AUXIER & ASSOCIATES, INC.

Westlake Landfill

STANDARD LEVEL IV
REPORT OF ANALYSIS

WORK ORDER #15-08106-OR

September 25, 2015

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 # 15-08106

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

Date for Partial	Initials	Date	Initials	Checklist Items
		8/25/15	JEB	Sample Log-In
		09/09/15	EJ	Data Compilation
		9-17-15	MLT	First Technical Data Review
		9/18/15	[illegible]	Second Technical Data Review
		9/24/15	[illegible]	Data Entry/Electronic Deliverable
		9/24/15	[illegible]	Case Narrative
		9/24/15	KBB	Electronic Deliverable Proof
		9/25/15	MSH	Samples Analyzed within Holding Time Yes? [X] No? [ ]
		9/25/15	MSH	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: [signature] [signature] 9/25/15

Laboratory Manager Date

Copy No. _____

SECTION I

CHAIN OF CUSTODY

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: Westlake Landfill	Project Number:
Send Report To: EMSI / Auxier & Assoc.	Sampler (Print Name): BILL ABERNATHY
Address: Environmental Management Support, Inc. 7220 W. Jefferson Ave., Suite 406	Sampler (Print Name): MIKE SPURGEON
Lakewood, CO 80235 Auxier & Associates, Inc.	Shipment Method: FedEx
9821 Cogdill Road, Suite 1 Knoxville, TN 37932	Airbill Number: 7737 0431 9290 2
Phone: EMSI (303) 940-3426 / A & A (865) 675-3669	Laboratory Receiving: 601 Scarboro Road Oak Ridge, TN 37830
Fax: EMSI (303) 940-3422 / A & A (865) 675-3677	(865) 481-0683

~~REC'D MAY 29 2015~~ JGB 8/25/15

Page 1 of 1

~~15-08106~~ JEB 8/25/15

~~15-05134~~ JEB 8/25/15

Purchase Order #:

Field Sample ID		Sample 3 Date	Sample 4 Time	Sample Matrix	Number of Containers	Gross alpha	Gross beta	Comments, Special Instructions, etc.	Lab Sample ID (to be completed by lab)
ENGWESA001	4	5/27/15	1612	air filter	1	X	X		
ENGWESA002	5	5/28/15	0830	air filter	1	X	X		
ENGWESA003	6	5/28/15	0906	air filter	1	X	X		
ENGWESA004	7	5/28/15	0930	air filter	1	X	X		
ENGWESA005	8	5/27/15	1508	air filter	1	X	X		
ENGWESA006	9	5/27/15	1650	air filter	1	X	X		
ENGWESA007	10	5/27/15	1200	air filter	1	X	X		
ENGWESA008	11	5/27/15	1538	air filter	1	X	X		
ENGWESA009	12	5/28/15	1042	air filter	1	X	X		
ENGWESA010	13	5/28/15	1106	air filter	1	X	X		
ENGWESA011	14	5/27/15	0910	air filter	1	X	X		
ENGWESA012	15	5/27/15	1036	air filter	1	X	X		
ENGWESA013	16	5/27/15	1117	air filter	1	X	X		
Field Blank	~~17~~ 18	5/28/15	0830	air filter	1	X	X		
ENGWESA013 Field Dup	16	05/27/15	1117						
Eyr 08/26/15	Eyr 08/26/15								

lab: select one of the filters at random (not the field blank) and split it for a field duplicate.

Samples not analyzed per client request. Eyr 08/26/15

15-08106

~~RECD AUG 25 2015~~

Relog

Relinquished by: (Signature)	Received by: (Signature)	Date: 7	Time: 8
5 [signature]	6 FEDEX 7737 0431 9290	5/28/15	1430
Relinquished by: (Signature) Fed Ex	Received by: (Signature) Kristen Coulston	Date: 5/29/15	Time: 930
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Sample Custodian Remarks (Completed By Laboratory):

QA/QC Level		Turnaround		Sample Receipt	
Level IV	☒			Total # Containers Received?	
Level I	☐	Routine	☒	COC Seals Present?	
Level II	☐	24 Hour	☐	COC Seals Intact?	
Level III	☐	1 Week	☐	Received Containers Intact?	
Other	☐	Other _____		Temperature?	

000025

EBERLINE SERVICES Oak Ridge Laboratory	Internal Chain of Custody	Work Order #	15-08106
		Lab Deadline	9/15/2015
		Analysis	UUISO - Level 4
		Sample Matrix	Air Filter

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Run Gamma 1st ASAP!!!	04	36	S1.3
	05	45	S1.3
	06	36	S1.3
	07	35	S1.3
	08	46	S1.3
	09	43	S1.3
	10	40	S1.3
	11	39	S1.3
	12	41	S1.3
Samples are re-log of 15-05134, fractions 04-16 only	13	43	S1.3
	14	44	S1.3
	15	42	S1.3
	16	41	S1.3

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	9/2/15	
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	9/4/15	1000
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	9/4/15	1000
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	9/8/15	0734
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		0734
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	9/8/15	1105
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 #	15-08106
		Lab Deadline	9/15/2015
		Analysis	ThISO - Level 4
		Sample Matrix	Air Filter

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Run Gamma 1st ASAP!!!	04	36	S1.3
	05	45	S1.3
	06	36	S1.3
	07	35	S1.3
	08	46	S1.3
	09	43	S1.3
	10	40	S1.3
	11	39	S1.3
	12	41	S1.3
Samples are re-log of 15-05134, fractions 04-16 only	13	43	S1.3
	14	44	S1.3
	15	42	S1.3
	16	41	S1.3

	Location (circle one)					Initials	Date
Received by	(Sample Storage)	Rough Prep	Prep	Separations	Count Room	JWOIPe	9/2/15 1100
Relinquished by	Sample Storage	Rough Prep	(Prep)	Separations	Count Room	JWOIPe	9/4/15 1100
Received by	Sample Storage	Rough Prep	Prep	(Separations)	Count Room	[illegible]	9-4-15 [illegible]
Relinquished by	Sample Storage	Rough Prep	Prep	(Separations)	Count Room	[illegible]	9-8-15 0734
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room	[illegible]	0704
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	(Count Room)	KD	9/8/15 1450
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 #	15-08106
		Lab Deadline	9/15/2015
		Analysis	Gamma - Level 4
		Sample Matrix	Air Filter

Comments	Sample Fraction	HP 210 / 270 Detector Activity	Storage Location
Run Gamma 1st ASAP!!!	04	36	S1.3
	05	45	S1.3
	06	36	S1.3
	07	35	S1.3
	08	46	S1.3
Report Ac228, Bi214, K40, Pa231, Pb210/214 & true positives.	09	43	S1.3
	10	40	S1.3
	11	39	S1.3
	12	41	S1.3
Samples are re-log of 15-05134, fractions 04-16 only	13	43	S1.3
	14	44	S1.3
	15	42	S1.3
	16	41	S1.3

	Location (circle one)					Initials	Date
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room 1300	Kenny Sch	8-26-15
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room 0735	Kenny Sch	8-27-15
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room 0775	C	8/27
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room	[illegible]	0511
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Received by	Sample Storage	Rough Prep	Prep	Separations	Count Room		
Relinquished by	Sample Storage	Rough Prep	Prep	Separations	Count Room		

SECTION II

SAMPLE ACKNOWLEDGEMENT

Client Name	Contract/PO	Project Type	Date Received	Required Turnaround Days	Eberline Services Work Order
Auxier & Associates, Inc.	WESTLAKE	Environmental	08/25/2015	28	15-08106
Project Name	**Client WO**	**Sample Disp**	**Lab Deadline**	**Internal Deadline**	**Client Deadline**
WESTLAKE	WESTLAKE LANDFILL AIR	H	09/15/2015	09/21/2015	09/22/2015

Internal ID	Client ID	Sample Date	Matrix	Storage	Gamma	ThISO	UUISO																					Ttl
01	LCS	08/26/15	AF	S1.3	X	X	X																					3
02	BLANK	08/26/15	AF	S1.3	X	X	X																					3
03	DUP	08/26/15	AF	S1.3	X	X	X																					3
04	ENGWESA001	05/27/15 16:12	AF	S1.3	X	X	X																					3
05	ENGWESA002	05/28/15 08:30	AF	S1.3	X	X	X																					3
06	ENGWESA003	05/28/15 09:06	AF	S1.3	X	X	X																					3
07	ENGWESA004	05/28/15 09:30	AF	S1.3	X	X	X																					3
08	ENGWESA005	05/27/15 15:08	AF	S1.3	X	X	X																					3
09	ENGWESA006	05/27/15 16:50	AF	S1.3	X	X	X																					3
10	ENGWESA007	05/27/15 12:00	AF	S1.3	X	X	X																					3
11	ENGWESA008	05/27/15 15:38	AF	S1.3	X	X	X																					3
12	ENGWESA009	05/28/15 10:42	AF	S1.3	X	X	X																					3
13	ENGWESA010	05/28/15 11:06	AF	S1.3	X	X	X																					3
14	ENGWESA011	05/27/15 09:10	AF	S1.3	X	X	X																					3
15	ENGWESA012	05/27/15 10:36	AF	S1.3	X	X	X																					3
16	ENGWESA013	05/27/15 11:17	AF	S1.3	X	X	X																					3
																												0
																												0
																												0
																												0
		Totals Per Analysis (non QA samples)			13	13	13	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	Accounts Payable Auxier & Associates, Inc. 9821 Cogdill Drive #1 Knoxville, TN 37932
Voice	865-675-3669
Fax	865-675-3677
Contact	Cecilia Greene
Voice	865-675-3669
Fax	865-675-3677

Report Data	Marsha Joseph Auxier & Associates, Inc. 9821 Cogdill Drive #1 Knoxville, TN 37932
Voice	865-675-3669
Fax	865-675-3677

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Eberline Services – Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST
MP-001-2

WORK ORDER # 15-08106

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: James E. Bailey DATE: 8 25 15

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-39706

September 25, 2015

Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Road #1
Knoxville, TN 37932

CASE NARRATIVE
Work Order # 15-08106-OR

SAMPLE RECEIPT

This work order contains thirteen air filter samples relogged 08/25/2015 at the request of the client. These samples were analyzed for Isotopic Uranium, Isotopic Thorium, Actinium-227 (reported from Thorium-227) and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
ENGWESA001	15-08106-04	ENGWESA008	15-08106-11
ENGWESA002	15-08106-05	ENGWESA009	15-08106-12
ENGWESA003	15-08106-06	ENGWESA010	15-08106-13
ENGWESA004	15-08106-07	ENGWESA011	15-08106-14
ENGWESA005	15-08106-08	ENGWESA012	15-08106-15
ENGWESA006	15-08106-09	ENGWESA013	15-08106-16
ENGWESA007	15-08106-10		

ANALYTICAL METHODS

Isotopic Uranium was analyzed using Method EML U-02 Modified. Isotopic Thorium was analyzed using Method EML Th-01 Modified. Gamma Spectroscopy was performed using Method LANL ER-130 Modified.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 2-sigma value.

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

ANALYTICAL RESULTS CONTINUED

ISOTOPIC URANIUM

Samples were prepared by digestion of filter media using mixed acids followed by subsequent dilutions. Aliquots from dilutions were taken and Uranium was selectively extracted by ion exchange. 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.

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-238 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Uranium-235 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 prepared by digestion of filter media using mixed acids followed by subsequent dilutions. Aliquots from dilutions were taken and 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-227, 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. Actinium-227 results were reported from Thorium-227 assuming secular equilibrium. Chemical recovery was acceptable for all samples. The Thorium-227, Thorium-230 and Thorium-232 method blank demonstrated acceptable results. Results for the Thorium-230 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the 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 and Thorium-232 laboratory control sample demonstrated an acceptable percent recovery.

GAMMA SPECTROSCOPY

Air Filters for Gamma Spectroscopy analysis were prepared by transferring directly to standard geometry containers. Samples were counted on High Purity Germanium (HPGe) gamma ray detectors.

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Beryllium-7, Potassium-40 and Lead-210 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cobalt-60 and Cesium-137 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: 9/25/2015

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

Eberline Analytical
Final Report of Analysis

Report To:

Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Drive #1
Knoxville, TN 37932

Work Order Details:

SDG:	**15-08106**
Project:	WESTLAKE
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	AF

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-08106-01	LCS	KNOWN	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Cobalt-60	LANL ER-130 Modified	9.82E+03	3.93E+02				pCi/s
15-08106-01	LCS	KNOWN	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Cesium-137	LANL ER-130 Modified	6.23E+03	2.49E+02				pCi/s
15-08106-01	LCS	SPIKE	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Cobalt-60	LANL ER-130 Modified	9.53E+03	9.19E+02	1.04E+03	1.45E+02	1.04E+02	pCi/s
15-08106-01	LCS	SPIKE	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Cesium-137	LANL ER-130 Modified	6.38E+03	1.08E+03	1.13E+03	1.35E+02	6.64E+01	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Actinium-228	LANL ER-130 Modified	6.69E+00	7.62E+00	7.62E+00	1.36E+01	6.30E+00	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Beryllium-7	LANL ER-130 Modified	1.58E+01	1.52E+01	1.52E+01	2.26E+01	1.07E+01	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Bismuth-214	LANL ER-130 Modified	2.98E+00	5.72E+00	5.72E+00	6.52E+00	3.09E+00	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Potassium-40	LANL ER-130 Modified	2.43E+00	2.25E+01	2.25E+01	3.80E+01	1.68E+01	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Protactinium-231	LANL ER-130 Modified	-3.23E+00	4.69E+01	4.69E+01	7.24E+01	3.47E+01	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Lead-210	LANL ER-130 Modified	2.32E+01	2.09E+01	2.09E+01	3.47E+01	1.70E+01	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	8/28/2015	15-08106	Lead-214	LANL ER-130 Modified	4.30E+00	3.25E+00	3.26E+00	5.48E+00	2.63E+00	pCi/s
15-08106-03	DUP	ENGWESA001	05/27/15 16:12	8/25/2015	8/28/2015	15-08106	Actinium-228	LANL ER-130 Modified	7.58E+00	8.67E+00	8.68E+00	1.44E+01	6.65E+00	pCi/s
15-08106-03	DUP	ENGWESA001	05/27/15 16:12	8/25/2015	8/28/2015	15-08106	Beryllium-7	LANL ER-130 Modified	2.82E+03	3.15E+02	3.47E+02	1.34E+02	6.50E+01	pCi/s
15-08106-03	DUP	ENGWESA001	05/27/15 16:12	8/25/2015	8/28/2015	15-08106	Bismuth-214	LANL ER-130 Modified	1.50E+00	4.71E+00	4.71E+00	7.31E+00	3.46E+00	pCi/s
15-08106-03	DUP	ENGWESA001	05/27/15 16:12	8/25/2015	8/28/2015	15-08106	Potassium-40	LANL ER-130 Modified	4.15E+01	3.58E+01	3.59E+01	6.25E+01	2.88E+01	pCi/s
15-08106-03	DUP	ENGWESA001	05/27/15 16:12	8/25/2015	8/28/2015	15-08106	Protactinium-231	LANL ER-130 Modified	2.53E+01	7.57E+01	7.57E+01	1.13E+02	5.46E+01	pCi/s
15-08106-03	DUP	ENGWESA001	05/27/15 16:12	8/25/2015	8/28/2015	15-08106	Lead-210	LANL ER-130 Modified	3.70E+02	6.14E+01	6.42E+01	7.71E+01	3.81E+01	pCi/s
15-08106-03	DUP	ENGWESA001	05/27/15 16:12	8/25/2015	8/28/2015	15-08106	Lead-214	LANL ER-130 Modified	3.46E+00	4.03E+00	4.03E+00	6.38E+00	3.05E+00	pCi/s
15-08106-04	DO	ENGWESA001	05/27/15 16:12	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	7.24E+00	8.73E+00	8.74E+00	1.48E+01	6.84E+00	pCi/s
15-08106-04	DO	ENGWESA001	05/27/15 16:12	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	2.54E+03	2.81E+02	3.10E+02	1.01E+02	4.84E+01	pCi/s
15-08106-04	DO	ENGWESA001	05/27/15 16:12	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	6.47E+00	4.51E+00	4.52E+00	7.65E+00	3.63E+00	pCi/s
15-08106-04	DO	ENGWESA001	05/27/15 16:12	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	3.94E+01	2.36E+01	2.37E+01	3.13E+01	1.32E+01	pCi/s
15-08106-04	DO	ENGWESA001	05/27/15 16:12	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	2.68E+00	7.57E+01	7.57E+01	1.12E+02	5.41E+01	pCi/s
15-08106-04	DO	ENGWESA001	05/27/15 16:12	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	3.78E+02	5.66E+01	5.98E+01	6.41E+01	3.16E+01	pCi/s
15-08106-04	DO	ENGWESA001	05/27/15 16:12	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	1.24E+00	4.74E+00	4.74E+00	7.10E+00	3.42E+00	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	7.15E+00	5.63E+00	5.64E+00	9.45E+00	4.41E+00	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	3.82E+03	4.03E+02	4.48E+02	9.24E+01	4.48E+01	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	6.92E+00	4.10E+00	4.12E+00	6.97E+00	3.37E+00	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	2.45E+01	1.94E+01	1.95E+01	3.57E+01	1.65E+01	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	4.09E+01	4.64E+01	4.64E+01	7.69E+01	3.72E+01	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	4.92E+02	5.30E+01	5.87E+01	6.02E+01	2.98E+01	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	2.47E+00	2.72E+00	2.72E+00	4.60E+00	2.22E+00	pCi/s

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original; CV=Critical Value

EBERLINE SERVICES

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

Eberline Analytical
Final Report of Analysis

Report To:

Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Drive #1
Knoxville, TN 37932

Work Order Details:

SDG: **15-08106**
Project: WESTLAKE
Analysis Category: ENVIRONMENTAL
Sample Matrix: AF

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	9.35E+00	6.76E+00	6.78E+00	1.11E+01	5.23E+00	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	3.50E+03	3.98E+02	4.37E+02	1.77E+02	8.68E+01	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	4.75E+00	5.60E+00	5.61E+00	9.35E+00	4.55E+00	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	5.71E+01	2.44E+01	2.46E+01	4.55E+01	2.13E+01	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	-1.03E+01	6.30E+01	6.30E+01	8.06E+01	3.90E+01	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	3.97E+02	5.58E+01	5.94E+01	6.83E+01	3.38E+01	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	5.46E+00	3.74E+00	3.75E+00	5.42E+00	2.62E+00	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	5.09E+00	9.37E+00	9.38E+00	1.61E+01	7.46E+00	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	2.31E+03	1.16E+03	1.17E+03	1.54E+02	7.43E+01	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	3.91E+00	7.52E+00	7.53E+00	8.54E+00	4.05E+00	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	1.58E+01	2.84E+01	2.84E+01	5.26E+01	2.35E+01	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	1.09E+01	6.37E+01	6.38E+01	1.19E+02	5.77E+01	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	3.25E+02	4.44E+01	4.74E+01	5.07E+01	2.49E+01	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	2.96E+00	4.59E+00	4.59E+00	7.41E+00	3.57E+00	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	-2.30E-01	1.97E+00	1.97E+00	7.72E+00	3.55E+00	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	3.33E+03	3.55E+02	3.94E+02	8.56E+01	4.14E+01	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	4.35E+00	3.28E+00	3.29E+00	5.35E+00	2.56E+00	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	1.83E+01	2.18E+01	2.18E+01	3.75E+01	1.73E+01	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	-3.81E+01	4.39E+01	4.40E+01	6.78E+01	3.26E+01	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	4.31E+02	5.13E+01	5.58E+01	4.35E+01	2.14E+01	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	4.59E+00	2.56E+00	2.57E+00	4.51E+00	2.17E+00	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	-1.02E+01	1.10E+01	1.10E+01	1.55E+01	7.15E+00	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	2.01E+03	1.01E+03	1.01E+03	1.57E+02	7.58E+01	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	1.92E+00	5.78E+00	5.78E+00	8.32E+00	3.94E+00	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	1.42E+01	2.68E+01	2.68E+01	4.96E+01	2.20E+01	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	8.76E+00	7.54E+01	7.54E+01	1.17E+02	5.66E+01	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	2.79E+02	4.26E+01	4.49E+01	5.26E+01	2.59E+01	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	-1.36E+00	4.62E+00	4.62E+00	7.04E+00	3.38E+00	pCi/s

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original; CV=Critical Value

Eberline Analytical
Final Report of Analysis

Report To:

Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Drive #1
Knoxville, TN 37932

Work Order Details:

SDG: **15-08106**
Project: WESTLAKE
Analysis Category: ENVIRONMENTAL
Sample Matrix: AF

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	7.09E+00	6.21E+00	6.22E+00	1.04E+01	4.85E+00	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	2.48E+03	2.86E+02	3.13E+02	1.14E+02	5.53E+01	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	8.59E+00	3.85E+00	3.88E+00	6.50E+00	3.12E+00	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	5.98E+01	2.30E+01	2.32E+01	4.43E+01	2.07E+01	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	-1.68E+01	5.99E+01	5.99E+01	7.63E+01	3.68E+01	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	2.91E+02	3.74E+01	4.03E+01	8.29E+01	4.11E+01	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	6.69E+00	3.63E+00	3.65E+00	5.38E+00	2.60E+00	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	6.93E+00	6.21E+00	6.22E+00	1.07E+01	4.96E+00	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	2.86E+03	3.05E+02	3.39E+02	7.68E+01	3.67E+01	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	2.23E+00	3.40E+00	3.40E+00	5.43E+00	2.58E+00	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	1.74E+01	2.67E+01	2.67E+01	4.29E+01	1.96E+01	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	3.38E+01	5.97E+01	5.97E+01	8.99E+01	4.36E+01	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	3.76E+02	5.09E+01	5.44E+01	5.30E+01	2.61E+01	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	4.33E-01	3.26E+00	3.26E+00	4.83E+00	2.32E+00	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	1.73E+00	6.25E+00	6.25E+00	9.83E+00	4.60E+00	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	1.06E+03	1.32E+02	1.43E+02	7.83E+01	3.78E+01	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	2.33E+00	3.21E+00	3.21E+00	5.07E+00	2.42E+00	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	2.87E+01	2.00E+01	2.01E+01	3.71E+01	1.72E+01	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	1.98E+01	3.60E+01	3.61E+01	6.03E+01	2.89E+01	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	2.01E+02	3.29E+01	3.45E+01	3.98E+01	1.96E+01	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	2.09E+00	2.29E+00	2.29E+00	3.97E+00	1.90E+00	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	4.99E+00	8.64E+00	8.64E+00	1.52E+01	6.99E+00	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	1.73E+03	8.68E+02	8.73E+02	1.43E+02	6.89E+01	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	4.95E+00	8.65E+00	8.65E+00	8.64E+00	4.10E+00	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	1.79E+01	2.71E+01	2.71E+01	5.82E+01	2.63E+01	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	1.23E+02	7.16E+01	7.18E+01	1.19E+02	5.78E+01	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	2.72E+02	4.65E+01	4.86E+01	6.25E+01	3.09E+01	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	1.44E+00	4.53E+00	4.53E+00	7.19E+00	3.46E+00	pCi/s

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original; CV=Critical Value

Eberline Analytical
Final Report of Analysis

Report To:

Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Drive #1
Knoxville, TN 37932

Work Order Details:

SDG: **15-08106**
Project: WESTLAKE
Analysis Category: ENVIRONMENTAL
Sample Matrix: AF

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	9.82E+00	6.86E+00	6.88E+00	1.13E+01	5.30E+00	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	3.14E+03	3.53E+02	3.88E+02	1.14E+02	5.55E+01	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	6.03E+00	3.91E+00	3.92E+00	6.41E+00	3.08E+00	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	6.92E+01	2.61E+01	2.63E+01	4.86E+01	2.28E+01	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	3.71E+00	6.22E+01	6.22E+01	8.11E+01	3.92E+01	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	3.58E+02	5.03E+01	5.35E+01	6.09E+01	3.01E+01	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	4.14E+00	3.75E+00	3.75E+00	5.28E+00	2.55E+00	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	-4.31E-01	6.00E+00	6.00E+00	9.23E+00	4.23E+00	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	2.79E+03	3.00E+02	3.32E+02	8.89E+01	4.28E+01	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	1.54E+00	3.37E+00	3.37E+00	5.32E+00	2.52E+00	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	3.65E+01	2.82E+01	2.83E+01	4.40E+01	2.02E+01	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	3.84E+01	4.57E+01	4.58E+01	7.61E+01	3.67E+01	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	3.84E+02	4.67E+01	5.07E+01	5.27E+01	2.60E+01	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	1.38E-01	3.45E+00	3.45E+00	5.10E+00	2.45E+00	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	8/31/2015	15-08106	Actinium-228	LANL ER-130 Modified	1.35E+01	1.56E+01	1.56E+01	2.57E+01	1.20E+01	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	8/31/2015	15-08106	Beryllium-7	LANL ER-130 Modified	6.65E+03	7.27E+02	8.03E+02	2.31E+02	1.11E+02	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	8/31/2015	15-08106	Bismuth-214	LANL ER-130 Modified	9.21E-01	8.60E+00	8.60E+00	1.30E+01	6.20E+00	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	8/31/2015	15-08106	Potassium-40	LANL ER-130 Modified	2.17E+01	5.54E+01	5.54E+01	8.70E+01	3.96E+01	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	8/31/2015	15-08106	Protactinium-231	LANL ER-130 Modified	8.90E+00	1.16E+02	1.16E+02	1.89E+02	9.09E+01	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	8/31/2015	15-08106	Lead-210	LANL ER-130 Modified	8.35E+02	1.01E+02	1.09E+02	1.28E+02	6.30E+01	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	8/31/2015	15-08106	Lead-214	LANL ER-130 Modified	5.02E+00	6.72E+00	6.73E+00	1.14E+01	5.47E+00	pCi/s

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original; CV=Critical Value

Eberline Analytical
Final Report of Analysis

Report To:
Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Drive #1
Knoxville, TN 37932

Work Order Details:
SDG: **15-08106**
Project: WESTLAKE
Analysis Category: ENVIRONMENTAL
Sample Matrix: AF

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	1.63E-01	1.04E-01	1.06E-01	8.90E-02	1.43E-03	pCi/s
15-08106-03	DUP	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	4.35E-01	4.04E-01	4.07E-01	3.76E-01	2.34E-02	pCi/s
15-08106-04	TRG	ENGWESA001	05/27/15 16:12	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	6.21E-01	3.48E-01	3.56E-01	2.17E-01	1.93E-02	pCi/s
15-08106-05	DO	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	3.06E-01	2.94E-01	2.96E-01	3.14E-01	2.80E-02	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	2.82E-01	2.01E-01	2.04E-01	1.98E-01	3.41E-02	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	2.84E-01	2.00E-01	2.03E-01	1.89E-01	3.01E-03	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	2.93E-01	2.01E-01	2.04E-01	1.77E-01	2.36E-02	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	4.44E-01	2.58E-01	2.64E-01	2.23E-01	4.57E-02	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	3.26E-01	2.12E-01	2.16E-01	1.39E-01	8.62E-03	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	1.45E-01	1.39E-01	1.40E-01	1.49E-01	1.32E-02	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	1.43E-01	1.62E-01	1.63E-01	2.26E-01	3.89E-02	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	3.83E-01	2.57E-01	2.61E-01	2.30E-01	3.66E-03	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	2.79E-01	2.03E-01	2.06E-01	1.89E-01	2.52E-02	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	5.28E-02	1.14E-01	1.14E-01	2.21E-01	4.52E-02	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	9/8/2015	15-08106	Actinium-227	EML Th-01 Modified	1.75E-01	1.82E-01	1.83E-01	1.90E-01	1.18E-02	pCi/s
15-08106-01	LCS	KNOWN	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	5.33E+00	1.44E-01				pCi/s
15-08106-01	LCS	SPIKE	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	6.39E+00	1.03E+00	1.29E+00	8.22E-02	9.30E-02	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	6.02E-02	6.52E-02	6.57E-02	8.68E-02	9.08E-02	pCi/s
15-08106-03	DUP	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	9.30E-01	5.92E-01	6.03E-01	4.17E-01	5.03E-01	pCi/s
15-08106-04	TRG	ENGWESA001	05/27/15 16:12	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.01E+00	4.42E-01	4.60E-01	1.84E-01	2.46E-01	pCi/s
15-08106-05	DO	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.19E+00	5.75E-01	5.94E-01	3.04E-01	3.68E-01	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.21E+00	4.19E-01	4.45E-01	1.45E-01	1.76E-01	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.37E+00	4.56E-01	4.87E-01	1.83E-01	1.65E-01	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.27E+00	4.32E-01	4.59E-01	1.45E-01	1.75E-01	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.32E+00	4.48E-01	4.77E-01	1.31E-01	1.76E-01	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	2.31E+00	6.47E-01	7.08E-01	1.93E-01	1.74E-01	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.35E+00	4.46E-01	4.76E-01	1.44E-01	1.73E-01	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	9.26E-01	3.84E-01	4.01E-01	1.66E-01	2.01E-01	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.82E+00	5.95E-01	6.36E-01	2.22E-01	2.01E-01	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.55E+00	5.03E-01	5.38E-01	1.55E-01	1.87E-01	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.49E+00	4.81E-01	5.15E-01	1.30E-01	1.74E-01	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	9/8/2015	15-08106	Thorium-230	EML Th-01 Modified	1.81E+00	6.27E-01	6.66E-01	2.65E-01	2.39E-01	pCi/s

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original; CV=Critical Value

Eberline Analytical
Final Report of Analysis

Report To:
Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Drive #1
Knoxville, TN 37932

Work Order Details:
SDG: 15-08106
Project: WESTLAKE
Analysis Category: ENVIRONMENTAL
Sample Matrix: AF

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-08106-01	LCS	KNOWN	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	4.79E+00	1.72E-01				pCi/s
15-08106-01	LCS	SPIKE	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	5.44E+00	9.01E-01	1.02E+00	1.07E-01	2.25E-02	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	-2.46E-03	2.88E-02	2.88E-02	6.04E-02	3.54E-03	pCi/s
15-08106-03	DUP	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	3.76E-01	3.92E-01	3.93E-01	4.91E-01	6.58E-02	pCi/s
15-08106-04	TRG	ENGWESA001	05/27/15 16:12	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	1.17E-01	1.52E-01	1.52E-01	2.10E-01	1.82E-02	pCi/s
15-08106-05	DO	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	5.08E-01	3.82E-01	3.85E-01	3.81E-01	4.79E-03	pCi/s
15-08106-06	TRG	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	3.89E-01	2.23E-01	2.25E-01	1.27E-01	7.46E-03	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	6.35E-01	2.90E-01	2.96E-01	1.27E-01	7.47E-03	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	5.00E-01	2.57E-01	2.61E-01	1.59E-01	1.77E-02	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	7.07E-01	3.15E-01	3.21E-01	1.65E-01	1.83E-02	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	6.68E-01	3.06E-01	3.12E-01	1.34E-01	7.86E-03	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	3.56E-01	2.12E-01	2.14E-01	1.26E-01	7.36E-03	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	3.06E-01	2.10E-01	2.12E-01	1.45E-01	8.53E-03	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	6.60E-01	3.27E-01	3.32E-01	1.54E-01	9.07E-03	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	6.97E-01	3.18E-01	3.24E-01	1.70E-01	1.89E-02	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	4.81E-01	2.55E-01	2.59E-01	1.63E-01	1.81E-02	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	9/8/2015	15-08106	Thorium-232	EML Th-01 Modified	7.42E-01	3.75E-01	3.80E-01	1.84E-01	1.08E-02	pCi/s
15-08106-01	LCS	KNOWN	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	8.05E+00	2.90E-01				pCi/s
15-08106-01	LCS	SPIKE	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	7.09E+00	1.04E+00	1.16E+00	7.15E-02	6.95E-03	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	2.97E-02	4.44E-02	4.44E-02	7.22E-02	1.03E-02	pCi/s
15-08106-03	DUP	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	2.54E+00	9.95E-01	1.01E+00	4.69E-01	5.67E-02	pCi/s
15-08106-04	TRG	ENGWESA001	05/27/15 16:12	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.68E+00	5.80E-01	5.92E-01	1.95E-01	1.38E-02	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.35E+00	4.47E-01	4.58E-01	1.63E-01	1.58E-02	pCi/s
15-08106-06	DO	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.57E+00	7.01E-01	7.10E-01	4.15E-01	5.92E-02	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.92E+00	8.25E-01	8.36E-01	4.58E-01	7.44E-02	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	2.16E+00	6.39E-01	6.57E-01	1.96E-01	1.91E-02	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.20E+00	4.56E-01	4.64E-01	2.23E-01	3.19E-02	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.87E+00	5.84E-01	5.99E-01	2.11E-01	2.54E-02	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.13E+00	4.59E-01	4.66E-01	2.42E-01	3.45E-02	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.58E+00	5.03E-01	5.16E-01	2.76E-01	8.08E-02	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	2.34E+00	6.49E-01	6.70E-01	2.15E-01	3.07E-02	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.18E+00	4.41E-01	4.49E-01	2.45E-01	4.86E-02	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	1.57E+00	5.44E-01	5.56E-01	1.78E-01	1.27E-02	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	9/8/2015	15-08106	Uranium-234	EML U-02 Modified	7.48E-01	5.42E-01	5.45E-01	5.59E-01	1.12E-01	pCi/s

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original; CV=Critical Value

Eberline Analytical
Final Report of Analysis

Report To:
Marsha Joseph
Auxier & Associates, Inc.
9821 Cogdill Drive #1
Knoxville, TN 37932

Work Order Details:
SDG: **15-08106**
Project: WESTLAKE
Analysis Category: ENVIRONMENTAL
Sample Matrix: AF

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-08106-01	LCS	SPIKE	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	5.84E-01	2.16E-01	2.20E-01	8.83E-02	6.01E-03	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	4.97E-02	6.32E-02	6.33E-02	9.45E-02	1.17E-02	pCi/s
15-08106-03	DUP	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	2.93E-01	3.79E-01	3.80E-01	5.27E-01	3.59E-02	pCi/s
15-08106-04	TRG	ENGWESA001	05/27/15 16:12	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	2.21E-01	2.28E-01	2.29E-01	2.41E-01	1.09E-02	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	8.39E-02	1.43E-01	1.43E-01	2.52E-01	2.15E-03	pCi/s
15-08106-06	DO	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	3.17E-01	3.61E-01	3.62E-01	4.76E-01	4.21E-02	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	7.83E-02	1.88E-01	1.88E-01	3.94E-01	1.78E-02	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	3.33E-02	1.02E-01	1.02E-01	2.41E-01	1.65E-02	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	-2.49E-02	9.99E-02	9.99E-02	2.56E-01	2.27E-02	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	1.49E-01	1.95E-01	1.95E-01	2.97E-01	2.53E-03	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	3.34E-01	2.80E-01	2.81E-01	2.98E-01	3.18E-02	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	6.35E-02	1.21E-01	1.21E-01	2.24E-01	1.98E-02	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	2.03E-01	2.10E-01	2.11E-01	2.66E-01	2.82E-02	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	8.38E-02	1.28E-01	1.28E-01	1.91E-01	8.62E-03	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	8.75E-02	1.49E-01	1.49E-01	2.52E-01	1.72E-02	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	9/8/2015	15-08106	Uranium-235	EML U-02 Modified	8.69E-02	2.09E-01	2.09E-01	4.37E-01	1.98E-02	pCi/s
15-08106-01	LCS	KNOWN	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	7.85E+00	2.82E-01				pCi/s
15-08106-01	LCS	SPIKE	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	7.97E+00	1.14E+00	1.28E+00	7.12E-02	6.07E-03	pCi/s
15-08106-02	MBL	BLANK	08/26/15 00:00	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	5.73E-03	4.63E-02	4.63E-02	1.07E-01	3.35E-02	pCi/s
15-08106-03	DUP	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.26E+00	6.96E-01	7.02E-01	5.32E-01	8.16E-02	pCi/s
15-08106-04	TRG	ENGWESA001	05/27/15 16:12	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.43E+00	5.32E-01	5.42E-01	2.23E-01	1.90E-02	pCi/s
15-08106-05	TRG	ENGWESA002	05/28/15 08:30	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.48E+00	4.70E-01	4.82E-01	1.62E-01	1.38E-02	pCi/s
15-08106-06	DO	ENGWESA003	05/28/15 09:06	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	2.22E+00	8.54E-01	8.69E-01	5.38E-01	1.30E-01	pCi/s
15-08106-07	TRG	ENGWESA004	05/28/15 09:30	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.60E+00	7.47E-01	7.56E-01	4.80E-01	8.29E-02	pCi/s
15-08106-08	TRG	ENGWESA005	05/27/15 15:08	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.85E+00	5.86E-01	6.01E-01	2.30E-01	3.05E-02	pCi/s
15-08106-09	TRG	ENGWESA006	05/27/15 16:50	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.08E+00	4.29E-01	4.36E-01	2.07E-01	2.28E-02	pCi/s
15-08106-10	TRG	ENGWESA007	05/27/15 12:00	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.72E+00	5.60E-01	5.73E-01	2.52E-01	4.35E-02	pCi/s
15-08106-11	TRG	ENGWESA008	05/27/15 15:38	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.96E+00	6.16E-01	6.32E-01	1.78E-01	1.01E-02	pCi/s
15-08106-12	TRG	ENGWESA009	05/28/15 10:42	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	8.89E-01	3.58E-01	3.64E-01	1.44E-01	8.21E-03	pCi/s
15-08106-13	TRG	ENGWESA010	05/28/15 11:06	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.68E+00	5.37E-01	5.50E-01	2.27E-01	3.49E-02	pCi/s
15-08106-14	TRG	ENGWESA011	05/27/15 09:10	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.07E+00	4.09E-01	4.16E-01	1.54E-01	8.77E-03	pCi/s
15-08106-15	TRG	ENGWESA012	05/27/15 10:36	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	1.14E+00	4.55E-01	4.62E-01	1.77E-01	1.01E-02	pCi/s
15-08106-16	TRG	ENGWESA013	05/27/15 11:17	8/25/2015	9/8/2015	15-08106	Uranium-238	EML U-02 Modified	8.02E-01	5.39E-01	5.42E-01	4.44E-01	4.91E-02	pCi/s

