ENGINEERING MANAGEMENT SUPPORT, INC.

West Lake OU-1

STANDARD LEVEL IV
REPORT OF ANALYSIS

WORK ORDER #13-04108-OR

May 16, 2013

EBERLINE ANALYTICAL/OAK RIDGE LABORATORY
OAK RIDGE, TN

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Eberline Services – Oak Ridge Laboratory

LABORATORY DATA SUPPORT CHECKLIST

MP-001-3

Eberline Services Work Order # 13-04108

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

Date for Partial	Initials	Date	Initials	Checklist Items
		4/16/13	KC	Sample Log-In
		5/10/13	KBS	Data Compilation
		5-15-13	MLT	First Technical Data Review
		5/15/13	MSA	Second Technical Data Review
		5/15/13		Data Entry/Electronic Deliverable
		5/15/13		Case Narrative
		5/16/13	KBS	Electronic Deliverable Proof
		5/16/13	MSA	Samples Analyzed within Holding Time Yes? [X] No? [ ]
		5/16/13	MSA	QA/QC Review
				Client in Possession of Data Electronic or Hard Copy
				Invoiced by Laboratory

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

Date package approved by: _____ _____

Laboratory Manager Date

Copy No. _____

Radiochemistry Services

SECTION I

CHAIN OF CUSTODY
&
pH CHECK SHEET

REC'D APR 16 2013

13-04108

Chain of Custody Record

№ 1604

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

EBERLINE SERVICES

Project Name: West Lake OU-1	Project Number:
Send Report To: Paul Rosasco	Sampler (Print Name): John D Reagan
Address:	Sampler (Print Name):
	Shipment Method: Courier
	Airbill Number: —
Phone:	Laboratory Receiving:
Fax:	

Page 2 of 2

Purchase Order #: _____

Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	Diss U-238, U-235, U-234	Diss Ra-226, Ra-228	Diss Thor 232, 230, 228	Tot U-238, 235, 234	Tot Ra 226, 228	Tot Thor 232, 230, 228	Comments, Special Instructions, etc.	Lab Sample ID (to be completed by lab)
D-6	4/9/13	1545	Aqueous	1	X	X	X	X	X	X	① Lab to filter for dissolved parameters.	
D-83	↓	1616	↑	↑	X	X	X	X	X	X	↓	
Dup 05	4/9/13	—			X	X	X	X	X	X		
PZ-102-55	4/11/13	0910			X	X	X	X	X	X		
PZ-102R-55		1130			X	X	X	X	X	X		
PZ-104-50		1138			X	X	X	X	X	X		
PZ-104-55		1259			X	X	X	X	X	X		
PZ-113-AD		1335			X	X	X	X	X	X		
FBED-3		1350			X	X	X	X	X	X		
D-3		1424			X	X	X	X	X	X		
D-85		1445			X	X	X	X	X	X		
S-84		1530			X	X	X	X	X	X		
S-5		1531			X	X	X	X	X	X		
PZ-109-55		1608			X	X	X	X	X	X		
PZ-104-125		1708			X	X	X	X	X	X		
4,5 Dup 06	4/10/13	—	↓	↓	X	X	X	X	X	X		
6,7 I-4	4/12/13	1320	Aqueous	1	X	X	X	X	X	X	①	

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
[signature]	First Capital Courier	4/15/13	0800
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
	[signature]	4/16/13	940
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Sample Custodian Remarks (Completed By Laboratory):

QA/QC Level	Turnaround
Level I ☐	Routine ☐
Level II ☐	24 Hour ☐
Level III ☐	1 Week ☐
Other ☐	Other _____

Sample Receipt	
Total # Containers Received?	
COC Seals Present?	
COC Seals Intact?	
Received Containers Intact?	
Temperature?	

569

EBERLINE SERVICES
Oak Ridge Laboratory

Internal Chain of Custody

Work Order #	13-04108
Lab Deadline	See Comments
Analysis	UUISO - Level 4
Sample Matrix	WA

Comments

Re-Analysis: 2Fxns 04 & 06 are TOTAL

Fxns 05 & 07 are DISSOLVED

Original Lab Deadline: 05/14/13
Rerun Lab Deadline: 05/14/13

Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
04	38	T1.5
05	38	T1.5
06	42	T1.5
07	42	T1.5

	Location (circle one)					Technician Initials
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	SB 5/8/13 0900
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JW 5/8/13 1233
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JPD 5/8/13 1233
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	0900 RM 5/10/13
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	0900
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	1732
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 #	13-04108
		Lab Deadline	5/7/2013
		Analysis	ThISO - Level 4
		Sample Matrix	Water

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Fxns 04 & 06 are TOTAL Fxns 05 & 07 are DISSOLVED	04	38	T1.5
	05	38	T1.5
	06	42	T1.5
	07	42	T1.5

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	4/29/13 0800
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JB	4/30/13 0530
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	0530 RM	4/30/13
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	1000 RM	5/3/13
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	1000	5/7
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	[illegible]	0810
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 #	13-04108
Lab Deadline	5/7/2013
Analysis	Ra226 - Level 4
Sample Matrix	Water

Comments

Fxns 04 & 06 are TOTAL

Fxns 05 & 07 are DISSOLVED

Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
04	38	T1.5
05	38	T1.5
06	42	T1.5
07	42	T1.5

	Location (circle one)					Initials	Date
Received by	Sample Storage (circled)	Rough Prep	Prep	Separations	Count Room	BK	4/29/13
Relinquished by	Sample Storage	Rough Prep	Prep (circled)	Separations	Count Room	LW	4/29/13 1940
Received by	Sample Storage	Rough Prep	Prep	Separations (circled)	Count Room	LW	4/30/13 1300
Relinquished by	Sample Storage	Rough Prep	Prep	Separations (circled)	Count Room	LW	5/1/13 1450
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room (circled)	KB	5/1/13 1455
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		

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EBERLINE SERVICES
Oak Ridge Laboratory

Internal Chain of Custody

Work Order #	13-04108
Lab Deadline	5/7/2013
Analysis	Ra228 - Level 4
Sample Matrix	Water

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Fxns 04 & 06 are TOTAL Fxns 05 & 07 are DISSOLVED	04	38	T1.5
	05	38	T1.5
	06	42	T1.5
	07	42	T1.5

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JBT	4/29/13 0900
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JW	4/29/13 1940
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JW	4/30/13 1300
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JW	5/1/13 1450
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	5/1/13 1455
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		0847
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	JW	5/2/13 1305
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		5/3 0458
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		0848
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	KB	5/6/13 1225
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		

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EBERLINE SERVICES

Sample Receiving Report
(Volumes, pH, & CPM)

Internal Work Order
13-04108
Received By
KCOULSTON

FR	ClientID	# Btls	Comments	Matrix	Storage	Rec Vol Ttl	CPM Max
01	LCS	0		WA	T1.5		
02	BLANK	0		WA	T1.5		
03	DUP	0		WA	T1.5		
04	DUP 06 TOT	1		WA	T1.5	9.50	38
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	9.5000	38
05	DUP 06 DIS	1		WA	T1.5	0.00	38
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1				38
06	I-4 TOT	1		WA	T1.5	9.50	42
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	9.5000	42
07	I-4 DIS	1		WA	T1.5	0.00	42
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1				42

EJ 04/16/13

Received by: Kristen Coulston Date: 4/16/13

SECTION II

SAMPLE ACKNOWLEDGEMENT

Client Name	Contract/PO	Project Type	Date Received	Required Turnaround Days	Eberline Services Work Order
Engineering Management Support, Inc.	**West Lake OU-1**	**Environmental**	**04/16/2013**	**28**	**13-04108**
Project Name	**Client WO**	**Sample Disp**	**Lab Deadline**	**Internal Deadline**	**Client Deadline**
West Lake OU-1	**West Lake OU-1**	**W**	**05/07/2013**	**05/13/2013**	**05/14/2013**

Internal ID	Client ID	Sample Date	Matrix	Storage	Ra226	Ra228	ThISO	UISO																					Ttl
01	LCS	04/16/13	WA	T1.5	X	X	X	X																					4
02	BLANK	04/16/13	WA	T1.5	X	X	X	X																					4
03	DUP	04/16/13	WA	T1.5	X	X	X	X																					4
04	DUP 06 TOT	04/11/13 00:00	WA	T1.5	X	X	X	X																					4
05	DUP 06 DIS	04/11/13 00:00	WA	T1.5	X	X	X	X																					4
06	I-4 TOT	04/12/13 13:20	WA	T1.5	X	X	X	X																					4
07	I-4 DIS	04/12/13 13:20	WA	T1.5	X	X	X	X																					4
																													0
																													0
																													0
																													0
																													0
																													0
																													0
																													0
																													0
																													0
																													0
																													0
																													0
				Totals Per Analysis (non QA samples)	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

EBERLINE SERVICES

Sample Log In Report

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

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

Invoice	Paul V. Rosasco, P.E. Engineering Management Support, Inc 7220 West Jefferson Avenue, Suite 406 Lakewood, CO 80235	**Report Data**	Paul V. Rosasco, P.E. Engineering Management Support, Inc 7220 West Jefferson Ave, Suite 406 Lakewood, CO 80235
Voice	303-640-3426	Voice	303-940-3426
Fax		Fax	
Contact	Lyn Fitzgerald		
Voice	303-601-4255		
Fax			

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Eberline Services – Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST
MP-001-2

WORK ORDER # 13-04108

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: Kristen Carlota DATE: 4/16/13

SECTION III

CASE NARRATIVE

EBERLINE SERVICES

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

EBS-OR-35569

May 16, 2013

Paul V. Rosasco, P.E.
Engineering Management Support, Inc.
7220 West Jefferson Ave, Suite 406
Lakewood, CO 80235

CASE NARRATIVE
Work Order # 13-04108-OR

SAMPLE RECEIPT

This work order contains two water samples received 04/16/2013. All samples were analyzed as total and dissolved for Isotopic Uranium, Isotopic Thorium and Radium-226/228.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
DUP 06 TOT	13-04108-04	I-4 TOT	13-04108-06
DUP 06 DIS	13-04108-05	I-4 DIS	13-04108-07

ANALYTICAL METHODS

Isotopic Uranium and Isotopic Thorium were analyzed using Method HASL 300, 4.5.2. Radium-226 was analyzed using Method EPA 903.0. Radium-228 was analyzed using Method EPA 904.0.

Laboratory qualifiers are as follows:

J - Indicates a situation where the result minus the error is less than the detection limit but greater than zero.

U - Indicates a situation where the result minus the error is less than or equal to zero.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 2-sigma value.

ISOTOPIC URANIUM

Samples were filtered to disassociate dissolved and total fractions. All samples were prepared by removing a representative aliquot followed by mixed acid digestions and dilutions as appropriate. Uranium was eluted, micro-precipitated and mounted on micro-porous filter media. Sample activities were then determined by alpha spectroscopy using energy specific regions of interest for Uranium-234, Uranium-235 and Uranium-238. Chemical recovery was determined by the use of a Uranium-232 tracer. Activity of the Uranium-232 tracer was determined by alpha spectroscopy using an energy specific region of interest.

ANALYTICAL RESULTS CONTINUED

ISOTOPIC URANIUM CONTINUED

2nd Analytical Attempt

Samples were reanalyzed using smaller aliquots due to low chemical recoveries. Samples demonstrated acceptable results for all Uranium analyses. Chemical recovery was acceptable for all samples. The Uranium-234, Uranium-235 and Uranium-238 method blank demonstrated acceptable results. Results for the Uranium-234 and Uranium-235 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Uranium-238 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Uranium-234 and Uranium-238 laboratory control sample demonstrated an acceptable percent recovery.

ISOTOPIC THORIUM

Samples were filtered to disassociate dissolved and total fractions. All samples were prepared by removing a representative aliquot followed by mixed acid digestions as appropriate. Thorium was selectively extracted by ion exchange. Thorium was eluted, micro-precipitated and mounted on micro-porous filter media. Sample activities were then determined by alpha spectroscopy using energy specific regions of interest for Thorium-228, Thorium-230 and Thorium-232. Chemical recovery was determined by the use of a Thorium-229 tracer. Activity of the Thorium-229 tracer was determined by alpha spectroscopy using an energy specific region of interest.

Samples demonstrated acceptable results for all Thorium analyses. Chemical recovery was acceptable for all samples. The Thorium-228 and Thorium-232 method blank demonstrated acceptable results. The Thorium-230 method blank demonstrated results slightly greater than the detection limit. Results for the Thorium-228 and Thorium-232 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Thorium-230 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Thorium-228, Thorium-230 and Thorium-232 laboratory control sample demonstrated an acceptable percent recovery.

RADIUM-226

Samples were filtered to disassociate dissolved and total fractions. All samples were prepared by mixed acid digestions and dilutions as appropriate. This was followed by selective sulfate precipitations of the Radium. Samples were then mounted by semi-micro-precipitations onto micro-porous filters. Samples were counted by alpha spectroscopy using an energy specific region of interest for Radium-226. 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 acceptable results. Results for the Radium-226 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Radium-226 laboratory control sample demonstrated an acceptable percent recovery.

ANALYTICAL RESULTS CONTINUED

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 acceptable results. Results for the Radium-228 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique limit. Results for the Radium-228 laboratory control sample demonstrated an acceptable percent recovery.

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: 5/16/2013

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

SECTION IV

ANALYTICAL RESULTS SUMMARY

Paul V. Rosasco, P.E.
Engineering Management Support, Inc.
7220 West Jefferson Ave, Suite 406
Lakewood, CO 80235

Project: West Lake OU-1
SDG: 1304108
Received: 04/16/2013
Matrix: Water

Client Sample ID	Lab Sample ID	Analysis Date/Time	Analyte	Method	Result	Error	MDA	Qualifier	Units
LCS13-04108-01	13-04108-01	05/02/2013 05:33:25	Radium-226	E903.0	9.24	1.09	0.18		pCi/l
LCS13-04108-01	13-04108-01	05/06/2013 09:24:31	Radium-228	E904.0	8.64	0.91	1.10		pCi/l
LCS13-04108-01	13-04108-01	05/06/2013 05:43:37	Thorium-228	HASL 300, 4.5.2	5.06	0.75	0.05		pCi/l
LCS13-04108-01	13-04108-01	05/06/2013 05:43:37	Thorium-230	HASL 300, 4.5.2	4.71	0.71	0.06		pCi/l
LCS13-04108-01	13-04108-01	05/06/2013 05:43:37	Thorium-232	HASL 300, 4.5.2	4.65	0.70	0.07		pCi/l
LCS13-04108-01	13-04108-01	05/10/2013 09:20:53	Uranium-234	HASL 300, 4.5.2	8.04	1.05	0.06		pCi/l
LCS13-04108-01	13-04108-01	05/10/2013 09:20:53	Uranium-235	HASL 300, 4.5.2	0.65	0.21	0.09		pCi/l
LCS13-04108-01	13-04108-01	05/10/2013 09:20:53	Uranium-238	HASL 300, 4.5.2	7.59	1.00	0.06		pCi/l
BLANK13-04108-02	13-04108-02	05/02/2013 05:33:26	Radium-226	E903.0	0.00	0.04	0.13	U	pCi/l
BLANK13-04108-02	13-04108-02	05/06/2013 09:24:31	Radium-228	E904.0	0.87	0.38	0.71	J	pCi/l
BLANK13-04108-02	13-04108-02	05/06/2013 05:43:39	Thorium-228	HASL 300, 4.5.2	0.06	0.05	0.05	J	pCi/l
BLANK13-04108-02	13-04108-02	05/06/2013 05:43:39	Thorium-230	HASL 300, 4.5.2	0.17	0.09	0.05		pCi/l
BLANK13-04108-02	13-04108-02	05/06/2013 05:43:39	Thorium-232	HASL 300, 4.5.2	0.05	0.05	0.07	U	pCi/l
BLANK13-04108-02	13-04108-02	05/10/2013 10:35:19	Uranium-234	HASL 300, 4.5.2	0.00	0.02	0.07	U	pCi/l
BLANK13-04108-02	13-04108-02	05/10/2013 10:35:19	Uranium-235	HASL 300, 4.5.2	-0.01	0.03	0.08	U	pCi/l
BLANK13-04108-02	13-04108-02	05/10/2013 10:35:19	Uranium-238	HASL 300, 4.5.2	0.03	0.04	0.07	U	pCi/l
DUP 06 TOT DUP	13-04108-03	05/02/2013 05:33:21	Radium-226	E903.0	1.31	0.35	0.12		pCi/l
DUP 06 TOT DUP	13-04108-03	05/06/2013 09:24:31	Radium-228	E904.0	0.46	0.38	0.76	J	pCi/l
I-4 TOT DUP	13-04108-03	05/06/2013 05:43:33	Thorium-228	HASL 300, 4.5.2	0.02	0.04	0.08	U	pCi/l
I-4 TOT DUP	13-04108-03	05/06/2013 05:43:33	Thorium-230	HASL 300, 4.5.2	0.27	0.15	0.09		pCi/l
I-4 TOT DUP	13-04108-03	05/06/2013 05:43:33	Thorium-232	HASL 300, 4.5.2	0.00	0.04	0.08	U	pCi/l
DUP 06 TOT DUP	13-04108-03	05/10/2013 10:35:20	Uranium-234	HASL 300, 4.5.2	0.50	0.32	0.33	J	pCi/l
DUP 06 TOT DUP	13-04108-03	05/10/2013 10:35:20	Uranium-235	HASL 300, 4.5.2	0.20	0.22	0.26	U	pCi/l
DUP 06 TOT DUP	13-04108-03	05/10/2013 10:35:20	Uranium-238	HASL 300, 4.5.2	0.15	0.18	0.25	U	pCi/l
DUP 06 TOT	13-04108-04	05/02/2013 05:33:23	Radium-226	E903.0	1.53	0.39	0.12		pCi/l
DUP 06 TOT	13-04108-04	05/06/2013 09:24:32	Radium-228	E904.0	0.86	0.40	0.75	J	pCi/l
DUP 06 TOT	13-04108-04	05/06/2013 05:43:35	Thorium-228	HASL 300, 4.5.2	0.10	0.08	0.07	J	pCi/l
DUP 06 TOT	13-04108-04	05/06/2013 05:43:35	Thorium-230	HASL 300, 4.5.2	0.07	0.06	0.06	J	pCi/l
DUP 06 TOT	13-04108-04	05/06/2013 05:43:35	Thorium-232	HASL 300, 4.5.2	0.00	0.02	0.06	U	pCi/l
DUP 06 TOT	13-04108-04	05/10/2013 10:35:14	Uranium-234	HASL 300, 4.5.2	0.77	0.55	0.54	J	pCi/l
DUP 06 TOT	13-04108-04	05/10/2013 10:35:14	Uranium-235	HASL 300, 4.5.2	0.26	0.37	0.56	U	pCi/l
DUP 06 TOT	13-04108-04	05/10/2013 10:35:14	Uranium-238	HASL 300, 4.5.2	0.18	0.30	0.51	U	pCi/l

Paul V. Rosasco, P.E.
Engineering Management Support, Inc.
7220 West Jefferson Ave, Suite 406
Lakewood, CO 80235

Project: West Lake OU-1
SDG: 1304108
Received: 04/16/2013
Matrix: Water

Client Sample ID	Lab Sample ID	Analysis Date/Time	Analyte	Method	Result	Error	MDA	Qualifier	Units
DUP 06 DIS	13-04108-05	05/02/2013 05:33:33	Radium-226	E903.0	1.10	0.33	0.13		pCi/l
DUP 06 DIS	13-04108-05	05/06/2013 09:24:36	Radium-228	E904.0	1.03	0.44	0.82	J	pCi/l
DUP 06 DIS	13-04108-05	05/06/2013 05:44:02	Thorium-228	HASL 300, 4.5.2	0.01	0.06	0.14	U	pCi/l
DUP 06 DIS	13-04108-05	05/06/2013 05:44:02	Thorium-230	HASL 300, 4.5.2	0.22	0.12	0.08		pCi/l
DUP 06 DIS	13-04108-05	05/06/2013 05:44:02	Thorium-232	HASL 300, 4.5.2	-0.01	0.03	0.07	U	pCi/l
DUP 06 DIS	13-04108-05	05/10/2013 10:35:15	Uranium-234	HASL 300, 4.5.2	0.41	0.28	0.22	J	pCi/l
DUP 06 DIS	13-04108-05	05/10/2013 10:35:15	Uranium-235	HASL 300, 4.5.2	0.09	0.16	0.30	U	pCi/l
DUP 06 DIS	13-04108-05	05/10/2013 10:35:15	Uranium-238	HASL 300, 4.5.2	0.27	0.23	0.19	J	pCi/l
I-4 TOT	13-04108-06	05/02/2013 05:33:29	Radium-226	E903.0	0.65	0.27	0.18		pCi/l
I-4 TOT	13-04108-06	05/06/2013 09:24:37	Radium-228	E904.0	1.15	0.45	0.83	J	pCi/l
I-4 TOT	13-04108-06	05/06/2013 05:44:03	Thorium-228	HASL 300, 4.5.2	0.08	0.08	0.11	U	pCi/l
I-4 TOT	13-04108-06	05/06/2013 05:44:03	Thorium-230	HASL 300, 4.5.2	0.29	0.14	0.10		pCi/l
I-4 TOT	13-04108-06	05/06/2013 05:44:03	Thorium-232	HASL 300, 4.5.2	-0.01	0.03	0.09	U	pCi/l
I-4 TOT	13-04108-06	05/10/2013 10:35:16	Uranium-234	HASL 300, 4.5.2	1.05	0.57	0.32		pCi/l
I-4 TOT	13-04108-06	05/10/2013 10:35:16	Uranium-235	HASL 300, 4.5.2	0.27	0.32	0.39	U	pCi/l
I-4 TOT	13-04108-06	05/10/2013 10:35:16	Uranium-238	HASL 300, 4.5.2	0.14	0.27	0.50	U	pCi/l
I-4 DIS	13-04108-07	05/02/2013 05:33:31	Radium-226	E903.0	0.11	0.11	0.14	U	pCi/l
I-4 DIS	13-04108-07	05/06/2013 09:24:37	Radium-228	E904.0	0.43	0.38	0.75	J	pCi/l
I-4 DIS	13-04108-07	05/06/2013 05:44:00	Thorium-228	HASL 300, 4.5.2	0.01	0.08	0.18	U	pCi/l
I-4 DIS	13-04108-07	05/06/2013 05:44:00	Thorium-230	HASL 300, 4.5.2	0.21	0.13	0.12	J	pCi/l
I-4 DIS	13-04108-07	05/06/2013 05:44:00	Thorium-232	HASL 300, 4.5.2	0.06	0.08	0.12	U	pCi/l
I-4 DIS	13-04108-07	05/10/2013 10:35:18	Uranium-234	HASL 300, 4.5.2	0.09	0.29	0.61	U	pCi/l
I-4 DIS	13-04108-07	05/10/2013 10:35:18	Uranium-235	HASL 300, 4.5.2	0.25	0.34	0.52	U	pCi/l
I-4 DIS	13-04108-07	05/10/2013 10:35:18	Uranium-238	HASL 300, 4.5.2	-0.08	0.17	0.51	U	pCi/l

SECTION V

ANALYTICAL STANDARDS

QA/QC REVIEWED
Date 1/16/95 Initials MK

U-8

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Radionuclide:	U-238NAT	Customer:	TMA EBERLINE
Half Life:	(4.468 ± 0.005) x 10^9 years	P.O.No.:	OR2778
Catalog No.:	7338	Reference Date:	January 1 1995 12:00 PST.
Source No.:	479-50	Contained Radioactivity:	(Total U) 8.016 μCi
		Contained Radioactivity:	(Total U) 297 kBq

Description of Solution

a. Mass of solution: 65.2896 g in a 50 ml flame sealed ampoule

b. Chemical form: Uranyl Nitrate in H2O

c. Carrier content: None

d. Density: Approximately 1.3202 g/ml @ 20°C.

Radioimpurities: Refer to attached technical data sheet

Radioactive Daughters: Refer to attached technical data sheet

Radionuclide Concentration

(Total U) 0.1228 μCi/g.

Method of Calibration

Activity calculations are based upon known specific activity and mass.

Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:	±3.0%
b. Random uncertainty in assay:	±0.0%
c. Random uncertainty in weighing(s):	±2.0%
d. Total uncertainty at the 99% confidence level:	±3.6%

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).

ERIC, ERIC ALLAS
QUALITY CONTROL

29 DECEMBER 1994
Date Signed

ISOTOPE PRODUCTS LABORATORIES
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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	9/6/2012 0:00
SOLUTION REFERENCE #	IPL 479-50	SOLUTION #	U-8

Principal Radionuclide	Half Life, Years	Half Life, Days
$^{234, 235, 238}U$	4.468E+09	1.632E+12

Radionuclide	$^{234, 235, 238}U$	Reference Date	1/1/1995 0:00
Certified Activity	8.016E+00 µCi		
Certified Concentration	µCi per gram		

Ampoule /Solution Gross	97.6400	Weight, Grams
Empty Ampoule	32.5020	Weight, Grams
Solution Net	65.1380	Weight, Grams
Total Activity in Ampoule	8.0160	µCi

Chemical Composition of Standard Solution

Uranyl nitrate in dilute HNO_3

Dilution Instructions:

Dilution Solvent Used 1M HNO_3

Dilute to a volume of 1000.00 **milliliters**

Certified Total Activity of 8.0160 µCi **Which Equals** 1.780E+07 **dpm at the date listed above**

And after dilution the activity of this solution is 1.77955E+04 **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 6, 2013

Verified & Approved By _____ Date: 9/26/2012 0:00

QC Approval _____ Date: 9/26/12

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MP-009

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Title: **Radioactive Reference Standards Solutions & Records**

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

	MP-009	Date	9/6/2012 0:00
Solution Reference #	IPL 479-50	Solution #	U-8a

Principal Radionuclide	Half Life, Years	Half Life, Days
$^{234, 235, 238}U$	4.468E+09	1.632E+12

Radionuclide of Interest: $^{234, 235, 238}U$

Parent Solution Conc.: 1.7796E+04 dpm/ml

Reference Date: 1/1/1995 0:00

Chemical Composition of Standard Solution

Uranly Nitrate in 1M HNO_3

Dilution Instructions:

Dilution Solvent Used: 1M HNO_3

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution:	4.0000	ml
Total Activity:	7.1182E+04	dpm
Final Volume:	1000.00	ml

Final Activity Concentration: 7.1182E+01 dpm/ml

NOTES:

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

Isotopic Distribution as:
U-238 Atom % = 48.239 U-238 = 71.182 dpm/ml X 0.48249 = 34.345 dpm/ml
U-235 Atom % = 2.25 U-235 = 71.182 dpm/ml X 0.0225 = 1.602 dpm/ml
U-234 Atom % = 49.501 U-238 = 71.182 dpm/ml X 0.49501 = 35.236 dpm/ml
All values +/- 3.6%

Isotopic ratios from manufacturer's data sheet

Expiration Date: September 6, 2013

Verified & Approved By _____ Date: 9/26/2012 0:00

QC Approval _____ Date: 9/26/12

Tracer Solution for Environmental Analysis & Disequilibrium Studies

Product Description & Measurement Certificate

Description	Principal radionuclide:	**uranium 232** (U-232)	Product code: **UDP10050**
	Daughter Nuclide:	Th-228	Batch Number: 92/232/67
Measurement	Reference date:		01 March 2000
	Radioactive concentration U-232		6.739E+03 becquerels per gram of solution
	which is equivalent to		1.821E-01 microcuries per gram of solution
	Mass of solution		5.356 grams
	Volume of solution		5.035 millilitres
	Total activity of U-232		3.61E+04 becquerels
	which is equivalent to		9.76E-01 microcuries

Method of measurement (see reverse of this certificate)

Accuracy Random uncertainty is: ± 0.7% Systematic uncertainty: ± 0.5%
Overall uncertainty in the radioactive concentration quoted above: ± 1.7%
Overall uncertainty is defined on the reverse of this certificate.

Radionuclidic Purity Any radioactive impurities measured are listed below, expressed as percentages of the activity of the principle radionuclide at the reference date .

Th-228 and daughter activity removed 2 Feb 2000
U-232 daughters activity will increase with time. By alpha 88% U-232, 12% daughters on 1/3/00

Isotopic Purity The isotopic composition, expressed as atom per cent at the reference date .

Not measured

Chemical Composition Calculated weight of U-232, 4.42E-08 grams, as 2M HNO3 solution in a flame sealed glass vial.
This Tracer solution has been produced 'carrier free'.

Physical Data Recommended half life of uranium 232: 6.980E+01 years
Principle energies of alpha emissions (MeV): 5.263 31.7%, 5.320 68.0%
Branching ratio for alpha emission: 100%
Calculated specific activity of uranium 232: 8.167E+05 Bq per microgram U-232.

Remarks For safety information and notes to ensure correct usage by all persons handling this radioactive Tracer solution please read the instructions accompanying the package.

AEA Technology operates a quality management system which has been independently audited and approved to ISO 9001.

Approved Signatory

Roger Wiltshire

Project Ref. AE2315

Prepared and characterised in the UK, for world wide distribution by **Isotrak, AEA Technology, QSA.**

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Title: Radioactive Reference Standards Solutions & Records

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

CURRENT DATE: 12/13/2012 0:00

SOLUTION REFERENCE #: AEA/Amersham 92/232/67

SOLUTION #: U-10

Principal Radionuclide	Half Life, Years	Half Life, Days
^{232}U	7.200E+01	2.630E+04

Radionuclide: ^{232}U

Reference Date: 3/1/2000 0:00

Certified Activity: 9.760E-01 µCi

Certified Concentration: µCi per gram

Ampoule /Solution Gross: Weight, Grams

Empty Ampoule: Weight, Grams

Solution Net: Weight, Grams

Total Activity in Ampoule: 0.9760 µCi

Chemical Composition of Standard Solution

$^{232}U(NO_3)_6$ in 2M HNO_3

Dilution Instructions:

Dilution Solvent Used: 2M HNO_3

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 0.9760 µCi Which Equals 2.167E+06 dpm at the date listed above

And after dilution the activity of this solution is 2.167E+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: December 7, 2013

Verified & Approved By _____ Date: 12/13/2012 0:00

QC Approval _____ Date: 12/13/12

EBERLINE SERVICES | QUALITY CONTROL PROGRAM
MP-009

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

	MP-009	Date	12/7/2012 0:00
Solution Reference #	AEA/Amersham 92/232/67	Solution #	U-10a

Principal Radionuclide	Half Life, Years	Half Life, Days
^{232}U	7.200E+01	2.630E+04

Radionuclide of Interest: ^{232}U
Parent Solution Conc.: 2.167E+03 dpm/ml

Reference Date: 3/1/2000 0:00

Chemical Composition of Standard Solution
$^{232}U(NO_3)_6$ in 2M HNO_3

Dilution Instructions:

Dilution Solvent Used: 2M HNO_3

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 10.0000 ml
Total Activity: 2.1670E+04 dpm
Final Volume: 1000.00 ml

Final Activity Concentration: 2.1670E+01 dpm/ml

NOTES:

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

Expiration Date: December 7, 2013

Verified & Approved By _____ Date: 12/13/2012 0:00

QC Approval _____ Date: 12/13/12

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Radionuclide	Th-230	Customer:	TMA EBERLINE
Half Life:	(7.54 ± 0.03) x 10^4 years	P.O.No.:	TT4944
Catalog No.:	7230	Reference Date:	November 1 1991 12:00 PST.
Source No.:	388-116	Contained Radioactivity:	1.036 µCi.

Description of Solution

a. Mass of solution:	5.0042	grams.
b. Chemical form:	Th(NO3)4 in 0.1N HNO3	
c. Carrier content:	None added	
d. Density:	1.0016	gram/ml @ 20°C.

Radioimpurities

See attached technical data sheet

Radioactive Daughters

See attached technical data sheet

Radionuclide Concentration

0.207 µCi/gram.

Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:	±2.0%
b. Random uncertainty in assay:	±0.5%
c. Random uncertainty in weighing(s):	±0.2%
d. Total uncertainty at the 99% confidence level:	±2.7%

NIST Traceability

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

Notes

1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
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)

QUALITY CONTROL

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SECONDARY DILUTION RECERTIFICATION

	MP-009	Date	3/4/2013 0:00
Solution Reference #	IPL 388-116	Solution #	Th-1b

Principal Radionuclide	Half Life, Years	Half Life, Days
^{230}Th	7.540E+04	2.754E+07

Radionuclide of Interest: ^{230}Thorium
Parent Solution Conc.: 2.30E+03 dpm/ml

Reference Date: 11/1/1991 0:00

Chemical Composition of Standard Solution
$^{230}Th(NO_3)_4$ in 0.1N HNO_3

Dilution Instructions:

Dilution Solvent Used: 0.1N HNO_3

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 10.0000 ml
Total Activity: 2.2999E+04 dpm
Final Volume: 1000.00 ml

Final Activity Concentration: 2.2999E+01 dpm/ml

NOTES:

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

Expiration Date: March 4, 2014

Recertified By _____ Date: 3/21/2013 0:00

Verified & Approved By _____ Date: 3/21/13

QC Approval _____ Date: 3/21/13

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RADIOACTIVE REFERENCE SOLUTIONS
PRIMARY DILUTION RECERTIFICATION
MP 009

CURRENT DATE: 3/4/2013 0:00

SOLUTION REFERENCE #: IPL 388-116 | SOLUTION #: Th-1

Principal Radionuclide	Half Life, Years	Half Life, Days
^{230}Th	7.540E+04	2.754E+07

Radionuclide: ^{230}Thorium
Reference Date: 11/1/1991 0:00
Certified Activity: 1.036E+00 µCi
Certified Concentration: µCi per gram

Ampoule /Solution Gross	9.2660	Weight, Grams
Empty Ampoule	4.6218	Weight, Grams
Solution Net	4.6442	Weight, Grams
Total Activity in Ampoule	1.0360	µCi

Chemical Composition of Standard Solution

$^{230}Th(NO_3)_4$ in 0.1N HNO_3

Dilution Instructions:

Dilution Solvent Used: 0.1N HNO_3

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 1.0360 µCi Which Equals 2.300E+06 dpm at the date listed above

And after dilution the activity of this solution is 2.300E+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: March 4, 2014

Recertified By _____ Date: 3/21/2013 0:00

QC Approval _____ Date: 3/21/13

Th-8

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Radionuclide:	Th-232	Customer:	TMA EBERLINE
Half Life:	(1.405 ± 0.006) x 10^10 years	P.O.No.:	VH1632
Catalog No.:	7232	Reference Date:	November 1 1993 12:00 PST.
Source No.:	435-104-2	Contained Radioactivity:	(Th-232) 0.0933 μCi.
		Contained Radioactivity:	(Th-232) 3.45 kBq.

Description of Solution

a. Mass of solution:	11.9712 g (in a 10 ml flame sealed ampoule)
b. Chemical form:	Th(NO3)4 in water
c. Carrier content:	None added
d. Density:	Approx. 1.21 g/ml @ 20°C.

Radioimpurities: None detected (other than daughters).

Radioactive Daughters

Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Po-212, Tl-208

Radionuclide Concentration

(Th-232) 0.00779 μCi/g.

Method of Calibration

Activity calculations are based upon known specific activity and mass.

Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration:	±3.0%
b. Random uncertainty in assay:	±0.0%
c. Random uncertainty in weighing(s):	±2.0%
d. Total uncertainty at the 99% confidence level:	±3.6%

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).

Anna U. Khan
QUALITY CONTROL

Nov. 8, 1993
Date Signed

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EBERLINE SERVICES

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RADIOACTIVE REFERENCE SOLUTIONS
PRIMARY DILUTION RECERTIFICATION
MP 009

CURRENT DATE: 10/9/2012 0:00

SOLUTION REFERENCE #: IPL 435-104-2 | SOLUTION #: Th-8

Principal Radionuclide	Half Life, Years	Half Life, Days
^{232}Th, ^{228}Th	1.405E+10	5.132E+12

Radionuclide: $^{232\ \&\ 228}Th$
Reference Date: 11/1/1993 0:00
Certified Activity: 9.330E-02 µCi
Certified Concentration: µCi per gram

Ampoule /Solution Gross	18.8415	Weight, Grams
Empty Ampoule	6.9296	Weight, Grams
Solution Net	11.9119	Weight, Grams
Total Activity in Ampoule	0.0933	µCi

Chemical Composition of Standard Solution

$Th(NO_3)_4$ in H_2O

Dilution Instructions:

Dilution Solvent Used: 1% Nitric Acid

Dilute to a volume of 1000.00 millilliters

Certified Total Activity of 0.0933 µCi Which Equals 2.071E+05 dpm at the date listed above

And after dilution the activity of this solution is 2.071E+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: October 9, 2013

Verified & Approved By _____ Date: 10/9/2012 0:00

QC Approval _____ Date: 11/12/12

EBERLINE SERVICES | QUALITY CONTROL PROGRAM
MP-009

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

	MP-009	Date	11/9/2012 0:00
Solution Reference #	IPL 435-104-2	Solution #	Th-8b

Principal Radionuclide	Half Life, Years	Half Life, Days
$^{228\ \&\ 232}$Th	1.405E+10	5.132E+12

Radionuclide of Interest: $^{228\ \&\ 232}$Th
Parent Solution Conc.: 2.07E+02 dpm/ml

Reference Date: 11/1/1993 0:00

Chemical Composition of Standard Solution
$Th(NO_3)_4$ in 1% HNO_3

Dilution Instructions:

Dilution Solvent Used: 1% Nitric Acid

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 500.0000 ml
Total Activity: 1.0355E+05 dpm
Final Volume: 1000.00 ml

Final Activity Concentration: 1.0355E+02 dpm/ml

NOTES:

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

Expiration Date: October 9, 2013

Verified & Approved By _____ Date: 11/9/2012 0:00

QC Approval _____ Date: 11/12/12

Th-18

Isotope Products Laboratories
An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661•309•1010
Fax 661•257•8303

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Radionuclide:	Th-229	**Customer:**	EBERLINE SERVICES
Half-life:	7340 ± 160 years	**P.O. No.:**	00009633
Catalog No.:	7229	**Reference Date:**	15-Jan-02 12:00 PST
Source No.:	867-54	**Contained Radioactivity:** (Th-229 only)	1.013 µCi 37.48 kBq

Physical Description:

A. Mass of solution:	5.0147 g in 5 mL flame-sealed ampoule
B. Chemical form:	$Th(NO_3)_4$ in 0.1M HNO_3
C. Carrier content:	10µg Th/mL
D. Density:	1.0016 g/mL @ 20°C.

Radioimpurities:

None detected (daughters in equilibrium)

Radionuclide Concentration: 0.2020 µCi/g, 7.474 kBq/g

Method of Calibration:

This source was prepared from a weighed aliquot of solution whose activity in µCi/g was determined using gamma ray spectrometry.

Peak energy used for integration:	193.5 keV
Branching ratio used:	0.0441 gammas per decay

Uncertainty of Measurement:

A. Type A (random) uncertainty:	± 0.7 %
B. Type B (systematic) uncertainty:	± 3.0 %
C. Uncertainty in aliquot weighing:	± 0.0 %
D. Total uncertainty at the 99% confidence level:	± 3.1 %

Notes:

- See reverse side for leak test(s) performed on this source.
- IPL participates in a 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).
- Nuclear data was taken from IAEA Technical Report Series No. 261.
- This solution has a working life of 5 years.

Quality Control

9-Jan-02
Date Signed

IPL Ref. No.: 867-54

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
PRIMARY DILUTION RECERTIFICATION
MP 009

CURRENT DATE: 11/9/2012 0:00

SOLUTION REFERENCE #: IPL 867-54

SOLUTION #: Th-18

Principal Radionuclide	Half Life, Years	Half Life, Days
^{229}Th	7.340E+03	2.681E+06

Radionuclide: ^{229}Th

Reference Date: 1/15/2002 0:00

Certified Activity: 1.013E+00 µCi

Certified Concentration: µCi per gram

Ampoule /Solution Gross	8.7752	Weight, Grams
Empty Ampoule	3.7591	Weight, Grams
Solution Net	5.0161	Weight, Grams
Total Activity in Ampoule	1.0130	µCi

Chemical Composition of Standard Solution

$^{229}Th(NO_3)_4$ in 0.1M HNO_3

Dilution Instructions:

Dilution Solvent Used: 0.1 M HNO_3

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 1.0130 µCi Which Equals 2.249E+06 dpm at the date listed above

And after dilution the activity of this solution is 2.249E+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: October 9, 2013

Verified & Approved By _____ Date: 11/9/2012 0:00

QC Approval _____ Date: 11/12/12

EBERLINE SERVICES | QUALITY CONTROL PROGRAM
MP-009

Rev.7; 9/29/99
Title: Radioactive Reference Standards Solutions & Records

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

	MP-009	Date	11/9/2012 0:00
Solution Reference #	IPL 867-54	Solution #	Th-18a

Principal Radionuclide	Half Life, Years	Half Life, Days
^{229}Th	7.340E+03	2.681E+06

Radionuclide of Interest: ^{229}Th
Parent Solution Conc.: 2.25E+03 dpm/ml

Reference Date: 1/15/2002 0:00

Chemical Composition of Standard Solution
$TH(NO_3)_4$ in 0.1M HNO_3

Dilution Instructions:

Dilution Solvent Used: 0.1M HNO_3

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 10.0000 ml
Total Activity: 2.2490E+04 dpm
Final Volume: 1000.00 ml

Final Activity Concentration: 2.2490E+01 dpm/ml

NOTES:

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

Expiration Date: October 9, 2013

Verified & Approved By _____ Date: 11/9/2012 0:00

QC Approval _____ Date: 11/12/12

Ba-6
(f 6a)

National Institute of Standards & Technology

Certificate

Standard Reference Material 4251C
Barium-133 Radioactivity Standard

ORIGINAL

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.

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: 9/20/2012 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: September 20, 2013

Verified & Approved By _____ Date: 9/27/12

QC Approval _____ Date: 9/27/12

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	9/20/12
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

NOTES:

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

Expiration Date: September 20, 2013

Verified & Approved By _____ Date: 9/27/12

QC Approval _____ Date: 9/27/12

Ra-5

QA/QC REVIEWED
Date 2/8/94 Initials MT

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

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

Description of Solution

a. Mass of solution: 5.1864 g (in a 5 ml Flame Sealed Ampoule)

b. Chemical form: Ra(NO3)2 in 1 N HNO3

c. Carrier content: None added

d. Density: 1.0318 g/ml @ 20°C.

Radioimpurities: None detected(other than daughters)

Radioactive Daughters

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

Radionuclide Concentration

(Ra-226) 0.1929 μCi/g.

