33E-02	P	-5.07E-02	9.59E-02	2.43E-01
LB4110A - A3	Alpha	11/2/2017	9/26/2018	1.33E-01	P	-3.23E-02	1.04E-01	2.41E-01
LB4110A - A4	Alpha	11/2/2017	9/26/2018	1.33E-01	P	-3.08E-02	9.19E-02	2.15E-01
LB4110A - B1	Alpha	11/2/2017	9/26/2018	1.83E-01	P	-3.38E-02	1.12E-01	2.58E-01
LB4110A - B2	Alpha	11/2/2017	9/26/2018	1.50E-01	P	-1.72E-02	1.17E-01	2.52E-01
LB4110A - B3	Alpha	11/2/2017	9/26/2018	1.00E-01	P	-5.49E-02	8.00E-02	2.15E-01
LB4110A - B4	Alpha	11/2/2017	9/26/2018	5.00E-02	P	-3.92E-02	7.94E-02	1.98E-01
LB4110A - C1	Alpha	11/2/2017	9/26/2018	6.67E-02	P	-2.37E-02	8.78E-02	1.99E-01
LB4110A - C2	Alpha	11/2/2017	9/26/2018	3.33E-02	P	-3.91E-02	5.93E-02	1.58E-01
LB4110A - C3	Alpha	11/2/2017	9/26/2018	8.33E-02	P	-5.48E-02	6.77E-02	1.90E-01
LB4110A - C4	Alpha	11/2/2017	9/26/2018	1.67E-02	P	-3.10E-02	8.05E-02	1.92E-01
LB4110A - D1	Alpha	11/2/2017	9/26/2018	1.17E-01	P	-3.24E-02	1.36E-01	3.05E-01
LB4110A - D2	Alpha	11/2/2017	9/26/2018	2.00E-01	P	-1.83E-02	1.25E-01	2.67E-01
LB4110A - D3	Alpha	11/2/2017	9/26/2018	5.00E-02	P	-4.44E-02	1.06E-01	2.56E-01
LB4110A - D4	Alpha	11/2/2017	9/26/2018	1.33E-01	P	-2.07E-02	1.46E-01	3.14E-01
LB4110A - E1	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-4.29E-02	1.10E-01	2.62E-01
LB4110A - E2	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-3.09E-02	6.37E-02	1.58E-01
LB4110A - E3	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-8.81E-02	9.11E-02	2.70E-01
LB4110A - E4	Alpha	11/2/2017	3/23/2018	0.00E+00	P	-4.55E-02	7.04E-02	1.86E-01
LB4110A - F1	Alpha	11/2/2017	9/26/2018	1.17E-01	P	-4.06E-02	7.56E-02	1.92E-01
LB4110A - F2	Alpha	11/2/2017	9/26/2018	3.33E-02	P	-3.16E-02	5.12E-02	1.34E-01
LB4110A - F3	Alpha	11/2/2017	9/26/2018	8.33E-02	P	-4.73E-02	6.15E-02	1.70E-01
LB4110A - F4	Alpha	11/2/2017	9/26/2018	6.67E-02	P	-2.22E-02	7.18E-02	1.66E-01
LB4110A - G1	Alpha	11/2/2017	9/26/2018	8.33E-02	P	-4.55E-02	6.09E-02	1.67E-01
LB4110A - G2	Alpha	11/2/2017	9/26/2018	3.33E-02	P	-4.28E-02	7.58E-02	1.94E-01
LB4110A - G3	Alpha	11/2/2017	9/26/2018	8.33E-02	P	-4.49E-02	8.28E-02	2.10E-01
LB4110A - G4	Alpha	11/2/2017	9/26/2018	5.00E-02	P	-3.02E-02	8.10E-02	1.92E-01

GPC Detector Report
(ALL Backgrounds)

KP
9/26/18

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
_B4110A - A1	Beta	11/2/2017	9/26/2018	1.32E+00	P	8.48E-01	1.37E+00	1.89E+00
_B4110A - A2	Beta	11/2/2017	9/26/2018	1.50E+00	P	9.16E-01	1.51E+00	2.11E+00
_B4110A - A3	Beta	11/2/2017	9/26/2018	1.57E+00	P	1.02E+00	1.51E+00	2.00E+00
_B4110A - A4	Beta	11/2/2017	9/26/2018	1.68E+00	P	9.47E-01	1.41E+00	1.88E+00
_B4110A - B1	Beta	11/2/2017	9/26/2018	1.43E+00	P	1.05E+00	1.54E+00	2.03E+00
_B4110A - B2	Beta	11/2/2017	9/26/2018	1.97E+00	P	6.70E-01	1.52E+00	2.38E+00
_B4110A - B3	Beta	11/2/2017	9/26/2018	1.33E+00	P	9.18E-01	1.37E+00	1.81E+00
_B4110A - B4	Beta	11/2/2017	9/26/2018	1.20E+00	P	7.33E-01	1.37E+00	2.00E+00
_B4110A - C1	Beta	11/2/2017	9/26/2018	1.25E+00	P	8.22E-01	1.26E+00	1.69E+00
_B4110A - C2	Beta	11/2/2017	9/26/2018	1.38E+00	P	-3.89E-01	1.27E+00	2.92E+00
_B4110A - C3	Beta	11/2/2017	9/26/2018	1.82E+00	P	9.70E-01	1.80E+00	2.63E+00
_B4110A - C4	Beta	11/2/2017	9/26/2018	1.25E+00	P	7.92E-01	1.22E+00	1.65E+00
_B4110A - D1	Beta	11/2/2017	9/26/2018	1.23E+00	P	8.62E-01	1.32E+00	1.79E+00
_B4110A - D2	Beta	11/2/2017	9/26/2018	1.50E+00	P	-2.31E-01	1.63E+00	3.49E+00
_B4110A - D3	Beta	11/2/2017	9/26/2018	1.25E+00	P	7.64E-01	1.27E+00	1.78E+00
_B4110A - D4	Beta	11/2/2017	9/26/2018	1.55E+00	P	9.50E-01	1.44E+00	1.93E+00
_B4110A - E1	Beta	11/2/2017	3/23/2018	3.33E-02	P	7.66E-01	1.32E+00	1.88E+00
_B4110A - E2	Beta	11/2/2017	3/23/2018	1.67E-02	P	5.45E-01	9.58E-01	1.37E+00
_B4110A - E3	Beta	11/2/2017	3/23/2018	6.67E-02	P	4.98E-01	1.20E+00	1.91E+00
_B4110A - E4	Beta	11/2/2017	3/23/2018	0.00E+00	P	5.67E-01	1.04E+00	1.50E+00
_B4110A - F1	Beta	11/2/2017	9/26/2018	1.57E+00	P	8.76E-01	1.36E+00	1.85E+00
_B4110A - F2	Beta	11/2/2017	9/26/2018	9.83E-01	P	5.26E-01	8.99E-01	1.27E+00
_B4110A - F3	Beta	11/2/2017	9/26/2018	9.83E-01	P	4.02E-02	1.23E+00	2.42E+00
_B4110A - F4	Beta	11/2/2017	9/26/2018	1.23E+00	P	6.92E-01	1.15E+00	1.61E+00
_B4110A - G1	Beta	11/2/2017	9/26/2018	1.12E+00	P	6.87E-01	1.37E+00	2.05E+00
_B4110A - G2	Beta	11/2/2017	9/26/2018	1.43E+00	P	1.06E+00	1.81E+00	2.56E+00
_B4110A - G3	Beta	11/2/2017	9/26/2018	1.23E+00	P	7.60E-01	1.50E+00	2.23E+00
_B4110A - G4	Beta	11/2/2017	9/26/2018	1.28E+00	P	5.59E-01	1.46E+00	2.37E+00

GPC Detector Report
(ALL Efficiencies)

KP
9/26/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/2/2017	9/26/2018	0.2273	P	0.2138	0.2253	0.2367
LB4110A - A2	Alpha	11/2/2017	9/26/2018	0.2116	P	0.1969	0.2115	0.2260
LB4110A - A3	Alpha	11/2/2017	9/26/2018	0.1944	P	0.1837	0.1997	0.2157
LB4110A - A4	Alpha	11/2/2017	9/26/2018	0.2242	P	0.2061	0.2260	0.2459
LB4110A - B1	Alpha	11/2/2017	9/26/2018	0.2264	P	0.2037	0.2230	0.2423
LB4110A - B2	Alpha	11/2/2017	9/26/2018	0.1985	P	0.1833	0.2006	0.2178
LB4110A - B3	Alpha	11/2/2017	9/26/2018	0.2348	P	0.2176	0.2346	0.2515
LB4110A - B4	Alpha	11/2/2017	9/26/2018	0.2285	P	0.2036	0.2212	0.2388
LB4110A - C1	Alpha	11/2/2017	9/26/2018	0.2043	P	0.1948	0.2073	0.2198
LB4110A - C2	Alpha	11/2/2017	9/26/2018	0.2150	P	-0.0985	0.2240	0.5465
LB4110A - C3	Alpha	11/2/2017	9/26/2018	0.2475	P	0.2295	0.2423	0.2552
LB4110A - C4	Alpha	11/2/2017	9/26/2018	0.2134	P	0.1984	0.2147	0.2310
LB4110A - D1	Alpha	11/2/2017	9/26/2018	0.2197	P	0.2102	0.2218	0.2334
LB4110A - D2	Alpha	11/2/2017	9/26/2018	0.2447	P	0.2319	0.2508	0.2697
LB4110A - D3	Alpha	11/2/2017	9/26/2018	0.2515	P	0.2342	0.2496	0.2651
LB4110A - D4	Alpha	11/2/2017	9/26/2018	0.1921	P	0.1763	0.1958	0.2152
LB4110A - E1	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1687	0.2258	0.2830
LB4110A - E2	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1518	0.2051	0.2584
LB4110A - E3	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1547	0.2075	0.2603
LB4110A - E4	Alpha	11/2/2017	3/23/2018	0.0000	F	0.1747	0.2355	0.2963
LB4110A - F1	Alpha	11/2/2017	9/26/2018	0.2149	P	0.1618	0.2123	0.2628
LB4110A - F2	Alpha	11/2/2017	9/26/2018	0.1864	P	0.1711	0.1830	0.1950
LB4110A - F3	Alpha	11/2/2017	9/26/2018	0.2280	P	0.2215	0.2367	0.2519
LB4110A - F4	Alpha	11/2/2017	9/26/2018	0.2036	P	0.1930	0.2094	0.2259
LB4110A - G1	Alpha	11/2/2017	9/26/2018	0.1908	P	0.1849	0.1982	0.2114
LB4110A - G2	Alpha	11/2/2017	9/26/2018	0.1974	P	0.1917	0.2017	0.2117
LB4110A - G3	Alpha	11/2/2017	9/26/2018	0.2123	W	0.2102	0.2237	0.2373
LB4110A - G4	Alpha	11/2/2017	9/26/2018	0.1789	F	0.1830	0.1982	0.2135

GPC Detector Report
(ALL Efficiencies)

KP
9/26/18

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/2/2017	9/26/2018	0.5349	P	0.5100	0.5372	0.5644
LB4110A - A2	Beta	11/2/2017	9/26/2018	0.4688	P	0.4162	0.4643	0.5124
LB4110A - A3	Beta	11/2/2017	9/26/2018	0.4661	P	0.4361	0.4789	0.5217
LB4110A - A4	Beta	11/2/2017	9/26/2018	0.5408	P	0.4985	0.5409	0.5832
LB4110A - B1	Beta	11/2/2017	9/26/2018	0.5503	P	0.4989	0.5395	0.5801
LB4110A - B2	Beta	11/2/2017	9/26/2018	0.4956	P	0.4623	0.4994	0.5365
LB4110A - B3	Beta	11/2/2017	9/26/2018	0.5918	P	0.5444	0.5823	0.6202
LB4110A - B4	Beta	11/2/2017	9/26/2018	0.5605	P	0.5007	0.5431	0.5856
LB4110A - C1	Beta	11/2/2017	9/26/2018	0.4780	P	0.4436	0.4794	0.5152
LB4110A - C2	Beta	11/2/2017	9/26/2018	0.5208	P	0.4904	0.5180	0.5456
LB4110A - C3	Beta	11/2/2017	9/26/2018	0.6137	P	0.5675	0.5997	0.6318
LB4110A - C4	Beta	11/2/2017	9/26/2018	0.5228	P	0.4813	0.5236	0.5659
LB4110A - D1	Beta	11/2/2017	9/26/2018	0.6488	P	0.6152	0.6406	0.6660
LB4110A - D2	Beta	11/2/2017	9/26/2018	0.6430	P	0.5880	0.6423	0.6966
LB4110A - D3	Beta	11/2/2017	9/26/2018	0.6573	P	0.5998	0.6408	0.6818
LB4110A - D4	Beta	11/2/2017	9/26/2018	0.4934	P	0.4637	0.5038	0.5439
LB4110A - E1	Beta	11/2/2017	3/23/2018	0.0436	F	0.4162	0.5409	0.6655
LB4110A - E2	Beta	11/2/2017	3/23/2018	0.0428	F	0.3730	0.4913	0.6097
LB4110A - E3	Beta	11/2/2017	3/23/2018	0.0551	F	0.3852	0.4994	0.6137
LB4110A - E4	Beta	11/2/2017	3/23/2018	0.0569	F	0.4534	0.5890	0.7247
LB4110A - F1	Beta	11/2/2017	9/26/2018	0.5248	P	0.4033	0.5278	0.6522
LB4110A - F2	Beta	11/2/2017	9/26/2018	0.4521	P	0.4291	0.4575	0.4859
LB4110A - F3	Beta	11/2/2017	9/26/2018	0.5921	P	0.5702	0.6104	0.6506
LB4110A - F4	Beta	11/2/2017	9/26/2018	0.5223	P	0.4887	0.5296	0.5705
LB4110A - G1	Beta	11/2/2017	9/26/2018	0.4553	P	0.4335	0.4569	0.4804
LB4110A - G2	Beta	11/2/2017	9/26/2018	0.4710	P	0.4662	0.4852	0.5041
LB4110A - G3	Beta	11/2/2017	9/26/2018	0.5227	P	0.5082	0.5409	0.5737
LB4110A - G4	Beta	11/2/2017	9/26/2018	0.4290	F	0.4443	0.4834	0.5224