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original; CV=Critical Value

EBERLINE SERVICES

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

SECTION V

ANALYTICAL STANDARD

QA/QC REVIEWED
Date 1/16/95 Initials [illegible]

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

U-8

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 ALLAS
QUALITY CONTROL

29 DECEMBER 1994
Date Signed

ISOTOPE PRODUCTS LABORATORIES
3017 N. SAN FERNANDO BLVD.
BURBANK, CALIFORNIA 91504
818·843·7000 FAX 818·843·6168

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: 9/2/2014 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: July 30, 2015

Verified & Approved By _____ Date: 9/2/2014 0:00

QC Approval _____ Date: 9/3/14

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

Solution Reference # MP-009 IPL 479-50

Date 9/2/2014 0:00
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

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:

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: July 30, 2015

Verified & Approved By _____ Date: 9/2/2014 0:00

QC Approval _____ Date: 9/3/14

RECORD COPY

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

Roger Wiltshire

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

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: 11/11/2014 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: November 4, 2015

Verified & Approved By _____ Date: 11/11/2014 0:00

QC Approval _____ Date: 11/3/14

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 # AEA/Amersham 92/232/67
Date 11/11/2014 0:00
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: November 4, 2015

Verified & Approved By _____ Date: 11/11/2014 0:00

QC Approval _____ Date: 11/13/14

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

ISOTOPE PRODUCTS LABORATORIES
1800 North Keystone Street
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(818) 843 - 7000

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: 9/2/2014 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 H2O

Dilution Instructions: Dilution Solvent Used: 1% Nitric Acid

Dilute to a volume of 1000.00 milliliters

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: August 28, 2015

Verified & Approved By _____ Date: 9/2/2014 0:00

QC Approval _____ Date: 9/3/14

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 STANDARD SOLUTIONS
SECONDARY DILUTION RECERTIFICATION

MP-009
Solution Reference # IPL 435-104-2

Date 9/2/2014 0:00
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: August 28, 2015

Verified & Approved By _____ Date: 9/2/2014 0:00

QC Approval _____ Date: 9/3/14

QA/QC REVIEWED
Date 10/14/91 Initials WT
WT 10/14/91

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Received
OCT 14 1991
TMA/Eberline
Oak Ridge Lab

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

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone Street.,
Burbank, California 91504
(818) 843 - 7000

EBERLINE SERVICES

QUALITY CONTROL PROGRAM

MP-009

Rev.14; 10/10/2012
Title: Radioactive Reference Standards Solutions & Records

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

CURRENT DATE: 4/15/2015 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: February 12, 2016

Recertified By _____ Date: 4/15/2015 0:00

QC Approval _____ Date: 4/15/15

EBERLINE SERVICES

QUALITY CONTROL PROGRAM
MP-009

Rev.14; 10/10/2012
Title: Radioactive Reference Standards Solutions & Records

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

Solution Reference # MP-009 IPL 388-116 **Date** 4/15/2015 0:00 **Solution #** Th-1b

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

Radionuclide of Interest ^{230}Thorium **Reference Date** 11/1/1991 0:00
Parent Solution Conc. 2.30E+03 **dpm/ml**

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: February 12, 2016

Recertified By _____ Date: 4/15/2015 0:00

QC Approval _____ Date: 4/15/15

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: 9/2/2014 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: August 28, 2015

Verified & Approved By _____ Date: 9/2/2014 0:00

QC Approval _____ Date: 9/3/14

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

Solution Reference # IPL 867-54

Date 9/2/2014 0:00

Solution # Th-18a

Principal Radionuclide	Half Life, Years	Half Life, Days
^{228}Th	7.340E+03	2.681E+06

Radionuclide of Interest ^{228}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: August 28, 2015

Verified & Approved By _____ Date: 9/2/2014 0:00

QC Approval _____ Date: 9/3/14

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404·352·8677
Fax 404·352·2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

GAF-14
LPGAF-14

98505

47 mm Diameter Simulated Filter in Falcon Petri

Customer: Eberline Analytical Corporation
P.O. No.: OR-1405030, Item 8 Product Code: 8401-GF-FP
Reference Date: 01-Oct-2014 12:00 PM EST **Grams of Master Source:** 0.0016721

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Additional radionuclides were added gravimetrically from solutions calibrated by gamma-ray spectrometry, ionization chamber, or liquid scintillation counting. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 2, July 2007, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* γps/gram	This Source γps	Uncertainty*, % Type u_A	u_B	U	Calibration Method*
Am-241	59.5	1.580E+05	———	1.942E+02	0.1	1.8	3.6	4π LS
Cd-109	88.0	4.614E+02	1.663E+05	2.781E+02	0.5	2.0	4.1	HPGe
Co-57	122.1	2.717E+02	8.913E+04	1.490E+02	0.4	1.7	3.5	HPGe
Ce-139	165.9	1.376E+02	1.241E+05	2.075E+02	0.4	1.7	3.5	HPGe
Hg-203	279.2	4.659E+01	2.675E+05	4.473E+02	0.3	1.7	3.5	HPGe
Sn-113	391.7	1.151E+02	1.796E+05	3.004E+02	0.4	1.9	3.9	HPGe
Cs-137	661.7	1.099E+04	1.111E+05	1.857E+02	0.7	1.9	4.0	HPGe
Y-88	898.0	1.066E+02	4.223E+05	7.061E+02	0.7	1.7	3.7	HPGe
Co-60	1173.2	1.925E+03	2.091E+05	3.497E+02	0.7	1.8	3.9	HPGe
Co-60	1332.5	1.925E+03	2.094E+05	3.502E+02	0.7	1.8	3.9	HPGe
Y-88	1836.1	1.066E+02	4.471E+05	7.475E+02	0.7	1.7	3.7	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

(Certificate continued on reverse side)

ANA Form005 Rev. —

ACCREDITED SOURCE CALIBRATION LABORATORY HEALTH PHYSICS SOCIETY FOUNDED 1958

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

00040

SECTION VI

QUALITY CONTROL SAMPLE RESULTS SUMMARY

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-08106	UUISO	1	pCi	s	Auxier & Associates, Inc.

Laboratory Control Sample

Analyte		LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
U-234		88.06%	16.32%	100.00%	3.60%	8.05E+00	2.90E-01	7.09E+00	1.16E+00	U-8a	3.52E+01	3.60E+00	5.07E-01
U-238		101.54%	16.04%	100.00%	3.60%	7.85E+00	2.82E-01	7.97E+00	1.28E+00	U-8a	3.44E+01	3.60E+00	5.07E-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	1.55	47.48	1.57E+00	7.10E-01	2.54E+00	1.01E+00
U-238	1.69	55.26	2.22E+00	8.69E-01	1.26E+00	7.02E-01
U-235	0.09	7.75	3.17E-01	3.62E-01	2.93E-01	3.80E-01

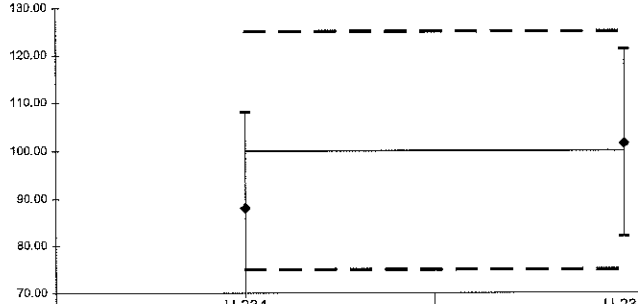
QC Summary

LCS Relative Bias	LCS % R		MS % R	MS ND	Rep RPD	Rep ND
0.88	OK				NA	OK
1.02	OK				NA	OK
	OK				NA	OK

Version

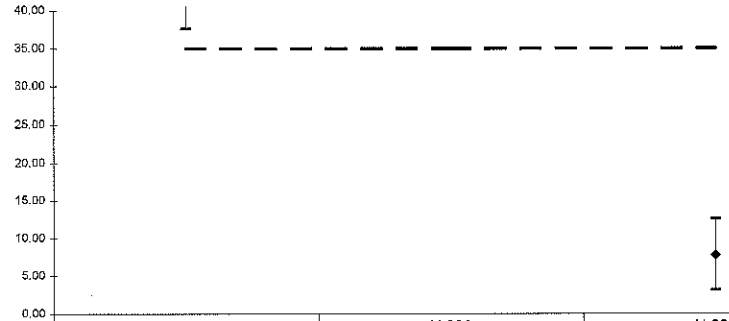
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-08106	UUISO	1	pCi	s	Auxier & Associates, Inc.

LCS % Recovery



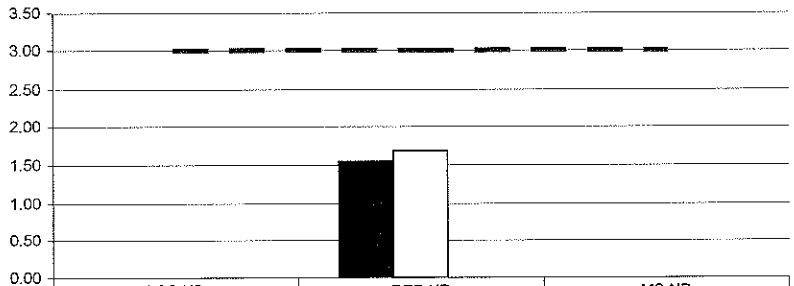
	U-234	U-238
Lower Error	68.14	81.90
Upper Error	107.98	121.17
%R	88.06	101.54
LCL	75	75
Mean	100	100
UCL	125	125

Replicate Sample RPD



	U-234	U-238	U-235
Lower Error	57.42	67.74	12.46
Upper Error	37.53	42.78	3.03
RPD	47.48	55.26	7.75
CL	35	35	35

Normalized Difference



	LCS ND	REP ND	MS ND
U-234	0.00	1.55	0.00
U-238	0.00	1.69	0.00
	0.00	0.00	0.00
UCL	3	3	3

No Matrix Spike

Version

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-08106	ThISO	1	pCi	s	Auxier & Associates, Inc.

Laboratory Control Sample

Analyte		LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
TH-228		114.72%	19.04%	100.00%	3.60%	4.79E+00	1.72E-01	5.50E+00	1.05E+00	Th-8b	1.04E+02	3.60E+00	1.03E-01
TH-230		119.75%	20.28%	100.00%	2.70%	5.33E+00	1.44E-01	6.39E+00	1.29E+00	Th-1b	2.35E+01	2.70E+00	5.03E-01
TH-232		113.50%	18.77%	100.00%	3.60%	4.79E+00	1.72E-01	5.44E+00	1.02E+00	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

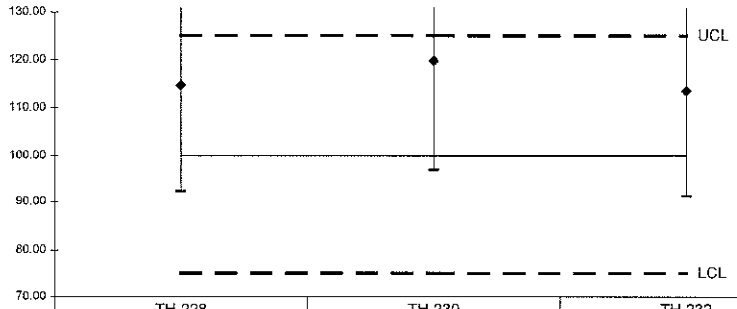
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU
TH-228	0.34	19.99	5.26E-01	4.31E-01	6.43E-01	5.19E-01
TH-230	0.60	24.33	1.19E+00	5.94E-01	9.30E-01	6.03E-01
TH-232	0.47	29.86	5.08E-01	3.85E-01	3.76E-01	3.93E-01

QC Summary

LCS Relative Bias	LCS % R		MS % R	MS ND	Rep RPD	Rep ND
1.15	OK				OK	OK
1.20	OK				OK	OK
1.14	OK				NA	OK

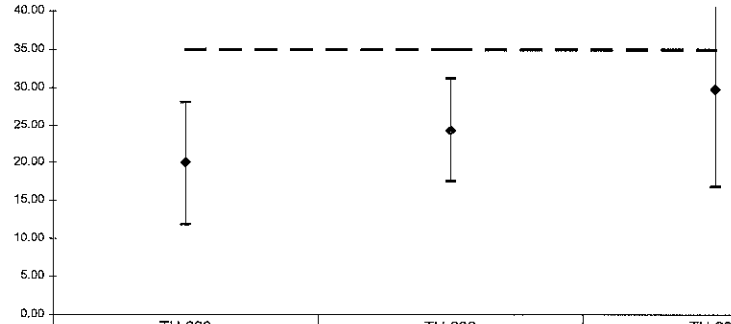
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-08106	ThISO	1	pCi	s	Auxier & Associates, Inc.

LCS % Recovery



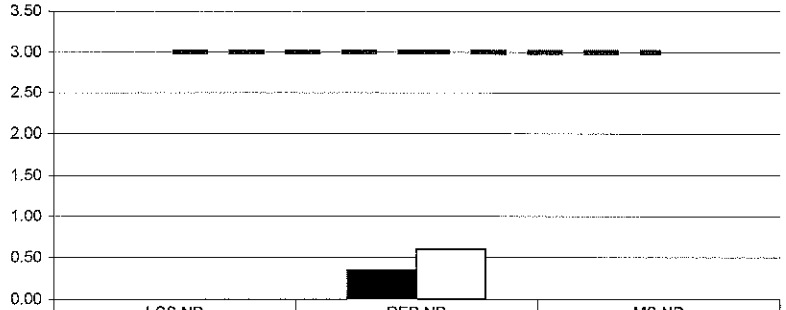
	TH-228	TH-230	TH-232
Lower Error	92.08	96.77	91.13
Upper Error	137.36	142.72	135.87
%R	114.72	119.75	113.50
LCL	75	75	75
Mean	100	100	100
UCL	125	125	125

Replicate Sample RPD



	TH-228	TH-230	TH-232
Lower Error	28.11	31.20	42.98
Upper Error	11.87	17.46	16.73
RPD	19.99	24.33	29.86
CL	35	35	35

Normalized Difference



	LCS ND	REP ND	MS ND
TH-228	0.00	0.34	0.00
TH-230	0.00	0.60	0.00
UCL	3	3	3

No Matrix Spike

Version

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-08106	Gamma	1	pCi	s	Auxier & Associates, Inc.

Laboratory Control Sample

Analyte		LCS Measured	CSU Measured	LCS Expected	Uncert. Expected	Known	Known Error	Result	CSU	Standard ID	Standard ACT (dpm)	Standard Error	Standard Added (g)
CO-60		97.04%	10.92%	100.00%	4.00%	9.82E+03	3.93E+02	9.53E+03	1.04E+03	GAF-13	9.82E+03	3.93E+02	1.00E+00
CS-137		102.31%	17.74%	100.00%	4.00%	6.23E+03	2.49E+02	6.38E+03	1.13E+03	GAF-13	6.23E+03	2.49E+02	1.00E+00

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

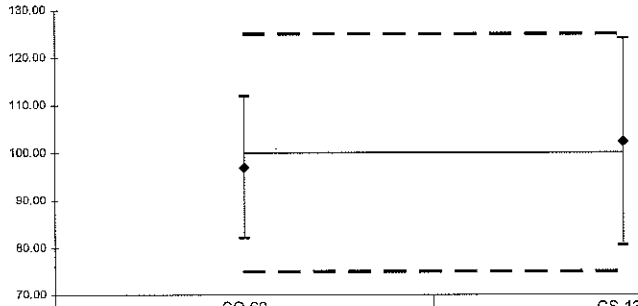
Analyte	*Normalized Difference*	*RPD*	*Original Result*	*Original CSU*	*Replicate Result*	*Replicate CSU*
BE-7	1.20	10.62	2.54E+03	3.10E+02	2.82E+03	3.47E+02
K-40	0.10	5.19	3.94E+01	2.37E+01	4.15E+01	3.59E+01
PB-210	0.17	2.08	3.78E+02	5.98E+01	3.70E+02	6.42E+01

QC Summary

LCS Relative Bias	*LCS % R*		*MS % R*	*MS ND*	*Rep RPD*	*Rep ND*
0.97	OK		<CS-137	BE-7>	NA	
1.02	OK		<CO-60	K-40>	NA	OK
				PB-210>	NA	OK

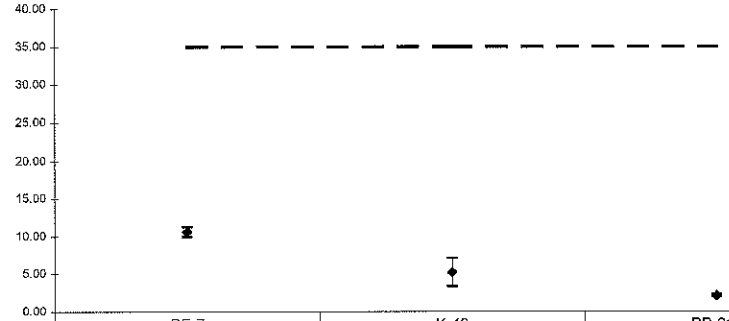
WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-08106	Gamma	1	pCi	s	Auxier & Associates, Inc.

LCS % Recovery



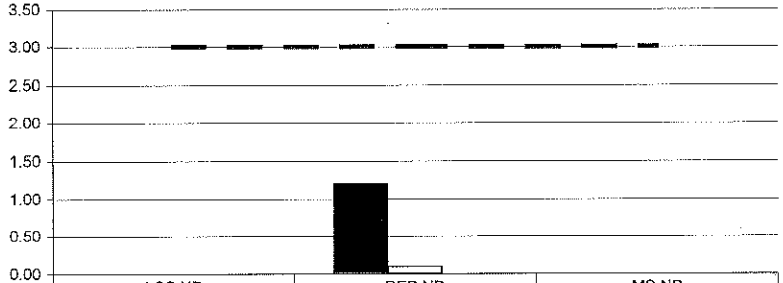
	CO-60	CS-137
Lower Error	82.12	80.58
Upper Error	111.95	124.05
%R	97.04	102.31
LCL	75	75
Mean	100	100
UCL	125	125

Replicate Sample RPD



	BE-7	K-40	PB-210
Lower Error	11.27	7.10	2.25
Upper Error	9.97	3.27	1.91
RPD	10.62	5.19	2.08
CL	35	35	35

Normalized Difference



	LCS ND	REP ND	MS ND
CO-60	0.00	1.20	0.00
CS-137	0.00	0.10	0.00
	0.00	0.00	0.00
UCL	3	3	3

No Matrix Spike

Version

SECTION VII

LABORATORY TECHNICIAN'S NOTES & RUN LOGS

ISO U NOTES

: 00049

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	15-08106
		Analysis Code	UUISO
		Run Number	1

#	Date	Dept	User	Notes
1	09/03/15 07:22	PREP	JWOLFE	DISSOLVED SAMPLES WITH HF AND DRIED SAMPLES DOWN- DIGESTED WITH MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- REDISSOLVED SAMPLES WITH HNO3 AND WATER AND CENTRIFUGED- DILUTED- ALIQUOTED FROM DILUTIONS AND ADDED SPIKES AND TRACERS- DRIED SAMPLES DOWN AND SUBMITTED SAMPLES TO SEPARATIONS

JWolfe
9/3/15

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	15-08106
Analysis Code	UUISO
Run Number	1

#	Date	Dept	User	Notes
1	09/03/15 07:22	PREP	JWOLFE	DISSOLVED SAMPLES WITH HF AND DRIED SAMPLES DOWN- DIGESTED WITH MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- REDISSOLVED SAMPLES WITH HNO3 AND WATER AND CENTRIFUGED- DILUTED- ALIQUOTED FROM DILUTIONS AND ADDED SPIKES AND TRACERS- DRIED SAMPLES DOWN AND SUBMITTED SAMPLES TO SEPARATIONS
2	09/04/15 16:35	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.

9/4/15

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	15-08106
Analysis Code	UUISO
Run Number	1

#	Date	Dept	User	Notes
1	09/03/15 07:22	PREP	JWOLFE	DISSOLVED SAMPLES WITH HF AND DRIED SAMPLES DOWN- DIGESTED WITH MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- REDISSOLVED SAMPLES WITH HNO3 AND WATER AND CENTRIFUGED- DILUTED- ALIQUOTED FROM DILUTIONS AND ADDED SPIKES AND TRACERS- DRIED SAMPLES DOWN AND SUBMITTED SAMPLES TO SEPARATIONS
2	09/04/15 16:35	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	09/08/15 05:00	CHEM	TSMITH	Followed steps 12.1.7 to 12.4.5 in AP-005 . (Precipitated and filtered samples for Uranium)

9-8-15
JMW

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
15-08106	
Analysis Code	Run
UUISO	1

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
016253P	Hydrofluoric Acid	Reagent Grade	JWOLFE	9/3/2015
016519P	Nitric Acid	Reagent Grade	JWOLFE	9/3/2015
016158P	Perchloric Acid	Reagent Grade	JWOLFE	9/3/2015
015490P	Sulfuric Acid	Reagent Grade	JWOLFE	9/3/2015
016740P	Anion Exchange Resin	Reagent Grade	JDEMELAS	9/4/2015
016757S	HCl - HF	6.5N - 0.04N	JDEMELAS	9/4/2015
016232D12	Hydrochloric Acid	0.5N	JDEMELAS	9/4/2015
016710S	Hydrochloric Acid	6.5N	JDEMELAS	9/4/2015
016128P	Hydrochloric Acid	Reagent Grade	JDEMELAS	9/4/2015
016790S	Hydrochloric Acid	8N	JDEMELAS	9/4/2015
016802S	HCl - NH4I	8N - 0.1M	JDEMELAS	9/4/2015
016569P	Hydrofluoric Acid	Reagent Grade	TSMITH	9/8/2015
016583S	Neodymium Carrier	1 mg/ml	TSMITH	9/8/2015
016514P	Reagent Alcohol	Reagent Grade	TSMITH	9/8/2015
016606P	Titanous Chloride	Reagent Grade	TSMITH	9/8/2015
016775S	Carbon substrate	Solution	TSMITH	9/8/2015

Alpha #3

Date	Sample #	Client	Time Rec'd	C/T Time	Analyzed	Tech
9/3	1508087A(4)	UCOR	0841	24hr	Am243	—
9/3	1508104A(1-4)	UCOR	0842	24hr	U238	—
9/3	1508104A(1-4)	UCOR	0842	24hr	U234	C
9/3	1508087A(1-4)	UCOR	0842	24hr	Pu242	C
9/3	1508104A(1-4)	UCOR	0843	24hr	Pu242	C
9/3	1508087A(1-4)	UCOR	0844	24hr	Th229	C
9/3	1508104A(1-4)	UCOR	0844	24hr	Th229	C
9/3	1508087A(1-4)	UCOR	0845	24hr	Np237	C
9/3	1508104A(1,2)	UCOR	0845	24hr	Np237	C
9/3/15	1508104A(3-4)	UCOR	1142	2hr 50=	Np	KB
9/3/15	1508087A(1-2)	UCOR	1200	2hr 50=	Pu242	KB
9/3/15	1508075A(1-11)	Accutest	1558	2hr 50=	Rad	KB
9/4	Reinsplitter	LAB	0508	1hr	NA	—
9/4	SBCA(C7-4B)	LAB	0524	24hr	NA	C
9/4	SBCA(45-60)	LAB	0800	24hr	NA	C
9/4	1508104A(3,4)	UCOR	0872	24hr	Am241	C
9/4	1508104A(1-4)	UCOR	0873	24hr	Am243	—
9/4	1508104A(1-4,16)	UCOR	0874	24hr	Pu238	—
9/4	1508104A(1-4)	UCOR	0874	24hr	Th230	—
9/4	1508105A(1)	Auxier	0875	24hr	U238	—
9/4/15	1508105A(2-13)	Auxier	1034	2hr 50=	U	KB
9/4/15	1508105A(14-16)	Auxier	1129	2hr 50=	U	KB
9/4/15	1508105A(1-13)	Auxier	1130	2hr 50=	Iso-Th	KB
9/4/15	1508105A(14-16)	Auxier	1328	2hr 50=	Iso-Th	KB
9/4	1508104A(1-4)	UCOR	1328	24hr	Rad	C
9/4/15	System Blkgd	Lab	1628	16.40 hrs	α	KB
9/2	Reinsplitter	LAB	0518	10hr	NA	C
9/8/15	1508115A(1-5)	STOFFER	0533	24hr	Rad	—
9/2	1508204A(4)	USA	0803	24hr	U238	—
9/2	1508106A(1-16)	Auxier	0805	24hr	U238	—
9/2	1508106A(1-5)	Auxier	0806	24hr	Th230	—

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	15-08106
		Analysis Code	ThISO
		Run Number	1

#	Date	Dept	User	Notes
1	09/03/15 07:22	PREP	JWOLFE	DISSOLVED SAMPLES WITH HF AND DRIED SAMPLES DOWN- DIGESTED WITH MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- REDISSOLVED SAMPLES WITH HNO3 AND WATER AND CENTRIFUGED- DILUTED- ALIQUOTED FROM DILUTIONS AND ADDED SPIKES AND TRACERS- DRIED SAMPLES DOWN AND SUBMITTED SAMPLES TO SEPARATIONS

JWolfe
9/3/15

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	15-08106
		Analysis Code	ThISO
		Run Number	1

#	Date	Dept	User	Notes
1	09/03/15 07:22	PREP	JWOLFE	DISSOLVED SAMPLES WITH HF AND DRIED SAMPLES DOWN- DIGESTED WITH MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- REDISSOLVED SAMPLES WITH HNO3 AND WATER AND CENTRIFUGED- DILUTED- ALIQUOTED FROM DILUTIONS AND ADDED SPIKES AND TRACERS- DRIED SAMPLES DOWN AND SUBMITTED SAMPLES TO SEPARATIONS
2	09/04/15 16:35	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.

9/4/15

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	15-08106
Analysis Code	ThISO
Run Number	1

#	Date	Dept	User	Notes
1	09/03/15 07:22	PREP	JWOLFE	DISSOLVED SAMPLES WITH HF AND DRIED SAMPLES DOWN- DIGESTED WITH MIXED ACIDS AND TOOK SAMPLES TO DRYNESS- REDISSOLVED SAMPLES WITH HNO3 AND WATER AND CENTRIFUGED- DILUTED- ALIQUOTED FROM DILUTIONS AND ADDED SPIKES AND TRACERS- DRIED SAMPLES DOWN AND SUBMITTED SAMPLES TO SEPARATIONS
2	09/04/15 16:35	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	09/08/15 05:01	CHEM	TSMITH	Followed steps 12.2.4 to 12.4.5 in AP-005 . (Preicpitated and filtered samples for Thorium)

9-8-15
JM

EBERLINE SERVICES

Reagents Used in an Analysis

Internal Work Order	
15-08106	
Analysis Code	Run
ThISO	1

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
016253P	Hydrofluoric Acid	Reagent Grade	JWOLFE	9/3/2015
016519P	Nitric Acid	Reagent Grade	JWOLFE	9/3/2015
016158P	Perchloric Acid	Reagent Grade	JWOLFE	9/3/2015
015490P	Sulfuric Acid	Reagent Grade	JWOLFE	9/3/2015
016740P	Anion Exchange Resin	Reagent Grade	JDEMELAS	9/4/2015
016790S	Hydrochloric Acid	8N	JDEMELAS	9/4/2015
016128P	Hydrochloric Acid	Reagent Grade	JDEMELAS	9/4/2015
016519P	Nitric Acid	Reagent Grade	JDEMELAS	9/4/2015
016791S	Nitric Acid	8N	JDEMELAS	9/4/2015
016557S	Cerrium Carrier	0.1mg/ml	TSMITH	9/8/2015
016569P	Hydrofluoric Acid	Reagent Grade	TSMITH	9/8/2015
016514P	Reagent Alcohol	Reagent Grade	TSMITH	9/8/2015
016775S	Carbon substrate	Solution	TSMITH	9/8/2015

Alpha #3

Date	Sample #	Client	Time Rec'd	CT Time	Analyst	Tech
9/3	1508087A(4)	UCOR	0841	24hr	Am243	—
9/3	1508104A(1-4)	UCOR	0842	24hr	U238	—
9/3	1508104A(1-4)	UCOR	0842	24hr	U238	C
9/3	1508087A(1-4)	UCOR	0842	24hr	Pu242	C
9/3	1508104A(1-4)	UCOR	0843	24hr	Pu242	C
9/3	1508087A(1-4)	UCOR	0844	24hr	Th229	C
9/3	1508104A(1-4)	UCOR	0844	24hr	Th229	C
9/3	1508087A(1-4)	UCOR	0845	24hr	Np237	C
9/3	1508104A(1,2)	UCOR	0845	24hr	Np237	C
9/3/15	1508104A(3-4)	UCOR	1142	2hr 50=	Np	KB
9/3/15	1508087A(1-2)	UCOR	1200	2hr 50=	Pu242	KB
9/3/15	1508075A(1-11)	Accutest	1558	2hr 50=	Pu-Le	KB
9/4	Reinsplate	LAB	0808	1hr	NA	—
9/4	SBCA(C3-4B)	LAB	0824	24hr	NA	C
9/4	SBCA(C5-6)	LAB	0800	24hr	NA	C
9/4	1508104A(3,4)	UCOR	0872	24hr	Am241	—
9/4	1508104A(1-4)	UCOR	0873	24hr	Am243	—
9/4	1508104A(1-4,16)	UCOR	0874	24hr	Pu-Iso	—
9/4	1508104A(1-4)	UCOR	0874	24hr	Th-Iso	—
9/4	1508105A(1)	Auxier	0875	24hr	U-Iso	—
9/4/15	1508105A(2-13)	Auxier	1034	2hr 50=	UU	KB
9/4/15	1508105A(14-16)	Auxier	1129	2hr 50=	UU	KB
9/4/15	1508105A(1-13)	Auxier	1130	2hr 50=	Iso-Th	KB
9/4/15	1508105A(14-16)	Auxier	1328	2hr 50=	Iso-Th	KB
9/4	1508104A(1-4)	UCOR	1328	24hr	Rac	C
9/4/15	System Rkgd	Lab	1628	16.40 hrs	—	KB
9/2	Reinsplate	LAB	0818	10hr	NA	C
9/8/15	1508115A(1-5)	STOFAB	0833	24hr	Rac	—
9/2	1509020A(4)	USA	0803	24hr	U-Iso	—
9/2	1508106A(1-16)	Auxier	0805	24hr	U-Iso	—
9/2	1508106A(1-5)	Auxier	0806	24hr	Th-Iso	—
9/2	1508106A(6-11)	Auxier	0825	24hr	Th-Iso	—

Alpha #3

Date	Sample	Client	Time	CT Time	Analyst	Stat
9/3	1508087A(4)	UCOR	0841	2hr	Am243	—
9/3	1508104A(4-4)	UCOR	0842	2hr	U238	—
9/3	1508104A(1-4)	UCOR	0842	2hr	U234	C
9/3	1508087A(1-4)	UCOR	0842	2hr	Pu242	C
9/3	1508104A(1-4)	UCOR	0843	2hr	Pu242	C
9/3	1508087A(1-4)	UCOR	0844	2hr	Th229	C
9/3	1508104A(1-4)	UCOR	0844	2hr	Th229	C
9/3	1508087A(1-4)	UCOR	0845	2hr	NP237	C
9/3	1508104A(1,12)	UCOR	0845	2hr	NP237	C
9/3/15	1508104A(3-4)	UCOR	1142	2hr 50	Np	KB
9/3/15	1508087A (1-2)	UCOR	1200	2hr 50	Pu242	KB
9/3/15	1508076A(1-11)	Accutest	1558	2hr 50	Rad	KB
9/4	Reinjection	LAS	0508	1	NA	—
9/4	SBCCA(1-4B)	LAS	0524	2hr	NA	C
9/4	SBCCA(1-6)	LAS	0800	2hr	NA	C
9/4	1508104A(3,4)	UCOR	0872	2hr	Am241	—
9/4	1508104A(1-4)	UCOR	0873	2hr	Am243	—
9/4	1508104A(1-4,16)	UCOR	0874	2hr	Pu250	—
9/4	1508104A(1-4)	UCOR	0874	2hr	Th250	—
9/4	1508105A(1)	Auxier	0875	2hr	U250	—
9/4/15	1508105A(2-13)	Auxier	1034	2hr 50	UU	KB
9/4/15	1508105A(14-16)	Auxier	1129	2hr 50	UU	KB
9/4/15	1508105A(1-13)	Auxier	1130	2hr 50	Iso-Th	KB
9/4/15	1508105A(14-16)	Auxier	1328	2hr 50	Iso-Th	KB
9/4	1508104A(1-4)	UCOR	1328	2hr	Rad	C
9/4/15	System Flushed	Lab	1628	16.40 hrs	—	KB
9/8	Reinjection	LAS	0578	10	NA	C
9/8/15	1508115A(1-5)	STORAD	0577	2hr	Rad	—
9/8	1508106A(4)	USA	0803	2hr	U238	—
9/8	1508106A(1-16)	Auxier	0805	2hr	U250	C
9/8	1508106A(1-5)	Auxier	0806	2hr	Th250	—
9/8	1508106A(6-11)	Auxier	0825	2hr	Th250	—
9/8/15	1509106A(12-16)	Auxier	1118	2hr 50	Iso-Th	KB
9/8/15	1509019A(1-4)	USA	1119	2hr 50	Rad	KB

GAMMA NOTES

GE 4

DATE	Sample #	Client	Load Time	CT Time	Analysis	Tech
8/27	1508012-06	CT. Dept.	0604	2h	✓	[illegible]
8/27	1508012-10	CT Dept.	0806	2h	✓	[illegible]
8/27	1508012-14	CT. Dept.	1007	2h	✓	[illegible]
8/27	1508012-15	CT. Dept.	1209	2h	✓	[illegible]
8/27/15	1508068-05	MPA	1410	15 mins	Ba	KB
8/27/15	1508098-01	UCOR	1426	15 mins	Ba	KB
8/27/15	1508098-07	UCOR	1441	15 mins	Ba	KB
8/27/15	1508067-02	MPA	1502	15 mins	Ba	KB
8/27/15	1508067-04	MPA	1518	15 mins	Ba	KB
8/27/15	1508067-06	MPA	1534	15 mins	Ba	KB
8/27/15	1508067-08	MPA	1550	15 mins	Ba	KB
8/27/15	1508052-01	UCOR	1605	15 mins	Ba	KB
8/27/15	1508052-05	UCOR	1621	15 mins	Ba	KB
8/27/15	1508052-07	UCOR	1638	15 mins	Ba	KB
8/27/15	1508052-16	UCOR	1653	15 min	Ba	KB
8/27/15	1508052-13	UCOR	1709	15 —	Ba	KB
8/27/15	1508052-08	UCOR	1724	15 min	Ba	KB
8/27/15	1508072-04	UCOR	1740	15 mins	Ba	KB
8/27/15	1508105-02	Auxin	1807	4 hrs	✓	KB
8/28	[illegible]	LMS	0571	15	✓	[illegible]
8/28	[illegible]	LMS	0572	15	✓	[illegible]
8/28	1508105-08	Auxier	0610	4h	✓	[illegible]
8/28	1508112-03	CB	1012	2h	✓	c
8/28	1508112-04	CB	1113	2h	✓	c
8/28	1508112-02	CB	1215	2h	✓	c
8/28	1508112-01	CB	1314	3h	✓	c
8/28/15	1508117-03	UCOR	1347	2hr	✓	KB
8/28/15	1508117-04	UCOR	1549	2hr	✓	KB
8/28/15	1508106-02	Auxin	1751	4 hrs	✓	KB