Method of Calibration

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

Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration: ±3.4%

b. Random uncertainty in assay: ±3.1%

c. Random uncertainty in weighing(s): ±0.2%

d. Total uncertainty at the 99% confidence level: ±4.6%

NIST Traceability

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

Leak Test(s)

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

Notes

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

Ann U. Kuen
QUALITY CONTROL

Feb. 3, 1994
Date Signed

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

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	11/9/2012 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	Reference Date	2/1/1994 0:00
Certified Activity	1.001E+00	µCi	
Certified Concentration		µCi per gram	

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

Chemical Composition of Standard Solution

$^{226}Ra(NO_3)_2$ 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: November 9, 2013

Verified & Approved By _____ Date: 11/9/2012

QC Approval _____ Date: 11/12/12

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

Solution Reference # IPL-453-26 | Date 11/9/2012 0:00 | Solution # Ra-5b

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

Radionuclide of Interest: ^{226}Radium
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: November 9, 2013

Verified & Approved By _____ Date: 11/9/2012 0:00

QC Approval _____ Date: 11/12/12

RA-11

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

62680-416

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):	2.585 E3
HALF-LIFE:	5.75 years
CALIBRATION DATE:	November 7, 2001 12:00 EST
TOTAL UNCERTAINTY*:	4.0%
SYSTEMATIC:	3.0%
RANDOM:	1.0%

*99% Confidence Level

Impurities: γ-impurities (other than decay products) <0.1%

5.07198 grams 0.1M HCl solution with 50 μg/g Ba carrier.

P O NUMBER 9508, Item 1 (Part #4339A)

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: [signature] 11/7/01

New vial from the 6/11/01 Shipment.
P.S. Different activity Level
[initials] 8/9/11

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
RECERTIFICATION
MP 009

CURRENT DATE: 4/16/2012 0:00

SOLUTION REFERENCE #: Analytics 62680-416 | SOLUTION #: Ra-11

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

Radionuclide: ^{228}Ra
Certified Activity: 6.986E-02 µCi
Certified Concentration: µCi per gram

Reference Date: 11/7/2001 0:00

Ampoule /Solution Gross	9.4982	Weight, Grams
Empty Ampoule	4.4895	Weight, Grams
Solution Net	5.0087	Weight, Grams
Total Activity in Ampoule	0.0699	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: 1000.00 milliliters

Certified Total Activity of: 0.0699 µCi Which Equals: 1.551E+05 dpm at the date listed above

And after dilution the activity of this solution is: 1.551E+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: April 12, 2013

Recertified By: _____ Date: 4/16/12

Verified & Approved By: _____ Date: _____

QC Approval: _____ Date: 4/16/12

SECTION VI

QUALITY CONTROL SAMPLE RESULTS SUMMARY

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	UUISO	2	pCi	l	Engineering Management Support, Inc.

Laboratory Control Sample

Analyte	Normalized Difference	LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
U-234	0.17	98.75%	14.88%	100.00%	3.60%	8.15E+00	2.93E-01	8.04E+00	1.20E+00	U-8a	3.52E+01	3.60E+00	5.13E-01
U-238	0.59	95.63%	14.99%	100.00%	3.60%	7.94E+00	2.86E-01	7.59E+00	1.14E+00	U-8a	3.44E+01	3.60E+00	5.13E-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)

Replicate Sample

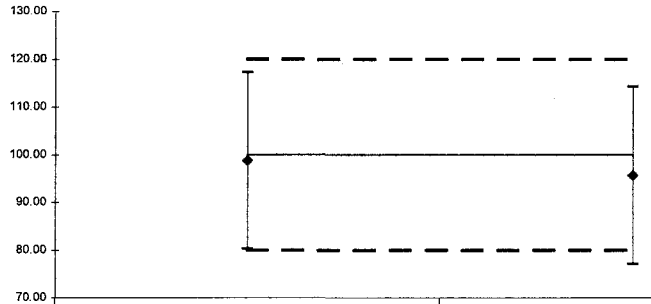
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU
U-234	0.83	42.26	7.70E-01	5.49E-01	5.01E-01	3.23E-01
U-238	0.21	22.35	1.84E-01	2.98E-01	1.47E-01	1.77E-01
U-235	0.29	27.20	2.63E-01	3.67E-01	2.00E-01	2.18E-01

QC Summary

LCS Relative Bias	LCS % R	LCS ND	MS % R	MS ND	Rep RPD	Rep ND
0.99	OK	OK			NA	OK
0.96	OK	OK			NA	OK
	OK	OK			NA	OK

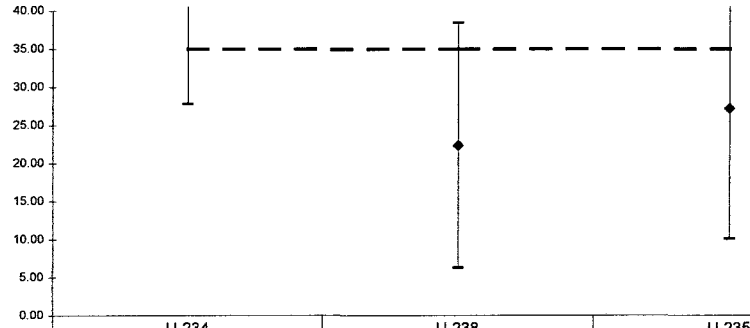
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	UUISO	2	pCi	l	Engineering Management Support, Inc.

LCS % Recovery



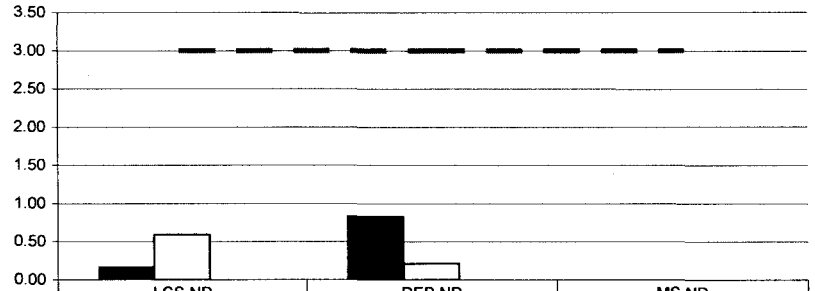
	U-234	U-238
Lower Error	80.26	77.04
Upper Error	117.23	114.22
%R	98.75	95.63
LCL	80	80
Mean	100	100
UCL	120	120

Replicate Sample RPD



	U-234	U-238	U-235
Lower Error	56.76	38.41	44.33
Upper Error	27.77	6.29	10.07
RPD	42.26	22.35	27.20
CL	35	35	35

Normalized Difference



	LCS ND	REP ND	MS ND
U-234	0.17	0.83	0.00
U-238	0.59	0.21	0.00
	0.00	0.00	0.00
UCL	3	3	3

No Matrix Spike

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	ThISO	1	pCi	l	Engineering Management Support, Inc.

Laboratory Control Sample

Analyte	Normalized Difference	LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
TH-228	0.54	105.11%	17.52%	100.00%	3.60%	4.82E+00	1.73E-01	5.06E+00	8.88E-01	Th-8b	1.04E+02	3.60E+00	1.03E-01
TH-230	1.60	86.26%	19.45%	100.00%	2.70%	5.46E+00	1.47E-01	4.71E+00	9.15E-01	Th-1b	2.35E+01	2.70E+00	5.15E-01
TH-232	0.41	96.42%	17.44%	100.00%	3.60%	4.82E+00	1.73E-01	4.65E+00	8.10E-01	Th-8b	1.04E+02	3.60E+00	1.03E-01

Matrix Spike

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

Replicate Sample

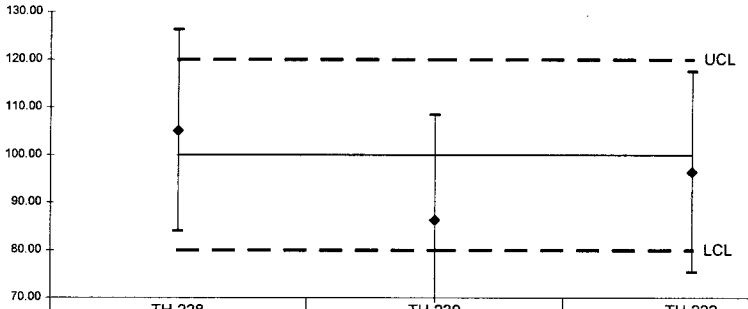
Analyte	*Normalized Difference*	*RPD*	*Original Result*	*Original CSU*	*Replicate Result*	*Replicate CSU*
TH-228	1.34	129.68	7.84E-02	8.06E-02	1.67E-02	4.02E-02
TH-230	0.18	6.87	2.88E-01	1.42E-01	2.69E-01	1.57E-01
TH-232	0.42	122.40	-1.39E-02	2.90E-02	-3.34E-03	3.91E-02

QC Summary

LCS Relative Bias	*LCS % R*	*LCS ND*	*MS % R*	*MS ND*	*Rep RPD*	*Rep ND*
1.05	OK	OK			NA	OK
0.86	OK	OK			NA	OK
0.96	OK	OK			NA	OK

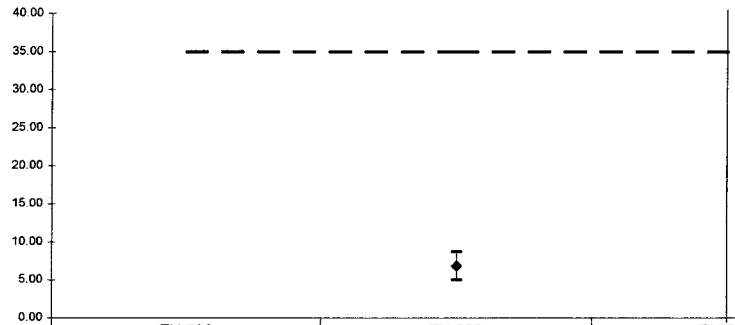
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	ThISO	1	pCi	I	Engineering Management Support, Inc.

LCS % Recovery



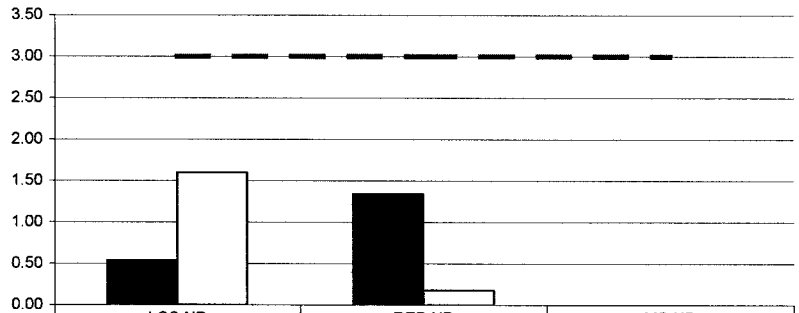
	TH-228	TH-230	TH-232
Lower Error	83.98	64.11	75.38
Upper Error	126.23	108.41	117.46
%R	105.11	86.26	96.42
LCL	80	80	80
Mean	100	100	100
UCL	120	120	120

Replicate Sample RPD



	TH-228	TH-230	TH-232
Lower Error	212.05	8.71	-119.55
Upper Error	47.32	5.03	364.35
RPD	129.68	6.87	122.40
CL	35	35	35

Normalized Difference



	LCS ND	REP ND	MS ND
TH-228	0.54	1.34	0.00
TH-230	1.60	0.18	0.00
UCL	3	3	3

No Matrix Spike

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	Ra226	1	pCi	l	Engineering Management Support, Inc.

Laboratory Control Sample

Analyte	Normalized Difference	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	0.97	89.21%	24.23%	100.00%	4.60%	1.04E+01	4.76E-01	9.24E+00	2.24E+00	Ra-5b	4.41E+01	4.60E+00	5.22E-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)*

Replicate Sample

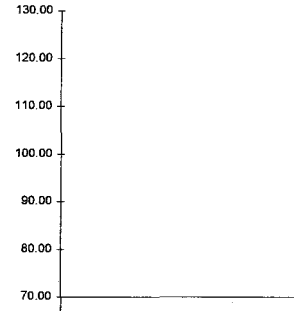
Analyte	*Normalized Difference*	*RPD*	*Original Result*	*Original CSU*	*Replicate Result*	*Replicate CSU*
RA-226	0.63	15.32	1.53E+00	5.04E-01	1.31E+00	4.46E-01

QC Summary

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

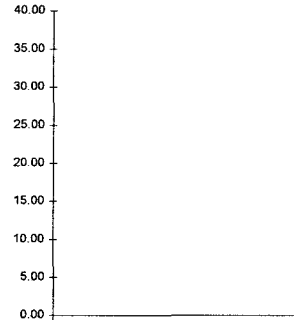
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	Ra226	1	pCi	l	Engineering Management Support, Inc.

LCS % Recovery



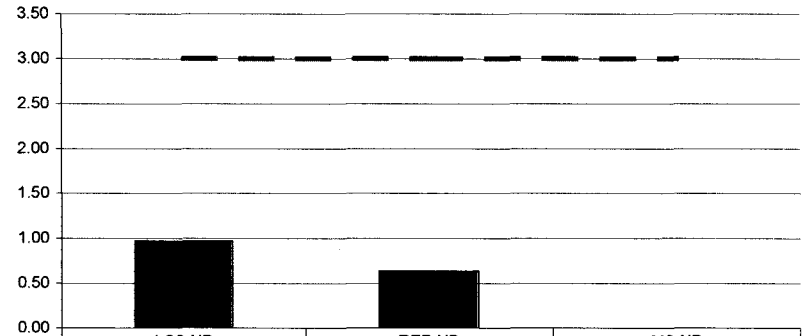
	RA-226
Lower Error	60.38
Upper Error	118.04
%R	89.21
LCL	80
Mean	100
UCL	120

Replicate Sample RPD



	RA-226
Lower Error	17.88
Upper Error	12.76
RPD	15.32
CL	35

Normalized Difference



	LCS ND	REP ND	MS ND
RA-226	0.97	0.63	0.00
UCL	3	3	3

No Matrix Spike

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	Ra228	1	pCi	l	Engineering Management Support, Inc.

Laboratory Control Sample

Analyte	Normalized Difference	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	0.35	95.75%	24.96%	100.00%	5.10%	9.02E+00	4.60E-01	8.64E+00	2.16E+00	Ra-11	3.89E+01	5.10E+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)*

Replicate Sample

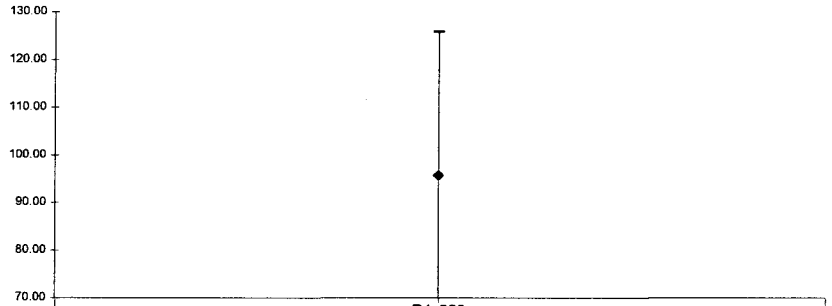
Analyte	*Normalized Difference*	*RPD*	*Original Result*	*Original CSU*	*Replicate Result*	*Replicate CSU*
RA-228	1.31	59.85	8.59E-01	4.42E-01	4.63E-01	3.95E-01

QC Summary

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

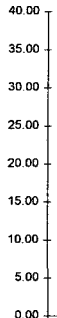
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
13-04108	Ra228	1	pCi	l	Engineering Management Support, Inc.

LCS % Recovery



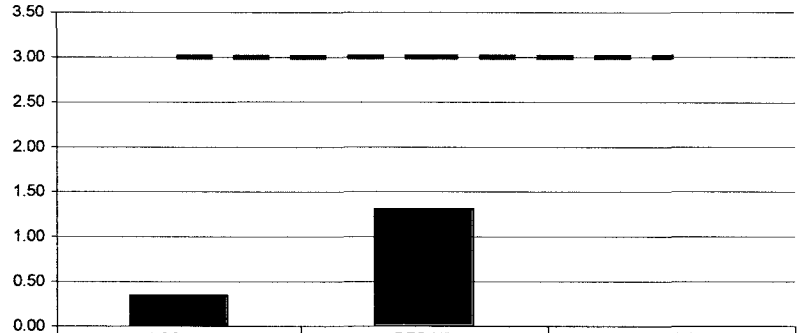
	RA-228
Lower Error	65.68
Upper Error	125.81
%R	95.75
LCL	80
Mean	100
UCL	120

Replicate Sample RPD



	RA-228
Lower Error	78.78
Upper Error	40.92
RPD	59.85
CL	35

Normalized Difference



	LCS ND	REP ND	MS ND
RA-228	0.35	1.31	0.00
UCL	3	3	3

No Matrix Spike

SECTION VII

LABORATORY TECHNICIAN'S NOTES

ISO U NOTES

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	13-04108
Analysis Code	UUISO
Run Number	2

#	Date	Dept	User	Notes
1	05/08/13 09:56	PREP	JBARNARD	ALIQUOTED AND FILTERED SAMPLES FOR DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PRESERVED SAMPLES WITH HNO3 AND DRIED SAMPLES DOWN

5/8/13

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	13-04108
Analysis Code	UUISO
Run Number	2

#	Date	Dept	User	Notes
1	05/08/13 09:56	PREP	JBARNARD	ALIQUOTED AND FILTERED SAMPLES FOR DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PRESERVED SAMPLES WITH HNO3 AND DRIED SAMPLES DOWN
2	05/09/13 18:00	CHEM	JDEMELAS	Added concentrated HCl to sample beakers and heated to dryness; Added 20 ml 8N HCL to samples and transferred to new, labeled C-Tubes, rinsing with 8N HCl to bring volume to 35 ml; Preconditioned resin columns with 35 ml 8N HCl; Centrifuged samples and loaded onto columns; Rinsed C-Tubes with 20 ml 8N HCl, centrifuged as needed and loaded onto columns; Rinsed columns with 35 ml 8N HCl – 0.1N NH4I, 35 ml of 6.5N HCl – 0.04N HF, and 10 ml of 6.5N HCl; Eluted Uranium with 50 ml of 0.5N HCl into clean, labeled 100-ml beakers; Dried-down samples on hotplate; Dissolved samples in ~10 ml of concentrated HCl; Transferred to new, labeled C-Tubes with DI H2O. Set samples aside for later precipitation and filtering.

5/9/13

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	13-04108
Analysis Code	UUISO
Run Number	2

#	Date	Dept	User	Notes
1	05/08/13 09:56	PREP	JBARNARD	ALIQUOTED AND FILTERED SAMPLES FOR DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PRESERVED SAMPLES WITH HNO3 AND DRIED SAMPLES DOWN
2	05/09/13 18:00	CHEM	JDEMELAS	Added concentrated HCl to sample beakers and heated to dryness; Added 20 ml 8N HCL to samples and transferred to new, labeled C-Tubes, rinsing with 8N HCl to bring volume to 35 ml; Preconditioned resin columns with 35 ml 8N HCl; Centrifuged samples and loaded onto columns; Rinsed C-Tubes with 20 ml 8N HCl, centrifuged as needed and loaded onto columns; Rinsed columns with 35 ml 8N HCl – 0.1N NH4I, 35 ml of 6.5N HCl – 0.04N HF, and 10 ml of 6.5N HCl; Eluted Uranium with 50 ml of 0.5N HCl into clean, labeled 100-ml beakers; Dried-down samples on hotplate; Dissolved samples in ~10 ml of concentrated HCl; Transferred to new, labeled C-Tubes with DI H2O. Set samples aside for later precipitation and filtering.
3	05/10/13 06:11	CHEM	RMARTZ	ADDED 0.1 ML NEODYMIUM CARRIER, 0.3 ML TITANOUS CHLORIDE, & 1 ML HF TO C-TUBES; LET SET SIT IN ICE BATH FOR ONE HOUR. SET UP FILTERS BY ADDING ALCOHOL & CARBON SUBSTRATE THEN ADDED SAMPLES; WHEN SAMPLES WERE THROUGH FILTERS, ADDED 10 ML DI H2O RINSES FROM C-TUBES, REMOVED FILTERS, LET DRY IN DESSICATOR, THEN SENT SET TO COUNT ROOM.

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
13-04108	
Analysis Code	Run
UUISO	2

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
013624P	Nitric Acid	Reagent Grade	JBARNARD	5/8/2013
013708P	Anion Exchange Resin	Reagent Grade	JDEMELAS	5/9/2013
013826S	HCl - HF	6.5N - 0.04N	JDEMELAS	5/9/2013
013848S	HCl - NH4I	8N - 0.1M	JDEMELAS	5/9/2013
013675D02	Hydrochloric Acid	0.5N	JDEMELAS	5/9/2013
013734S	Hydrochloric Acid	6.5N	JDEMELAS	5/9/2013
013839S	Hydrochloric Acid	8N	JDEMELAS	5/9/2013
013809P	Hydrochloric Acid	Reagent Grade	JDEMELAS	5/9/2013
013246S	Carbon substrate	Solution	RMARTZ	5/10/2013
012809P	Ethyl Alcohol	Reagent Grade	RMARTZ	5/10/2013
013221P	Hydrofluoric Acid	Reagent Grade	RMARTZ	5/10/2013
013191S	Neodymium Carrier	1 mg/ml	RMARTZ	5/10/2013
013434P	Titanous Chloride	Reagent Grade	RMARTZ	5/10/2013

Date	Sample#	Client	Load Time	Ct Time	Analysis	Tech
5/7/17	1705010A(1-4)	Ucon	1011	2hrs	AN241	C
5/7/17	1705010A(1,2)	Ucon	1011	2hrs	AN243	C
5/7/17	1705010A(3,4)	Ucon	1719	2hrs	UU250	C
5/7/17	1705010A(1-4)	Ucon	1719	2hrs	NP277	C
5/7/13	1305008A(4-5)	Unitech	1653	2hrs 50mins	UU	KB
5/7/13	1304131A (1-4)	Eng. Manag. Svc.	1654	2hr 50min	Th	KB
5/8/17	Daily Pulser	QA	0526	1 min	NA	C
5/8/17	1704125A(1,4)	Ucon	0552	2hrs	NP277	C
5/8/17	1704170A(1/4)	Energysol	0553	2hr	NP270	C
5/8/17	1704110A(1-8)	Energysol	0928	2hrs	AN241	C
5/8/17	1704110A(1-7)	Energysol	0928	2hrs	AN-241	C
5/8/13	1305010A(1-4)	UCON	1242	2hr 50min	Th	KB
5/8/13	1305010A (4)	UCON	1242	2hr 50min	Th NJ	KB
5/8/13	1304135A (1)	UCON	1243	2hr 50min	Th	KB
5/8/13	1304131A (8-13)	Eng. Manag. Svc.	1554	2hr 50min	UU	KB
5/9/17	Daily Pulser	NA	0573	1 min	NA	—
5/9/17	1704170A(1-4)	Ucon	0946	2hrs	AN241	C
5/9/17	1704170A(1,2)	Ucon	0947	2hrs	AN243	C
5/9/13	1305017A(1-4,6)	UCON	1253	2hr 50min	Np	KB
5/9/13	1304170A (1)	UCON	1253	2hr 50min	Np	KB
5/9/13	1304132A (1-6)	Eng. Manag. Svc.	1629	2hr 50min	Th	KB
5/10/17	Daily Pulser	NA	0505	1 min	NA	—
5/10/17	SECCAL	NA	0802	2hr 30m	NA	C
5/10/17	1704108A(2-7)	Energysol	1025	2hrs	UU250	C

Alpha #3

Date	Sample#	Client	Load Time	CT Time	Analyst	Tech
5/7/17	1705007A(3,4)	UCOR	1727	2hrs	NP237	C
5/7/13	1304135A(1-4,7)	UCOR	1439	2hr 50mins	PU	KB
5/7/13	1304135A (4)	UCOR	1440	2hr 50 mins	PUNT	KB
5/7/13	1305008A (1-3)	United	1442	2hr 50min	UU	KB
5/7/13	1304131A (11-19)	Eng. Manag. Su.	1745	2hr 50min	Th	KB
5/7/13	1304135A (1-2)	UCOR	1744	2hr 50min	Np	KB
5/8/17	Daily Pulser	[illegible]	0826	1hr	MCE	C
5/8/17	1704110A(6-9)	Energy Sol	0855	2hrs	NP237	C
5/8/17	1704110A(1-4)	Energy Sol	0855	2hrs	Pu Z50	—
5/8/17	1704175A(1-4)	UCOR	0859	2hrs	Ra 226	C
5/8/17	1704110A(5-9)	Energy Sol	0858	2hrs	Pu Z50	—
5/8/17	1704175A(1)	UCOR	0858	2hrs	Pu Z50	—
5/8/17	1704110A(1-5)	Energy Sol	0927	2hrs	[illegible]	C
5/8/17	1705010A(1-4,7)	UCOR	1152	2hrs	Pu Z50	C
5/8/17	1705010A(4)	UCOR	1152	2hrs	PUNT	C
5/8/13	1304131A(3-7)	Eng. Manag. Su.	1248	2hr 50min	UU	KB
5/8/13	1305010A (4)	UCOR	1513	2hr 50min	PU	KB
5/8/13	1305010A (4)	UCOR	1514	2hr 50min	PUNT	KB
5/8/13	1304131A (14-19)	Eng. Manag. Su.	1554	2hr 50min	UU	KB
5/9/17	Daily Pulser	[illegible]	0877	1hr	[illegible]	—
5/9/17	1705016A(5)	UCOR	0948	2hrs	UNZ50	C
5/9/17	1704140A (1-4)	UCOR	0949	2hrs	UNZ50	C
5/9/17	1704172A(1-6)	Energy Sol	0957	2hrs	UNZ50	—
5/9/13	1304132A(10-19)	Eng. Manag. Su.	1255	2hr 50min	UU	KB
5/9/13	1304132A(13-19)	Eng. Manag. Su.	1630	2hr 50min	Th	KB
5/10/17	Daily Pulser	[illegible]	0509	1hr	[illegible]	—
5/10/17	SEC Check	[illegible]	0526	2hrs	[illegible]	—
5/10/17	1705017A(1-4,6)	UCOR	0920	2hrs	Ra 226	C
5/10/17	1705017A(1-4,6)	UCOR	0920	2hrs	UNZ50	C
5/10/17	1704104A(1)	Energy Sol	0920	2hrs	UNZ50	C

ISO TH NOTES

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	13-04108
Analysis Code	ThISO
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:35	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PRESERVED SAMPLES WITH HNO3 AND DRIED SAMPLES DOWN

JB 4/29/13

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	13-04108
Analysis Code	ThISO
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:35	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PRESERVED SAMPLES WITH HNO3 AND DRIED SAMPLES DOWN
2	05/02/13 17:31	CHEM	JDEMELAS	Added concentrated HNO3 to sample beakers and heated to dryness; Added 20 ml 8N HNO3 to samples and transferred to new, labeled C-Tubes, adding 8N HNO3 to bring volume to 35 ml; Preconditioned resin columns with 50 ml 8N HNO3; Centrifuged samples as needed, and passed through columns; Rinsed C-Tubes with 20 ml 8N HNO3; Centrifuged rinsates and loaded onto columns; Rinsed columns with 40 ml 8N HNO3; Eluted Thorium with 50 ml of 8N HCl into clean, labeled 100-ml beakers; Dried-down samples on hotplate; Dissolved samples in ~10 ml of concentrated HCl; Transferred to new, labeled C-Tubes with deiononized water, bringing volume to ~15ml. Set samples aside for later precipitation and filtering.

5/2/13

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	13-04108
Analysis Code	ThISO
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:35	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PRESERVED SAMPLES WITH HNO3 AND DRIED SAMPLES DOWN
2	05/02/13 17:31	CHEM	JDEMELAS	Added concentrated HNO3 to sample beakers and heated to dryness; Added 20 ml 8N HNO3 to samples and transferred to new, labeled C-Tubes, adding 8N HNO3 to bring volume to 35 ml; Preconditioned resin columns with 50 ml 8N HNO3; Centrifuged samples as needed, and passed through columns; Rinsed C-Tubes with 20 ml 8N HNO3; Centrifuged rinsates and loaded onto columns; Rinsed columns with 40 ml 8N HNO3; Eluted Thorium with 50 ml of 8N HCl into clean, labeled 100-ml beakers; Dried-down samples on hotplate; Dissolved samples in ~10 ml of concentrated HCl; Transferred to new, labeled C-Tubes with deiononized water, bringing volume to ~15ml. Set samples aside for later precipitation and filtering.
3	05/03/13 06:24	CHEM	RMARTZ	ADDED 0.75 ML 0.1MG/ML CERIUM CARRIER & 1 ML HF TO C-TUBES & LET SET SIT IN ICE BATH FOR ONE HOUR; SET UP FILTERS BY ADDING ALCOHOL & CARBON SUBSTRATE THEN ADDED SAMPLES; WHEN SAMPLES WERE THROUGH FILTERS, ADDED 10 ML DI H2O RINSES FROM C-TUBES, REMOVED FILTERS, LET DRY IN DESSICATOR.

RA 5/3/13

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
13-04108	
Analysis Code	Run
ThISO	1

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
013624P	Nitric Acid	Reagent Grade	JBARNARD	4/29/2013
013721P	Anion Exchange Resin	Reagent Grade	JDEMELAS	5/2/2013
013813S	Hydrochloric Acid	8N	JDEMELAS	5/2/2013
013809P	Hydrochloric Acid	Reagent Grade	JDEMELAS	5/2/2013
013814S	Nitric Acid	8N	JDEMELAS	5/2/2013
013624P	Nitric Acid	Reagent Grade	JDEMELAS	5/2/2013
013246S	Carbon substrate	Solution	RMARTZ	5/3/2013
013017S	Cerrium Carrier	0.1mg/ml	RMARTZ	5/3/2013
012809P	Ethyl Alcohol	Reagent Grade	RMARTZ	5/3/2013
013221P	Hydrofluoric Acid	Reagent Grade	RMARTZ	5/3/2013

Alpha #1

Date	Sample #	Client	Load Time	Count Time	Analytes	Tech
5/1/13	1304106A(1-6)	Eng-Manag. Su	1248	2hr50min	Th	KB
5/1/13	1304106A(19)	Eng. Manag. Su	1616	2hr50min	Th	KB
5/1/13	1304164A(4)	UCOR	1617	2hr50min	PU	KB
5/1/13	1304105A(1-4)	Eng. Manag. Su	1618	2hr50min	Ra	KB
5/2/13	Daily Pulse	LAB	0615	10m	NA	C
5/2/13	1304105A(18,19)	Eng Man	0832	2hr50	Ra6	C
5/2/13	1304148A(1-4)	M/A	0832	2hr50	Ra6	C
5/2/13	1304176A(7,4)	UCOR	0915	2hr	U-U230	C
5/2/13	1304107A(1-4)	Eng Man	0915	2hr	U-U230	C
5/2/13	SEEDA(1-3)	LAB	1235	2hr	Ra6	C
5/2/13	1304107A(11-13)	Eng Man	1237	2hr	U-U230	C
5/2/13	1304107A(7-12)	Eng. Manag. Su	1629	2hr50min	Th	KB
5/3/13	Daily Pulse	LAB	0720	10m	NA	C
5/3/13	1304106A(1-6)	Eng Man	0844	2hr	Ra6	C
5/3/13	SEED AL	LAB	0878	2hr	NA	C
5/3/13	Seed 2A-RA (4-6)	Lab	1113	2hr50min	Ra6	KB
5/3/13	1305001A(6,9)	UCOR	1113	2hr	Pu239	C
5/3/13	1305001A(4)	UCOR	1114	2hr	Pu[illegible]	C
5/3/13	1305001A(6)	UCOR	1409	2hr50min	PUNT	KB
5/3/13	1305001A(4,6)	UCOR	1410	2hr50min	Am243	KB
5/3/13	System Bkgd	Lab	1703	16.40 hrs	α	KB
5/4/13	Daily Pulser	LAB	1123	10min	NA	C
5/4/13	1305001AP(1-4,6) Actinium	UCOR	1145	2hr	NP 237	C
5/4/13	1305001A(1)	UCOR	1145	2hr	U-U230	C
5/6/13	Daily Pulse	LAB	0521	10m	NA	C
5/6/13	1304108A(5-7)	Eng Man	0543	2hr	Th230	C

Alpha #7

Date	Sample #	Client	Load Time	Count Time	Analysis	Tech
5/2/13	1704121A(1-4)	Ucon	1238	2hrs	Th230	c
5/2/13	1704121A(1-4)	Ucon	1239	2hrs	ThNT	c
5/2/13	1704107A(1-6)	Eng Man	1239	2hrs	Th230	c
5/2/13	1304107A(13-19)	Eng. Manag. Sw	1629	2hr 50mins	Th	ICB
5/7/13	Daily Pulser	Lab	0521	10min	NA	c
5/7/13	SGC CAL	Lab	0545	2hrs	NA	c
5/7/13	1704106A(17,18)	Eng Man	0820	2hrs	Ra	c
5/7/13	1704178A(2,4)	Unitech	0524	2hrs	Am241	c
5/7/13	1705001A(1,2)	Ucon	0524	2hrs	Am241	c
5/7/13	1705001A(7,8)	Ucon	1115	2hrs	Am241	c
5/7/13	1705001A(1-4)	Ucon	1115	2hrs	Pu239	c
5/3/13	1304178A(1-4)	Unitech	1217	2hr 50min	Pu	ICB
5/3/13	1305001A(1-4,6)	UCOR	1411	2hr 50mins	Th	ICB
5/3/13	1305001A(4,6)	UCOR	1411	2hr 50mins	ThNT	ICB
5/3/13	System Bkgd	Lab	1708	16.40 hrs	–	ICB
5/14/13	Daily Pulser	Lab	1123	10min	NA	c
5/14/13	1704178A(2,4)	Unitech	1150	2hrs	U234	c
5/14/13	1704178A(1-4)	Unitech	1151	~~[illegible]~~ 2hrs	Th230	c
5/14/13	1704178A(1-4)	Unitech	1151	2hrs	NP237	c
5/16/13	Daily Pulser	Lab	0521	10min	NA	–
5/16/13	1704108A(1-7)	Eng Man	0537	2hrs	U234	c
5/16/13	1704108A(1-4)	Eng Man	0547	2hrs	Th230	c

RA-226 NOTES

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	13-04108
Analysis Code	Ra226
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:34	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS

4/29/13

EBERLINE SERVICES

Work Order Analysis Notes

Oak Ridge Laboratory
601 Scarboro Rd.
Oak Ridge, TN 37830
Voice: 865.481.0683
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Internal Work Order	13-04108
Analysis Code	Ra226
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:34	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS
2	04/30/13 13:07	PREP	LWALKER	ADDED EDTA TO PRECIP-VORTEX-LET SIT OVERNIGHT TO DIGEST.
3	05/01/13 14:51	PREP	LWALKER	FOLLOWED STEPS 12.1 TO 12.8 IN AP-006 REV 12 FOR RA 226 ANALYSIS (SYRINGE FILTERED-PRECIP-FILTERED-DRIED-OBTAIN FINAL WEIGHT) SUBMIT TO COUNT ROOM.

L. Walker
5/1/13

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
13-04108	
Analysis Code	Run
Ra226	1

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
013376P	Ammonium Hydroxide	Reagent Grade	JBARNARD	4/29/2013
012766D14	Barium Carrier	1 mg/ml	JBARNARD	4/29/2013
012729D07	Lead Carrier	166 mg/ml	JBARNARD	4/29/2013
013624P	Nitric Acid	Reagent Grade	JBARNARD	4/29/2013
013575D02	Ammonium Sulfate	200 mg/ml	JBARNARD	4/29/2013
013788S	EDTA	0.25M	LWALKER	4/30/2013
011383P	Acetic Acid	Reagent Grade	LWALKER	5/1/2013
013575D02	Ammonium Sulfate	200 mg/ml	LWALKER	5/1/2013

Alpha #3

Date	Sample #	Client	Load Time	CT Time	Analysis	Tech
4/27/13	1304104A(13-19)	Eng. Manag. Su.	1049	2hr 50min	U	KB
4/27/13	1304113A(1-4)	UCOR	1049	2hr 50min	Np	KB
4/29/13	Daily Pulse	[illegible]	0521	1 min	[illegible]	—
4/29/13	1304105A(17-18)	Eng Man	1000	2hr	U232	c
4/29/13	1304104A(1-4)	Eng Man	1000	2hr	Th228	c
4/29/13	1304104A(17-19)	Eng. Manag. Su	1259	2hr 50min	Th	KB
4/29/13	1304113A(4)	UCOR	1700	2hr 50min	Th	KB
4/29/13	1304113A(4)	UCOR	1701	2hr 50min	ThNT	KB
4/29/13	1304104A(1-6)	Eng. Man	1701	2hr	Ra226	c
~~4/29/13~~	~~1304104A(13~~	~~Eng. Manag. Su~~	KB 4/29/13	~~2hr 50min~~	~~Rad~~	~~KB~~
4/29/13	1304104A(13-19)	Eng. Manag. Su	1620	2hr 50min	Rad	KB
4/30/13	Daily Pulse	[illegible]	0521	1 min	[illegible]	c
4/30/13	1304166A(1-4)	UCOR	0848	2hr	Am243	c
4/30/13	1304121A(1-4)	UCOR	0849	2hr	Am241	c
4/30/13	1304121A(1-4)	UCOR	0849	2hr	Am243	c
4/30/13	1304121A(4)	UCOR	1147	2hr	Pu238	c
4/30/13	1304121ANT(4)	UCOR	1148	2hr	PuNT	c
4/30/13	1304105A(4-9)	Eng Man	1148	2hr	Th230	c
4/30/13	1304106A(3-13)	Eng. Manag. Su.	1443	2hr 50min	U	KB
5/1/13	Daily Pulse	[illegible]	0526	1 min	[illegible]	—
5/1/13	1304089A(1-4)	UCOR	0854	2hr	Po210	c
5/1/13	1304166A(3,4)	UCOR	0941	2hr	Th230	c
5/1/13	1304166ANT(4)	UCOR	0941	2hr	ThNT	c
5/1/13	1304121A(1-4)	UCOR	0941	2hr	U[illegible]	c
5/1/13	1304121A(1-4)	UCOR	1206	2hr 50min	Rad	KB
5/1/13	1304089A(1)	UCOR	1247	2hr 50min	Po210	KB
5/1/13	1304106A(13-17)	Eng. Manag. Sv.	1249	2hr 50min	Th	KB
5/1/13	1304105A(11-17)	Eng. Manag. Su.	1619	2hr 50min	Rad	KB
5/1/13	1304166A(1-4)	UCOR	1619	2hr 50min	Rad	KB
5/2/13	Daily Pulse	[illegible]	0515	1 min	[illegible]	—
5/2/13	1304108A(1-7)	Eng Man	0537	2hr	Rad	c

RA-228 NOTES

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	13-04108
Analysis Code	Ra228
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:34	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS

4/29/13

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	13-04108
Analysis Code	Ra228
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:34	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS
2	05/02/13 13:12	PREP	LWALKER	RECEIVED FILTERS BACK FROM COUNT ROOM-PUT BACK INTO C-TUBES-ADDED EDTA AND SWIRLED-LET SIT OVERNIGHT TO DIGEST.
3	05/03/13 20:29	PREP	LWALKER	FOLLOWED STEPS 12.1 TO 12.7 IN AP-007 REV 17 (CHEMICAL CLEANUP FOR RA 228)

L. Walker
5/3/13

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	13-04108
Analysis Code	Ra228
Run Number	1

#	Date	Dept	User	Notes
1	04/29/13 10:34	PREP	JBARNARD	ALIQUOTED AND FILTERED DISSOLVED FRACTIONS- ADDED SPIKES AND TRACERS- PH'D SAMPLES- PRECIPITATED WITH BA AND PB CARRIERS AND AMMONIUM SULFATE- DECANTED SAMPLES AND CENTRIFUGED- SUBMITTED RADIUM PRECIP TO SEPARATIONS
2	05/02/13 13:12	PREP	LWALKER	RECEIVED FILTERS BACK FROM COUNT ROOM-PUT BACK INTO C-TUBES-ADDED EDTA AND SWIRLED-LET SIT OVERNIGHT TO DIGEST.
3	05/03/13 20:29	PREP	LWALKER	FOLLOWED STEPS 12.1 TO 12.7 IN AP-007 REV 17 (CHEMICAL CLEANUP FOR RA 228)
4	05/06/13 07:18	CHEM	TSMITH	Followed steps 12.7 to 12.15 in AP-007 rev. 17 . (Precipitated samples, hot bathed, centrifuged, and discarded supernate. Dissolved precip, precipitated samples, hot bathed, centrifuged, and discarded supernate. Dissolved precip, precipitated and filtered samples, obtained final weights, covered with aluminum foil, and took to count room)

5-6-13

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
13-04108	
Analysis Code	Run
Ra228	1

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
013376P	Ammonium Hydroxide	Reagent Grade	JBARNARD	4/29/2013
012766D14	Barium Carrier	1 mg/ml	JBARNARD	4/29/2013
012729D07	Lead Carrier	166 mg/ml	JBARNARD	4/29/2013
013624P	Nitric Acid	Reagent Grade	JBARNARD	4/29/2013
013575D02	Ammonium Sulfate	200 mg/ml	JBARNARD	4/29/2013
011504D21	Ammonium Sulfide	2%	LWALKER	5/3/2013
012729D08	Lead Carrier	1.5 mg/ml	LWALKER	5/3/2013
013797P	Nitric Acid	Reagent Grade	LWALKER	5/3/2013
013690S	Sodium Hydroxide	10M	LWALKER	5/3/2013
013587S	Yttrium Carrier	9 mg/ml	LWALKER	5/3/2013
012717D04	Ammonium Oxalate	5%	TSMITH	5/6/2013
013624D03	Nitric Acid	1N	TSMITH	5/6/2013
013290D18	Nitric Acid	6N	TSMITH	5/6/2013
013690S	Sodium Hydroxide	10M	TSMITH	5/6/2013
013065D04	Sodium Hydroxide	18M	TSMITH	5/6/2013

LB4110 REP

Date	Sample #	Client	Load time	C.T. Time	Analysis	Seal
5/16/17	E77pl	LAS	0529	7	SR	C
5/16/17	DIL6000	LAS	0407		SR	—
5/16/17	1704094S(4-8)	NYPE	0744	7	SR904	C
5/16/17	1704094S4(1)	NYPE	0744	70	SR904	C
5/16/17	1704094SM(4-8)	NYPE	0822	7	SR707	C
5/16/17	1704108RA(1-7)	Engl	1017	7	RA8	C

SECTION VIII

ANALYTICAL DATA (ISOTOPIC URANIUM)

Eberline Services
Oak Ridge Laboratory
Analysis Sheet

13-04108
UUISO
Run 2

Work Order	13-04108
Analysis Code	UUISO
Run	2
Date Received	4/16/2013
Lab Deadline	5/7/2013
Client	Engineering Management Support, Inc.
Project	West Lake OU-1
Report Level	4
Activity Units	pCi
Aliquot Units	l
Matrix	WA
Method	NAS NS-3050 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	U-232
Radiometric Sol#	U-10a
Tracer Act (dpm/g)	19.087
Carrier	
Carrier Conc (mg/ml)	

Internal Fraction	*Sample Desc*	*Client ID*	*Login CPM*	*Sample Date*	*Sample Aliquot*
01	LCS	LCS		04/16/13 00:00	1.0000E+00
02	MBL	BLANK		04/16/13 00:00	1.0000E+00
03	DUP	DUP 06 TOT	38	04/11/13 00:00	2.5000E-01
04	DO	DUP 06 TOT	38	04/11/13 00:00	2.5000E-01
05	TRG	DUP 06 DIS	38	04/11/13 00:00	2.5000E-01
06	TRG	I-4 TOT	42	04/12/13 13:20	2.5000E-01
07	TRG	I-4 DIS	42	04/12/13 13:20	2.5000E-01

0081

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

13-04108
UUISO
Run 2

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	0.6090	11.6		0.00								
02	MBL	0.6056	11.6		0.00								
03	DUP	0.6009	11.5		0.00								
04	DO	0.5952	11.4		0.00								
05	TRG	0.5906	11.3		0.00								
06	TRG	0.5919	11.3		0.00								
07	TRG	0.6019	11.5		0.00								

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

13-04108
UUISO
Run 2

Internal Fraction	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep t0 Date/Time	Sep t0 By	Sep t1 Date/Time	Sep t1 By
01	LCS			05/08/13 09:01	JBARNARD				
02	MBL			05/08/13 09:01	JBARNARD				
03	DUP			05/08/13 09:01	JBARNARD				
04	DO			05/08/13 09:01	JBARNARD				
05	TRG			05/08/13 09:01	JBARNARD				
06	TRG			05/08/13 09:01	JBARNARD				
07	TRG			05/08/13 09:01	JBARNARD				

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

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-UUISO-2

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
Analysis Code: UUISO
Run: 2

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	U-234	LCS	LCS	pCi/l	8.04E+00	1.05E+00	6.48E-02	8.15E+00	98.75	OK		OK	
02	U-234	MBL	BLANK	pCi/l	1.76E-03	2.46E-02	7.01E-02					OK	OK
03	U-234	DUP	DUP 06 TOT	pCi/l	5.01E-01	3.21E-01	3.26E-01				NA	OK	
04	U-234	DO	DUP 06 TOT	pCi/l	7.70E-01	5.46E-01	5.40E-01					OK	
05	U-234	TRG	DUP 06 DIS	pCi/l	4.05E-01	2.79E-01	2.24E-01					OK	
06	U-234	TRG	I-4 TOT	pCi/l	1.05E+00	5.75E-01	3.17E-01					OK	
07	U-234	TRG	I-4 DIS	pCi/l	9.12E-02	2.88E-01	6.11E-01					OK	

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
Analysis Code: UUISO
Run: 2

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	U-234	LCS	04/16/13 00:00	1.00E+00	128.01	0.00	0.00			
02	U-234	MBL	04/16/13 00:00	1.00E+00	129.83	0.00	0.00			
03	U-234	DUP	04/11/13 00:00	2.50E-01	123.35	0.00	0.00			
04	U-234	DO	04/11/13 00:00	2.50E-01	62.94	0.00	0.00			
05	U-234	TRG	04/11/13 00:00	2.50E-01	114.97	0.00	0.00			
06	U-234	TRG	04/12/13 13:20	2.50E-01	74.71	0.00	0.00			
07	U-234	TRG	04/12/13 13:20	2.50E-01	71.27	0.00	0.00			

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-UUISO-2

Run: 2
Analysis Code: UUISO
Eberline Services Work Order: 13-04108
Client: Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	U-234	LCS	05/10/13 09:20		A_Spec	Alpha_048	170	6.51 E+02	3.00 E-03	16.8
02	U-234	MBL	05/10/13 10:35		A_Spec	Alpha_003	170	1.50 E-01	5.00 E-03	17.5
03	U-234	DUP	05/10/13 10:35		A_Spec	Alpha_004	170	1.13 E+01	1.00 E-02	19.4
04	U-234	DO	05/10/13 10:35		A_Spec	Alpha_010	170.02	8.98 E+00	6.00 E-03	19.7
05	U-234	TRG	05/10/13 10:35		A_Spec	Alpha_011	170.02	8.66 E+00	2.00 E-03	19.7
06	U-234	TRG	05/10/13 10:35		A_Spec	Alpha_013	170	1.38 E+01	1.00 E-03	18.7
07	U-234	TRG	05/10/13 10:35		A_Spec	Alpha_014	170	1.13 E+00	1.10 E-02	18.5

Run: 2
Analysis Code: UUISO
Eberline Services Work Order: 13-04108
Client: Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	U-238	LCS	LCS	pCi/l	7.59E+00	1.00E+00	5.88E-02	7.94E+00	95.63	OK		OK	
02	U-238	MBL	BLANK	pCi/l	2.71E-02	4.04E-02	6.58E-02					OK	OK
03	U-238	DUP	DUP 06 TOT	pCi/l	1.47E-01	1.76E-01	2.49E-01				NA	OK	
04	U-238	DO	DUP 06 TOT	pCi/l	1.84E-01	2.98E-01	5.11E-01					OK	
05	U-238	TRG	DUP 06 DIS	pCi/l	2.72E-01	2.26E-01	1.95E-01					OK	
06	U-238	TRG	I-4 TOT	pCi/l	1.37E-01	2.66E-01	4.99E-01					OK	
07	U-238	TRG	I-4 DIS	pCi/l	-8.20E-02	1.71E-01	5.06E-01					OK	

Work Order: 13-04108-UUISO-2

Run	Analysis Code	Eberline Services Work Order	Client
2	UUISO	13-04108	Engineering Management Support, Inc.