0106

SECTION X

BARIUM-133 ANALYTICAL TRACER DATA

KB 9/24/18

2

Apex-Gamma

Analysis Report for 1809064-01

SPIKE

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 1809064-01
Sample Description	: SPIKE
Sample Type	: RA RECOVERY
Sample Size	: 1.000E+00 units
Facility	: Countroom
Sample Taken On	: 9/24/2018 2:34:51PM
Acquisition Started	: 9/24/2018 2:48:03PM
Procedure	: BAFIL
Operator	: Administrator
Detector Name	: GE1
Geometry	: BAFIL
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 2.50
Peak Locate Range (in channels)	: 1 - 4096
Peak Area Range (in channels)	: 19 - 4096
Identification Energy Tolerance	: 1.000FWHM
Energy Calibration Used Done On	: 6/16/2018
Efficiency Calibration Used Done On	: 2/17/2018
Efficiency Calibration Description	:
Sample Number	: 72253

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 3:03:07PM

Peak Analysis From Channel : 1

Peak Analysis To Channel : 4096

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

0108

Analysis Report for 1809064-01

SPIKE

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	30.80	25 -	49	31.17	3.20E+03	119.00	2.63E+02	1.91
m	2	35.35	25 -	49	35.73	8.78E+02	95.35	2.26E+02	2.39
	3	52.93	49 -	57	53.30	1.20E+02	43.45	2.17E+02	2.22
M	4	59.34	58 -	70	59.71	5.97E+01	21.58	9.03E+01	2.23
m	5	61.99	58 -	70	62.35	3.40E+02	51.64	2.14E+02	2.11
m	6	65.63	58 -	70	65.99	1.71E+02	53.14	3.17E+02	2.24
M	7	77.96	77 -	86	78.32	3.25E+01	37.04	2.27E+02	1.87
m	8	81.16	77 -	86	81.52	1.19E+03	79.80	3.35E+02	1.90
	9	87.98	86 -	90	88.34	3.94E+01	35.25	2.33E+02	1.59
	10	102.22	100 -	105	102.58	4.91E+01	28.67	1.24E+02	2.67
M	11	111.94	106 -	121	112.29	2.71E+02	44.82	1.49E+02	2.10
m	12	115.92	106 -	121	116.28	7.65E+01	40.56	1.84E+02	2.11
	13	161.34	158 -	167	161.68	3.77E+01	45.68	2.81E+02	3.66
	14	254.20	251 -	257	254.52	2.32E+01	23.10	7.95E+01	2.71
	15	275.56	270 -	279	275.88	9.80E+01	31.97	9.00E+01	2.28
M	16	295.27	290 -	316	295.58	1.76E+01	22.18	7.82E+01	2.77
m	17	302.91	290 -	316	303.22	2.62E+02	36.29	5.21E+01	1.86
m	18	307.49	290 -	316	307.80	4.17E+01	30.92	6.00E+01	2.53
M	19	333.87	330 -	345	334.17	1.02E+02	26.81	6.74E+01	1.92
m	20	337.60	330 -	345	337.90	3.46E+01	23.56	4.03E+01	1.92
m	21	356.10	350 -	359	356.40	7.98E+02	60.16	8.46E+01	1.85
	22	363.54	361 -	366	363.84	2.15E+01	21.40	6.90E+01	1.36
M	23	377.51	373 -	400	377.80	1.92E+01	14.39	1.83E+01	2.14
m	24	384.08	373 -	400	384.37	1.65E+02	31.22	1.93E+01	2.14
m	25	387.01	373 -	400	387.30	3.08E+02	43.39	2.12E+01	2.05
m	26	391.34	373 -	400	391.63	7.90E+01	30.71	2.32E+01	2.15
m	27	395.09	373 -	400	395.37	1.29E+01	18.52	2.38E+01	2.15
	28	414.98	413 -	419	415.27	2.75E+01	25.67	1.03E+02	1.19
	29	437.02	433 -	440	437.30	1.20E+02	27.71	5.52E+01	2.18
	30	517.76	516 -	521	518.02	7.05E+00	8.43	7.91E+00	2.10
	31	549.86	548 -	553	550.11	8.00E+00	7.87	6.00E+00	2.63
	32	570.15	566 -	574	570.40	6.50E+00	9.19	9.00E+00	2.50
	33	594.30	592 -	596	594.55	4.50E+00	6.36	5.00E+00	0.90
	34	600.89	599 -	603	601.13	6.50E+00	6.96	5.00E+00	2.58
	35	608.89	604 -	613	609.13	4.20E+01	15.43	1.00E+01	2.85
	36	708.81	706 -	711	709.04	7.20E+00	7.62	5.60E+00	1.86
	37	716.49	713 -	720	716.71	8.67E+00	8.94	6.67E+00	3.15
	38	824.58	822 -	828	824.78	9.00E+00	6.00	0.00E+00	1.33
	39	870.47	868 -	872	870.67	6.00E+00	4.90	0.00E+00	1.47
	40	1120.11	1116 -	1123	1120.26	1.49E+01	9.17	4.18E+00	3.39

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

0109

Analysis Report for 1809064-01

SPIKE

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/24/2018 3:03:07PM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	30.80	3.20E+03	119.00			3.20E+03	1.19E+02
m	2	35.35	8.78E+02	95.35			8.78E+02	9.54E+01
	3	52.93	1.20E+02	43.45			1.20E+02	4.35E+01
M	4	59.34	5.97E+01	21.58			5.97E+01	2.16E+01
m	5	61.99	3.40E+02	51.64			3.40E+02	5.16E+01
m	6	65.63	1.71E+02	53.14			1.71E+02	5.31E+01
M	7	77.96	3.25E+01	37.04			3.25E+01	3.70E+01
m	8	81.16	1.19E+03	79.80			1.19E+03	7.98E+01
	9	87.98	3.94E+01	35.25	1.23E+00	5.97E-01	3.82E+01	3.53E+01
	10	102.22	4.91E+01	28.67			4.91E+01	2.87E+01
M	11	111.94	2.71E+02	44.82			2.71E+02	4.48E+01
m	12	115.92	7.65E+01	40.56			7.65E+01	4.06E+01
	13	161.34	3.77E+01	45.68			3.77E+01	4.57E+01
	14	254.20	2.32E+01	23.10			2.32E+01	2.31E+01
	15	275.56	9.80E+01	31.97			9.80E+01	3.20E+01
M	16	295.27	1.76E+01	22.18			1.76E+01	2.22E+01
m	17	302.91	2.62E+02	36.29			2.62E+02	3.63E+01
m	18	307.49	4.17E+01	30.92			4.17E+01	3.09E+01
M	19	333.87	1.02E+02	26.81			1.02E+02	2.68E+01
m	20	337.60	3.46E+01	23.56	0.00E+00	0.00E+00	3.46E+01	2.36E+01
m	21	356.10	7.98E+02	60.16			7.98E+02	6.02E+01
	22	363.54	2.15E+01	21.40			2.15E+01	2.14E+01
M	23	377.51	1.92E+01	14.39			1.92E+01	1.44E+01
m	24	384.08	1.65E+02	31.22			1.65E+02	3.12E+01
m	25	387.01	3.08E+02	43.39			3.08E+02	4.34E+01
m	26	391.34	7.90E+01	30.71			7.90E+01	3.07E+01
m	27	395.09	1.29E+01	18.52			1.29E+01	1.85E+01
	28	414.98	2.75E+01	25.67			2.75E+01	2.57E+01
	29	437.02	1.20E+02	27.71			1.20E+02	2.77E+01
	30	517.76	7.05E+00	8.43			7.05E+00	8.43E+00
	31	549.86	8.00E+00	7.87			8.00E+00	7.87E+00
	32	570.15	6.50E+00	9.19			6.50E+00	9.19E+00
	33	594.30	4.50E+00	6.36			4.50E+00	6.36E+00
	34	600.89	6.50E+00	6.96			6.50E+00	6.96E+00
	35	608.89	4.20E+01	15.43	2.15E+00	1.11E+00	3.98E+01	1.55E+01
	36	708.81	7.20E+00	7.62			7.20E+00	7.62E+00
	37	716.49	8.67E+00	8.94			8.67E+00	8.94E+00
	38	824.58	9.00E+00	6.00			9.00E+00	6.00E+00
	39	870.47	6.00E+00	4.90			6.00E+00	4.90E+00
	40	1120.11	1.49E+01	9.17			1.49E+01	9.17E+00

0110

Analysis Report for 1809064-01

SPIKE

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
CD-109	1.00	88.03	*	3.72	2.58E+02	2.41E+02
SN-113	0.99	255.12	*	1.93	1.31E+03	1.52E+03
		391.69	*	61.90	4.69E+01	1.86E+01
I-125	0.99	35.49	*	6.49	8.81E+00	9.57E-01
BA-133	1.00	30.80	*	97.60	5.95E-01	2.21E-02
		302.84	*	17.80	1.16E+03	5.33E+02
		356.01	*	60.00	6.73E+02	8.94E+01
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	8.95E+03	4.12E+03
TH-234	0.95	63.29	*	3.80	3.81E+02	5.86E+01
AM-241	0.99	59.54	*	35.90	5.43E+00	1.97E+00

* = 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

Analysis Report for 1809064-01

SPIKE

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
	CD-109	1.000	2.58E+02	2.41E+02	
	SN-113	0.996	4.71E+01	1.86E+01	
	I-125	0.999	8.81E+00	9.57E-01	
X	I-129	0.749			
	BA-133	1.000	5.95E-01	2.21E-02	
	PA-231	1.000	8.95E+03	4.12E+03	
	TH-234	0.950	3.81E+02	5.86E+01	
X	NP-237	0.939			
	AM-241	0.999	5.43E+00	1.97E+00	

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

Errors quoted at 2.000sigma

0112

Analysis Report for 1809064-01

SPIKE

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2018 3:03:07PM
Peak Locate From Channel : 1
Peak Locate To Channel : 4096

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	3	52.93	1.33656E-01	18.06		
m	6	65.63	1.90483E-01	15.50	Sum	
M	7	77.96	3.60604E-02	57.07		
m	8	81.16	1.32099E+00	3.36		
	10	102.22	5.45546E-02	29.20		
M	11	111.94	3.01293E-01	8.26		
m	12	115.92	8.50389E-02	26.50		
	13	161.34	4.18414E-02	60.66		
	15	275.56	1.08889E-01	16.31		
M	16	295.27	1.95098E-02	63.16		
m	18	307.49	4.63113E-02	37.09		
M	19	333.87	1.13887E-01	13.08	Sum	
m	20	337.60	3.84940E-02	34.00	Sum	
	22	363.54	2.38889E-02	49.77	Sum	
M	23	377.51	2.13530E-02	37.43		
m	24	384.08	1.83562E-01	9.45		
m	25	387.01	3.42499E-01	7.04	Sum	
m	27	395.09	1.43384E-02	71.76		
	28	414.98	3.05485E-02	46.69	Sum	
	29	437.02	1.33798E-01	11.51		
	30	517.76	7.82828E-03	59.80		
	31	549.86	8.88889E-03	49.21		
	32	570.15	7.22222E-03	70.71		
	33	594.30	5.00000E-03	70.71		
	34	600.89	7.22222E-03	53.57		
	35	608.89	4.42777E-02	19.41	Sum	
	36	708.81	8.00000E-03	52.89		
	37	716.49	9.62963E-03	51.60		
	38	824.58	1.00000E-02	33.33		
	39	870.47	6.66667E-03	40.82		
	40	1120.11	1.65686E-02	30.73		

0113

Analysis Report for 1809064-01

SPIKE

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	1.90E-13	1.90E-13	0.00E+00	0.00E+00
	CO-57	122.06		85.51	3.94E+01	3.94E+01	9.15E+00	1.85E+01
		136.48		10.60	3.84E+02		-1.02E+02	1.80E+02
	NI-59	6.92		29.80	2.77E-12	2.77E-12	0.00E+00	0.00E+00
	MO-93	16.59		52.90	7.31E-06	7.31E-06	-1.04E-05	3.21E-06
		18.60		10.00	4.46E-04		4.91E-04	2.13E-04
	NB-93M	16.57		9.43	4.04E-05	4.04E-05	-5.76E-05	1.78E-05
+	CD-109	88.03	*	3.72	3.85E+02	3.85E+02	2.58E+02	1.83E+02
+	SN-113	255.12	*	1.93	2.10E+03	3.84E+01	1.31E+03	9.74E+02
		391.69	*	61.90	3.84E+01		4.69E+01	1.84E+01
	SN-119M	23.87		16.10	5.19E-03	5.19E-03	-2.89E-03	2.48E-03
		25.10		22.70	5.92E-03		-3.90E-03	2.82E-03
+	I-125	35.49	*	6.49	1.92E+00	1.92E+00	8.81E+00	9.45E-01
	I-129	29.78	*	57.00	6.09E-02	6.09E-02	1.02E+00	3.00E-02
		33.60		13.20	6.26E-01		-3.64E+00	3.09E-01
		39.58		7.52	1.54E+00		-1.86E+00	7.41E-01
+	BA-133	30.80	*	97.60	3.56E-02	3.56E-02	5.95E-01	1.75E-02
		302.84	*	17.80	4.24E+02		1.16E+03	2.06E+02
		356.01	*	60.00	4.26E+01		6.73E+02	2.02E+01
	CE-139	165.85		80.35	7.13E+01	7.13E+01	2.97E+01	3.36E+01
	CE-144	133.54		10.80	3.68E+02	3.68E+02	1.50E+01	1.73E+02
	HG-203	279.19		77.30	5.60E+01	5.60E+01	7.91E-01	2.64E+01
	PB-210	46.50		4.25	6.31E+00	6.31E+00	2.20E-01	2.96E+00
+	PA-231	9.28		42.00	2.61E-10	2.61E-10	0.00E+00	0.00E+00
		10.11		20.20	2.08E-09		0.00E+00	0.00E+00
		283.67		1.60	1.90E+03		3.29E+02	8.73E+02
		302.67	*	2.30	3.28E+03		8.95E+03	1.59E+03
	TH-231	25.64		14.70	1.29E-02	1.29E-02	-2.69E-02	6.16E-03
		84.21		6.40	2.33E+02		-1.94E+03	1.12E+02
	PA-234M	9.89		89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
		21.72		64.90	5.29E-04		6.77E-04	2.55E-04
		37.93		23.75	6.12E-01		1.51E+00	2.99E-01
		131.42		20.40	1.90E+02		4.73E+01	8.90E+01
+	TH-234	63.29	*	3.80	1.16E+02	1.16E+02	3.81E+02	5.66E+01