DATE	Sample #	Client	Load Time	Ct. Time	Analysis	Tech
8/27	1508012-04	CT. Dept.	0604	2L	✓	C
8/27	1508012-10	CT Dept.	0806	2L	✓	C
8/27	1508012-14	CT. Dept.	1007	2L	✓	C
8/27	1508012-15	CT. Dept.	1209	2L	✓	C
8/27/15	1508068-05	MPA	1410	15 mins	Ba	KB
8/27/15	1508098-01	UCON	1426	15 mins	Ba	KB
8/27/15	1508098-07	UCON	1441	15 mins	Ba	KB
8/27/15	1508067-02	MPA	1502	15 mins	Ba	KB
8/27/15	1508067-04	MPA	1518	15 mins	Ba	KB
8/27/15	1508067-06	MPA	1534	15 mins	Ba	KB
8/27/15	1508067-08	MPA	1550	15 mins	Ba	KB
8/27/15	1508052-01	UCON	1605	15 mins	Ba	KB
8/27/15	1508052-05	UCON	1621	15 mins	Ba	KB
8/27/15	1508052-07	UCON	1638	15 mins	Ba	KB
8/27/15	1508052-16	UCON	1653	15 min	Ba	KB
8/27/15	1508052-13	UCON	1709	15	Ba	KB
8/27/15	1508052-08	UCON	1724	15 min	Ba	KB
8/27/15	1508072-04	UCON	1740	15 mins	Ba	KB
8/27/15	1508105-02	Auxin	1807	4 hrs	✓	KB
8/28	GE-4	LAB	0571	15	✓	C
8/28	Dup	LAB	0572	15	✓	C
8/28	1508105-08	Auxin	0610	4L	✓	C
8/28	1508112-03	CB	1012	2L	✓	C
8/28	1508112-04	CB	1113	2L	✓	C
8/28	1508112-02	CB	1215	2L	✓	C
8/28	1508112-01	CB	1314	2L	✓	C
8/28/15	1508117-03	UCON	1347	2 hrs	✓	KB
8/28/15	1508117-04	UCON	1549	2 hrs	✓	KB
8/28/15	1508106-02	Auxin	1751	4 hrs	✓	KB
8/29/15	System BKgd	Lab	0710	24 hrs	✓	KB
8/31	GE-4	LAB	0528	15	✓	C
8/31	Dup	LAB	0555	15	✓	C

GE4

DATE	Sample #	Client	Load Time	CT. Time	Analysis	Tech
8/31	1508106-07	Auxier	0616	4hr	✓	✓
8/31/15	1508120-002	MJW	1203	1hr	✓	KB
8/31/15	1508120-01	MJW	1204	30mins	✓	KB
8/31/15	1508106-09	Auxier	1336	4 hr	✓	KB
8/31/15	1508106-13	Auxier	1738	4 hr	✓	KB

GE 4

DATE	Sample #	Client	Load Time	CT Time	Analysis	Tech
8/27	1508012-06	CT. Dept.	0604	2L	✓	C
8/27	1508012-10	CT Dept.	0806	2L	✓	C
8/27	1508012-14	CT. Dept.	1007	2L	✓	—
8/27	1508012-15	CT. Dept.	1209	2L	✓	—
8/27/15	1508068-05	MPA	1410	15 mins	Ba	KB
8/27/15	1508098-01	UCON	1426	15 mins	Ba	KB
8/27/15	1508098-07	UCON	1441	15 mins	Ba	KB
8/27/15	1508067-02	MPA	1502	15 mins	Ba	KB
8/27/15	1508067-04	MPA	1518	15 mins	Ba	KB
8/27/15	1508067-06	MPA	1534	15 mins	Ba	KB
8/27/15	1508067-08	MPA	1550	15 mins	Ba	KB
8/27/15	1508052-01	UCON	1605	15 mins	Ba	KB
8/27/15	1508052-05	UCON	1621	15 mins	Ba	KB
8/27/15	1508052-07	UCON	1638	15 mins	Ba	KB
8/27/15	1508052-16	UCON	1653	15 min.	Ba	KB
8/27/15	1508052-13	UCON	1709	15 —	Ba	KB
8/27/15	1508052-08	UCON	1724	15 min	Ba	KB
8/27/15	1508072-04	UCON	1740	15 mins	Ba	KB
8/27/15	1508105-02	Auxin	1807	4 hrs	✓	KB
8/28	Gas 14	LB	0721	15	✓	C
8/28	Daily Pr	LB	0555	15	✓	C
8/28	1508105-09	Auxin	0610	4L	✓	—
8/28	1508112-03	CB	1012	7L	✓	C
8/28	1508112-04	CB	1113	7L	✓	C
8/28	1508112-02	CB	1215	7L	✓	C
8/28	1508112-01	CB	1314	7L	✓	C
8/28/15	1508117-03	UCON	1347	2hr	✓	KB
8/28/15	1508117-04	UCON	1549	2hr	✓	KB
8/28/15	1508106-02	Auxin	1751	4 hrs	✓	KB
8/29/15	System Bkgd	Lab	0710	24 hrs	✓	KB
8/31	Gas-4	LB	0528	15	✓	
8/31	Daily	LB	0555	15	✓	C

GE 2

DATE	Sample #	Client	Load Time	CT Time	Analysis	Tech
8/27/15	1508068-03	MPA	1410	15mins	Da	KB
8/27/15	1508104-02	UCOR	1427	4hrs	r	KB
8/27/15	1508105-05	Auxier	1828	4hrs	r	KB
8/28	CTS 1401	LAB	0571	1r	r	[illegible]
8/28	Daily B	LAB	0577	1r	r	[illegible]
8/28	1508105-07	Auxier	0610	4L	r	—
8/28	1508105-11	Auxier	1012	4L	r	—
8/28/15	1508105-14	Auxier	1412	4hrs	r	KB
8/28/15	1508105-16	Auxier	1813	4hrs	r	KB
8/29/15	System Blksd	Lab	0710	24 hrs	r	KB
8/31	CTS 1401	LAB	0528	1r	r	[illegible]
8/31	Daily B	LAB	0577	1r	r	[illegible]
8/31	1508106-06	Auxier	0616	4L	r	—
8/31/15	1508120-03	MJW	1203	1hr	r	KB
8/31/15	1508120-04	MJW	1203	1hr	r	KB
8/31/15	1508106-10	Auxier	1407	4hrs	r	KB
8/31/15	1508106-14	Auxier	1809	4hrs	r	KB

GE 3

DATE	SAMPLE #	Client	Load Time	CT Time	Analysis	Tech
8/28/15	1508117-01	UCOR	1431	15 mins	γ	KB
8/28/15	1508117-02	UCOR	1505	2 hr	γ	KB
8/28/15	1508060-01	Accutest	1706	15 mins	Ba	KB
8/28/15	1508060-02	Accutest	1721	15 mins	Ba	KB
8/28/15	1508060-05	Accutest	1737	15 min	Ba	KB
8/28/15	1508106-01	Auxier	1753	15 mins	γ	KB
8/28/15	1508106-03	Auxier	1910	4 hr	γ	KB
8/29/15	System Based	Lab	0710	24 hrs	γ	KB
8/31	Effluent	LMS	0528	15	γ	[illegible]
8/31	Dairy	LMS	0555	15	γ	[illegible]
8/31	1508106-04	Auxier	0616	4	γ	[illegible]
8/31/15	1508120-05	MJW	1203	1 hr	γ	KB
8/31/15	1508120-06	MJW	1304	1 hr	γ	KB
8/31/15	1508106-11	Auxier	1407	4 hr	γ	KB
8/31/15	1508106-15	Auxier	1909	4 hr	γ	KB

GE 1

DATE	Sample #	Client	Load Time	CT. Time	Analysis	Tech
8/27/15	1508052-11	UCOR	1655	15min	Ba	KB
8/27/15	1508052-14	UCOR	1710	15mins	Ba	KB
8/27/15	1508072-01	UCOR	1724	15min	Ba	KB
8/27/15	1508072-02	UCOR	1742	15min	Ba	KB
8/27/15	1508105-01	Auxier	1758	15mins	γ	KB
8/27/15	1508105-03	Auxier	1814	4hrs	γ	KB
8/28	GH 14	LAB	0531	15	γ	[illegible]
8/28	Dwight	LAB	0552	15	γ	[illegible]
8/28	1508105-04	Auxier	0610	4hr	γ	[illegible]
8/28	1508105-10	Auxier	1010	4hr	γ	[illegible]
8/28/15	1508105-13	Auxier	1412	4hrs	γ	KB
8/28/15	1508105-15	Auxier	1813	4hrs	γ	KB
8/29/15	System Blank	Lab	0710	24 hrs	γ	KB
8/31	GH 14	LAB	0528	15	γ	[illegible]
8/31	Dwight	LAB	0552	15	γ	[illegible]
8/31	1508106-05	Auxier	0616	4hr	γ	[illegible]
8/31/15	1508106-08	Auxier	1019	4hrs	γ	KB
8/31/15	1508106-12	Auxier	1420	4hrs	γ	KB
8/31/15	1508106-14	Auxier	1821	4hrs	γ	KB

SECTION VIII

ANALYTICAL DATA (ISOTOPIC URANIUM)

Eberline Services
Oak Ridge Laboratory
Analysis Sheet

15-08106
UUISO
Run 1

Work Order	15-08106
Analysis Code	UUISO
Run	1
Date Received	8/25/2015
Lab Deadline	9/15/2015
Client	Auxier & Associates, Inc.
Project	WESTLAKE
Report Level	4
Activity Units	pCi
Aliquot Units	S
Matrix	AF
Method	EML U-02 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	U-232
Radiometric Sol#	U-10a
Tracer Act (dpm/g)	18.66
Carrier	
Carrier Conc (mg/ml)	

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		08/26/15 00:00	1.0000E+00
02	MBL	BLANK		08/26/15 00:00	1.0000E+00
03	DUP	ENGWESA003	36	05/28/15 09:06	1.9600E-01
04	TRG	ENGWESA001	36	05/27/15 16:12	2.8400E-01
05	TRG	ENGWESA002	45	05/28/15 08:30	3.9200E-01
06	DO	ENGWESA003	36	05/28/15 09:06	1.9600E-01
07	TRG	ENGWESA004	35	05/28/15 09:30	3.9200E-01
08	TRG	ENGWESA005	46	05/27/15 15:08	3.9200E-01
09	TRG	ENGWESA006	43	05/27/15 16:50	3.9200E-01
10	TRG	ENGWESA007	40	05/27/15 12:00	3.9200E-01
11	TRG	ENGWESA008	39	05/27/15 15:38	3.9200E-01
12	TRG	ENGWESA009	41	05/28/15 10:42	3.9200E-01
13	TRG	ENGWESA010	43	05/28/15 11:06	3.9200E-01
14	TRG	ENGWESA011	44	05/27/15 09:10	3.9200E-01
15	TRG	ENGWESA012	42	05/27/15 10:36	3.9200E-01
16	TRG	ENGWESA013	41	05/27/15 11:17	2.8400E-01

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

15-08106
UUISO
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	0.6039	11.3		0.00								
02	MBL	0.6022	11.2		0.00								
03	DUP	0.6020	11.2		0.00								
04	TRG	0.6025	11.2		0.00								
05	TRG	0.6013	11.2		0.00								
06	DO	0.5992	11.2		0.00								
07	TRG	0.6010	11.2		0.00								
08	TRG	0.6009	11.2		0.00								
09	TRG	0.5995	11.2		0.00								
10	TRG	0.5977	11.2		0.00								
11	TRG	0.5977	11.2		0.00								
12	TRG	0.6009	11.2		0.00								
13	TRG	0.5997	11.2		0.00								
14	TRG	0.5990	11.2		0.00								
15	TRG	0.5995	11.2		0.00								
16	TRG	0.5999	11.2		0.00								

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

15-08106
UUISO
Run 1

Internal Fraction	Sample Desc	Rough Prep Date	Rough Prep By	Prep Date	Prep By	Sep t0 Date/Time	Sep t0 By	Sep t1 Date/Time	Sep t1 By
01	LCS			09/03/15 07:36	JWOLFE				
02	MBL			09/03/15 07:36	JWOLFE				
03	DUP			09/03/15 07:36	JWOLFE				
04	TRG			09/03/15 07:36	JWOLFE				
05	TRG			09/03/15 07:36	JWOLFE				
06	DO			09/03/15 07:36	JWOLFE				
07	TRG			09/03/15 07:36	JWOLFE				
08	TRG			09/03/15 07:36	JWOLFE				
09	TRG			09/03/15 07:36	JWOLFE				
10	TRG			09/03/15 07:36	JWOLFE				
11	TRG			09/03/15 07:36	JWOLFE				
12	TRG			09/03/15 07:36	JWOLFE				
13	TRG			09/03/15 07:36	JWOLFE				
14	TRG			09/03/15 07:36	JWOLFE				
15	TRG			09/03/15 07:36	JWOLFE				
16	TRG			09/03/15 07:36	JWOLFE				

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

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-UUISO-1

Run: 1
Analysis Code: UUISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, Inc.

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	U-234	LCS	LCS	pCi/s	7.09E+00	1.04E+00	7.15E-02	8.05E+00	88.06	OK		OK	
02	U-234	MBL	BLANK	pCi/s	2.97E-02	4.44E-02	7.22E-02					OK	OK
03	U-234	DUP	ENGWESA003	pCi/s	2.54E+00	9.95E-01	4.69E-01				NA	OK	
04	U-234	TRG	ENGWESA001	pCi/s	1.68E+00	5.80E-01	1.95E-01					OK	
05	U-234	TRG	ENGWESA002	pCi/s	1.35E+00	4.47E-01	1.63E-01					OK	
06	U-234	DO	ENGWESA003	pCi/s	1.57E+00	7.01E-01	4.15E-01					OK	
07	U-234	TRG	ENGWESA004	pCi/s	1.92E+00	8.25E-01	4.58E-01					OK	
08	U-234	TRG	ENGWESA005	pCi/s	2.16E+00	6.39E-01	1.96E-01					OK	
09	U-234	TRG	ENGWESA006	pCi/s	1.20E+00	4.56E-01	2.23E-01					OK	
10	U-234	TRG	ENGWESA007	pCi/s	1.87E+00	5.84E-01	2.11E-01					OK	
11	U-234	TRG	ENGWESA008	pCi/s	1.13E+00	4.59E-01	2.42E-01					OK	
12	U-234	TRG	ENGWESA009	pCi/s	1.58E+00	5.03E-01	2.76E-01					OK	
13	U-234	TRG	ENGWESA010	pCi/s	2.34E+00	6.49E-01	2.15E-01					OK	
14	U-234	TRG	ENGWESA011	pCi/s	1.18E+00	4.41E-01	2.45E-01					OK	
15	U-234	TRG	ENGWESA012	pCi/s	1.57E+00	5.44E-01	1.78E-01					OK	
16	U-234	TRG	ENGWESA013	pCi/s	7.48E-01	5.42E-01	5.59E-01					OK	

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-UUISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
Analysis Code: UUISO
Run: 1

Lab Fraction	Nuclide	Sample Desc	Sample Date	Sample Aliquot	Radiometric % Rec	Grav % Rec	Mean % Rec	SAF	Sep t0 Date/Time	Sep t1 Date/Time
01	U-234	LCS	08/26/15 00:00	1.00E+00	95.61	0.00	0.00			
02	U-234	MBL	08/26/15 00:00	1.00E+00	110.78	0.00	0.00			
03	U-234	DUP	05/28/15 09:06	1.96E-01	87.31	0.00	0.00			
04	U-234	TRG	05/27/15 16:12	2.84E-01	100.06	0.00	0.00			
05	U-234	TRG	05/28/15 08:30	3.92E-01	108.45	0.00	0.00			
06	U-234	DO	05/28/15 09:06	1.96E-01	104.65	0.00	0.00			
07	U-234	TRG	05/28/15 09:30	3.92E-01	49.84	0.00	0.00			
08	U-234	TRG	05/27/15 15:08	3.92E-01	100.24	0.00	0.00			
09	U-234	TRG	05/27/15 16:50	3.92E-01	100.53	0.00	0.00			
10	U-234	TRG	05/27/15 12:00	3.92E-01	110.55	0.00	0.00			
11	U-234	TRG	05/27/15 15:38	3.92E-01	110.63	0.00	0.00			
12	U-234	TRG	05/28/15 10:42	3.92E-01	128.59	0.00	0.00			
13	U-234	TRG	05/28/15 11:06	3.92E-01	110.48	0.00	0.00			
14	U-234	TRG	05/27/15 09:10	3.92E-01	125.35	0.00	0.00			
15	U-234	TRG	05/27/15 10:36	3.92E-01	109.24	0.00	0.00			
16	U-234	TRG	05/27/15 11:17	2.84E-01	70.39	0.00	0.00			

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-UUISO-1

Client	Eberline Services Work Order	Analysis Code	Run
Auxier & Associates, Inc.	15-08106	UUISO	1

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	U-234	LCS	09/08/15 08:04		A_Spec	Alpha_040	170	4.74 E+02	2.00 E-03	18.6
02	U-234	MBL	09/08/15 08:04		A_Spec	Alpha_041	170	2.32 E+00	4.00 E-03	18.7
03	U-234	DUP	09/08/15 08:04		A_Spec	Alpha_042	170	2.85 E+01	3.00 E-03	17.4
04	U-234	TRG	09/08/15 08:04		A_Spec	Alpha_043	170	3.58 E+01	1.00 E-03	20
05	U-234	TRG	09/08/15 08:04		A_Spec	Alpha_044	170	3.97 E+01	2.00 E-03	18.4
06	U-234	DO	09/08/15 08:04		A_Spec	Alpha_045	170	2.13 E+01	4.00 E-03	17.6
07	U-234	TRG	09/08/15 08:04		A_Spec	Alpha_046	170	2.51 E+01	5.00 E-03	17.8
08	U-234	TRG	09/08/15 08:04		A_Spec	Alpha_047	170	5.27 E+01	2.00 E-03	16.5
09	U-234	TRG	09/08/15 08:04		A_Spec	Alpha_048	170	3.03 E+01	4.00 E-03	17
10	U-234	TRG	09/08/15 08:05		A_Spec	Alpha_049	170	4.65 E+01	3.00 E-03	15.3
11	U-234	TRG	09/08/15 08:05		A_Spec	Alpha_050	170	2.63 E+01	4.00 E-03	14.3
12	U-234	TRG	09/08/15 08:05		A_Spec	Alpha_051	170	4.58 E+01	1.30 E-02	15.2
13	U-234	TRG	09/08/15 08:05		A_Spec	Alpha_052	170	6.13 E+01	4.00 E-03	16.1
14	U-234	TRG	09/08/15 08:05		A_Spec	Alpha_053	170	3.18 E+01	7.00 E-03	14.6
15	U-234	TRG	09/08/15 08:05		A_Spec	Alpha_054	170	3.68 E+01	1.00 E-03	14.5
16	U-234	TRG	09/08/15 08:05		A_Spec	Alpha_055	170	8.81 E+00	7.00 E-03	15.6

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-UUISO-1

Run: 1
Analysis Code: UUISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, Inc.

Lab Fraction	Nuclide	Sample Desc	Client Identification	Activity Units	Results	Error Estimate	MDA	LCS Known	LCS %R	LCS Flag	RPD Flag	MDA Flag	Blank Flag
01	U-238	LCS	LCS	pCi/s	7.97E+00	1.14E+00	7.12E-02	7.85E+00	101.54	OK		OK	
02	U-238	MBL	BLANK	pCi/s	5.73E-03	4.63E-02	1.07E-01					OK	OK
03	U-238	DUP	ENGWESA003	pCi/s	1.26E+00	6.96E-01	5.32E-01				NA	OK	
04	U-238	TRG	ENGWESA001	pCi/s	1.43E+00	5.32E-01	2.23E-01					OK	
05	U-238	TRG	ENGWESA002	pCi/s	1.48E+00	4.70E-01	1.62E-01					OK	
06	U-238	DO	ENGWESA003	pCi/s	2.22E+00	8.54E-01	5.38E-01					OK	
07	U-238	TRG	ENGWESA004	pCi/s	1.60E+00	7.47E-01	4.80E-01					OK	
08	U-238	TRG	ENGWESA005	pCi/s	1.85E+00	5.86E-01	2.30E-01					OK	
09	U-238	TRG	ENGWESA006	pCi/s	1.08E+00	4.29E-01	2.07E-01					OK	
10	U-238	TRG	ENGWESA007	pCi/s	1.72E+00	5.60E-01	2.52E-01					OK	
11	U-238	TRG	ENGWESA008	pCi/s	1.96E+00	6.16E-01	1.78E-01					OK	
12	U-238	TRG	ENGWESA009	pCi/s	8.89E-01	3.58E-01	1.44E-01					OK	
13	U-238	TRG	ENGWESA010	pCi/s	1.68E+00	5.37E-01	2.27E-01					OK	
14	U-238	TRG	ENGWESA011	pCi/s	1.07E+00	4.09E-01	1.54E-01					OK	
15	U-238	TRG	ENGWESA012	pCi/s	1.14E+00	4.55E-01	1.77E-01					OK	
16	U-238	TRG	ENGWESA013	pCi/s	8.02E-01	5.39E-01	4.44E-01					OK	

Preliminary Data Report & Analytical Calculations

Work Order: 15-08106-UUISO-1

Client	Eberline Services Work Order	Analysis Code	Run
Auxier & Associates, Inc.	15-08106	UUISO	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	U-238	LCS	08/26/15 00:00	1.00E+00	95.61	0.00	0.00			
02	U-238	MBL	08/26/15 00:00	1.00E+00	110.78	0.00	0.00			
03	U-238	DUP	05/28/15 09:06	1.96E-01	87.31	0.00	0.00			
04	U-238	TRG	05/27/15 16:12	2.84E-01	100.06	0.00	0.00			
05	U-238	TRG	05/28/15 08:30	3.92E-01	108.45	0.00	0.00			
06	U-238	DO	05/28/15 09:06	1.96E-01	104.65	0.00	0.00			
07	U-238	TRG	05/28/15 09:30	3.92E-01	49.84	0.00	0.00			
08	U-238	TRG	05/27/15 15:08	3.92E-01	100.24	0.00	0.00			
09	U-238	TRG	05/27/15 16:50	3.92E-01	100.53	0.00	0.00			
10	U-238	TRG	05/27/15 12:00	3.92E-01	110.55	0.00	0.00			
11	U-238	TRG	05/27/15 15:38	3.92E-01	110.63	0.00	0.00			
12	U-238	TRG	05/28/15 10:42	3.92E-01	128.59	0.00	0.00			
13	U-238	TRG	05/28/15 11:06	3.92E-01	110.48	0.00	0.00			
14	U-238	TRG	05/27/15 09:10	3.92E-01	125.35	0.00	0.00			
15	U-238	TRG	05/27/15 10:36	3.92E-01	109.24	0.00	0.00			
16	U-238	TRG	05/27/15 11:17	2.84E-01	70.39	0.00	0.00			

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-UUISO-1

Run: 1
Analysis Code: UUISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	U-238	LCS	09/08/15 08:04		A_Spec	Alpha_040	170	5.35 E+02	2.00 E-03	18.6
02	U-238	MBL	09/08/15 08:04		A_Spec	Alpha_041	170	4.50 E-01	1.50 E-02	18.7
03	U-238	DUP	09/08/15 08:04		A_Spec	Alpha_042	170	1.41 E+01	5.00 E-03	17.4
04	U-238	TRG	09/08/15 08:04		A_Spec	Alpha_043	170	3.07 E+01	2.00 E-03	20
05	U-238	TRG	09/08/15 08:04		A_Spec	Alpha_044	170	4.37 E+01	2.00 E-03	18.4
06	U-238	DO	09/08/15 08:04		A_Spec	Alpha_045	170	3.03 E+01	1.00 E-02	17.6
07	U-238	TRG	09/08/15 08:04		A_Spec	Alpha_046	170	2.10 E+01	6.00 E-03	17.8
08	U-238	TRG	09/08/15 08:04		A_Spec	Alpha_047	170	4.53 E+01	4.00 E-03	16.5
09	U-238	TRG	09/08/15 08:04		A_Spec	Alpha_048	170	2.75 E+01	3.00 E-03	17
10	U-238	TRG	09/08/15 08:05		A_Spec	Alpha_049	170	4.30 E+01	6.00 E-03	15.3
11	U-238	TRG	09/08/15 08:05		A_Spec	Alpha_050	170	4.58 E+01	1.00 E-03	14.3
12	U-238	TRG	09/08/15 08:05		A_Spec	Alpha_051	170	2.58 E+01	1.00 E-03	15.2
13	U-238	TRG	09/08/15 08:05		A_Spec	Alpha_052	170	4.42 E+01	5.00 E-03	16.1
14	U-238	TRG	09/08/15 08:05		A_Spec	Alpha_053	170	2.88 E+01	1.00 E-03	14.6
15	U-238	TRG	09/08/15 08:05		A_Spec	Alpha_054	170	2.68 E+01	1.00 E-03	14.5
16	U-238	TRG	09/08/15 08:05		A_Spec	Alpha_055	170	9.49 E+00	3.00 E-03	15.6

Preliminary Data Report & Analytical Calculations

Work Order: 15-08106-UUISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
Analysis Code: UUISO
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	U-235	LCS	LCS	pCi/s	5.84E-01	2.16E-01	8.83E-02					OK	
02	U-235	MBL	BLANK	pCi/s	4.97E-02	6.32E-02	9.45E-02					OK	OK
03	U-235	DUP	ENGWESA003	pCi/s	2.93E-01	3.79E-01	5.27E-01				NA	OK	
04	U-235	TRG	ENGWESA001	pCi/s	2.21E-01	2.28E-01	2.41E-01					OK	
05	U-235	TRG	ENGWESA002	pCi/s	8.39E-02	1.43E-01	2.52E-01					OK	
06	U-235	DO	ENGWESA003	pCi/s	3.17E-01	3.61E-01	4.76E-01					OK	
07	U-235	TRG	ENGWESA004	pCi/s	7.83E-02	1.88E-01	3.94E-01					OK	
08	U-235	TRG	ENGWESA005	pCi/s	3.33E-02	1.02E-01	2.41E-01					OK	
09	U-235	TRG	ENGWESA006	pCi/s	-2.49E-02	9.99E-02	2.56E-01					OK	
10	U-235	TRG	ENGWESA007	pCi/s	1.49E-01	1.95E-01	2.97E-01					OK	
11	U-235	TRG	ENGWESA008	pCi/s	3.34E-01	2.80E-01	2.98E-01					OK	
12	U-235	TRG	ENGWESA009	pCi/s	6.35E-02	1.21E-01	2.24E-01					OK	
13	U-235	TRG	ENGWESA010	pCi/s	2.03E-01	2.10E-01	2.66E-01					OK	
14	U-235	TRG	ENGWESA011	pCi/s	8.38E-02	1.28E-01	1.91E-01					OK	
15	U-235	TRG	ENGWESA012	pCi/s	8.75E-02	1.49E-01	2.52E-01					OK	
16	U-235	TRG	ENGWESA013	pCi/s	8.69E-02	2.09E-01	4.37E-01					OK	

Preliminary Data Report & Analytical Calculations

Work Order: 15-08106-UUISO-1

Run: 1
Analysis Code: UUISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, 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	08/26/15 00:00	1.00E+00	95.61	0.00	0.00			
02	U-235	MBL	08/26/15 00:00	1.00E+00	110.78	0.00	0.00			
03	U-235	DUP	05/28/15 09:06	1.96E-01	87.31	0.00	0.00			
04	U-235	TRG	05/27/15 16:12	2.84E-01	100.06	0.00	0.00			
05	U-235	TRG	05/28/15 08:30	3.92E-01	108.45	0.00	0.00			
06	U-235	DO	05/28/15 09:06	1.96E-01	104.65	0.00	0.00			
07	U-235	TRG	05/28/15 09:30	3.92E-01	49.84	0.00	0.00			
08	U-235	TRG	05/27/15 15:08	3.92E-01	100.24	0.00	0.00			
09	U-235	TRG	05/27/15 16:50	3.92E-01	100.53	0.00	0.00			
10	U-235	TRG	05/27/15 12:00	3.92E-01	110.55	0.00	0.00			
11	U-235	TRG	05/27/15 15:38	3.92E-01	110.63	0.00	0.00			
12	U-235	TRG	05/28/15 10:42	3.92E-01	128.59	0.00	0.00			
13	U-235	TRG	05/28/15 11:06	3.92E-01	110.48	0.00	0.00			
14	U-235	TRG	05/27/15 09:10	3.92E-01	125.35	0.00	0.00			
15	U-235	TRG	05/27/15 10:36	3.92E-01	109.24	0.00	0.00			
16	U-235	TRG	05/27/15 11:17	2.84E-01	70.39	0.00	0.00			

Preliminary Data Report & Analytical Calculations

Work Order: 15-08106-UUISO-1

Run: 1
Analysis Code: UUISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	U-235	LCS	09/08/15 08:04		A_Spec	Alpha_040	170	3.17 E+01	2.00 E-03	18.6
02	U-235	MBL	09/08/15 08:04		A_Spec	Alpha_041	170	3.15 E+00	5.00 E-03	18.7
03	U-235	DUP	09/08/15 08:04		A_Spec	Alpha_042	170	2.66 E+00	2.00 E-03	17.4
04	U-235	TRG	09/08/15 08:04		A_Spec	Alpha_043	170	3.83 E+00	1.00 E-03	20
05	U-235	TRG	09/08/15 08:04		A_Spec	Alpha_044	170	2.00 E+00	0.00 E+00	18.4
06	U-235	DO	09/08/15 08:04		A_Spec	Alpha_045	170	3.49 E+00	3.00 E-03	17.6
07	U-235	TRG	09/08/15 08:04		A_Spec	Alpha_046	170	8.30 E-01	1.00 E-03	17.8
08	U-235	TRG	09/08/15 08:04		A_Spec	Alpha_047	170	6.60 E-01	2.00 E-03	16.5
09	U-235	TRG	09/08/15 08:04		A_Spec	Alpha_048	170	-5.10 E-01	3.00 E-03	17
10	U-235	TRG	09/08/15 08:05		A_Spec	Alpha_049	170	3.00 E+00	0.00 E+00	15.3
11	U-235	TRG	09/08/15 08:05		A_Spec	Alpha_050	170	6.32 E+00	4.00 E-03	14.3
12	U-235	TRG	09/08/15 08:05		A_Spec	Alpha_051	170	1.49 E+00	3.00 E-03	15.2
13	U-235	TRG	09/08/15 08:05		A_Spec	Alpha_052	170	4.32 E+00	4.00 E-03	16.1
14	U-235	TRG	09/08/15 08:05		A_Spec	Alpha_053	170	1.83 E+00	1.00 E-03	14.6
15	U-235	TRG	09/08/15 08:05		A_Spec	Alpha_054	170	1.66 E+00	2.00 E-03	14.5
16	U-235	TRG	09/08/15 08:05		A_Spec	Alpha_055	170	8.30 E-01	1.00 E-03	15.6

Count Room Report
Client: Auxier Associates, Inc.

15-08106-UUISO-1 (pCi/s) in AF
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	08/26/15 00:00	1.0000	0.6039	11.2688		0.00		
02	MBL	BLANK	08/26/15 00:00	1.0000	0.6022	11.2371		0.00		
03	DUP	ENGWESA003	05/28/15 09:06	0.1960	0.6020	11.2333		0.00		
04	TRG	ENGWESA001	05/27/15 16:12	0.2840	0.6025	11.2427		0.00		
05	TRG	ENGWESA002	05/28/15 08:30	0.3920	0.6013	11.2203		0.00		
06	DO	ENGWESA003	05/28/15 09:06	0.1960	0.5992	11.1811		0.00		
07	TRG	ENGWESA004	05/28/15 09:30	0.3920	0.6010	11.2147		0.00		
08	TRG	ENGWESA005	05/27/15 15:08	0.3920	0.6009	11.2128		0.00		
09	TRG	ENGWESA006	05/27/15 16:50	0.3920	0.5995	11.1867		0.00		
10	TRG	ENGWESA007	05/27/15 12:00	0.3920	0.5977	11.1531		0.00		
11	TRG	ENGWESA008	05/27/15 15:38	0.3920	0.5977	11.1531		0.00		
12	TRG	ENGWESA009	05/28/15 10:42	0.3920	0.6009	11.2128		0.00		
13	TRG	ENGWESA010	05/28/15 11:06	0.3920	0.5997	11.1904		0.00		
14	TRG	ENGWESA011	05/27/15 09:10	0.3920	0.5990	11.1773		0.00		
15	TRG	ENGWESA012	05/27/15 10:36	0.3920	0.5995	11.1867		0.00		
16	TRG	ENGWESA013	05/27/15 11:17	0.2840	0.5999	11.1941		0.00		

Eberline Services
Oak Ridge Laboratory

Spike and Tracer Worksheet

Printed: 9/3/2015 7:37 AM

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
15-08106	1	UUISO	9/3/2015 7:22	JWOLFE	JW	

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	9/3/2015	0.500	0.5071				8.05	0.290	0.00	0.000	0.00	0.000	0.00	0.000
U-238	U-8a	34.350	9/3/2015	0.500	0.5071				7.85	0.282	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	18.660	9/3/2015	0.6039	0.6500
02	U-232	U-10a	18.660	9/3/2015	0.6022	0.6500
03	U-232	U-10a	18.660	9/3/2015	0.6020	0.6500
04	U-232	U-10a	18.660	9/3/2015	0.6025	0.6500
05	U-232	U-10a	18.660	9/3/2015	0.6013	0.6500
06	U-232	U-10a	18.660	9/3/2015	0.5992	0.6500
07	U-232	U-10a	18.660	9/3/2015	0.6010	0.6500
08	U-232	U-10a	18.660	9/3/2015	0.6009	0.6500
09	U-232	U-10a	18.660	9/3/2015	0.5995	0.6500
10	U-232	U-10a	18.660	9/3/2015	0.5977	0.6500
11	U-232	U-10a	18.660	9/3/2015	0.5977	0.6500
12	U-232	U-10a	18.660	9/3/2015	0.6009	0.6500
13	U-232	U-10a	18.660	9/3/2015	0.5997	0.6500
14	U-232	U-10a	18.660	9/3/2015	0.5990	0.6500
15	U-232	U-10a	18.660	9/3/2015	0.5995	0.6500
16	U-232	U-10a	18.660	9/3/2015	0.5999	0.6500

Balance Printer Tapes

Tracer

0.6039 g
0.6022 g
0.6020 g
0.6025 g
0.6013 g
0.5992 g
0.6010 g
0.6009 g
0.5995 g
0.5977 g
0.5977 g
0.6009 g
0.5997 g
0.5990 g
0.5995 g
0.5999 g

LCS

0.5071 g

Matrix Spike

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
15-08106	1	UUISO	s	9/15/2015	JWOLFE

Lab Fraction	Auxier & Associates, Inc. Client ID	Sample Type	Muffle Data Ratio Post/Pre	Dilution Data No of Dils	Dil Factor	Ratio	Aliquot Data Aliquot	Net Equiv	MS Aliquot Data Aliquot	Net Equiv	H-3 Solids Only Water Added (ml)	H3 Dist Aliq
01	LCS	LCS					1.0000E+00	1.0000E+00				
02	BLANK	MBL					1.0000E+00	1.0000E+00				
03	ENGWESA003	DUP					1.9600E-01	1.9600E-01				
04	ENGWESA001	TRG					2.8400E-01	2.8400E-01				
05	ENGWESA002	TRG					3.9200E-01	3.9200E-01				
06	ENGWESA003	DO					1.9600E-01	1.9600E-01				
07	ENGWESA004	TRG					3.9200E-01	3.9200E-01				
08	ENGWESA005	TRG					3.9200E-01	3.9200E-01				
09	ENGWESA006	TRG					3.9200E-01	3.9200E-01				
10	ENGWESA007	TRG					3.9200E-01	3.9200E-01				
11	ENGWESA008	TRG					3.9200E-01	3.9200E-01				
12	ENGWESA009	TRG					3.9200E-01	3.9200E-01				
13	ENGWESA010	TRG					3.9200E-01	3.9200E-01				
14	ENGWESA011	TRG					3.9200E-01	3.9200E-01				
15	ENGWESA012	TRG					3.9200E-01	3.9200E-01				
16	ENGWESA013	TRG					2.8400E-01	2.8400E-01				

Comments	

Technician: JWolfe Date: 9/3/15

58085

KB
9/8/15

Apex-Alpha™

Sample Description: SPIKE
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 01
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_040
Chamber Serial Number: 06027396B
Detector Serial Number: 91135
Env. Background: System Bkgd 128405
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 sample
Sample Date/Time: 9/8/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:38 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.604 mL
Effective Efficiency: 0.1774 +/- 0.0105
Counting Efficiency: 0.1856 +/- 0.0032 on 10/25/2014 2:57:14 PM
Chem. Recovery Factor: 0.9561 +/- 0.0589

Control Certificate Name: NatU_U-8A
Chem. Recov. of Control: U-238 0.989787 +/- 0.078353
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	5.275	337.66	10.67	0.34	0.00E+000	31.4
U-234		4.730	473.66	9.01	0.34	0.00E+000	12.0
U-235		4.393	31.66	35.05	0.34	0.00E+000	4.5
U-238		4.149	534.66	8.48	0.34	0.00E+000	41.4