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	U-238	LCS	04/16/13 00:00	1.00E+00	128.01	0.00	0.00			
02	U-238	MBL	04/16/13 00:00	1.00E+00	129.83	0.00	0.00			
03	U-238	DUP	04/11/13 00:00	2.50E-01	123.35	0.00	0.00			
04	U-238	DO	04/11/13 00:00	2.50E-01	62.94	0.00	0.00			
05	U-238	TRG	04/11/13 00:00	2.50E-01	114.97	0.00	0.00			
06	U-238	TRG	04/12/13 13:20	2.50E-01	74.71	0.00	0.00			
07	U-238	TRG	04/12/13 13:20	2.50E-01	71.27	0.00	0.00			

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
Analysis Code: UUISO
Run: 2

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	U-238	LCS	05/10/13 09:20		A_Spec	Alpha_048	170	6.18 E+02	2.00 E-03	16.8
02	U-238	MBL	05/10/13 10:35		A_Spec	Alpha_003	170	2.32 E+00	4.00 E-03	17.5
03	U-238	DUP	05/10/13 10:35		A_Spec	Alpha_004	170	3.32 E+00	4.00 E-03	19.4
04	U-238	DO	05/10/13 10:35		A_Spec	Alpha_010	170.02	2.15 E+00	5.00 E-03	19.7
05	U-238	TRG	05/10/13 10:35		A_Spec	Alpha_011	170.02	5.83 E+00	1.00 E-03	19.7
06	U-238	TRG	05/10/13 10:35		A_Spec	Alpha_013	170	1.81 E+00	7.00 E-03	18.7
07	U-238	TRG	05/10/13 10:35		A_Spec	Alpha_014	170	-1.02 E+00	6.00 E-03	18.5

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-UUISO-2

Run: 2
Analysis Code: UUISO
Eberline Services Work Order: 13-04108
Client: Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	U-235	LCS	LCS	pCi/l	6.55E-01	2.10E-01	9.13E-02					OK	
02	U-235	MBL	BLANK	pCi/l	-7.37E-03	2.95E-02	7.58E-02					OK	OK
03	U-235	DUP	DUP 06 TOT	pCi/l	2.00E-01	2.17E-01	2.62E-01				NA	OK	
04	U-235	DO	DUP 06 TOT	pCi/l	2.63E-01	3.66E-01	5.55E-01					OK	
05	U-235	TRG	DUP 06 DIS	pCi/l	8.60E-02	1.64E-01	3.03E-01					OK	
06	U-235	TRG	I-4 TOT	pCi/l	2.66E-01	3.22E-01	3.92E-01					OK	
07	U-235	TRG	I-4 DIS	pCi/l	2.48E-01	3.45E-01	5.23E-01					OK	

Run: 2
Analysis Code: UUISO
Eberline Services Work Order: 13-04108
Client: Engineering Management Support, Inc.

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	U-235	LCS	04/16/13 00:00	1.00E+00	128.01	0.00	0.00			
02	U-235	MBL	04/16/13 00:00	1.00E+00	129.83	0.00	0.00			
03	U-235	DUP	04/11/13 00:00	2.50E-01	123.35	0.00	0.00			
04	U-235	DO	04/11/13 00:00	2.50E-01	62.94	0.00	0.00			
05	U-235	TRG	04/11/13 00:00	2.50E-01	114.97	0.00	0.00			
06	U-235	TRG	04/12/13 13:20	2.50E-01	74.71	0.00	0.00			
07	U-235	TRG	04/12/13 13:20	2.50E-01	71.27	0.00	0.00			

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-UUISO-2

Run: 2
Analysis Code: UUISO
Eberline Services Work Order: 13-04108
Client: Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	U-235	LCS	05/10/13 09:20		A_Spec	Alpha_048	170	4.30 E+01	0.00 E+00	16.8
02	U-235	MBL	05/10/13 10:35		A_Spec	Alpha_003	170	-5.10 E-01	3.00 E-03	17.5
03	U-235	DUP	05/10/13 10:35		A_Spec	Alpha_004	170	3.66 E+00	2.00 E-03	19.4
04	U-235	DO	05/10/13 10:35		A_Spec	Alpha_010	170.02	2.49 E+00	3.00 E-03	19.7
05	U-235	TRG	05/10/13 10:35		A_Spec	Alpha_011	170.02	1.49 E+00	3.00 E-03	19.7
06	U-235	TRG	05/10/13 10:35		A_Spec	Alpha_013	170	2.83 E+00	1.00 E-03	18.7
07	U-235	TRG	05/10/13 10:35		A_Spec	Alpha_014	170	2.49 E+00	3.00 E-03	18.5

Count Room Report
Client: Engineering Management Su

13-04108-UUISO-2 (pCi/l) in WA
Tracer ID: U-10a

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	04/16/13 00:00	1.0000	0.6090	11.6240		0.00		
02	MBL	BLANK	04/16/13 00:00	1.0000	0.6056	11.5591		0.00		
03	DUP	DUP 06 TOT	04/11/13 00:00	0.2500	0.6009	11.4694		0.00		
04	DO	DUP 06 TOT	04/11/13 00:00	0.2500	0.5952	11.3606		0.00		
05	TRG	DUP 06 DIS	04/11/13 00:00	0.2500	0.5906	11.2728		0.00		
06	TRG	I-4 TOT	04/12/13 13:20	0.2500	0.5919	11.2976		0.00		
07	TRG	I-4 DIS	04/12/13 13:20	0.2500	0.6019	11.4885		0.00		

3569

Spike and Tracer Worksheet

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
13-04108	2	UUISO	5/8/2013 9:01	JBARNARD		

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*
U-234	U-8a	35.240	5/8/2013	0.500	0.5132				8.15	0.293	0.00	0.000	0.00	0.000	0.00	0.000
U-238	U-8a	34.350	5/8/2013	0.500	0.5132				7.94	0.286	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	U-232	U-10a	19.087	5/8/2013	0.6090	0.6300
02	U-232	U-10a	19.087	5/8/2013	0.6056	0.6300
03	U-232	U-10a	19.087	5/8/2013	0.6009	0.6300
04	U-232	U-10a	19.087	5/8/2013	0.5952	0.6300
05	U-232	U-10a	19.087	5/8/2013	0.5906	0.6300
06	U-232	U-10a	19.087	5/8/2013	0.5919	0.6300
07	U-232	U-10a	19.087	5/8/2013	0.6019	0.6300

Balance Printer Tapes

Tracer

0.6090 g
0.6056 g
-0.6009 g
-0.5952 g
-0.5906 g
-0.5919 g
-0.6019 g

LCS

0.5132 g

Matrix Spike

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Printed: 5/8/2013 9:01 AM

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
13-04108	2	UUISO	liters	5/7/2013	JBARNARD

Lab Fraction	Engineering Management Support, Inc. Client ID	Sample Type	Muffle Data	Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
			Ratio Post/Pre	No of Dils	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq
01	LCS	LCS					1.0000E+00	1.0000E+00				
02	BLANK	MBL					1.0000E+00	1.0000E+00				
03	DUP 06 TOT	DUP					2.5000E-01	2.5000E-01				
04	DUP 06 TOT	DO					2.5000E-01	2.5000E-01				
05	DUP 06 DIS	TRG					2.5000E-01	2.5000E-01				
06	I-4 TOT	TRG					2.5000E-01	2.5000E-01				
07	I-4 DIS	TRG					2.5000E-01	2.5000E-01				

Comments	

Technician: _____ Date: 5/8/13

Apex-Alpha™

Sample Description: SPIKE
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000576
Batch Identification: 1304108B-UU
Sample Identification: 01
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_048
Chamber Serial Number: 02030596B
Detector Serial Number: 83111
Env. Background: System Bkgd 56382
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 5/10/2013 7:24:25 AM
Acquisition Date/Time: 5/10/2013 9:20:53 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.609 mL
Effective Efficiency: 0.2150 +/- 0.0116
Counting Efficiency: 0.1680 +/- 0.0030 on 12/16/2012 5:49:20 PM
Chem. Recovery Factor: 1.2801 +/- 0.0726

Control Certificate Name: NatU_U-8A
Chem. Recov. of Control: U-238 0.932213 +/- 0.068630
Peak Match Tolerance: 0.150 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T	5.272	422.49	9.54	0.51	0.00E+000	13.3
U-234		4.723	651.49	7.68	0.51	0.00E+000	33.9
U-235		4.390	43.00	30.24	0.00	0.00E+000	3.0
U-238		4.139	617.66	7.89	0.34	0.00E+000	28.2

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.993	5302.50*	5.22E+000 +/- 5.51E-001	6.48E-002 +/- 6.84E-003
U-234	0.990	4761.50*	8.04E+000 +/- 1.05E+000	6.48E-002 +/- 6.84E-003
U-235	1.000	4385.50*	6.55E-001 +/- 2.10E-001	9.13E-002 +/- 9.64E-003
U-238	0.986	4184.40*	7.59E+000 +/- 1.00E+000	5.88E-002 +/- 6.20E-003

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5/10/13

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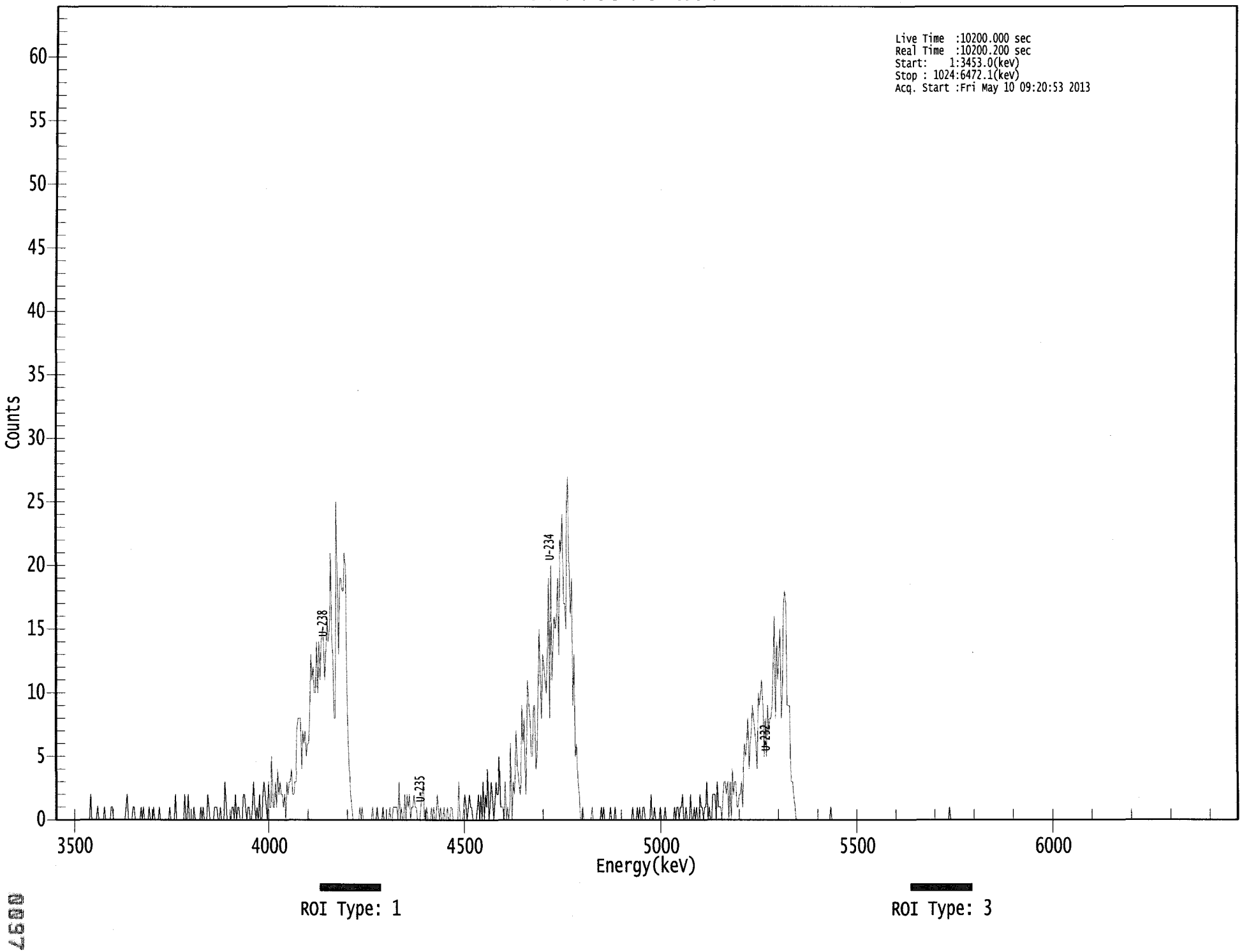

0097

****
***** 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	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	2	0
33:	0	0	0	0	1	0	0	0
41:	0	0	1	0	0	0	0	0
49:	1	1	0	0	0	0	0	0
57:	0	0	0	0	0	1	2	0
65:	0	0	0	1	1	0	0	0
73:	0	0	1	0	1	0	0	0
81:	0	1	0	0	0	1	0	0
89:	0	0	1	0	0	0	0	0
97:	0	0	0	1	0	0	0	0
105:	2	0	0	0	0	0	0	0
113:	2	0	0	2	0	0	0	0
121:	1	0	0	0	0	0	1	0
129:	1	0	0	0	2	1	0	0
137:	0	0	1	1	1	0	0	1
145:	0	0	0	3	1	0	0	0
153:	0	1	1	0	2	0	1	1
161:	0	0	0	2	2	1	0	1
169:	1	0	0	1	3	1	0	1
177:	0	2	0	0	2	3	2	1
185:	0	3	1	1	5	1	1	3
193:	1	4	2	3	2	2	1	2
201:	0	3	2	3	3	4	2	2
209:	3	3	7	8	8	8	4	7
217:	6	7	5	6	6	8	13	11
225:	12	10	10	14	10	14	11	14
233:	15	14	11	13	16	14	15	21
241:	14	13	8	8	25	19	13	19
249:	19	18	18	21	20	11	7	4
257:	2	1	0	0	0	0	0	0
265:	1	0	1	0	0	0	0	0
273:	0	0	0	1	0	0	0	1
281:	0	0	0	0	1	0	0	0
289:	0	0	1	0	0	1	1	1
297:	1	0	3	0	1	0	0	2
305:	0	2	1	2	0	1	1	2
313:	1	1	0	0	0	1	2	3
321:	0	0	1	0	0	0	1	0
329:	1	0	0	2	1	0	1	0
337:	0	1	0	0	1	0	0	1
345:	1	0	0	0	0	0	3	0
353:	0	0	1	2	1	0	1	2
361:	1	1	0	0	0	0	1	2

369:	0	2	0	3	0	2	1	4

Sample Title: 01

Channel								
377:	0	1	3	2	0	1	3	2
385:	2	5	1	1	1	0	3	0
393:	1	0	1	6	0	3	2	4
401:	7	4	3	2	3	9	6	8
409:	2	6	11	9	8	5	5	9
417:	9	4	5	10	15	11	8	13
425:	12	11	10	13	19	8	20	11
433:	14	16	15	16	19	13	22	21
441:	24	17	17	15	25	27	19	16
449:	19	9	13	5	6	3	2	0
457:	0	1	0	0	0	0	0	0
465:	0	1	0	0	0	0	0	0
473:	0	1	0	1	0	0	0	0
481:	0	1	0	0	0	1	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	1	0	0	0
505:	1	0	1	0	0	1	1	0
513:	0	0	0	0	2	0	0	1
521:	0	0	0	0	1	0	0	0
529:	1	0	0	0	0	0	0	0
537:	1	0	1	1	0	1	1	2
545:	0	0	1	0	0	0	2	0
553:	0	1	0	1	0	0	2	1
561:	1	0	1	1	3	0	1	0
569:	0	2	2	2	0	3	1	1
577:	1	0	2	3	3	2	3	0
585:	3	0	4	2	3	3	1	1
593:	2	2	3	1	4	6	5	6
601:	8	4	6	7	9	8	7	6
609:	4	10	9	10	11	9	5	8
617:	5	9	7	8	8	9	12	16
625:	8	14	11	13	15	8	10	17
633:	18	17	9	9	9	3	3	2
641:	1	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	1
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	1	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: 01

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	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™

Sample Description: BLANK
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000576
Batch Identification: 1304108B-UU
Sample Identification: 02
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_003
Chamber Serial Number:
Detector Serial Number: 3
Env. Background: System Bkgd 56360
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 5/10/2013 7:24:25 AM
Acquisition Date/Time: 5/10/2013 10:35:19 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.606 mL
Effective Efficiency: 0.2267 +/- 0.0120
Counting Efficiency: 0.1746 +/- 0.0033 on 12/15/2012 11:26:47 AM
Chem. Recovery Factor: 1.2983 +/- 0.0728

Peak Match Tolerance: 0.150 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T	5.276	442.98	9.32	1.02	0.00E+000	22.6
U-234		4.617	0.15	1397.8	0.85	0.00E+000	3.0
U-235		4.396	-0.51	400.63	0.51	0.00E+000	0.0
U-238		4.120	2.32	149.12	0.68	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.995	5302.50*	5.19E+000 +/- 5.37E-001	7.38E-002 +/- 7.64E-003
U-234	0.862	4761.50*	1.76E-003 +/- 2.46E-002	7.01E-002 +/- 7.26E-003
U-235	0.999	4385.50*	-7.37E-003 +/- 2.95E-002	7.58E-002 +/- 7.85E-003
U-238	0.971	4184.40*	2.71E-002 +/- 4.04E-002	6.58E-002 +/- 6.81E-003

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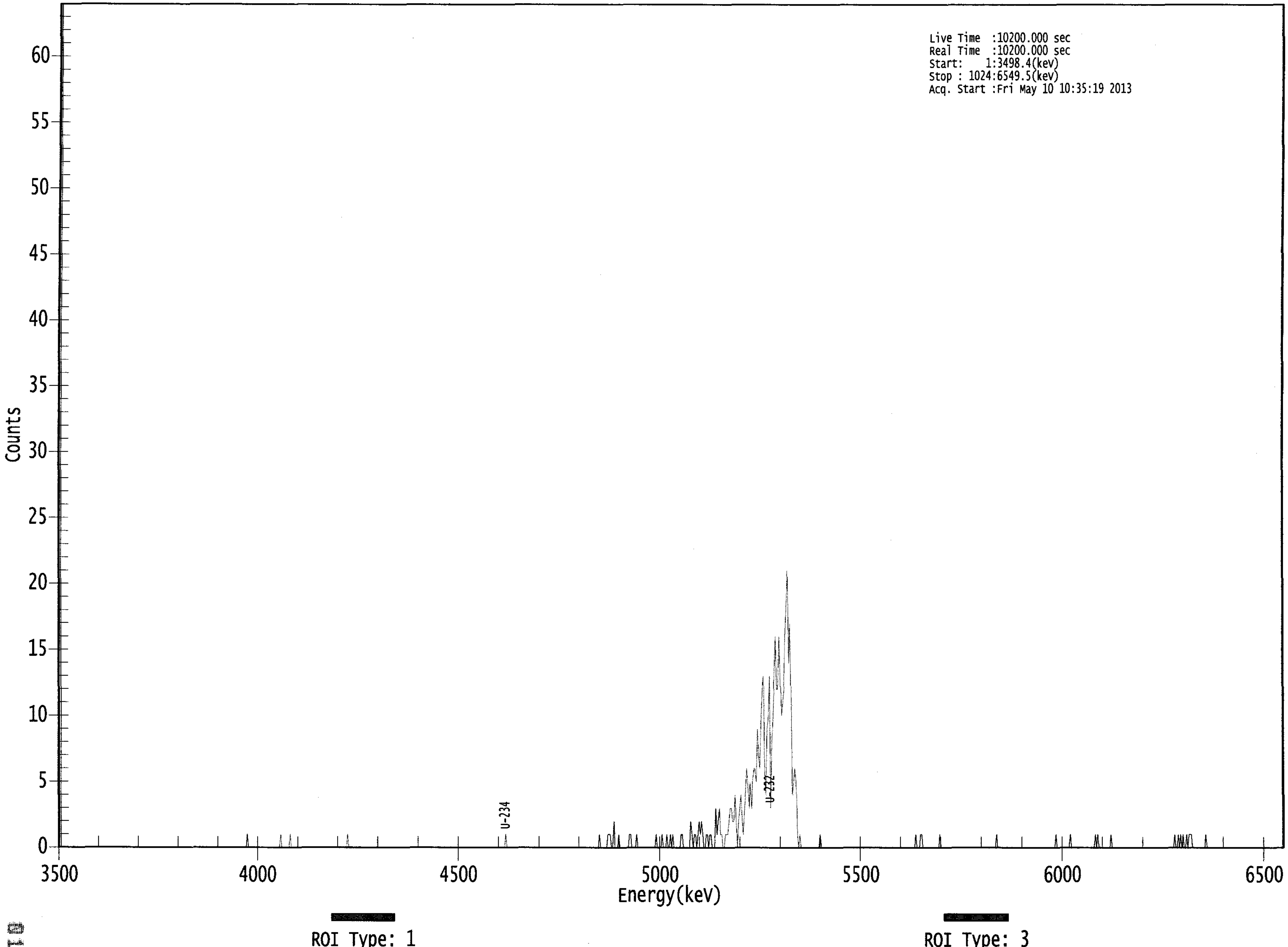
5/10/13

0000057653.CNF



0102

****
***** 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:	10200	10200	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	1
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	1	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	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	1	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	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

369:	0	0	0	0	0	0	0	1

Sample Title: 02

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	0	0	0	1	0	0
457:	0	0	0	0	1	1	1	0
465:	0	2	0	0	0	1	0	0
473:	0	0	0	0	0	0	1	1
481:	0	0	0	0	1	0	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	1	0	0	0
505:	0	1	0	0	0	1	0	0
513:	1	0	1	0	0	0	0	0
521:	0	1	1	0	0	0	0	0
529:	0	2	1	0	1	1	0	1
537:	2	1	2	1	0	0	1	1
545:	0	1	1	0	0	0	3	1
553:	2	3	1	1	0	0	1	1
561:	1	2	3	3	2	2	4	2
569:	0	2	3	4	2	1	3	4
577:	6	5	3	5	3	5	6	6
585:	5	9	7	6	10	12	13	6
593:	4	9	10	13	3	8	10	13
601:	16	12	12	16	13	10	11	12
609:	16	19	21	14	17	11	4	5
617:	6	5	1	0	1	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	1	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	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	1	0	0
721:	0	1	1	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	1	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:	1	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	1	0	0	0	0	0	0
841:	0	0	0	0	0	1	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	1	0	1	0	0	0
873:	0	0	0	0	0	0	0	1
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	1	0	0	1
937:	0	1	0	1	0	0	1	0
945:	1	1	1	0	0	0	0	0
953:	0	0	0	0	0	0	1	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™

Sample Description: DUP 06 TOT-DUP
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000576
Batch Identification: 1304108B-UU
Sample Identification: 03
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_004
Chamber Serial Number:
Detector Serial Number: 4
Env. Background: System Bkgd 56361
Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter
Sample Date/Time: 4/11/2013 7:24:25 AM
Acquisition Date/Time: 5/10/2013 10:35:20 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.601 mL
Effective Efficiency: 0.2393 +/- 0.0124
Counting Efficiency: 0.1940 +/- 0.0036 on 12/15/2012 11:26:46 AM
Chem. Recovery Factor: 1.2335 +/- 0.0679

Peak Match Tolerance: 0.150 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T	5.273	463.98	9.11	1.02	0.00E+000	22.7
U-234		4.766	11.30	63.23	1.70	0.00E+000	4.4
U-235		4.403	3.66	107.87	0.34	0.00E+000	2.9
U-238		4.111	3.32	119.77	0.68	0.00E+000	2.9

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.994	5302.50*	2.06E+001 +/- 2.09E+000	2.80E-001 +/- 2.84E-002
U-234	1.000	4761.50*	5.01E-001 +/- 3.21E-001	3.26E-001 +/- 3.31E-002
U-235	0.998	4385.50*	2.00E-001 +/- 2.17E-001	2.62E-001 +/- 2.66E-002
U-238	0.962	4184.40*	1.47E-001 +/- 1.76E-001	2.49E-001 +/- 2.53E-002

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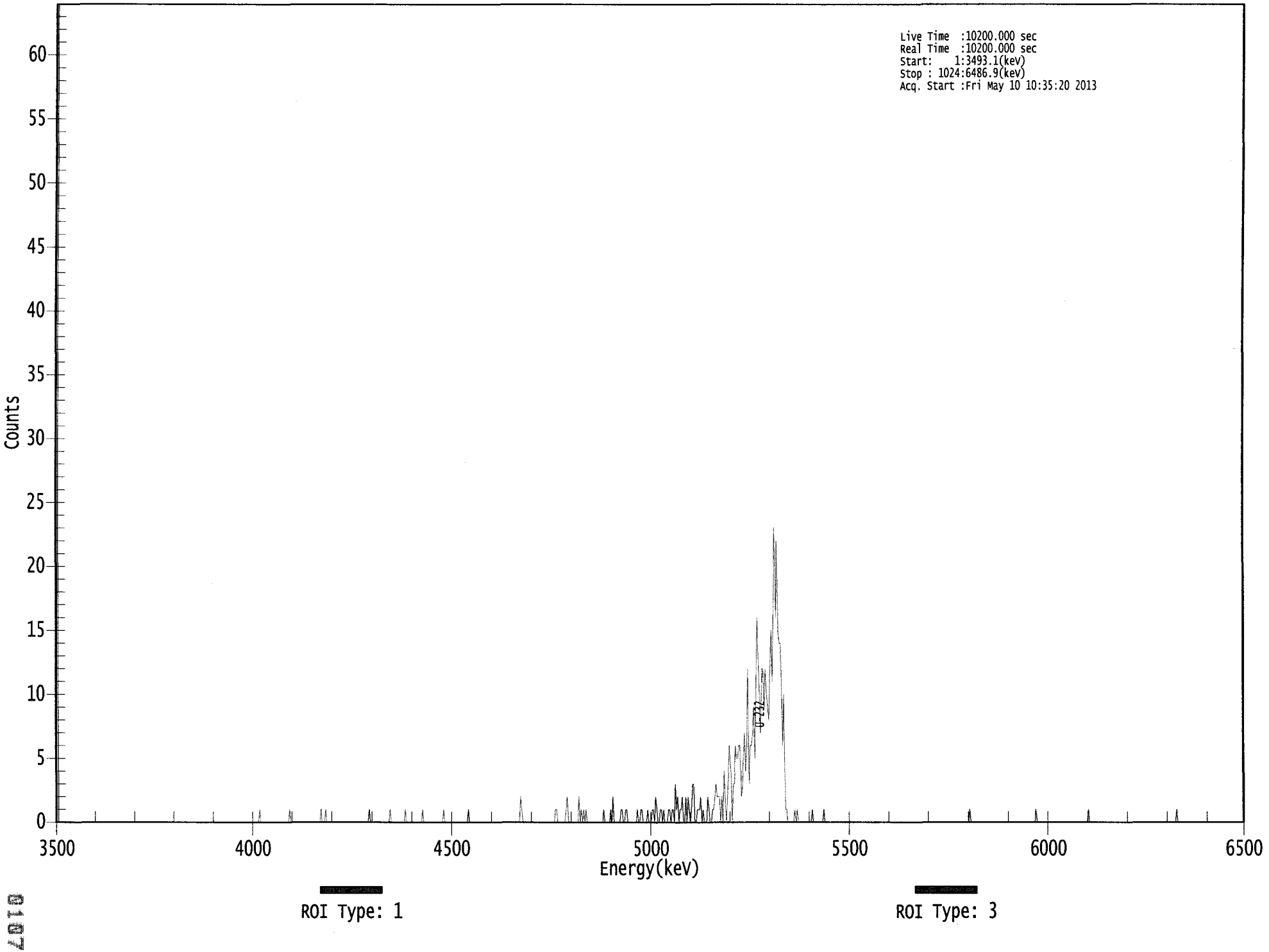
5/10/13

0000057654.CNF



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

Sample Title: 03

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	10200	10200	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	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	1	0
233:	0	0	1	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	1
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	1	0	0	0	0	0	0
297:	0	0	0	0	0	0	1	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	1	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	1
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	1	0	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 03

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	2	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	0	0	1
433:	1	0	0	0	0	0	0	0
441:	1	2	0	0	0	0	0	0
449:	0	0	0	2	0	1	0	1
457:	0	1	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0
473:	1	0	0	0	0	0	1	0
481:	2	0	0	0	0	0	0	1
489:	1	0	0	1	1	0	0	0
497:	0	0	0	0	0	1	0	0
505:	1	1	0	0	0	0	1	0
513:	0	0	1	1	0	2	1	0
521:	0	1	1	0	1	0	0	0
529:	1	1	0	1	1	0	3	1
537:	2	0	1	1	2	0	0	2
545:	0	2	1	0	1	3	3	0
553:	0	1	1	1	2	0	1	0
561:	0	0	2	1	0	0	1	1
569:	2	3	2	2	2	0	2	0
577:	4	2	0	2	4	6	4	0
585:	3	3	6	5	5	6	6	2
593:	3	5	7	4	6	12	3	6
601:	6	7	9	5	10	16	13	10
609:	7	12	12	9	12	10	9	8
617:	12	15	11	18	23	16	22	15
625:	14	14	11	6	10	1	1	0
633:	0	0	0	0	0	1	0	1
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	1	0	0	0
657:	0	0	0	0	0	0	1	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	1	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	1	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	1	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	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	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™

Sample Description: DUP 06 TOT
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000576
Batch Identification: 1304108B-UU
Sample Identification: 04
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_010
Chamber Serial Number:
Detector Serial Number: 10
Env. Background: System Bkgd 56362
Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter
Sample Date/Time: 4/11/2013 7:24:25 AM
Acquisition Date/Time: 5/10/2013 10:35:14 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.595 mL
Effective Efficiency: 0.1238 +/- 0.0086
Counting Efficiency: 0.1967 +/- 0.0036 on 12/15/2012 11:26:40 AM
Chem. Recovery Factor: 0.6294 +/- 0.0450

Peak Match Tolerance: 0.150 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T	5.288	237.79	12.78	2.21	0.00E+000	11.7
U-234		4.759	8.98	69.62	1.02	0.00E+000	2.9
U-235		4.429	2.49	138.30	0.51	0.00E+000	2.9
U-238		4.178	2.15	161.66	0.85	0.00E+000	5.9

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.998	5302.50*	2.04E+001 +/- 2.77E+000	6.86E-001 +/- 9.30E-002
U-234	1.000	4761.50*	7.70E-001 +/- 5.46E-001	5.40E-001 +/- 7.32E-002
U-235	0.987	4385.50*	2.63E-001 +/- 3.66E-001	5.55E-001 +/- 7.52E-002
U-238	1.000	4184.40*	1.84E-001 +/- 2.98E-001	5.11E-001 +/- 6.93E-002

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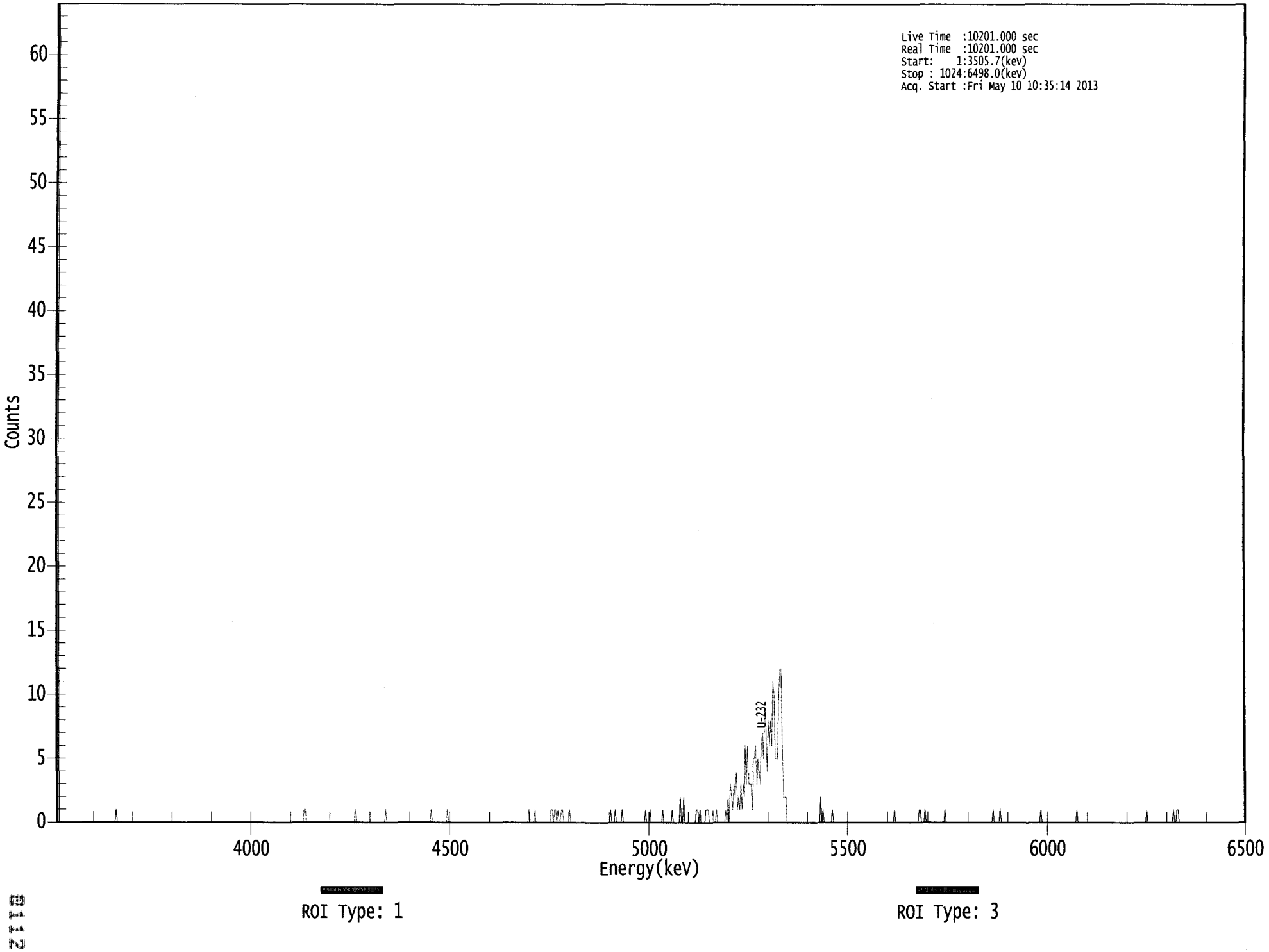
0000057649.CNF



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

Sample Title: 04

Elapsed Live time: 10201
Elapsed Real Time: 10201

Channel								
1:	10201	10201	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	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	1	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	1
217:	1	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	1	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	1	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	1	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	1	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

369:	0	0	0	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	0	0
401:	0	0	0	0	0	0	0	0
409:	1	0	0	0	0	1	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	1	1	0	1	1
433:	0	1	0	0	1	1	0	0
441:	0	0	0	1	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	1	0
481:	0	0	1	0	0	0	0	0
489:	1	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	1	0	0	0
513:	1	0	0	0	0	0	0	0
521:	0	0	0	1	0	0	0	0
529:	0	0	0	1	0	0	0	0
537:	0	0	2	0	0	2	0	0
545:	0	0	0	0	0	0	0	0
553:	1	1	0	1	0	0	0	0
561:	1	1	1	0	0	0	1	0
569:	0	1	0	0	0	0	0	0
577:	0	1	0	2	0	3	2	1
585:	3	2	4	1	2	1	3	1
593:	3	2	6	3	6	3	3	3
601:	1	5	5	6	3	5	4	3
609:	6	7	5	9	8	4	8	6
617:	8	6	11	10	5	5	5	10
625:	12	12	7	2	2	2	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	2	0	1	0	0
665:	0	0	0	0	0	1	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	1	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	1
745:	1	0	0	0	1	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	1	0	0
769:	0	0	0	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	1	0

Sample Title: 04

Channel								
809:	0	0	0	0	1	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	1
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	1	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	1	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	1	0	0	1	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™

Sample Description: DUP 06 DIS
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000576
Batch Identification: 1304108B-UU
Sample Identification: 05
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_011
Chamber Serial Number:
Detector Serial Number: 11
Env. Background: System Bkgd 56363
Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter
Sample Date/Time: 4/11/2013 7:24:25 AM
Acquisition Date/Time: 5/10/2013 10:35:15 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.591 mL
Effective Efficiency: 0.2269 +/- 0.0121
Counting Efficiency: 0.1973 +/- 0.0042 on 12/15/2012 11:28:06 AM
Chem. Recovery Factor: 1.1497 +/- 0.0660

Peak Match Tolerance: 0.150 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T	5.268	432.30	9.45	1.70	0.00E+000	18.7
U-234		4.729	8.66	68.12	0.34	0.00E+000	5.3
U-235		4.438	1.49	190.03	0.51	0.00E+000	2.7
U-238		4.143	5.83	82.55	0.17	0.00E+000	2.7