Analysis Report for 1809064-01

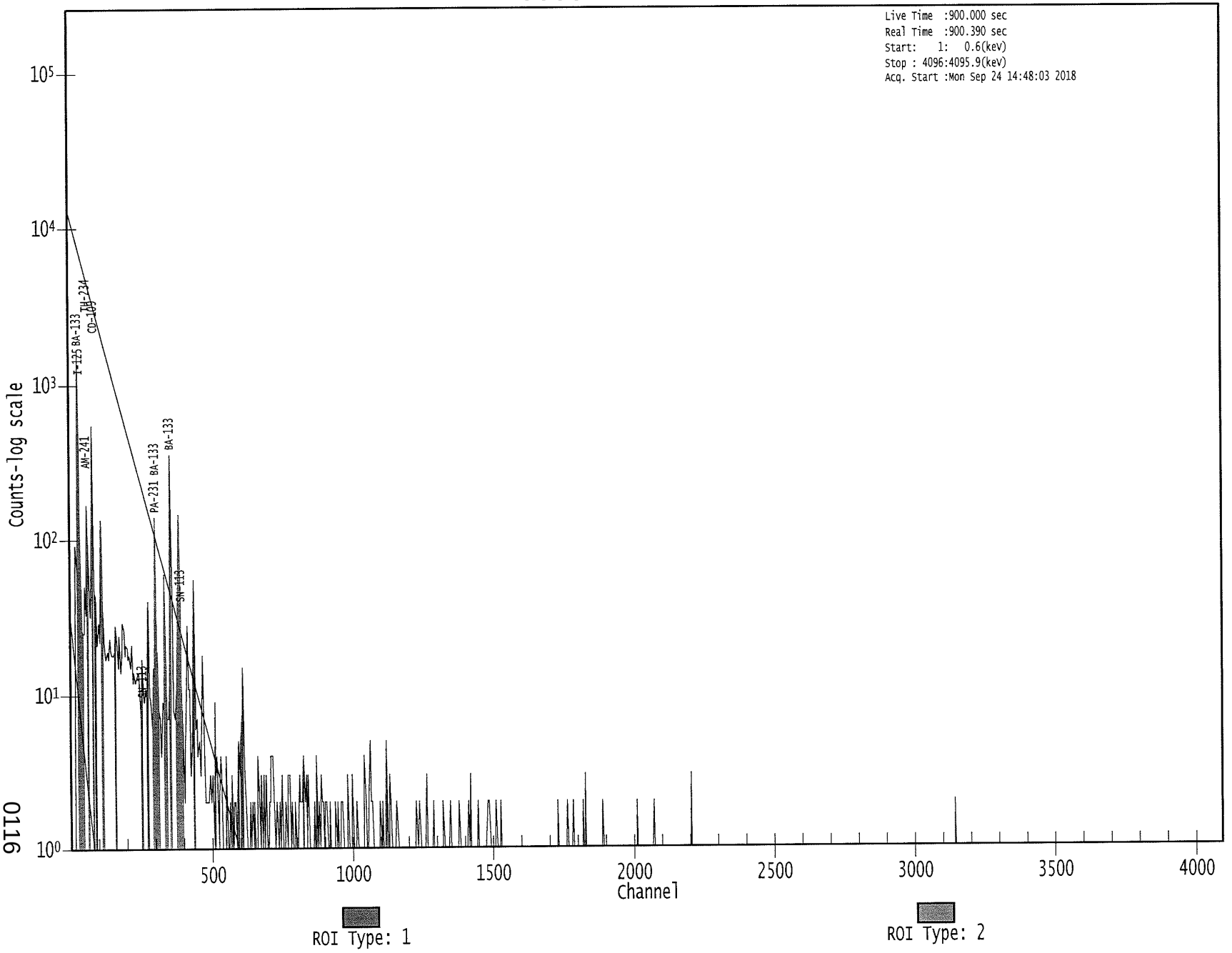
SPIKE

	Nuclide Name	Energy (keV)		Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
	NP-237	29.37	*	14.00	2.48E-01	2.48E-01	4.15E+00	1.22E-01
		86.50	*	12.60	1.14E+02		7.61E+01	5.42E+01
	U-237	97.08		16.30	1.05E+02	7.89E+01	-4.95E+01	4.94E+01
		101.07		26.30	7.89E+01		2.70E+01	3.73E+01
		114.00		12.30	4.60E+02		9.96E+02	2.23E+02
		208.01		22.00	2.35E+02		1.21E+01	1.10E+02
+	AM-241	59.54	*	35.90	9.12E+00	9.12E+00	5.43E+00	4.44E+00
	AM-243	74.67		66.00	1.03E+01	1.03E+01	-3.75E+00	4.91E+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

0115

0000072253.CNF



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2

Apex-Gamma

Analysis Report for 1809064-02
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GAMMA SPECTRUM ANALYSIS

Sample Identification	: 1809064-02
Sample Description	: BLANK
Sample Type	: RA RECOVERY
Sample Size	: 1.000E+00 units
Facility	: Countroom
Sample Taken On	: 9/24/2018 2:35:00PM
Acquisition Started	: 9/24/2018 2:48:10PM
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	: 72254

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 3:03:25PM

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)

0117

Analysis Report for 1809064-02

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	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.82	35 -	40	35.61	5.33E+02	82.60	3.93E+02	2.50
	2	53.06	50 -	55	52.84	6.45E+01	31.54	1.75E+02	1.52
M	3	62.33	58 -	69	62.10	2.64E+02	43.04	1.63E+02	1.65
m	4	65.93	58 -	69	65.70	9.02E+01	37.32	1.73E+02	1.67
	5	81.46	76 -	85	81.22	1.10E+03	81.10	3.11E+02	1.44
	6	111.99	108 -	115	111.73	1.65E+02	49.44	3.00E+02	1.24
	7	161.17	158 -	163	160.90	2.23E+01	28.20	1.41E+02	1.26
	8	222.99	219 -	227	222.69	2.95E+01	33.35	1.53E+02	1.68
	9	276.39	272 -	280	276.06	9.99E+01	28.49	6.43E+01	1.44
	10	303.05	301 -	305	302.70	1.98E+02	31.69	4.95E+01	1.57
	11	307.44	306 -	311	307.10	1.60E+01	20.59	7.20E+01	1.46
	12	324.14	321 -	327	323.79	1.35E+01	13.02	2.10E+01	1.60
	13	333.86	330 -	336	333.50	5.36E+01	24.10	6.68E+01	1.85
	14	338.45	337 -	342	338.09	1.36E+01	17.12	4.29E+01	1.55
	15	356.21	352 -	359	355.84	7.47E+02	59.03	8.09E+01	1.52
	16	364.04	361 -	366	363.67	1.92E+01	14.76	2.57E+01	1.30
M	17	384.25	381 -	397	383.87	1.52E+02	32.30	2.52E+01	1.96
m	18	391.31	381 -	397	390.92	4.18E+01	20.17	1.36E+01	1.97
M	19	414.55	411 -	427	414.15	2.23E+01	11.95	8.75E+00	1.65
m	20	418.25	411 -	427	417.85	1.63E+01	12.28	7.30E+00	1.66
	21	437.06	432 -	439	436.65	9.98E+01	22.80	2.05E+01	1.64
	22	467.76	464 -	471	467.34	1.47E+01	13.42	2.06E+01	1.70
	23	608.58	604 -	611	608.08	1.41E+01	8.94	3.81E+00	3.11
	24	699.09	696 -	700	698.54	4.57E+00	6.36	4.86E+00	1.68
	25	765.28	761 -	767	764.69	6.38E+00	6.65	3.25E+00	2.65
	26	804.75	801 -	806	804.14	7.00E+00	5.29	0.00E+00	1.16
	27	827.66	824 -	829	827.04	4.50E+00	5.74	3.00E+00	2.89
	28	879.81	876 -	881	879.17	6.00E+00	4.90	0.00E+00	2.74
	29	1120.07	1116 -	1122	1119.28	5.43E+00	6.34	3.14E+00	1.10

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/24/2018 3:03:25PM

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

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

Analysis Report for 1809064-02

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	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	35.82	5.33E+02	82.60			5.33E+02	8.26E+01
	2	53.06	6.45E+01	31.54			6.45E+01	3.15E+01
M	3	62.33	2.64E+02	43.04			2.64E+02	4.30E+01
m	4	65.93	9.02E+01	37.32			9.02E+01	3.73E+01
	5	81.46	1.10E+03	81.10			1.10E+03	8.11E+01
	6	111.99	1.65E+02	49.44			1.65E+02	4.94E+01
	7	161.17	2.23E+01	28.20			2.23E+01	2.82E+01
	8	222.99	2.95E+01	33.35			2.95E+01	3.34E+01
	9	276.39	9.99E+01	28.49			9.99E+01	2.85E+01
	10	303.05	1.98E+02	31.69			1.98E+02	3.17E+01
	11	307.44	1.60E+01	20.59			1.60E+01	2.06E+01
	12	324.14	1.35E+01	13.02			1.35E+01	1.30E+01
	13	333.86	5.36E+01	24.10			5.36E+01	2.41E+01
	14	338.45	1.36E+01	17.12			1.36E+01	1.71E+01
	15	356.21	7.47E+02	59.03			7.47E+02	5.90E+01
	16	364.04	1.92E+01	14.76			1.92E+01	1.48E+01
M	17	384.25	1.52E+02	32.30			1.52E+02	3.23E+01
m	18	391.31	4.18E+01	20.17			4.18E+01	2.02E+01
M	19	414.55	2.23E+01	11.95			2.23E+01	1.19E+01
m	20	418.25	1.63E+01	12.28			1.63E+01	1.23E+01
	21	437.06	9.98E+01	22.80			9.98E+01	2.28E+01
	22	467.76	1.47E+01	13.42			1.47E+01	1.34E+01
	23	608.58	1.41E+01	8.94	3.23E+00	9.76E-01	1.09E+01	9.00E+00
	24	699.09	4.57E+00	6.36			4.57E+00	6.36E+00
	25	765.28	6.38E+00	6.65			6.38E+00	6.65E+00
	26	804.75	7.00E+00	5.29			7.00E+00	5.29E+00
	27	827.66	4.50E+00	5.74	1.44E-01	6.98E-01	4.36E+00	5.79E+00
	28	879.81	6.00E+00	4.90			6.00E+00	4.90E+00
	29	1120.07	5.43E+00	6.34	5.17E-01	6.41E-01	4.91E+00	6.38E+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

0119

Analysis Report for 1809064-02

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Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.96	255.12		1.93		
		391.69	*	61.90	2.56E+01	1.25E+01
I-125	0.99	35.49	*	6.49	2.07E+01	3.20E+00
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	5.84E+03	2.00E+03
TH-234	0.97	63.29	*	3.80	4.46E+02	7.39E+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	2.56E+01	1.25E+01	
I-125	0.997	2.07E+01	3.20E+00	
PA-231	1.000	5.84E+03	2.00E+03	
TH-234	0.976	4.46E+02	7.39E+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

0120

Analysis Report for 1809064-02
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UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2018 3:03:25PM
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	7.16374E-02	24.46		
m	4	65.93	1.00233E-01	20.68		
	5	81.46	1.22375E+00	3.68		
	6	111.99	1.83527E-01	14.97		
	7	161.17	2.47670E-02	63.25		
	8	222.99	3.27778E-02	56.53		
	9	276.39	1.10960E-01	14.26		
	11	307.44	1.77778E-02	64.35		
	12	324.14	1.50000E-02	48.22		
	13	333.86	5.95594E-02	22.48		
	14	338.45	1.50794E-02	63.06	Sum	
	15	356.21	8.29512E-01	3.95	Tol.	BA-133
	16	364.04	2.12847E-02	38.54	Sum	
M	17	384.25	1.68769E-01	10.63		
M	19	414.55	2.48055E-02	26.76		
m	20	418.25	1.81511E-02	37.58		
	21	437.06	1.10833E-01	11.43		
	22	467.76	1.63333E-02	45.63		
	23	608.58	1.20737E-02	41.40		
	24	699.09	5.07936E-03	69.61		
	25	765.28	7.08333E-03	52.17		
	26	804.75	7.77778E-03	37.80		
	27	827.66	4.84044E-03	66.42		
	28	879.81	6.66667E-03	40.82		
	29	1120.07	5.45724E-03	64.91		