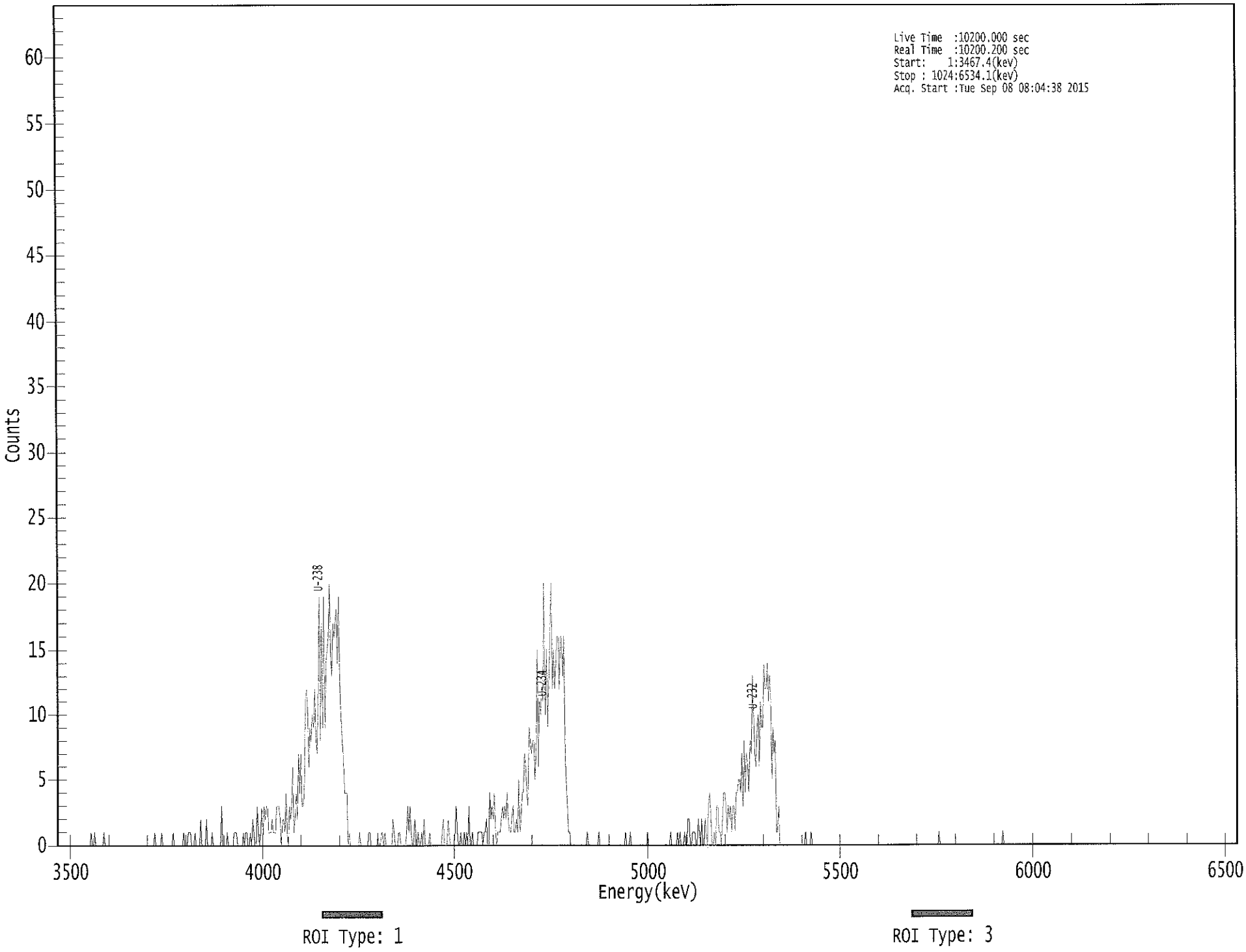
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.994	5302.50*	5.05E+000 +/- 5.86E-001	7.15E-002 +/- 8.29E-003
U-234	0.993	4761.50*	7.09E+000 +/- 1.04E+000	7.15E-002 +/- 8.29E-003
U-235	1.000	4385.50*	5.84E-001 +/- 2.16E-001	8.83E-002 +/- 1.02E-002
U-238	0.991	4184.40*	7.97E+000 +/- 1.14E+000	7.12E-002 +/- 8.25E-003

AG
9/8/15

0000128107.CNF



: 000037

****
***** 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	1	0	0
33:	1	0	0	0	0	0	0	0
41:	1	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	1	0	0	0
89:	0	0	1	0	0	0	0	0
97:	0	0	0	0	1	0	0	0
105:	0	0	0	0	0	1	0	0
113:	0	1	1	1	0	0	0	1
121:	0	0	0	0	2	0	0	0
129:	0	2	0	0	0	0	1	0
137:	0	0	0	0	0	0	3	0
145:	0	0	0	1	0	0	0	0
153:	0	1	1	1	0	0	0	0
161:	0	1	0	1	1	0	0	1
169:	0	2	1	0	0	3	1	0
177:	1	3	0	3	2	3	3	1
185:	1	1	2	1	1	1	3	3
193:	3	2	0	2	2	1	4	1
201:	0	3	2	3	6	1	2	4
209:	2	7	4	7	3	3	4	11
217:	12	10	6	9	8	10	9	12
225:	8	7	12	19	8	17	9	19
233:	9	14	15	16	20	15	13	17
241:	16	17	18	14	19	13	10	8
249:	7	4	4	4	0	1	0	0
257:	0	0	0	0	0	0	1	0
265:	0	0	0	0	0	0	1	1
273:	0	0	0	0	0	0	1	0
281:	0	1	1	0	1	0	0	0
289:	0	0	0	2	1	0	0	0
297:	1	1	0	0	0	0	0	1
305:	3	1	3	1	0	0	2	1
313:	0	1	0	0	1	0	2	0
321:	0	0	0	1	0	0	0	0
329:	0	0	0	0	0	0	1	2
337:	0	0	0	2	1	0	0	0
345:	0	1	3	1	0	0	1	0
353:	0	1	0	1	0	3	0	0
361:	1	0	0	0	0	1	1	1

369:	1	0	1	1	2	0	0	4

Sample Title: 01

Channel								
377:	2	3	2	4	1	0	1	1
385:	1	2	3	2	3	2	4	2
393:	1	1	2	3	1	1	2	1
401:	5	1	2	4	4	7	6	4
409:	3	9	8	7	8	8	5	7
417:	15	6	11	10	12	11	20	10
425:	15	9	13	16	20	12	15	12
433:	14	16	16	12	16	16	13	16
441:	7	5	3	1	1	0	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	1	0	0	0	0
465:	0	0	0	0	0	1	0	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	0	0	1	0	0	0
497:	1	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	1
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	1	0	0	0	0
537:	0	1	0	1	0	0	0	1
545:	0	0	2	2	0	0	1	1
553:	1	0	0	2	1	0	2	0
561:	0	2	1	0	3	4	2	0
569:	0	1	0	3	3	1	1	0
577:	2	4	4	3	1	3	2	3
585:	1	3	3	1	4	4	5	5
593:	4	7	3	8	4	7	6	4
601:	8	7	13	10	7	6	9	10
609:	6	11	9	9	14	12	12	14
617:	11	13	11	5	9	7	8	1
625:	1	3	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	0	0	0	0	1	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	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:	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	1	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	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™

VB 9/8/15

Sample Description: BLANK
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001280
Batch Identification: 1508106A-UU
Sample Identification: 02
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_041
Chamber Serial Number: 05026930A
Detector Serial Number: 91087
Env. Background: System Bkgd 128406
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 sample
Sample Date/Time: 9/8/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:40 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: 0.2075 +/- 0.0115
Counting Efficiency: 0.1873 +/- 0.0033 on 10/25/2014 3:00:28 PM
Chem. Recovery Factor: 1.1078 +/- 0.0643

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	393.83	9.88	0.17	0.00E+000	22.4
U-234		4.626	2.32	149.12	0.68	0.00E+000	3.0
U-235		4.431	3.15	126.67	0.85	0.00E+000	3.0
U-238		4.074	0.45	807.07	2.55	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.994	5302.50*	5.04E+000 +/- 5.47E-001	5.34E-002 +/- 5.80E-003
U-234	0.877	4761.50*	2.97E-002 +/- 4.44E-002	7.22E-002 +/- 7.84E-003
U-235	0.986	4385.50*	4.97E-002 +/- 6.32E-002	9.45E-002 +/- 1.03E-002
U-238	0.917	4184.40*	5.73E-003 +/- 4.63E-002	1.07E-001 +/- 1.16E-002

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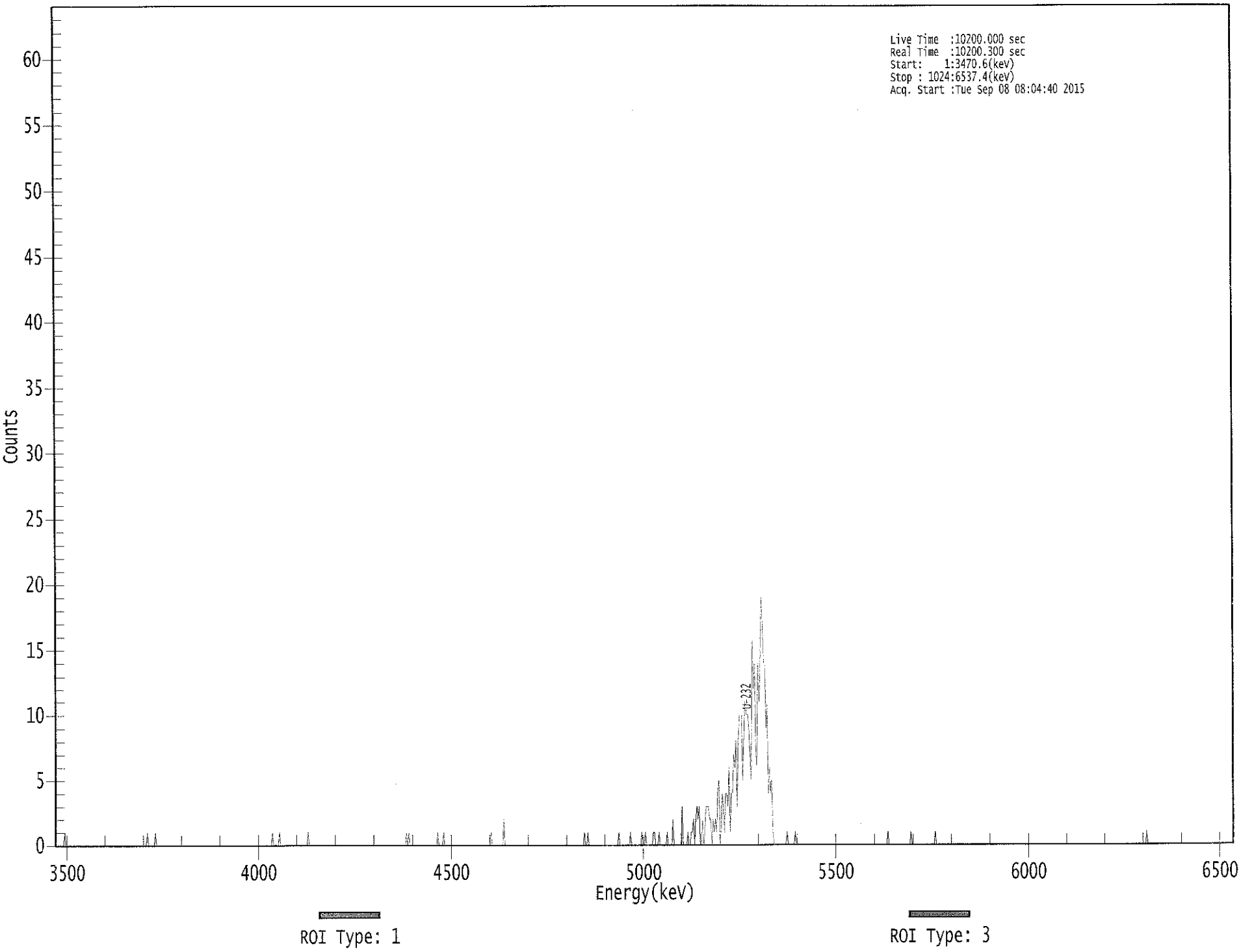
0000128097.CNF



25000 :

****
***** 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:	1	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	1
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	1	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	1	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	1	0	1	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	1	0	0	0
337:	0	1	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	1	0	0	0	0	0
385:	0	0	0	0	0	2	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	0
433:	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	1	0	0	1	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	1	0	0	0	0	0	0
497:	0	0	0	1	0	0	0	0
505:	0	0	0	0	0	1	0	0
513:	1	0	0	0	0	0	0	1
521:	1	0	0	0	1	0	0	0
529:	0	0	0	1	0	0	0	0
537:	2	0	0	0	0	0	0	0
545:	3	0	0	0	0	1	0	0
553:	1	1	2	0	2	3	2	3
561:	0	0	2	0	1	3	3	3
569:	2	2	0	2	1	2	1	4
577:	5	1	1	4	3	1	4	4
585:	3	6	1	4	4	7	6	8
593:	3	8	10	10	10	5	9	11
601:	10	10	9	7	5	16	12	14
609:	8	6	14	11	14	19	17	14
617:	14	9	11	4	6	4	5	1
625:	0	0	0	0	0	0	0	0
633:	0	0	0	1	0	0	0	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	1	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	1	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	1	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 02

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

KB
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Apex-Alpha™

Sample Description: ENGWESA003-DUP
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001280
Batch Identification: 1508106A-UU
Sample Identification: 03
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_042
Chamber Serial Number: 05026930B
Detector Serial Number: 84185
Env. Background: System Bkgd 128407
Reagent Blank: <not performed>

Sample Size: 1.960E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:43 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: 0.1517 +/- 0.0096
Counting Efficiency: 0.1737 +/- 0.0030 on 10/25/2014 3:04:21 PM
Chem. Recovery Factor: 0.8731 +/- 0.0574

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	5.281	287.81	11.58	1.19	0.00E+000	13.5
U-234		4.736	28.49	37.10	0.51	0.00E+000	3.8
U-235		4.379	2.66	128.85	0.34	0.00E+000	3.0
U-238		4.138	14.15	53.90	0.85	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.997	5302.50*	2.58E+001 +/- 3.20E+000	5.90E-001 +/- 7.33E-002
U-234	0.995	4761.50*	2.54E+000 +/- 9.95E-001	4.69E-001 +/- 5.82E-002
U-235	1.000	4385.50*	2.93E-001 +/- 3.79E-001	5.27E-001 +/- 6.55E-002
U-238	0.985	4184.40*	1.26E+000 +/- 6.96E-001	5.32E-001 +/- 6.62E-002

AG
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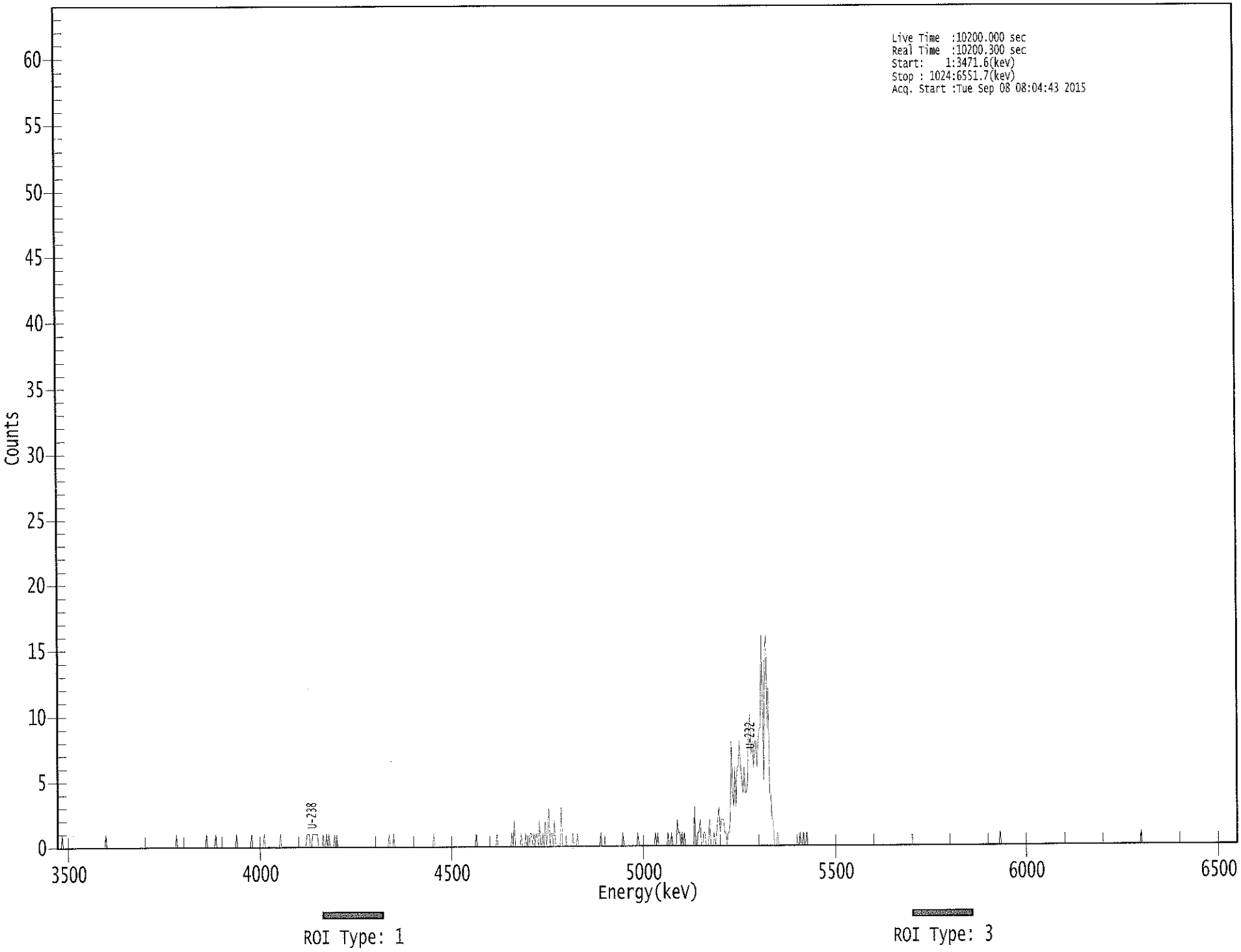
0000128098.CNF



LS000 :

```
*****************************************************
*****   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	1	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	1
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	1	0	0	0	0	0	0
137:	0	1	0	0	0	0	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	1	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	1	0	0	0	0	0	0	0
177:	0	0	0	1	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	1	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:	1	1	1	0	0	1	1	1
225:	1	1	0	0	0	0	1	0
233:	0	1	0	1	0	0	0	0
241:	1	0	1	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	1
289:	0	0	0	1	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	1	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	1	0	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 03

Channel								
377:	0	0	0	0	0	1	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	1	0	2	0	0	0
401:	0	0	1	0	0	0	1	0
409:	0	0	1	1	0	1	0	1
417:	1	0	2	0	0	1	0	2
425:	0	1	3	0	1	1	0	2
433:	0	0	0	0	0	3	0	0
441:	0	0	0	0	0	0	0	1
449:	0	0	0	1	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	1
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	1	0	0	0	0	0
497:	0	0	0	0	0	0	0	1
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	0	1	0
521:	1	0	0	0	0	0	0	0
529:	0	1	0	0	1	0	0	0
537:	0	2	1	1	0	1	0	1
545:	0	0	0	0	0	0	0	0
553:	3	0	0	1	1	2	0	0
561:	1	1	0	0	0	2	0	0
569:	0	1	0	1	2	3	1	2
577:	2	2	1	1	0	1	1	2
585:	8	4	3	6	3	6	6	8
593:	6	5	4	6	4	4	5	9
601:	10	7	8	6	8	8	6	8
609:	9	9	16	11	5	15	16	9
617:	12	4	4	2	2	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	1	0	0	1	0
649:	0	1	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 03

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

KB 9/8/15

Sample Description: ENGWESA001
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 04
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_043
Chamber Serial Number: 04026481A
Detector Serial Number: 91088
Env. Background: System Bkgd 128408
Reagent Blank: <not performed>

Sample Size: 2.840E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:45 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.603 mL
Effective Efficiency: 0.1999 +/- 0.0113
Counting Efficiency: 0.1998 +/- 0.0035 on 10/25/2014 3:08:45 PM
Chem. Recovery Factor: 1.0006 +/- 0.0589

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	5.279	379.66	10.06	0.34	0.00E+000	6.0
U-234		4.745	35.83	32.83	0.17	0.00E+000	4.5
U-235		4.373	3.83	102.72	0.17	0.00E+000	3.0
U-238		4.156	30.66	35.63	0.34	0.00E+000	4.5

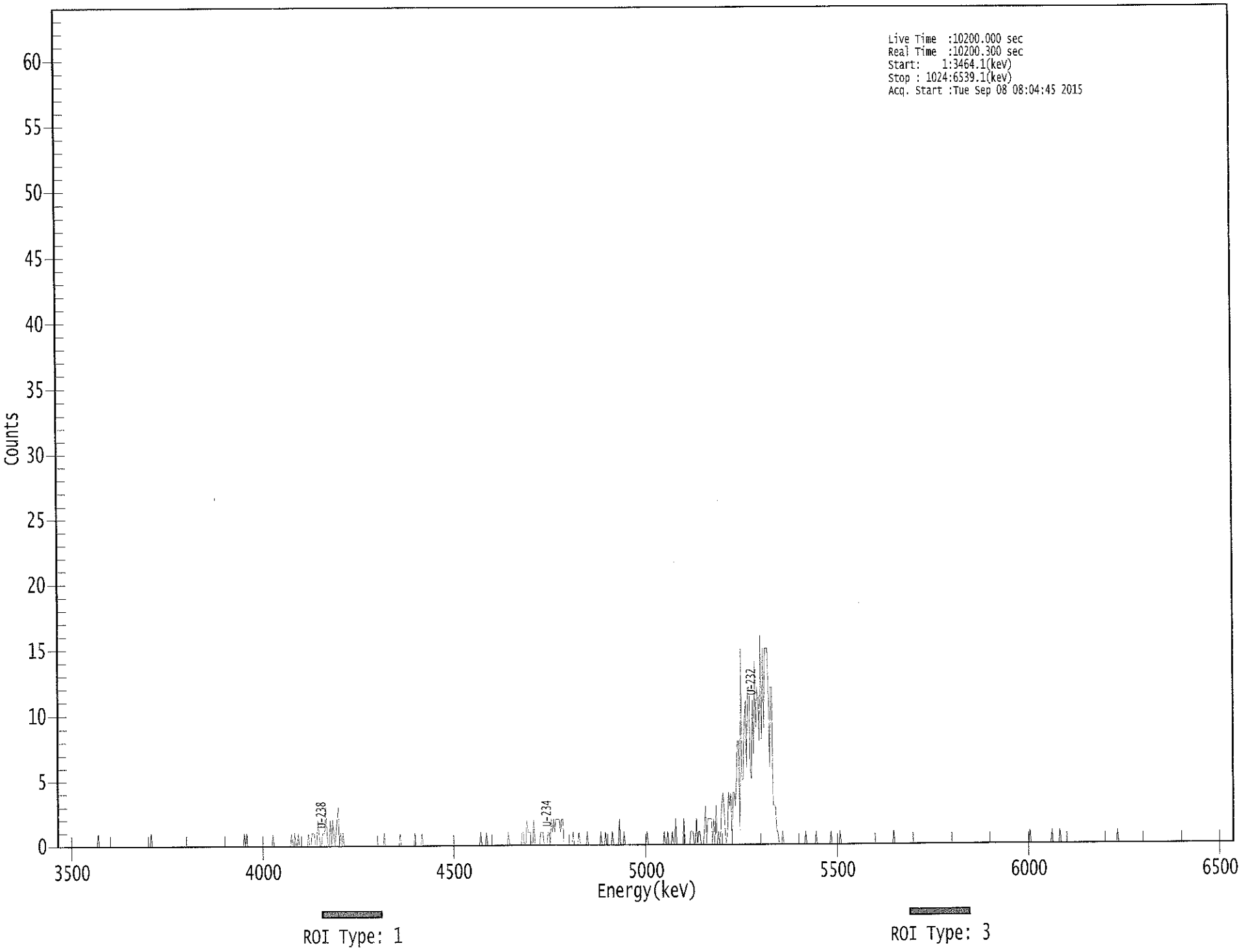
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.996	5302.50*	1.78E+001 +/- 1.96E+000	2.24E-001 +/- 2.47E-002
U-234	0.998	4761.50*	1.68E+000 +/- 5.80E-001	1.95E-001 +/- 2.15E-002
U-235	0.999	4385.50*	2.21E-001 +/- 2.28E-001	2.41E-001 +/- 2.65E-002
U-238	0.994	4184.40*	1.43E+000 +/- 5.32E-001	2.23E-001 +/- 2.45E-002

AG
9/8/15

0000128108.CNF



20102 : 00

```
*****************************************************
*****   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	1	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	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	1	0	1	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	1	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	1	0	0	1	0
209:	0	1	0	0	0	0	0	0
217:	0	0	1	0	0	1	1	1
225:	0	0	2	1	0	0	1	1
233:	1	3	1	0	0	2	0	2
241:	1	0	1	2	3	0	1	0
249:	1	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	1	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	1	0	0	0	0	0
305:	0	0	0	0	0	0	0	1
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	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

369:	1	0	0	0	0	1	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:	1	0	0	0	0	0	0	0
401:	0	0	0	0	1	1	0	0
409:	2	1	1	1	0	0	2	0
417:	0	0	0	0	1	1	1	0
425:	0	0	1	1	0	2	1	2
433:	1	2	2	2	2	1	2	2
441:	0	0	0	0	0	0	0	0
449:	1	0	0	0	0	1	0	0
457:	0	0	0	0	1	0	0	0
465:	0	0	0	0	0	0	0	0
473:	1	0	0	0	1	0	0	0
481:	0	0	1	0	0	0	0	0
489:	2	0	0	0	1	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	1	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	1
529:	0	0	1	0	0	0	1	0
537:	0	2	0	0	0	0	0	0
545:	2	0	0	0	0	0	1	1
553:	1	0	0	2	0	1	1	0
561:	0	0	1	3	0	2	2	2
569:	2	0	2	0	3	0	1	0
577:	1	3	4	3	1	0	1	4
585:	3	4	0	4	4	3	5	8
593:	8	1	15	5	5	9	11	6
601:	12	12	6	5	11	7	14	9
609:	12	11	8	16	8	15	9	15
617:	15	15	12	6	12	12	3	3
625:	3	1	1	0	0	0	1	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	1	0	0	0	0	0
657:	0	0	0	1	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	1	0	0	0	0	0	0	0
681:	1	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	1
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 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	1	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	1	0	0	0	0	0	0	1
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	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	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™

KB 9/8/15

Sample Description: ENGWESA002
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 05
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_044
Chamber Serial Number: 04026481B
Detector Serial Number: 84168
Env. Background: System Bkgd 128409
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:48 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: 0.1992 +/- 0.0112
Counting Efficiency: 0.1837 +/- 0.0032 on 10/25/2014 3:13:11 PM
Chem. Recovery Factor: 1.0845 +/- 0.0641

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	5.284	377.49	10.10	0.51	0.00E+000	24.6
U-234		4.731	39.66	31.28	0.34	0.00E+000	6.0
U-235		4.422	2.00	169.74	0.00	0.00E+000	3.0
U-238		4.171	43.66	29.80	0.34	0.00E+000	12.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.998	5302.50*	1.29E+001 +/- 1.42E+000	1.79E-001 +/- 1.98E-002
U-234	0.994	4761.50*	1.35E+000 +/- 4.47E-001	1.63E-001 +/- 1.80E-002
U-235	0.991	4385.50*	8.39E-002 +/- 1.43E-001	2.52E-001 +/- 2.78E-002
U-238	0.999	4184.40*	1.48E+000 +/- 4.70E-001	1.62E-001 +/- 1.79E-002

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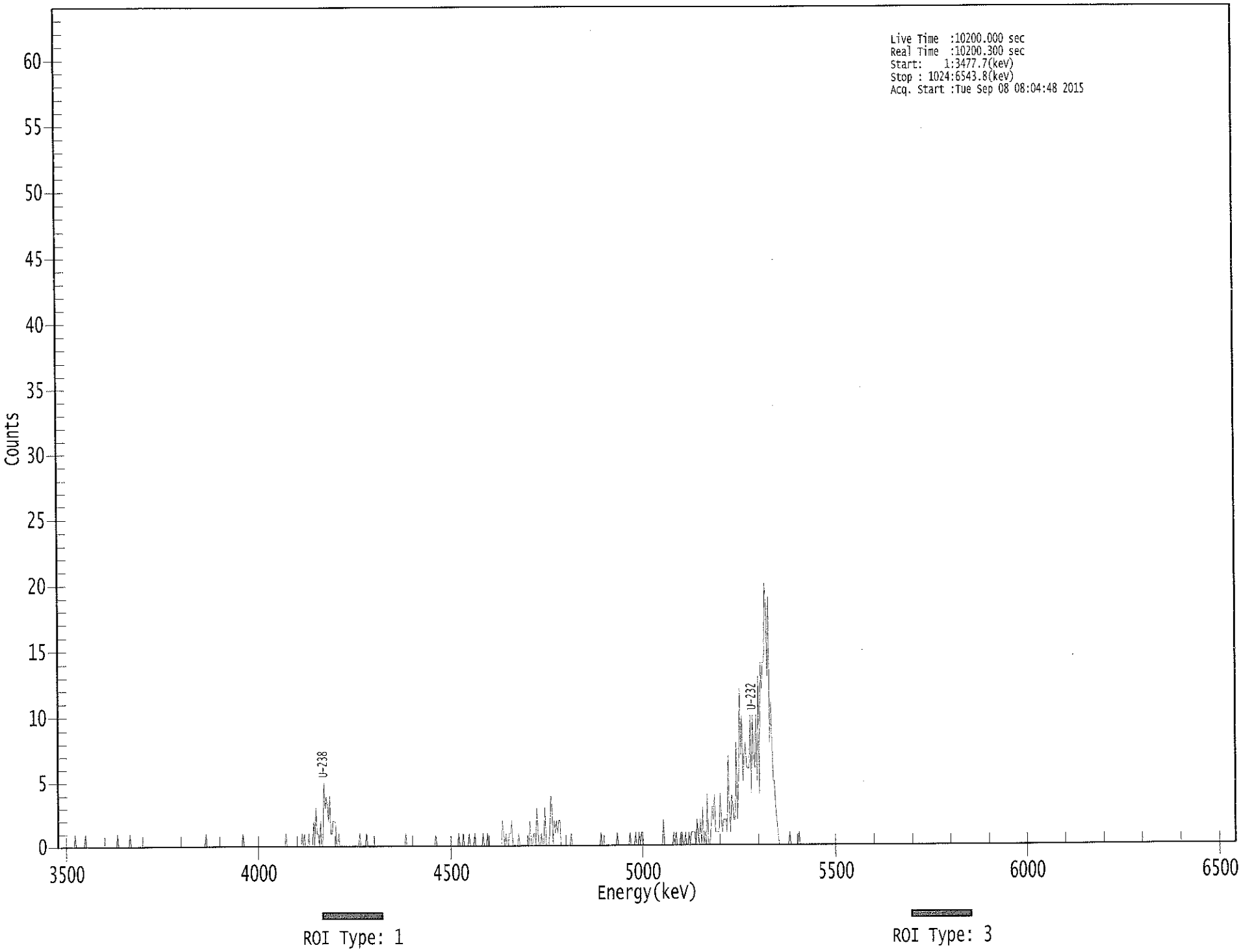
0000128109.CNF



10087

****
***** 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	1
17:	0	0	0	0	0	0	0	0
25:	1	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	1	0	0	0
57:	0	0	0	0	0	0	0	1
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	1	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	1	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	1	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	1	0	1	0
217:	0	0	1	0	0	0	2	0
225:	3	1	1	0	2	0	0	5
233:	3	4	3	2	4	1	1	2
241:	2	2	0	0	1	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	1	0
265:	0	0	0	0	1	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	1	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	1	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	1	0	0	0
353:	1	0	0	0	0	1	0	0
361:	0	0	1	0	0	0	0	0

369:	0	1	0	0	0	1	0	0

Sample Title: 05

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	2	1	0	1	0	0
393:	1	1	2	0	0	0	0	0
401:	1	0	0	0	0	0	0	0
409:	0	0	2	0	0	1	1	0
417:	3	1	0	0	1	0	0	3
425:	0	0	0	1	4	3	0	2
433:	1	2	1	2	2	0	0	0
441:	0	0	0	0	0	0	1	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:	1	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	1	0
489:	0	0	0	0	0	0	0	0
497:	0	1	0	0	0	0	1	0
505:	0	1	0	1	1	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	2	0
529:	0	0	0	0	0	0	0	1
537:	0	1	0	0	0	1	1	0
545:	0	1	0	0	1	0	1	1
553:	1	1	0	2	1	0	2	0
561:	3	0	1	0	4	0	0	1
569:	3	2	4	1	1	1	1	4
577:	2	1	2	2	2	1	7	3
585:	1	4	3	2	2	8	2	5
593:	12	7	10	5	7	8	6	6
601:	6	10	4	10	7	6	10	5
609:	13	4	14	12	14	14	20	18
617:	13	19	8	11	8	5	5	3
625:	2	1	0	0	0	0	0	0
633:	0	0	0	1	0	0	0	0
641:	0	0	0	1	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 05

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

Apex-Alpha™

KB 9/8/15

Sample Description: ENGWESA003
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001280
Batch Identification: 1508106A-UU
Sample Identification: 06
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_045
Chamber Serial Number: 04026482A
Detector Serial Number: 91131
Env. Background: System Bkgd 128410
Reagent Blank: <not performed>

Sample Size: 1.960E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:50 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.599 mL
Effective Efficiency: 0.1842 +/- 0.0108
Counting Efficiency: 0.1760 +/- 0.0031 on 10/25/2014 3:16:42 PM
Chem. Recovery Factor: 1.0465 +/- 0.0638

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	5.299	347.83	10.51	0.17	0.00E+000	24.8
U-234		4.749	21.32	43.23	0.68	0.00E+000	3.5
U-235		4.406	3.49	113.53	0.51	0.00E+000	6.0
U-238		4.175	30.30	36.76	1.70	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	1.000	5302.50*	2.57E+001 +/- 2.93E+000	3.08E-001 +/- 3.52E-002
U-234	0.999	4761.50*	1.57E+000 +/- 7.01E-001	4.15E-001 +/- 4.75E-002
U-235	0.997	4385.50*	3.17E-001 +/- 3.61E-001	4.76E-001 +/- 5.45E-002
U-238	0.999	4184.40*	2.22E+000 +/- 8.54E-001	5.38E-001 +/- 6.15E-002

AG
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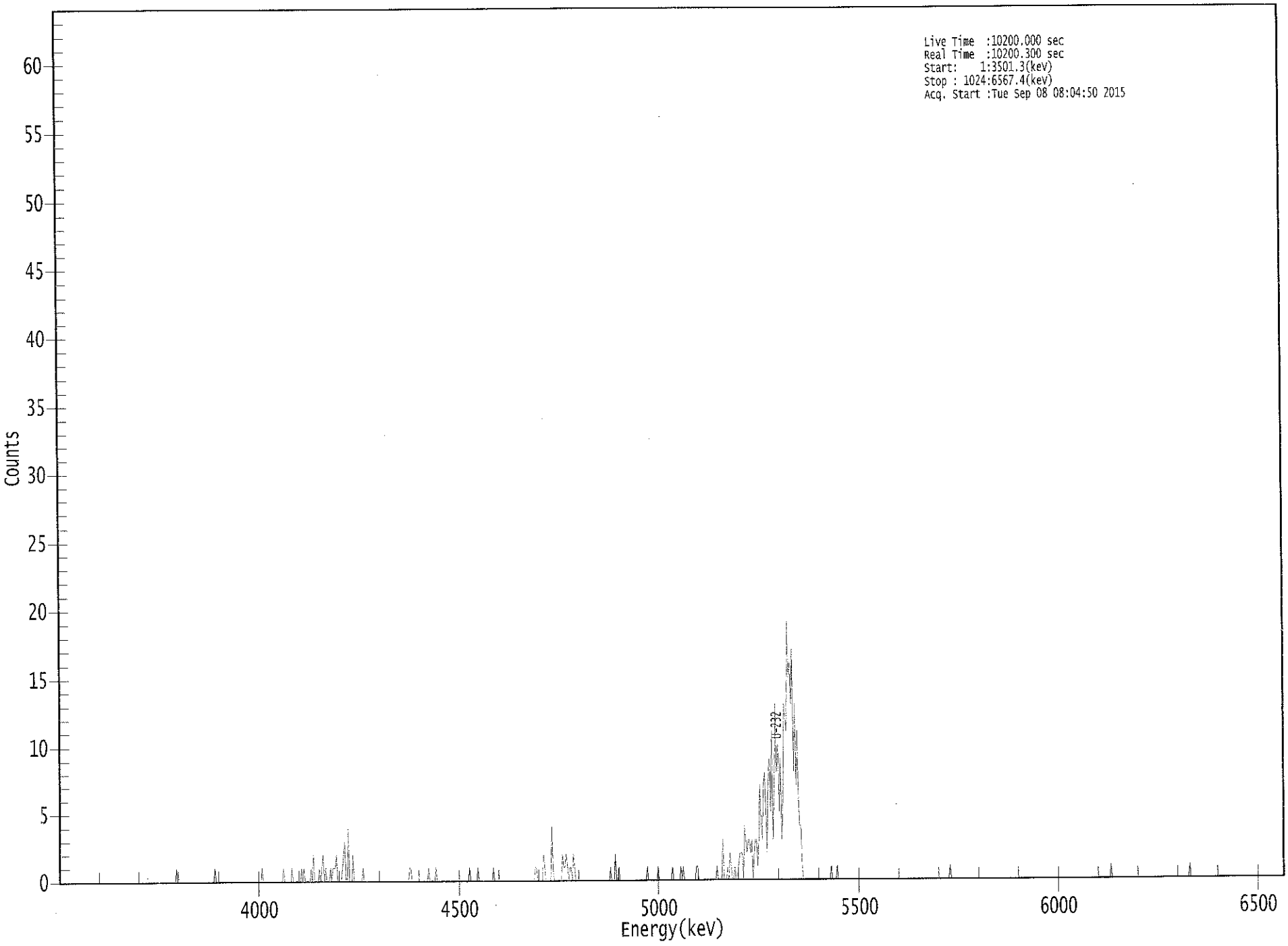
0000128099.CNF