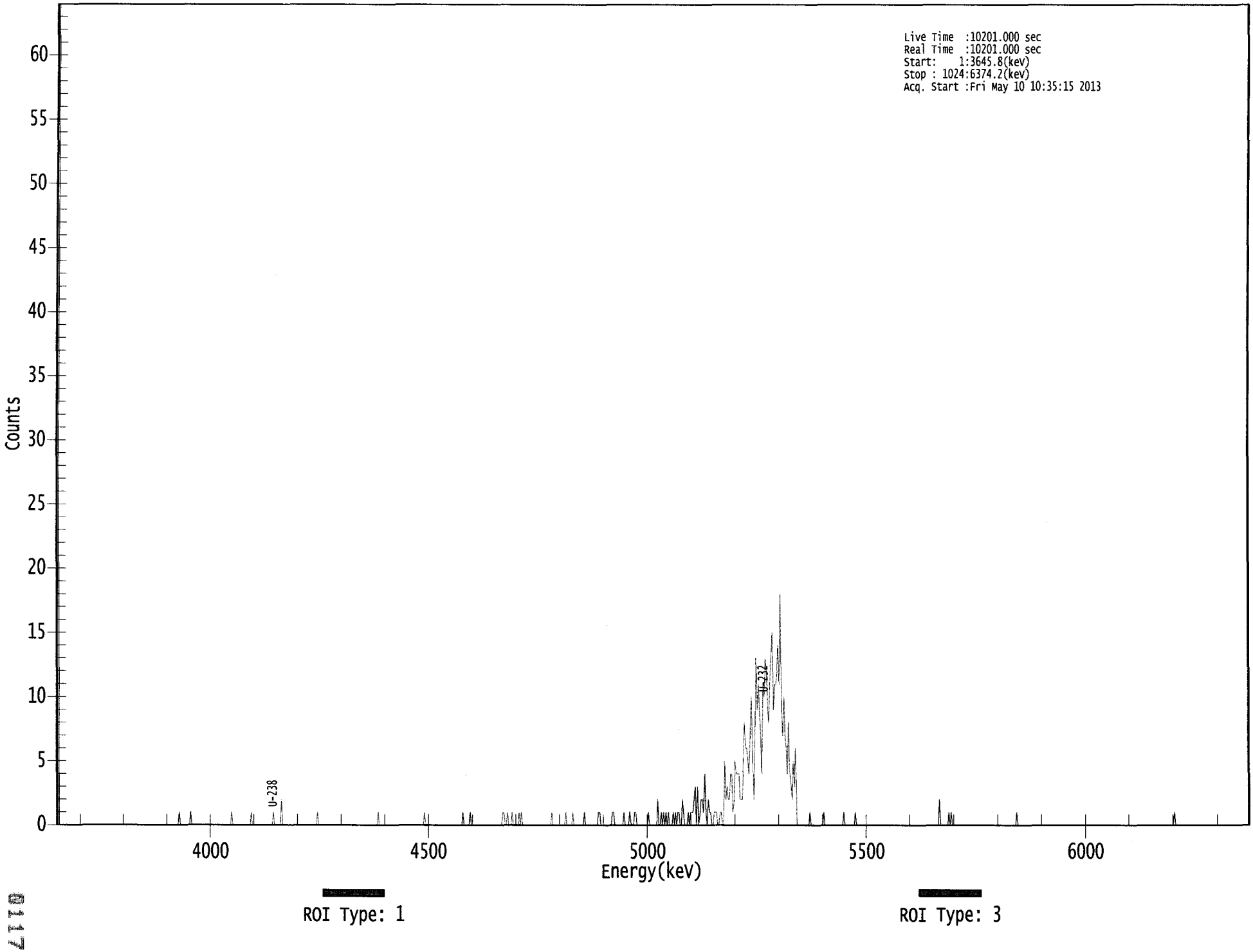
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.992	5302.50*	2.03E+001 +/- 2.12E+000	3.44E-001 +/- 3.60E-002
U-234	0.992	4761.50*	4.05E-001 +/- 2.79E-001	2.24E-001 +/- 2.34E-002
U-235	0.981	4385.50*	8.60E-002 +/- 1.64E-001	3.03E-001 +/- 3.17E-002
U-238	0.988	4184.40*	2.72E-001 +/- 2.26E-001	1.95E-001 +/- 2.04E-002

AG
5/10/13

0000057650.CNF



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

Sample Title: 05

Elapsed Live time: 10201
Elapsed Real Time: 10201

Channel								
1:	10201	10201	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	1	0	0	0	0	0
113:	0	0	0	0	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	0	0
145:	0	0	0	0	0	0	0	1
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	1	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	1	0	0	0	0
193:	0	0	2	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	1	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	1	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	1	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	1	0
353:	0	0	0	0	1	0	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 05

Channel								
377:	0	0	0	0	0	0	0	0
385:	1	1	0	0	1	0	0	0
393:	1	0	0	0	0	0	1	0
401:	1	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	1	0	0	0	0	0
433:	0	0	0	0	0	0	1	0
441:	0	0	0	0	1	0	0	0
449:	0	0	0	0	0	0	1	0
457:	0	0	0	0	0	0	0	0
465:	0	0	1	1	0	0	0	0
473:	0	0	0	0	0	0	1	1
481:	0	0	0	0	0	0	0	0
489:	1	0	0	0	0	1	0	0
497:	0	1	1	0	0	0	0	0
505:	0	0	0	0	0	1	0	0
513:	0	0	0	0	0	2	0	0
521:	1	0	1	0	1	0	1	0
529:	0	0	1	0	1	0	1	1
537:	0	0	2	1	0	0	0	1
545:	0	1	1	1	2	3	0	3
553:	0	1	2	2	1	4	1	0
561:	2	1	1	0	0	1	1	1
569:	0	0	1	1	0	0	5	2
577:	3	2	2	4	4	1	2	5
585:	4	4	4	2	2	2	5	8
593:	6	6	5	4	7	10	6	2
601:	6	13	9	11	9	7	4	11
609:	10	13	12	9	8	12	13	15
617:	9	11	11	12	14	11	18	9
625:	7	10	7	6	4	8	4	3
633:	2	5	3	6	0	0	0	0
641:	0	0	0	0	0	0	0	1
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	1	0	0	0
681:	0	0	0	0	0	0	1	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	2	0
761:	0	0	0	0	0	0	1	0
769:	1	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:	1	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	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	1
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™

Sample Description: I-4 TOT
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000576
Batch Identification: 1304108B-UU
Sample Identification: 06
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_013
Chamber Serial Number:
Detector Serial Number: 13
Env. Background: System Bkgd 56364
Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter
Sample Date/Time: 4/12/2013 7:24:25 AM
Acquisition Date/Time: 5/10/2013 10:35:16 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.592 mL
Effective Efficiency: 0.1396 +/- 0.0092
Counting Efficiency: 0.1869 +/- 0.0035 on 12/15/2012 11:26:45 AM
Chem. Recovery Factor: 0.7471 +/- 0.0509

Peak Match Tolerance: 0.150 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T	5.277	266.64	12.04	1.36	0.00E+000	10.9
U-234		4.730	13.83	53.08	0.17	0.00E+000	2.8
U-235		4.351	2.83	120.53	0.17	0.00E+000	2.8
U-238		4.063	1.81	193.78	1.19	0.00E+000	2.8

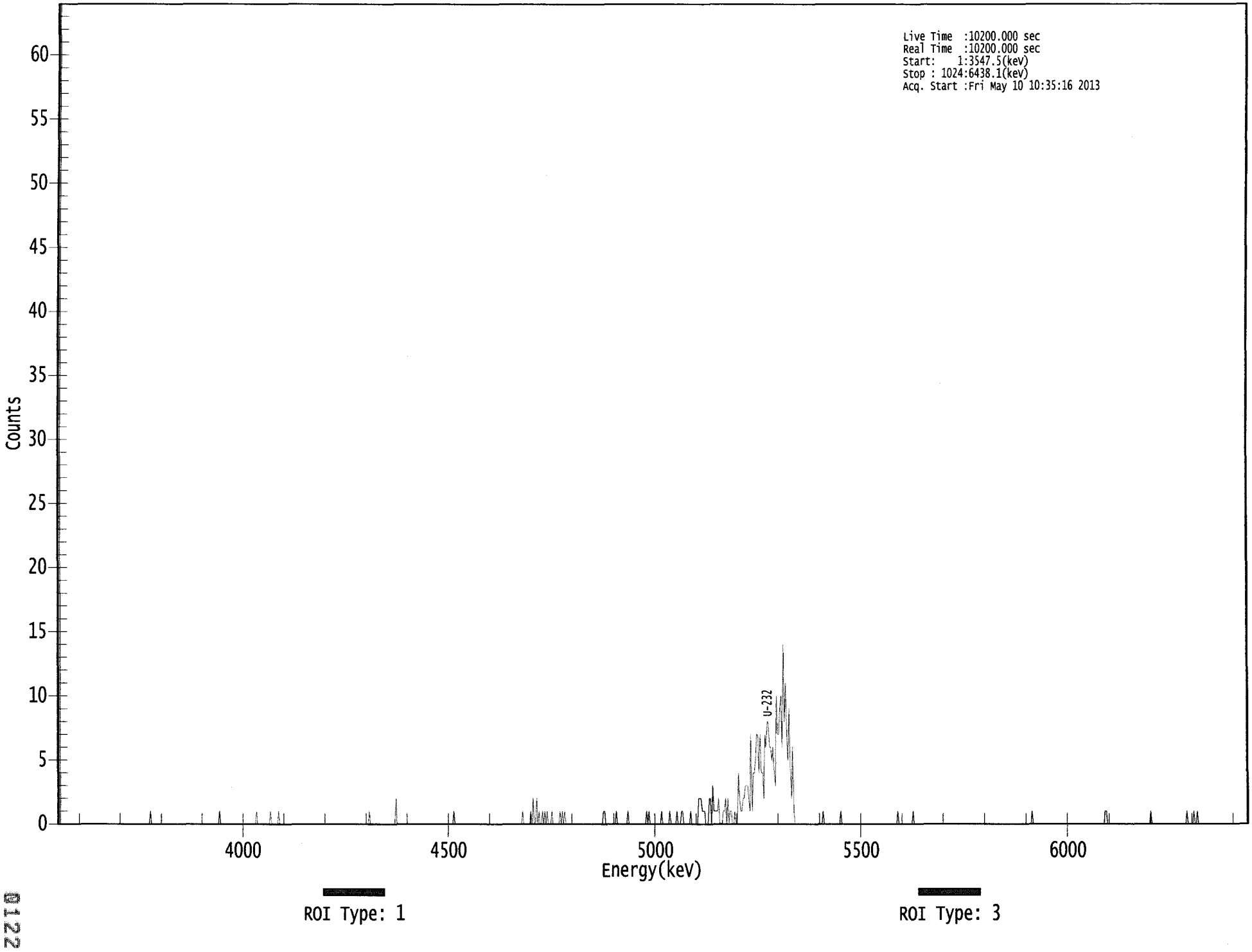
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.996	5302.50*	2.03E+001 +/- 2.61E+000	5.22E-001 +/- 6.71E-002
U-234	0.993	4761.50*	1.05E+000 +/- 5.75E-001	3.17E-001 +/- 4.08E-002
U-235	0.992	4385.50*	2.66E-001 +/- 3.22E-001	3.92E-001 +/- 5.03E-002
U-238	0.900	4184.40*	1.37E-001 +/- 2.66E-001	4.99E-001 +/- 6.41E-002

AG
5/10/13

0000057651.CNF



9122

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

Sample Title: 06

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	10200	10200	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:	1	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	1	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	1	0	0	0
177:	0	0	0	0	0	0	0	0
185:	1	0	0	0	0	0	0	1
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	1	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	2	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	1	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

369:	0	0	0	0	0	0	0	0

Sample Title: 06

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	1	0	0	0	0	0	0
409:	1	0	2	0	0	2	0	1
417:	0	0	1	0	1	0	1	0
425:	0	0	1	0	0	0	0	0
433:	0	1	0	1	0	1	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	1	1
473:	0	0	0	0	0	0	0	0
481:	0	1	0	0	0	0	0	0
489:	0	0	0	1	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	1	0	1	0	0
513:	0	0	0	0	0	0	0	0
521:	1	0	0	0	0	0	0	1
529:	0	0	0	0	0	1	0	0
537:	0	1	1	0	0	0	0	0
545:	0	1	0	0	0	0	0	0
553:	2	2	2	1	1	1	0	0
561:	0	2	2	0	3	1	1	1
569:	1	2	0	0	0	1	1	2
577:	0	2	0	1	1	0	0	1
585:	0	0	4	2	1	1	2	2
593:	3	3	3	2	1	7	1	4
601:	4	5	7	7	4	7	4	4
609:	2	7	6	8	8	6	6	5
617:	6	4	3	10	7	7	9	10
625:	6	14	8	11	7	5	9	4
633:	2	6	1	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	1	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	1	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	1	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: 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	0	0	0
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	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	1	1	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	1	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	1	0	0	0	0	0
977:	1	0	0	1	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™

Sample Description: I-4 DIS
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000576
Batch Identification: 1304108B-UU
Sample Identification: 07
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_014
Chamber Serial Number:
Detector Serial Number: 14
Env. Background: System Bkgd 56365
Reagent Blank: <not performed>

Sample Size: 2.500E-001 +/- 0.000E+000 liter
Sample Date/Time: 4/12/2013 7:24:25 AM
Acquisition Date/Time: 5/10/2013 10:35:18 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.602 mL
Effective Efficiency: 0.1315 +/- 0.0088
Counting Efficiency: 0.1846 +/- 0.0034 on 12/15/2012 11:26:44 AM
Chem. Recovery Factor: 0.7127 +/- 0.0496

Peak Match Tolerance: 0.150 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T	5.278	255.45	12.33	2.55	0.00E+000	35.6
U-234		4.787	1.13	315.93	1.87	0.00E+000	2.9
U-235		4.381	2.49	138.29	0.51	0.00E+000	2.9
U-238		4.133	-1.02	208.15	1.02	0.00E+000	0.0

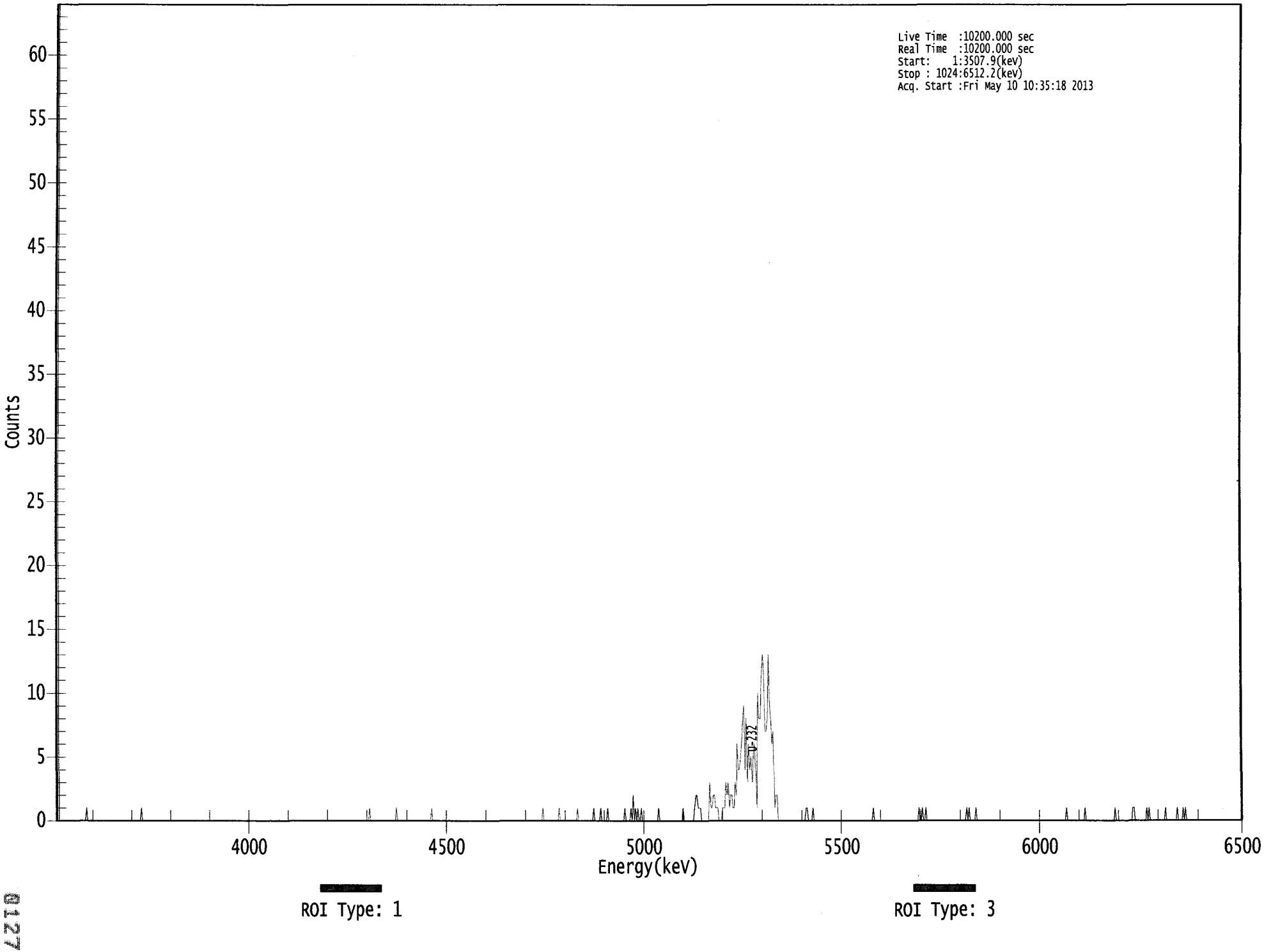
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.996	5302.50*	2.06E+001 +/- 2.71E+000	6.78E-001 +/- 8.90E-002
U-234	0.995	4761.50*	9.12E-002 +/- 2.88E-001	6.11E-001 +/- 8.03E-002
U-235	1.000	4385.50*	2.48E-001 +/- 3.45E-001	5.23E-001 +/- 6.86E-002
U-238	0.982	4184.40*	-8.20E-002 +/- 1.71E-001	5.06E-001 +/- 6.65E-002

AG
5/10/13

0000057652.CNF



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

Sample Title: 07

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	10200	10200	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	1	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	1	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	1	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	1
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	1	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

369:	0	0	0	0	0	0	0	0

Sample Title: 07

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	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	1	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	1	0	0	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	0	1	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	1	0	0	0	0	0	1
473:	0	0	0	0	0	1	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	0	0	1	0	0	0
497:	0	1	0	2	0	1	0	1
505:	0	0	1	0	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	1	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	1	0
545:	0	0	0	0	0	0	0	0
553:	1	2	2	1	1	1	0	0
561:	0	0	0	0	0	3	1	1
569:	2	2	1	1	1	0	0	0
577:	1	1	1	3	2	3	1	2
585:	2	1	1	3	2	6	4	4
593:	5	6	8	9	4	8	3	6
601:	4	5	3	5	6	4	1	10
609:	8	8	11	13	12	7	7	8
617:	13	9	8	6	7	1	2	2
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:	1	1	0	0	0	0	1	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	1	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	1	0	0	1	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	1	0	1	0	0	0
793:	0	0	1	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 07

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

5/10/2013 6:26:21 AM

Apex-Alpha™

QA SUMMARY REPORT
Review Of QA Results - Pulser Check

Date : 5/10/2013
Time : 6:26:21 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_001	21f	ALL	Not Done	
Alpha_002	21f	ALL	Not Done	
Alpha_003	21f	ALL	Passed	5/10/2013 5:09:38 AM
Alpha_004	21f	ALL	Passed	5/10/2013 5:09:39 AM
Alpha_005	21f	ALL	Not Done	
Alpha_006	21f	ALL	Not Done	
Alpha_007	21f	ALL	Not Done	
Alpha_008	21f	ALL	Not Done	
Alpha_009	21f	ALL	Not Done	
Alpha_010	21f	ALL	Passed	5/10/2013 5:09:39 AM
Alpha_011	21f	ALL	Passed	5/10/2013 5:09:40 AM
Alpha_012	21f	ALL	Not Done	
Alpha_013	21f	ALL	Passed	5/10/2013 5:09:41 AM
Alpha_014	21f	ALL	Passed	5/10/2013 5:09:42 AM
Alpha_015	21f	ALL	Not Done	
Alpha_016	21f	ALL	Not Done	
Alpha_017	AIM730	ALL	Not Done	
Alpha_018	AIM730	ALL	Passed	5/10/2013 5:09:43 AM
Alpha_019	AIM730	ALL	Not Done	
Alpha_020	AIM730	ALL	Not Done	
Alpha_021	AIM730	ALL	Not Done	
Alpha_022	AIM730	ALL	Passed	5/10/2013 5:09:44 AM
Alpha_023	AIM730	ALL	Not Done	
Alpha_024	AIM730	ALL	Passed	5/10/2013 5:09:45 AM
Alpha_025	AIM730	ALL	Passed	5/10/2013 5:09:45 AM
Alpha_026	AIM730	ALL	Not Done	
Alpha_027	AIM730	ALL	Passed	5/10/2013 5:09:46 AM
Alpha_028	AIM730	ALL	Not Done	
Alpha_029	AIM730	ALL	Passed	5/10/2013 5:09:47 AM
Alpha_030	AIM730	ALL	Not Done	
Alpha_031	AIM730	ALL	Not Done	
Alpha_032	AIM730	ALL	Not Done	
Alpha_033	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:09:48 AM
Alpha_034	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:09:50 AM
Alpha_035	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:09:51 AM
Alpha_036	Alpha Analyst100DC	ALL	Not Done	
Alpha_037	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:09:53 AM
Alpha_038	Alpha Analyst100DC	ALL	Not Done	
Alpha_039	Alpha Analyst100DC	ALL	Not Done	
Alpha_040	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:09:55 AM
Alpha_041	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:09:57 AM
Alpha_042	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:09:59 AM

Review of QA Results - Pulser Check

5/10/2013 6:26:21 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_043	Alpha Analyst100DC	ALL	Not Done	
Alpha_044	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:10:02 AM
Alpha_045	Alpha Analyst100DC	ALL	Not Done	
Alpha_046	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:10:04 AM
Alpha_047	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:10:07 AM
Alpha_048	Alpha Analyst100DC	ALL	Passed	5/10/2013 5:10:10 AM

APPROVED BY: C

APPROVAL DATE: 5/10/13

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

Nuclide Library Title: Uranium

Nuclide Library Description: U-232,-234,-235,-238

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
U-232	2.174E+009	5302.500*	0.000	99.8000	0.0000
U-234	7.731E+012	4761.500*	0.000	99.8000	0.0000
U-235	2.221E+016	4385.500*	0.000	80.9000	0.0000
U-238	1.410E+017	4184.400*	0.000	100.2300	0.0000

* = key line

TOTALS: 4 Nuclides 4 Energy Lines

SECTION IX

ANALYTICAL DATA (ISOTOPIC THORIUM)

13-04108
ThISO
Run 1

Work Order	13-04108
Analysis Code	ThISO
Run	1
Date Received	4/16/2013
Lab Deadline	5/7/2013
Client	Engineering Management Support, Inc.
Project	West Lake OU-1
Report Level	4
Activity Units	pCi
Aliquot Units	l
Matrix	WA
Method	NAS NS-3004 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	Th-229
Radiometric Sol#	Th-18a
Tracer Act (dpm/g)	22.467
Carrier	
Carrier Conc (mg/ml)	

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		04/16/13 00:00	1.0000E+00
02	MBL	BLANK		04/16/13 00:00	1.0000E+00
03	DUP	I-4 TOT	42	04/12/13 13:20	1.0000E+00
04	TRG	DUP 06 TOT	38	04/11/13 00:00	1.0000E+00
05	TRG	DUP 06 DIS	38	04/11/13 00:00	1.0000E+00
06	DO	I-4 TOT	42	04/12/13 13:20	1.0000E+00
07	TRG	I-4 DIS	42	04/12/13 13:20	1.0000E+00

* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. ** 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	0.4727	10.6		0.00								
02	MBL	0.2363	5.3		0.00								
03	DUP	0.2347	5.3		0.00								
04	TRG	0.2312	5.2		0.00								
05	TRG	0.2329	5.2		0.00								
06	DO	0.2302	5.2		0.00								
07	TRG	0.2300	5.2		0.00								

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

Internal Fraction	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep t0 Date/Time	Sep t0 By	Sep t1 Date/Time	Sep t1 By
01	LCS			04/29/13 10:18	JBARNARD				
02	MBL			04/29/13 10:18	JBARNARD				
03	DUP			04/29/13 10:18	JBARNARD				
04	TRG			04/29/13 10:18	JBARNARD				
05	TRG			04/29/13 10:18	JBARNARD				
06	DO			04/29/13 10:18	JBARNARD				
07	TRG			04/29/13 10:18	JBARNARD				

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

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-ThISO-1

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
Analysis Code: ThISO
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	TH-228	LCS	LCS	pCi/l	5.06E+00	7.49E-01	4.85E-02	4.82E+00	105.11	OK		OK	
02	TH-228	MBL	BLANK	pCi/l	5.87E-02	5.41E-02	5.07E-02					OK	OK
03	TH-228	DUP	I-4 TOT	pCi/l	1.67E-02	4.02E-02	8.41E-02				NA	OK	
04	TH-228	TRG	DUP 06 TOT	pCi/l	1.04E-01	7.59E-02	7.07E-02					OK	
05	TH-228	TRG	DUP 06 DIS	pCi/l	5.55E-03	6.38E-02	1.40E-01					OK	
06	TH-228	DO	I-4 TOT	pCi/l	7.84E-02	8.03E-02	1.14E-01					OK	
07	TH-228	TRG	I-4 DIS	pCi/l	5.00E-03	8.12E-02	1.84E-01					OK	

Run	Analysis Code	Eberline Services Work Order	Client
1	ThISO	13-04108	Engineering Management Support, Inc.

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	TH-228	LCS	04/16/13 00:00	1.00E+00	119.96	0.00	0.00			
02	TH-228	MBL	04/16/13 00:00	1.00E+00	121.99	0.00	0.00			
03	TH-228	DUP	04/12/13 13:20	1.00E+00	74.00	0.00	0.00			
04	TH-228	TRG	04/11/13 00:00	1.00E+00	129.11	0.00	0.00			
05	TH-228	TRG	04/11/13 00:00	1.00E+00	115.01	0.00	0.00			
06	TH-228	DO	04/12/13 13:20	1.00E+00	100.33	0.00	0.00			
07	TH-228	TRG	04/12/13 13:20	1.00E+00	71.74	0.00	0.00			

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
Analysis Code: ThISO
Run: 1

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	TH-228	LCS	05/06/13 05:43		A_Spec	Alpha_044	170	4.36 E+02	1.00 E-03	19
02	TH-228	MBL	05/06/13 05:43		A_Spec	Alpha_046	170	4.83 E+00	1.00 E-03	17.9
03	TH-228	DUP	05/06/13 05:43		A_Spec	Alpha_047	170	8.30 E-01	1.00 E-03	18.2
04	TH-228	TRG	05/06/13 05:43		A_Spec	Alpha_048	170	8.32 E+00	4.00 E-03	16.8
05	TH-228	TRG	05/06/13 05:44		A_Spec	Alpha_003	170	4.10 E-01	2.70 E-02	17.5
06	TH-228	DO	05/06/13 05:44		A_Spec	Alpha_004	170	5.62 E+00	1.40 E-02	19.4
07	TH-228	TRG	05/06/13 05:44		A_Spec	Alpha_010	170	2.60 E-01	2.20 E-02	19.7

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-ThISO-1

Run	Analysis Code	Eberline Services Work Order	Client
1	ThISO	13-04108	Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	TH-230	LCS	LCS	pCi/l	4.71E+00	7.07E-01	6.11E-02	5.46E+00	86.26	OK		OK	
02	TH-230	MBL	BLANK	pCi/l	1.68E-01	9.29E-02	5.07E-02					OK	OK
03	TH-230	DUP	I-4 TOT	pCi/l	2.69E-01	1.53E-01	9.41E-02				NA	OK	
04	TH-230	TRG	DUP 06 TOT	pCi/l	6.72E-02	6.01E-02	6.42E-02					OK	
05	TH-230	TRG	DUP 06 DIS	pCi/l	2.24E-01	1.16E-01	8.33E-02					OK	
06	TH-230	DO	I-4 TOT	pCi/l	2.88E-01	1.37E-01	1.03E-01					OK	
07	TH-230	TRG	I-4 DIS	pCi/l	2.07E-01	1.34E-01	1.19E-01					OK	

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-ThISO-1

Run	Analysis Code	Eberline Services Work Order	Client
1	ThISO	13-04108	Engineering Management Support, Inc.

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	TH-230	LCS	04/16/13 00:00	1.00E+00	119.96	0.00	0.00			
02	TH-230	MBL	04/16/13 00:00	1.00E+00	121.99	0.00	0.00			
03	TH-230	DUP	04/12/13 13:20	1.00E+00	74.00	0.00	0.00			
04	TH-230	TRG	04/11/13 00:00	1.00E+00	129.11	0.00	0.00			
05	TH-230	TRG	04/11/13 00:00	1.00E+00	115.01	0.00	0.00			
06	TH-230	DO	04/12/13 13:20	1.00E+00	100.33	0.00	0.00			
07	TH-230	TRG	04/12/13 13:20	1.00E+00	71.74	0.00	0.00			

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-ThISO-1

Run	Analysis Code	Eberline Services Work Order	Client
1	ThISO	13-04108	Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	TH-230	LCS	05/06/13 05:43		A_Spec	Alpha_044	170	4.04 E+02	3.00 E-03	19
02	TH-230	MBL	05/06/13 05:43		A_Spec	Alpha_046	170	1.38 E+01	1.00 E-03	17.9
03	TH-230	DUP	05/06/13 05:43		A_Spec	Alpha_047	170	1.37 E+01	2.00 E-03	18.2
04	TH-230	TRG	05/06/13 05:43		A_Spec	Alpha_048	170	5.49 E+00	3.00 E-03	16.8
05	TH-230	TRG	05/06/13 05:44		A_Spec	Alpha_003	170	1.70 E+01	6.00 E-03	17.5
06	TH-230	DO	05/06/13 05:44		A_Spec	Alpha_004	170	2.11 E+01	1.10 E-02	19.4
07	TH-230	TRG	05/06/13 05:44		A_Spec	Alpha_010	170	1.10 E+01	6.00 E-03	19.7

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-ThISO-1

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
Analysis Code: ThISO
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	TH-232	LCS	LCS	pCi/l	4.65E+00	6.99E-01	6.96E-02	4.82E+00	96.42	OK		OK	
02	TH-232	MBL	BLANK	pCi/l	4.86E-02	5.37E-02	7.28E-02					OK	OK
03	TH-232	DUP	I-4 TOT	pCi/l	-3.34E-03	3.91E-02	8.20E-02				NA	OK	
04	TH-232	TRG	DUP 06 TOT	pCi/l	-4.15E-03	2.46E-02	5.84E-02					OK	
05	TH-232	TRG	DUP 06 DIS	pCi/l	-6.73E-03	2.70E-02	6.92E-02					OK	
06	TH-232	DO	I-4 TOT	pCi/l	-1.39E-02	2.90E-02	8.58E-02					OK	
07	TH-232	TRG	I-4 DIS	pCi/l	5.60E-02	7.59E-02	1.18E-01					OK	

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-ThISO-1

Client	Eberline Services Work Order	Analysis Code	Run
Engineering Management Support, Inc.	13-04108	ThISO	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	TH-232	LCS	04/16/13 00:00	1.00E+00	119.96	0.00	0.00			
02	TH-232	MBL	04/16/13 00:00	1.00E+00	121.99	0.00	0.00			
03	TH-232	DUP	04/12/13 13:20	1.00E+00	74.00	0.00	0.00			
04	TH-232	TRG	04/11/13 00:00	1.00E+00	129.11	0.00	0.00			
05	TH-232	TRG	04/11/13 00:00	1.00E+00	115.01	0.00	0.00			
06	TH-232	DO	04/12/13 13:20	1.00E+00	100.33	0.00	0.00			
07	TH-232	TRG	04/12/13 13:20	1.00E+00	71.74	0.00	0.00			

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-ThISO-1

Run	Analysis Code	Eberline Services Work Order	Client
1	ThISO	13-04108	Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	TH-232	LCS	05/06/13 05:43		A_Spec	Alpha_044	170	4.00 E+02	0.00 E+00	19
02	TH-232	MBL	05/06/13 05:43		A_Spec	Alpha_046	170	4.00 E+00	0.00 E+00	17.9
03	TH-232	DUP	05/06/13 05:43		A_Spec	Alpha_047	170	-1.70 E-01	1.00 E-03	18.2
04	TH-232	TRG	05/06/13 05:43		A_Spec	Alpha_048	170	-3.40 E-01	2.00 E-03	16.8
05	TH-232	TRG	05/06/13 05:44		A_Spec	Alpha_003	170	-5.10 E-01	3.00 E-03	17.5
06	TH-232	DO	05/06/13 05:44		A_Spec	Alpha_004	170	-1.02 E+00	6.00 E-03	19.4
07	TH-232	TRG	05/06/13 05:44		A_Spec	Alpha_010	170	2.98 E+00	6.00 E-03	19.7

Count Room Report
Client: Engineering Management Su

13-04108-ThISO-1 (pCi/l) in WA
Tracer ID: Th-18a

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	04/16/13 00:00	1.0000	0.4727	10.6202		0.00		
02	MBL	BLANK	04/16/13 00:00	1.0000	0.2363	5.3090		0.00		
03	DUP	I-4 TOT	04/12/13 13:20	1.0000	0.2347	5.2730		0.00		
04	TRG	DUP 06 TOT	04/11/13 00:00	1.0000	0.2312	5.1944		0.00		
05	TRG	DUP 06 DIS	04/11/13 00:00	1.0000	0.2329	5.2326		0.00		
06	DO	I-4 TOT	04/12/13 13:20	1.0000	0.2302	5.1719		0.00		
07	TRG	I-4 DIS	04/12/13 13:20	1.0000	0.2300	5.1674		0.00		

Spike and Tracer Worksheet

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
13-04108	1	ThISO	4/29/2013 10:18	JBARNARD		

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*
Th-228	Th-8b	103.560	4/29/2013	**0.100**	**0.1033**				4.82	0.173	0.00	0.000	0.00	0.000	0.00	0.000
Th-230	Th-1b	23.525	4/29/2013	**0.500**	**0.5149**				5.46	0.147	0.00	0.000	0.00	0.000	0.00	0.000
Th-232	Th-8b	103.560	4/29/2013	**0.100**	**0.1033**				4.82	0.173	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	**Th-229**	Th-18a	22.467	4/29/2013	**0.4727**	**0.2200**
02	**Th-229**	Th-18a	22.467	4/29/2013	**0.2363**	**0.2200**
03	**Th-229**	Th-18a	22.467	4/29/2013	**0.2347**	**0.2200**
04	**Th-229**	Th-18a	22.467	4/29/2013	**0.2312**	**0.2200**
05	**Th-229**	Th-18a	22.467	4/29/2013	**0.2329**	**0.2200**
06	**Th-229**	Th-18a	22.467	4/29/2013	**0.2302**	**0.2200**
07	**Th-229**	Th-18a	22.467	4/29/2013	**0.2300**	**0.2200**

Balance Printer Tapes

Tracer

0.4727 g
0.2363 g
-0.2347 g
-0.2312 g
-0.2329 g
-0.2302 g
-0.2300 g

LCS

0.5149 g
0.1033 g

Matrix Spike

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Printed: 4/29/2013 10:19 AM

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
13-04108	1	ThISO	liters	5/7/2013	JBARNARD

Lab Fraction	Engineering Management Support, Inc. Client ID	Sample Type	Muffle Data Ratio Post/Pre	Dilution Data No of Dils	Dilution Data Dil Factor	Dilution Data Ratio	Aliquot Data Aliquot	Aliquot Data Net Equiv	MS Aliquot Data Aliquot	MS Aliquot Data Net Equiv	H-3 Solids Only Water Added (ml)	H-3 Solids Only H3 Dist Aliq
01	LCS	LCS					1.0000E+00	1.0000E+00				
02	BLANK	MBL					1.0000E+00	1.0000E+00				
03	I-4 TOT	DUP					1.0000E+00	1.0000E+00				
04	DUP 06 TOT	TRG					1.0000E+00	1.0000E+00				
05	DUP 06 DIS	TRG					1.0000E+00	1.0000E+00				
06	I-4 TOT	DO					1.0000E+00	1.0000E+00				
07	I-4 DIS	TRG					1.0000E+00	1.0000E+00				

Comments	

Technician: JB Date: 4/29/13

5479

Apex-Alpha™

5/6

Sample Description: SPIKE
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000571
Batch Identification: 1304108A-TH
Sample Identification: 01
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_044
Chamber Serial Number: 04026481B
Detector Serial Number: 84168
Env. Background: System Bkgd 56379
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 5/6/2013 7:42:10 AM
Acquisition Date/Time: 5/6/2013 5:43:37 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.1 minutes

Tracer Certificate: Th229_TH-18A
Tracer Quantity: 0.473 mL
Effective Efficiency: 0.2281 +/- 0.0133
Counting Efficiency: 0.1902 +/- 0.0033 on 12/16/2012 5:49:26 PM
Chem. Recovery Factor: 1.1996 +/- 0.0729

Control Certificate Name: NatTh_Th-8
Chem. Recov. of Control: TH-232 0.964171 +/- 0.079488
Peak Match Tolerance: 0.175 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
TH-227		5.865	30.49	35.84	0.51	0.00E+000	3.0
TH-228		5.374	435.83	9.39	0.17	0.00E+000	33.5
TH-229	T	4.883	411.83	9.66	0.17	0.00E+000	8.3
TH-230		4.633	404.49	9.75	0.51	0.00E+000	16.2
TH-232		3.964	400.00	9.81	0.00	0.00E+000	19.5

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.999	5850.00*	3.63E-001 +/- 1.37E-001	6.25E-002 +/- 7.13E-003
TH-228	0.996	5400.00*	5.06E+000 +/- 7.49E-001	4.85E-002 +/- 5.54E-003
TH-229	0.999	4872.00*	4.81E+000 +/- 5.49E-001	4.87E-002 +/- 5.56E-003
TH-230	0.992	4672.00*	4.71E+000 +/- 7.07E-001	6.11E-002 +/- 6.97E-003
TH-232	0.994	3997.00*	4.65E+000 +/- 6.99E-001	6.96E-002 +/- 7.95E-003

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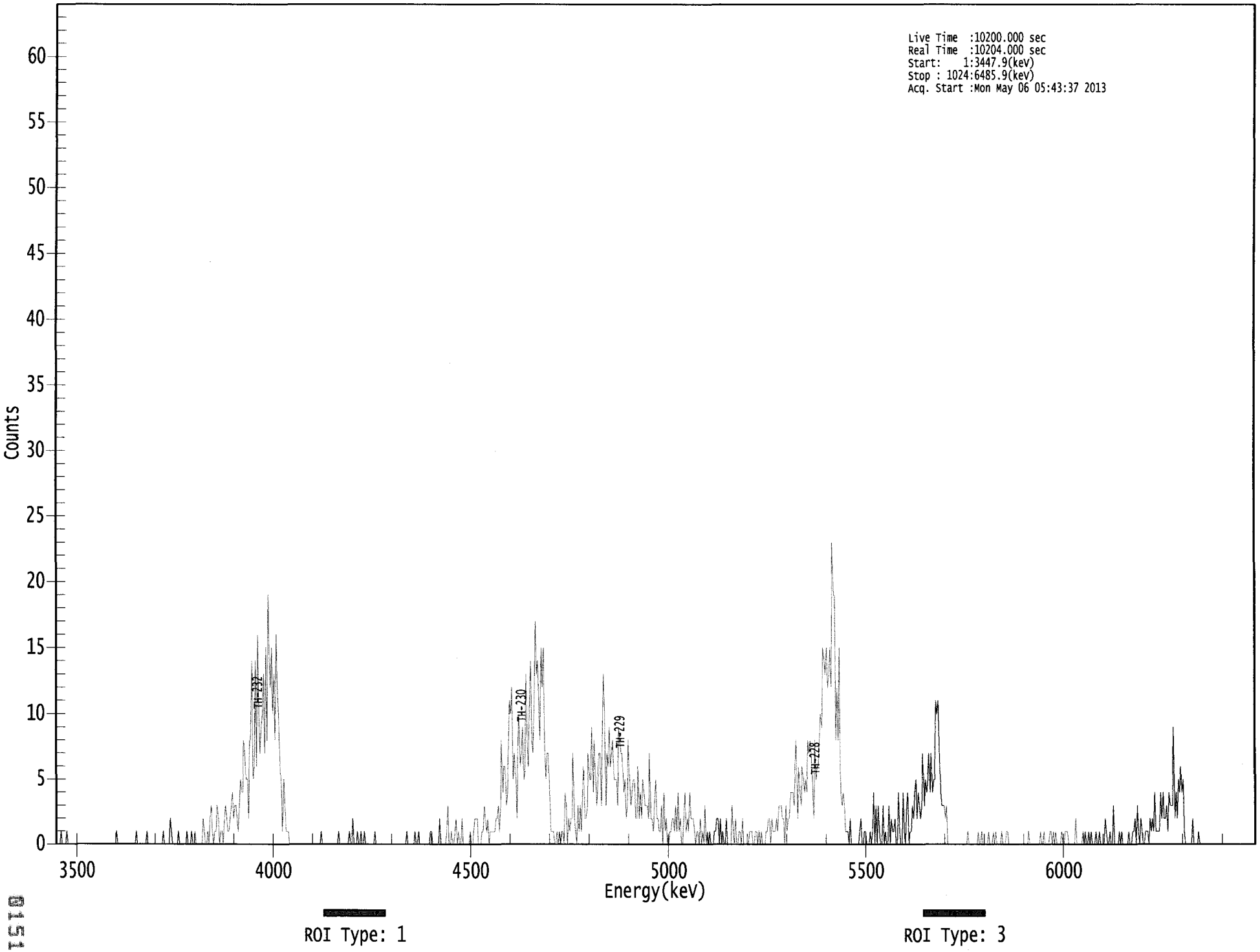
0000057179.CNF



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

Sample Title: 01

Elapsed Live time: 10200
Elapsed Real Time: 10204

Channel								
1:	0	0	0	0	1	0	0	0
9:	0	1	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	1	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	1	0	0
73:	0	0	0	0	0	0	1	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	1	0	0	0
97:	0	0	2	1	0	0	0	0
105:	0	1	0	0	0	0	0	0
113:	1	0	0	0	1	0	0	1
121:	0	0	0	0	0	0	2	1
129:	0	0	1	0	2	3	1	0
137:	1	1	3	2	0	1	1	0
145:	2	3	2	1	1	2	3	4
153:	2	3	3	2	1	3	5	4
161:	4	8	7	5	5	2	8	8
169:	14	5	6	14	6	16	10	7
177:	9	10	13	7	15	8	19	14
185:	12	15	10	13	8	16	12	10
193:	7	4	1	5	3	1	1	1
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	1	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	1	0	0	0	0	0
249:	0	0	0	1	0	0	2	0
257:	0	0	1	0	0	1	0	0
265:	1	0	0	0	0	0	0	0
273:	0	1	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	1	0	0	1	0
313:	0	0	0	0	0	0	0	0
321:	1	1	0	0	0	0	0	0
329:	2	0	0	0	0	0	1	3
337:	0	0	1	0	0	1	2	0
345:	1	0	0	2	0	0	0	0
353:	0	0	1	0	0	1	2	2
361:	2	0	0	0	1	1	3	2