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

0121

Analysis Report for 1809064-02

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NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Line MDA (pCi/units)	Nuclide MDA (pCi/units)	Activity (pCi/units)	Dec. Level (pCi/units)
	FE-55	5.89		24.50	1.20E-10	1.20E-10	0.00E+00	0.00E+00
	CO-57	122.06		85.51	2.63E+01	2.63E+01	-1.31E+01	1.22E+01
		136.48		10.60	3.08E+02		1.73E+02	1.44E+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	1.30E+01	1.37E+02
+	SN-113	255.12		1.93	1.46E+03	2.49E+01	3.89E+02	6.72E+02
		391.69	*	61.90	2.49E+01		2.56E+01	1.16E+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	4.48E+00	4.48E+00	2.07E+01	2.19E+00
	I-129	29.78		57.00	2.61E-01	2.61E-01	1.68E+00	1.29E-01
		33.60		13.20	1.66E+00		-6.73E+00	8.16E-01
		39.58		7.52	2.11E+00		-1.70E+00	9.68E-01
	BA-133	30.80		97.60	2.23E-01	2.23E-01	2.48E+00	1.10E-01
		302.84		17.80	2.76E+02		7.69E+02	1.33E+02
		356.01		60.00	1.06E+02		6.03E+02	5.21E+01
	CE-139	165.85		80.35	4.90E+01	4.90E+01	1.72E+01	2.29E+01
	CE-144	133.54		10.80	2.81E+02	2.81E+02	1.04E+01	1.32E+02
	HG-203	279.19		77.30	3.48E+01	3.48E+01	-4.05E+01	1.61E+01
	PB-210	46.50		4.25	1.13E+01	1.13E+01	2.70E+00	5.24E+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	1.24E+03		-5.10E+02	5.58E+02
		302.67	*	2.30	7.84E+02		5.84E+03	3.52E+02
	TH-231	25.64		14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
		84.21		6.40	3.21E+02		1.08E+02	1.56E+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	7.15E-01		-1.43E+00	3.36E-01
		131.42		20.40	1.39E+02		-7.81E+01	6.51E+01
+	TH-234	63.29	*	3.80	1.49E+02	1.49E+02	4.46E+02	7.23E+01
	NP-237	29.37		14.00	3.66E-01	3.66E-01	-1.02E+01	1.77E-01
		86.50		12.60	8.73E+01		9.86E+00	4.10E+01
	U-237	97.08		16.30	8.30E+01	6.23E+01	-2.36E+01	3.86E+01
		101.07		26.30	6.23E+01		1.92E+01	2.91E+01
		114.00		12.30	3.18E+02		4.33E+02	1.53E+02
		208.01		22.00	1.65E+02		1.80E+01	7.67E+01
	AM-241	59.54		35.90	7.98E+00	7.98E+00	-4.94E+01	3.80E+00
	AM-243	74.67		66.00	9.80E+00	9.80E+00	-2.58E+00	4.61E+00

0122

Analysis Report for 1809064-02

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

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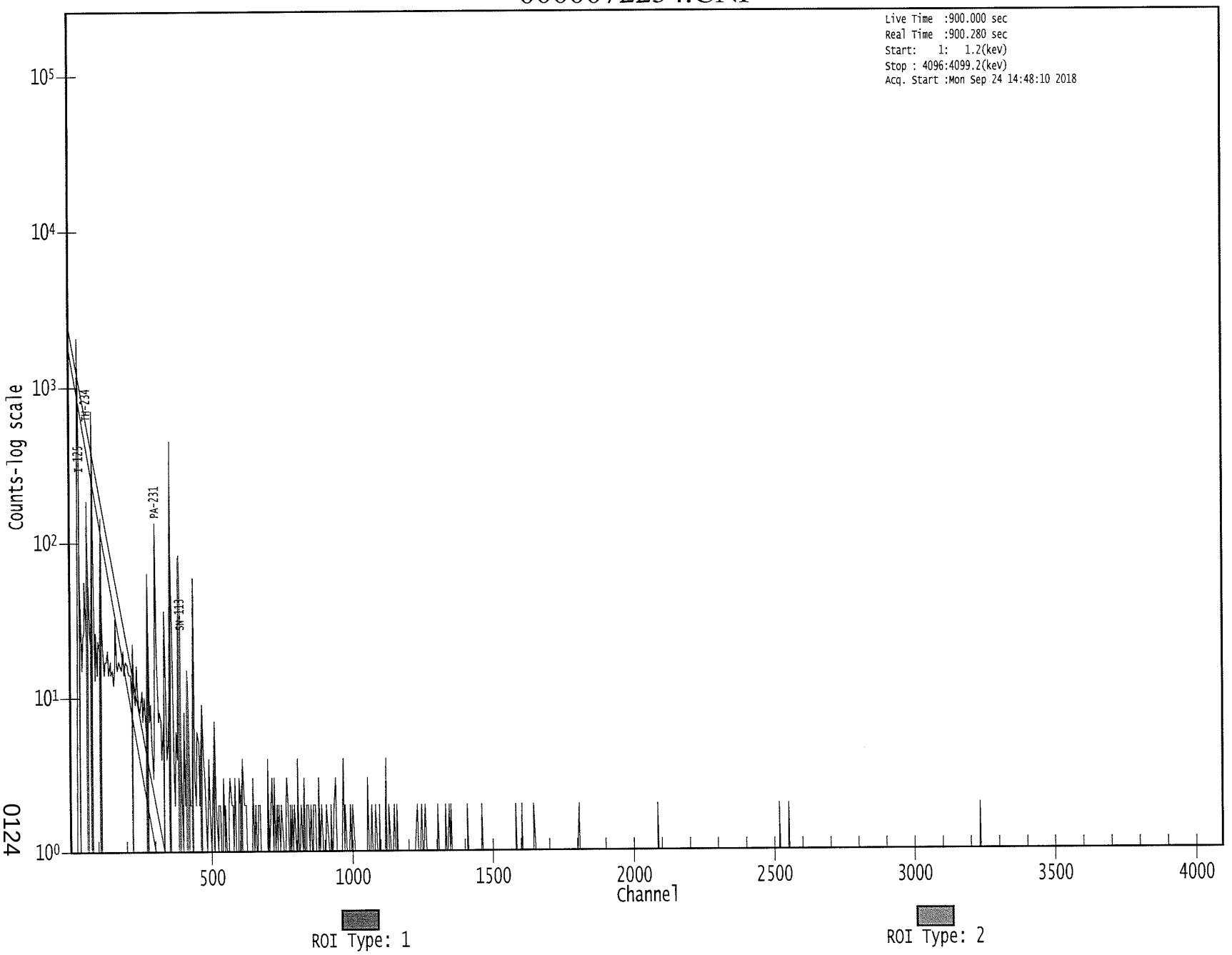

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Apex-Gamma

Analysis Report for 1809064-03

BAGLEY RIG SUPPLY WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 1809064-03
Sample Description	: BAGLEY RIG SUPPLY WELL
Sample Type	: RA RECOVERY
Sample Size	: 1.000E+00 units
Facility	: Countroom
Sample Taken On	: 9/24/2018 2:35:21PM
Acquisition Started	: 9/24/2018 2:48:24PM
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	: 72255

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 3:03:39PM

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)

0125

Analysis Report for 1809064-03

BAGLEY RIG SUPPLY WELL

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.99	17 -	25	21.36	1.54E+02	54.41	3.62E+02	2.55
M	2	31.04	26 -	40	31.40	2.76E+03	113.24	2.68E+02	2.19
m	3	35.35	26 -	40	35.71	6.94E+02	95.38	1.96E+02	2.31
	4	53.55	50 -	57	53.90	7.59E+01	42.14	2.40E+02	1.71
M	5	62.01	58 -	72	62.36	3.20E+02	52.95	2.15E+02	2.73
m	6	66.47	58 -	72	66.82	1.26E+02	50.04	2.48E+02	2.62
	7	81.22	76 -	86	81.56	1.15E+03	82.54	2.97E+02	2.34
M	8	112.05	107 -	130	112.37	3.13E+02	45.39	1.56E+02	2.78
m	9	116.15	107 -	130	116.47	7.26E+01	45.21	1.36E+02	2.72
m	10	127.68	107 -	130	128.00	3.15E+01	24.98	8.61E+01	2.14
	11	147.91	146 -	152	148.22	2.87E+01	29.90	1.39E+02	3.51
	12	277.19	273 -	283	277.45	7.00E+01	34.64	1.12E+02	2.51
M	13	303.34	300 -	314	303.59	1.87E+02	30.97	4.20E+01	2.27
m	14	307.78	300 -	314	308.02	4.34E+01	29.19	4.80E+01	2.53
	15	334.53	329 -	342	334.77	1.03E+02	31.38	6.55E+01	2.63
	16	356.38	351 -	363	356.60	6.28E+02	57.81	9.84E+01	2.25
M	17	384.39	380 -	396	384.60	1.33E+02	38.02	2.70E+01	3.04
m	18	387.79	380 -	396	388.00	2.28E+02	37.91	2.10E+01	2.35
	19	418.88	413 -	431	419.08	6.82E+01	31.68	4.96E+01	4.74
	20	437.36	433 -	441	437.56	8.67E+01	22.21	2.25E+01	1.93
	21	804.44	801 -	807	804.50	8.00E+00	5.66	0.00E+00	1.66

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/24/2018 3:03:39PM

Env. Background File : \\OR-GAMMA1\ApexRoot\Countroom\Data\0000072212.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.99	1.54E+02	54.41			1.54E+02	5.44E+01
M	2	31.04	2.76E+03	113.24			2.76E+03	1.13E+02
m	3	35.35	6.94E+02	95.38			6.94E+02	9.54E+01
	4	53.55	7.59E+01	42.14			7.59E+01	4.21E+01
M	5	62.01	3.20E+02	52.95	1.61E+01	2.19E+00	3.04E+02	5.30E+01
m	6	66.47	1.26E+02	50.04			1.26E+02	5.00E+01
	7	81.22	1.15E+03	82.54			1.15E+03	8.25E+01
M	8	112.05	3.13E+02	45.39			3.13E+02	4.54E+01

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Analysis Report for 1809064-03

BAGLEY RIG SUPPLY WELL

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	9	116.15	7.26E+01	45.21			7.26E+01	4.52E+01
m	10	127.68	3.15E+01	24.98			3.15E+01	2.50E+01
	11	147.91	2.87E+01	29.90			2.87E+01	2.99E+01
	12	277.19	7.00E+01	34.64			7.00E+01	3.46E+01
M	13	303.34	1.87E+02	30.97			1.87E+02	3.10E+01
m	14	307.78	4.34E+01	29.19			4.34E+01	2.92E+01
	15	334.53	1.03E+02	31.38			1.03E+02	3.14E+01
	16	356.38	6.28E+02	57.81			6.28E+02	5.78E+01
M	17	384.39	1.33E+02	38.02			1.33E+02	3.80E+01
m	18	387.79	2.28E+02	37.91			2.28E+02	3.79E+01
	19	418.88	6.82E+01	31.68			6.82E+01	3.17E+01
	20	437.36	8.67E+01	22.21			8.67E+01	2.22E+01
	21	804.44	8.00E+00	5.66			8.00E+00	5.66E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
I-125	1.00	35.49	*	6.49	3.29E+01	4.52E+00
BA-133	0.99	30.80	*	97.60	3.73E+00	1.53E-01
		302.84	*	17.80	7.00E+02	2.79E+02
		356.01	*	60.00	5.44E+02	7.97E+01
HG-203	0.93	279.19	*	77.30	6.69E+01	4.27E+01
TH-234	0.97	63.29	*	3.80	4.81E+02	8.54E+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

0127

Analysis Report for 1809064-03

BAGLEY RIG SUPPLY WELL

2

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
	I-125	1.000	3.29E+01	4.52E+00	
X	I-129	0.900			
	BA-133	0.998	3.73E+00	1.53E-01	
	HG-203	0.931	6.69E+01	4.27E+01	
	TH-234	0.971	4.81E+02	8.54E+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

0128

Analysis Report for 1809064-03
BAGLEY RIG SUPPLY WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2018 3:03:39PM
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	20.99	1.71333E-01	17.64	Tol.	PA-234M
	4	53.55	8.43254E-02	27.76		
m	6	66.47	1.40075E-01	19.85	Sum	
	7	81.22	1.27403E+00	3.60		
M	8	112.05	3.47905E-01	7.25	Tol.	U-237
m	9	116.15	8.06126E-02	31.16		
m	10	127.68	3.50035E-02	39.65		
	11	147.91	3.19161E-02	52.05		
m	14	307.78	4.82330E-02	33.62	Sum	
	15	334.53	1.14726E-01	15.20	Sum	
M	17	384.39	1.48241E-01	14.25		
m	18	387.79	2.53194E-01	8.32	Sum	
	19	418.88	7.57826E-02	23.23	Sum	
	20	437.36	9.63832E-02	12.80		
	21	804.44	8.88889E-03	35.36		

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)