001112

****
***** 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	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	1	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	1	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	1	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	1	0	0	0	0	0
201:	0	0	1	0	1	0	0	0
209:	0	0	1	0	2	0	0	0
217:	0	1	0	1	2	0	1	0
225:	0	0	1	0	1	1	1	2
233:	0	0	0	0	1	2	3	0
241:	0	4	0	0	0	2	0	0
249:	0	0	0	0	0	1	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	1	1	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	1	0	0	0
313:	0	0	1	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	1	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	1	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	1	1	0
401:	0	0	0	0	2	1	0	0
409:	0	0	0	4	1	0	0	0
417:	0	0	0	0	2	1	1	2
425:	1	0	1	1	0	2	1	0
433:	0	0	0	0	0	0	0	0
441:	0	0	0	0	0	0	0	0
449:	0	0	0	0	0	0	0	0
457:	0	0	0	0	1	0	0	0
465:	2	0	0	1	0	0	0	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	0	1	0	0	0	0
497:	0	0	0	0	1	0	0	0
505:	0	0	0	0	0	0	0	0
513:	1	0	0	0	0	0	0	1
521:	0	1	0	0	0	0	0	0
529:	0	0	0	0	1	1	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	1	0	0
553:	0	0	3	0	0	0	1	0
561:	2	1	0	0	1	0	0	1
569:	2	2	2	0	4	3	2	3
577:	3	2	3	0	2	3	3	1
585:	3	7	4	3	7	8	5	2
593:	8	9	5	11	3	6	13	8
601:	10	5	9	3	5	13	12	11
609:	19	15	16	13	17	8	13	7
617:	11	6	4	4	1	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	1	0	0	0
649:	0	1	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	1
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	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	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:	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

KB 9/8/15

Apex-Alpha™

Sample Description: ENGWESA004
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 07
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_046
Chamber Serial Number: 04026482B
Detector Serial Number: 58762
Env. Background: System Bkgd 128411
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:52 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: 0.0885 +/- 0.0071
Counting Efficiency: 0.1776 +/- 0.0031 on 10/25/2014 3:20:08 PM
Chem. Recovery Factor: 0.4984 +/- 0.0411

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	5.283	167.66	15.16	0.34	0.00E+000	8.2
U-234		4.732	25.15	39.85	0.85	0.00E+000	4.5
U-235		4.412	0.83	239.53	0.17	0.00E+000	3.0
U-238		4.153	20.98	43.99	1.02	0.00E+000	3.8

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.997	5302.50*	1.29E+001 +/- 2.03E+000	3.67E-001 +/- 5.80E-002
U-234	0.994	4761.50*	1.92E+000 +/- 8.25E-001	4.58E-001 +/- 7.24E-002
U-235	0.995	4385.50*	7.83E-002 +/- 1.88E-001	3.94E-001 +/- 6.23E-002
U-238	0.993	4184.40*	1.60E+000 +/- 7.47E-001	4.80E-001 +/- 7.59E-002