369:	1	2	0	1	1	1	1	1

Sample Title: 01

Channel								
377:	2	2	3	1	3	8	4	6
385:	6	3	4	7	11	10	12	5
393:	7	5	2	8	10	6	7	9
401:	5	6	13	8	6	11	14	8
409:	7	11	17	13	14	11	8	15
417:	12	15	8	5	7	7	4	1
425:	1	1	0	0	1	0	1	0
433:	1	1	0	4	3	0	2	1
441:	2	2	7	2	1	0	3	1
449:	3	1	4	6	2	2	3	7
457:	5	5	9	4	8	5	3	5
465:	7	7	3	8	13	10	3	7
473:	6	9	6	7	8	5	5	5
481:	3	9	8	7	7	4	5	2
489:	3	8	5	3	4	5	5	2
497:	2	6	2	4	2	5	4	3
505:	3	3	2	7	2	2	1	3
513:	5	2	2	1	1	3	0	4
521:	1	2	0	0	1	1	2	2
529:	1	3	1	4	1	2	0	0
537:	2	4	1	2	1	4	2	2
545:	2	1	0	1	1	0	2	0
553:	1	0	3	0	1	0	1	0
561:	0	0	1	1	2	2	0	2
569:	0	1	0	0	2	0	0	0
577:	0	3	1	0	2	0	0	1
585:	1	0	2	0	0	0	0	0
593:	1	1	1	0	0	1	1	0
601:	1	0	1	0	0	0	1	1
609:	2	2	0	2	1	1	1	2
617:	1	3	3	3	2	2	0	3
625:	1	2	2	4	4	4	3	6
633:	8	2	6	4	3	6	5	4
641:	5	4	8	7	8	7	4	2
649:	8	5	6	6	8	10	9	15
657:	14	13	15	12	13	15	12	23
665:	19	19	8	12	8	15	4	3
673:	4	3	1	1	1	0	2	0
681:	0	0	0	0	0	0	1	2
689:	0	0	1	1	0	0	0	1
697:	0	1	4	0	3	0	3	1
705:	0	0	3	0	1	0	0	3
713:	0	2	1	1	2	0	0	4
721:	1	0	0	4	1	0	3	4
729:	0	1	1	3	2	4	5	2
737:	4	3	2	3	7	3	5	4
745:	5	7	4	7	4	5	5	11
753:	10	11	8	4	3	3	3	2
761:	3	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	1	0	0	0	0	0
785:	0	0	0	1	0	0	1	0
793:	0	0	0	0	1	0	0	0

801:	1	0	1	0	0	0	0	1

Sample Title: 01

Channel								
809:	0	0	0	1	1	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	1	0
833:	0	0	0	0	0	0	0	0
841:	1	0	0	1	0	0	0	0
849:	1	1	0	1	0	1	0	0
857:	0	0	1	0	0	1	1	1
865:	0	0	0	0	0	0	2	0
873:	0	0	0	0	1	0	1	0
881:	0	1	0	1	0	0	0	1
889:	0	0	1	0	0	0	0	2
897:	1	0	0	1	0	0	3	0
905:	0	0	0	1	0	1	0	0
913:	0	0	0	1	0	0	1	1
921:	2	0	3	1	0	2	1	0
929:	0	1	1	1	0	2	1	2
937:	1	4	1	1	1	1	4	2
945:	4	2	2	3	1	4	3	3
953:	3	9	2	4	2	5	4	6
961:	4	5	1	0	0	0	0	0
969:	0	2	0	0	0	0	1	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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5/6/13

Sample Description: BLANK
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000571
Batch Identification: 1304108A-TH
Sample Identification: 02
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_046
Chamber Serial Number: 04026482B
Detector Serial Number: 58762
Env. Background: System Bkgd 56380
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 5/6/2013 7:42:10 AM
Acquisition Date/Time: 5/6/2013 5:43:39 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_TH-18A
Tracer Quantity: 0.236 mL
Effective Efficiency: 0.2183 +/- 0.0170
Counting Efficiency: 0.1789 +/- 0.0031 on 12/16/2012 5:49:23 PM
Chem. Recovery Factor: 1.2199 +/- 0.0974

Peak Match Tolerance: 0.175 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
TH-227		5.787	6.00	86.43	0.00	0.00E+000	3.0
TH-228		5.246	4.83	91.00	0.17	0.00E+000	3.0
TH-229	T	4.873	197.00	14.00	0.00	0.00E+000	7.7
TH-230		4.661	13.83	53.08	0.17	0.00E+000	3.0
TH-232		3.995	4.00	109.57	0.00	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.980	5850.00*	7.47E-002 +/- 6.56E-002	7.46E-002 +/- 1.14E-002
TH-228	0.884	5400.00*	5.87E-002 +/- 5.41E-002	5.07E-002 +/- 7.74E-003
TH-229	1.000	4872.00*	2.40E+000 +/- 3.67E-001	7.31E-002 +/- 1.12E-002
TH-230	0.999	4672.00*	1.68E-001 +/- 9.29E-002	5.07E-002 +/- 7.75E-003
TH-232	1.000	3997.00*	4.86E-002 +/- 5.37E-002	7.28E-002 +/- 1.11E-002

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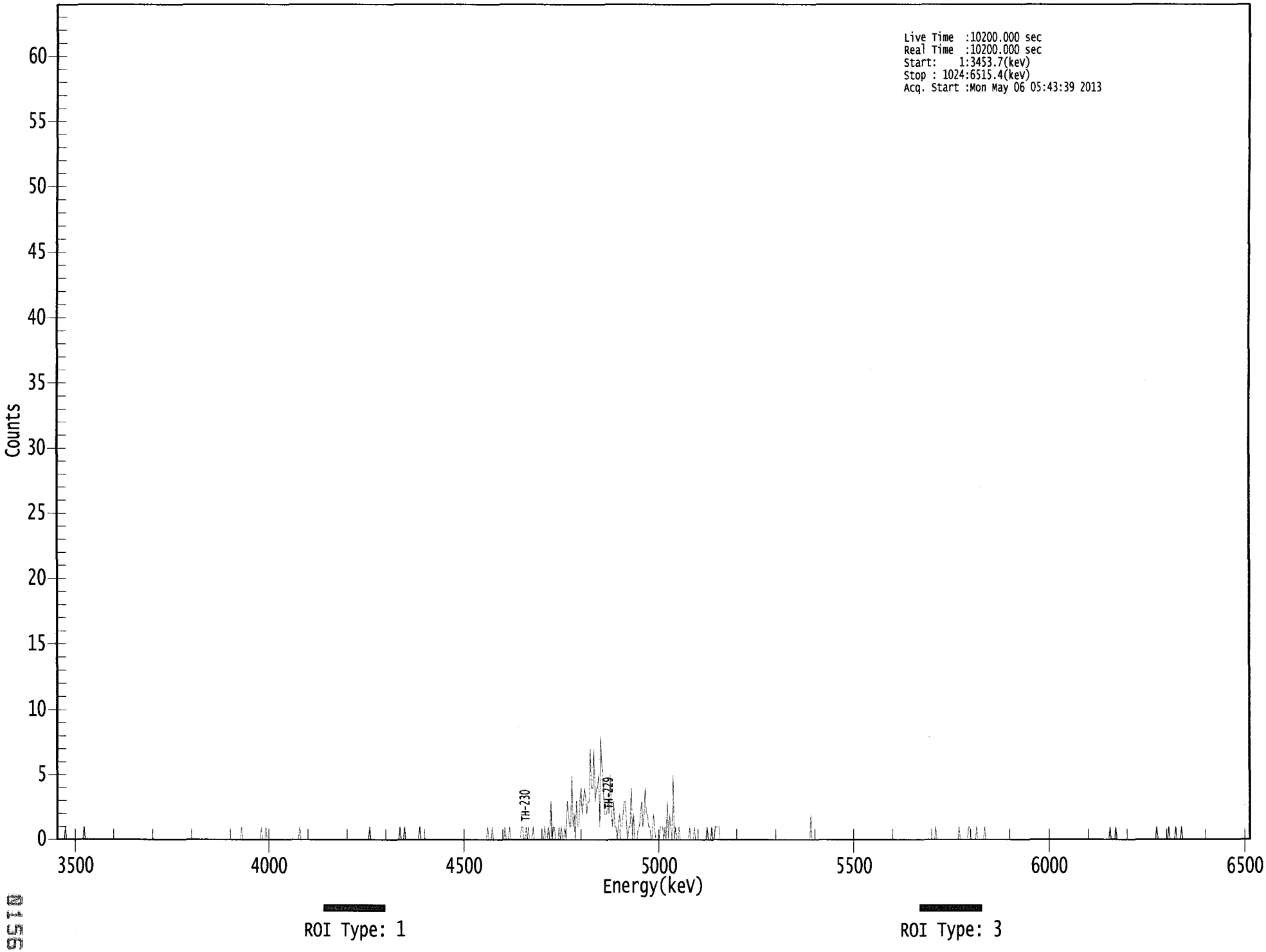
0000057172.CNF



0156

****
***** 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	1
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	1
25:	0	0	0	0	0	0	0	0
33:	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	1
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	1	0	0	0	1	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	1	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	1	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	1
297:	0	0	0	1	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	1	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	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

369:	0	0	1	0	0	0	1	0

Sample Title: 02

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	1	0	0	0	1	0	0
393:	0	0	0	0	0	0	0	1
401:	1	0	0	1	0	1	0	0
409:	0	1	0	0	0	0	0	0
417:	0	0	0	1	0	0	1	0
425:	3	0	1	1	0	0	0	1
433:	0	1	0	0	1	0	3	2
441:	1	1	5	1	2	0	3	1
449:	1	3	4	2	3	4	3	2
457:	3	3	7	4	4	7	3	4
465:	4	5	1	8	6	4	2	2
473:	2	3	2	5	2	1	3	1
481:	1	0	1	2	1	1	2	3
489:	3	1	0	1	1	4	0	2
497:	0	0	0	1	1	2	3	1
505:	2	4	2	2	1	1	0	0
513:	2	1	0	0	0	0	1	1
521:	1	0	1	0	3	0	2	1
529:	0	5	0	1	0	0	1	0
537:	0	0	0	0	0	0	0	1
545:	0	0	0	1	0	0	0	0
553:	0	0	0	0	0	0	1	0
561:	0	0	1	0	0	1	1	1
569:	1	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	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	2
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	1	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	1	0
777:	0	0	0	0	0	0	1	1
785:	0	0	0	0	0	1	0	0
793:	0	0	0	0	1	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	1
905:	0	0	0	0	1	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	1
945:	0	0	0	0	0	0	0	0
953:	0	1	0	0	0	0	0	1
961:	0	0	0	0	1	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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Sample Description: I-4 TOT-DUP
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000571
Batch Identification: 1304108A-TH
Sample Identification: 03
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_047
Chamber Serial Number: 02030596A
Detector Serial Number: 91086
Env. Background: System Bkgd 56381
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 4/12/2013 7:42:10 AM
Acquisition Date/Time: 5/6/2013 5:43:33 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_TH-18A
Tracer Quantity: 0.235 mL
Effective Efficiency: 0.1348 +/- 0.0130
Counting Efficiency: 0.1822 +/- 0.0032 on 12/16/2012 5:49:21 PM
Chem. Recovery Factor: 0.7400 +/- 0.0723

Peak Match Tolerance: 0.175 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
TH-227		5.873	-0.34	592.90	0.34	0.00E+000	0.0
TH-228		5.382	0.83	239.53	0.17	0.00E+000	2.9
TH-229	T	4.858	120.83	17.85	0.17	0.00E+000	4.4
TH-230		4.616	13.66	53.80	0.34	0.00E+000	2.9
TH-232		3.949	-0.17	1169.4	0.17	0.00E+000	0.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.997	5850.00*	-6.87E-003 +/- 4.07E-002	9.66E-002 +/- 1.82E-002
TH-228	0.998	5400.00*	1.67E-002 +/- 4.02E-002	8.41E-002 +/- 1.58E-002
TH-229	0.999	4872.00*	2.39E+000 +/- 4.50E-001	8.24E-002 +/- 1.55E-002
TH-230	0.984	4672.00*	2.69E-001 +/- 1.53E-001	9.41E-002 +/- 1.77E-002
TH-232	0.988	3997.00*	-3.34E-003 +/- 3.91E-002	8.20E-002 +/- 1.55E-002

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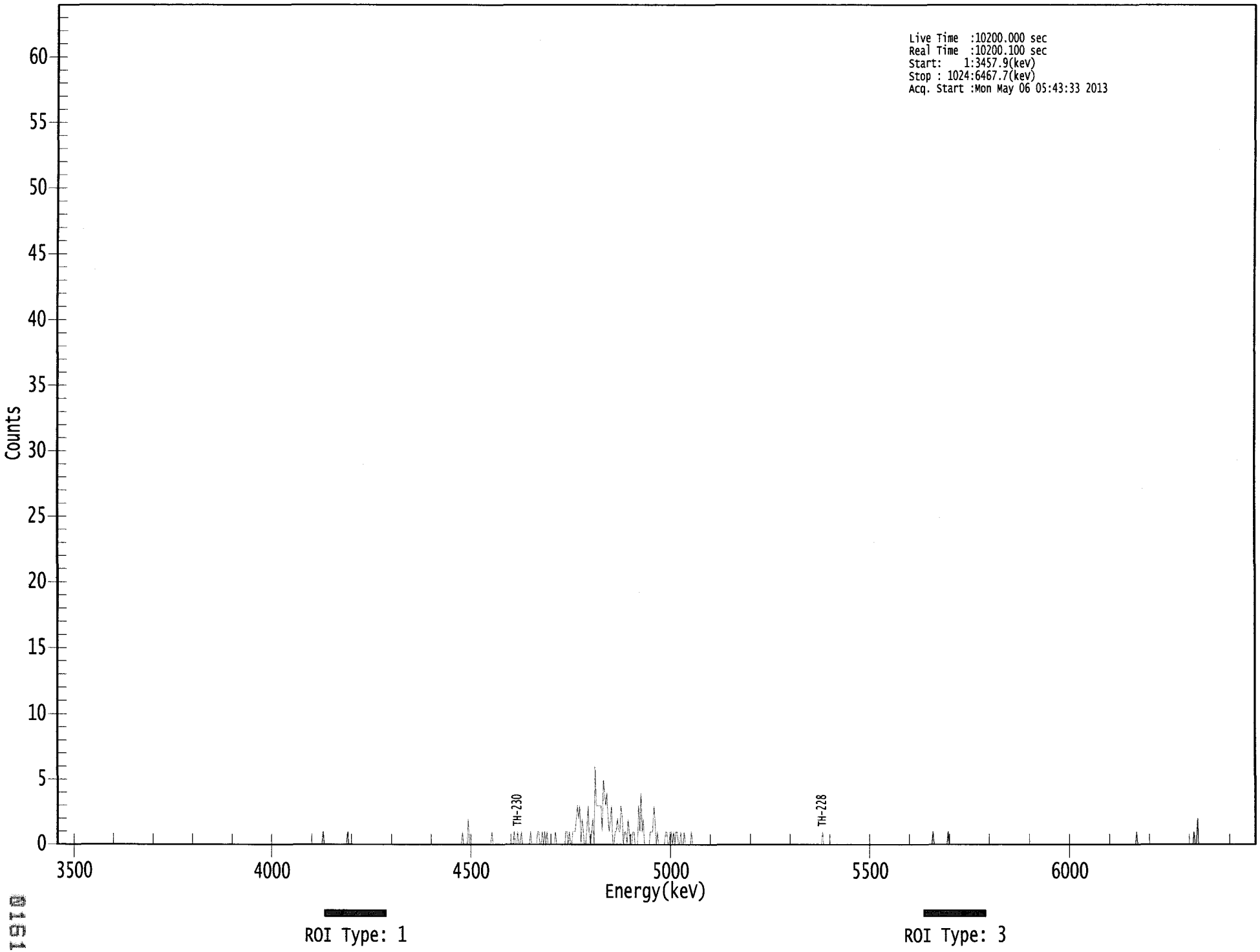

****
***** S P E C T R A L D A T A R E P O R T *****
****

Sample Title: 03

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	1	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	1	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	0	0	1	0	0	0	0
353:	2	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	1	0	0	0

Sample Title: 03

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	1
393:	0	0	1	0	0	1	0	0
401:	0	0	0	0	0	1	0	0
409:	0	0	0	1	1	0	0	1
417:	0	1	0	1	0	0	0	0
425:	0	0	1	0	0	0	0	0
433:	0	0	0	1	1	0	1	0
441:	0	1	1	1	2	3	2	3
449:	0	2	1	0	0	1	3	1
457:	0	1	2	0	6	3	3	3
465:	3	3	1	5	4	3	4	2
473:	1	2	3	0	0	1	1	2
481:	1	1	3	2	0	1	1	0
489:	2	1	0	0	1	1	0	0
497:	0	3	1	4	1	2	0	0
505:	0	0	0	1	1	1	3	2
513:	0	1	0	0	0	0	0	0
521:	1	1	0	0	1	1	0	1
529:	0	1	1	0	0	1	0	0
537:	1	0	0	0	0	0	1	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	1	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	1	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	1	0	0	0	0	0	0
769:	0	0	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	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	1	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	1	0	0	2	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™

C 5/6/13

Sample Description: DUP 06 TOT
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000571
Batch Identification: 1304108A-TH
Sample Identification: 04
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_048
Chamber Serial Number: 02030596B
Detector Serial Number: 83111
Env. Background: System Bkgd 56382
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 4/11/2013 7:42:10 AM
Acquisition Date/Time: 5/6/2013 5:43:35 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_TH-18A
Tracer Quantity: 0.231 mL
Effective Efficiency: 0.2169 +/- 0.0171
Counting Efficiency: 0.1680 +/- 0.0030 on 12/16/2012 5:49:20 PM
Chem. Recovery Factor: 1.2911 +/- 0.1042

Peak Match Tolerance: 0.175 MeV

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

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
TH-227		5.837	4.83	91.00	0.17	0.00E+000	3.0
TH-228		5.335	8.32	71.13	0.68	0.00E+000	3.0
TH-229	T	4.883	191.49	14.19	0.51	0.00E+000	7.6
TH-230		4.665	5.49	88.08	0.51	0.00E+000	3.0
TH-232		3.949	-0.34	592.90	0.34	0.00E+000	0.0

T = Tracer Peak used for Effective Efficiency

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

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.999	5850.00*	6.07E-002 +/- 5.60E-002	5.24E-002 +/- 8.09E-003
TH-228	0.978	5400.00*	1.04E-001 +/- 7.59E-002	7.07E-002 +/- 1.09E-002
TH-229	0.999	4872.00*	2.35E+000 +/- 3.63E-001	6.44E-002 +/- 9.94E-003
TH-230	1.000	4672.00*	6.72E-002 +/- 6.01E-002	6.42E-002 +/- 9.91E-003
TH-232	0.988	3997.00*	-4.15E-003 +/- 2.46E-002	5.84E-002 +/- 9.02E-003

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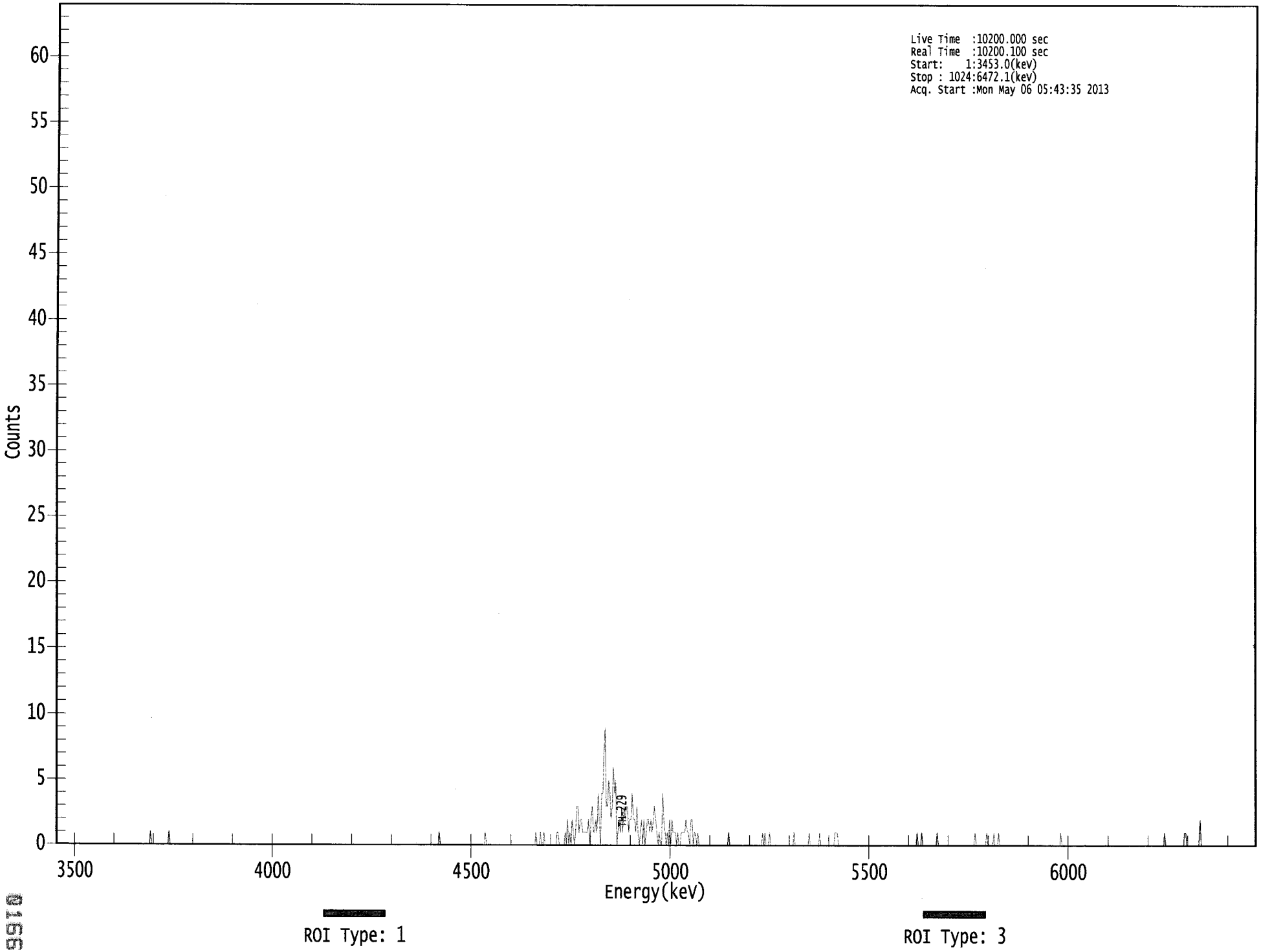

9156

****
***** 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	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	1	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	1	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	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:	1	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	1

369:	0	0	0	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	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	1	0	0	0	1	0
417:	0	1	0	0	0	0	0	0
425:	0	0	0	0	1	1	0	0
433:	0	0	0	1	0	2	0	1
441:	0	2	1	0	1	3	3	1
449:	2	2	1	1	1	1	1	2
457:	0	2	3	1	1	2	1	4
465:	2	0	4	4	7	9	3	3
473:	5	4	2	3	6	4	5	0
481:	1	2	1	3	1	3	2	3
489:	3	1	2	2	4	2	2	1
497:	3	1	0	1	2	0	2	0
505:	1	2	2	1	2	1	2	3
513:	2	1	0	1	0	0	4	2
521:	1	0	1	0	2	0	2	1
529:	1	1	0	1	0	0	1	1
537:	1	1	2	1	1	0	2	2
545:	0	1	1	0	1	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	1	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	1	0	1	0	0
609:	0	1	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	1	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	1	0	0	0	0
649:	0	0	0	0	1	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	1	1	1	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	1
737:	0	0	0	1	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	1	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	1	0	0	0	0	0	0	0
793:	0	0	1	0	0	0	0	0

801:	1	0	0	0	1	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	1	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	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	1	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	1	1	0	0	0	0
969:	0	0	0	0	0	0	0	2
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™

Sample Description: DUP 06 DIS
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000571
Batch Identification: 1304108A-TH
Sample Identification: 05
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_003
Chamber Serial Number:
Detector Serial Number: 3
Env. Background: System Bkgd 56360
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 4/11/2013 7:42:10 AM
Acquisition Date/Time: 5/6/2013 5:44:02 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_TH-18A
Tracer Quantity: 0.233 mL
Effective Efficiency: 0.2008 +/- 0.0163
Counting Efficiency: 0.1746 +/- 0.0033 on 12/15/2012 11:26:47 AM
Chem. Recovery Factor: 1.1501 +/- 0.0959

Peak Match Tolerance: 0.175 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
TH-227		5.816	1.09	427.97	3.91	0.00E+000	3.0
TH-228		5.301	0.41	1149.3	4.59	0.00E+000	3.0
TH-229	T	4.871	178.64	14.73	1.36	0.00E+000	4.1
TH-230		4.681	16.98	49.21	1.02	0.00E+000	3.0
TH-232		3.949	-0.51	400.63	0.51	0.00E+000	0.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.994	5850.00*	1.48E-002 +/- 6.33E-002	1.32E-001 +/- 2.11E-002
TH-228	0.950	5400.00*	5.55E-003 +/- 6.38E-002	1.40E-001 +/- 2.23E-002
TH-229	1.000	4872.00*	2.37E+000 +/- 3.77E-001	9.09E-002 +/- 1.45E-002
TH-230	1.000	4672.00*	2.24E-001 +/- 1.16E-001	8.33E-002 +/- 1.33E-002
TH-232	0.988	3997.00*	-6.73E-003 +/- 2.70E-002	6.92E-002 +/- 1.10E-002

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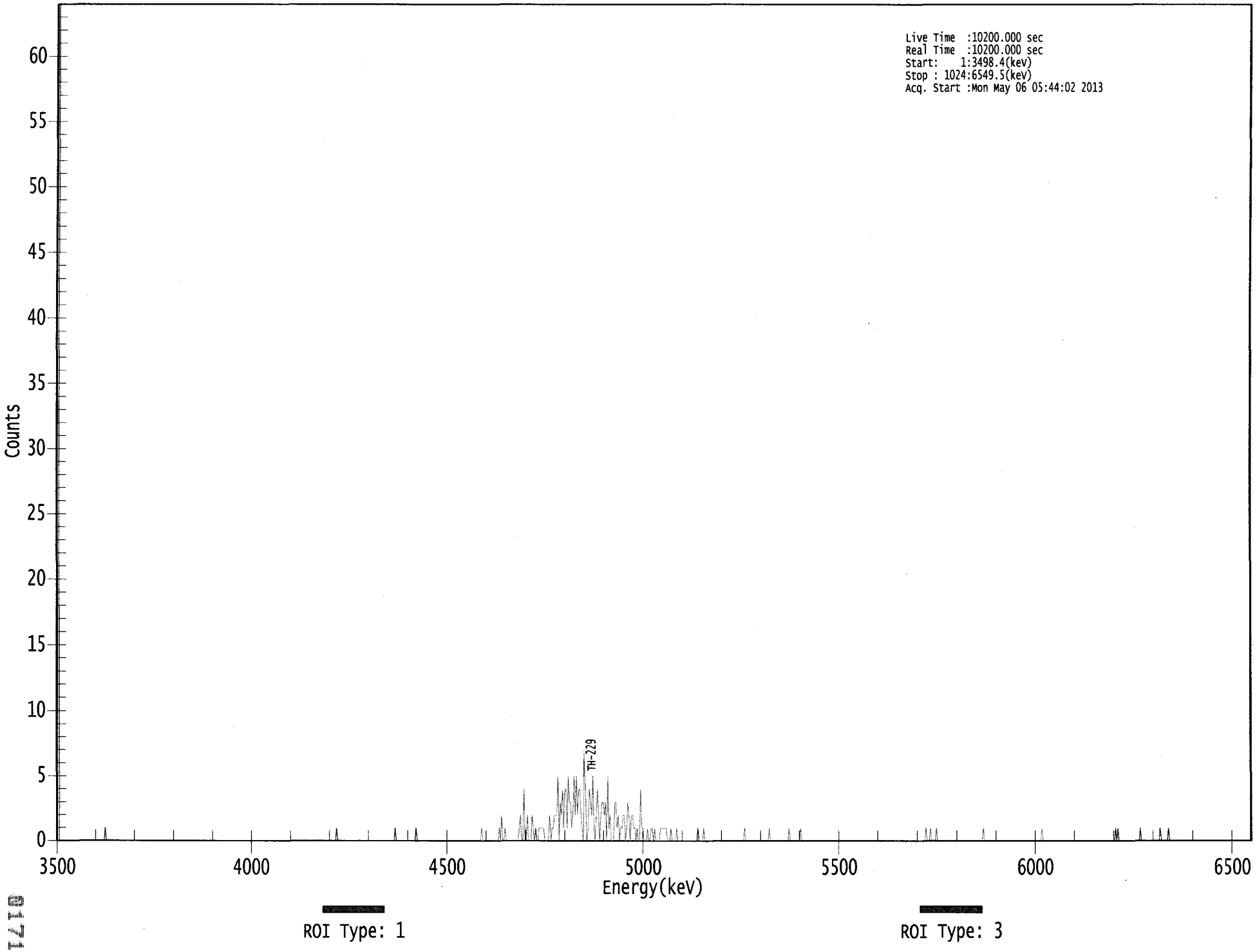
5/6/13

0000057168.CNF



9171

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

Sample Title: 05

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	10200	10200	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	1	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	1	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	1	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	1	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	1	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 05

Channel								
377:	0	0	0	0	1	0	2	0
385:	0	1	0	0	0	0	0	0
393:	0	0	0	0	0	1	2	0
401:	0	4	0	0	2	0	0	0
409:	2	1	0	1	0	0	1	1
417:	1	1	1	0	0	0	0	2
425:	0	1	1	2	2	2	5	0
433:	3	2	4	1	4	4	1	5
441:	3	3	1	2	5	2	5	2
449:	4	4	2	1	0	7	3	0
457:	1	4	3	2	5	1	0	2
465:	4	2	0	2	3	3	2	3
473:	0	5	1	2	0	0	0	3
481:	3	1	2	0	1	1	2	2
489:	0	1	3	2	0	2	2	1
497:	1	0	1	0	0	4	1	1
505:	0	0	0	1	0	0	1	1
513:	0	1	0	0	0	0	1	1
521:	1	1	1	1	0	0	0	1
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	1	0
553:	0	0	0	1	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	1	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	1	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	1	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	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	1	0	0	0	1	0	0
753:	0	0	1	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	1	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	1	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	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	1	0	1	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	1	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	1	0	0	0	0	0	0
953:	1	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™

C
Filter

Sample Description: I-4 TOT
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000571
Batch Identification: 1304108A-TH
Sample Identification: 06
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_004
Chamber Serial Number:
Detector Serial Number: 4
Env. Background: System Bkgd 56361
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 4/12/2013 7:42:10 AM
Acquisition Date/Time: 5/6/2013 5:44:03 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_TH-18A
Tracer Quantity: 0.230 mL
Effective Efficiency: 0.1947 +/- 0.0161
Counting Efficiency: 0.1940 +/- 0.0036 on 12/15/2012 11:26:46 AM
Chem. Recovery Factor: 1.0033 +/- 0.0850

Peak Match Tolerance: 0.175 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
TH-227		5.847	3.13	144.40	1.87	0.00E+000	2.9
TH-228		5.375	5.62	101.11	2.38	0.00E+000	5.9
TH-229	T	4.853	171.15	15.03	0.85	0.00E+000	6.0
TH-230		4.604	21.13	44.79	1.87	0.00E+000	2.9
TH-232		3.947	-1.02	208.15	1.02	0.00E+000	0.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	1.000	5850.00*	4.38E-002 +/- 6.36E-002	1.06E-001 +/- 1.72E-002
TH-228	0.997	5400.00*	7.84E-002 +/- 8.03E-002	1.14E-001 +/- 1.85E-002
TH-229	0.998	4872.00*	2.34E+000 +/- 3.79E-001	8.19E-002 +/- 1.33E-002
TH-230	0.976	4672.00*	2.88E-001 +/- 1.37E-001	1.03E-001 +/- 1.67E-002
TH-232	0.987	3997.00*	-1.39E-002 +/- 2.90E-002	8.58E-002 +/- 1.39E-002

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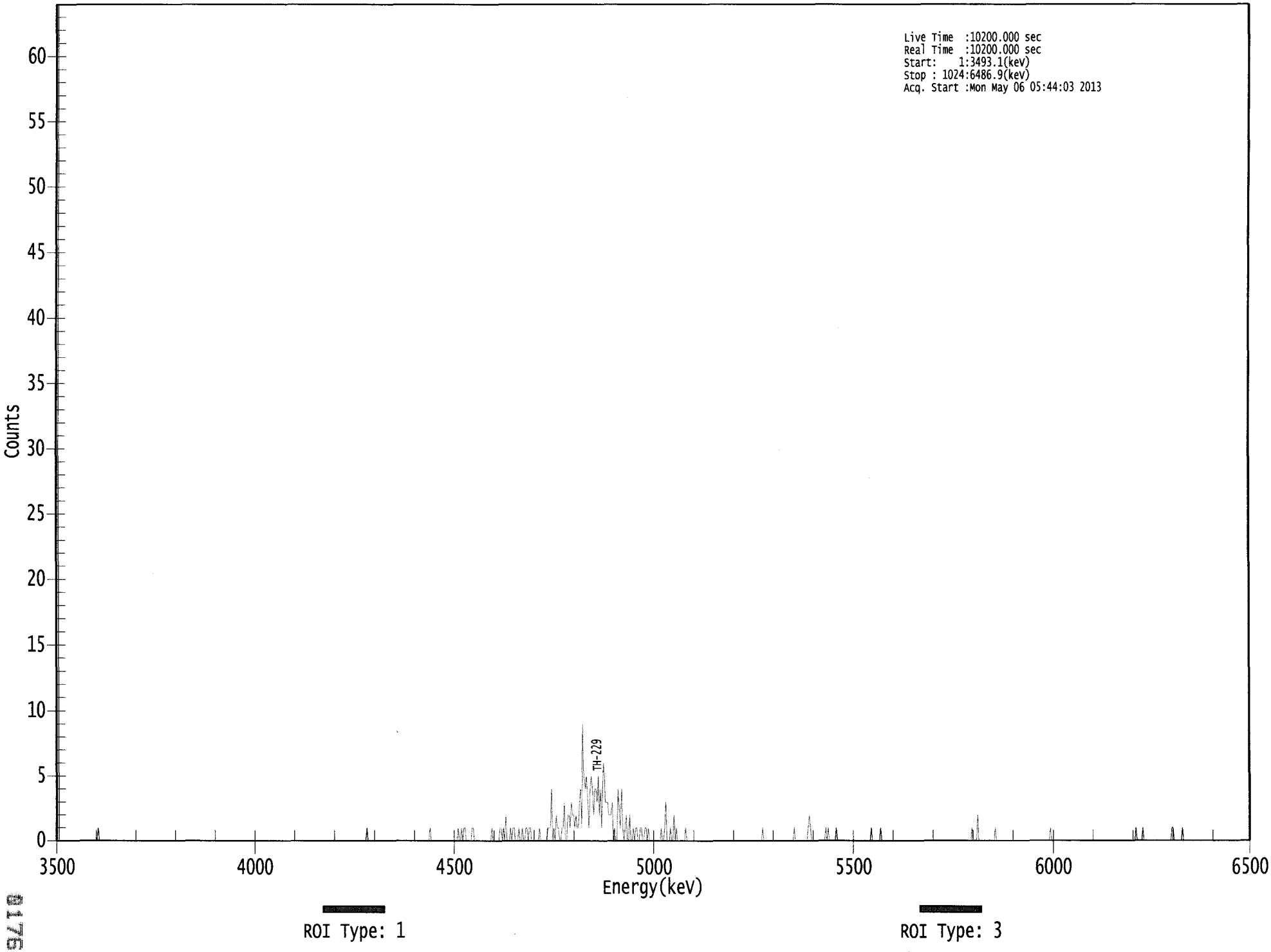
0000057169.CNF



9176

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

Sample Title: 06

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	10200	10200	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	1	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	1	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	1	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	1	0	1	1
353:	0	0	0	0	0	1	1	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	1	0

Sample Title: 06

Channel								
377:	0	0	0	0	0	1	1	0
385:	1	0	2	0	0	0	1	0
393:	1	1	0	0	0	1	0	0
401:	1	0	0	1	1	0	1	1
409:	0	0	0	0	0	0	0	1
417:	0	0	0	0	0	0	1	1
425:	1	4	0	1	0	2	1	1
433:	0	0	1	1	3	0	0	2
441:	2	1	3	2	2	1	2	1
449:	1	3	4	1	9	5	4	5
457:	3	1	4	5	4	2	4	4
465:	3	5	2	4	1	5	6	3
473:	3	3	2	2	2	3	0	1
481:	0	0	4	2	1	4	1	0
489:	1	2	0	0	2	0	0	1
497:	0	1	1	0	0	1	1	0
505:	0	1	1	0	1	0	0	0
513:	0	0	0	0	0	0	0	1
521:	0	0	1	3	0	0	0	1
529:	0	0	2	0	1	0	0	0
537:	0	0	0	0	1	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	1	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	1	0	0	0	0	0	0
641:	0	0	0	0	0	1	2	1
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	1	0	1	0
665:	0	0	0	0	0	1	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	1	0	0	0	0
705:	0	0	0	1	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	1	0	0	0	0	2	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	1	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	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	1	0	0	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	1	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	1	1	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™

Sample Description: I-4 DIS
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000571
Batch Identification: 1304108A-TH
Sample Identification: 07
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_010
Chamber Serial Number:
Detector Serial Number: 10
Env. Background: System Bkgd 56362
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Sample Date/Time: 4/12/2013 7:42:10 AM
Acquisition Date/Time: 5/6/2013 5:44:00 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_TH-18A
Tracer Quantity: 0.230 mL
Effective Efficiency: 0.1411 +/- 0.0135
Counting Efficiency: 0.1967 +/- 0.0036 on 12/15/2012 11:26:40 AM
Chem. Recovery Factor: 0.7174 +/- 0.0700

Peak Match Tolerance: 0.175 MeV

PEAK AREA REPORT

Nuclide		Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
TH-227		5.842	4.77	120.14	3.23	0.00E+000	2.9
TH-228		5.337	0.26	1622.7	3.74	0.00E+000	2.9
TH-229	T	4.871	123.96	17.77	2.04	0.00E+000	4.7
TH-230		4.634	10.98	62.28	1.02	0.00E+000	2.9
TH-232		3.980	2.98	134.36	1.02	0.00E+000	2.9

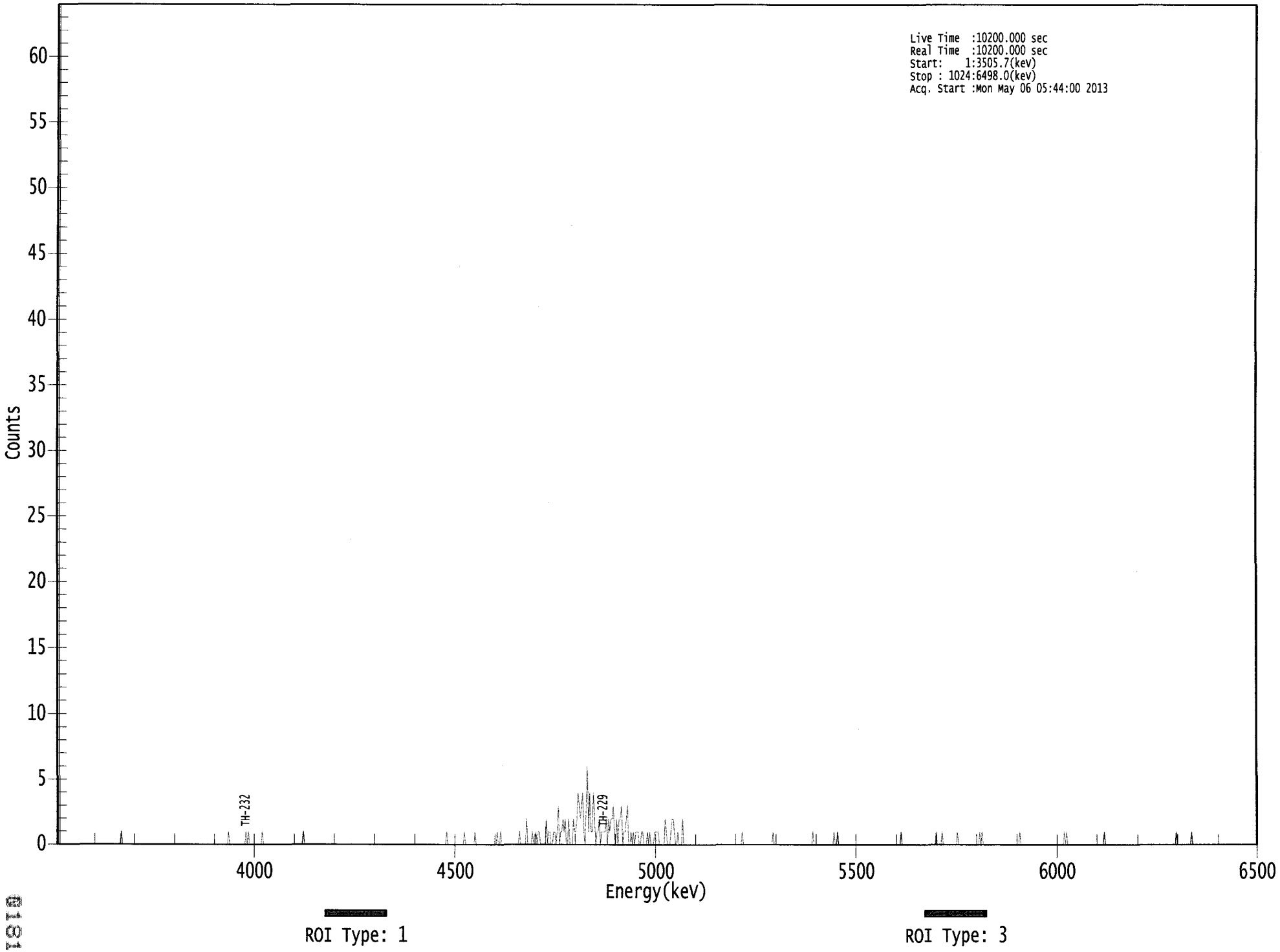
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	1.000	5850.00*	9.21E-002 +/- 1.12E-001	1.76E-001 +/- 3.30E-002
TH-228	0.979	5400.00*	5.00E-003 +/- 8.12E-002	1.84E-001 +/- 3.46E-002
TH-229	1.000	4872.00*	2.34E+000 +/- 4.39E-001	1.47E-001 +/- 2.76E-002
TH-230	0.992	4672.00*	2.07E-001 +/- 1.34E-001	1.19E-001 +/- 2.23E-002
TH-232	0.999	3997.00*	5.60E-002 +/- 7.59E-002	1.18E-001 +/- 2.22E-002

AG
5/6/13

0000057170.CNF



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

Sample Title: 07

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	10200	10200	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	1
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	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	1	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	0	0	1	0	1	0	0	0
169:	0	0	0	0	0	0	0	0
177:	1	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	1	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	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	1	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	1	0	0	0
353:	0	0	0	0	0	1	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 07