0129

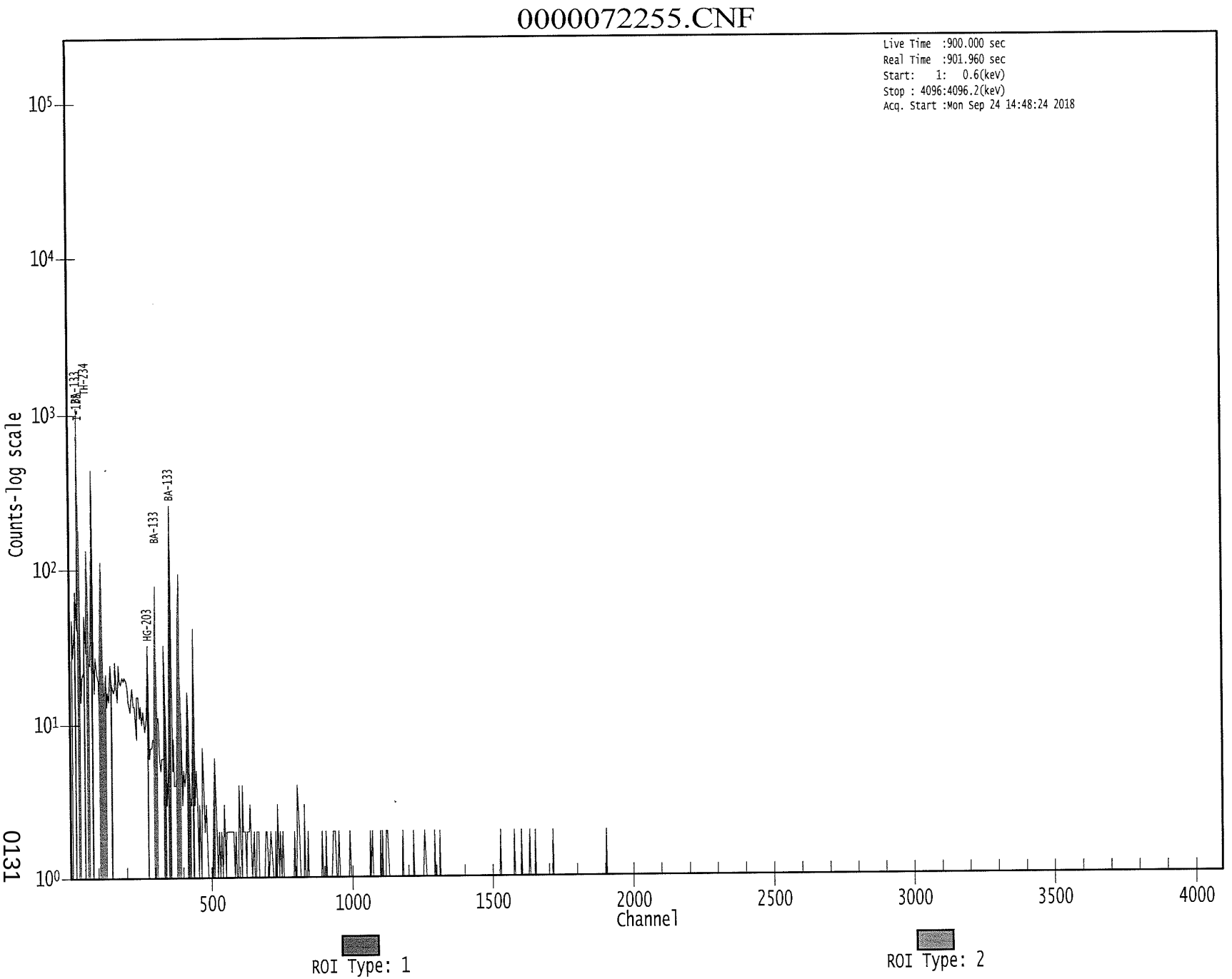
Analysis Report for 1809064-03

BAGLEY 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	4.26E-09	4.26E-09	-2.63E-08	1.35E-09
	CO-57	122.06		85.51	2.66E+01	2.66E+01	-2.33E+01	1.25E+01
		136.48		10.60	2.66E+02		3.88E+01	1.25E+02
	NI-59	6.92		29.80	1.20E-07	1.20E-07	1.77E-08	5.56E-08
	MO-93	16.59		52.90	1.12E-03	1.12E-03	-2.51E-04	5.36E-04
		18.60		10.00	2.05E-02		2.29E-02	9.88E-03
	NB-93M	16.57		9.43	6.23E-03	6.23E-03	-1.39E-03	2.98E-03
	CD-109	88.03		3.72	2.97E+02	2.97E+02	-1.59E+02	1.40E+02
	SN-113	255.12		1.93	1.32E+03	4.52E+01	-5.97E+02	6.02E+02
		391.69		61.90	4.52E+01		4.84E+01	2.16E+01
	SN-119M	23.87		16.10	1.00E-01	9.98E-02	-9.41E-02	4.83E-02
		25.10		22.70	9.98E-02		-1.16E+00	4.81E-02
+	I-125	35.49	*	6.49	5.36E+00	5.36E+00	3.29E+01	2.61E+00
	I-129	29.78	*	57.00	2.65E-01	2.65E-01	6.39E+00	1.30E-01
		33.60	*	13.20	2.63E+00		1.62E+01	1.28E+00
		39.58		7.52	5.94E+00		-4.25E-01	2.86E+00
+	BA-133	30.80	*	97.60	1.55E-01	1.55E-01	3.73E+00	7.57E-02
		302.84	*	17.80	1.80E+02		7.00E+02	8.50E+01
		356.01	*	60.00	4.34E+01		5.44E+02	2.05E+01
	CE-139	165.85		80.35	4.52E+01	4.52E+01	-1.57E+01	2.13E+01
	CE-144	133.54		10.80	2.39E+02	2.39E+02	1.21E+00	1.12E+02
+	HG-203	279.19	*	77.30	5.86E+01	5.86E+01	6.69E+01	2.80E+01
	PB-210	46.50		4.25	1.86E+01	1.86E+01	-9.78E-02	8.84E+00
	PA-231	9.28		42.00	4.37E-06	4.37E-06	8.03E-06	2.09E-06
		10.11		20.20	2.30E-05		4.22E-05	1.10E-05
		283.67		1.60	1.31E+03		5.73E+02	5.94E+02
		302.67		2.30	2.01E+03		3.37E+03	9.65E+02
	TH-231	25.64		14.70	1.82E-01	1.82E-01	-5.98E+00	8.79E-02
		84.21		6.40	3.79E+02		7.97E+00	1.86E+02
	PA-234M	9.89		89.00	4.12E-06	4.12E-06	7.56E-06	1.97E-06
		21.72		64.90	1.22E-02		2.11E-02	5.91E-03
		37.93		23.75	2.55E+00		8.51E+00	1.25E+00
		131.42		20.40	1.20E+02		4.04E+01	5.63E+01
+	TH-234	63.29	*	3.80	1.63E+02	1.63E+02	4.81E+02	7.92E+01
	NP-237	29.37	*	14.00	1.08E+00	1.08E+00	2.60E+01	5.28E-01
		86.50		12.60	9.04E+01		-4.07E+00	4.30E+01
	U-237	97.08		16.30	9.56E+01	6.46E+01	-1.53E+00	4.54E+01
		101.07		26.30	6.46E+01		1.69E+01	3.06E+01
		114.00		12.30	3.33E+02		9.37E+02	1.62E+02
		208.01		22.00	1.69E+02		-3.71E+00	7.91E+01
	AM-241	59.54		35.90	1.33E+01	1.33E+01	2.63E+01	6.45E+00
	AM-243	74.67		66.00	1.09E+01	1.09E+01	1.64E+00	5.20E+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

0130



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RB 9/25/18

2

Apex-Gamma

Analysis Report for 1809064-04
BAGLEY RIG SUPPLY WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 1809064-04
Sample Description	: BAGLEY RIG SUPPLY WELL
Sample Type	: RA RECOVERY
Sample Size	: 1.000E+00 units
Facility	: Countroom
Sample Taken On	: 9/24/2018 2:35:39PM
Acquisition Started	: 9/24/2018 2:48:31PM
Procedure	: BAFIL
Operator	: Administrator
Detector Name	: GE4
Geometry	: BAFIL
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
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	: 72256

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 3:03:52PM

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)

0132

Analysis Report for 1809064-04

BAGLEY RIG SUPPLY WELL

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	20.47	15 -	23	19.52	1.18E+02	49.32	3.03E+02	1.83
M	2	31.17	24 -	43	30.23	2.77E+03	111.22	2.01E+02	2.34
m	3	35.54	24 -	43	34.60	7.10E+02	89.21	1.38E+02	2.49
M	4	54.05	47 -	68	53.13	8.23E+01	40.45	2.21E+02	2.53
m	5	62.47	47 -	68	61.56	2.30E+02	50.40	2.14E+02	2.54
m	6	66.36	47 -	68	65.44	1.14E+02	35.75	1.57E+02	2.55
	7	81.28	74 -	85	80.38	1.09E+03	85.06	3.60E+02	2.28
M	8	112.09	105 -	118	111.21	2.06E+02	43.27	1.67E+02	2.57
m	9	116.74	105 -	118	115.86	2.26E+01	36.76	1.89E+02	2.32
	10	160.97	157 -	162	160.13	3.09E+01	26.83	1.18E+02	2.02
	11	217.16	214 -	219	216.36	2.14E+01	21.68	7.53E+01	3.75
	12	276.36	270 -	283	275.61	5.06E+01	39.15	1.51E+02	2.65
	13	303.33	299 -	308	302.60	1.59E+02	37.05	1.06E+02	2.33
	14	334.56	328 -	339	333.86	5.70E+01	28.35	7.20E+01	1.90
	15	356.36	350 -	360	355.68	5.09E+02	47.36	2.79E+01	2.19
M	16	384.76	381 -	389	384.11	1.18E+02	28.14	3.14E+01	2.82
m	17	387.54	381 -	389	386.89	1.00E+02	30.85	4.96E+01	1.70
	18	416.87	410 -	423	416.24	4.72E+01	22.47	3.57E+01	5.18
	19	437.27	433 -	442	436.66	6.38E+01	18.17	1.24E+01	1.99
	20	466.94	463 -	470	466.35	8.59E+00	11.49	1.68E+01	4.82
	21	499.45	494 -	502	498.90	6.72E+00	7.50	4.56E+00	2.98
	22	511.34	505 -	516	510.80	2.50E+01	10.00	0.00E+00	3.47
	23	801.48	798 -	803	801.20	5.50E+00	6.08	3.00E+00	1.80
	24	1076.50	1072 -	1078	1076.50	6.00E+00	4.90	0.00E+00	1.16

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

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 9/24/2018 3:03:52PM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	20.47	1.18E+02	49.32			1.18E+02	4.93E+01
M	2	31.17	2.77E+03	111.22			2.77E+03	1.11E+02
m	3	35.54	7.10E+02	89.21			7.10E+02	8.92E+01
M	4	54.05	8.23E+01	40.45			8.23E+01	4.04E+01
m	5	62.47	2.30E+02	50.40	1.08E+01	1.04E+00	2.20E+02	5.04E+01

Analysis Report for 1809064-04

BAGLEY RIG SUPPLY WELL

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	6	66.36	1.14E+02	35.75			1.14E+02	3.57E+01
	7	81.28	1.09E+03	85.06			1.09E+03	8.51E+01
M	8	112.09	2.06E+02	43.27	1.93E+00	1.85E+00	2.04E+02	4.33E+01
m	9	116.74	2.26E+01	36.76			2.26E+01	3.68E+01
	10	160.97	3.09E+01	26.83			3.09E+01	2.68E+01
	11	217.16	2.14E+01	21.68			2.14E+01	2.17E+01
	12	276.36	5.06E+01	39.15			5.06E+01	3.92E+01
	13	303.33	1.59E+02	37.05			1.59E+02	3.71E+01
	14	334.56	5.70E+01	28.35			5.70E+01	2.84E+01
	15	356.36	5.09E+02	47.36			5.09E+02	4.74E+01
M	16	384.76	1.18E+02	28.14			1.18E+02	2.81E+01
m	17	387.54	1.00E+02	30.85			1.00E+02	3.09E+01
	18	416.87	4.72E+01	22.47			4.72E+01	2.25E+01
	19	437.27	6.38E+01	18.17			6.38E+01	1.82E+01
	20	466.94	8.59E+00	11.49			8.59E+00	1.15E+01
	21	499.45	6.72E+00	7.50			6.72E+00	7.50E+00
	22	511.34	2.50E+01	10.00	1.18E+01	1.26E+00	1.32E+01	1.01E+01
	23	801.48	5.50E+00	6.08			5.50E+00	6.08E+00
	24	1076.50	6.00E+00	4.90			6.00E+00	4.90E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
I-125	1.00	35.49	*	6.49	6.44E+02	8.25E+01
BA-133	0.99	30.80	*	97.60	1.27E+02	5.67E+00
		302.84	*	17.80	7.83E+02	3.02E+02
		356.01	*	60.00	7.99E+02	1.28E+02
TH-234	0.98	63.29	*	3.80	9.50E+02	2.28E+02

0134

Analysis Report for 1809064-04

BAGLEY RIG SUPPLY WELL

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
	I-125	1.000	6.44E+02	8.25E+01	
X	I-129	0.840			
	BA-133	0.997	1.29E+02	5.66E+00	
	TH-234	0.987	9.50E+02	2.28E+02	
X	NP-237	0.557			

? = 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

0135

Analysis Report for 1809064-04

BAGLEY RIG SUPPLY WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2018 3:03:52PM
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	20.47	1.30562E-01	20.99	Tol.	MO-93 PA-234M
M	4	54.05	9.14628E-02	24.57		
m	6	66.36	1.26638E-01	15.68	Sum	
	7	81.28	1.21000E+00	3.91		
M	8	112.09	2.26586E-01	10.62	Tol.	U-237
m	9	116.74	2.51664E-02	81.14		
	10	160.97	3.43704E-02	43.37		
	11	217.16	2.37288E-02	50.76		
	12	276.36	5.62610E-02	38.66		
	14	334.56	6.33333E-02	24.87	Sum	
M	16	384.76	1.30624E-01	11.97		
m	17	387.54	1.11186E-01	15.42	Sum	
	18	416.87	5.23932E-02	23.83	Sum	
	19	437.27	7.09048E-02	14.23		
	20	466.94	9.54248E-03	66.89		
	21	499.45	7.46914E-03	55.79		
	22	511.34	1.46627E-02	38.19		
	23	801.48	6.11111E-03	55.30		
	24	1076.50	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