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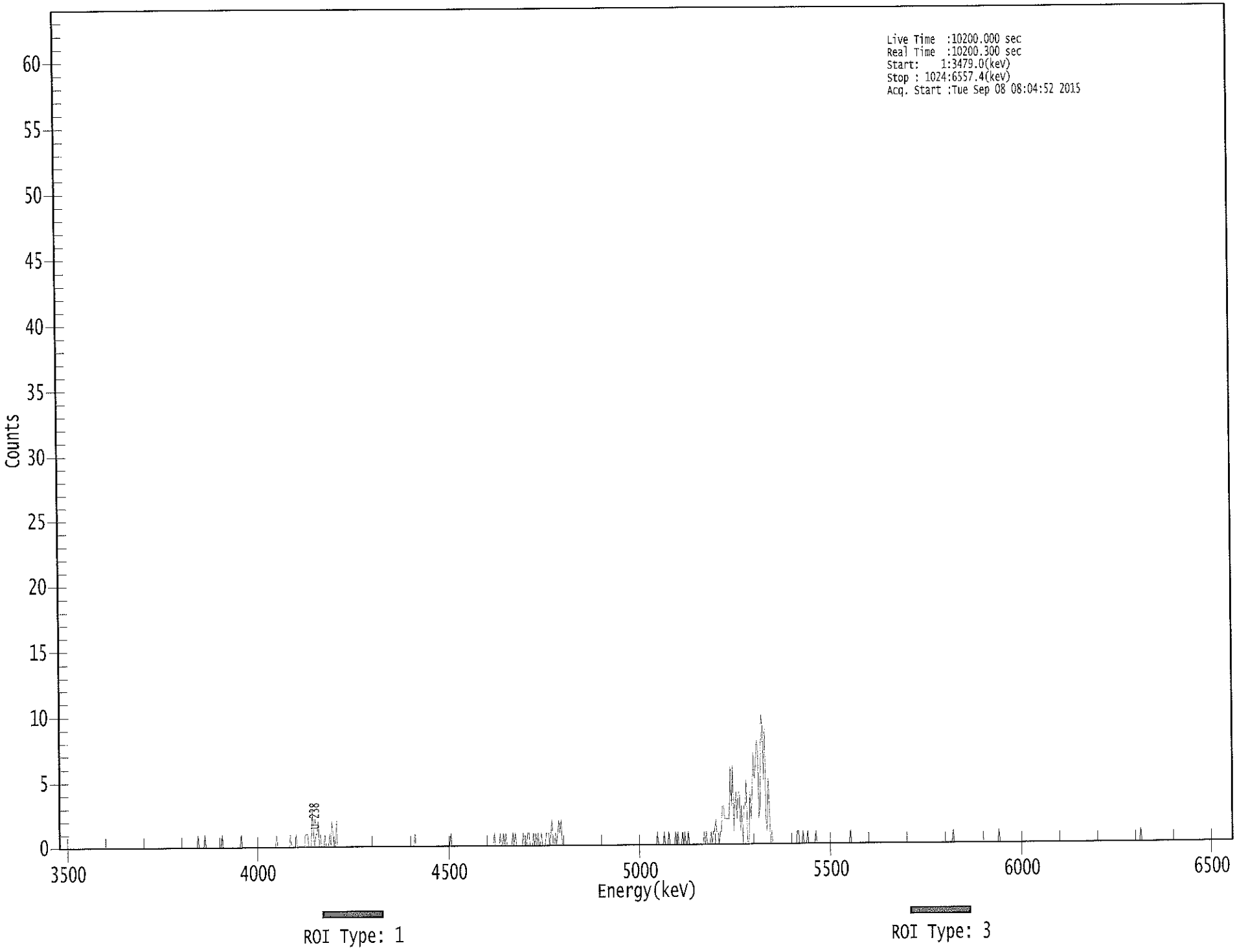
0000128100.CNF



```
*****************************************************
*****   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:	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	1	0	0	0	0	0	1
129:	0	0	0	0	0	0	0	0
137:	0	0	0	0	0	0	1	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	1
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	1	0
193:	0	0	0	0	0	0	0	0
201:	0	0	1	0	0	0	0	1
209:	0	0	0	0	0	0	0	1
217:	1	1	0	0	0	3	1	0
225:	1	1	2	0	1	0	0	0
233:	1	0	0	0	1	0	2	1
241:	0	0	2	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	1	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	1	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	1	0	0	0	0
385:	1	0	0	1	0	1	0	0
393:	0	0	0	1	0	1	0	0
401:	0	0	0	0	1	0	0	0
409:	1	1	0	0	0	1	0	1
417:	0	1	0	0	1	0	0	0
425:	1	1	1	0	1	2	0	0
433:	1	0	1	2	1	2	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	1	0	0	0	0	0	1
529:	0	0	0	1	0	0	0	0
537:	0	1	0	1	0	0	0	1
545:	0	1	0	0	1	0	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	1	0	1	0	0	0
569:	1	0	1	1	2	1	1	0
577:	1	1	3	3	2	2	2	2
585:	2	6	3	6	1	3	4	2
593:	4	4	1	3	0	3	3	5
601:	0	0	4	2	4	7	5	6
609:	8	7	2	3	10	9	5	9
617:	2	1	5	3	0	1	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	1	1	0	0	0
649:	1	0	0	0	1	0	0	0
657:	0	0	0	1	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	1	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	1	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 07

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	1	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	1	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™

KB 9/9/15

Sample Description: ENGWESA005
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 08
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_047
Chamber Serial Number: 02030596A
Detector Serial Number: 91086
Env. Background: System Bkgd 128412
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:55 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: 0.1654 +/- 0.0101
Counting Efficiency: 0.1650 +/- 0.0029 on 10/25/2014 3:23:35 PM
Chem. Recovery Factor: 1.0024 +/- 0.0637

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	313.32	11.09	0.68	0.00E+000	35.4
U-234		4.716	52.66	27.11	0.34	0.00E+000	8.9
U-235		4.349	0.66	305.43	0.34	0.00E+000	3.0
U-238		4.138	45.32	29.37	0.68	0.00E+000	8.9

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.996	5302.50*	1.29E+001 +/- 1.54E+000	2.32E-001 +/- 2.77E-002
U-234	0.985	4761.50*	2.16E+000 +/- 6.39E-001	1.96E-001 +/- 2.34E-002
U-235	0.991	4385.50*	3.33E-002 +/- 1.02E-001	2.41E-001 +/- 2.89E-002
U-238	0.985	4184.40*	1.85E+000 +/- 5.86E-001	2.30E-001 +/- 2.75E-002

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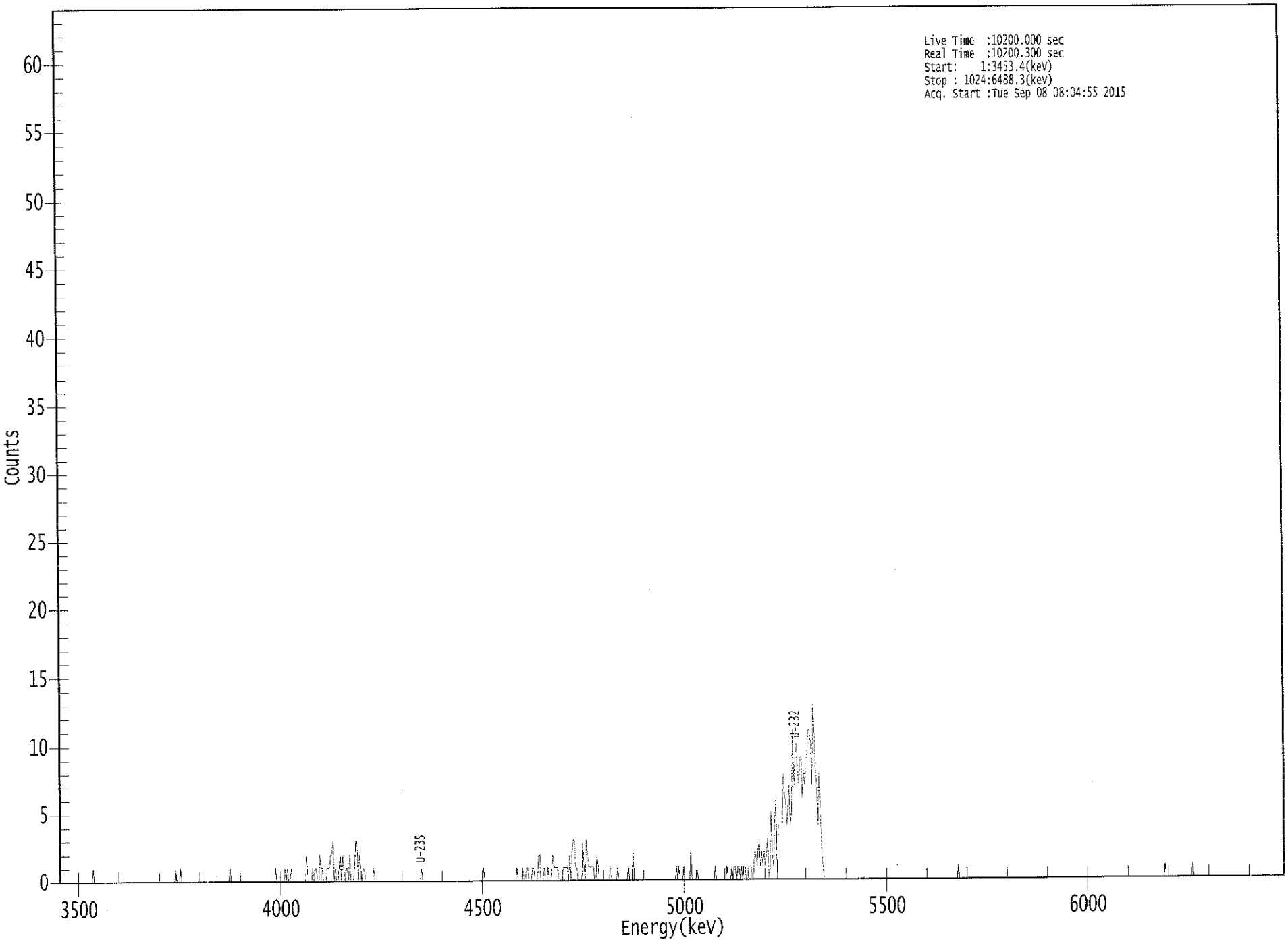
0000128110.CNF



22100 :

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

Sample Title: 08

Elapsed Live time: 10200
Elapsed Real Time: 10200

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

369:	0	0	0	0	0	0	0	0

Sample Title: 08

Channel								
377:	0	0	0	0	0	0	1	0
385:	0	0	0	1	0	0	1	1
393:	0	0	0	1	1	0	0	0
401:	2	2	0	0	0	1	0	0
409:	1	0	0	1	2	1	1	1
417:	1	0	0	0	0	1	1	1
425:	1	0	2	0	2	3	3	1
433:	1	0	0	0	0	3	1	0
441:	3	2	1	1	1	1	1	0
449:	0	2	1	0	0	0	0	0
457:	0	0	0	0	1	0	0	0
465:	0	0	1	0	0	0	0	0
473:	0	0	0	1	0	0	0	2
481:	0	0	0	0	0	0	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	1	0	1	0	0
521:	0	1	0	0	0	0	0	2
529:	0	0	0	0	1	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	1	0	0	0	0
553:	0	0	0	0	0	1	0	0
561:	0	1	0	1	1	0	1	1
569:	0	1	0	1	1	0	0	1
577:	1	1	0	0	2	2	1	2
585:	3	1	2	1	2	1	2	3
593:	0	1	5	2	1	4	6	0
601:	4	4	4	4	8	6	6	4
609:	5	7	4	5	11	7	9	10
617:	8	7	9	9	6	8	7	9
625:	9	11	11	10	7	13	11	8
633:	7	4	8	5	2	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	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	1	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 08

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

KB
9/8/15

Apex-Alpha™

Sample Description: ENGWESA006
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 09
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_048
Chamber Serial Number: 02030596B
Detector Serial Number: 83111
Env. Background: System Bkgd 128413
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:04:58 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.600 mL
Effective Efficiency: 0.1709 +/- 0.0103
Counting Efficiency: 0.1700 +/- 0.0030 on 10/25/2014 3:27:02 PM
Chem. Recovery Factor: 1.0053 +/- 0.0632

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	5.283	322.98	10.93	1.02	0.00E+000	28.5
U-234		4.743	30.32	36.06	0.68	0.00E+000	5.9
U-235		4.398	-0.51	400.63	0.51	0.00E+000	0.0
U-238		4.146	27.49	37.79	0.51	0.00E+000	5.9

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.997	5302.50*	1.28E+001 +/- 1.52E+000	2.50E-001 +/- 2.96E-002
U-234	0.998	4761.50*	1.20E+000 +/- 4.56E-001	2.23E-001 +/- 2.64E-002
U-235	0.999	4385.50*	-2.49E-002 +/- 9.99E-002	2.56E-001 +/- 3.03E-002
U-238	0.990	4184.40*	1.08E+000 +/- 4.29E-001	2.07E-001 +/- 2.45E-002

AG
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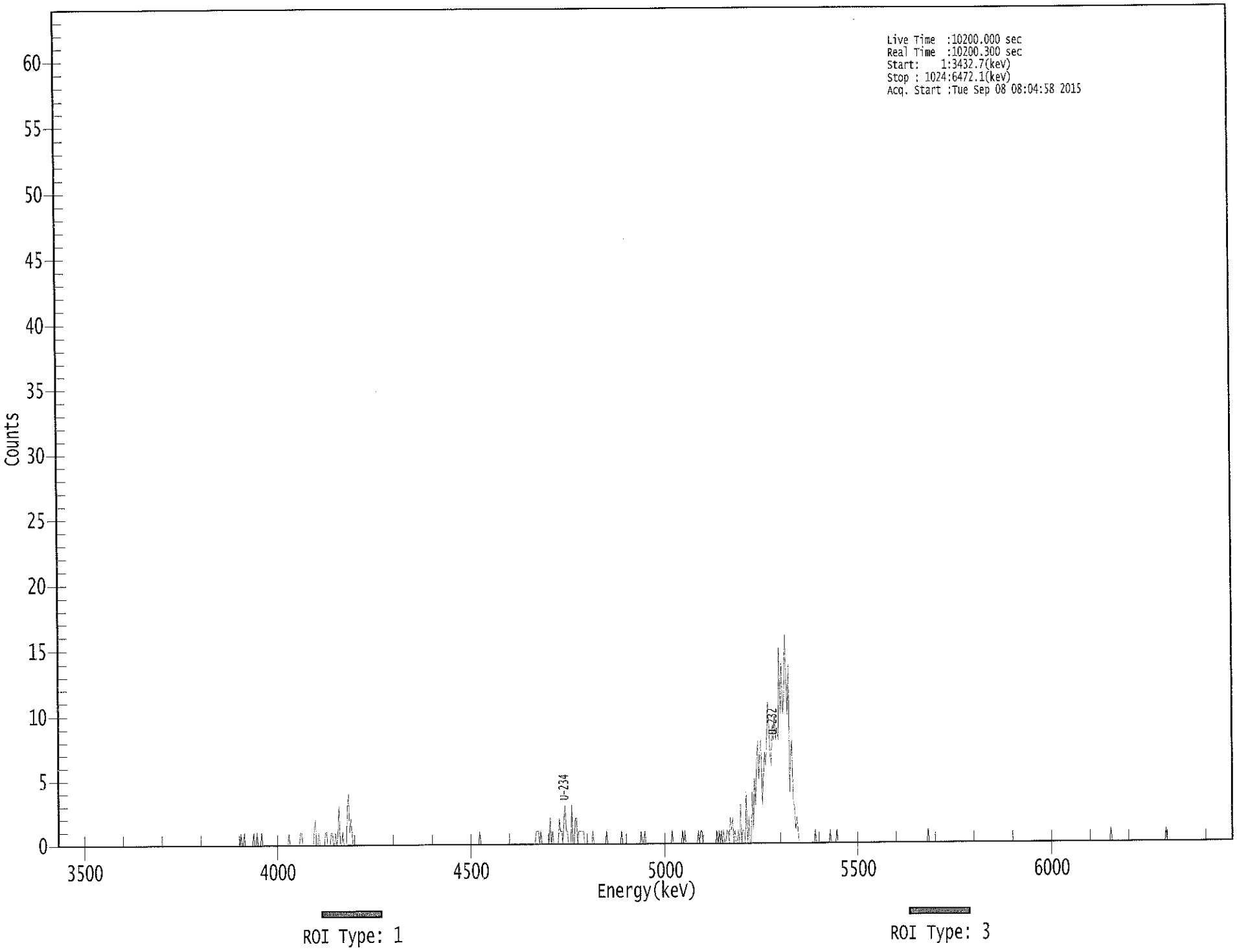
0000128111.CNF



12/08/15

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

Sample Title: 09

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
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	1	0	0	0	0	0
169:	0	0	1	0	0	1	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	1	0	0	0	0	0	0
209:	0	0	0	1	1	0	0	0
217:	0	0	0	0	0	0	0	1
225:	2	0	0	1	0	0	0	0
233:	0	1	1	0	0	0	1	1
241:	0	0	1	0	1	3	0	0
249:	1	0	0	0	3	4	1	2
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	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: 09

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:	1	1	1	0	1	0	0	0
425:	0	0	0	0	2	0	1	0
433:	0	0	0	0	2	1	1	0
441:	2	3	1	1	0	0	0	3
449:	0	0	2	2	0	1	1	1
457:	1	1	0	0	0	0	0	0
465:	0	1	0	0	0	0	0	0
473:	0	0	0	0	0	1	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	1	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	1	0	0	1	0
513:	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	1	0
537:	0	0	0	0	0	0	0	1
545:	0	1	0	0	0	0	0	0
553:	0	0	0	0	0	1	0	1
561:	1	0	0	0	0	0	0	0
569:	0	0	0	0	0	1	0	1
577:	0	1	0	1	0	0	1	1
585:	0	2	1	2	0	1	0	0
593:	1	0	3	0	1	1	0	4
601:	0	2	0	0	4	1	5	3
609:	6	8	5	7	8	3	5	7
617:	6	8	11	9	7	6	9	8
625:	10	8	9	8	15	10	14	10
633:	11	16	13	10	14	4	7	8
641:	3	3	1	2	1	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	1	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	1	0	0	0	0	0	1	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	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	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	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 09

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

KB 9/8/15

Sample Description: ENGWESA007
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 10
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_049
Chamber Serial Number: 10006121A
Detector Serial Number: 49
Env. Background: System Bkgd 128414
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:05:26 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.598 mL
Effective Efficiency: 0.1686 +/- 0.0102
Counting Efficiency: 0.1525 +/- 0.0027 on 12/13/2014 2:45:02 PM
Chem. Recovery Factor: 1.1055 +/- 0.0700

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	5.280	317.66	11.00	0.34	0.00E+000	31.5
U-234		4.741	46.49	28.93	0.51	0.00E+000	3.5
U-235		4.368	3.00	130.67	0.00	0.00E+000	3.0
U-238		4.145	42.98	30.31	1.02	0.00E+000	4.3

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.996	5302.50*	1.28E+001 +/- 1.52E+000	1.93E-001 +/- 2.29E-002
U-234	0.997	4761.50*	1.87E+000 +/- 5.84E-001	2.11E-001 +/- 2.51E-002
U-235	0.998	4385.50*	1.49E-001 +/- 1.95E-001	2.97E-001 +/- 3.53E-002
U-238	0.989	4184.40*	1.72E+000 +/- 5.60E-001	2.52E-001 +/- 3.00E-002

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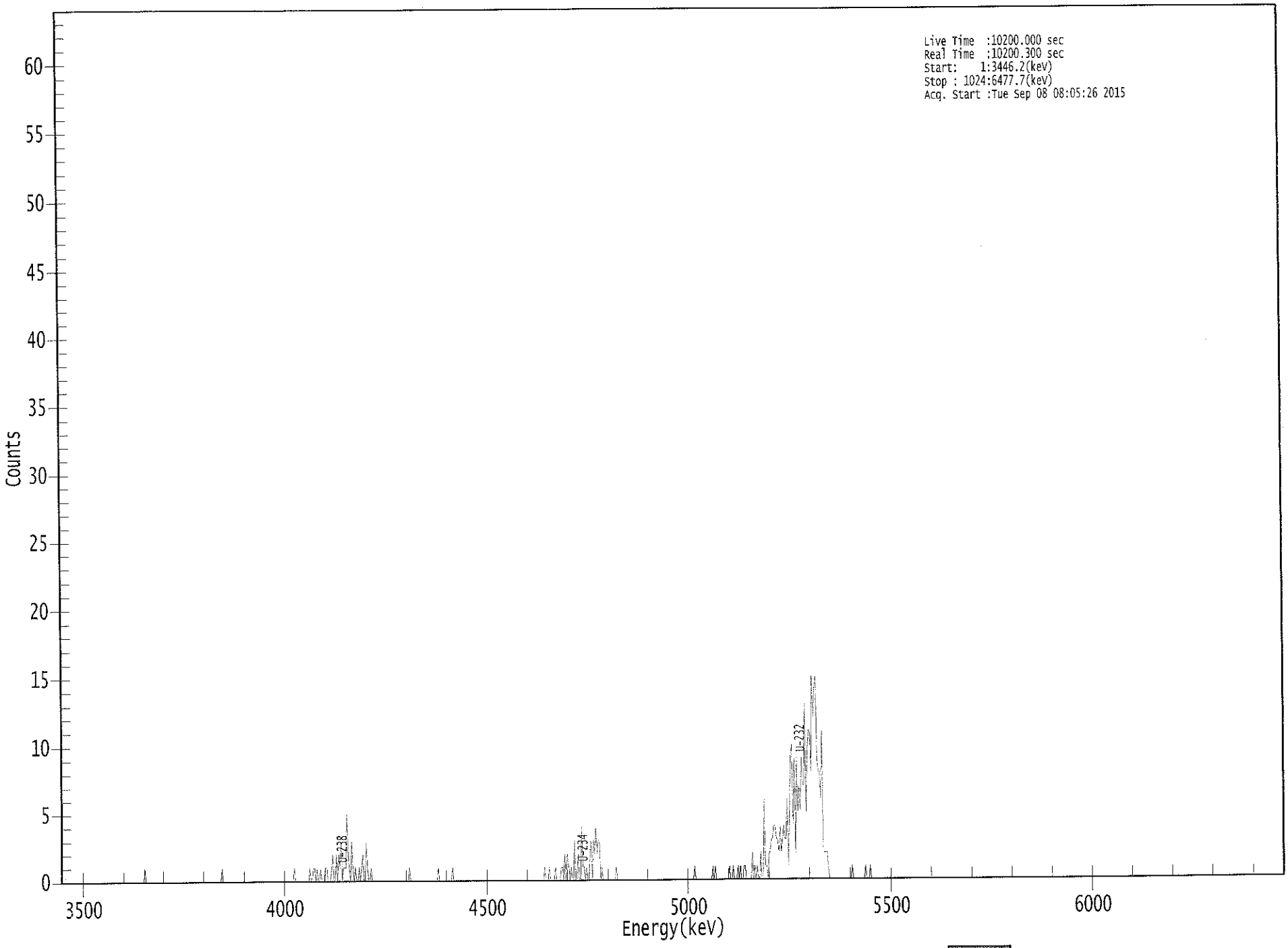
0000128112.CNF



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

Sample Title: 10

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel							
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	1	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	1
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	1	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	1	0	0	1	1	0	1	0
217:	0	1	0	0	0	1	1	0
225:	0	0	1	2	0	0	2	0
233:	2	1	3	0	1	1	1	5
241:	2	1	0	3	1	0	1	0
249:	0	1	0	1	2	0	0	3
257:	1	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	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	0	0	0
313:	0	0	0	1	0	0	0	0
321:	0	0	0	0	0	0	0	1
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 10

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	1	0	0	0
409:	1	0	0	0	0	1	0	0
417:	0	0	1	1	0	2	0	2
425:	1	0	1	0	0	3	0	0
433:	2	0	0	4	1	1	0	1
441:	0	0	2	3	0	3	2	4
449:	2	3	3	0	1	0	0	0
457:	0	0	0	0	0	0	0	0
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	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	1	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	1	0	1	0	0	0	0
553:	0	0	0	0	0	0	0	1
561:	0	0	1	0	0	0	1	0
569:	1	0	0	1	1	0	0	0
577:	0	0	2	0	1	0	1	0
585:	0	2	0	0	6	1	1	0
593:	2	2	3	3	4	4	3	3
601:	2	4	2	3	4	3	3	6
609:	1	5	9	10	4	9	2	9
617:	5	7	5	9	7	7	13	5
625:	9	11	11	8	15	12	14	15
633:	9	8	8	6	11	2	2	2
641:	2	1	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	1	0	0
665:	0	0	0	0	0	0	0	0
673:	1	0	0	0	1	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	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: 10

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

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Apex-Alpha™

Sample Description: ENGWESA008
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 11
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_050
Chamber Serial Number: 10006121B
Detector Serial Number: 50
Env. Background: System Bkgd 128415
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:05:28 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.598 mL
Effective Efficiency: 0.1579 +/- 0.0099
Counting Efficiency: 0.1428 +/- 0.0026 on 12/13/2014 2:43:59 PM
Chem. Recovery Factor: 1.1063 +/- 0.0719

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	5.280	297.49	11.38	0.51	0.00E+000	28.1
U-234		4.729	26.32	38.78	0.68	0.00E+000	6.7
U-235		4.427	6.32	82.73	0.68	0.00E+000	3.0
U-238		4.155	45.83	29.01	0.17	0.00E+000	4.9

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.997	5302.50*	1.28E+001 +/- 1.57E+000	2.26E-001 +/- 2.76E-002
U-234	0.993	4761.50*	1.13E+000 +/- 4.59E-001	2.42E-001 +/- 2.96E-002
U-235	0.988	4385.50*	3.34E-001 +/- 2.80E-001	2.98E-001 +/- 3.65E-002
U-238	0.994	4184.40*	1.96E+000 +/- 6.16E-001	1.78E-001 +/- 2.18E-002

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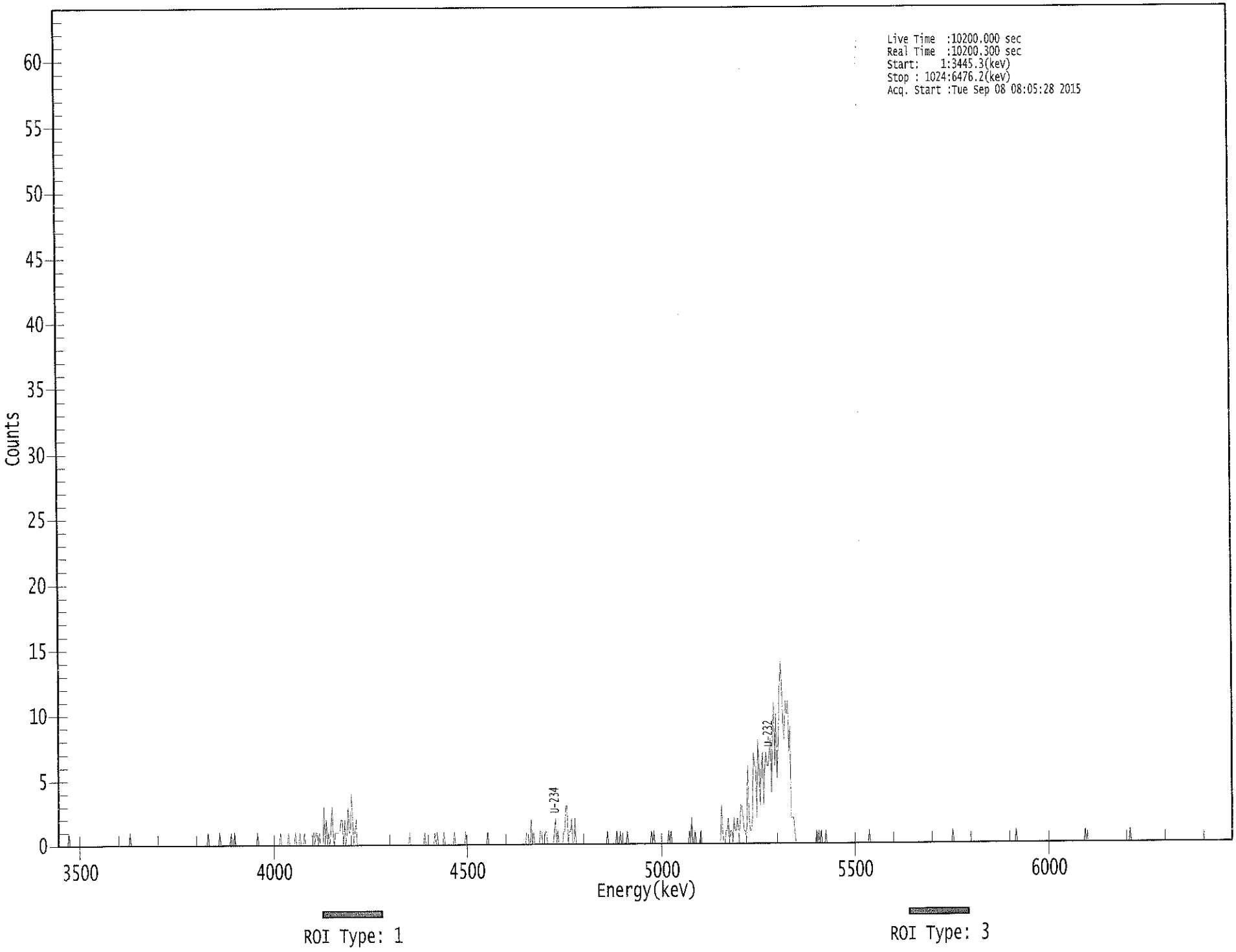
0000128113.CNF



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

Sample Title: 11

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel							
1:	0	0	0	0	0	0	0	0
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	0	0	0	0
57:	0	0	0	0	0	0	1	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	1	0	0	0	0	0
137:	0	0	0	0	1	0	0	0
145:	0	0	0	0	0	0	1	0
153:	0	1	0	0	0	0	0	0
161:	0	0	0	0	0	0	0	0
169:	0	0	0	0	0	1	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	1	0	0	0	0	0	0
201:	1	0	0	0	0	0	1	0
209:	0	0	1	0	0	0	1	0
217:	0	0	0	0	0	0	1	0
225:	1	1	0	1	0	0	0	3
233:	0	2	0	1	0	1	3	1
241:	0	1	1	1	1	1	2	2
249:	0	2	0	1	3	1	1	4
257:	2	0	1	2	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	1	0	0	0	0	0
313:	0	0	0	0	0	0	0	1
321:	0	0	0	0	0	0	0	0
329:	1	0	1	0	0	0	0	0
337:	1	0	0	0	0	0	0	0
345:	0	1	0	0	0	0	0	0
353:	0	0	0	1	0	0	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	1	0

Sample Title: 11

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	1	0	0	2	0	1	0
417:	0	0	0	0	1	1	0	0
425:	1	1	0	0	0	0	0	0
433:	1	2	0	1	0	0	0	0
441:	1	1	3	3	0	1	1	2
449:	0	0	2	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	0	0	0	0	1	0
489:	0	1	0	0	0	0	0	1
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	1	0	1	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	1	0	1	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	1	0	2
553:	0	0	1	0	0	0	0	1
561:	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	3	1	0	0	1	1	2
585:	0	1	1	0	2	1	1	2
593:	1	1	3	3	2	1	1	0
601:	6	2	1	1	2	7	6	6
609:	2	8	6	3	6	7	3	6
617:	7	6	6	7	8	4	9	11
625:	6	10	5	9	12	14	12	9
633:	8	11	10	11	7	9	2	2
641:	2	1	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	1	0	1	0
665:	1	0	0	0	1	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	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	1	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: 11

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	1	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	1	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	1	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™

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Sample Description: ENGWESA009
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 12
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_051
Chamber Serial Number: 10006123A
Detector Serial Number: 51
Env. Background: System Bkgd 128416
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:05:30 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: 0.1960 +/- 0.0112
Counting Efficiency: 0.1524 +/- 0.0027 on 12/13/2014 2:42:37 PM
Chem. Recovery Factor: 1.2859 +/- 0.0768

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	5.285	371.11	10.22	2.89	0.00E+000	28.3
U-234		4.735	45.79	29.77	2.21	0.00E+000	4.9
U-235		4.384	1.49	190.02	0.51	0.00E+000	3.0
U-238		4.167	25.83	38.71	0.17	0.00E+000	3.7

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.998	5302.50*	1.29E+001 +/- 1.44E+000	3.03E-001 +/- 3.39E-002
U-234	0.995	4761.50*	1.58E+000 +/- 5.03E-001	2.76E-001 +/- 3.09E-002
U-235	1.000	4385.50*	6.35E-002 +/- 1.21E-001	2.24E-001 +/- 2.50E-002
U-238	0.998	4184.40*	8.89E-001 +/- 3.58E-001	1.44E-001 +/- 1.60E-002

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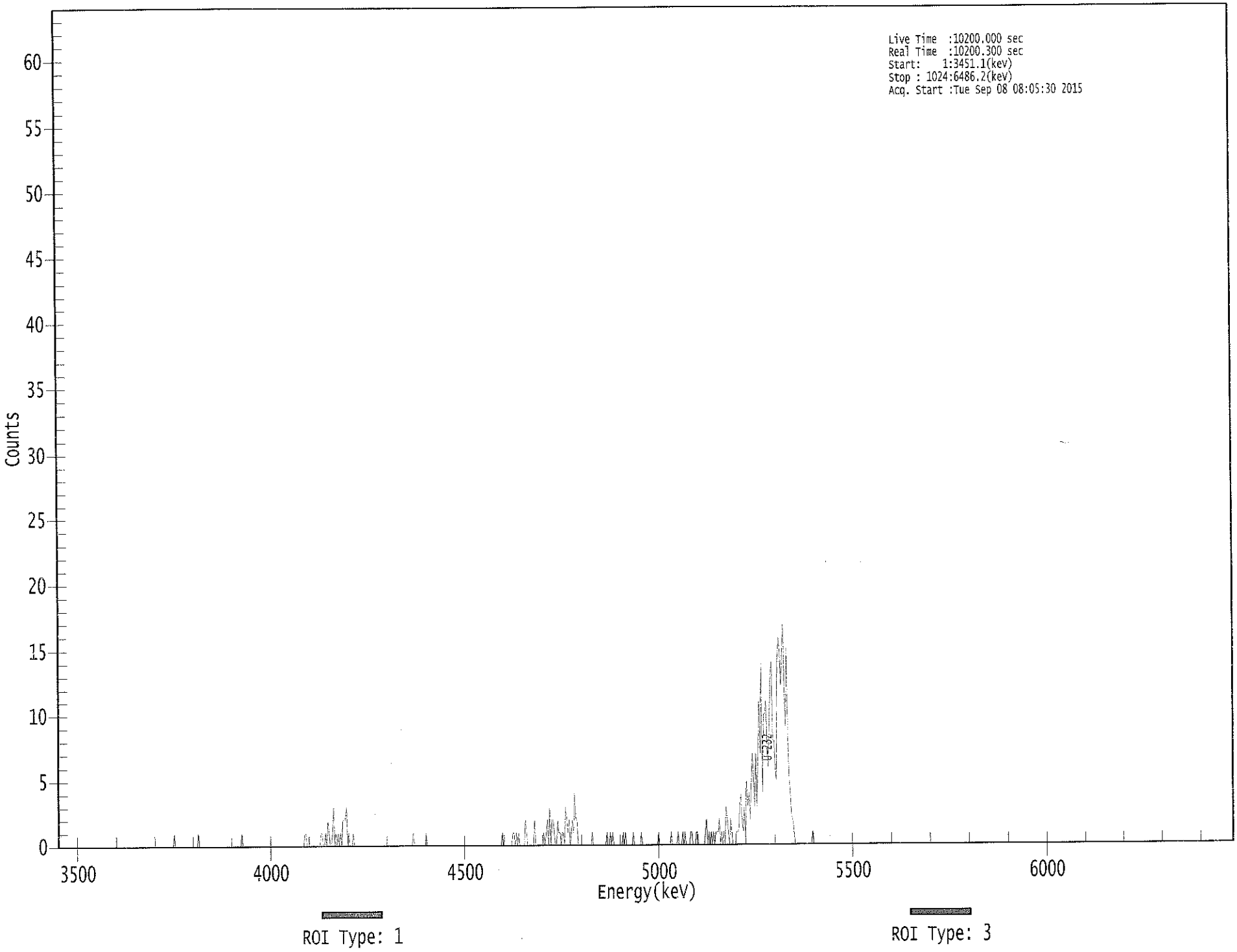
0000128114.CNF



00142

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

Sample Title: 12

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	1	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	1	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:	1	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	1	1	0
233:	0	1	0	2	1	0	0	1
241:	3	0	1	0	1	0	1	0
249:	2	2	2	3	0	1	0	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	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	1	0	0
313:	0	0	0	0	0	0	0	0
321:	1	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	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: 12

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	1	0	0	0	0	0
393:	0	0	0	1	1	0	1	0
401:	1	0	0	0	0	0	2	1
409:	0	0	0	0	0	0	2	0
417:	0	0	0	0	0	0	1	0
425:	1	2	0	3	0	2	2	1
433:	0	0	2	1	1	0	1	1
441:	0	3	2	1	2	0	1	2
449:	1	4	2	2	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	1	0	0	0	0	0	0	0
473:	0	0	0	0	0	1	0	0
481:	1	0	1	0	0	0	0	0
489:	0	0	0	1	0	1	0	0
497:	0	0	0	0	1	0	0	0
505:	0	0	0	1	0	0	0	0
513:	0	0	0	0	0	0	0	0
521:	0	0	1	0	0	0	0	0
529:	0	0	0	0	0	1	0	0
537:	0	0	0	1	0	0	0	1
545:	0	1	0	0	0	0	1	1
553:	0	0	0	1	1	0	0	0
561:	0	0	0	1	2	0	1	0
569:	1	0	1	0	1	1	1	2
577:	0	1	0	1	0	3	2	1
585:	0	2	1	0	0	0	1	1
593:	1	3	4	2	1	3	0	5
601:	3	4	2	5	7	5	3	7
609:	3	7	11	7	14	4	10	10
617:	11	7	6	10	13	14	8	8
625:	6	5	14	16	15	12	15	17
633:	12	9	15	8	5	4	2	2
641:	1	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	1	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	0	0	0
793:	0	0	0	0	0	0	0	0

801:	0	0	0	0	0	0	0	0

Sample Title: 12

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

KB
9/8/15

Apex-Alpha™

Sample Description: ENGWESA010
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 13
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_052
Chamber Serial Number: 10006123B
Detector Serial Number: 52
Env. Background: System Bkgd 128417
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:05:31 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.600 mL
Effective Efficiency: 0.1775 +/- 0.0105
Counting Efficiency: 0.1607 +/- 0.0029 on 12/13/2014 2:40:57 PM
Chem. Recovery Factor: 1.1048 +/- 0.0684

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	5.280	335.49	10.71	0.51	0.00E+000	18.3
U-234		4.746	61.32	25.19	0.68	0.00E+000	14.7
U-235		4.380	4.32	102.62	0.68	0.00E+000	2.9
U-238		4.163	44.15	29.83	0.85	0.00E+000	8.1

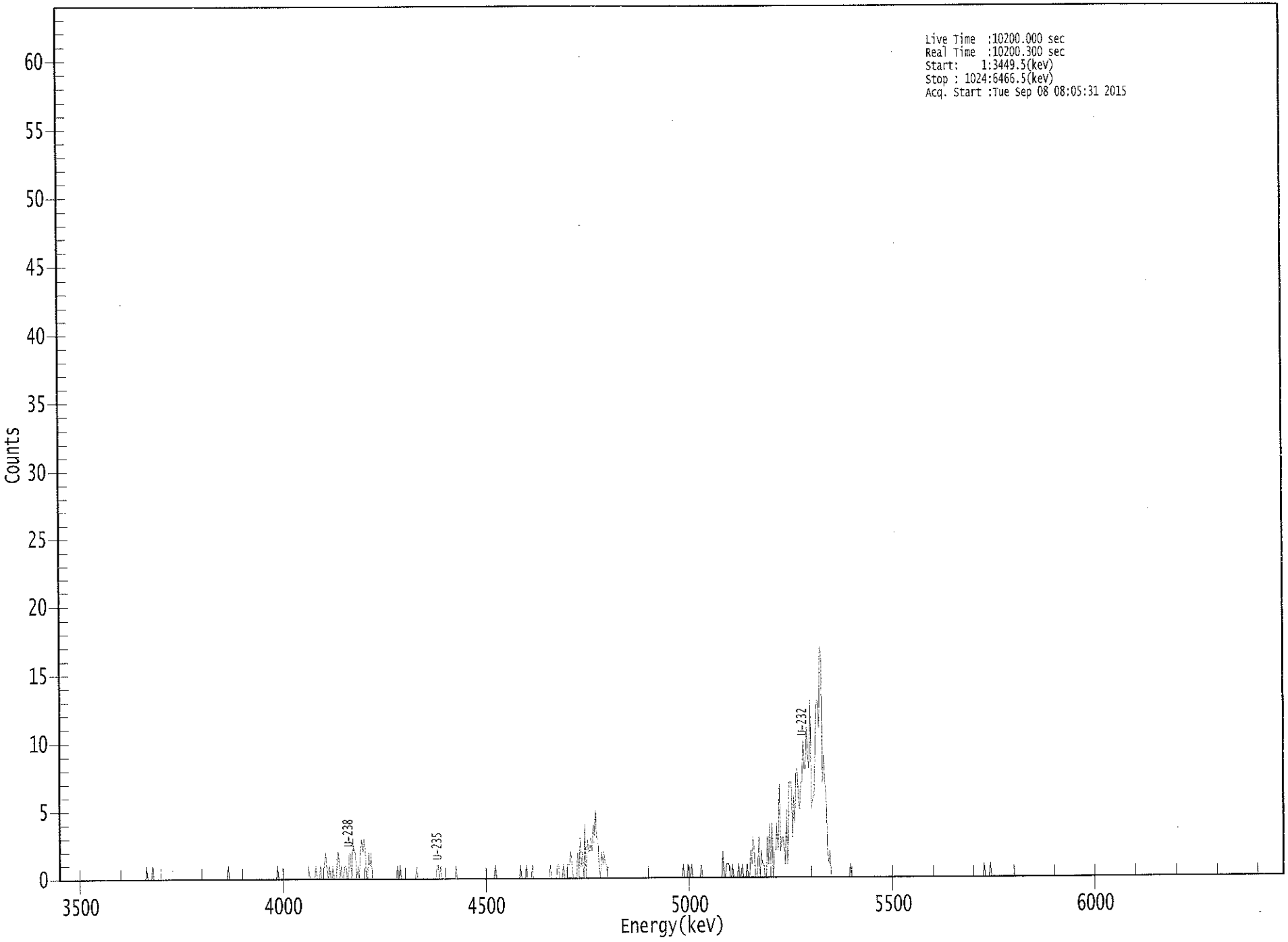
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.996	5302.50*	1.28E+001 +/- 1.49E+000	2.01E-001 +/- 2.33E-002
U-234	0.998	4761.50*	2.34E+000 +/- 6.49E-001	2.15E-001 +/- 2.50E-002
U-235	1.000	4385.50*	2.03E-001 +/- 2.10E-001	2.66E-001 +/- 3.09E-002
U-238	0.997	4184.40*	1.68E+000 +/- 5.37E-001	2.27E-001 +/- 2.64E-002

AG
9/8/15

0000128101.CNF



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

Sample Title: 13

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	0	0	0	0	0	0	0	0
9:	0	0	0	0	0	0	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	0	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	0	0
49:	0	0	0	0	0	0	0	0
57:	0	0	0	0	0	0	0	0
65:	0	0	0	0	0	0	0	0
73:	0	1	0	0	0	0	1	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	1	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	1	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:	1	0	0	0	0	0	1	0
217:	0	0	1	0	0	1	2	1
225:	0	1	0	0	1	0	0	0
233:	2	2	0	1	0	0	1	1
241:	0	0	2	2	0	3	2	2
249:	0	1	0	2	3	2	3	2
257:	0	0	2	1	2	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	1	0	1	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	1	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	1	1	0	1	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	1	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	1	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 13

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	1	0	0	0	0	1	0
393:	0	0	0	1	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	1	0	0	0	0	0
417:	1	1	0	0	0	1	0	0
425:	1	1	1	2	1	0	0	0
433:	0	2	0	3	1	2	0	4
441:	0	3	2	2	3	2	4	3
449:	5	3	3	1	0	2	1	2
457:	1	1	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	1	0	0	0	1	0	0
529:	1	0	0	0	0	0	0	0
537:	1	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	0	0	2	0	0	1	1	1
561:	0	0	1	0	0	0	0	1
569:	0	0	1	0	0	0	1	0
577:	0	2	1	3	2	0	0	1
585:	3	0	2	1	1	0	0	3
593:	1	4	1	4	0	2	2	4
601:	2	7	2	3	3	2	1	5
609:	1	7	7	7	3	6	4	8
617:	8	6	5	7	7	10	8	8
625:	11	9	8	13	5	6	6	10
633:	13	13	11	17	16	7	9	7
641:	6	2	1	2	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	1	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	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	1	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:	0	0	0	0	0	0	0	0

Sample Title: 13

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

KB 9/8/15

Sample Description: ENGWESA011
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 14
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_053
Chamber Serial Number: 10006122A
Detector Serial Number: 53
Env. Background: System Bkgd 128418
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:05:33 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.599 mL
Effective Efficiency: 0.1824 +/- 0.0107
Counting Efficiency: 0.1455 +/- 0.0026 on 12/13/2014 2:39:33 PM
Chem. Recovery Factor: 1.2535 +/- 0.0769

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	5.286	344.32	10.57	0.68	0.00E+000	24.4
U-234		4.724	31.81	35.50	1.19	0.00E+000	3.5
U-235		4.448	1.83	152.56	0.17	0.00E+000	3.0
U-238		4.161	28.83	36.63	0.17	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.998	5302.50*	1.28E+001 +/- 1.47E+000	2.10E-001 +/- 2.42E-002
U-234	0.990	4761.50*	1.18E+000 +/- 4.41E-001	2.45E-001 +/- 2.81E-002
U-235	0.973	4385.50*	8.38E-002 +/- 1.28E-001	1.91E-001 +/- 2.20E-002
U-238	0.996	4184.40*	1.07E+000 +/- 4.09E-001	1.54E-001 +/- 1.77E-002

AG
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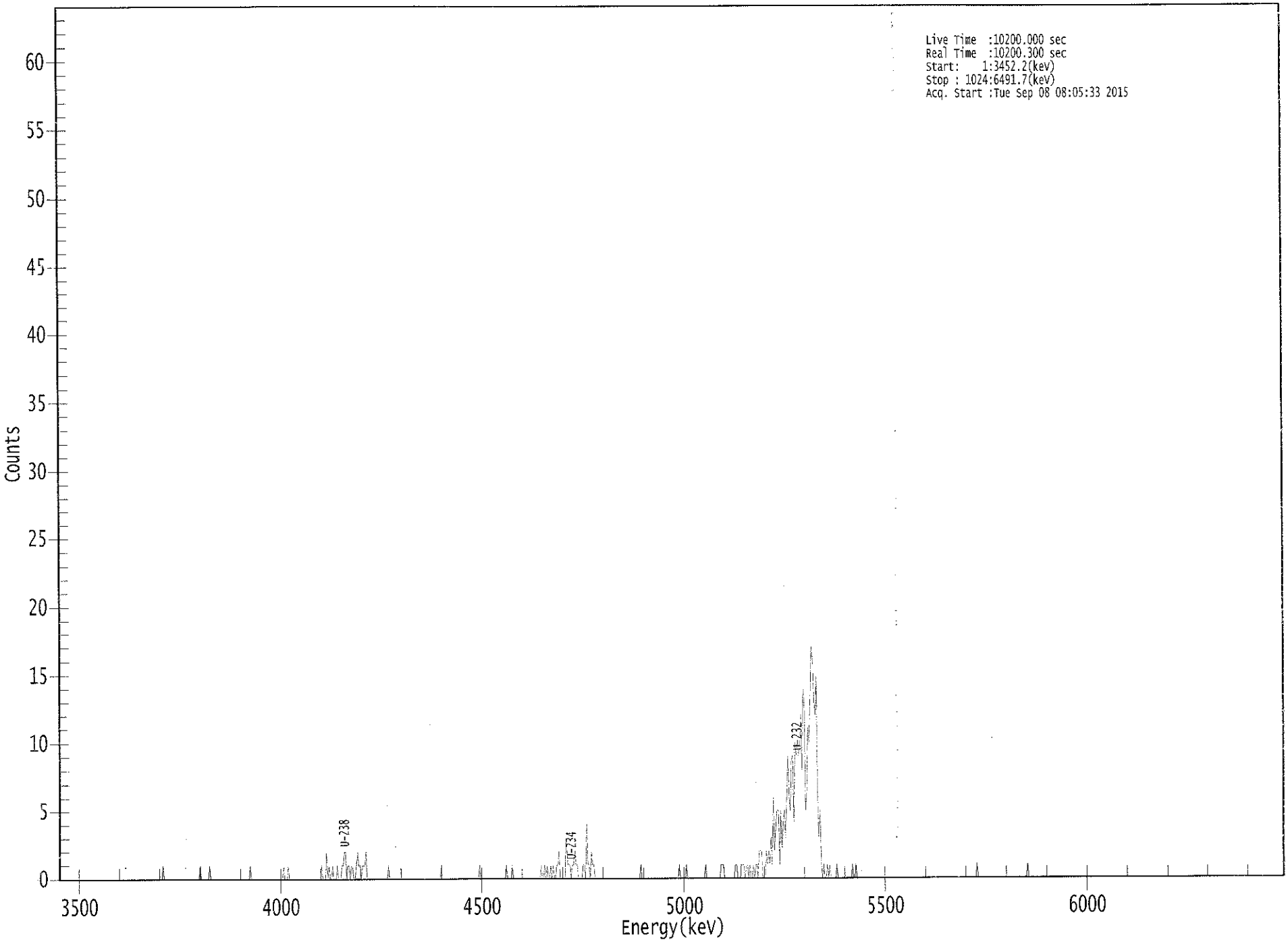
0000128102.CNF



: 00152

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

Sample Title: 14

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	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	1	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	1	0	0
121:	0	0	0	0	0	1	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	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	1	0	0	0	2
225:	0	1	0	0	1	0	0	0
233:	1	0	0	0	1	1	2	2
241:	0	1	1	0	1	1	0	0
249:	1	2	1	1	0	1	1	1
257:	2	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	1	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	1
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	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	1	0	0

Sample Title: 14

Channel								
377:	0	0	1	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	1	0	0	1	0	1
409:	0	0	1	0	1	0	0	1
417:	1	2	0	0	0	0	0	3
425:	1	1	1	0	1	1	2	1
433:	1	0	0	0	0	1	1	0
441:	4	1	1	0	2	1	1	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	1	0	0
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	0	0	0	0	0	0	0
513:	0	0	0	0	0	1	0	0
521:	0	0	0	1	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	1	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	1	1	1	0	0	0	0	0
561:	0	0	0	0	1	1	0	0
569:	0	1	1	1	0	1	1	0
577:	1	0	0	1	0	1	1	0
585:	2	2	2	0	0	0	2	1
593:	2	1	3	1	6	2	4	5
601:	5	1	5	2	4	5	3	6
609:	9	6	5	9	9	4	10	9
617:	10	9	10	12	8	14	13	5
625:	6	11	10	14	17	16	13	12
633:	15	6	3	5	1	0	1	0
641:	0	1	0	1	0	0	0	0
649:	0	1	0	0	0	0	0	0
657:	0	0	0	0	0	0	1	0
665:	0	1	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	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	1	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: 14

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

NB 9/18/15

Apex-Alpha™

Sample Description: ENGWESA012
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 15
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_054
Chamber Serial Number: 10006122B
Detector Serial Number: 54
Env. Background: System Bkgd 128419
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:05:35 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.600 mL
Effective Efficiency: 0.1586 +/- 0.0099
Counting Efficiency: 0.1452 +/- 0.0026 on 12/13/2014 2:38:19 PM
Chem. Recovery Factor: 1.0924 +/- 0.0708

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	5.283	299.66	11.33	0.34	0.00E+000	13.3
U-234		4.737	36.83	32.38	0.17	0.00E+000	4.3
U-235		4.438	1.66	169.38	0.34	0.00E+000	3.0
U-238		4.153	26.83	37.98	0.17	0.00E+000	3.4

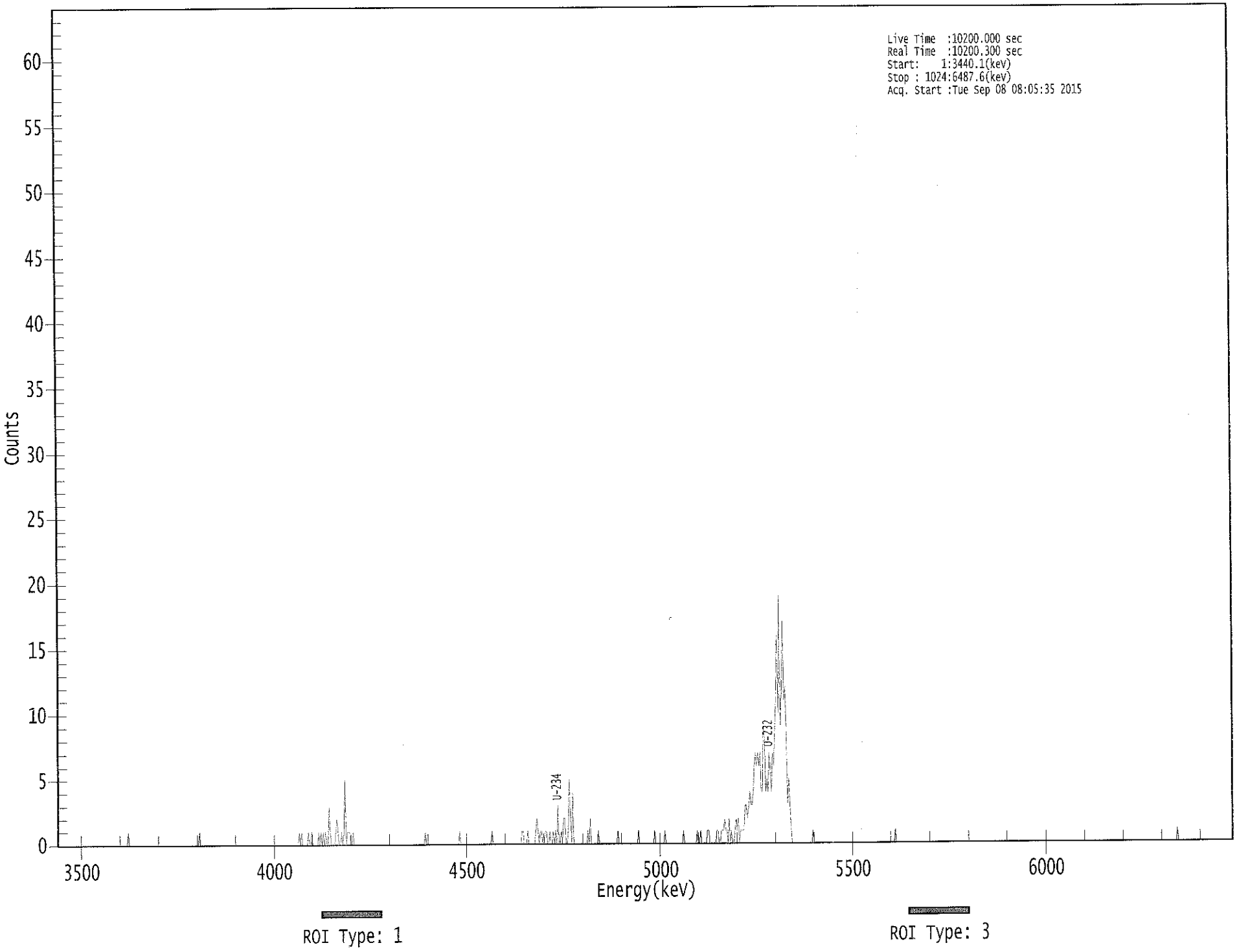
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.997	5302.50*	1.28E+001 +/- 1.57E+000	2.05E-001 +/- 2.50E-002
U-234	0.996	4761.50*	1.57E+000 +/- 5.44E-001	1.78E-001 +/- 2.17E-002
U-235	0.981	4385.50*	8.75E-002 +/- 1.49E-001	2.52E-001 +/- 3.07E-002
U-238	0.993	4184.40*	1.14E+000 +/- 4.55E-001	1.77E-001 +/- 2.16E-002

AG
9/8/15

0000128103.CNF



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

Sample Title: 15

Elapsed Live time: 10200
Elapsed Real Time: 10200

Channel								
1:	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	1	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	1	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	1	0	1	0	0	0
217:	0	0	1	0	0	1	0	0
225:	0	0	0	1	0	1	0	1
233:	0	1	0	0	3	1	0	0
241:	0	0	1	2	1	0	0	1
249:	0	1	5	0	1	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	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0
321:	1	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	1	0
353:	0	0	0	0	0	0	0	0
361:	0	0	0	0	0	0	0	0

369:	0	0	0	0	0	0	0	0

Sample Title: 15

Channel								
377:	0	0	1	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	1	1	0	0
409:	0	1	0	0	0	0	0	0
417:	1	2	1	0	1	1	0	0
425:	1	1	0	0	1	0	0	1
433:	0	1	0	3	0	0	1	0
441:	2	2	0	0	1	5	2	0
449:	4	0	0	0	0	0	0	0
457:	0	0	0	0	0	1	0	2
465:	0	0	0	0	0	0	1	0
473:	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	1
489:	0	0	0	0	0	0	0	0
497:	0	0	0	0	0	0	0	0
505:	0	1	0	0	0	0	0	0
513:	0	0	0	0	0	0	0	1
521:	0	0	0	0	0	0	0	0
529:	1	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	1	0	0	0	0	0	0	0
553:	0	0	0	0	1	0	0	1
561:	0	0	0	0	0	1	1	0
569:	0	0	0	0	0	1	1	0
577:	0	1	1	1	2	1	1	0
585:	2	0	1	0	0	1	2	1
593:	2	0	1	1	1	1	3	3
601:	2	3	4	3	3	4	6	7
609:	6	7	6	7	4	4	9	8
617:	4	5	4	7	6	4	7	6
625:	8	11	16	10	19	9	12	17
633:	11	12	9	3	5	3	1	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	1	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	1	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0
777:	0	0	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: 15

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	0	0
897:	0	0	0	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	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

NB 9/8/15

Apex-Alpha™

Sample Description: ENGWESA013
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-UU
Sample Identification: 16
Sample Geometry: Shelf 2
Procedure Description: U iso

Detector Name: Alpha_055
Chamber Serial Number: 10006124A
Detector Serial Number: 55
Env. Background: System Bkgd 128420
Reagent Blank: <not performed>

Sample Size: 2.840E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:10:54 AM
Acquisition Date/Time: 9/8/2015 8:05:37 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
Tracer Quantity: 0.600 mL
Effective Efficiency: 0.1101 +/- 0.0081
Counting Efficiency: 0.1564 +/- 0.0028 on 12/13/2014 2:35:48 PM
Chem. Recovery Factor: 0.7039 +/- 0.0530

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	5.280	208.15	13.62	0.85	0.00E+000	12.6
U-234		4.733	8.81	71.06	1.19	0.00E+000	3.0
U-235		4.367	0.83	239.53	0.17	0.00E+000	3.0
U-238		4.124	9.49	65.59	0.51	0.00E+000	3.0

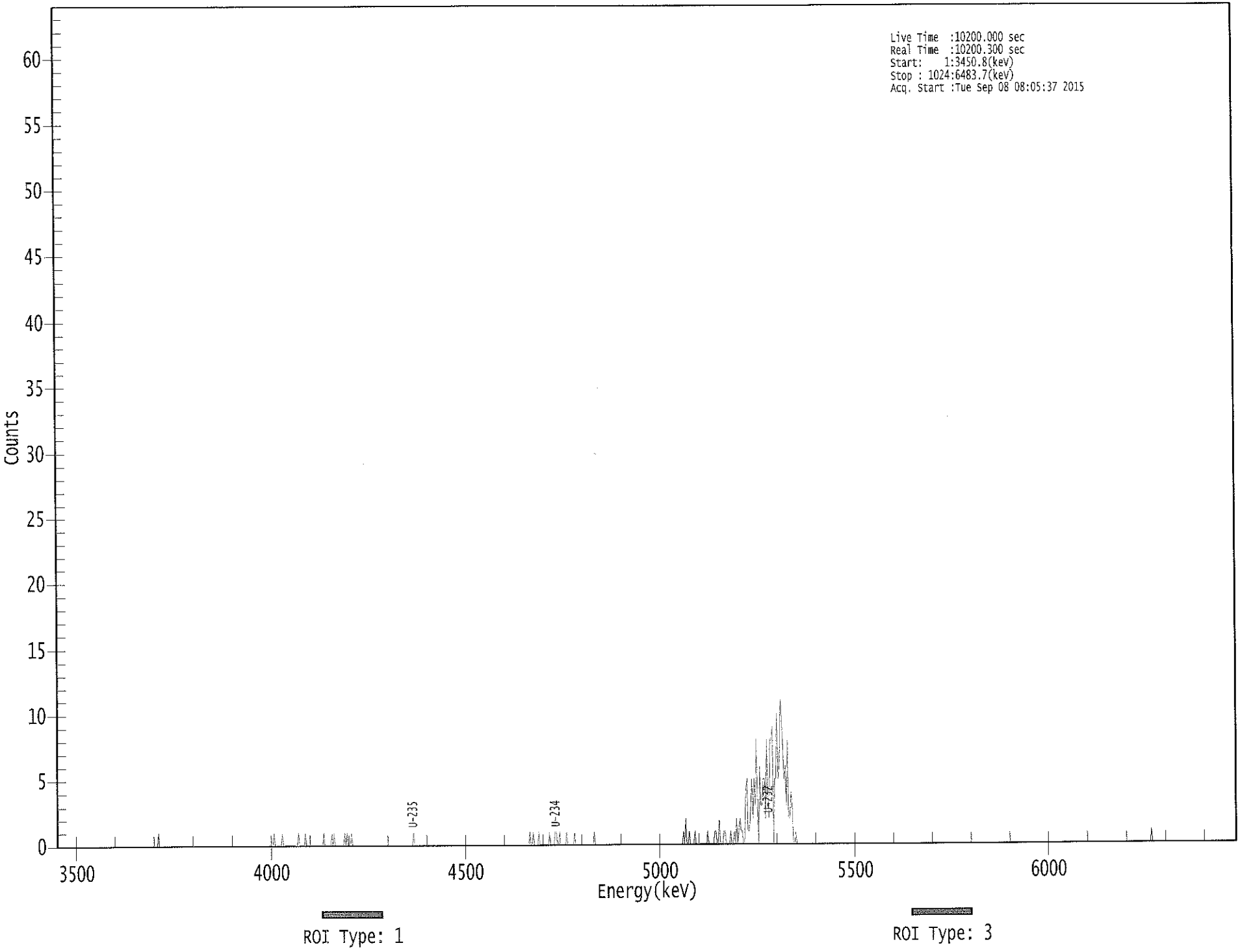
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
U-232	0.996	5302.50*	1.77E+001 +/- 2.54E+000	5.10E-001 +/- 7.31E-002
U-234	0.994	4761.50*	7.48E-001 +/- 5.42E-001	5.59E-001 +/- 8.03E-002
U-235	0.998	4385.50*	8.69E-002 +/- 2.09E-001	4.37E-001 +/- 6.27E-002
U-238	0.974	4184.40*	8.02E-001 +/- 5.39E-001	4.44E-001 +/- 6.36E-002

AG 9/8/15

0000128104.CNF



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

Sample Title: 16

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:	1	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	1	0	0	0
193:	0	0	0	1	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	1	0	0	0	0	0	1
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	1
233:	0	0	0	0	0	0	1	0
241:	1	0	0	0	0	0	0	0
249:	0	1	0	1	0	0	0	1
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	1	0	0
313:	0	0	0	0	0	0	0	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: 16

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	1	0	0
417:	0	0	1	0	0	0	0	0
425:	0	0	0	1	0	0	0	0
433:	1	1	0	0	1	0	0	0
441:	0	0	1	0	0	0	0	0
449:	0	1	0	0	0	0	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	1	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	1
545:	0	2	0	0	1	0	0	0
553:	0	1	0	0	0	0	0	0
561:	0	0	0	0	1	0	0	0
569:	0	0	1	1	0	0	2	0
577:	0	0	1	1	0	0	0	0
585:	1	0	0	1	0	2	0	1
593:	2	1	1	0	0	4	5	1
601:	1	3	5	2	5	3	8	3
609:	0	6	3	3	5	5	2	8
617:	4	2	8	8	9	0	5	5
625:	10	5	6	11	10	7	5	6
633:	3	8	2	2	4	3	0	0
641:	1	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	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: 16

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	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	1	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	0	0	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0

9/8/2015 5:51:19 AM

Apex-Alpha™

QA SUMMARY REPORT

Review Of QA Results - Pulser Check

Date : 9/8/2015
Time : 5:51:19 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_001	21f	ALL	Not Done	
Alpha_002	21f	ALL	Not Done	
Alpha_003	21f	ALL	Passed	9/8/2015 5:18:49 AM
Alpha_004	21f	ALL	Passed	9/8/2015 5:18:50 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	9/8/2015 5:18:51 AM
Alpha_011	21f	ALL	Passed	9/8/2015 5:18:51 AM
Alpha_012	21f	ALL	Passed	9/8/2015 5:18:52 AM
Alpha_013	21f	ALL	Not Done	
Alpha_014	21f	ALL	Passed	9/8/2015 5:18:53 AM
Alpha_015	21f	Peak Energy	Action	9/8/2015 5:18:54 AM
Alpha_016	21f	ALL	Not Done	
Alpha_033	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:18:55 AM
Alpha_034	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:18:57 AM
Alpha_035	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:18:58 AM
Alpha_036	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:18:59 AM
Alpha_037	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:01 AM
Alpha_038	Alpha Analyst100DC	Peak Energy	Action	9/8/2015 5:19:02 AM
Alpha_039	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:04 AM
Alpha_040	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:05 AM
Alpha_041	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:07 AM
Alpha_042	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:09 AM
Alpha_043	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:10 AM
Alpha_044	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:12 AM
Alpha_045	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:14 AM
Alpha_046	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:15 AM
Alpha_047	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:17 AM
Alpha_048	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:19 AM
Alpha_049	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:21 AM
Alpha_050	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:22 AM
Alpha_051	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:24 AM
Alpha_052	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:27 AM
Alpha_053	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:29 AM
Alpha_054	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:32 AM
Alpha_055	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:35 AM
Alpha_056	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:38 AM
Alpha_057	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:41 AM
Alpha_058	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:44 AM

Review of QA Results - Pulser Check

9/8/2015 5:51:19 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_059	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:47 AM
Alpha_060	Alpha Analyst100DC	ALL	Passed	9/8/2015 5:19:50 AM

APPROVED BY: _____

APPROVAL DATE: _____

```
*********************************************************************
*****          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)

15-08106
ThISO
Run 1

Work Order	15-08106
Analysis Code	ThISO
Run	1
Date Received	8/25/2015
Lab Deadline	9/15/2015
Client	Auxier & Associates, Inc.
Project	WESTLAKE
Report Level	4
Activity Units	pCi
Aliquot Units	s
Matrix	AF
Method	EML Th-01 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	Th-229
Radiometric Sol#	Th-18a
Tracer Act (dpm/g)	22.46
Carrier	
Carrier Conc (mg/ml)	

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		08/26/15 00:00	1.0000E+00
02	MBL	BLANK		08/26/15 00:00	1.0000E+00
03	DUP	ENGWESA002	45	05/28/15 08:30	1.9600E-01
04	TRG	ENGWESA001	36	05/27/15 16:12	2.8400E-01
05	DO	ENGWESA002	45	05/28/15 08:30	1.9600E-01
06	TRG	ENGWESA003	36	05/28/15 09:06	3.9200E-01
07	TRG	ENGWESA004	35	05/28/15 09:30	3.9200E-01
08	TRG	ENGWESA005	46	05/27/15 15:08	3.9200E-01
09	TRG	ENGWESA006	43	05/27/15 16:50	3.9200E-01
10	TRG	ENGWESA007	40	05/27/15 12:00	3.9200E-01
11	TRG	ENGWESA008	39	05/27/15 15:38	3.9200E-01
12	TRG	ENGWESA009	41	05/28/15 10:42	3.9200E-01
13	TRG	ENGWESA010	43	05/28/15 11:06	3.9200E-01
14	TRG	ENGWESA011	44	05/27/15 09:10	3.9200E-01
15	TRG	ENGWESA012	42	05/27/15 10:36	3.9200E-01
16	TRG	ENGWESA013	41	05/27/15 11:17	2.8400E-01

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

15-08106
ThISO
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	0.4707	10.6		0.00								
02	MBL	0.2344	5.3		0.00								
03	DUP	0.2343	5.3		0.00								
04	TRG	0.2342	5.3		0.00								
05	DO	0.2339	5.3		0.00								
06	TRG	0.2338	5.3		0.00								
07	TRG	0.2331	5.2		0.00								
08	TRG	0.2340	5.3		0.00								
09	TRG	0.2335	5.2		0.00								
10	TRG	0.2338	5.3		0.00								
11	TRG	0.2316	5.2		0.00								
12	TRG	0.2336	5.2		0.00								
13	TRG	0.2330	5.2		0.00								
14	TRG	0.2336	5.2		0.00								
15	TRG	0.2332	5.2		0.00								
16	TRG	0.2332	5.2		0.00								