Channel								
377:	1	0	0	1	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	1	0	0	0	0
401:	0	2	0	0	0	0	1	0
409:	0	1	0	1	1	0	0	0
417:	0	0	2	0	1	1	0	0
425:	1	1	0	1	3	0	1	1
433:	2	1	2	0	0	2	0	0
441:	0	2	1	1	2	4	3	2
449:	3	4	1	0	3	6	1	4
457:	1	1	4	2	0	1	1	2
465:	0	1	1	1	1	2	0	2
473:	1	2	2	3	1	0	2	0
481:	2	2	3	0	1	1	2	3
489:	0	0	1	0	1	0	1	1
497:	1	0	0	1	1	0	0	0
505:	1	0	1	0	0	0	1	1
513:	1	1	0	0	0	0	0	2
521:	1	0	0	0	1	2	2	1
529:	0	0	1	0	0	0	2	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	1	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	1	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	1	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	1
665:	0	0	1	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	1	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	1	0
753:	0	0	0	1	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	1	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	1	0	1	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 07

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	1	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	1	0	1	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	1	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	1	0	0	0	0	0
961:	0	0	0	0	0	0	0	1
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	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

5/6/2013 5:36:52 AM

Apex-Alpha™

QA SUMMARY REPORT

Review Of QA Results - Pulser Check

Date : 5/6/2013
Time : 5:36:52 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_001	21f	ALL	Not Done	
Alpha_002	21f	ALL	Not Done	
Alpha_003	21f	ALL	Passed	5/6/2013 5:21:40 AM
Alpha_004	21f	ALL	Passed	5/6/2013 5:21:40 AM
Alpha_005	21f	ALL	Not Done	
Alpha_006	21f	ALL	Not Done	
Alpha_007	21f	ALL	Not Done	
Alpha_008	21f	ALL	Not Done	
Alpha_009	21f	ALL	Not Done	
Alpha_010	21f	ALL	Passed	5/6/2013 5:21:41 AM
Alpha_011	21f	ALL	Passed	5/6/2013 5:21:42 AM
Alpha_012	21f	ALL	Not Done	
Alpha_013	21f	ALL	Passed	5/6/2013 5:21:43 AM
Alpha_014	21f	ALL	Passed	5/6/2013 5:21:44 AM
Alpha_015	21f	ALL	Not Done	
Alpha_016	21f	ALL	Not Done	
Alpha_017	AIM730	ALL	Not Done	
Alpha_018	AIM730	ALL	Passed	5/6/2013 5:21:45 AM
Alpha_019	AIM730	ALL	Not Done	
Alpha_020	AIM730	ALL	Not Done	
Alpha_021	AIM730	ALL	Not Done	
Alpha_022	AIM730	ALL	Passed	5/6/2013 5:21:45 AM
Alpha_023	AIM730	ALL	Not Done	
Alpha_024	AIM730	ALL	Passed	5/6/2013 5:21:46 AM
Alpha_025	AIM730	ALL	Passed	5/6/2013 5:21:47 AM
Alpha_026	AIM730	ALL	Not Done	
Alpha_027	AIM730	ALL	Passed	5/6/2013 5:21:48 AM
Alpha_028	AIM730	ALL	Not Done	
Alpha_029	AIM730	ALL	Passed	5/6/2013 5:21:49 AM
Alpha_030	AIM730	ALL	Not Done	
Alpha_031	AIM730	ALL	Not Done	
Alpha_032	AIM730	ALL	Not Done	
Alpha_033	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:21:50 AM
Alpha_034	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:21:51 AM
Alpha_035	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:21:53 AM
Alpha_036	Alpha Analyst100DC	ALL	Not Done	
Alpha_037	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:21:54 AM
Alpha_038	Alpha Analyst100DC	ALL	Not Done	
Alpha_039	Alpha Analyst100DC	ALL	Not Done	
Alpha_040	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:21:56 AM
Alpha_041	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:21:58 AM
Alpha_042	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:21:59 AM

Review of QA Results - Pulser Check

5/6/2013 5:36:52 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_043	Alpha Analyst100DC	ALL	Not Done	
Alpha_044	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:22:01 AM
Alpha_045	Alpha Analyst100DC	ALL	Not Done	
Alpha_046	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:22:02 AM
Alpha_047	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:22:04 AM
Alpha_048	Alpha Analyst100DC	ALL	Passed	5/6/2013 5:22:06 AM

APPROVED BY: C

APPROVAL DATE: 5/16/13

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

Nuclide Library Title: Thorium

Nuclide Library Description: Th-227,-228,-229,-230,-232

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
TH-227	6.873E+008	5850.000*	0.000	97.5000	0.0000
TH-228	6.034E+007	5400.000*	0.000	99.9400	0.0000
TH-229	2.487E+011	4872.000*	0.000	99.5200	0.0000
TH-230	2.379E+012	4672.000*	0.000	99.8200	0.0000
TH-232	4.434E+017	3997.000*	0.000	100.0000	0.0000

* = key line

TOTALS: 5 Nuclides 5 Energy Lines

SECTION X

ANALYTICAL DATA (RADIUM-226)

13-04108
Ra226
Run 1

Work Order	13-04108
Analysis Code	Ra226
Run	1
Date Received	4/16/2013
Lab Deadline	5/7/2013
Client	Engineering Management Support, Inc.
Project	West Lake OU-1
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)	1008.316
Carrier	
Carrier Conc (mg/ml)	

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		04/16/13 00:00	1.0000E+00
02	MBL	BLANK		04/16/13 00:00	1.5000E+00
03	DUP	DUP 06 TOT	38	04/11/13 00:00	1.5000E+00
04	DO	DUP 06 TOT	38	04/11/13 00:00	1.5000E+00
05	TRG	DUP 06 DIS	38	04/11/13 00:00	1.5000E+00
06	TRG	I-4 TOT	42	04/12/13 13:20	1.5000E+00
07	TRG	I-4 DIS	42	04/12/13 13:20	1.5000E+00

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

13-04108
Ra226
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	0.9162	923.8	417.7	100.38		0.0225	0.0284	0.0059		100.38	2.12	1.00
02	MBL	0.9076	915.1	421.1	102.15		0.0222	0.0284	0.0062		102.15	2.23	1.00
03	DUP	0.9050	912.5	429.6	104.51		0.0220	0.0288	0.0068		104.51	2.44	1.00
04	DO	0.9038	911.3	411.3	100.19		0.0226	0.0296	0.0070		100.19	2.50	1.00
05	TRG	0.9033	910.8	418.0	101.88		0.0220	0.0294	0.0074		101.88	2.61	1.00
06	TRG	0.9024	909.9	389.6	95.06		0.0223	0.0309	0.0086		95.06	2.91	1.00
07	TRG	0.9042	911.7	427.4	104.07		0.0225	0.0291	0.0066		104.07	2.37	1.00

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

13-04108
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			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH		
02	MBL			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH		
03	DUP			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH		
04	DO			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH		
05	TRG			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH		
06	TRG			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH		
07	TRG			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH		

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

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
Analysis Code: Ra226
Run: 1

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	RA-226	LCS	LCS	pCi/l	9.24E+00	1.09E+00	1.85E-01	1.04E+01	89.21	OK		OK	
02	RA-226	MBL	BLANK	pCi/l	3.18E-03	4.45E-02	1.27E-01					OK	OK
03	RA-226	DUP	DUP 06 TOT	pCi/l	1.31E+00	3.49E-01	1.24E-01				NA	OK	
04	RA-226	DO	DUP 06 TOT	pCi/l	1.53E+00	3.86E-01	1.18E-01					OK	
05	RA-226	TRG	DUP 06 DIS	pCi/l	1.10E+00	3.25E-01	1.27E-01					OK	
06	RA-226	TRG	I-4 TOT	pCi/l	6.51E-01	2.70E-01	1.80E-01					OK	
07	RA-226	TRG	I-4 DIS	pCi/l	1.13E-01	1.11E-01	1.43E-01					OK	

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-Ra226-1

Run: 1
Analysis Code: Ra226
Eberline Services Work Order: 13-04108
Client: Engineering Management Support, Inc.

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	04/16/13 00:00	1.00E+00	100.00	0.00	100.38		5/1/2013 10:55	
02	RA-226	MBL	04/16/13 00:00	1.50E+00	100.00	0.00	102.15		5/1/2013 10:55	
03	RA-226	DUP	04/11/13 00:00	1.50E+00	100.00	0.00	104.51		5/1/2013 10:55	
04	RA-226	DO	04/11/13 00:00	1.50E+00	100.00	0.00	100.19		5/1/2013 10:55	
05	RA-226	TRG	04/11/13 00:00	1.50E+00	100.00	0.00	101.88		5/1/2013 10:55	
06	RA-226	TRG	04/12/13 13:20	1.50E+00	95.06	0.00	95.06		5/1/2013 10:55	
07	RA-226	TRG	04/12/13 13:20	1.50E+00	100.00	0.00	104.07		5/1/2013 10:55	

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-Ra226-1

Run	1
Analysis Code	Ra226
Eberline Services Work Order	13-04108
Client	Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-226	LCS	05/02/13 05:33		A_Spec	Alpha_033	170	3.00 E+02	0.00 E+00	18.2
02	RA-226	MBL	05/02/13 05:33		A_Spec	Alpha_034	170	1.50 E-01	5.00 E-03	18.6
03	RA-226	DUP	05/02/13 05:33		A_Spec	Alpha_035	170	5.55 E+01	3.00 E-03	18.3
04	RA-226	DO	05/02/13 05:33		A_Spec	Alpha_037	170	6.17 E+01	2.00 E-03	17.8
05	RA-226	TRG	05/02/13 05:33		A_Spec	Alpha_040	170	4.55 E+01	3.00 E-03	19
06	RA-226	TRG	05/02/13 05:33		A_Spec	Alpha_041	170	2.38 E+01	7.00 E-03	19.8
07	RA-226	TRG	05/02/13 05:33		A_Spec	Alpha_042	170	4.98 E+00	6.00 E-03	18.5

Count Room Report
Client: Engineering Management Su

13-04108-Ra226-1 (pCi/l) in WA
Tracer ID: Ba-6a

2.5

Internal Fraction	Sample Desc	Client ID	Sample Date	Sample Aliquot	Tracer Aliquot (g)	Tracer ACT (dpm)	Radiometric Tracer (pCi)	Radiometric % Rec	SAF 1*	SAF 2*
01	LCS	LCS	04/16/13 00:00	1.0000	0.9162	923.8191	417.7000	100.38	2.12	1.00
02	MBL	BLANK	04/16/13 00:00	1.5000	0.9076	915.1476	421.1000	102.15	2.23	1.00
03	DUP	DUP 06 TOT	04/11/13 00:00	1.5000	0.9050	912.5260	429.6000	104.51	2.44	1.00
04	DO	DUP 06 TOT	04/11/13 00:00	1.5000	0.9038	911.3160	411.3000	100.19	2.50	1.00
05	TRG	DUP 06 DIS	04/11/13 00:00	1.5000	0.9033	910.8118	418.0000	101.88	2.61	1.00
06	TRG	I-4 TOT	04/12/13 13:20	1.5000	0.9024	909.9044	389.6000	95.06	2.91	1.00
07	TRG	I-4 DIS	04/12/13 13:20	1.5000	0.9042	911.7193	427.4000	104.07	2.37	1.00

Spike and Tracer Worksheet

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
13-04108	1	Ra226	4/29/2013 10:16	JBARNARD	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-226	Ra-5b	44.071	4/29/2013	0.500	0.5215				10.35	0.476	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	1008.316	4/29/2013	0.9162	1.0000
02	Ba-133	Ba-6a	1008.316	4/29/2013	0.9076	1.0000
03	Ba-133	Ba-6a	1008.316	4/29/2013	0.9050	1.0000
04	Ba-133	Ba-6a	1008.316	4/29/2013	0.9038	1.0000
05	Ba-133	Ba-6a	1008.316	4/29/2013	0.9033	1.0000
06	Ba-133	Ba-6a	1008.316	4/29/2013	0.9024	1.0000
07	Ba-133	Ba-6a	1008.316	4/29/2013	0.9042	1.0000

Balance Printer Tapes

Tracer

0.9162 g
0.9076 g
-0.9050 g
-0.9038 g
-0.9033 g
-0.9024 g
-0.9042 g

LCS

0.5215 g
0.5149 g

Matrix Spike

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Printed: 4/29/2013 10:18 AM

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
13-04108	1	Ra226	liters	5/7/2013	JBARNARD

Lab Fraction	Engineering Management Support, Inc. Client ID	Sample Type	Muffle Data	Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
			Ratio Post/Pre	No of Dils	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq
01	LCS	LCS					1.0000E+00	1.0000E+00				
02	BLANK	MBL					1.5000E+00	1.5000E+00				
03	DUP 06 TOT	DUP					1.5000E+00	1.5000E+00				
04	DUP 06 TOT	DO					1.5000E+00	1.5000E+00				
05	DUP 06 DIS	TRG					1.5000E+00	1.5000E+00				
06	I-4 TOT	TRG					1.5000E+00	1.5000E+00				
07	I-4 DIS	TRG					1.5000E+00	1.5000E+00				

Comments	

Technician: JBA Date: 4/29/13

2519

Gravimetric Worksheet

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
13-04108	**1**	**Ra226**			**LWALKER**

TRetec	Engineering Management Support, Inc.	Sample	Carrier Data	Filter Data			Gravimetric
Fraction	Client ID	Type	Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)	% Recovery
01	LCS	LCS		0.0225	0.0284	**0.0059**	
02	BLANK	MBL		0.0222	0.0284	**0.0062**	
03	DUP	DUP		0.0220	0.0288	**0.0068**	
04	DUP 06 TOT	DO		0.0226	0.0296	**0.0070**	
05	DUP 06 DIS	TRG		0.0220	0.0294	**0.0074**	
06	I-4 TOT	TRG		0.0223	0.0309	**0.0086**	
07	I-4 DIS	TRG		0.0225	0.0291	**0.0066**	

Technician: L. Walker Date: 5/1/13

Apex-Alpha™

Sample Description: SPIKE
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000568
Batch Identification: 1304108A-RA
Sample Identification: 01
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_033
Chamber Serial Number: 04026479A
Detector Serial Number: 91132
Env. Background: System Bkgd 55746
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.120E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 5/2/2013 10:55:07 PM
Acquisition Date/Time: 5/2/2013 5:33:25 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
Counting Efficiency: 0.1825 +/- 0.0032 on 12/16/2012 5:49:18 PM
Effective Efficiency: 0.1825 +/- 0.0032

Control Certificate Name: Ra226_Ra-5b
Chem. Recov. of Control: RA-226 0.420770 +/- 0.028392
Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

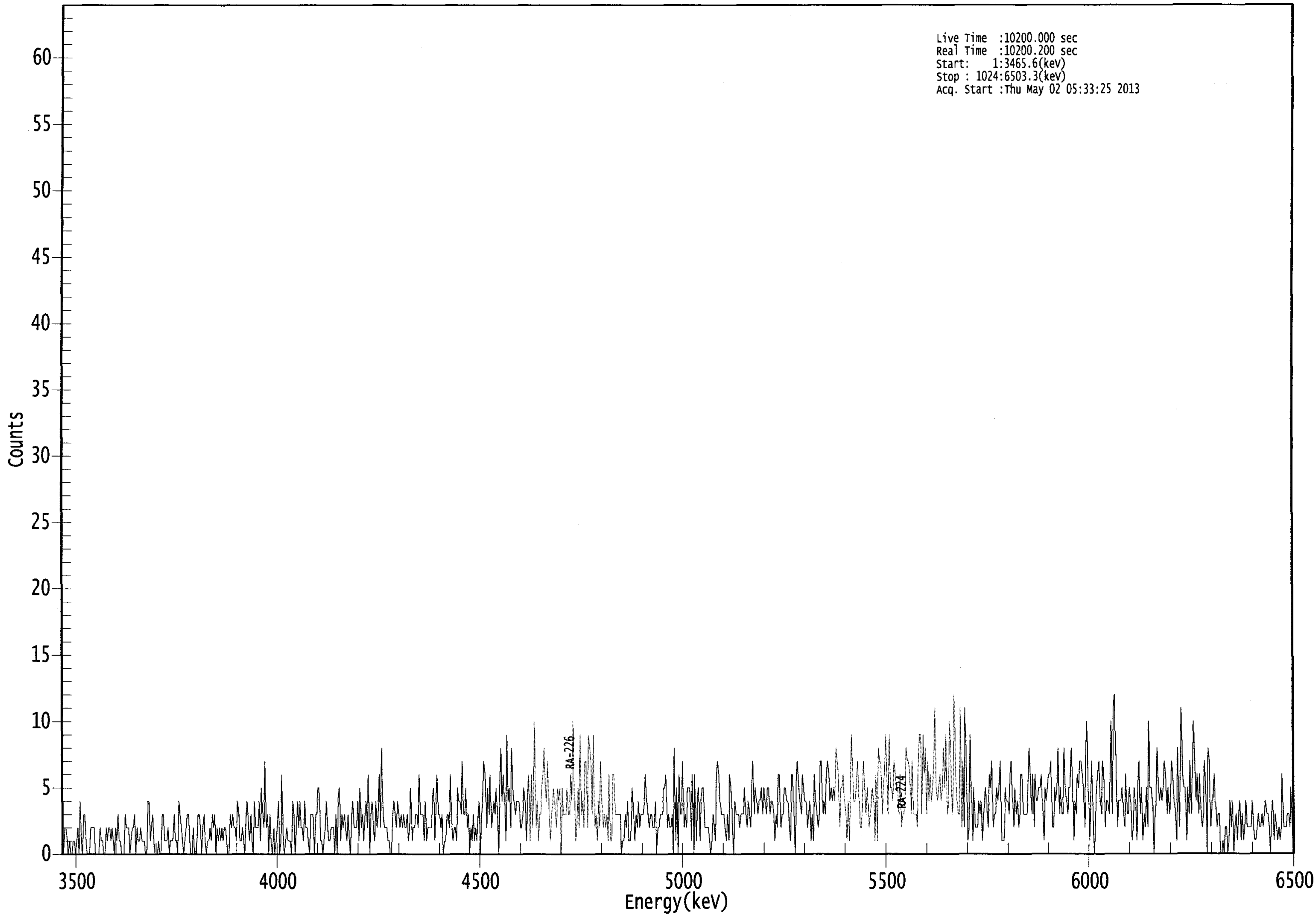
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.540	559.66	8.29	0.34	0.00E+000	5.5
RA-226	4.726	300.00	11.33	0.00	0.00E+000	4.8

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.973	5685.50*	1.58E+001 +/- 2.96E+003	1.35E-001 +/- 2.53E+001
RA-226	0.995	4785.00*	9.24E+000 +/- 1.09E+000	1.85E-001 +/- 6.36E-003

AG
5/2/13

0000056899.CNF



ROI Type: 1

0200

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

369:	6	4	1	9	4	5	2	8

Sample Title: 01

Channel								
377:	5	4	3	4	4	4	2	2
385:	3	5	4	1	4	6	1	6
393:	2	5	10	2	4	1	3	3
401:	5	6	8	5	4	7	3	1
409:	3	4	5	3	2	5	4	5
417:	0	5	3	3	3	5	3	3
425:	6	4	10	5	1	2	5	2
433:	9	3	4	2	7	7	2	9
441:	8	7	3	9	2	3	1	4
449:	2	7	4	2	3	2	3	1
457:	6	1	1	6	6	3	3	3
465:	3	3	0	1	1	3	2	4
473:	1	1	2	5	3	1	3	2
481:	4	2	3	3	3	4	6	4
489:	3	2	3	3	2	2	4	0
497:	2	2	3	3	3	5	5	6
505:	2	3	2	2	3	0	8	1
513:	5	0	6	3	3	7	2	3
521:	2	5	5	5	1	6	0	6
529:	1	4	5	1	4	5	5	2
537:	2	2	2	1	0	1	3	2
545:	1	6	7	6	4	3	3	3
553:	2	1	3	1	6	5	2	0
561:	4	3	3	3	2	3	3	3
569:	5	3	2	4	3	2	5	7
577:	3	5	4	3	4	4	5	3
585:	5	4	3	5	5	3	4	4
593:	3	1	3	2	6	6	2	3
601:	3	5	5	4	4	2	1	6
609:	6	2	0	6	7	5	4	3
617:	6	5	4	4	2	3	4	1
625:	3	1	6	4	3	2	3	7
633:	7	3	4	3	6	7	6	4
641:	5	4	5	4	8	7	6	2
649:	5	5	6	4	3	1	4	1
657:	5	9	6	4	4	5	7	5
665:	2	2	4	7	5	3	5	2
673:	3	4	5	4	1	6	1	8
681:	7	7	3	5	6	9	6	3
689:	9	5	5	4	7	6	5	5
697:	3	6	2	3	3	4	8	7
705:	7	6	3	7	3	3	3	2
713:	7	9	9	3	9	6	8	3
721:	7	4	6	4	5	7	11	5
729:	4	5	6	4	5	8	5	9
737:	3	4	10	8	3	5	12	6
745:	4	3	3	11	2	7	2	11
753:	7	1	2	9	5	1	5	2
761:	2	2	4	3	4	1	3	4
769:	5	3	2	6	5	7	2	3
777:	3	5	4	5	7	1	1	1
785:	5	4	4	3	6	7	4	2
793:	5	3	4	2	3	6	6	3

801:	3	3	3	5	8	6	3	6

Sample Title: 01

Channel								
809:	2	6	4	4	5	5	6	3
817:	1	5	4	5	6	6	7	2
825:	2	5	4	5	8	3	5	3
833:	3	8	5	4	3	5	5	8
841:	6	1	4	3	6	5	7	7
849:	6	5	2	8	10	5	1	4
857:	7	2	0	3	5	6	7	4
865:	3	7	6	2	4	4	3	5
873:	10	3	11	12	7	2	4	4
881:	4	5	3	2	6	3	3	5
889:	4	1	2	5	4	1	5	7
897:	3	5	1	3	2	5	2	10
905:	5	5	4	0	3	4	8	5
913:	4	5	4	5	7	6	3	5
921:	3	4	7	6	4	3	1	8
929:	2	5	11	6	5	5	1	5
937:	3	7	3	6	10	7	4	6
945:	3	6	3	2	3	7	5	0
953:	8	7	2	4	4	6	4	2
961:	3	3	0	0	1	0	2	2
969:	0	1	4	2	4	0	2	3
977:	1	3	4	1	3	1	2	4
985:	2	2	2	2	4	2	1	1
993:	2	3	2	2	3	2	3	4
1001:	3	3	2	0	3	4	1	3
1009:	2	1	2	1	2	6	2	2
1017:	2	3	3	2	5	2	0	5

Apex-Alpha™

c

Sample Description: BLANK
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000568
Batch Identification: 1304108A-RA
Sample Identification: 02
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_034
Chamber Serial Number: 04026479B
Detector Serial Number: 91136
Env. Background: System Bkgd 55747
Reagent Blank: <not performed>

Sample Size: 1.500E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.230E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 5/2/2013 10:55:07 PM
Acquisition Date/Time: 5/2/2013 5:33:26 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
Counting Efficiency: 0.1856 +/- 0.0032 on 12/16/2012 5:49:43 PM
Effective Efficiency: 0.1856 +/- 0.0032

Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.662	0.83	239.53	0.17	0.00E+000	3.0
RA-226	4.688	0.15	1397.8	0.85	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.999	5685.50*	1.62E-002 +/- 3.03E+000	8.12E-002 +/- 1.52E+001
RA-226	0.988	4785.00*	3.18E-003 +/- 4.45E-002	1.27E-001 +/- 4.34E-003

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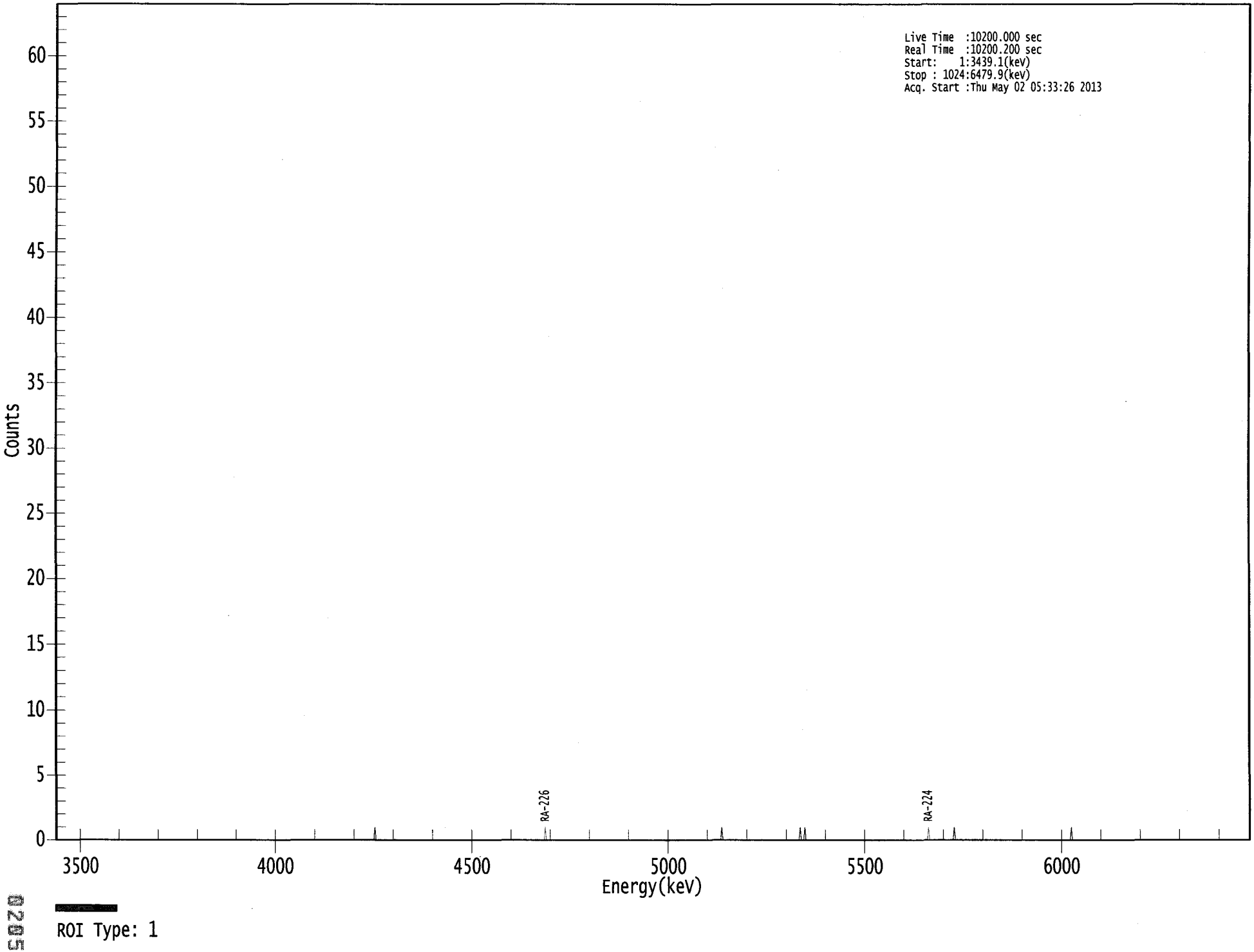
5/2/13

0000056893.CNF



5929

****
***** 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	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	1	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

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:	0	0	0	0	0	0	0	0
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	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	0	1	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	1	0
641:	0	0	1	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	1	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	1	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	1	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™

C
8/2m

Sample Description: DUP 06 TOT DUP
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000568
Batch Identification: 1304108A-RA
Sample Identification: 03
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_035
Chamber Serial Number: 04026477A
Detector Serial Number: 58771
Env. Background: System Bkgd 55748
Reagent Blank: <not performed>

Sample Size: 1.500E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.440E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 5/1/2013 10:55:07 PM
Acquisition Date/Time: 5/2/2013 5:33:21 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
Counting Efficiency: 0.1826 +/- 0.0032 on 12/16/2012 5:49:42 PM
Effective Efficiency: 0.1826 +/- 0.0032

Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.533	14.66	51.88	0.34	0.00E+000	2.9
RA-226	4.591	55.49	26.45	0.51	0.00E+000	10.3

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.970	5685.50*	3.83E-001 +/- 2.75E+001	1.25E-001 +/- 8.97E+000
RA-226	0.952	4785.00*	1.31E+000 +/- 3.49E-001	1.24E-001 +/- 4.24E-003

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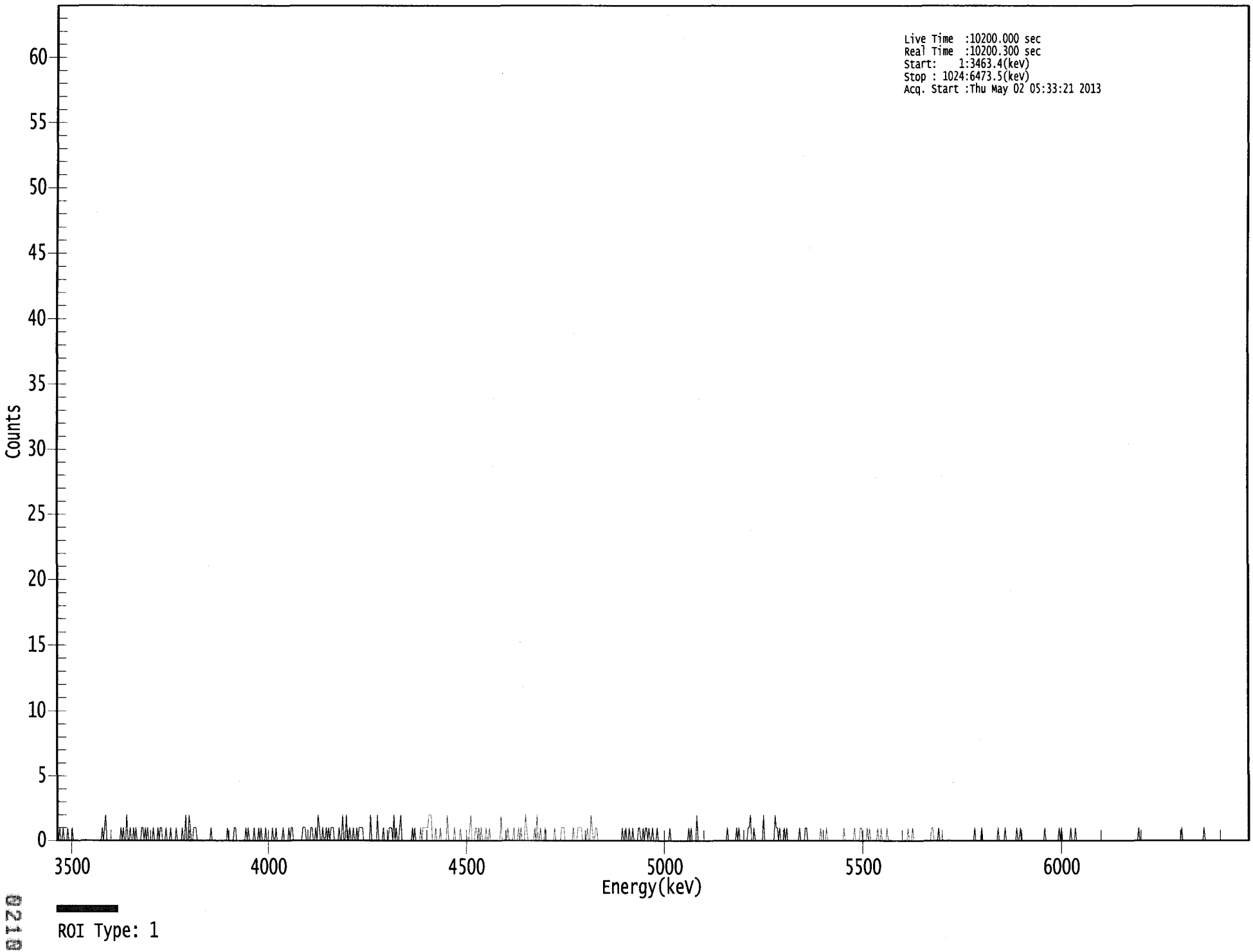
5/2/13

0000056894.CNF



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

Sample Title: 03

Elapsed Live time: 10200
Elapsed Real Time: 10200

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

369:	0	1	0	0	1	0	0	0

Sample Title: 03

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

801:	0	0	0	0	0	0	0	0

Sample Title: 03

Channel								
809:	1	0	0	0	0	0	1	0
817:	0	0	0	0	0	0	0	0
825:	1	0	0	1	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	1	0	0	0	0	0	0	0
857:	0	0	0	0	1	0	1	0
865:	0	0	0	0	0	0	1	0
873:	0	0	1	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	1	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	1	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	1	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	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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8/2/13

Sample Description: DUP 06 TOT
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000568
Batch Identification: 1304108A-RA
Sample Identification: 04
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_037
Chamber Serial Number: 04026478A
Detector Serial Number: 91133
Env. Background: System Bkgd 55750
Reagent Blank: <not performed>

Sample Size: 1.500E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.500E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 5/1/2013 10:55:07 PM
Acquisition Date/Time: 5/2/2013 5:33:23 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
Counting Efficiency: 0.1783 +/- 0.0033 on 1/26/2013 3:28:25 PM
Effective Efficiency: 0.1783 +/- 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	5.508	7.83	70.93	0.17	0.00E+000	2.9
RA-226	4.550	61.66	25.04	0.34	0.00E+000	4.4

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.960	5685.50*	2.15E-001 +/- 1.54E+001	1.15E-001 +/- 8.21E+000
RA-226	0.931	4785.00*	1.53E+000 +/- 3.86E-001	1.18E-001 +/- 4.31E-003

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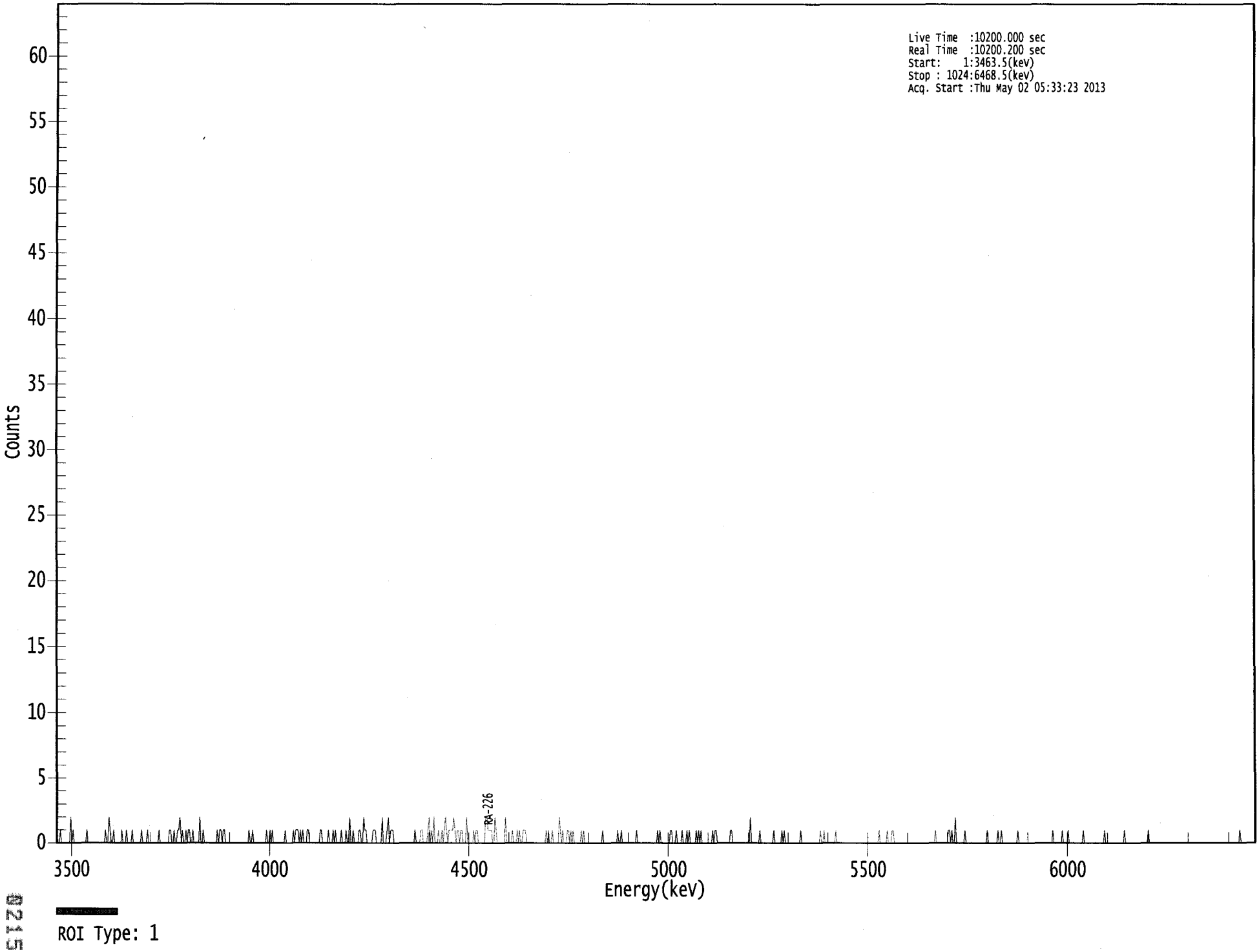
5/2/13

0000056895.CNF



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

Sample Title: 04

Elapsed Live time: 10200
Elapsed Real Time: 10200

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

369:	2	1	1	1	1	0	0	2

Sample Title: 04

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

801:	0	0	0	0	1	0	0	1

Sample Title: 04

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	1	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	1	0	0	0	0
857:	0	0	0	1	0	0	0	0
865:	1	0	0	0	0	0	0	0
873:	0	0	0	0	0	1	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	1
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	1	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	1	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	1	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0

Apex-Alpha™

Sample Description:	DUP 06 DIS
Spectrum File:	\\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000568
Batch Identification:	1304108A-RA
Sample Identification:	05
Sample Geometry:	Shelf 2
Procedure Description:	Ra
Detector Name:	Alpha_040
Chamber Serial Number:	06027396B
Detector Serial Number:	91135
Env. Background:	System Bkgd 55752
Reagent Blank:	<not performed>
Sample Size:	1.500E+000 +/- 0.000E+000 liter
Generic Mult. Factor:	2.610E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time:	5/1/2013 10:55:07 PM
Acquisition Date/Time:	5/2/2013 5:33:33 AM
Acquisition Live Time:	170.0 minutes
Acquisition Real Time:	170.0 minutes
Chem. Recovery Factor:	1.0000 +/- 0.0000
Counting Efficiency:	0.1900 +/- 0.0033 on 12/16/2012 5:49:33 PM
Effective Efficiency:	0.1900 +/- 0.0033
Peak Match Tolerance:	0.350 MeV

PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.511	7.32	76.28	0.68	0.00E+000	3.0
RA-226	4.560	45.49	29.25	0.51	0.00E+000	4.5

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.961	5685.50*	1.97E-001 +/- 1.41E+001	1.52E-001 +/- 1.09E+001
RA-226	0.936	4785.00*	1.10E+000 +/- 3.25E-001	1.27E-001 +/- 4.33E-003

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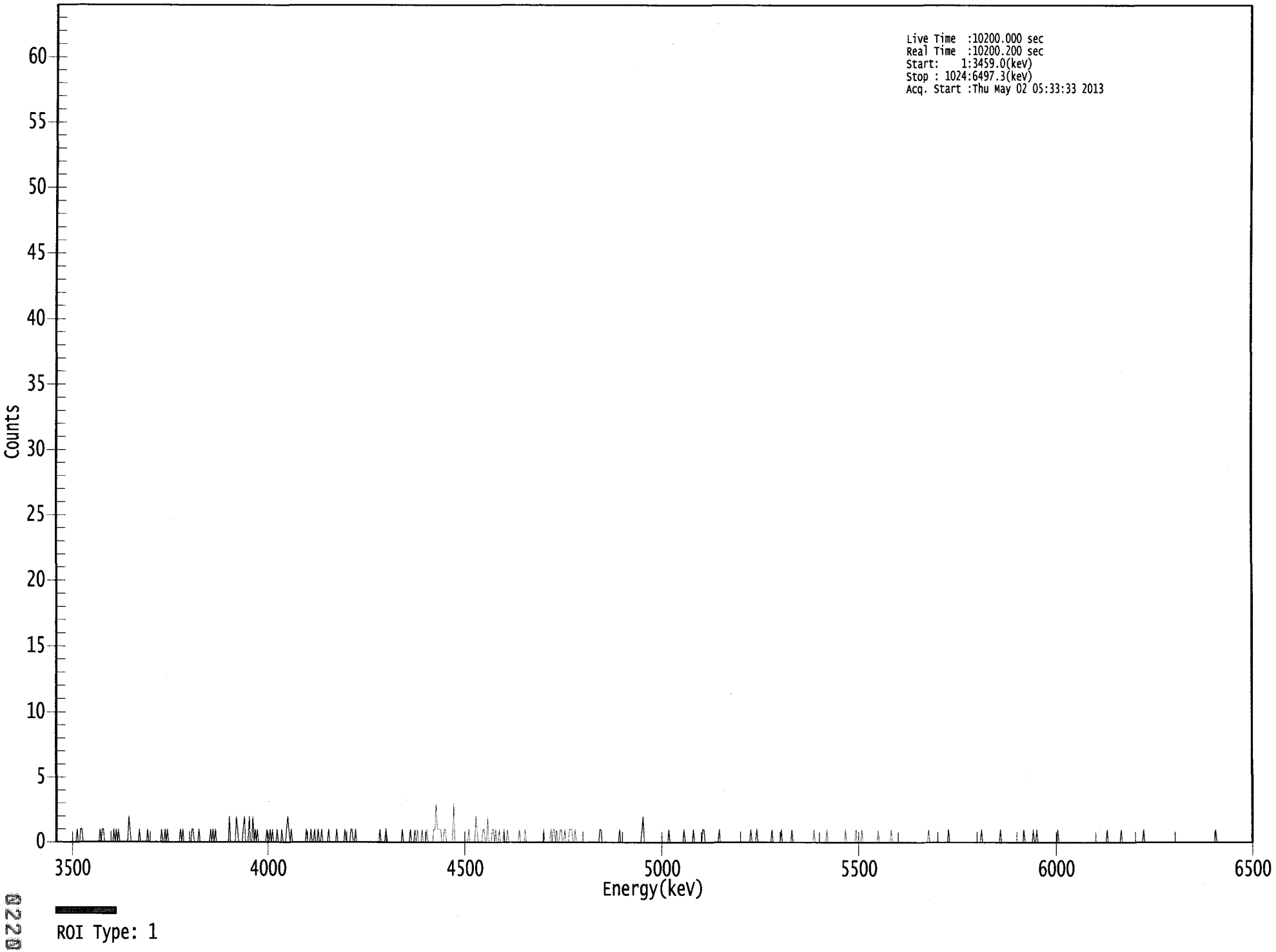
0000056896.CNF