0136

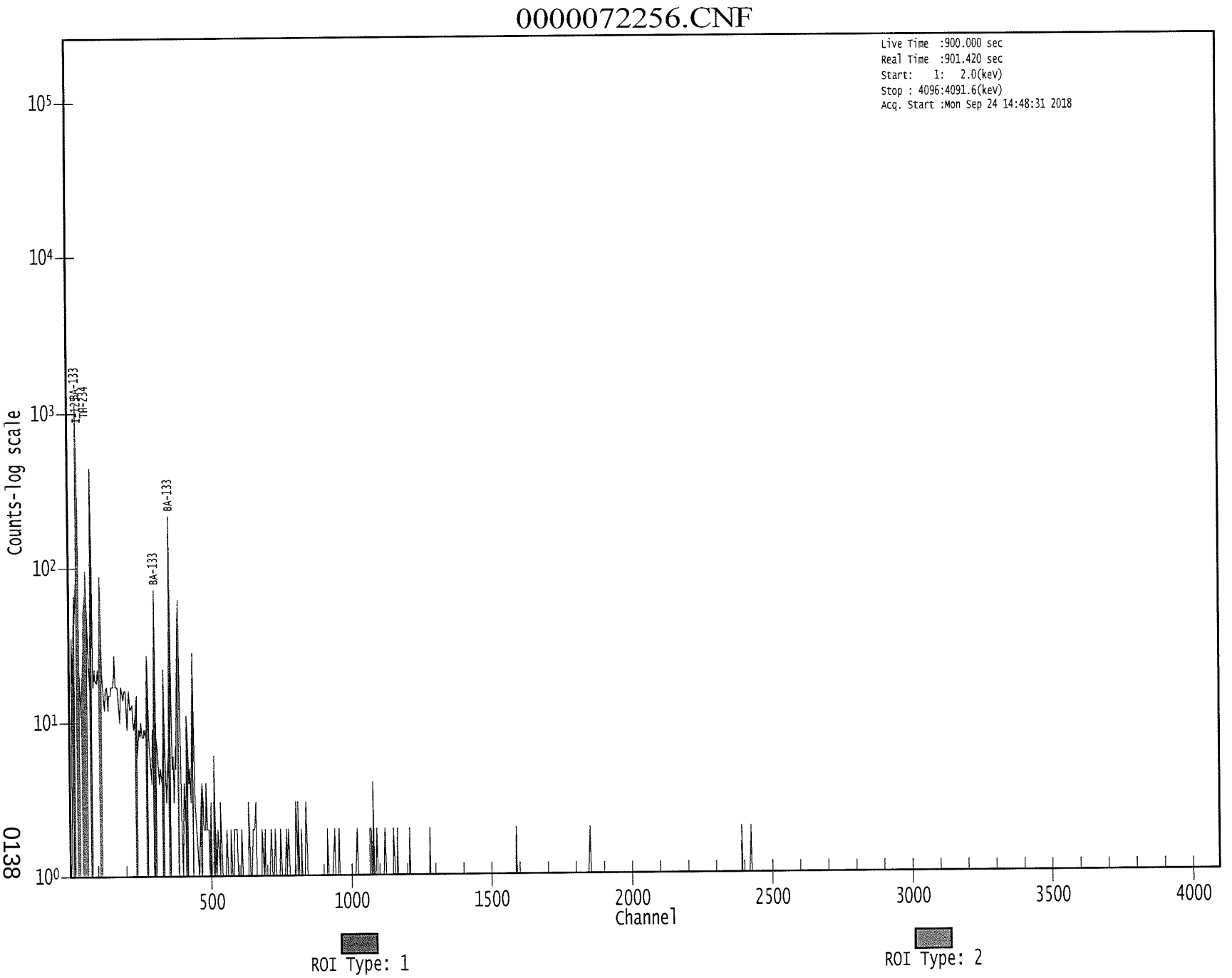
Analysis Report for 1809064-04

BAGLEY 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	2.16E+01	2.16E+01	-4.39E+00	1.02E+01
		136.48		10.60	1.93E+02		-5.20E+01	9.05E+01
	NI-59	6.92		29.80	3.92E-02	3.92E-02	-6.54E-02	1.59E-02
	MO-93	16.59		52.90	1.16E+00	1.16E+00	-1.47E-01	5.54E-01
		18.60		10.00	1.00E+01		1.58E+01	4.83E+00
	NB-93M	16.57		9.43	6.49E+00	6.49E+00	-8.22E-01	3.10E+00
	CD-109	88.03		3.72	3.46E+02	3.46E+02	-4.38E+01	1.63E+02
	SN-113	255.12		1.93	1.36E+03	8.77E+01	2.50E+02	6.22E+02
		391.69		61.90	8.77E+01		2.54E+01	4.17E+01
	SN-119M	23.87		16.10	1.14E+01	8.75E+00	-2.42E+01	5.49E+00
		25.10		22.70	8.75E+00		-1.20E+02	4.21E+00
+	I-125	35.49	*	6.49	1.16E+02	1.16E+02	6.44E+02	5.66E+01
	I-129	29.78	*	57.00	1.01E+01	1.01E+01	2.18E+02	4.97E+00
		33.60	*	13.20	5.69E+01		3.16E+02	2.78E+01
		39.58		7.52	6.55E+01		-2.05E+02	3.15E+01
+	BA-133	30.80	*	97.60	5.93E+00	5.93E+00	1.27E+02	2.90E+00
		302.84	*	17.80	2.33E+02		7.83E+02	1.10E+02
		356.01	*	60.00	4.14E+01		7.99E+02	1.86E+01
	CE-139	165.85		80.35	3.05E+01	3.05E+01	-4.40E-01	1.43E+01
	CE-144	133.54		10.80	1.91E+02	1.91E+02	1.13E+01	8.95E+01
	HG-203	279.19		77.30	5.01E+01	5.01E+01	5.09E+01	2.36E+01
	PB-210	46.50		4.25	1.05E+02	1.05E+02	1.17E+01	4.92E+01
	PA-231	9.28		42.00	1.96E-01	1.96E-01	1.65E-01	9.15E-02
		10.11		20.20	6.05E-01		7.42E-01	2.85E-01
		283.67		1.60	1.58E+03		2.51E+02	7.18E+02
		302.67		2.30	2.56E+03		5.44E+03	1.23E+03
	TH-231	25.64		14.70	1.55E+01	1.55E+01	-4.67E+02	7.49E+00
		84.21		6.40	6.14E+02		3.51E+03	3.02E+02
	PA-234M	9.89		89.00	1.29E-01	1.29E-01	1.58E-01	6.06E-02
		21.72		64.90	2.27E+00		1.18E+00	1.09E+00
		37.93		23.75	3.53E+01		1.31E+02	1.73E+01
		131.42		20.40	9.85E+01		-2.47E+01	4.63E+01
+	TH-234	63.29	*	3.80	6.07E+02	6.07E+02	9.50E+02	2.98E+02
	NP-237	29.37	*	14.00	4.13E+01	4.13E+01	8.86E+02	2.02E+01
		86.50		12.60	1.05E+02		2.09E+01	4.95E+01
	U-237	97.08		16.30	8.83E+01	6.25E+01	-6.88E+00	4.16E+01
		101.07		26.30	6.25E+01		6.22E+01	2.95E+01
		114.00		12.30	2.60E+02		5.89E+02	1.26E+02
		208.01		22.00	1.06E+02		-9.96E+01	4.85E+01
	AM-241	59.54		35.90	3.74E+01	3.74E+01	7.60E+01	1.81E+01
	AM-243	74.67		66.00	1.79E+01	1.79E+01	-1.16E-01	8.52E+00

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

0137


0000072256.CNF
Live Time :900.000 sec
Real Time :901.420 sec
Start: 1: 2.0(keV)
Stop : 4096:4091.6(keV)
Acq. Start :Mon Sep 24 14:48:31 2018
Counts-log scale
10^5
10^4
10^3
10^2
10^1
10^0
TH-234
BA-133
BA-133
BA-133
500
1000
1500
2000
2500
3000
3500
4000
Channel
ROI Type: 1
ROI Type: 2

Apex-Gamma

Analysis Report for 1809064-05
ROM RIG SUPPLY WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 1809064-05
Sample Description	: ROM RIG SUPPLY WELL
Sample Type	: RA RECOVERY
Sample Size	: 1.000E+00 units
Facility	: Countroom
Sample Taken On	: 9/24/2018 2:35:53PM
Acquisition Started	: 9/24/2018 3:04:30PM
Procedure	: BAFIL
Operator	: Administrator
Detector Name	: GE1
Geometry	: BAFIL
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 2.50
Peak Locate Range (in channels)	: 1 - 4096
Peak Area Range (in channels)	: 19 - 4096
Identification Energy Tolerance	: 1.000FWHM
Energy Calibration Used Done On	: 6/16/2018
Efficiency Calibration Used Done On	: 2/17/2018
Efficiency Calibration Description	:
Sample Number	: 72257

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 3:19:34PM

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)

0139

Analysis Report for 1809064-05

ROM RIG SUPPLY WELL

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	30.82	25 -	45	31.19	2.83E+03	112.45	2.66E+02	1.91
m	2	35.38	25 -	45	35.76	7.21E+02	90.64	2.26E+02	2.39
m	3	41.54	25 -	45	41.91	4.45E+01	38.29	1.71E+02	1.99
	4	52.71	49 -	56	53.08	7.59E+01	45.87	3.00E+02	2.64
M	5	61.74	58 -	71	62.11	3.23E+02	54.29	3.26E+02	2.09
m	6	66.02	58 -	71	66.38	1.07E+02	54.62	4.01E+02	2.24
	7	81.07	76 -	86	81.43	1.03E+03	90.00	5.29E+02	2.09
	8	111.72	108 -	114	112.07	2.59E+02	52.21	3.05E+02	2.29
	9	276.69	274 -	281	277.01	7.13E+01	27.42	8.15E+01	1.45
M	10	302.78	298 -	320	303.09	2.04E+02	32.86	4.80E+01	1.90
m	11	307.87	298 -	320	308.17	3.26E+01	21.35	4.80E+01	1.90
M	12	333.52	330 -	344	333.83	8.28E+01	24.60	4.36E+01	1.92
m	13	338.53	330 -	344	338.83	3.57E+01	20.12	6.24E+01	1.92
	14	356.08	351 -	360	356.37	7.18E+02	62.03	1.38E+02	2.10
	15	362.50	361 -	366	362.79	2.87E+01	21.66	6.45E+01	2.41
M	16	383.76	380 -	396	384.05	1.56E+02	32.60	5.84E+01	1.95
m	17	386.89	380 -	396	387.18	2.71E+02	43.30	4.36E+01	1.95
m	18	391.85	380 -	396	392.14	6.77E+01	24.47	2.80E+01	1.95
M	19	414.95	410 -	425	415.23	3.08E+01	23.04	4.66E+01	2.38
m	20	417.70	410 -	425	417.98	3.78E+01	21.91	3.38E+01	2.16
	21	436.98	433 -	442	437.26	1.30E+02	30.12	5.69E+01	2.06
M	22	462.91	462 -	474	463.18	5.63E+00	4.58	4.07E+00	1.99
m	23	467.81	462 -	474	468.08	3.93E+01	14.32	1.47E+01	1.99
	24	482.45	480 -	485	482.72	9.68E+00	7.28	2.64E+00	1.60
	25	609.54	606 -	613	609.78	1.14E+01	9.59	7.20E+00	1.86
	26	839.07	836 -	841	839.26	5.64E+00	6.08	2.71E+00	1.41
	27	1460.61	1457 -	1463	1460.71	7.00E+00	5.29	0.00E+00	3.31

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 : 9/24/2018 3:19:34PM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
M	1	30.82	2.83E+03	112.45			2.83E+03	1.12E+02
m	2	35.38	7.21E+02	90.64			7.21E+02	9.06E+01

Analysis Report for 1809064-05

ROM RIG SUPPLY WELL

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
m	3	41.54	4.45E+01	38.29			4.45E+01	3.83E+01
	4	52.71	7.59E+01	45.87			7.59E+01	4.59E+01
M	5	61.74	3.23E+02	54.29			3.23E+02	5.43E+01
m	6	66.02	1.07E+02	54.62			1.07E+02	5.46E+01
	7	81.07	1.03E+03	90.00			1.03E+03	9.00E+01
	8	111.72	2.59E+02	52.21			2.59E+02	5.22E+01
	9	276.69	7.13E+01	27.42			7.13E+01	2.74E+01
M	10	302.78	2.04E+02	32.86			2.04E+02	3.29E+01
m	11	307.87	3.26E+01	21.35			3.26E+01	2.14E+01
M	12	333.52	8.28E+01	24.60			8.28E+01	2.46E+01
m	13	338.53	3.57E+01	20.12	0.00E+00	0.00E+00	3.57E+01	2.01E+01
	14	356.08	7.18E+02	62.03			7.18E+02	6.20E+01
	15	362.50	2.87E+01	21.66			2.87E+01	2.17E+01
M	16	383.76	1.56E+02	32.60			1.56E+02	3.26E+01
m	17	386.89	2.71E+02	43.30			2.71E+02	4.33E+01
m	18	391.85	6.77E+01	24.47			6.77E+01	2.45E+01
M	19	414.95	3.08E+01	23.04			3.08E+01	2.30E+01
m	20	417.70	3.78E+01	21.91			3.78E+01	2.19E+01
	21	436.98	1.30E+02	30.12			1.30E+02	3.01E+01
M	22	462.91	5.63E+00	4.58			5.63E+00	4.58E+00
m	23	467.81	3.93E+01	14.32			3.93E+01	1.43E+01
	24	482.45	9.68E+00	7.28			9.68E+00	7.28E+00
	25	609.54	1.14E+01	9.59	2.15E+00	1.11E+00	9.25E+00	9.66E+00
	26	839.07	5.64E+00	6.08			5.64E+00	6.08E+00
	27	1460.61	7.00E+00	5.29	1.30E+00	5.99E-01	5.70E+00	5.33E+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	0.97	255.12		1.93		
		391.69	*	61.90	4.00E+01	1.48E+01
I-125	1.00	35.49	*	6.49	7.30E+00	9.17E-01
BA-133	1.00	30.80	*	97.60	5.28E-01	2.10E-02