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

: 00171

15-08106
ThISO
Run 1

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

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

Eberline Services
Oak Ridge Laboratory

Preliminary Data Report & Analytical Calculations

Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
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/s	5.50E+00	9.10E-01	1.19E-01	4.79E+00	114.72	OK		OK	
02	TH-228	MBL	BLANK	pCi/s	2.62E-02	5.10E-02	9.54E-02					OK	OK
03	TH-228	DUP	ENGWESA002	pCi/s	6.43E-01	5.16E-01	4.62E-01				OK	OK	
04	TH-228	TRG	ENGWESA001	pCi/s	3.89E-01	2.96E-01	3.07E-01					OK	
05	TH-228	DO	ENGWESA002	pCi/s	5.26E-01	4.28E-01	5.01E-01					OK	
06	TH-228	TRG	ENGWESA003	pCi/s	8.91E-01	3.69E-01	1.77E-01					OK	
07	TH-228	TRG	ENGWESA004	pCi/s	1.23E+00	4.45E-01	1.77E-01					OK	
08	TH-228	TRG	ENGWESA005	pCi/s	1.01E+00	4.06E-01	2.55E-01					OK	
09	TH-228	TRG	ENGWESA006	pCi/s	8.19E-01	3.58E-01	1.83E-01					OK	
10	TH-228	TRG	ENGWESA007	pCi/s	1.76E+00	5.65E-01	1.87E-01					OK	
11	TH-228	TRG	ENGWESA008	pCi/s	1.15E+00	4.25E-01	1.88E-01					OK	
12	TH-228	TRG	ENGWESA009	pCi/s	2.50E-01	2.05E-01	2.02E-01					OK	
13	TH-228	TRG	ENGWESA010	pCi/s	1.29E+00	5.03E-01	2.15E-01					OK	
14	TH-228	TRG	ENGWESA011	pCi/s	6.88E-01	3.43E-01	2.72E-01					OK	
15	TH-228	TRG	ENGWESA012	pCi/s	9.48E-01	3.87E-01	1.81E-01					OK	
16	TH-228	TRG	ENGWESA013	pCi/s	1.49E+00	5.83E-01	2.57E-01					OK	

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
Analysis Code: ThISO
Run: 1

Lab Fraction	Nuclide	Sample Desc	Sample Date	Sample Aliquot	Radiometric % Rec	Grav % Rec	Mean % Rec	SAF	Sep t0 Date/Time	Sep t1 Date/Time
01	TH-228	LCS	08/26/15 00:00	1.00E+00	105.85	0.00	0.00			
02	TH-228	MBL	08/26/15 00:00	1.00E+00	116.07	0.00	0.00			
03	TH-228	DUP	05/28/15 08:30	1.96E-01	94.62	0.00	0.00			
04	TH-228	TRG	05/27/15 16:12	2.84E-01	123.63	0.00	0.00			
05	TH-228	DO	05/28/15 08:30	1.96E-01	137.88	0.00	0.00			
06	TH-228	TRG	05/28/15 09:06	3.92E-01	123.41	0.00	0.00			
07	TH-228	TRG	05/28/15 09:30	3.92E-01	124.06	0.00	0.00			
08	TH-228	TRG	05/27/15 15:08	3.92E-01	135.19	0.00	0.00			
09	TH-228	TRG	05/27/15 16:50	3.92E-01	119.15	0.00	0.00			
10	TH-228	TRG	05/27/15 12:00	3.92E-01	123.34	0.00	0.00			
11	TH-228	TRG	05/27/15 15:38	3.92E-01	139.07	0.00	0.00			
12	TH-228	TRG	05/28/15 10:42	3.92E-01	107.99	0.00	0.00			
13	TH-228	TRG	05/28/15 11:06	3.92E-01	102.11	0.00	0.00			
14	TH-228	TRG	05/27/15 09:10	3.92E-01	126.57	0.00	0.00			
15	TH-228	TRG	05/27/15 10:36	3.92E-01	120.45	0.00	0.00			
16	TH-228	TRG	05/27/15 11:17	2.84E-01	123.88	0.00	0.00			

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client	Eberline Services Work Order	Analysis Code	Run
Auxier & Associates, Inc.	15-08106	ThISO	1

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	TH-228	LCS	09/08/15 08:06		A_Spec	Alpha_056	170	3.51 E+02	1.10 E-02	16
02	TH-228	MBL	09/08/15 08:06		A_Spec	Alpha_057	170	1.81 E+00	7.00 E-03	15.8
03	TH-228	DUP	09/08/15 08:06		A_Spec	Alpha_058	170	6.66 E+00	2.00 E-03	16.4
04	TH-228	TRG	09/08/15 08:06		A_Spec	Alpha_059	170	7.98 E+00	6.00 E-03	17.2
05	TH-228	DO	09/08/15 08:06		A_Spec	Alpha_060	170	7.47 E+00	9.00 E-03	15.4
06	TH-228	TRG	09/08/15 08:25		A_Spec	Alpha_033	170	2.65 E+01	3.00 E-03	18
07	TH-228	TRG	09/08/15 08:25		A_Spec	Alpha_034	170	3.65 E+01	3.00 E-03	17.9
08	TH-228	TRG	09/08/15 08:25		A_Spec	Alpha_035	170	3.01 E+01	1.10 E-02	16.5
09	TH-228	TRG	09/08/15 08:25		A_Spec	Alpha_036	170	2.35 E+01	3.00 E-03	18.1
10	TH-228	TRG	09/08/15 08:25		A_Spec	Alpha_037	170	4.95 E+01	3.00 E-03	17.1
11	TH-228	TRG	09/08/15 08:26		A_Spec	Alpha_038	170	3.43 E+01	4.00 E-03	16.2
12	TH-228	TRG	09/08/15 11:18		A_Spec	Alpha_033	170	6.49 E+00	3.00 E-03	18
13	TH-228	TRG	09/08/15 11:18		A_Spec	Alpha_034	170	3.15 E+01	3.00 E-03	17.9
14	TH-228	TRG	09/08/15 11:18		A_Spec	Alpha_035	170	1.91 E+01	1.10 E-02	16.5
15	TH-228	TRG	09/08/15 11:18		A_Spec	Alpha_036	170	2.75 E+01	3.00 E-03	18.1
16	TH-228	TRG	09/08/15 11:18		A_Spec	Alpha_037	170	3.05 E+01	3.00 E-03	17.1

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
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-230	LCS	LCS	pCi/s	6.39E+00	1.03E+00	8.22E-02	5.33E+00	119.75	OK		OK	
02	TH-230	MBL	BLANK	pCi/s	6.02E-02	6.52E-02	8.68E-02					OK	OK
03	TH-230	DUP	ENGWESA002	pCi/s	9.30E-01	5.92E-01	4.17E-01				OK	OK	
04	TH-230	TRG	ENGWESA001	pCi/s	1.01E+00	4.42E-01	1.84E-01					OK	
05	TH-230	DO	ENGWESA002	pCi/s	1.19E+00	5.75E-01	3.04E-01					OK	
06	TH-230	TRG	ENGWESA003	pCi/s	1.21E+00	4.19E-01	1.45E-01					OK	
07	TH-230	TRG	ENGWESA004	pCi/s	1.37E+00	4.56E-01	1.83E-01					OK	
08	TH-230	TRG	ENGWESA005	pCi/s	1.27E+00	4.32E-01	1.45E-01					OK	
09	TH-230	TRG	ENGWESA006	pCi/s	1.32E+00	4.48E-01	1.31E-01					OK	
10	TH-230	TRG	ENGWESA007	pCi/s	2.31E+00	6.47E-01	1.93E-01					OK	
11	TH-230	TRG	ENGWESA008	pCi/s	1.35E+00	4.46E-01	1.44E-01					OK	
12	TH-230	TRG	ENGWESA009	pCi/s	9.26E-01	3.84E-01	1.66E-01					OK	
13	TH-230	TRG	ENGWESA010	pCi/s	1.82E+00	5.95E-01	2.22E-01					OK	
14	TH-230	TRG	ENGWESA011	pCi/s	1.55E+00	5.03E-01	1.55E-01					OK	
15	TH-230	TRG	ENGWESA012	pCi/s	1.49E+00	4.81E-01	1.30E-01					OK	
16	TH-230	TRG	ENGWESA013	pCi/s	1.81E+00	6.27E-01	2.65E-01					OK	

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
Analysis Code: ThISO
Run: 1

Lab Fraction	Nuclide	Sample Desc	Sample Date	Sample Aliquot	Radiometric % Rec	Grav % Rec	Mean % Rec	SAF	Sep t0 Date/Time	Sep t1 Date/Time
01	TH-230	LCS	08/26/15 00:00	1.00E+00	105.85	0.00	0.00			
02	TH-230	MBL	08/26/15 00:00	1.00E+00	116.07	0.00	0.00			
03	TH-230	DUP	05/28/15 08:30	1.96E-01	94.62	0.00	0.00			
04	TH-230	TRG	05/27/15 16:12	2.84E-01	123.63	0.00	0.00			
05	TH-230	DO	05/28/15 08:30	1.96E-01	137.88	0.00	0.00			
06	TH-230	TRG	05/28/15 09:06	3.92E-01	123.41	0.00	0.00			
07	TH-230	TRG	05/28/15 09:30	3.92E-01	124.06	0.00	0.00			
08	TH-230	TRG	05/27/15 15:08	3.92E-01	135.19	0.00	0.00			
09	TH-230	TRG	05/27/15 16:50	3.92E-01	119.15	0.00	0.00			
10	TH-230	TRG	05/27/15 12:00	3.92E-01	123.34	0.00	0.00			
11	TH-230	TRG	05/27/15 15:38	3.92E-01	139.07	0.00	0.00			
12	TH-230	TRG	05/28/15 10:42	3.92E-01	107.99	0.00	0.00			
13	TH-230	TRG	05/28/15 11:06	3.92E-01	102.11	0.00	0.00			
14	TH-230	TRG	05/27/15 09:10	3.92E-01	126.57	0.00	0.00			
15	TH-230	TRG	05/27/15 10:36	3.92E-01	120.45	0.00	0.00			
16	TH-230	TRG	05/27/15 11:17	2.84E-01	123.88	0.00	0.00			

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Run: 1
Analysis Code: ThISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
01	TH-230	LCS	09/08/15 08:06		A_Spec	Alpha_056	170	4.07 E+02	3.00 E-03	16
02	TH-230	MBL	09/08/15 08:06		A_Spec	Alpha_057	170	4.15 E+00	5.00 E-03	15.8
03	TH-230	DUP	09/08/15 08:06		A_Spec	Alpha_058	170	1.07 E+01	2.00 E-03	16.4
04	TH-230	TRG	09/08/15 08:06		A_Spec	Alpha_059	170	2.28 E+01	1.00 E-03	17.2
05	TH-230	DO	09/08/15 08:06		A_Spec	Alpha_060	170	1.87 E+01	2.00 E-03	15.4
06	TH-230	TRG	09/08/15 08:25		A_Spec	Alpha_033	170	3.97 E+01	2.00 E-03	18
07	TH-230	TRG	09/08/15 08:25		A_Spec	Alpha_034	170	4.50 E+01	0.00 E+00	17.9
08	TH-230	TRG	09/08/15 08:25		A_Spec	Alpha_035	170	4.17 E+01	2.00 E-03	16.5
09	TH-230	TRG	09/08/15 08:25		A_Spec	Alpha_036	170	4.18 E+01	1.00 E-03	18.1
10	TH-230	TRG	09/08/15 08:25		A_Spec	Alpha_037	170	7.20 E+01	0.00 E+00	17.1
11	TH-230	TRG	09/08/15 08:26		A_Spec	Alpha_038	170	4.47 E+01	2.00 E-03	16.2
12	TH-230	TRG	09/08/15 11:18		A_Spec	Alpha_033	170	2.67 E+01	2.00 E-03	18
13	TH-230	TRG	09/08/15 11:18		A_Spec	Alpha_034	170	4.90 E+01	0.00 E+00	17.9
14	TH-230	TRG	09/08/15 11:18		A_Spec	Alpha_035	170	4.77 E+01	2.00 E-03	16.5
15	TH-230	TRG	09/08/15 11:18		A_Spec	Alpha_036	170	4.78 E+01	1.00 E-03	18.1
16	TH-230	TRG	09/08/15 11:18		A_Spec	Alpha_037	170	4.10 E+01	0.00 E+00	17.1

Eberline Services
Oak Ridge Laboratory

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
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/s	5.44E+00	9.01E-01	1.07E-01	4.79E+00	113.50	OK		OK	
02	TH-232	MBL	BLANK	pCi/s	-2.46E-03	2.88E-02	6.04E-02					OK	OK
03	TH-232	DUP	ENGWESA002	pCi/s	3.76E-01	3.92E-01	4.91E-01				NA	OK	
04	TH-232	TRG	ENGWESA001	pCi/s	1.17E-01	1.52E-01	2.10E-01					OK	
05	TH-232	DO	ENGWESA002	pCi/s	5.08E-01	3.82E-01	3.81E-01					OK	
06	TH-232	TRG	ENGWESA003	pCi/s	3.89E-01	2.23E-01	1.27E-01					OK	
07	TH-232	TRG	ENGWESA004	pCi/s	6.35E-01	2.90E-01	1.27E-01					OK	
08	TH-232	TRG	ENGWESA005	pCi/s	5.00E-01	2.57E-01	1.59E-01					OK	
09	TH-232	TRG	ENGWESA006	pCi/s	7.07E-01	3.15E-01	1.65E-01					OK	
10	TH-232	TRG	ENGWESA007	pCi/s	6.68E-01	3.06E-01	1.34E-01					OK	
11	TH-232	TRG	ENGWESA008	pCi/s	3.56E-01	2.12E-01	1.26E-01					OK	
12	TH-232	TRG	ENGWESA009	pCi/s	3.06E-01	2.10E-01	1.45E-01					OK	
13	TH-232	TRG	ENGWESA010	pCi/s	6.60E-01	3.27E-01	1.54E-01					OK	
14	TH-232	TRG	ENGWESA011	pCi/s	6.97E-01	3.18E-01	1.70E-01					OK	
15	TH-232	TRG	ENGWESA012	pCi/s	4.81E-01	2.55E-01	1.63E-01					OK	
16	TH-232	TRG	ENGWESA013	pCi/s	7.42E-01	3.75E-01	1.84E-01					OK	

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
Analysis Code: ThISO
Run: 1

Lab Fraction	Nuclide	Sample Desc	Sample Date	Sample Aliquot	Radiometric % Rec	Grav % Rec	Mean % Rec	SAF	Sep t0 Date/Time	Sep t1 Date/Time
01	TH-232	LCS	08/26/15 00:00	1.00E+00	105.85	0.00	0.00			
02	TH-232	MBL	08/26/15 00:00	1.00E+00	116.07	0.00	0.00			
03	TH-232	DUP	05/28/15 08:30	1.96E-01	94.62	0.00	0.00			
04	TH-232	TRG	05/27/15 16:12	2.84E-01	123.63	0.00	0.00			
05	TH-232	DO	05/28/15 08:30	1.96E-01	137.88	0.00	0.00			
06	TH-232	TRG	05/28/15 09:06	3.92E-01	123.41	0.00	0.00			
07	TH-232	TRG	05/28/15 09:30	3.92E-01	124.06	0.00	0.00			
08	TH-232	TRG	05/27/15 15:08	3.92E-01	135.19	0.00	0.00			
09	TH-232	TRG	05/27/15 16:50	3.92E-01	119.15	0.00	0.00			
10	TH-232	TRG	05/27/15 12:00	3.92E-01	123.34	0.00	0.00			
11	TH-232	TRG	05/27/15 15:38	3.92E-01	139.07	0.00	0.00			
12	TH-232	TRG	05/28/15 10:42	3.92E-01	107.99	0.00	0.00			
13	TH-232	TRG	05/28/15 11:06	3.92E-01	102.11	0.00	0.00			
14	TH-232	TRG	05/27/15 09:10	3.92E-01	126.57	0.00	0.00			
15	TH-232	TRG	05/27/15 10:36	3.92E-01	120.45	0.00	0.00			
16	TH-232	TRG	05/27/15 11:17	2.84E-01	123.88	0.00	0.00			

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
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-232	LCS	09/08/15 08:06		A_Spec	Alpha_056	170	3.48 E+02	8.00 E-03	16
02	TH-232	MBL	09/08/15 08:06		A_Spec	Alpha_057	170	-1.70 E-01	1.00 E-03	15.8
03	TH-232	DUP	09/08/15 08:06		A_Spec	Alpha_058	170	4.32 E+00	4.00 E-03	16.4
04	TH-232	TRG	09/08/15 08:06		A_Spec	Alpha_059	170	2.66 E+00	2.00 E-03	17.2
05	TH-232	DO	09/08/15 08:06		A_Spec	Alpha_060	170	8.00 E+00	0.00 E+00	15.4
06	TH-232	TRG	09/08/15 08:25		A_Spec	Alpha_033	170	1.28 E+01	1.00 E-03	18
07	TH-232	TRG	09/08/15 08:25		A_Spec	Alpha_034	170	2.08 E+01	1.00 E-03	17.9
08	TH-232	TRG	09/08/15 08:25		A_Spec	Alpha_035	170	1.65 E+01	3.00 E-03	16.5
09	TH-232	TRG	09/08/15 08:25		A_Spec	Alpha_036	170	2.25 E+01	3.00 E-03	18.1
10	TH-232	TRG	09/08/15 08:25		A_Spec	Alpha_037	170	2.08 E+01	1.00 E-03	17.1
11	TH-232	TRG	09/08/15 08:26		A_Spec	Alpha_038	170	1.18 E+01	1.00 E-03	16.2
12	TH-232	TRG	09/08/15 11:18		A_Spec	Alpha_033	170	8.83 E+00	1.00 E-03	18
13	TH-232	TRG	09/08/15 11:18		A_Spec	Alpha_034	170	1.78 E+01	1.00 E-03	17.9
14	TH-232	TRG	09/08/15 11:18		A_Spec	Alpha_035	170	2.15 E+01	3.00 E-03	16.5
15	TH-232	TRG	09/08/15 11:18		A_Spec	Alpha_036	170	1.55 E+01	3.00 E-03	18.1
16	TH-232	TRG	09/08/15 11:18		A_Spec	Alpha_037	170	1.68 E+01	1.00 E-03	17.1

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Client: Auxier & Associates, Inc.
Eberline Services Work Order: 15-08106
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
02	TH-227	MBL	BLANK	pCi/s	1.63E-01	1.04E-01	8.90E-02					OK	OK
03	TH-227	DUP	ENGWESA002	pCi/s	4.35E-01	4.04E-01	3.76E-01				NA	OK	
04	TH-227	TRG	ENGWESA001	pCi/s	6.21E-01	3.48E-01	2.17E-01					OK	
05	TH-227	DO	ENGWESA002	pCi/s	3.06E-01	2.94E-01	3.14E-01					OK	
06	TH-227	TRG	ENGWESA003	pCi/s	2.82E-01	2.01E-01	1.98E-01					OK	
07	TH-227	TRG	ENGWESA004	pCi/s	2.84E-01	2.00E-01	1.89E-01					OK	
08	TH-227	TRG	ENGWESA005	pCi/s	2.93E-01	2.01E-01	1.77E-01					OK	
09	TH-227	TRG	ENGWESA006	pCi/s	4.44E-01	2.58E-01	2.23E-01					OK	
10	TH-227	TRG	ENGWESA007	pCi/s	3.26E-01	2.12E-01	1.39E-01					OK	
11	TH-227	TRG	ENGWESA008	pCi/s	1.45E-01	1.39E-01	1.49E-01					OK	
12	TH-227	TRG	ENGWESA009	pCi/s	1.43E-01	1.62E-01	2.26E-01					OK	
13	TH-227	TRG	ENGWESA010	pCi/s	3.83E-01	2.57E-01	2.30E-01					OK	
14	TH-227	TRG	ENGWESA011	pCi/s	2.79E-01	2.03E-01	1.89E-01					OK	
15	TH-227	TRG	ENGWESA012	pCi/s	5.28E-02	1.14E-01	2.21E-01					OK	
16	TH-227	TRG	ENGWESA013	pCi/s	1.75E-01	1.82E-01	1.90E-01					OK	

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Run: 1
Analysis Code: ThISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, 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
02	TH-227	MBL	08/26/15 00:00	1.00E+00	116.07	0.00	0.00			
03	TH-227	DUP	05/28/15 08:30	1.96E-01	94.62	0.00	0.00			
04	TH-227	TRG	05/27/15 16:12	2.84E-01	123.63	0.00	0.00			
05	TH-227	DO	05/28/15 08:30	1.96E-01	137.88	0.00	0.00			
06	TH-227	TRG	05/28/15 09:06	3.92E-01	123.41	0.00	0.00			
07	TH-227	TRG	05/28/15 09:30	3.92E-01	124.06	0.00	0.00			
08	TH-227	TRG	05/27/15 15:08	3.92E-01	135.19	0.00	0.00			
09	TH-227	TRG	05/27/15 16:50	3.92E-01	119.15	0.00	0.00			
10	TH-227	TRG	05/27/15 12:00	3.92E-01	123.34	0.00	0.00			
11	TH-227	TRG	05/27/15 15:38	3.92E-01	139.07	0.00	0.00			
12	TH-227	TRG	05/28/15 10:42	3.92E-01	107.99	0.00	0.00			
13	TH-227	TRG	05/28/15 11:06	3.92E-01	102.11	0.00	0.00			
14	TH-227	TRG	05/27/15 09:10	3.92E-01	126.57	0.00	0.00			
15	TH-227	TRG	05/27/15 10:36	3.92E-01	120.45	0.00	0.00			
16	TH-227	TRG	05/27/15 11:17	2.84E-01	123.88	0.00	0.00			

Preliminary Data Report & Analytical Calculations
Work Order: 15-08106-ThISO-1

Run: 1
Analysis Code: ThISO
Eberline Services Work Order: 15-08106
Client: Auxier & Associates, Inc.

Lab Fraction	Nuclide	Sample Desc	Counting Date/Time	Halflife (days)	Detect	Carrier	Count Time	Counts	Bkg CPM	Eff
02	TH-227	MBL	09/08/15 08:06		A_Spec	Alpha_057	170	1.10 E+01	0.00 E+00	15.8
03	TH-227	DUP	09/08/15 08:06		A_Spec	Alpha_058	170	4.83 E+00	1.00 E-03	16.4
04	TH-227	TRG	09/08/15 08:06		A_Spec	Alpha_059	170	1.37 E+01	2.00 E-03	17.2
05	TH-227	DO	09/08/15 08:06		A_Spec	Alpha_060	170	4.66 E+00	2.00 E-03	15.4
06	TH-227	TRG	09/08/15 08:25		A_Spec	Alpha_033	170	8.98 E+00	6.00 E-03	18
07	TH-227	TRG	09/08/15 08:25		A_Spec	Alpha_034	170	9.00 E+00	0.00 E+00	17.9
08	TH-227	TRG	09/08/15 08:25		A_Spec	Alpha_035	170	9.32 E+00	4.00 E-03	16.5
09	TH-227	TRG	09/08/15 08:25		A_Spec	Alpha_036	170	1.36 E+01	8.00 E-03	18.1
10	TH-227	TRG	09/08/15 08:25		A_Spec	Alpha_037	170	9.83 E+00	1.00 E-03	17.1
11	TH-227	TRG	09/08/15 08:26		A_Spec	Alpha_038	170	4.66 E+00	2.00 E-03	16.2
12	TH-227	TRG	09/08/15 11:18		A_Spec	Alpha_033	170	3.98 E+00	6.00 E-03	18
13	TH-227	TRG	09/08/15 11:18		A_Spec	Alpha_034	170	1.00 E+01	0.00 E+00	17.9
14	TH-227	TRG	09/08/15 11:18		A_Spec	Alpha_035	170	8.32 E+00	4.00 E-03	16.5
15	TH-227	TRG	09/08/15 11:18		A_Spec	Alpha_036	170	1.64 E+00	8.00 E-03	18.1
16	TH-227	TRG	09/08/15 11:18		A_Spec	Alpha_037	170	3.83 E+00	1.00 E-03	17.1

Count Room Report
Client: Auxier Associates, Inc.

15-08106-ThISO-1 (pCi/s) in AF
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	08/26/15 00:00	1.0000	0.4707	10.5719		0.00		
02	MBL	BLANK	08/26/15 00:00	1.0000	0.2344	5.2646		0.00		
03	DUP	ENGWESA002	05/28/15 08:30	0.1960	0.2343	5.2624		0.00		
04	TRG	ENGWESA001	05/27/15 16:12	0.2840	0.2342	5.2601		0.00		
05	DO	ENGWESA002	05/28/15 08:30	0.1960	0.2339	5.2534		0.00		
06	TRG	ENGWESA003	05/28/15 09:06	0.3920	0.2338	5.2511		0.00		
07	TRG	ENGWESA004	05/28/15 09:30	0.3920	0.2331	5.2354		0.00		
08	TRG	ENGWESA005	05/27/15 15:08	0.3920	0.2340	5.2556		0.00		
09	TRG	ENGWESA006	05/27/15 16:50	0.3920	0.2335	5.2444		0.00		
10	TRG	ENGWESA007	05/27/15 12:00	0.3920	0.2338	5.2511		0.00		
11	TRG	ENGWESA008	05/27/15 15:38	0.3920	0.2316	5.2017		0.00		
12	TRG	ENGWESA009	05/28/15 10:42	0.3920	0.2336	5.2467		0.00		
13	TRG	ENGWESA010	05/28/15 11:06	0.3920	0.2330	5.2332		0.00		
14	TRG	ENGWESA011	05/27/15 09:10	0.3920	0.2336	5.2467		0.00		
15	TRG	ENGWESA012	05/27/15 10:36	0.3920	0.2332	5.2377		0.00		
16	TRG	ENGWESA013	05/27/15 11:17	0.2840	0.2332	5.2377		0.00		

56
60
77
78
33-37
00185

Eberline Services
Oak Ridge Laboratory

Spike and Tracer Worksheet

Printed: 9/3/2015 7:18 AM

Internal Work Order	Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
15-08106	1	ThISO	9/3/2015 7:06	JWOLFE	JW	

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	9/3/2015	0.100	0.1027				4.79	0.172	0.00	0.000	0.00	0.000	0.00	0.000
Th-230	Th-1b	23.520	9/3/2015	0.500	0.5033				5.33	0.144	0.00	0.000	0.00	0.000	0.00	0.000
Th-232	Th-8b	103.560	9/3/2015	0.100	0.1027				4.79	0.172	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	22.460	9/3/2015	0.4707	0.2200
02	Th-229	Th-18a	22.460	9/3/2015	0.2344	0.2200
03	Th-229	Th-18a	22.460	9/3/2015	0.2343	0.2200
04	Th-229	Th-18a	22.460	9/3/2015	0.2342	0.2200
05	Th-229	Th-18a	22.460	9/3/2015	0.2339	0.2200
06	Th-229	Th-18a	22.460	9/3/2015	0.2338	0.2200
07	Th-229	Th-18a	22.460	9/3/2015	0.2331	0.2200
08	Th-229	Th-18a	22.460	9/3/2015	0.2340	0.2200
09	Th-229	Th-18a	22.460	9/3/2015	0.2335	0.2200
10	Th-229	Th-18a	22.460	9/3/2015	0.2338	0.2200
11	Th-229	Th-18a	22.460	9/3/2015	0.2316	0.2200
12	Th-229	Th-18a	22.460	9/3/2015	0.2336	0.2200
13	Th-229	Th-18a	22.460	9/3/2015	0.2330	0.2200
14	Th-229	Th-18a	22.460	9/3/2015	0.2336	0.2200
15	Th-229	Th-18a	22.460	9/3/2015	0.2332	0.2200
16	Th-229	Th-18a	22.460	9/3/2015	0.2332	0.2200

Balance Printer Tapes

Tracer	LCS
0.4707 g 0.2344 g 0.2343 g 0.2342 g 0.2339 g 0.2338 g 0.2331 g 0.2340 g 0.2335 g 0.2338 g 0.2316 g 0.2336 g 0.2330 g 0.2336 g 0.2332 g 0.2332 g	0.5033 g 0.1027 g

Matrix Spike

Version 2.0 08/99

00186

Eberline Analytical
Oak Ridge Laboratory

Aliquot Worksheet

Work Order	Run	Analysis Code	Rpt Units	Lab Deadline	Technician
15-08106	1	ThISO	s	9/15/2015	JWOLFE

Lab Fraction	Auxier & Associates, Inc. Client ID	Sample Type	Muffle Data Ratio Post/Pre	Dilution Data No of Dils	Dil Factor	Ratio	Aliquot Data Aliquot	Net Equiv	MS Aliquot Data Aliquot	Net Equiv	H-3 Solids Only Water Added (ml)	H3 Dist Aliq
01	LCS	LCS				1.00E+00	1.0000E+00	1.0000E+00				
02	BLANK	MBL				1.00E+00	1.0000E+00	1.0000E+00				
03	ENGWESA002	DUP				1.00E+00	1.9600E-01	1.9600E-01				
04	ENGWESA001	TRG				1.00E+00	2.8400E-01	2.8400E-01				
05	ENGWESA002	DO				1.00E+00	1.9600E-01	1.9600E-01				
06	ENGWESA003	TRG				1.00E+00	3.9200E-01	3.9200E-01				
07	ENGWESA004	TRG				1.00E+00	3.9200E-01	3.9200E-01				
08	ENGWESA005	TRG				1.00E+00	3.9200E-01	3.9200E-01				
09	ENGWESA006	TRG				1.00E+00	3.9200E-01	3.9200E-01				
10	ENGWESA007	TRG				1.00E+00	3.9200E-01	3.9200E-01				
11	ENGWESA008	TRG				1.00E+00	3.9200E-01	3.9200E-01				
12	ENGWESA009	TRG				1.00E+00	3.9200E-01	3.9200E-01				
13	ENGWESA010	TRG				1.00E+00	3.9200E-01	3.9200E-01				
14	ENGWESA011	TRG				1.00E+00	3.9200E-01	3.9200E-01				
15	ENGWESA012	TRG				1.00E+00	3.9200E-01	3.9200E-01				
16	ENGWESA013	TRG				1.00E+00	2.8400E-01	2.8400E-01				

Comments	

Technician: JWOLFE Date: 9/3/15

001187

Apex-Alpha™

Sample Description: SPIKE
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-TH
Sample Identification: 01
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_056
Chamber Serial Number: 10006124B
Detector Serial Number: 56
Env. Background: System Bkgd 128421
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 sample
Sample Date/Time: 9/8/2015 6:18:53 AM
Acquisition Date/Time: 9/8/2015 8:06:10 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
Tracer Quantity: 0.471 mL
Effective Efficiency: 0.1694 +/- 0.0111
Counting Efficiency: 0.1600 +/- 0.0028 on 12/13/2014 2:30:22 PM
Chem. Recovery Factor: 1.0585 +/- 0.0716

Control Certificate Name: NatTh_Th-8
Chem. Recov. of Control: TH-232 1.135002 +/- 0.101862
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		5.781	33.47	34.77	1.53	0.00E+000	3.0
TH-228		5.367	351.13	10.49	1.87	0.00E+000	7.9
TH-229	T	4.870	304.47	11.27	1.53	0.00E+000	10.1
TH-230		4.616	407.49	9.72	0.51	0.00E+000	12.7
TH-232		3.944	347.64	10.54	1.36	0.00E+000	5.9

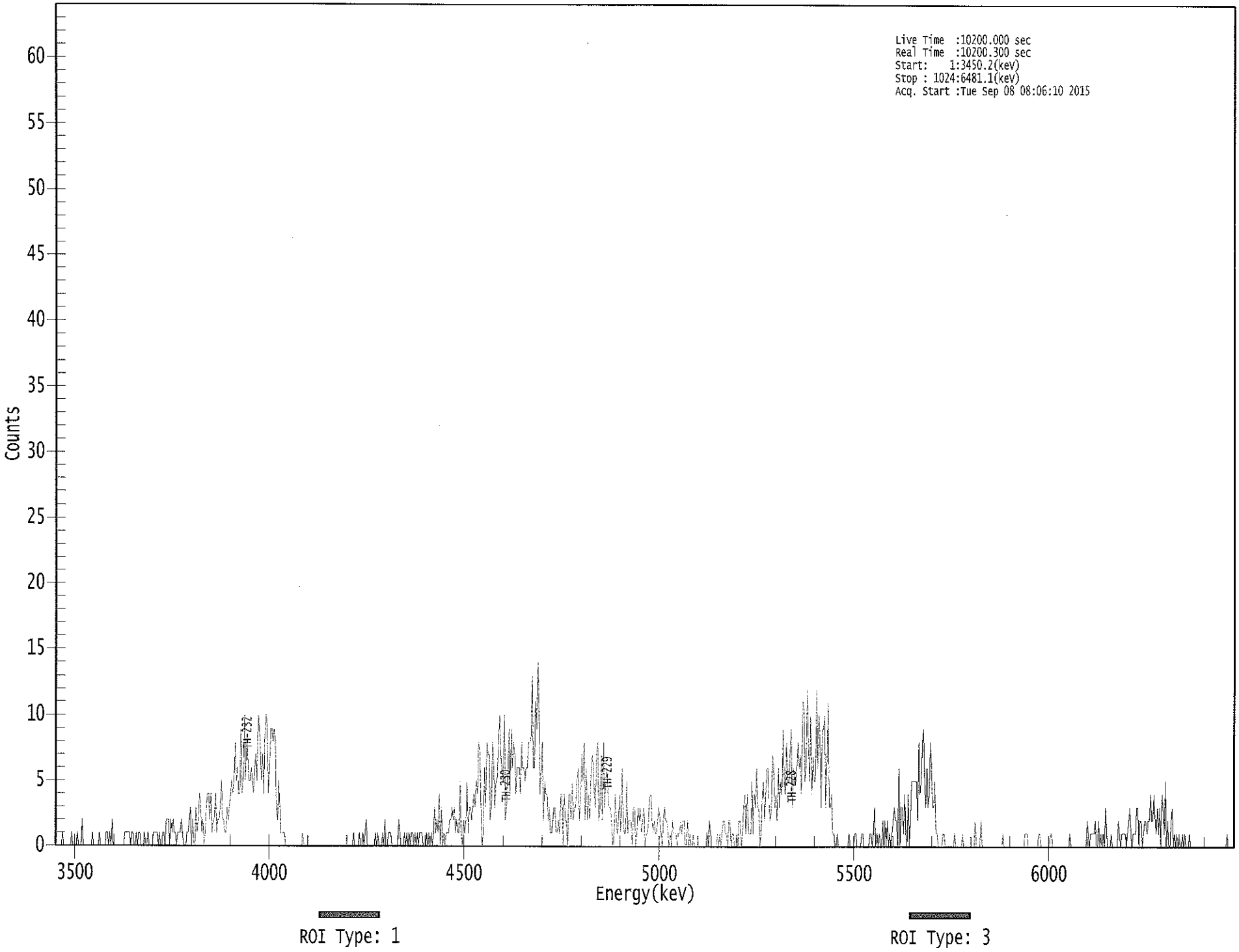
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
TH-227	0.975	5850.00*	5.37E-001 +/- 1.99E-001	1.14E-001 +/- 1.46E-002
TH-228	0.994	5400.00*	5.50E+000 +/- 9.10E-001	1.19E-001 +/- 1.52E-002
TH-229	1.000	4872.00*	4.79E+000 +/- 6.13E-001	1.12E-001 +/- 1.43E-002
TH-230	0.984	4672.00*	6.39E+000 +/- 1.03E+000	8.22E-002 +/- 1.05E-002
TH-232	0.986	3997.00*	5.44E+000 +/- 9.01E-001	1.07E-001 +/- 1.37E-002

AG
9/8/15

0000128105.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: 10200

Channel								
1:	0	0	0	0	0	0	1	0
9:	0	0	0	0	0	0	1	0
17:	0	0	0	1	0	0	0	2
25:	0	0	0	0	0	0	0	0
33:	1	0	0	0	0	0	1	0
41:	0	0	0	0	1	1	0	1
49:	0	2	0	0	0	0	0	0
57:	0	0	0	0	1	1	1	1
65:	1	0	1	1	0	0	1	0
73:	1	1	0	0	0	1	0	0
81:	1	0	0	0	0	1	1	1
89:	1	0	1	0	0	1	1	0
97:	2	2	2	0	2	1	2	1
105:	1	0	1	1	1	2	1	0
113:	0	0	1	1	2	3	0	2
121:	0	0	3	1	2	4	3	1
129:	2	0	1	3	4	4	2	4
137:	1	2	2	4	1	2	2	3
145:	5	2	2	1	1	3	2	3
153:	4	5	4	5	8	5	6	4
161:	4	9	4	5	10	5	8	7
169:	5	5	6	5	4	6	7	5
177:	10	9	7	5	7	4	10	10
185:	8	4	6	9	9	8	9	8
193:	3	2	5	3	1	1	1	1
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	1
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	1	0	0	0	0
265:	1	0	0	1	0	1	2	0
273:	0	0	0	0	0	0	1	0
281:	1	0	0	0	1	0	2	0
289:	0	1	1	1	0	0	0	0
297:	0	0	2	1	0	0	0	1
305:	0	1	0	1	0	1	1	0
313:	1	0	1	0	1	1	1	0
321:	0	0	1	0	1	0	1	0
329:	1	3	1	2	1	4	0	3
337:	0	1	0	1	1	1	2	2
345:	3	2	3	1	2	1	1	5
353:	1	0	2	1	2	5	1	3
361:	3	2	3	4	3	5	4	8