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

Sample Title: 05

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

369:	0	0	2	0	0	0	1	1

Sample Title: 05

Channel								
377:	0	1	0	0	1	0	0	0
385:	1	0	0	1	0	0	0	0
393:	0	0	0	0	0	1	0	0
401:	0	0	1	0	0	0	0	0
409:	0	0	0	0	0	0	0	0
417:	0	0	1	0	0	0	0	0
425:	1	0	1	1	0	1	0	0
433:	1	1	0	0	1	0	0	0
441:	1	1	1	0	0	1	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	1	1	0	0	0	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	1	0	0	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	1	2
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	1	0	0	0	0	0
545:	0	0	1	0	0	0	0	0
553:	0	0	1	1	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:	1	0	0	0	0	0	0	0
609:	0	0	0	0	0	1	0	0
617:	0	0	0	0	0	1	0	0
625:	0	0	0	0	0	0	1	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	1	0	0	0	0	0	0
657:	0	0	0	0	1	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	1	0	0	0
681:	0	0	0	0	0	1	0	0
689:	0	0	1	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	1	0	0	0	0	0	0	0
713:	0	0	0	1	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	1	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	1	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	1	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 05

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

Sample Description: I-4 TOT
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000568
Batch Identification: 1304108A-RA
Sample Identification: 06
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_041
Chamber Serial Number: 05026930A
Detector Serial Number: 91087
Env. Background: System Bkgd 55753
Reagent Blank: <not performed>

Sample Size: 1.500E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.910E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 5/1/2013 10:55:07 PM
Acquisition Date/Time: 5/2/2013 5:33:29 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 0.9506 +/- 0.0000
Counting Efficiency: 0.1978 +/- 0.0034 on 12/16/2012 5:49:31 PM
Effective Efficiency: 0.1881 +/- 0.0032

Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

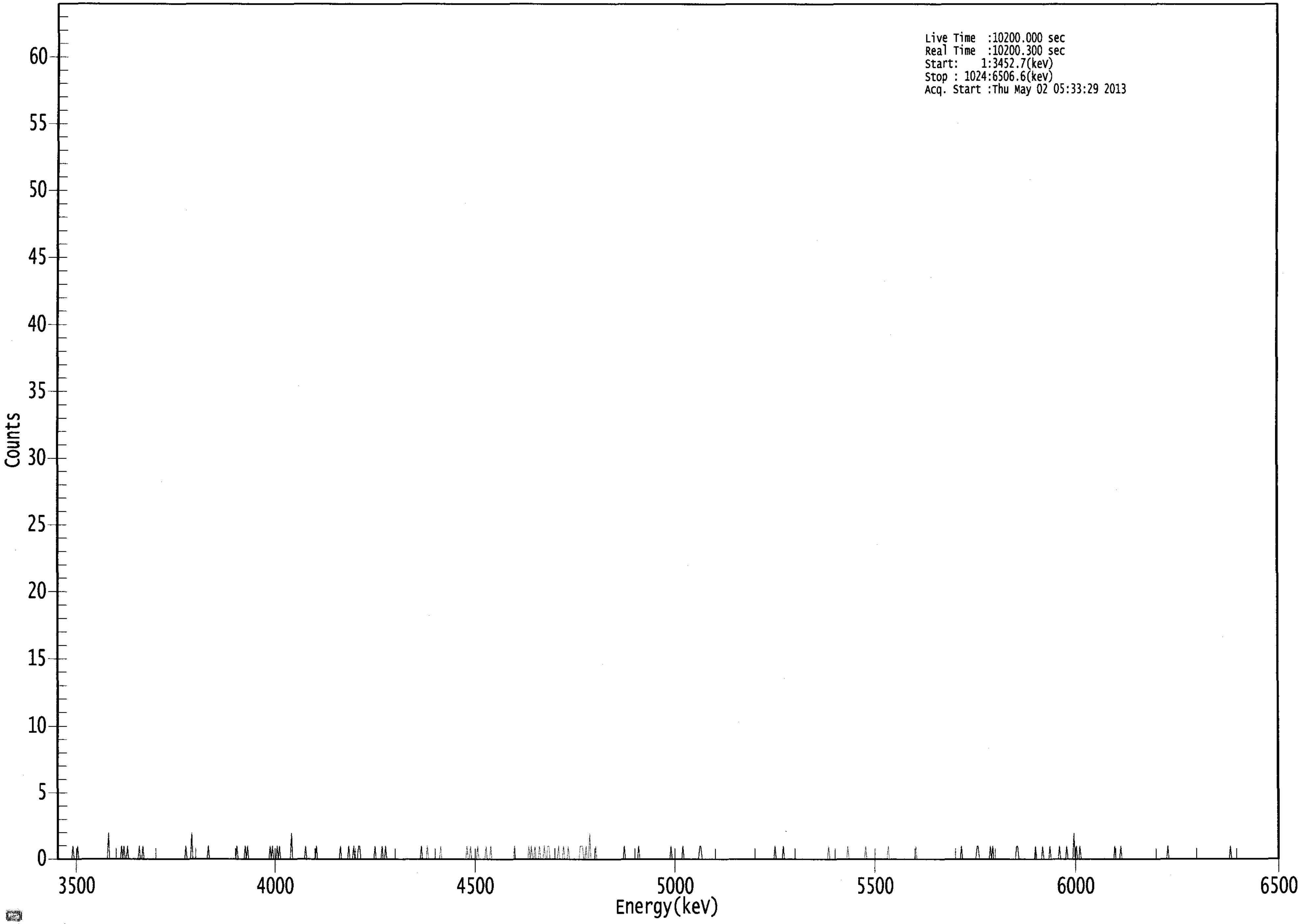
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.486	4.66	94.59	0.34	0.00E+000	3.0
RA-226	4.647	23.81	41.33	1.19	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.949	5685.50*	1.41E-001 +/- 1.01E+001	1.45E-001 +/- 1.04E+001
RA-226	0.976	4785.00*	6.51E-001 +/- 2.70E-001	1.80E-001 +/- 6.09E-003

AG
5/6/13

0000056897.CNF



0225

ROI Type: 1

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

Sample Title: 06

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	1	0	0
17:	0	1	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	2	0	0	0	0
49:	0	0	0	0	0	0	1	0
57:	1	0	0	1	0	0	0	0
65:	0	0	0	0	0	1	0	0
73:	1	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	1	0	0	0
113:	0	2	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	1
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	1
153:	0	0	0	0	0	0	1	0
161:	1	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	1	0	1	0	0
185:	0	1	0	1	0	0	0	0
193:	0	0	0	0	0	2	0	0
201:	0	0	0	0	0	0	0	0
209:	0	1	0	0	0	0	0	0
217:	0	0	1	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	1	0
241:	0	0	0	0	0	1	0	0
249:	0	1	0	0	0	1	1	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	1	0	0	0	0
273:	0	1	0	0	1	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	1	0	0	0	0	1
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:	1	0	0	1	0	0	0	0
353:	0	1	0	0	0	0	0	0
361:	1	0	0	0	1	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 06

Channel								
377:	0	0	0	0	0	0	0	0
385:	1	0	0	0	0	0	0	0
393:	0	0	0	0	1	0	1	0
401:	0	1	0	0	0	1	0	0
409:	0	1	0	0	1	1	0	0
417:	0	0	0	0	0	1	0	0
425:	0	1	0	0	0	1	0	0
433:	0	0	0	0	0	0	0	1
441:	1	1	0	0	1	0	0	2
449:	0	0	0	0	1	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	1	0	0	0
481:	0	0	0	0	0	0	0	0
489:	1	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	1	0	0	0	0
521:	0	0	0	0	0	1	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	1	1	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	1	0	0	0	0	0
609:	0	1	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	1
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	1
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	1	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	1	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	1	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	1	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	1	1	0	0	0
777:	0	0	0	0	0	0	1	0
785:	1	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	1	1	0	0

Sample Title: 06

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	1	0	0	0
825:	0	0	1	0	0	0	0	0
833:	1	0	0	0	0	0	0	0
841:	1	0	0	0	0	0	1	0
849:	0	0	0	0	2	0	1	0
857:	0	1	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	1	0
889:	0	0	0	1	0	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	1	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	1	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™

Sample Description: I-4 DIS
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00000568
Batch Identification: 1304108A-RA
Sample Identification: 07
Sample Geometry: Shelf 2
Procedure Description: Ra

Detector Name: Alpha_042
Chamber Serial Number: 05026930B
Detector Serial Number: 84185
Env. Background: System Bkgd 55754
Reagent Blank: <not performed>

Sample Size: 1.500E+000 +/- 0.000E+000 liter
Generic Mult. Factor: 2.370E+000 Generic Div. Factor: 1.000E+000
Sample Date/Time: 5/1/2013 10:55:07 PM
Acquisition Date/Time: 5/2/2013 5:33:31 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Chem. Recovery Factor: 1.0000 +/- 0.0000
Counting Efficiency: 0.1846 +/- 0.0032 on 12/16/2012 5:49:29 PM
Effective Efficiency: 0.1846 +/- 0.0032

Peak Match Tolerance: 0.350 MeV

PEAK AREA REPORT

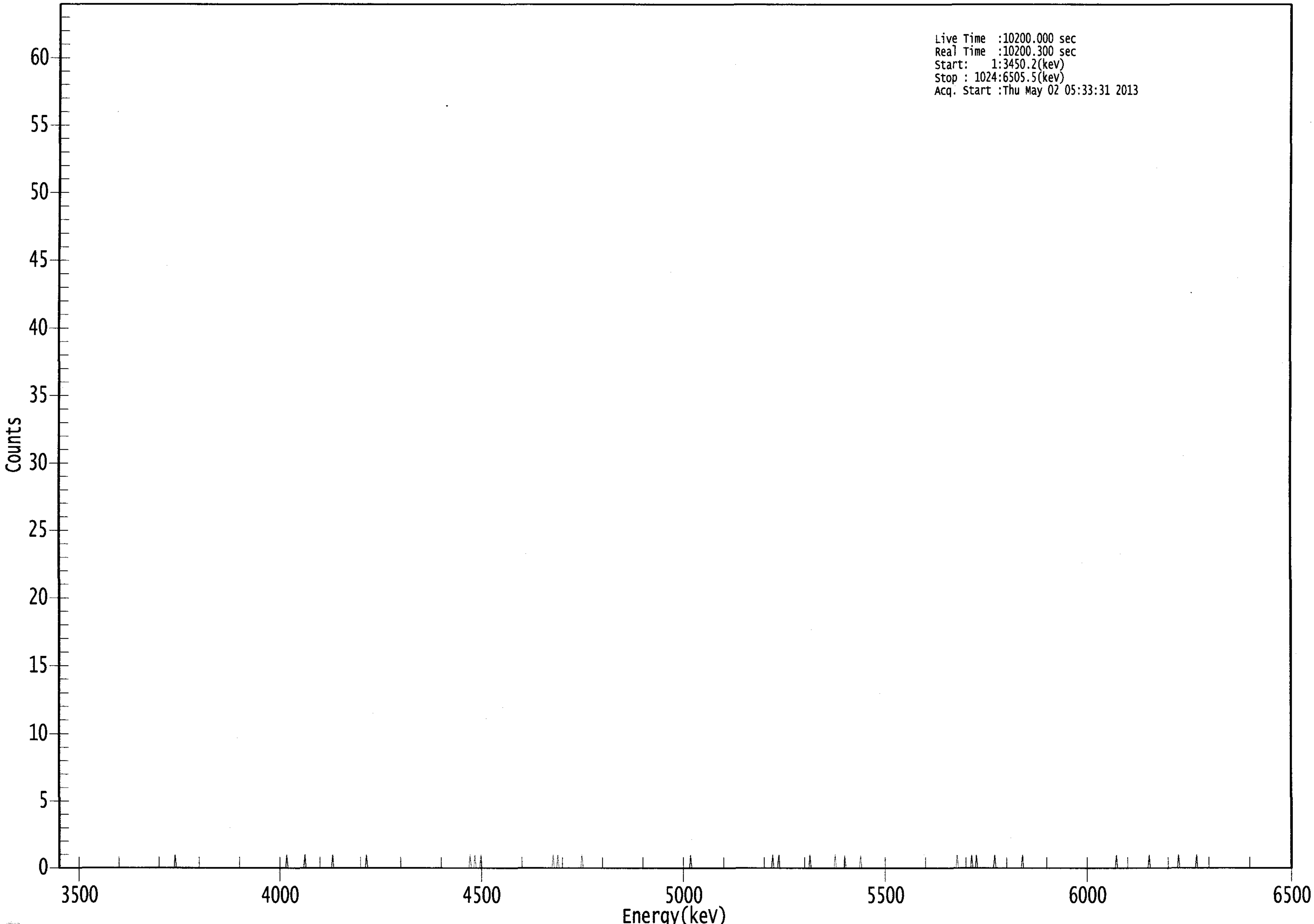
Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
RA-224	5.474	3.15	126.67	0.85	0.00E+000	3.0
RA-226	4.595	4.98	97.79	1.02	0.00E+000	3.0

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
RA-224	0.943	5685.50*	7.92E-002 +/- 5.68E+000	1.50E-001 +/- 1.08E+001
RA-226	0.954	4785.00*	1.13E-001 +/- 1.11E-001	1.43E-001 +/- 4.87E-003

AG
5/2/13

0000056898.CNF



ROI Type: 1

0230

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

Sample Title: 07

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel							
1:	0	0	0	0	0	0	0	0
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	1	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	1	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	1	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	1	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:	1	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	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	1	0
345:	0	0	1	0	0	0	0	1
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 07

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	0	1	0	0	0	1
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	1	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	1	0	0	0	0	1	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	1	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	1	0	0
649:	0	0	0	0	0	1	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	1	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	1	0	0	0	0	0
753:	0	0	0	0	0	0	1	0
761:	0	0	1	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	1	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:	1	0	0	0	0	0	0	0

Sample Title: 07

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	1	0	0	0	0	0	0
937:	0	0	0	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

5/2/2013 5:59:41 AM

Apex-Alpha™

QA SUMMARY REPORT

Review Of QA Results - Pulser Check

Date : 5/2/2013
Time : 5:59:41 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_001	21f	ALL	Not Done	
Alpha_002	21f	ALL	Not Done	
Alpha_003	21f	ALL	Passed	5/2/2013 5:15:45 AM
Alpha_004	21f	ALL	Passed	5/2/2013 5:15:46 AM
Alpha_005	21f	ALL	Not Done	
Alpha_006	21f	ALL	Not Done	
Alpha_007	21f	ALL	Not Done	
Alpha_008	21f	ALL	Not Done	
Alpha_009	21f	ALL	Not Done	
Alpha_010	21f	ALL	Passed	5/2/2013 5:15:47 AM
Alpha_011	21f	ALL	Passed	5/2/2013 5:15:48 AM
Alpha_012	21f	ALL	Not Done	
Alpha_013	21f	ALL	Passed	5/2/2013 5:15:49 AM
Alpha_014	21f	ALL	Passed	5/2/2013 5:15:49 AM
Alpha_015	21f	ALL	Not Done	
Alpha_016	21f	ALL	Not Done	
Alpha_017	AIM730	ALL	Not Done	
Alpha_018	AIM730	ALL	Passed	5/2/2013 5:15:50 AM
Alpha_019	AIM730	ALL	Not Done	
Alpha_020	AIM730	ALL	Not Done	
Alpha_021	AIM730	ALL	Not Done	
Alpha_022	AIM730	ALL	Passed	5/2/2013 5:15:51 AM
Alpha_023	AIM730	ALL	Not Done	
Alpha_024	AIM730	ALL	Passed	5/2/2013 5:15:52 AM
Alpha_025	AIM730	ALL	Passed	5/2/2013 5:15:53 AM
Alpha_026	AIM730	ALL	Not Done	
Alpha_027	AIM730	ALL	Passed	5/2/2013 5:15:54 AM
Alpha_028	AIM730	ALL	Not Done	
Alpha_029	AIM730	ALL	Passed	5/2/2013 5:15:54 AM
Alpha_030	AIM730	ALL	Not Done	
Alpha_031	AIM730	ALL	Not Done	
Alpha_032	AIM730	ALL	Not Done	
Alpha_033	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:15:56 AM
Alpha_034	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:15:57 AM
Alpha_035	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:15:59 AM
Alpha_036	Alpha Analyst100DC	ALL	Passed	4/29/2013 5:29:59 AM
Alpha_037	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:01 AM
Alpha_038	Alpha Analyst100DC	ALL	Not Done	
Alpha_039	Alpha Analyst100DC	ALL	Passed	4/29/2013 5:30:03 AM
Alpha_040	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:03 AM
Alpha_041	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:04 AM
Alpha_042	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:06 AM

Review of QA Results - Pulser Check

5/2/2013 5:59:41 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_043	Alpha Analyst100DC	ALL	Passed	4/29/2013 5:30:09 AM
Alpha_044	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:09 AM
Alpha_045	Alpha Analyst100DC	ALL	Not Done	
Alpha_046	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:12 AM
Alpha_047	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:15 AM
Alpha_048	Alpha Analyst100DC	ALL	Passed	5/2/2013 5:16:18 AM

APPROVED BY: C

APPROVAL DATE: 5/2/13

****
***** 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

SECTION XI

ANALYTICAL DATA (RADIUM-228)

Work Order	13-04108
Analysis Code	Ra228
Run	1
Date Received	4/16/2013
Lab Deadline	5/7/2013
Client	Engineering Management Support, Inc.
Project	West Lake OU-1
Report Level	4
Activity Units	pCi
Aliquot Units	l
Matrix	WA
Method	EPA 904.0 Modified
Instrument Type	Alpha/Beta GPC
Radiometric Tracer	Ba-133
Radiometric Sol#	Ba-6a
Tracer Act (dpm/g)	1008.316
Carrier	Yttirum
Carrier Conc (mg/ml)	34

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		04/16/13 00:00	1.0000E+00
02	MBL	BLANK		04/16/13 00:00	1.5000E+00
03	DUP	DUP 06 TOT	38	04/11/13 00:00	1.5000E+00
04	DO	DUP 06 TOT	38	04/11/13 00:00	1.5000E+00
05	TRG	DUP 06 DIS	38	04/11/13 00:00	1.5000E+00
06	TRG	I-4 TOT	42	04/12/13 13:20	1.5000E+00
07	TRG	I-4 DIS	42	04/12/13 13:20	1.5000E+00

* SAF1 is used for Gross Alpha and all other radionuclides. SAF2 is used for Gross Beta only. ** 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	0.9162	923.8	417.7	100.38	2.000	0.0965	0.1514	0.0549	80.74	81.04	1.00	1.00
02	MBL	0.9076	915.1	421.1	102.15	2.000	0.0959	0.1488	0.0529	77.79	79.47	1.00	1.00
03	DUP	0.9050	912.5	429.6	104.51	2.000	0.0966	0.1505	0.0539	79.26	82.84	1.00	1.00
04	DO	0.9038	911.3	411.3	100.19	2.000	0.0960	0.1525	0.0565	83.09	83.25	1.00	1.00
05	TRG	0.9033	910.8	418.0	101.88	2.000	0.0956	0.1483	0.0527	77.50	78.96	1.00	1.00
06	TRG	0.9024	909.9	389.6	95.06	2.000	0.0964	0.1529	0.0565	83.09	78.98	1.00	1.00
07	TRG	0.9042	911.7	427.4	104.07	2.000	0.0956	0.1509	0.0553	81.32	84.63	1.00	1.00

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

EC29

13-04108
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			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH	05/06/13 05:26	TSMITH
02	MBL			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH	05/06/13 05:26	TSMITH
03	DUP			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH	05/06/13 05:26	TSMITH
04	DO			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH	05/06/13 05:26	TSMITH
05	TRG			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH	05/06/13 05:26	TSMITH
06	TRG			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH	05/06/13 05:26	TSMITH
07	TRG			04/29/13 10:17	JBARNARD	05/01/13 10:55	TSMITH	05/06/13 05:26	TSMITH

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

02394

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-Ra228-1

Client: Engineering Management Support, Inc.
Eberline Services Work Order: 13-04108
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	8.64E+00	9.08E-01	1.10E+00	9.02E+00	95.75	OK		OK	
02	RA-228	MBL	BLANK	pCi/l	8.71E-01	3.82E-01	7.06E-01					OK	OK
03	RA-228	DUP	DUP 06 TOT	pCi/l	4.63E-01	3.81E-01	7.61E-01				NA	OK	
04	RA-228	DO	DUP 06 TOT	pCi/l	8.59E-01	3.97E-01	7.47E-01					OK	
05	RA-228	TRG	DUP 06 DIS	pCi/l	1.03E+00	4.40E-01	8.25E-01					OK	
06	RA-228	TRG	I-4 TOT	pCi/l	1.15E+00	4.49E-01	8.30E-01					OK	
07	RA-228	TRG	I-4 DIS	pCi/l	4.30E-01	3.76E-01	7.54E-01					OK	

Preliminary Data Report & Analytical Calculations

Work Order: 13-04108-Ra228-1

Client	Eberline Services Work Order	Analysis Code	Run
Engineering Management Support, Inc.	13-04108	Ra228	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-228	LCS	04/16/13 00:00	1.00E+00	100.38	80.74	81.04	1.00	5/1/2013 10:55	5/6/2013 5:26
02	RA-228	MBL	04/16/13 00:00	1.50E+00	102.15	77.79	79.47	1.00	5/1/2013 10:55	5/6/2013 5:26
03	RA-228	DUP	04/11/13 00:00	1.50E+00	104.51	79.26	82.84	1.00	5/1/2013 10:55	5/6/2013 5:26
04	RA-228	DO	04/11/13 00:00	1.50E+00	100.19	83.09	83.25	1.00	5/1/2013 10:55	5/6/2013 5:26
05	RA-228	TRG	04/11/13 00:00	1.50E+00	101.88	77.50	78.96	1.00	5/1/2013 10:55	5/6/2013 5:26
06	RA-228	TRG	04/12/13 13:20	1.50E+00	95.06	83.09	78.98	1.00	5/1/2013 10:55	5/6/2013 5:26
07	RA-228	TRG	04/12/13 13:20	1.50E+00	104.07	81.32	84.63	1.00	5/1/2013 10:55	5/6/2013 5:26

Run	1
Analysis Code	Ra228
Eberline Services Work Order	13-04108
Client	Engineering Management Support, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	RA-228	LCS	05/06/13 09:24		LB4110R	A1	120	623	0.966666667	0.4776
02	RA-228	MBL	05/06/13 09:24		LB4110R	A2	120	174	0.833333333	0.4699
03	RA-228	DUP	05/06/13 09:24		LB4110R	A3	120	176	1.116666667	0.4809
04	RA-228	DO	05/06/13 09:24		LB4110R	A4	120	203	1.05	0.4732
05	RA-228	TRG	05/06/13 09:24		LB4110R	B1	120	228	1.166666667	0.4754
06	RA-228	TRG	05/06/13 09:24		LB4110R	B2	120	232	1.133333333	0.4658
07	RA-228	TRG	05/06/13 09:24		LB4110R	B3	120	171	1.1	0.4713

Count Room Report
Client: Engineering Management Su

13-04108-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	04/16/13 00:00	1.0000	0.9162	923.8191	417.7000	100.38	1.00	1.00
02	MBL	BLANK	04/16/13 00:00	1.5000	0.9076	915.1476	421.1000	102.15	1.00	1.00
03	DUP	DUP 06 TOT	04/11/13 00:00	1.5000	0.9050	912.5260	429.6000	104.51	1.00	1.00
04	DO	DUP 06 TOT	04/11/13 00:00	1.5000	0.9038	911.3160	411.3000	100.19	1.00	1.00
05	TRG	DUP 06 DIS	04/11/13 00:00	1.5000	0.9033	910.8118	418.0000	101.88	1.00	1.00
06	TRG	I-4 TOT	04/12/13 13:20	1.5000	0.9024	909.9044	389.6000	95.06	1.00	1.00
07	TRG	I-4 DIS	04/12/13 13:20	1.5000	0.9042	911.7193	427.4000	104.07	1.00	1.00

Spike and Tracer Worksheet

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
13-04108	1	Ra228	4/29/2013 10:17	JBARNARD		

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-11	38.890	4/29/2013	0.510	0.5149				9.02	0.460	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	1008.316	4/29/2013	0.9162	1.0000
02	Ba-133	Ba-6a	1008.316	4/29/2013	0.9076	1.0000
03	Ba-133	Ba-6a	1008.316	4/29/2013	0.9050	1.0000
04	Ba-133	Ba-6a	1008.316	4/29/2013	0.9038	1.0000
05	Ba-133	Ba-6a	1008.316	4/29/2013	0.9033	1.0000
06	Ba-133	Ba-6a	1008.316	4/29/2013	0.9024	1.0000
07	Ba-133	Ba-6a	1008.316	4/29/2013	0.9042	1.0000

Balance Printer Tapes

Tracer

LCS

Matrix Spike

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Printed: 4/29/2013 10:18 AM

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
13-04108	1	Ra228	liters	5/7/2013	JBARNARD

Lab Fraction	Engineering Management Support, Inc. Client ID	Sample Type	Muffle Data	Dilution Data			Aliquot Data		MS Aliquot Data		H-3 Solids Only	
			Ratio Post/Pre	No of Dils	Dil Factor	Ratio	Aliquot	Net Equiv	Aliquot	Net Equiv	Water Added (ml)	H3 Dist Aliq
01	LCS	LCS					1.0000E+00	1.0000E+00				
02	BLANK	MBL					1.5000E+00	1.5000E+00				
03	DUP 06 TOT	DUP					1.5000E+00	1.5000E+00				
04	DUP 06 TOT	DO					1.5000E+00	1.5000E+00				
05	DUP 06 DIS	TRG					1.5000E+00	1.5000E+00				
06	I-4 TOT	TRG					1.5000E+00	1.5000E+00				
07	I-4 DIS	TRG					1.5000E+00	1.5000E+00				

Comments	

Technician: JBN Date: 4/29/13

Gravimetric Worksheet

Work Order	Run	Analysis Code	Gravimetric Carrier	Carrier Conc (mg/ml)	Technician
13-04108	1	Ra228	Yttirum	34.0000	TSMITH

TRetec	Engineering Management Support, Inc.	Sample	Carrier Data	Filter Data			Gravimetric
Fraction	Client ID	Type	Carrier Added (ml)	Filter Tare (g)	Filter Final (g)	Filter Net (g)	% Recovery
01	LCS	LCS	2.0000	0.0965	0.1514	0.0549	80.74
02	BLANK	MBL	2.0000	0.0959	0.1488	0.0529	77.79
03	DUP	DUP	2.0000	0.0966	0.1505	0.0539	79.26
04	DUP 06 TOT	DO	2.0000	0.0960	0.1525	0.0565	83.09
05	DUP 06 DIS	TRG	2.0000	0.0956	0.1483	0.0527	77.50
06	I-4 TOT	TRG	2.0000	0.0964	0.1529	0.0565	83.09
07	I-4 DIS	TRG	2.0000	0.0956	0.1509	0.0553	81.32

Technician: _____ Date: 5 / 6 / 13

(R)
5/6/13
JCB

Detector ID	Sample ID	Alpha	Beta	Count Time	Voltage	TOD
A1	1304108-01	35	623	120	1400	5/6/13 11:24
A2	1304108-02	12	174	120	1400	5/6/13 11:24
A3	1304108-03	14	176	120	1400	5/6/13 11:24
A4	1304108-04	13	203	120	1400	5/6/13 11:24
B1	1304108-05	19	228	120	1400	5/6/13 11:24
B2	1304108-06	16	232	120	1400	5/6/13 11:24
B3	1304108-07	16	171	120	1400	5/6/13 11:24

GPC Detector Report
(ALL Backgrounds)

C
5/6/13

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/18/2007	5/6/2013	6.67E-02	P	-2.18E+01	2.94E-01	2.24E+01
LB4110A - A2	Alpha	11/18/2007	5/6/2013	1.33E-01	P	-1.85E+01	2.63E-01	1.91E+01
LB4110A - A3	Alpha	11/18/2007	5/6/2013	1.67E-02	P	-1.80E+01	2.24E-01	1.85E+01
LB4110A - A4	Alpha	11/18/2007	5/6/2013	6.67E-02	P	-1.92E+01	2.45E-01	1.96E+01
LB4110A - B1	Alpha	11/18/2007	5/6/2013	3.33E-02	P	-9.89E-02	7.51E-02	2.49E-01
LB4110A - B2	Alpha	11/18/2007	5/6/2013	5.00E-02	P	-7.95E-02	7.27E-02	2.25E-01
LB4110A - B3	Alpha	11/18/2007	5/6/2013	0.00E+00	P	-6.39E-02	5.32E-02	1.70E-01
LB4110A - B4	Alpha	11/18/2007	5/6/2013	8.33E-02	P	-1.44E-01	7.91E-02	3.02E-01
LB4110A - C1	Alpha	11/18/2007	5/6/2013	1.50E-01	P	-1.53E-01	8.92E-02	3.31E-01
LB4110A - C2	Alpha	11/18/2007	5/6/2013	6.67E-02	P	-1.80E-01	8.83E-02	3.57E-01
LB4110A - C3	Alpha	11/18/2007	5/6/2013	3.33E-02	P	-1.76E-01	1.01E-01	3.79E-01
LB4110A - C4	Alpha	11/18/2007	5/6/2013	1.67E-02	P	-6.28E-02	6.88E-02	2.00E-01
LB4110A - D1	Alpha	11/18/2007	5/6/2013	6.67E-02	P	-5.35E-02	8.42E-02	2.22E-01
LB4110A - D2	Alpha	11/18/2007	5/6/2013	3.33E-02	P	-7.03E-02	6.04E-02	1.91E-01
LB4110A - D3	Alpha	11/18/2007	5/6/2013	1.67E-02	P	-4.75E-02	7.20E-02	1.91E-01
LB4110A - D4	Alpha	11/18/2007	5/6/2013	3.33E-02	P	-5.75E-02	7.09E-02	1.99E-01
LB4110R - A1	Alpha	11/24/2006	5/6/2013	5.00E-02	P	-1.01E-01	1.01E-01	3.03E-01
LB4110R - A2	Alpha	11/24/2006	5/6/2013	5.00E-02	P	-9.02E-02	7.74E-02	2.45E-01
LB4110R - A3	Alpha	11/24/2006	5/6/2013	1.00E-01	P	-7.37E-02	7.68E-02	2.27E-01
LB4110R - A4	Alpha	11/24/2006	5/6/2013	1.67E-02	P	-5.30E-02	7.17E-02	1.96E-01
LB4110R - B1	Alpha	11/24/2006	5/6/2013	3.33E-02	P	-9.59E-02	6.21E-02	2.20E-01
LB4110R - B2	Alpha	11/24/2006	5/6/2013	6.67E-02	P	-6.94E-02	6.44E-02	1.98E-01
LB4110R - B3	Alpha	11/24/2006	5/6/2013	8.33E-02	P	-6.54E-02	7.01E-02	2.06E-01
LB4110R - B4	Alpha	11/24/2006	5/6/2013	3.33E-02	P	-6.48E-02	7.08E-02	2.06E-01
LB4110R - C1	Alpha	11/24/2006	5/6/2013	3.33E-02	P	-7.80E-02	7.44E-02	2.27E-01
LB4110R - C2	Alpha	11/24/2006	5/6/2013	0.00E+00	P	-7.54E-02	7.23E-02	2.20E-01
LB4110R - C3	Alpha	11/24/2006	5/6/2013	8.33E-02	P	-8.91E-02	8.48E-02	2.59E-01
LB4110R - C4	Alpha	11/24/2006	5/6/2013	6.67E-02	P	-6.23E-02	8.21E-02	2.26E-01
LB4110R - D1	Alpha	11/24/2006	5/6/2013	0.00E+00	P	-9.92E-02	7.31E-02	2.45E-01
LB4110R - D2	Alpha	11/24/2006	5/6/2013	0.00E+00	P	-7.32E-02	7.25E-02	2.18E-01
LB4110R - D3	Alpha	11/24/2006	5/6/2013	0.00E+00	P	-7.85E-02	7.23E-02	2.23E-01
LB4110R - D4	Alpha	11/24/2006	5/6/2013	0.00E+00	P	-6.99E-02	7.73E-02	2.24E-01
LB5100 - 1	Alpha	7/10/2006	10/26/2007	5.00E-02	P	-1.56E-02	9.58E-02	2.07E-01

GPC Detector Report
(ALL Backgrounds)

5/6/13

Detector	Alpha/Beta	Calibration Date	Count Date	Bkg CPM	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/18/2007	5/6/2013	7.87E+00	P	-2.96E+02	7.63E+00	3.11E+02
LB4110A - A2	Beta	11/18/2007	5/6/2013	4.30E+00	P	-3.12E+01	2.55E+00	3.62E+01
LB4110A - A3	Beta	11/18/2007	5/6/2013	1.47E+00	P	-5.14E+01	2.68E+00	5.67E+01
LB4110A - A4	Beta	11/18/2007	5/6/2013	7.33E+00	P	-3.34E+01	3.02E+00	3.94E+01
LB4110A - B1	Beta	11/18/2007	5/6/2013	1.87E+00	P	-1.05E+01	3.26E+00	1.70E+01
LB4110A - B2	Beta	11/18/2007	5/6/2013	1.25E+00	P	-7.56E+00	1.99E+00	1.15E+01
LB4110A - B3	Beta	11/18/2007	5/6/2013	1.18E+00	P	1.06E-01	1.36E+00	2.62E+00
LB4110A - B4	Beta	11/18/2007	5/6/2013	1.22E+00	P	-7.62E+00	1.97E+00	1.16E+01
LB4110A - C1	Beta	11/18/2007	5/6/2013	1.35E+00	P	-5.51E+00	2.16E+00	9.82E+00
LB4110A - C2	Beta	11/18/2007	5/6/2013	1.00E+00	P	3.79E-01	1.27E+00	2.16E+00
LB4110A - C3	Beta	11/18/2007	5/6/2013	1.23E+00	P	4.69E-01	1.47E+00	2.47E+00
LB4110A - C4	Beta	11/18/2007	5/6/2013	1.30E+00	P	-1.77E+00	2.14E+00	6.05E+00
LB4110A - D1	Beta	11/18/2007	5/6/2013	2.10E+00	P	-2.39E+00	2.59E+00	7.56E+00
LB4110A - D2	Beta	11/18/2007	5/6/2013	1.55E+00	P	-6.82E-01	1.57E+00	3.81E+00
LB4110A - D3	Beta	11/18/2007	5/6/2013	4.63E+00	P	1.22E+00	4.47E+00	7.73E+00
LB4110A - D4	Beta	11/18/2007	5/6/2013	1.10E+00	P	-4.53E-01	1.38E+00	3.20E+00
LB4110R - A1	Beta	11/24/2006	5/6/2013	9.67E-01	P	-6.20E+01	3.78E+00	6.96E+01
LB4110R - A2	Beta	11/24/2006	5/6/2013	8.33E-01	P	-4.93E+01	2.06E+00	5.34E+01
LB4110R - A3	Beta	11/24/2006	5/6/2013	1.12E+00	P	-4.56E+01	2.80E+00	5.12E+01
LB4110R - A4	Beta	11/24/2006	5/6/2013	1.05E+00	P	-4.55E+01	2.02E+00	4.96E+01
LB4110R - B1	Beta	11/24/2006	5/6/2013	1.17E+00	P	-4.79E+01	2.05E+00	5.20E+01
LB4110R - B2	Beta	11/24/2006	5/6/2013	1.13E+00	P	-4.79E+01	2.08E+00	5.21E+01
LB4110R - B3	Beta	11/24/2006	5/6/2013	1.10E+00	P	-4.77E+01	2.71E+00	5.31E+01
LB4110R - B4	Beta	11/24/2006	5/6/2013	1.37E+00	P	-4.80E+01	1.95E+00	5.19E+01
LB4110R - C1	Beta	11/24/2006	5/6/2013	8.33E-01	P	-4.78E+01	3.04E+00	5.38E+01
LB4110R - C2	Beta	11/24/2006	5/6/2013	2.13E+00	P	-4.78E+01	2.75E+00	5.33E+01
LB4110R - C3	Beta	11/24/2006	5/6/2013	2.32E+00	P	-4.83E+01	2.56E+00	5.34E+01
LB4110R - C4	Beta	11/24/2006	5/6/2013	1.33E+00	P	-5.44E+01	2.99E+00	6.04E+01
LB4110R - D1	Beta	11/24/2006	5/6/2013	0.00E+00	P	-4.52E+01	5.79E+00	5.67E+01
LB4110R - D2	Beta	11/24/2006	5/6/2013	0.00E+00	P	-4.87E+01	1.95E+00	5.26E+01
LB4110R - D3	Beta	11/24/2006	5/6/2013	0.00E+00	P	-5.20E+01	5.76E+00	6.35E+01
LB4110R - D4	Beta	11/24/2006	5/6/2013	0.00E+00	P	-4.84E+01	2.33E+00	5.30E+01
LB5100 - 1	Beta	7/10/2006	10/26/2007	4.52E+00	F	-3.19E-01	1.58E+00	3.48E+00

GPC Detector Report
(ALL Efficiencies)

C
J1644

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Alpha	11/18/2007	5/6/2013	0.2367	P	-0.0191	0.2146	0.4483
LB4110A - A2	Alpha	11/18/2007	5/6/2013	0.2060	P	-0.0565	0.1725	0.4015
LB4110A - A3	Alpha	11/18/2007	5/6/2013	0.2077	P	-0.0801	0.1613	0.4028
LB4110A - A4	Alpha	11/18/2007	5/6/2013	0.2222	P	-0.0586	0.1803	0.4191
LB4110A - B1	Alpha	11/18/2007	5/6/2013	0.2136	P	0.1943	0.2247	0.2550
LB4110A - B2	Alpha	11/18/2007	5/6/2013	0.2119	P	0.1929	0.2218	0.2507
LB4110A - B3	Alpha	11/18/2007	5/6/2013	0.2368	P	0.1292	0.2326	0.3360
LB4110A - B4	Alpha	11/18/2007	5/6/2013	0.2298	P	0.2090	0.2367	0.2644
LB4110A - C1	Alpha	11/18/2007	5/6/2013	0.2210	P	0.1973	0.2208	0.2444
LB4110A - C2	Alpha	11/18/2007	5/6/2013	0.2246	P	0.1966	0.2252	0.2538
LB4110A - C3	Alpha	11/18/2007	5/6/2013	0.2494	P	0.2228	0.2494	0.2759
LB4110A - C4	Alpha	11/18/2007	5/6/2013	0.2169	P	0.1965	0.2258	0.2550
LB4110A - D1	Alpha	11/18/2007	5/6/2013	0.2091	W	0.2036	0.2334	0.2632
LB4110A - D2	Alpha	11/18/2007	5/6/2013	0.2366	P	0.2278	0.2584	0.2891
LB4110A - D3	Alpha	11/18/2007	5/6/2013	0.2454	P	0.2315	0.2639	0.2963
LB4110A - D4	Alpha	11/18/2007	5/6/2013	0.1808	P	0.1651	0.1999	0.2347
LB4110R - A1	Alpha	11/24/2006	5/6/2013	0.2349	P	0.2031	0.2389	0.2747
LB4110R - A2	Alpha	11/24/2006	5/6/2013	0.2171	P	0.1899	0.2207	0.2514
LB4110R - A3	Alpha	11/24/2006	5/6/2013	0.2171	P	0.1963	0.2249	0.2534
LB4110R - A4	Alpha	11/24/2006	5/6/2013	0.2408	P	0.2159	0.2457	0.2755
LB4110R - B1	Alpha	11/24/2006	5/6/2013	0.2208	P	0.1877	0.2261	0.2645
LB4110R - B2	Alpha	11/24/2006	5/6/2013	0.2081	P	0.1801	0.2176	0.2550
LB4110R - B3	Alpha	11/24/2006	5/6/2013	0.2457	P	0.2067	0.2440	0.2814
LB4110R - B4	Alpha	11/24/2006	5/6/2013	0.2223	P	0.1938	0.2320	0.2702
LB4110R - C1	Alpha	11/24/2006	5/6/2013	0.2161	P	0.1861	0.2153	0.2445
LB4110R - C2	Alpha	11/24/2006	5/6/2013	0.2151	P	0.1963	0.2248	0.2534
LB4110R - C3	Alpha	11/24/2006	5/6/2013	0.2355	P	0.2064	0.2398	0.2732
LB4110R - C4	Alpha	11/24/2006	5/6/2013	0.2079	P	0.1859	0.2230	0.2600
LB4110R - D1	Alpha	11/24/2006	5/6/2013	0.0000	F	0.0400	0.2077	0.3754
LB4110R - D2	Alpha	11/24/2006	5/6/2013	0.0000	F	0.0463	0.2362	0.4261
LB4110R - D3	Alpha	11/24/2006	5/6/2013	0.0000	F	0.0455	0.2320	0.4186
LB4110R - D4	Alpha	11/24/2006	5/6/2013	0.0000	F	0.0350	0.1870	0.3391
LB5100 - 1	Alpha	7/10/2006	10/26/2007	0.3368	P	0.3332	0.3455	0.3578

GPC Detector Report
(ALL Efficiencies)