Analysis Report for 1809064-05

ROM RIG SUPPLY WELL

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
BA-133	1.00	302.84	*	17.80	9.03E+02	4.23E+02
		356.01	*	60.00	6.06E+02	8.44E+01
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	6.99E+03	3.27E+03

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/units)	Wt mean Activity Uncertainty	Comments
	SN-113	0.971	4.00E+01	1.48E+01	
	I-125	1.000	7.30E+00	9.17E-01	
X	I-129	0.748			
	BA-133	1.000	5.28E-01	2.10E-02	
	PA-231	1.000	6.98E+03	3.27E+03	
X	NP-237	0.936			

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

Errors quoted at 2.000sigma

0142

Analysis Report for 1809064-05
ROM RIG SUPPLY WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2018 3:19:34PM
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	3	41.54	4.94626E-02	43.00		
	4	52.71	8.43215E-02	30.22		
M	5	61.74	3.59204E-01	8.40	Sum	
m	6	66.02	1.18782E-01	25.55	Sum	
	7	81.07	1.14968E+00	4.35		
	8	111.72	2.88139E-01	10.07		
	9	276.69	7.91865E-02	19.24		
m	11	307.87	3.62361E-02	32.74		
M	12	333.52	9.19751E-02	14.86	Sum	
m	13	338.53	3.96185E-02	28.22	Sum	
	15	362.50	3.19308E-02	37.68		
M	16	383.76	1.73768E-01	10.42		
m	17	386.89	3.01188E-01	7.99	Sum	
M	19	414.95	3.41849E-02	37.45		
m	20	417.70	4.20092E-02	28.97		
	21	436.98	1.43956E-01	11.62		
M	22	462.91	6.25193E-03	40.72		
m	23	467.81	4.36853E-02	18.21		
	24	482.45	1.07576E-02	37.60		
	25	609.54	1.02777E-02	52.19		
	26	839.07	6.26984E-03	53.90		
	27	1460.61	6.33241E-03	46.72		

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

0143

Analysis Report for 1809064-05

ROM 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	1.90E-13	1.90E-13	0.00E+00	0.00E+00
	CO-57	122.06		85.51	3.72E+01	3.72E+01	-1.16E+01	1.74E+01
		136.48		10.60	3.67E+02		1.19E+02	1.71E+02
	NI-59	6.92		29.80	2.77E-12	2.77E-12	0.00E+00	0.00E+00
	MO-93	16.59		52.90	7.49E-06	7.49E-06	-4.23E-06	3.30E-06
		18.60		10.00	4.33E-04		4.71E-04	2.07E-04
	NB-93M	16.57		9.43	4.14E-05	4.14E-05	-2.34E-05	1.82E-05
	CD-109	88.03		3.72	4.16E+02	4.16E+02	2.86E+02	1.99E+02
+	SN-113	255.12		1.93	2.05E+03	3.44E+01	1.12E+02	9.50E+02
		391.69	*	61.90	3.44E+01		4.00E+01	1.64E+01
	SN-119M	23.87		16.10	5.32E-03	5.32E-03	-1.94E-03	2.55E-03
		25.10		22.70	6.29E-03		-1.23E-03	3.01E-03
+	I-125	35.49	*	6.49	1.65E+00	1.65E+00	7.30E+00	8.11E-01
	I-129	29.78	*	57.00	5.23E-02	5.23E-02	9.05E-01	2.57E-02
		33.60		13.20	5.91E-01		-2.85E+00	2.91E-01
		39.58		7.52	1.59E+00		-1.27E+00	7.62E-01
+	BA-133	30.80	*	97.60	3.06E-02	3.06E-02	5.28E-01	1.50E-02
		302.84	*	17.80	3.54E+02		9.03E+02	1.71E+02
		356.01	*	60.00	4.57E+01		6.06E+02	2.17E+01
	CE-139	165.85		80.35	6.34E+01	6.34E+01	3.04E+00	2.96E+01
	CE-144	133.54		10.80	3.23E+02	3.23E+02	-1.33E+02	1.50E+02
	HG-203	279.19		77.30	5.81E+01	5.81E+01	-3.29E+00	2.74E+01
	PB-210	46.50		4.25	5.99E+00	5.99E+00	-1.69E+00	2.80E+00
+	PA-231	9.28		42.00	2.61E-10	2.61E-10	0.00E+00	0.00E+00
		10.11		20.20	2.08E-09		0.00E+00	0.00E+00
		283.67		1.60	2.00E+03		4.22E+02	9.22E+02
		302.67	*	2.30	2.74E+03		6.99E+03	1.33E+03
	TH-231	25.64		14.70	1.26E-02	1.26E-02	-3.23E-02	6.01E-03
		84.21		6.40	2.28E+02		-1.64E+03	1.10E+02
	PA-234M	9.89		89.00	3.36E-10	3.36E-10	0.00E+00	0.00E+00
		21.72		64.90	5.36E-04		7.86E-04	2.59E-04
		37.93		23.75	5.78E-01		1.30E+00	2.82E-01
		131.42		20.40	1.76E+02		5.27E+01	8.21E+01
	TH-234	63.29		3.80	1.28E+02	1.28E+02	2.19E+02	6.24E+01
	NP-237	29.37	*	14.00	2.13E-01	2.13E-01	3.68E+00	1.05E-01
		86.50		12.60	1.15E+02		7.39E+01	5.50E+01
	U-237	97.08		16.30	1.05E+02	7.63E+01	-4.75E+01	4.92E+01
		101.07		26.30	7.63E+01		2.67E+01	3.60E+01
		114.00		12.30	4.51E+02		-2.92E+01	2.19E+02
		208.01		22.00	2.25E+02		-1.78E+02	1.04E+02
	AM-241	59.54		35.90	8.35E+00	8.35E+00	1.10E+01	4.05E+00
	AM-243	74.67		66.00	9.29E+00	9.29E+00	-3.67E+00	4.40E+00

Analysis Report for 1809064-05

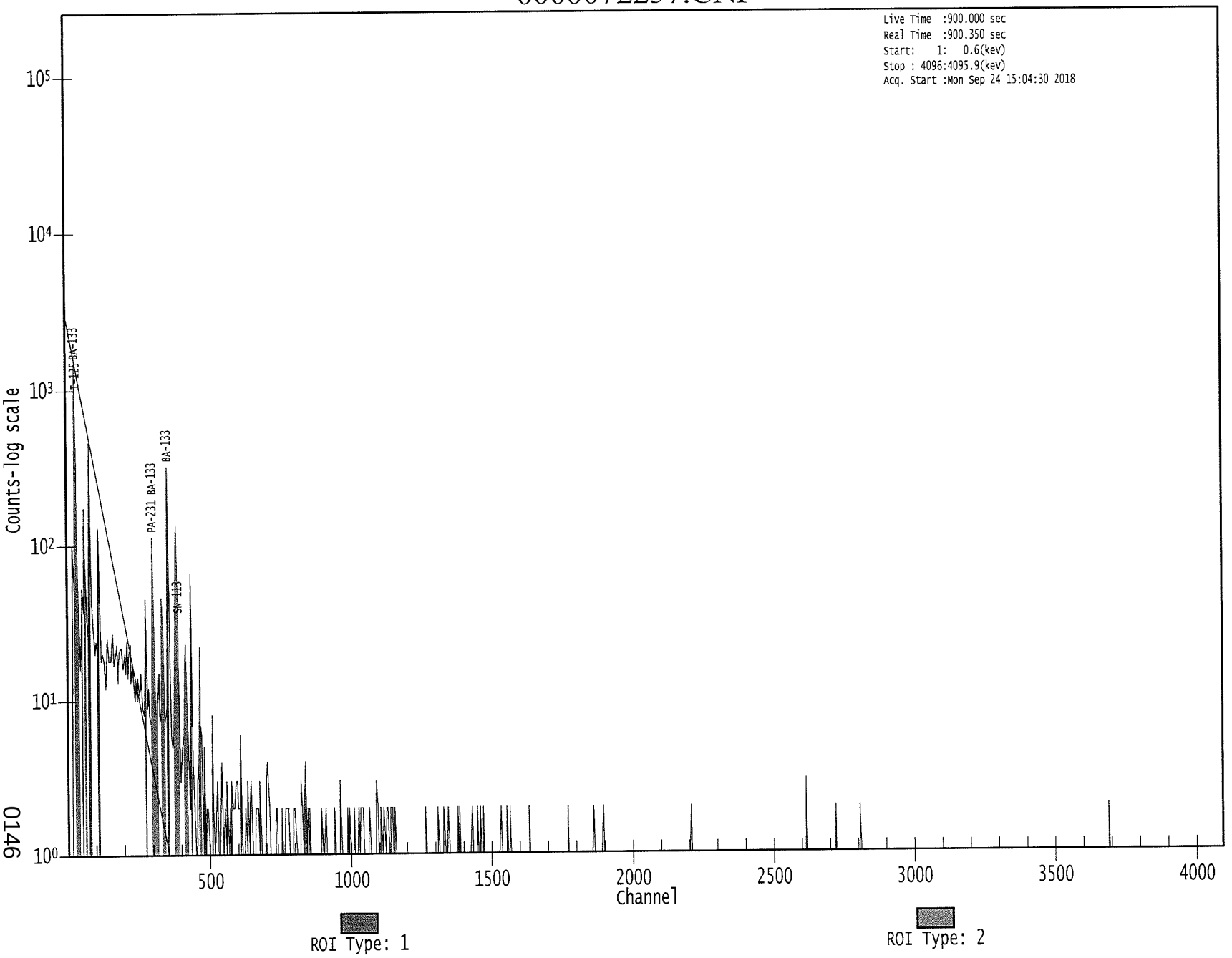
ROM RIG SUPPLY WELL

2

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

0145

0000072257.CNF



0146

LA47640X

2

Apex-Gamma

Analysis Report for 1809064-06
DERBONNE RELIEF WELL

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 1809064-06
Sample Description	: DERBONNE RELIEF WELL
Sample Type	: RA RECOVERY
Sample Size	: 1.000E+00 units
Facility	: Countroom
Sample Taken On	: 9/24/2018 2:36:10PM
Acquisition Started	: 9/24/2018 3:04:37PM
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	: 72258

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2018 3:19:54PM

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)

0147

Analysis Report for 1809064-06

DERBONNE RELIEF WELL

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	35.75	35 -	38	35.53	5.62E+02	68.91	3.24E+02	2.44
	2	52.97	49 -	57	52.75	9.25E+01	43.23	2.33E+02	3.45
M	3	62.30	58 -	72	62.07	2.86E+02	42.96	1.37E+02	1.65
m	4	66.21	58 -	72	65.98	1.44E+02	38.54	1.31E+02	1.67
	5	81.39	78 -	84	81.15	1.05E+03	75.98	2.83E+02	1.34
M	6	112.35	108 -	120	112.09	2.36E+02	38.16	1.22E+02	1.75
m	7	116.12	108 -	120	115.86	6.80E+01	31.87	1.17E+02	1.83
	8	160.63	156 -	163	160.35	3.99E+01	35.89	1.88E+02	1.32
m	9	249.18	235 -	251	248.87	1.31E+01	14.42	2.95E+01	1.46
	10	276.68	272 -	281	276.35	1.03E+02	29.97	6.86E+01	1.89
M	11	303.20	299 -	310	302.86	1.89E+02	31.81	5.74E+01	1.53
m	12	307.29	299 -	310	306.94	3.66E+01	20.19	8.70E+01	1.54
	13	322.32	318 -	326	321.96	1.51E+01	18.83	4.59E+01	3.82
	14	333.91	330 -	336	333.55	7.58E+01	29.03	9.84E+01	1.78
	15	356.19	352 -	360	355.82	6.96E+02	57.94	8.42E+01	1.44
M	16	384.53	379 -	395	384.15	1.66E+02	33.91	2.21E+01	1.62
m	17	391.52	379 -	395	391.14	4.73E+01	18.06	1.56E+01	1.63
	18	415.55	412 -	419	415.16	4.24E+01	24.58	7.33E+01	1.39
	19	437.14	433 -	439	436.73	9.80E+01	23.37	2.80E+01	1.37
	20	557.70	553 -	561	557.23	9.05E+00	8.02	3.91E+00	2.84
	21	695.55	692 -	697	695.00	6.00E+00	4.90	0.00E+00	3.00
	22	728.28	725 -	730	727.71	7.00E+00	5.29	0.00E+00	3.31

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 : 9/24/2018 3:19:54PM

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

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	35.75	5.62E+02	68.91			5.62E+02	6.89E+01
	2	52.97	9.25E+01	43.23			9.25E+01	4.32E+01
M	3	62.30	2.86E+02	42.96			2.86E+02	4.30E+01
m	4	66.21	1.44E+02	38.54			1.44E+02	3.85E+01
	5	81.39	1.05E+03	75.98			1.05E+03	7.60E+01
M	6	112.35	2.36E+02	38.16	0.00E+00	0.00E+00	2.36E+02	3.82E+01
m	7	116.12	6.80E+01	31.87			6.80E+01	3.19E+01

2

Analysis Report for 1809064-06

DERBONNE RELIEF WELL

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	8	160.63	3.99E+01	35.89			3.99E+01	3.59E+01
m	9	249.18	1.31E+01	14.42			1.31E+01	1.44E+01
	10	276.68	1.03E+02	29.97			1.03E+02	3.00E+01
M	11	303.20	1.89E+02	31.81			1.89E+02	3.18E+01
m	12	307.29	3.66E+01	20.19			3.66E+01	2.02E+01
	13	322.32	1.51E+01	18.83			1.51E+01	1.88E+01
	14	333.91	7.58E+01	29.03			7.58E+01	2.90E+01
	15	356.19	6.96E+02	57.94			6.96E+02	5.79E+01
M	16	384.53	1.66E+02	33.91			1.66E+02	3.39E+01
m	17	391.52	4.73E+01	18.06			4.73E+01	1.81E+01
	18	415.55	4.24E+01	24.58			4.24E+01	2.46E+01
	19	437.14	9.80E+01	23.37			9.80E+01	2.34E+01
	20	557.70	9.05E+00	8.02			9.05E+00	8.02E+00
	21	695.55	6.00E+00	4.90	7.56E-01	3.39E+00	5.24E+00	5.96E+00
	22	728.28	7.00E+00	5.29			7.00E+00	5.29E+00

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

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/units)	Activity Uncertainty
SN-113	0.96	255.12		1.93		
		391.69	*	61.90	2.90E+01	1.13E+01
I-125	0.99	35.49	*	6.49	2.15E+01	2.64E+00
PA-231	1.00	9.28		42.00		
		10.11		20.20		
		283.67		1.60		
		302.67	*	2.30	5.56E+03	1.93E+03
TH-234	0.97	63.29	*	3.80	4.84E+02	7.38E+01

Analysis Report for 1809064-06

DERBONNE RELIEF 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
SN-113	0.967	2.90E+01	1.13E+01	
I-125	0.998	2.15E+01	2.64E+00	
PA-231	1.000	5.56E+03	1.93E+03	
TH-234	0.975	4.84E+02	7.38E+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

0150

Analysis Report for 1809064-06

DERBONNE RELIEF WELL

2

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2018 3:19:54PM
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	52.97	1.02796E-01	23.36		
m	4	66.21	1.59855E-01	13.39		
	5	81.39	1.17048E+00	3.61		
M	6	112.35	2.61931E-01	8.09	Tol.	U-237
m	7	116.12	7.55414E-02	23.44		
	8	160.63	4.42993E-02	45.01		
m	9	249.18	1.45543E-02	55.05		
	10	276.68	1.14104E-01	14.59		
m	12	307.29	4.07010E-02	27.56		
	13	322.32	1.67251E-02	62.54		
	14	333.91	8.42044E-02	19.16		
	15	356.19	7.73234E-01	4.16		
M	16	384.53	1.84263E-01	10.22		
	18	415.55	4.70745E-02	29.00		
	19	437.14	1.08889E-01	11.92		
	20	557.70	1.00505E-02	44.31		
	21	695.55	5.82684E-03	56.81	Sum	
	22	728.28	7.77778E-03	37.80		

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

NUCLIDE MDA REPORT

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

0151

Analysis Report for 1809064-06

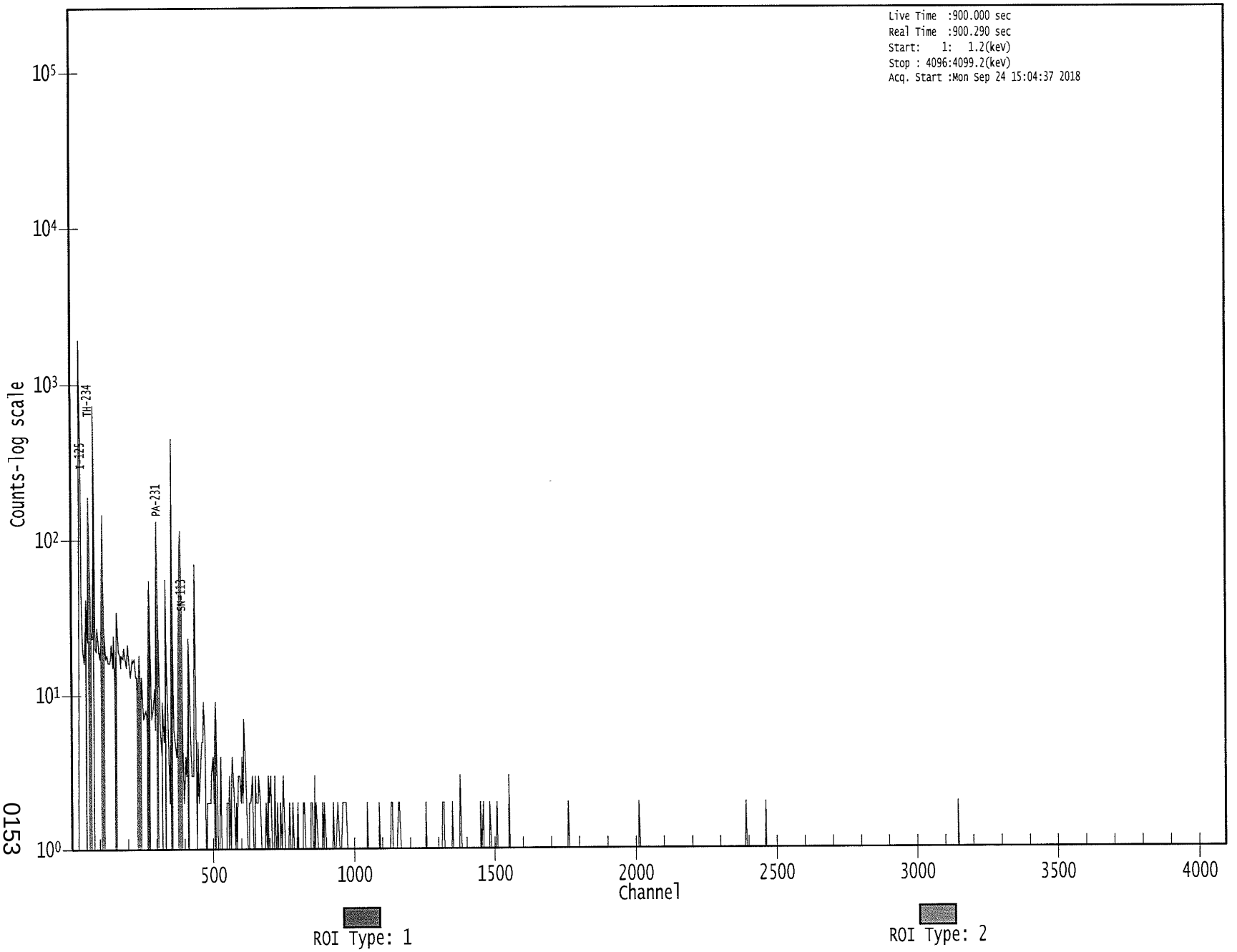
DERBONNE RELIEF WELL

	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	1.20E-10	1.20E-10	0.00E+00	0.00E+00
	CO-57	122.06		85.51	2.93E+01	2.93E+01	-6.65E+00	1.37E+01
		136.48		10.60	2.66E+02		-1.64E+01	1.24E+02
	NI-59	6.92		29.80	9.43E-10	9.43E-10	0.00E+00	0.00E+00
	MO-93	16.59		52.90	1.78E-05	1.78E-05	0.00E+00	0.00E+00
		18.60		10.00	2.91E-04		0.00E+00	0.00E+00
	NB-93M	16.57		9.43	9.85E-05	9.85E-05	0.00E+00	0.00E+00
	CD-109	88.03		3.72	2.93E+02	2.93E+02	-5.01E+01	1.37E+02
+	SN-113	255.12		1.93	1.28E+03	2.65E+01	2.67E+02	5.77E+02
		391.69	*	61.90	2.65E+01		2.90E+01	1.24E+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	3.25E+00	3.25E+00	2.15E+01	1.57E+00
	I-129	29.78		57.00	2.53E-01	2.53E-01	1.64E+00	1.25E-01
		33.60		13.20	1.56E+00		-8.52E+00	7.62E-01
		39.58		7.52	2.09E+00		4.80E-01	9.56E-01
	BA-133	30.80		97.60	2.14E-01	2.14E-01	2.29E+00	1.06E-01
		302.84		17.80	2.71E+02		7.76E+02	1.30E+02
		356.01		60.00	1.03E+02		5.69E+02	5.05E+01
	CE-139	165.85		80.35	4.54E+01	4.54E+01	1.56E+01	2.12E+01
	CE-144	133.54		10.80	2.59E+02	2.59E+02	-1.01E+02	1.20E+02
	HG-203	279.19		77.30	3.80E+01	3.80E+01	1.04E+01	1.77E+01
	PB-210	46.50		4.25	1.05E+01	1.05E+01	1.28E+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	1.15E+03		1.36E+02	5.13E+02
		302.67	*	2.30	1.57E+03		5.56E+03	7.43E+02
	TH-231	25.64		14.70	3.57E-03	3.57E-03	0.00E+00	0.00E+00
		84.21		6.40	3.10E+02		-1.99E+00	1.50E+02
	PA-234M	9.89		89.00	3.24E-08	3.24E-08	0.00E+00	0.00E+00
		21.72		64.90	1.91E-04		0.00E+00	0.00E+00
		37.93		23.75	6.66E-01		-1.81E+00	3.12E-01
		131.42		20.40	1.39E+02		1.72E+01	6.51E+01
+	TH-234	63.29	*	3.80	1.64E+02	1.64E+02	4.84E+02	7.99E+01
	NP-237	29.37		14.00	3.59E-01	3.59E-01	-9.43E+00	1.74E-01
		86.50		12.60	8.38E+01		-2.82E+01	3.93E+01
	U-237	97.08		16.30	9.44E+01	6.52E+01	3.46E+01	4.43E+01
		101.07		26.30	6.52E+01		4.47E+00	3.06E+01
		114.00		12.30	3.58E+02		6.04E+02	1.73E+02
		208.01		22.00	1.75E+02		9.69E+01	8.15E+01
	AM-241	59.54		35.90	8.21E+00	8.21E+00	-4.89E+01	3.91E+00
	AM-243	74.67		66.00	1.01E+01	1.01E+01	2.38E+00	4.77E+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

0152

0000072258.CNF



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LA47640X

2

SECTION XI

ANALYTICAL DATA (TOTAL DISSOLVED SOLIDS)

Eberline Services - Oak Ridge
Version 1.0 9/1999

TDS / TSS Worksheet

Printed: 9/18/2018 1:46 AM

Work Order	Run	Analysis Code	Technician
18-09064	1	TDS	MHIGHTOWER

TRetec Fraction	SGS North America Inc. Client ID	Aliquot ml	Filter Data: Filter Tare (g)	Filter Data: Filter Final (g)	Filter Data: Filter Net (g)	TDS/TSS (mg/L)	Maximum Aliq (mL)
04	BAGLEY RIG SUPPLY WELL	100.0000	97.8384	97.8720	0.0336	336.0000	297.62
05	ROM RIG SUPPLY WELL	100.0000	97.5758	97.6269	0.0511	511.0000	195.69
06	DERBONNE RELIEF WELL	100.0000	98.9498	99.0059	0.0561	561.0000	178.25

0155

Technician: MH Date: 9/18/18

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Printed: 9/17/2018 1:32 PM

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
18-09064	1	TDS	liters	10/4/2018	JPACHELLA

Lab Fraction	SGS North America Inc. Client ID	Sample Type	Muffle Data Ratio Post/Pre	Dilution Data No of Dils	Dil Factor	Ratio	Aliquot Data Aliquot	Net Equiv	MS Aliquot Data Aliquot	Net Equiv	H-3 Solids Only 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	BAGLEY RIG SUPPLY WELL	TRG					1.0000E-01	1.0000E-01				
05	ROM RIG SUPPLY WELL	TRG					1.0000E-01	1.0000E-01				
06	DERBONNE RELIEF WELL	TRG					1.0000E-01	1.0000E-01				

Comments	

0156

Technician: J Pachella Date: 9/17/18

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

LA47640

SAMPLE CHAIN-OF-CUSTODY RECORD

		Laboratory:	Eberline
Project Name:	Indigo	Collected By:	KC/WP
Project Number:	8060.00	Company:	Hydro-Environmental Technology, Inc.
Project Location:	DeSoto Parish, Louisiana	Date:	9/11/2018

	Sample I.D.	Type	Date/Time Sampled		Containers	Analysis Requested/Method	Comments	
1	Bagley Rig Supply Well	AQ	9/11/2018	11:50	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C	3
2	ROM Rig Supply Well	AQ	9/11/2018	14:55	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C	3
3	Derbonne Relief Well	AQ	9/11/2018	16:00	(2) Liter Plastic HNO3 (1) 250mL Plastic	Radium 226, Radium 228, TDS	4°C	3

Relinquished By: Wade A. Bijot	Relinquished By: Derek J. Broussard
Date/Time: 09-12-2018 / 1530	Date/Time: 09-12-2018 / 1530
Relinquished By: Derek J. Broussard	Relinquished By: [illegible]
Date/Time: 09-12-2018 / 1545	Date/Time: 09-12-18 1545
Analysis Due: Verbal:	Written:

Cs uncertain, C(unct 10, (2.4 DW441) @Ph 2, (a)

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LA47640X: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: LA47640 **Client:** HYDRO **Project:** INDIGO

Date / Time Received: 9/12/2018 3:45:00 PM **Delivery Method:** Client **Airbill #'s:**

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

Cooler Security	Y	N		Y	N
1. Custody Seals Present:	☑	☐	3. COC Present:	☑	☐
2. Custody Seals Intact:	☑	☐	4. Smpl Dates/Time OK	☑	☐

Cooler Temperature	Y	N
1. Temp criteria achieved:	☑	☐
2. Thermometer ID:	DV441;	
3. Cooler media:	Ice (direct contact)	
4. No. Coolers:	1	

Quality Control _Preservation	Y	N	N/A
1. Trip Blank present / cooler:	☐	☐	☑
2. Trip Blank listed on COC:	☐	☐	☑
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☐	☐	☑

Sample Integrity - Documentation	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Comments

LA47640X: Chain of Custody
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