Detector	Alpha/Beta	Calibration Date	Count Date	Eff	PFW	LCL	Mean	UCL
LB4110A - A1	Beta	11/18/2007	5/6/2013	0.5580	P	0.2031	0.5628	0.9226
LB4110A - A2	Beta	11/18/2007	5/6/2013	0.4842	P	0.1538	0.4632	0.7727
LB4110A - A3	Beta	11/18/2007	5/6/2013	0.4786	P	0.0811	0.4570	0.8329
LB4110A - A4	Beta	11/18/2007	5/6/2013	0.5219	P	0.1335	0.4877	0.8418
LB4110A - B1	Beta	11/18/2007	5/6/2013	0.5075	P	0.4637	0.5306	0.5975
LB4110A - B2	Beta	11/18/2007	5/6/2013	0.5129	P	0.4638	0.5277	0.5915
LB4110A - B3	Beta	11/18/2007	5/6/2013	0.5430	P	0.3188	0.5321	0.7453
LB4110A - B4	Beta	11/18/2007	5/6/2013	0.5289	P	0.4922	0.5547	0.6171
LB4110A - C1	Beta	11/18/2007	5/6/2013	0.5033	P	0.4501	0.5027	0.5553
LB4110A - C2	Beta	11/18/2007	5/6/2013	0.4936	P	0.4279	0.5012	0.5744
LB4110A - C3	Beta	11/18/2007	5/6/2013	0.6037	P	0.5276	0.5901	0.6526
LB4110A - C4	Beta	11/18/2007	5/6/2013	0.5168	P	0.4568	0.5251	0.5934
LB4110A - D1	Beta	11/18/2007	5/6/2013	0.5096	P	0.4798	0.5543	0.6288
LB4110A - D2	Beta	11/18/2007	5/6/2013	0.5282	P	0.4905	0.5889	0.6872
LB4110A - D3	Beta	11/18/2007	5/6/2013	0.5891	P	0.5367	0.6156	0.6944
LB4110A - D4	Beta	11/18/2007	5/6/2013	0.4314	P	0.3865	0.4736	0.5606
LB4110R - A1	Beta	11/24/2006	5/6/2013	0.5674	P	0.4813	0.5680	0.6547
LB4110R - A2	Beta	11/24/2006	5/6/2013	0.5130	P	0.4208	0.5089	0.5970
LB4110R - A3	Beta	11/24/2006	5/6/2013	0.5277	P	0.4580	0.5398	0.6216
LB4110R - A4	Beta	11/24/2006	5/6/2013	0.5960	P	0.5099	0.5917	0.6736
LB4110R - B1	Beta	11/24/2006	5/6/2013	0.5402	P	0.4534	0.5428	0.6322
LB4110R - B2	Beta	11/24/2006	5/6/2013	0.5180	P	0.4312	0.5203	0.6094
LB4110R - B3	Beta	11/24/2006	5/6/2013	0.6063	P	0.5015	0.5913	0.6811
LB4110R - B4	Beta	11/24/2006	5/6/2013	0.5266	P	0.4624	0.5501	0.6378
LB4110R - C1	Beta	11/24/2006	5/6/2013	0.4759	P	0.4243	0.5034	0.5825
LB4110R - C2	Beta	11/24/2006	5/6/2013	0.5087	P	0.4503	0.5293	0.6083
LB4110R - C3	Beta	11/24/2006	5/6/2013	0.5537	P	0.4813	0.5713	0.6614
LB4110R - C4	Beta	11/24/2006	5/6/2013	0.4969	P	0.4325	0.5266	0.6207
LB4110R - D1	Beta	11/24/2006	5/6/2013	0.0000	F	0.0948	0.4967	0.8987
LB4110R - D2	Beta	11/24/2006	5/6/2013	0.0000	F	0.1072	0.5582	1.0091
LB4110R - D3	Beta	11/24/2006	5/6/2013	0.0000	F	0.1041	0.5421	0.9801
LB4110R - D4	Beta	11/24/2006	5/6/2013	0.0000	F	0.0822	0.4462	0.8103
LB5100 - 1	Beta	7/10/2006	10/26/2007	0.4428	F	0.4555	0.4731	0.4906

SECTION XII

BARIUM-133 ANALYTICAL TRACER DATA

ICP 5.1.113

VAX/VMS Peak Search Report Generated 1-MAY-2013 16:15:48.14

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP_130410801_GE5_BAFIL_191187.CN
Analyses by : PEAK V16.9 PEAKEFF V2.2
Client ID : SPIKE
Deposition Date :
Sample Date : 1-MAY-2013 00:00:00. Acquisition date : 1-MAY-2013 16:00:30.
Sample ID : 1304108-01 Sample Quantity : 1.00000E+00 filter
Sample type : FILTER Sample Geometry : 0
Detector name : GE5 Detector Geometry: BAFIL
Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:01.21 0.1%
Start channel : 25 End channel : 4096
Sensitivity : 3.00000 Gaussian : 10.00000
Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	21.40	43	35	0.38	210.74	205	11	4.79E-02	33.3	
2	0	25.67	9	21	0.19	251.73	244	12	9.81E-03	109.2	
3	0	31.05	2050	118	0.70	303.34	291	30	2.28E+00	2.7	
4	1	35.14	397	5	0.62	342.54	331	31	4.41E-01	5.6	1.31E+00
5	1	35.96	83	2	0.62	350.46	331	31	9.24E-02	26.0	
6	0	46.65	9	6	0.15	453.06	447	12	1.00E-02	63.8	
7	0	53.40	36	25	0.35	517.76	509	15	4.00E-02	30.9	
8	0	58.95	11	9	0.50	571.06	561	14	1.19E-02	60.6	
9	0	61.90	263	44	0.84	599.37	586	29	2.92E-01	8.6	
10	3	65.89	71	25	0.72	637.63	625	30	7.90E-02	20.7	1.50E+00
11	3	66.94	34	15	0.78	647.69	625	30	3.76E-02	31.0	
12	4	79.68	77	15	1.02	769.94	758	37	8.56E-02	18.2	1.50E+00
13	4	81.17	827	10	0.71	784.30	758	37	9.19E-01	3.6	
14	0	92.44	26	3	1.13	892.42	884	19	2.92E-02	23.7	
15	0	111.97	223	63	0.78	1079.81	1063	35	2.48E-01	11.5	
16	0	116.09	40	22	1.21	1119.38	1106	22	4.44E-02	29.9	
17	0	130.23	26	0	0.15	1255.00	1245	22	2.89E-02	19.6	
18	0	160.91	33	8	0.96	1549.41	1541	18	3.62E-02	24.1	
19	2	276.02	31	8	1.03	2654.00	2643	26	3.44E-02	27.2	7.92E-01
20	2	276.84	21	2	0.98	2661.86	2643	26	2.31E-02	36.9	
21	0	302.98	134	7	0.60	2912.74	2897	28	1.49E-01	9.6	
22	3	333.66	30	10	1.21	3207.05	3194	26	3.30E-02	32.9	5.89E+00
23	3	334.04	71	7	1.46	3210.76	3194	26	7.91E-02	12.3	
24	5	355.97	332	18	0.79	3421.20	3404	32	3.69E-01	6.3	9.31E-01
25	5	356.61	15	20	1.11	3427.27	3404	32	1.66E-02	129.3	
26	0	383.87	84	7	1.10	3688.91	3674	26	9.38E-02	12.5	
27	3	386.38	64	9	1.16	3713.00	3703	27	7.15E-02	17.4	1.17E+00
28	3	387.15	68	5	0.85	3720.35	3703	27	7.61E-02	18.3	
29	3	387.74	26	0	1.16	3726.00	3703	27	2.87E-02	29.1	
30	0	391.23	27	7	0.51	3759.49	3747	24	2.98E-02	26.7	
31	0	414.54	21	11	0.68	3983.22	3971	21	2.36E-02	35.9	

Sample ID : 1304108-01 Acquisition date : 1-MAY-2013 16:00:30

Total number of lines in spectrum 31
Number of unidentified lines 23
Number of lines tentatively identified by NID 8 25.81%

Nuclide Type : FISSION

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
BA-133	10.50Y	1.00	4.177E+02	4.177E+02	0.704E+02	16.86	
	Total Activity :		4.177E+02	4.177E+02			

Nuclide Type : NATURAL

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
TH-234	4.47E+09Y	1.00	2.376E+02	2.376E+02	0.423E+02	17.79	
AM-241	432.20Y	1.00	8.923E-01	8.923E-01	10.82E-01	121.26	
	Total Activity :		2.385E+02	2.385E+02			
	Grand Total Activity :		6.562E+02	6.562E+02			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Sample ID : 1304108-01 Acquisition date : 1-MAY-2013 16:00:30

Nuclide Type: FISSION

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
BA-133	81.00	33.00*	1.802E+01	4.177E+02	4.177E+02	16.86	OK
	302.84	17.80	2.575E+00	8.760E+02	8.761E+02	32.63	OK
	356.01	60.00	4.312E+00	3.850E+02	3.850E+02	19.12	OK

Final Mean for 3 Valid Peaks = 4.177E+02+/- 7.043E+01 (16.86%)

Nuclide Type: NATURAL

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
TH-234	63.29	3.80*	8.750E+01	2.376E+02	2.376E+02	17.79	OK

Final Mean for 1 Valid Peaks = 2.376E+02+/- 4.228E+01 (17.79%)

AM-241	59.54	35.90*	1.000E+02	8.923E-01	8.923E-01	121.26	OK

Final Mean for 1 Valid Peaks = 8.923E-01+/- 1.082E+00 (121.26%)

Flag: "*" = Keyline

Sample ID : 1304108-01 Acquisition date : 1-MAY-2013 16:00:30

---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133	4.177E+02	7.043E+01	1.214E+01	1.788E+00	34.400
TH-234	2.376E+02	4.228E+01	2.817E+01	3.624E-01	8.436
AM-241	8.923E-01	1.082E+00	2.869E+00	3.229E-02	0.311

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/filter)	K.L. Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	9.344E+00		1.628E+01	3.137E+01	1.063E+01	0.298
CD-109	4.512E+01		1.054E+02	2.007E+02	1.931E+01	0.225
PA-231	-3.837E-01		8.542E-01	1.465E+00	1.649E-02	-0.262
PA-234	1.996E+00	+	1.333E+00	2.004E+00	2.255E-02	0.996
NP-237	7.941E-01		2.780E+01	5.074E+01	4.475E+00	0.016

KB 5/11/13

VAX/VMS Peak Search Report Generated 1-MAY-2013 16:31:31.77

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP_130410802_GE5_BAFIL_191189.CN
Analyses by : PEAK V16.9 PEAKEFF V2.2
Client ID : BLANK
Deposition Date :
Sample Date : 1-MAY-2013 00:00:00. Acquisition date : 1-MAY-2013 16:16:09.
Sample ID : 1304108-02 Sample Quantity : 1.00000E+00 filter
Sample type : FILTER Sample Geometry : 0
Detector name : GE5 Detector Geometry: BAFIL
Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:01.17 0.1%
Start channel : 25 End channel : 4096
Sensitivity : 3.00000 Gaussian : 10.00000
Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	4.64	24	22	0.14	49.88	44	12	2.67E-02	45.3	
2	0	21.11	70	44	0.65	207.99	195	22	7.78E-02	27.0	
3	0	28.11	14	18	0.28	275.14	268	10	1.50E-02	64.0	
4	0	29.09	29	32	0.99	284.48	277	13	3.17E-02	45.2	
5	0	31.06	2179	111	0.79	303.43	291	27	2.42E+00	2.5	
6	6	35.11	347	44	0.60	342.29	333	27	3.85E-01	7.5	1.50E+00
7	6	35.82	186	30	1.00	349.09	333	27	2.06E-01	15.1	
8	0	39.90	16	9	0.58	388.23	378	20	1.76E-02	54.8	
9	0	46.93	9	7	0.70	455.67	447	14	1.00E-02	70.7	
10	0	53.47	49	31	0.56	518.50	506	23	5.43E-02	29.8	
11	0	61.99	269	38	0.97	600.19	585	37	2.99E-01	9.2	
12	7	66.02	82	16	0.97	638.91	628	30	9.12E-02	17.4	3.71E+00
13	7	66.46	26	6	0.39	643.11	628	30	2.91E-02	40.3	
14	7	66.93	16	10	0.73	647.63	628	30	1.72E-02	84.6	
15	2	79.88	53	31	0.84	771.91	760	35	5.90E-02	42.0	9.53E-01
16	2	81.18	834	22	0.67	784.39	760	35	9.27E-01	3.7	
17	0	111.97	179	40	0.69	1079.81	1065	27	1.99E-01	11.2	
18	3	116.05	36	5	0.77	1119.00	1109	22	3.98E-02	26.9	8.10E-01
19	3	116.85	22	5	0.57	1126.66	1109	22	2.42E-02	26.2	
20	1	276.23	31	7	1.03	2656.00	2644	24	3.46E-02	25.7	1.46E+00
21	1	276.85	19	2	1.03	2662.00	2644	24	2.16E-02	33.2	
22	0	303.03	92	12	0.80	2913.21	2897	29	1.03E-01	12.7	
23	1	333.55	57	3	1.10	3206.00	3194	26	6.32E-02	13.5	1.49E+00
24	1	334.17	21	1	1.10	3212.00	3194	26	2.34E-02	33.5	
25	4	356.06	443	11	1.05	3422.02	3404	31	4.92E-01	4.7	2.86E+00
26	4	356.89	11	8	1.13	3430.00	3404	31	1.27E-02	83.7	
27	0	383.93	66	17	1.03	3689.47	3672	27	7.32E-02	17.1	
28	5	386.06	40	6	1.28	3709.89	3703	27	4.44E-02	24.8	1.85E+00
29	5	386.82	131	6	0.69	3717.22	3703	27	1.45E-01	10.4	
30	5	387.63	17	2	1.16	3725.00	3703	27	1.89E-02	50.1	
31	0	391.08	49	7	1.06	3758.08	3736	34	5.47E-02	18.1	

Sample ID : 1304108-02 Acquisition date : 1-MAY-2013 16:16:09

Total number of lines in spectrum 31
Number of unidentified lines 25
Number of lines tentatively identified by NID 6 19.35%

Nuclide Type : FISSION

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
BA-133	10.50Y	1.00	4.211E+02	4.211E+02	0.713E+02	16.93	
	Total Activity :		4.211E+02	4.211E+02			

Nuclide Type : NATURAL

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
TH-234	4.47E+09Y	1.00	2.428E+02	2.428E+02	0.458E+02	18.86	
	Total Activity :		2.428E+02	2.428E+02			
	Grand Total Activity :		6.639E+02	6.640E+02			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Nuclide Type: FISSION

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
BA-133	81.00	33.00*	1.802E+01	4.211E+02	4.211E+02	16.93	OK
	302.84	17.80	2.575E+00	6.053E+02	6.054E+02	36.63	OK
	356.01	60.00	4.312E+00	5.140E+02	5.141E+02	17.30	OK

Final Mean for 3 Valid Peaks = 4.211E+02+/- 7.131E+01 (16.93%)

Nuclide Type: NATURAL

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
TH-234	63.29	3.80*	8.750E+01	2.428E+02	2.428E+02	18.86	OK

Final Mean for 1 Valid Peaks = 2.428E+02+/- 4.581E+01 (18.86%)

Flag: "*" = Keyline

Sample ID : 1304108-02 Acquisition date : 1-MAY-2013 16:16:09

---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133	4.211E+02	7.131E+01	1.264E+01	1.862E+00	33.304
TH-234	2.428E+02	4.581E+01	2.209E+01	2.842E-01	10.993

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/filter)	K.L. Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	-6.300E+00		1.448E+01	2.472E+01	8.379E+00	-0.255
CD-109	2.012E+01		9.783E+01	1.834E+02	1.765E+01	0.110
PA-231	-6.053E-01		8.165E-01	1.322E+00	1.488E-02	-0.458
PA-234	3.239E+00	+	1.751E+00	1.937E+00	2.180E-02	1.673
NP-237	-2.067E+01		2.419E+01	3.867E+01	3.411E+00	-0.535
AM-241	1.651E+00		1.200E+00	2.386E+00	2.685E-02	0.692

KB 5/1/13

VAX/VMS Peak Search Report Generated 1-MAY-2013 16:47:10.06

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP_130410803_GE5_BAFIL_191190.CN
Analyses by : PEAK V16.9 PEAKEFF V2.2
Client ID : DUP 06 TOT
Deposition Date :
Sample Date : 1-MAY-2013 00:00:00. Acquisition date : 1-MAY-2013 16:31:53.
Sample ID : 1304108-03 Sample Quantity : 1.00000E+00 filter
Sample type : FILTER Sample Geometry : 0
Detector name : GE5 Detector Geometry: BAFIL
Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:01.09 0.1%
Start channel : 25 End channel : 4096
Sensitivity : 3.00000 Gaussian : 10.00000
Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	21.31	57	47	0.32	209.88	201	16	6.34E-02	31.0	
2	0	25.47	28	3	1.10	249.75	243	15	3.09E-02	24.2	
3	0	28.77	32	30	0.75	281.42	275	13	3.53E-02	40.7	
4	0	31.05	1956	91	0.77	303.38	292	24	2.17E+00	2.6	
5	0	35.17	308	141	0.67	342.84	335	16	3.42E-01	10.4	
6	0	36.25	57	41	0.26	353.23	350	12	6.30E-02	29.4	
7	0	53.75	26	48	0.19	521.17	507	19	2.86E-02	60.8	
8	1	61.34	49	25	0.65	594.00	585	30	5.42E-02	35.5	1.65E+00
9	1	61.97	182	17	0.65	600.00	585	30	2.02E-01	9.8	
10	1	66.10	129	21	0.73	639.63	623	34	1.44E-01	11.1	2.22E+00
11	1	66.86	32	19	0.66	647.00	623	34	3.59E-02	40.6	
12	1	79.51	48	12	0.76	768.33	759	36	5.36E-02	19.3	2.43E+00
13	1	80.17	48	13	0.76	774.67	759	36	5.34E-02	51.3	
14	1	81.22	851	6	0.72	784.77	759	36	9.45E-01	3.4	
15	0	84.46	19	19	0.40	815.79	802	19	2.07E-02	53.2	
16	1	111.47	45	32	0.76	1075.00	1068	29	5.04E-02	30.8	1.80E+00
17	1	112.20	169	26	0.77	1082.00	1068	29	1.88E-01	10.8	
18	0	116.11	42	23	0.58	1119.55	1109	20	4.62E-02	28.7	
19	4	160.78	47	6	0.84	1548.18	1540	18	5.22E-02	16.1	1.86E+00
20	4	161.44	9	4	0.56	1554.47	1540	18	9.49E-03	51.1	
21	0	166.80	11	8	0.45	1605.95	1597	15	1.17E-02	53.9	
22	0	276.36	47	0	1.32	2657.26	2642	27	5.22E-02	14.6	
23	1	302.49	56	11	1.06	2908.00	2896	26	6.17E-02	20.8	2.15E+00
24	1	303.43	50	7	1.06	2917.00	2896	26	5.58E-02	13.4	
25	1	333.44	91	2	1.10	3205.00	3193	26	1.01E-01	9.4	3.71E+00
26	1	334.07	11	2	1.10	3211.00	3193	26	1.24E-02	72.4	
27	2	355.59	69	8	1.11	3417.53	3406	28	7.65E-02	28.0	7.28E-01
28	2	356.22	292	11	0.91	3423.56	3406	28	3.24E-01	6.9	
29	0	383.93	65	12	1.39	3689.44	3673	27	7.22E-02	16.4	
30	1	386.28	30	12	1.16	3712.00	3703	27	3.33E-02	35.7	7.04E+00
31	1	386.90	204	15	1.16	3718.00	3703	27	2.27E-01	6.8	

Sample ID : 1304108-03 Acquisition date : 1-MAY-2013 16:31:53

Total number of lines in spectrum 31
Number of unidentified lines 24
Number of lines tentatively identified by NID 7 22.58%

Nuclide Type : FISSION

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
BA-133	10.50Y	1.00	4.296E+02	4.296E+02	0.719E+02	16.74	
	Total Activity :		4.296E+02	4.296E+02			

Nuclide Type : NATURAL

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
TH-234	4.47E+09Y	1.00	1.645E+02	1.645E+02	0.329E+02	19.97	
AM-241	432.20Y	1.00	4.081E+00	4.081E+00	2.899E+00	71.02	
	Total Activity :		1.686E+02	1.686E+02			
	Grand Total Activity :		5.982E+02	5.982E+02			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Sample ID : 1304108-03 Acquisition date : 1-MAY-2013 16:31:53

Nuclide Type: FISSION

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
BA-133	81.00	33.00*	1.802E+01	4.296E+02	4.296E+02	16.74	OK
	302.84	17.80	2.575E+00	3.636E+02	3.637E+02	49.26	OK
	356.01	60.00	4.312E+00	3.387E+02	3.387E+02	20.04	OK

Final Mean for 3 Valid Peaks = 4.296E+02+/- 7.190E+01 (16.74%)

Nuclide Type: NATURAL

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
TH-234	63.29	3.80*	8.750E+01	1.645E+02	1.645E+02	19.97	OK

Final Mean for 1 Valid Peaks = 1.645E+02+/- 3.286E+01 (19.97%)

AM-241	59.54	35.90*	1.000E+02	4.081E+00	4.081E+00	71.02	OK

Final Mean for 1 Valid Peaks = 4.081E+00+/- 2.899E+00 (71.02%)

Flag: "*" = Keyline

Sample ID : 1304108-03 Acquisition date : 1-MAY-2013 16:31:53

---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133	4.296E+02	7.190E+01	1.248E+01	1.838E+00	34.413
TH-234	1.645E+02	3.286E+01	1.531E+01	1.969E-01	10.750
AM-241	4.081E+00	2.899E+00	1.898E+00	2.136E-02	2.151

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/filter)	K.L. Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	-6.440E+00		1.407E+01	2.394E+01	8.114E+00	-0.269
CD-109	-5.192E+01		1.002E+02	1.696E+02	1.632E+01	-0.306
PA-231	6.625E-02		8.519E-01	1.595E+00	1.795E-02	0.042
PA-234	2.638E+00	+	1.638E+00	2.032E+00	2.288E-02	1.298
NP-237	9.620E+00		2.903E+01	5.074E+01	4.475E+00	0.190

VAX/VMS Peak Search Report Generated 1-MAY-2013 17:02:35.94

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP_130410804_GE5_BAFIL_191193.CN
Analyses by : PEAK V16.9 PEAKEFF V2.2
Client ID : DUP 06 TOT
Deposition Date :
Sample Date : 1-MAY-2013 00:00:00. Acquisition date : 1-MAY-2013 16:47:19.
Sample ID : 1304108-04 Sample Quantity : 1.00000E+00 filter
Sample type : FILTER Sample Geometry : 0
Detector name : GE5 Detector Geometry: BAFIL
Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:01.17 0.1%
Start channel : 25 End channel : 4096
Sensitivity : 3.00000 Gaussian : 10.00000
Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	5	20.10	25	10	0.59	198.25	193	23	2.75E-02	29.7	1.33E+00
2	5	21.24	92	5	0.70	209.16	193	23	1.02E-01	12.6	
3	0	28.57	15	24	0.29	279.55	274	9	1.70E-02	63.6	
4	0	31.05	2179	93	0.74	303.37	290	30	2.42E+00	2.5	
5	3	35.18	431	18	0.74	342.93	331	30	4.79E-01	5.6	6.67E-01
6	3	36.08	101	4	0.69	351.56	331	30	1.12E-01	19.8	
7	0	53.48	34	30	0.40	518.57	509	15	3.83E-02	34.2	
8	0	61.97	229	52	0.77	600.04	589	26	2.54E-01	10.2	
9	0	66.03	85	49	0.62	638.96	627	22	9.41E-02	21.2	
10	1	79.82	47	24	0.68	771.33	759	36	5.24E-02	28.4	1.10E+00
11	1	81.17	815	13	0.72	784.24	759	36	9.05E-01	3.7	
12	0	111.99	189	48	0.82	1079.96	1065	30	2.10E-01	11.7	
13	0	134.28	20	6	0.52	1293.85	1284	17	2.26E-02	31.9	
14	0	153.10	13	17	1.68	1474.50	1458	23	1.44E-02	69.1	
15	0	161.10	20	22	0.81	1551.23	1535	21	2.27E-02	48.3	
16	0	276.57	43	7	0.87	2659.29	2645	24	4.82E-02	19.0	
17	3	302.07	11	3	1.06	2904.00	2897	26	1.20E-02	72.1	9.69E+00
18	3	302.70	129	5	1.06	2910.00	2897	26	1.44E-01	9.0	
19	3	303.53	27	2	0.77	2917.98	2897	26	3.02E-02	29.2	
20	1	333.55	47	10	1.10	3206.00	3193	26	5.22E-02	20.7	6.91E-01
21	1	334.28	15	5	1.10	3213.00	3193	26	1.69E-02	45.9	
22	5	355.32	16	5	1.04	3414.92	3406	32	1.77E-02	94.9	9.42E-01
23	5	356.14	318	13	0.92	3422.84	3406	32	3.53E-01	6.2	
24	2	383.26	47	5	1.16	3683.00	3672	27	5.22E-02	21.3	6.07E-01
25	2	383.98	62	6	0.94	3689.97	3672	27	6.85E-02	17.2	
26	0	386.99	123	11	0.92	3718.82	3703	26	1.36E-01	10.3	
27	0	391.13	19	10	0.54	3758.52	3740	26	2.09E-02	42.1	

Sample ID : 1304108-04 Acquisition date : 1-MAY-2013 16:47:19

Total number of lines in spectrum 27
Number of unidentified lines 21
Number of lines tentatively identified by NID 6 22.22%

Nuclide Type : FISSION

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
BA-133	10.50Y	1.00	4.113E+02	4.113E+02	0.696E+02	16.93	
	Total Activity :		4.113E+02	4.113E+02			

Nuclide Type : NATURAL

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
TH-234	4.47E+09Y	1.00	2.068E+02	2.068E+02	0.430E+02	20.80	
	Total Activity :		2.068E+02	2.068E+02			
	Grand Total Activity :		6.181E+02	6.181E+02			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Nuclide Type: FISSION

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
BA-133	81.00	33.00*	1.802E+01	4.113E+02	4.113E+02	16.93	OK
	302.84	17.80	2.575E+00	8.472E+02	8.473E+02	31.99	OK
	356.01	60.00	4.312E+00	3.690E+02	3.690E+02	19.11	OK

Final Mean for 3 Valid Peaks = 4.113E+02+/- 6.963E+01 (16.93%)

Nuclide Type: NATURAL

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
TH-234	63.29	3.80*	8.750E+01	2.068E+02	2.068E+02	20.80	OK

Final Mean for 1 Valid Peaks = 2.068E+02+/- 4.301E+01 (20.80%)

Flag: "*" = Keyline

Sample ID : 1304108-04 Acquisition date : 1-MAY-2013 16:47:19

---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133	4.113E+02	6.963E+01	1.214E+01	1.788E+00	33.872
TH-234	2.068E+02	4.301E+01	1.871E+01	2.408E-01	11.052

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/filter)	K.L. Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	-9.800E+00		1.453E+01	2.334E+01	7.911E+00	-0.420
CD-109	1.421E+01		9.042E+01	1.702E+02	1.638E+01	0.083
PA-231	2.370E-01		9.289E-01	1.762E+00	1.983E-02	0.135
PA-234	4.238E+00	+	1.080E+00	2.061E+00	2.320E-02	2.056
NP-237	-2.327E+01		2.501E+01	3.943E+01	3.478E+00	-0.590
AM-241	1.026E+00		1.692E+00	2.860E+00	3.219E-02	0.359

ICB 5/1/13

VAX/VMS Peak Search Report Generated 1-MAY-2013 16:57:55.33

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP_130410805_GE3_BAFIL_191192.CN
Analyses by : PEAK V16.9 PEAKEFF V2.2
Client ID : DUP 06 DIS
Deposition Date :
Sample Date : 1-MAY-2013 00:00:00. Acquisition date : 1-MAY-2013 16:42:11.
Sample ID : 1304108-05 Sample Quantity : 1.00000E+00 filter
Sample type : FILTER Sample Geometry : 0
Detector name : GE3 Detector Geometry: BAFIL
Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:03.60 0.4%
Start channel : 25 End channel : 4096
Sensitivity : 3.00000 Gaussian : 10.00000
Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	3	30.91	1997	94	1.45	31.23	26	15	2.22E+00	2.3	5.57E+00
2	3	35.10	551	89	1.67	35.42	26	15	6.13E-01	5.1	
3	0	52.54	77	176	3.40	52.86	48	10	8.56E-02	34.1	
4	1	61.82	253	103	1.51	62.14	58	13	2.81E-01	8.9	4.33E+00
5	1	65.69	122	110	1.52	66.01	58	13	1.35E-01	15.8	
6	0	81.11	872	132	1.93	81.43	78	9	9.69E-01	4.1	
7	2	111.99	259	77	1.66	112.30	107	15	2.87E-01	7.9	2.58E+00
8	2	116.40	45	72	1.76	116.71	107	15	4.99E-02	31.9	
9	0	159.86	30	90	1.58	160.17	157	8	3.30E-02	58.3	
10	0	184.91	20	74	1.10	185.22	183	6	2.25E-02	70.9	
11	0	205.13	26	49	3.69	205.45	202	7	2.83E-02	49.7	
12	0	276.87	52	27	1.15	277.18	275	6	5.73E-02	21.0	
13	2	302.99	167	27	1.70	303.30	297	14	1.86E-01	8.7	8.69E+00
14	2	307.35	32	35	1.99	307.66	297	14	3.61E-02	31.5	
15	4	333.80	77	7	1.68	334.10	330	18	8.57E-02	13.1	2.15E+00
16	4	338.36	40	6	2.44	338.66	330	18	4.41E-02	23.8	
17	4	343.37	11	4	2.45	343.67	330	18	1.22E-02	62.0	
18	0	356.22	492	11	1.94	356.53	351	11	5.47E-01	4.7	
19	0	364.95	29	16	1.25	365.25	362	7	3.20E-02	29.6	
20	0	376.33	22	16	1.55	376.64	373	8	2.44E-02	38.0	
21	4	383.64	92	9	1.82	383.94	381	15	1.03E-01	12.3	7.73E+00
22	4	387.07	204	6	1.98	387.37	381	15	2.27E-01	8.7	
23	4	391.43	47	1	2.06	391.73	381	15	5.25E-02	18.0	
24	2	414.72	36	16	2.08	415.02	411	11	3.98E-02	26.2	1.45E+00
25	2	417.72	18	21	2.09	418.02	411	11	2.05E-02	53.0	
26	0	437.26	116	7	1.88	437.56	433	8	1.29E-01	10.0	
27	0	457.59	5	6	2.56	457.89	454	7	5.00E-03	97.3	
28	2	468.33	21	4	2.13	468.63	465	13	2.35E-02	26.9	8.37E-01
29	2	472.07	11	1	2.13	472.37	465	13	1.19E-02	51.8	
30	0	510.64	15	5	2.08	510.93	506	11	1.62E-02	40.6	
31	0	916.72	7	0	2.50	917.00	913	7	7.78E-03	37.8	

Sample ID : 1304108-05 Acquisition date : 1-MAY-2013 16:42:11

Total number of lines in spectrum 31
Number of unidentified lines 27
Number of lines tentatively identified by NID 4 12.90%

Nuclide Type : FISSION

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
BA-133	10.50Y	1.00	4.180E+02	4.180E+02	0.746E+02	17.85	
	Total Activity :		4.180E+02	4.180E+02			

Nuclide Type : NATURAL

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
TH-234	4.47E+09Y	1.00	7.548E+02	7.548E+02	1.441E+02	19.09	
	Total Activity :		7.548E+02	7.548E+02			
	Grand Total Activity :		1.173E+03	1.173E+03			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Nuclide Type: FISSION

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
BA-133	81.00	33.00*	1.899E+01	4.180E+02	4.180E+02	17.85	OK
	302.84	17.80	6.222E+00	4.529E+02	4.530E+02	26.94	OK
	356.01	60.00	5.860E+00	4.202E+02	4.203E+02	16.56	OK

Final Mean for 3 Valid Peaks = 4.180E+02+/- 7.462E+01 (17.85%)

Nuclide Type: NATURAL

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
TH-234	63.29	3.80*	2.648E+01	7.548E+02	7.548E+02	19.09	OK

Final Mean for 1 Valid Peaks = 7.548E+02+/- 1.441E+02 (19.09%)

Flag: "*" = Keyline

Sample ID : 1304108-05 Acquisition date : 1-MAY-2013 16:42:11

---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133	4.180E+02	7.462E+01	2.136E+01	3.266E+00	19.573
TH-234	7.548E+02	1.441E+02	1.382E+02	7.421E+00	5.463

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/filter)	K.L. Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	-9.988E-01		7.435E+00	1.164E+01	1.330E+00	-0.086
CD-109	5.738E+01		1.204E+02	2.020E+02	1.666E+01	0.284
PA-231	1.805E+00		1.733E+00	3.317E+00	4.717E-02	0.544
PA-234	3.511E+00		1.440E+00	2.739E+00	3.896E-02	1.282
NP-237	1.375E+00		3.530E+01	5.675E+01	4.588E+00	0.024
AM-241	2.743E+01		1.020E+01	1.894E+01	9.311E-01	1.448

KB 5.1.13

VAX/VMS Peak Search Report Generated 1-MAY-2013 17:13:02.35

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP_130410806_GE3_BAFIL_191195.CN
Analyses by : PEAK V16.9 PEAKEFF V2.2
Client ID : I-4 TOT
Deposition Date :
Sample Date : 1-MAY-2013 00:00:00. Acquisition date : 1-MAY-2013 16:57:41.
Sample ID : 1304108-06 Sample Quantity : 1.00000E+00 filter
Sample type : FILTER Sample Geometry : 0
Detector name : GE3 Detector Geometry: BAFIL
Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:03.90 0.4%
Start channel : 25 End channel : 4096
Sensitivity : 3.00000 Gaussian : 10.00000
Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	6	27.81	32	42	1.43	28.13	27	12	3.51E-02	27.5	5.46E+01
2	6	30.94	1890	72	1.42	31.26	27	12	2.10E+00	2.4	
3	6	34.94	557	94	2.33	35.26	27	12	6.18E-01	6.7	
4	5	52.13	66	107	2.18	52.45	48	25	7.31E-02	29.1	3.05E+00
5	5	55.68	30	61	1.36	56.00	48	25	3.35E-02	41.5	
6	5	61.82	285	73	1.74	62.14	48	25	3.17E-01	7.4	
7	5	65.82	140	100	2.22	66.13	48	25	1.56E-01	15.8	
8	0	81.20	813	113	1.97	81.52	78	9	9.03E-01	4.2	
9	0	111.72	198	157	1.74	112.03	107	9	2.20E-01	13.4	
10	0	117.03	56	53	1.38	117.34	116	5	6.21E-02	24.8	
11	0	276.86	50	42	1.13	277.17	273	8	5.52E-02	27.0	
12	4	303.16	149	7	1.70	303.46	301	10	1.65E-01	8.4	4.91E+00
13	4	307.60	26	14	2.06	307.90	301	10	2.84E-02	28.7	
14	2	333.86	91	5	2.01	334.16	328	21	1.01E-01	11.7	2.57E+00
15	2	339.69	18	3	1.67	340.00	328	21	2.05E-02	32.4	
16	0	356.33	444	30	1.90	356.64	353	9	4.94E-01	5.3	
17	0	364.76	22	10	2.08	365.07	362	6	2.44E-02	31.5	
18	4	383.98	90	40	2.38	384.28	381	10	9.97E-02	19.4	1.50E+01
19	4	387.09	153	45	1.75	387.40	381	10	1.70E-01	10.5	
20	0	391.77	32	20	3.28	392.07	391	6	3.54E-02	33.0	
21	3	414.92	35	10	2.29	415.23	412	10	3.84E-02	28.2	1.51E+00
22	3	417.92	27	15	2.13	418.23	412	10	3.02E-02	36.6	
23	0	437.22	93	13	1.89	437.52	434	7	1.03E-01	12.3	
24	0	468.37	20	11	2.02	468.67	465	10	2.23E-02	37.4	
25	2	509.01	10	2	2.16	509.31	507	10	1.10E-02	39.1	7.39E-01
26	2	511.69	9	5	2.16	511.99	507	10	1.05E-02	62.1	

Sample ID : 1304108-06 Acquisition date : 1-MAY-2013 16:57:41

Total number of lines in spectrum 26
Number of unidentified lines 22
Number of lines tentatively identified by NID 4 15.38%

Nuclide Type : FISSION

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
BA-133	10.50Y	1.00	3.896E+02	3.896E+02	0.699E+02	17.94	
	Total Activity :		3.896E+02	3.896E+02			

Nuclide Type : NATURAL

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
TH-234	4.47E+09Y	1.00	8.512E+02	8.512E+02	1.390E+02	16.33	
	Total Activity :		8.512E+02	8.512E+02			
	Grand Total Activity :		1.241E+03	1.241E+03			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Nuclide Type: FISSION

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
BA-133	81.00	33.00*	1.899E+01	3.896E+02	3.896E+02	17.94	OK
	302.84	17.80	6.222E+00	4.028E+02	4.028E+02	26.60	OK
	356.01	60.00	5.860E+00	3.795E+02	3.795E+02	17.22	OK

Final Mean for 3 Valid Peaks = 3.896E+02+/- 6.990E+01 (17.94%)

Nuclide Type: NATURAL

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
TH-234	63.29	3.80*	2.648E+01	8.512E+02	8.512E+02	16.33	OK

Final Mean for 1 Valid Peaks = 8.512E+02+/- 1.390E+02 (16.33%)

Flag: "*" = Keyline

Sample ID : 1304108-06 Acquisition date : 1-MAY-2013 16:57:41

---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133	3.896E+02	6.990E+01	1.915E+01	2.929E+00	20.344
TH-234	8.512E+02	1.390E+02	1.181E+02	6.342E+00	7.209

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/filter)	K.L. Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	-1.959E+00		5.733E+00	8.839E+00	1.010E+00	-0.222
CD-109	7.834E+01		1.130E+02	1.949E+02	1.607E+01	0.402
PA-231	2.645E-01		1.656E+00	3.002E+00	4.269E-02	0.088
PA-234	2.365E+00		1.390E+00	2.666E+00	3.792E-02	0.887
NP-237	1.187E+01		3.357E+01	5.592E+01	4.521E+00	0.212
AM-241	3.256E+01		9.180E+00	1.858E+01	9.134E-01	1.753

VAX/VMS Peak Search Report Generated 1-MAY-2013 17:18:07.30

Configuration : DKA100:[GAMMA.SCUSR.ARCHIVE]SMP_130410807_GE5_BAFIL_191196.CN
Analyses by : PEAK V16.9 PEAKEFF V2.2
Client ID : I-4 DIS
Deposition Date :
Sample Date : 1-MAY-2013 00:00:00. Acquisition date : 1-MAY-2013 17:02:46.
Sample ID : 1304108-07 Sample Quantity : 1.00000E+00 filter
Sample type : FILTER Sample Geometry : 0
Detector name : GE5 Detector Geometry: BAFIL
Elapsed live time: 0 00:15:00.00 Elapsed real time: 0 00:15:01.12 0.1%
Start channel : 25 End channel : 4096
Sensitivity : 3.00000 Gaussian : 10.00000
Critical level : No

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	Fit
1	0	13.19	10	10	0.61	131.97	123	13	1.14E-02	70.3	
2	5	19.51	25	12	0.66	192.58	186	31	2.77E-02	26.7	1.72E+00
3	5	21.11	96	8	0.81	207.96	186	31	1.06E-01	13.6	
4	0	31.05	1962	142	0.71	303.38	292	23	2.18E+00	2.8	
5	1	35.23	384	19	0.62	343.44	333	27	4.27E-01	6.1	2.50E+00
6	1	36.02	102	5	0.57	351.00	333	27	1.13E-01	19.8	
7	0	44.73	12	7	0.32	434.64	425	16	1.30E-02	61.1	
8	2	53.45	42	30	0.75	518.26	504	27	4.63E-02	34.5	1.02E+00
9	2	54.45	15	2	0.51	527.91	504	27	1.69E-02	24.8	
10	4	61.68	167	57	0.80	597.23	587	28	1.86E-01	12.9	1.81E+00
11	4	62.28	110	35	0.65	603.00	587	28	1.23E-01	18.2	
12	6	65.55	34	24	0.72	634.37	626	28	3.73E-02	36.4	2.13E+00
13	6	66.04	40	12	0.35	639.06	626	28	4.47E-02	24.6	
14	6	66.63	43	18	0.73	644.77	626	28	4.83E-02	30.9	
15	2	79.76	47	21	0.75	770.75	763	34	5.25E-02	25.0	1.66E+00
16	2	81.16	846	27	0.69	784.20	763	34	9.40E-01	3.7	
17	0	112.19	162	65	0.87	1081.93	1067	22	1.80E-01	13.0	
18	0	116.05	45	18	0.80	1118.95	1110	21	5.01E-02	24.7	
19	0	140.90	16	7	0.28	1357.38	1344	21	1.78E-02	43.1	
20	0	142.75	15	4	0.44	1375.16	1367	13	1.63E-02	36.3	
21	0	147.57	14	15	0.15	1421.38	1402	25	1.50E-02	65.3	
22	0	161.08	23	26	0.82	1551.09	1541	18	2.57E-02	45.3	
23	1	276.33	59	0	1.03	2657.00	2644	24	6.57E-02	12.2	1.03E+00
24	1	276.96	10	0	1.03	2663.00	2644	24	1.16E-02	51.5	
25	0	302.89	102	6	0.51	2911.82	2896	27	1.13E-01	10.9	
26	0	307.28	23	2	0.42	2953.99	2937	25	2.60E-02	23.9	
27	0	333.78	58	3	1.06	3208.20	3192	26	6.43E-02	14.2	
28	0	356.10	386	0	0.84	3422.46	3405	31	4.29E-01	5.1	
29	0	383.93	75	8	0.83	3689.44	3675	25	8.36E-02	13.4	
30	2	386.28	13	5	1.28	3712.02	3703	24	1.47E-02	85.8	1.19E+00
31	2	386.81	100	6	1.18	3717.11	3703	24	1.11E-01	13.1	
32	2	387.43	62	3	1.04	3723.03	3703	24	6.84E-02	14.6	

Sample ID : 1304108-07 Acquisition date : 1-MAY-2013 17:02:46

Total number of lines in spectrum	32	
Number of unidentified lines	26	
Number of lines tentatively identified by NID	6	18.75%

Nuclide Type : FISSION

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
BA-133	10.50Y	1.00	4.273E+02	4.274E+02	0.723E+02	16.91	
	Total Activity :		4.273E+02	4.274E+02			

Nuclide Type : NATURAL

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/filter	Wtd Mean Decay Corr pCi/filter	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
TH-234	4.47E+09Y	1.00	9.962E+01	9.962E+01	3.657E+01	36.71	
	Total Activity :		9.962E+01	9.962E+01			
	Grand Total Activity :		5.270E+02	5.270E+02			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Sample ID : 1304108-07 Acquisition date : 1-MAY-2013 17:02:46

Nuclide Type: FISSION

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
BA-133	81.00	33.00*	1.802E+01	4.273E+02	4.274E+02	16.91	OK
	302.84	17.80	2.575E+00	6.675E+02	6.676E+02	34.19	OK
	356.01	60.00	4.312E+00	4.481E+02	4.481E+02	17.69	OK

Final Mean for 3 Valid Peaks = 4.274E+02+/- 7.229E+01 (16.91%)

Nuclide Type: NATURAL

Nuclide	Energy	%Abn	%Eff	Uncorrected pCi/filter	Decay Corr pCi/filter	2-Sigma %Error	Status
TH-234	63.29	3.80*	8.750E+01	9.962E+01	9.962E+01	36.71	OK

Final Mean for 1 Valid Peaks = 9.962E+01+/- 3.657E+01 (36.71%)

Flag: "*" = Keyline

Sample ID : 1304108-07 Acquisition date : 1-MAY-2013 17:02:46

---- Identified Nuclides ----

Nuclide	Activity (pCi/filter)	Act error	MDA (pCi/filter)	MDA error	Act/MDA
BA-133	4.274E+02	7.229E+01	1.403E+01	2.066E+00	30.462
TH-234	9.962E+01	3.657E+01	2.817E+01	3.624E-01	3.536

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/filter)	K.L. Ided	Act error	MDA (pCi/filter)	MDA error	Act/MDA
CO-57	-6.440E+00		1.407E+01	2.394E+01	8.114E+00	-0.269
CD-109	-5.591E+01		9.104E+01	1.520E+02	1.463E+01	-0.368
PA-231	-6.887E-02		8.289E-01	1.518E+00	1.709E-02	-0.045
PA-234	4.428E+00	+	1.221E+00	2.138E+00	2.407E-02	2.071
NP-237	-1.631E+01		2.710E+01	4.536E+01	4.001E+00	-0.360
AM-241	-3.610E-02		1.481E+00	2.257E+00	2.541E-02	-0.016