369:	7	3	0	1	6	3	8	7

Sample Title: 01

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

801:	0	0	2	0	0	0	0	0

Sample Title: 01

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:	1	1	1	0	0	0	0	0
849:	0	0	0	0	1	1	0	0
857:	0	0	0	0	0	0	1	1
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	1
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	0	0	2	1
897:	0	1	1	1	1	2	0	0
905:	2	0	1	0	1	0	3	1
913:	0	0	0	1	0	0	0	0
921:	0	2	1	0	1	1	1	1
929:	0	1	2	3	1	0	1	1
937:	1	3	3	0	2	2	0	1
945:	2	2	1	2	2	4	2	2
953:	4	2	1	3	1	3	0	4
961:	3	1	5	0	2	0	0	2
969:	3	0	1	0	1	0	1	0
977:	0	1	0	1	0	0	0	1
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:	1	0	0	0	0	0	0	0

Apex-Alpha™

KB 9/8/15

Sample Description: BLANK
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-TH
Sample Identification: 02
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_057
Chamber Serial Number: 01017326A
Detector Serial Number: 57
Env. Background: System Bkgd 128422
Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 sample
Sample Date/Time: 9/8/2015 6:18:53 AM
Acquisition Date/Time: 9/8/2015 8:06:02 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
Tracer Quantity: 0.234 mL
Effective Efficiency: 0.1830 +/- 0.0154
Counting Efficiency: 0.1577 +/- 0.0028 on 12/13/2014 2:27:38 PM
Chem. Recovery Factor: 1.1607 +/- 0.0998

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		5.809	11.00	61.72	0.00	0.00E+000	3.0
TH-228		5.287	1.81	193.78	1.19	0.00E+000	3.0
TH-229	T	4.878	163.83	15.32	0.17	0.00E+000	5.9
TH-230		4.663	4.15	107.12	0.85	0.00E+000	3.0
TH-232		3.946	-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/sample)	MDA (pCi/sample)
TH-227	0.991	5850.00*	1.63E-001 +/- 1.04E-001	8.90E-002 +/- 1.47E-002
TH-228	0.936	5400.00*	2.62E-002 +/- 5.10E-002	9.54E-002 +/- 1.57E-002
TH-229	1.000	4872.00*	2.38E+000 +/- 3.93E-001	6.07E-002 +/- 1.00E-002
TH-230	1.000	4672.00*	6.02E-002 +/- 6.52E-002	8.68E-002 +/- 1.43E-002
TH-232	0.987	3997.00*	-2.46E-003 +/- 2.88E-002	6.04E-002 +/- 9.96E-003

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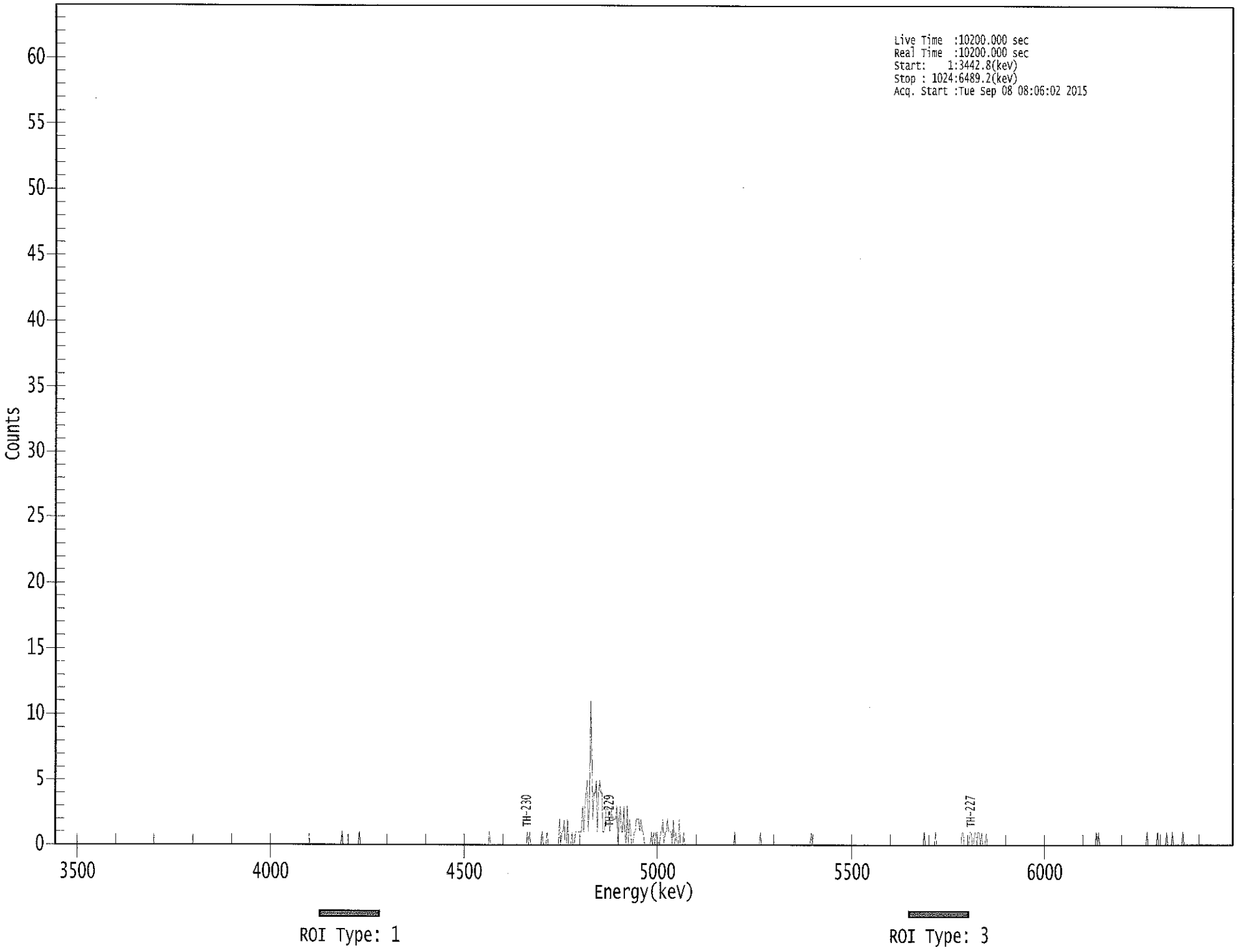
0000128115.CNF



****
***** 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	1	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	1	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	0

Sample Title: 02

Channel								
377:	0	1	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	1	0	1	0	0	0
417:	0	0	0	0	0	0	0	1
425:	0	0	0	1	0	0	0	0
433:	0	0	0	0	0	0	2	0
441:	1	1	2	0	0	2	0	0
449:	0	1	0	0	1	1	1	1
457:	1	1	3	1	3	4	5	1
465:	3	11	7	2	4	4	5	1
473:	4	5	4	4	1	1	2	3
481:	3	2	1	3	2	2	2	2
489:	3	0	2	3	1	1	3	1
497:	0	3	0	2	1	0	0	1
505:	1	2	2	2	1	2	1	1
513:	0	0	0	0	0	0	1	0
521:	1	0	1	1	0	0	1	1
529:	2	0	1	1	2	1	1	1
537:	0	2	0	1	0	0	2	0
545:	0	0	1	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	1	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	1	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	1	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	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	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	1	1	0	0	0
793:	0	0	1	1	0	0	1	1

801:	0	1	1	0	1	0	0	0

Sample Title: 02

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

KD
9/18/15

Apex-Alpha™

Sample Description: ENGWESA002-DUP
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-TH
Sample Identification: 03
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_058
Chamber Serial Number: 01017326B
Detector Serial Number: 58
Env. Background: System Bkgd 128423
Reagent Blank: <not performed>

Sample Size: 1.960E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:18:53 AM
Acquisition Date/Time: 9/8/2015 8:06:04 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
Tracer Quantity: 0.234 mL
Effective Efficiency: 0.1552 +/- 0.0140
Counting Efficiency: 0.1640 +/- 0.0029 on 12/13/2014 2:26:06 PM
Chem. Recovery Factor: 0.9462 +/- 0.0872

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		5.832	4.83	91.00	0.17	0.00E+000	3.0
TH-228		5.382	6.66	78.18	0.34	0.00E+000	3.0
TH-229	T	4.880	138.83	16.65	0.17	0.00E+000	5.2
TH-230		4.602	10.66	61.14	0.34	0.00E+000	4.5
TH-232		3.998	4.32	102.62	0.68	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
TH-227	0.998	5850.00*	4.35E-001 +/- 4.04E-001	3.76E-001 +/- 6.67E-002
TH-228	0.998	5400.00*	6.43E-001 +/- 5.16E-001	4.62E-001 +/- 8.18E-002
TH-229	1.000	4872.00*	1.22E+001 +/- 2.15E+000	3.65E-001 +/- 6.47E-002
TH-230	0.975	4672.00*	9.30E-001 +/- 5.92E-001	4.17E-001 +/- 7.39E-002
TH-232	1.000	3997.00*	3.76E-001 +/- 3.92E-001	4.91E-001 +/- 8.71E-002

AG
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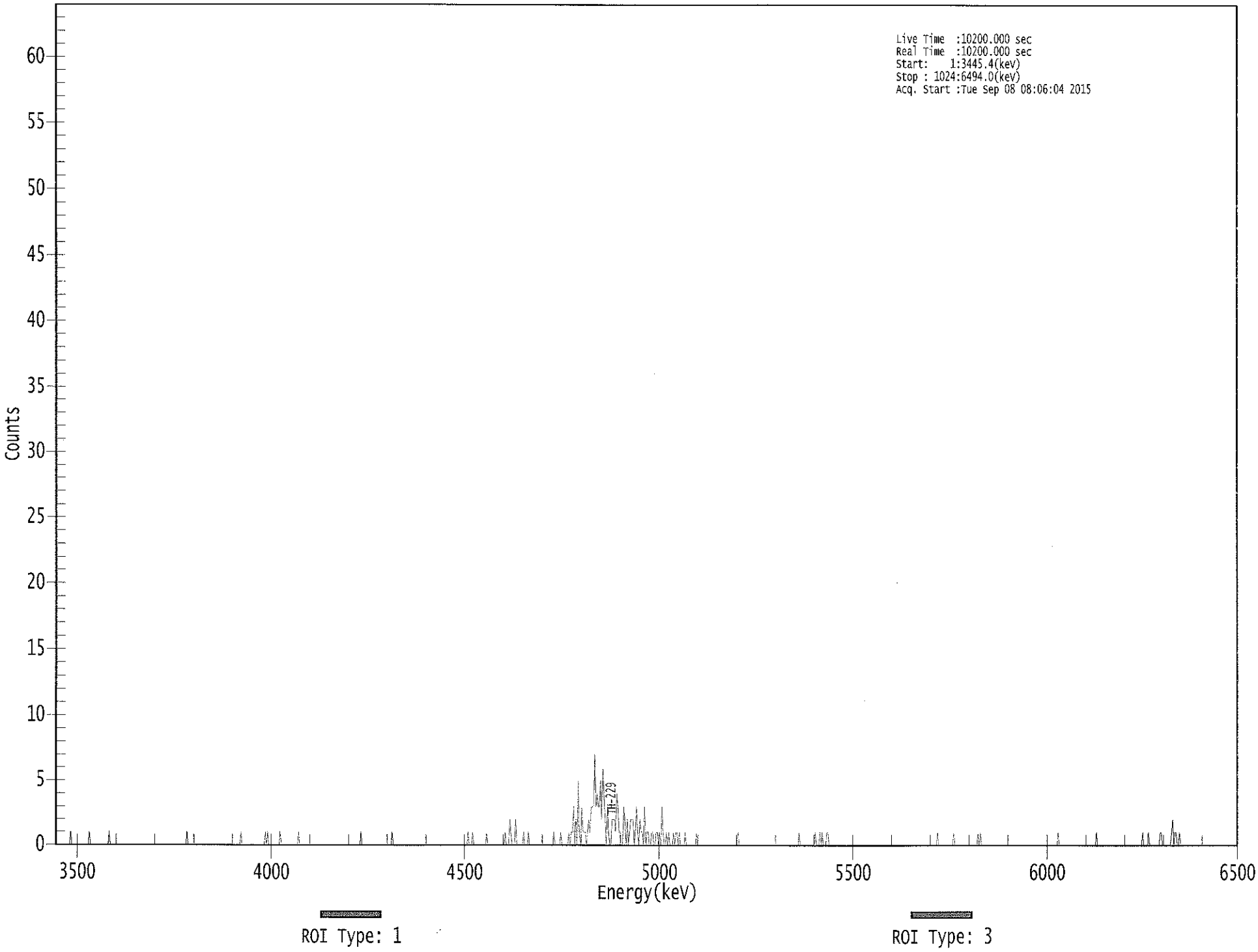
0000128106.CNF



661199

****
***** 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	1	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	1	0	0
33:	0	0	0	0	0	0	0	0
41:	0	0	0	0	0	0	1	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	1	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:	1	0	0	0	0	0	0	0
169:	0	0	0	0	0	0	0	0
177:	0	0	0	0	0	1	0	1
185:	0	0	0	0	0	0	0	0
193:	0	0	1	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	1	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:	1	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	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	1	0	0
361:	0	1	0	0	0	0	0	0

369:	0	0	0	0	0	1	0	0

Sample Title: 03

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	1	0	0
393:	0	2	1	0	0	0	2	0
401:	0	0	0	0	0	1	0	0
409:	0	1	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0
425:	0	0	0	0	0	0	0	1
433:	0	0	0	0	0	1	0	0
441:	0	0	0	0	1	0	1	1
449:	3	0	2	0	5	1	0	3
457:	1	1	1	0	1	2	1	3
465:	3	3	7	3	4	3	3	5
473:	2	6	4	2	0	3	1	0
481:	0	2	2	2	1	4	3	1
489:	1	0	0	3	2	0	2	0
497:	1	2	2	2	0	1	3	1
505:	0	2	1	1	0	3	0	1
513:	1	0	0	1	1	0	0	1
521:	1	0	1	0	3	1	0	0
529:	1	0	1	0	0	0	1	0
537:	1	1	0	1	0	0	0	0
545:	1	0	0	0	0	0	0	0
553:	0	0	1	0	0	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	1	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	1	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	1	0	0	0	1	0	1
665:	0	0	0	1	1	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	1	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	1	0

801:	1	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	1	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	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	1	0	0	0
945:	0	1	0	0	0	0	0	0
953:	0	0	0	1	1	0	0	0
961:	0	0	0	0	0	1	2	0
969:	1	1	0	0	1	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™

ICB 9/8/15

Sample Description: ENGWESA001
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-TH
Sample Identification: 04
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_059
Chamber Serial Number: 10006125A
Detector Serial Number: 59
Env. Background: System Bkgd 128424
Reagent Blank: <not performed>

Sample Size: 2.840E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/27/2015 6:18:53 AM
Acquisition Date/Time: 9/8/2015 8:06:06 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
Tracer Quantity: 0.234 mL
Effective Efficiency: 0.2123 +/- 0.0168
Counting Efficiency: 0.1717 +/- 0.0030 on 12/13/2014 2:24:23 PM
Chem. Recovery Factor: 1.2363 +/- 0.1000

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		5.817	13.66	53.80	0.34	0.00E+000	3.0
TH-228		5.324	7.98	74.39	1.02	0.00E+000	3.0
TH-229	T	4.883	189.83	14.23	0.17	0.00E+000	11.9
TH-230		4.624	22.83	41.20	0.17	0.00E+000	4.5
TH-232		3.975	2.66	128.85	0.34	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
TH-227	0.994	5850.00*	6.21E-001 +/- 3.48E-001	2.17E-001 +/- 3.37E-002
TH-228	0.970	5400.00*	3.89E-001 +/- 2.96E-001	3.07E-001 +/- 4.75E-002
TH-229	0.999	4872.00*	8.38E+000 +/- 1.30E+000	1.84E-001 +/- 2.85E-002
TH-230	0.988	4672.00*	1.01E+000 +/- 4.42E-001	1.84E-001 +/- 2.84E-002
TH-232	0.998	3997.00*	1.17E-001 +/- 1.52E-001	2.10E-001 +/- 3.25E-002

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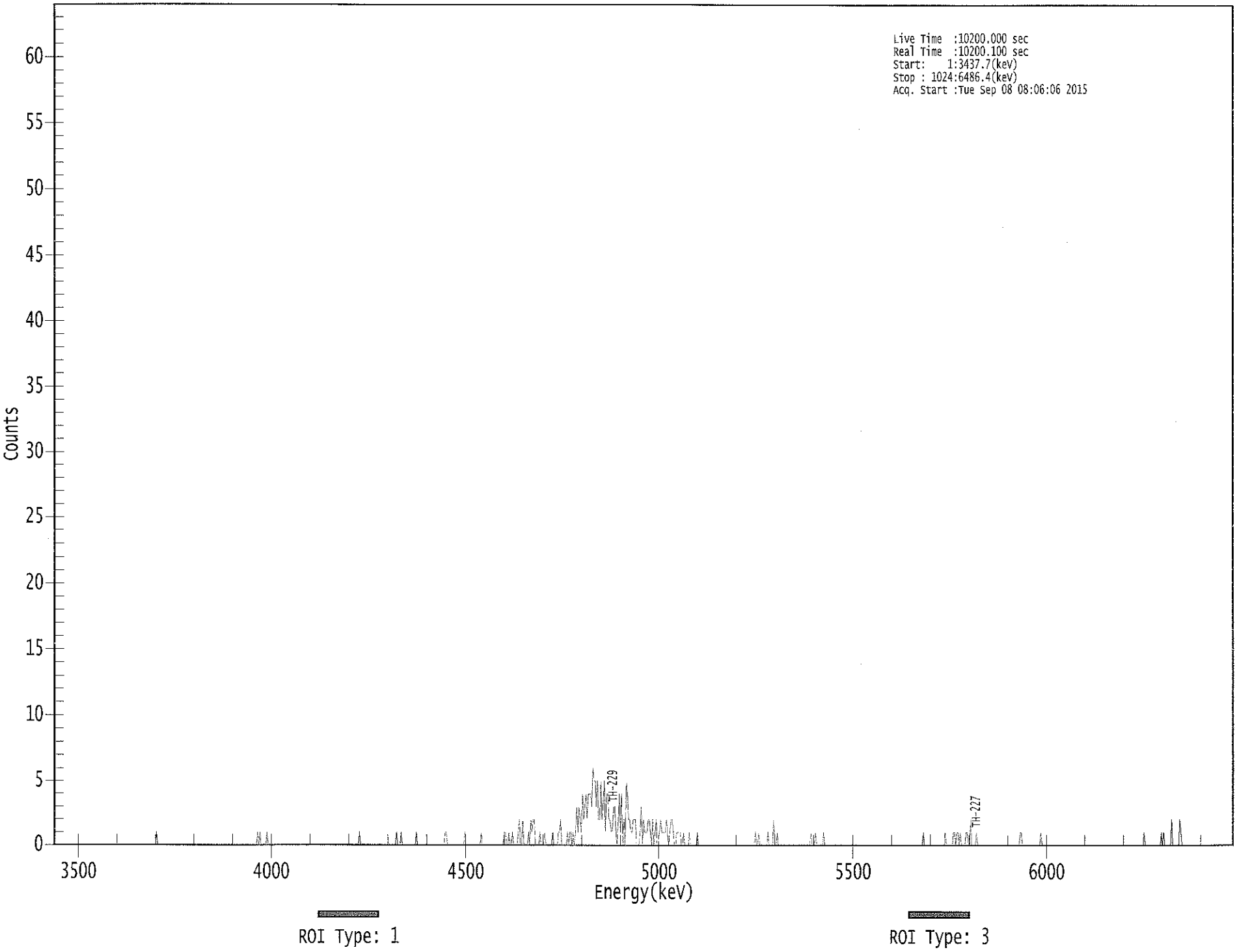
0000128116.CNF



102204

****
***** 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	0	0	0	0	0	0	0
89:	0	1	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	1	0	0	0	0
185:	0	1	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	1	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	1	0	0	0	1	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	1	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	1	1	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	1	0	0	0	0	0

Sample Title: 04

Channel								
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	1	1
393:	0	0	1	0	0	1	0	0
401:	0	0	1	2	0	0	2	0
409:	0	0	0	1	0	2	1	2
417:	2	0	0	0	0	1	0	0
425:	0	1	0	0	0	0	0	0
433:	1	0	0	0	0	1	1	2
441:	0	0	0	0	0	1	0	1
449:	1	0	1	0	1	3	1	3
457:	2	1	4	2	3	4	2	4
465:	4	4	3	6	5	5	3	5
473:	2	2	5	2	3	5	1	4
481:	4	2	2	1	1	3	3	1
489:	0	2	4	1	4	0	2	0
497:	5	4	2	2	1	1	2	2
505:	2	0	0	0	1	3	0	2
513:	1	1	1	2	2	1	0	2
521:	0	1	2	0	0	1	2	1
529:	1	1	1	2	1	0	1	2
537:	2	1	0	0	1	1	1	1
545:	0	0	1	0	0	0	0	1
553:	0	0	0	0	0	0	1	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:	1	0	0	1	0	0	0	0
617:	0	0	0	1	0	0	0	0
625:	2	0	0	1	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	1	0	0	0	1	0	0	0
665:	0	0	0	1	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	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	1	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	0	0	1	0	0	0
777:	0	0	0	1	1	0	1	1
785:	0	1	0	0	0	0	1	1
793:	0	0	2	0	0	0	0	1

801:	0	0	0	0	0	0	0	0

Sample Title: 04

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	1	1	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	1
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	1	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	1	0	1	0	0	0	0	0
969:	0	2	0	0	0	0	0	0
977:	2	1	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

JCB 9/8/15

Apex-Alpha™

Sample Description: ENGWESA002
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-TH
Sample Identification: 05
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_060
Chamber Serial Number: 10006125B
Detector Serial Number: 60
Env. Background: System Bkgd 128425
Reagent Blank: <not performed>

Sample Size: 1.960E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:18:53 AM
Acquisition Date/Time: 9/8/2015 8:06:08 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
Tracer Quantity: 0.234 mL
Effective Efficiency: 0.2127 +/- 0.0168
Counting Efficiency: 0.1543 +/- 0.0028 on 12/13/2014 2:22:05 PM
Chem. Recovery Factor: 1.3788 +/- 0.1118

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		5.802	4.66	94.59	0.34	0.00E+000	3.0
TH-228		5.342	7.47	79.84	1.53	0.00E+000	5.9
TH-229	T	4.889	189.98	14.26	1.02	0.00E+000	4.7
TH-230		4.616	18.66	45.85	0.34	0.00E+000	3.0
TH-232		3.923	8.00	73.50	0.00	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
TH-227	0.988	5850.00*	3.06E-001 +/- 2.94E-001	3.14E-001 +/- 4.88E-002
TH-228	0.982	5400.00*	5.26E-001 +/- 4.28E-001	5.01E-001 +/- 7.76E-002
TH-229	0.999	4872.00*	1.21E+001 +/- 1.88E+000	4.02E-001 +/- 6.24E-002
TH-230	0.984	4672.00*	1.19E+000 +/- 5.75E-001	3.04E-001 +/- 4.72E-002
TH-232	0.972	3997.00*	5.08E-001 +/- 3.82E-001	3.81E-001 +/- 5.91E-002

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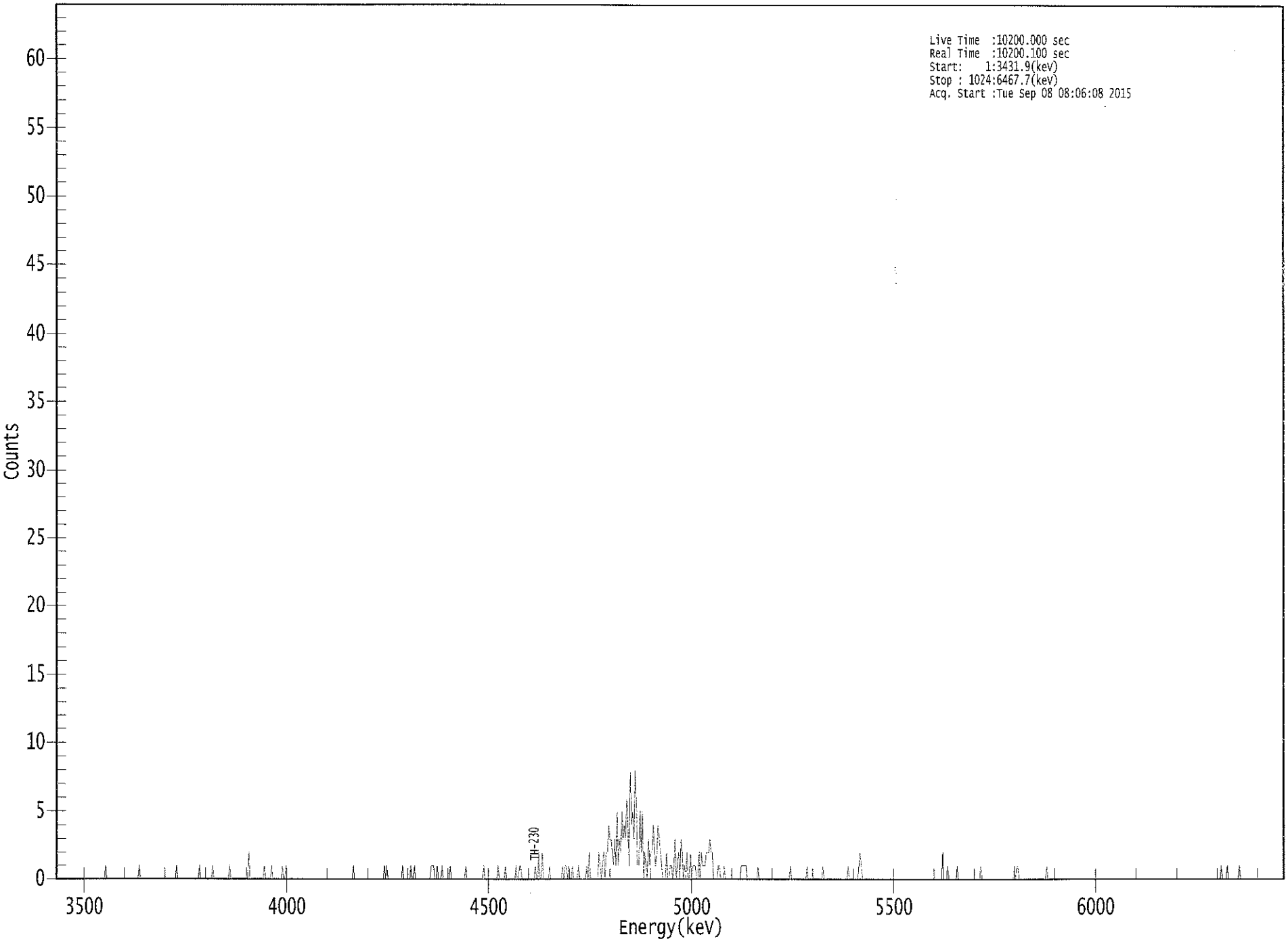
0000128117.CNF



ROI Type: 1

ROI Type: 3

00128117

****
***** 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	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	1	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	1	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	1	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	1
121:	0	0	0	0	0	0	0	0
129:	0	0	1	0	0	0	0	0
137:	0	0	0	0	0	0	0	0
145:	1	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	2	0	0	0	0	0	0	0
169:	0	0	0	0	0	1	0	0
177:	0	0	0	1	0	0	0	0
185:	0	0	0	0	1	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	1
249:	0	0	0	0	0	0	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	1	0	1	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	1	0	0	0	0	0	0	1
297:	0	0	1	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	1	1	1	0	0	1	0	0
321:	0	1	0	0	0	0	0	0
329:	1	0	0	0	0	0	0	0
337:	0	0	0	0	0	1	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:	1	0	0	0	0	0	1	0

Sample Title: 05

Channel								
377:	0	0	0	0	0	0	0	1
385:	0	0	1	1	0	0	0	0
393:	0	0	0	0	0	0	0	1
401:	0	0	2	0	0	2	0	0
409:	0	0	0	1	0	0	0	0
417:	0	0	0	0	0	0	1	0
425:	1	1	0	1	0	0	1	0
433:	0	0	0	1	0	0	0	0
441:	0	0	1	0	2	0	0	0
449:	0	0	0	0	2	1	0	1
457:	2	0	2	2	4	3	3	2
465:	1	3	1	5	1	3	2	5
473:	3	4	3	6	4	1	8	4
481:	5	3	8	5	1	1	5	2
489:	5	0	2	1	0	3	1	2
497:	2	4	2	1	2	4	3	2
505:	1	0	0	0	2	0	0	1
513:	1	0	1	3	0	1	2	0
521:	3	2	0	1	0	2	0	0
529:	2	0	1	1	1	0	0	2
537:	0	2	1	1	1	2	2	2
545:	3	2	2	0	0	0	0	1
553:	1	0	0	0	1	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	1	1	1	1	1	0
577:	0	0	0	0	0	0	0	0
585:	1	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	1	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	1	0	0	0	0	0	0
633:	0	0	0	0	0	0	1	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	1	2	1	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	2	0	0	0	1	0
745:	0	0	0	0	0	0	1	0
753:	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0
769:	0	0	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	1	0

801:	1	1	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	1	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	1	0	0	0	0	1
977:	0	0	0	0	0	0	0	0
985:	0	1	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0

Apex-Alpha™

Sample Description: ENGWESA003
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-TH
Sample Identification: 06
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_033
Chamber Serial Number: 04026479A
Detector Serial Number: 91132
Env. Background: System Bkgd 128398
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:18:53 AM
Acquisition Date/Time: 9/8/2015 8:25:49 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
Tracer Quantity: 0.234 mL
Effective Efficiency: 0.2227 +/- 0.0172
Counting Efficiency: 0.1805 +/- 0.0032 on 10/25/2014 2:26:39 PM
Chem. Recovery Factor: 1.2341 +/- 0.0980

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		5.834	8.98	69.62	1.02	0.00E+000	3.0
TH-228		5.278	26.49	38.51	0.51	0.00E+000	3.7
TH-229	T	4.885	198.83	13.91	0.17	0.00E+000	6.0
TH-230		4.596	39.66	31.28	0.34	0.00E+000	3.0
TH-232		3.943	12.83	55.14	0.17	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
TH-227	0.999	5850.00*	2.82E-001 +/- 2.01E-001	1.98E-001 +/- 3.00E-002
TH-228	0.925	5400.00*	8.91E-001 +/- 3.69E-001	1.77E-001 +/- 2.68E-002
TH-229	0.999	4872.00*	6.06E+000 +/- 9.20E-001	1.27E-001 +/- 1.93E-002
TH-230	0.970	4672.00*	1.21E+000 +/- 4.19E-001	1.45E-001 +/- 2.21E-002
TH-232	0.985	3997.00*	3.89E-001 +/- 2.23E-001	1.27E-001 +/- 1.92E-002

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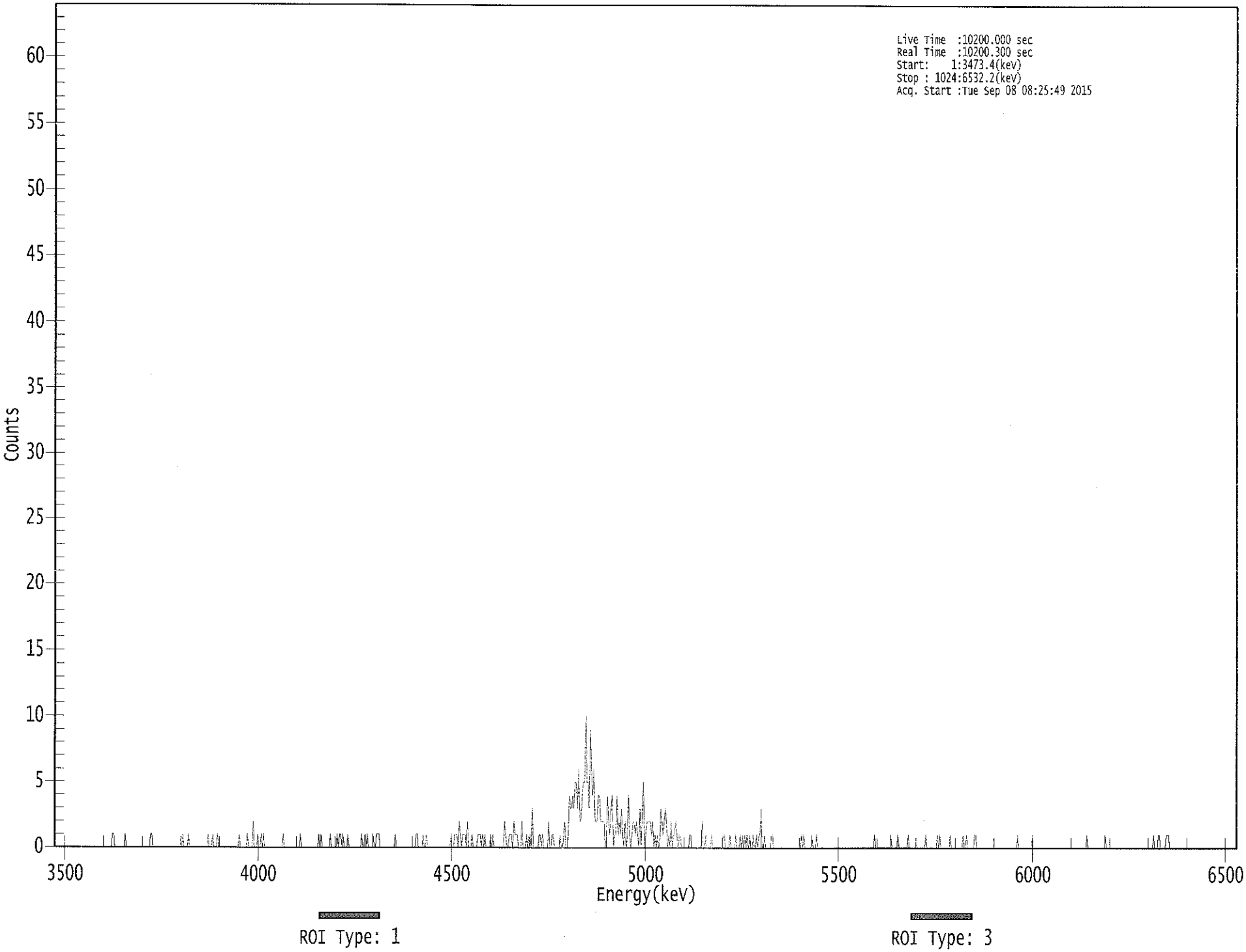
0000128118.CNF



****
***** 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	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	1	1	0	0	0	0
57:	0	0	0	0	0	1	0	0
65:	0	0	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	1	1	0	0	0
89:	0	0	0	0	0	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	1
113:	0	0	0	0	1	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	0	0	1	0	0
137:	0	1	0	0	0	1	0	0
145:	0	0	0	0	0	0	0	0
153:	0	0	0	0	0	0	0	0
161:	1	0	0	0	0	0	0	1
169:	0	0	0	0	2	0	0	0
177:	1	0	0	1	0	1	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	1	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	1	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	1	0	1
233:	0	0	0	0	0	0	0	1
241:	0	0	0	0	0	1	0	1
249:	1	0	1	0	0	0	1	0
257:	0	0	0	0	0	0	0	0
265:	0	0	1	0	0	1	0	1
273:	0	0	0	0	1	0	0	1
281:	1	1	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	1	1	0	0	0	0	1
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	1
345:	0	0	1	1	1	0	2	1
353:	0	1	1	1	0	2	0	0
361:	0	1	0	0	0	0	1	1

369:	1	0	1	0	1	0	0	0

Sample Title: 06

Channel								
377:	0	1	0	1	0	0	0	0
385:	0	0	0	0	0	2	1	0
393:	0	1	1	1	0	2	1	1
401:	1	0	0	0	2	0	0	0
409:	1	0	0	1	0	3	0	0
417:	0	0	0	1	1	0	1	0
425:	0	0	0	2	0	0	1	1
433:	0	0	0	0	0	1	0	0
441:	1	2	0	0	1	4	3	3
449:	4	3	5	5	3	6	2	2
457:	4	5	5	10	5	5	3	9
465:	6	4	6	2	2	2	4	4
473:	2	2	2	2	0	1	4	2
481:	1	3	4	0	1	1	4	1
489:	2	1	3	1	0	2	0	1
497:	4	1	0	1	2	2	1	2
505:	1	0	3	0	3	5	0	1
513:	2	2	2	2	1	2	0	1
521:	0	1	0	0	3	2	1	2
529:	3	2	0	1	0	2	0	1
537:	1	2	1	0	1	1	0	0
545:	0	0	0	0	0	1	1	0
553:	0	0	0	0	0	0	0	0
561:	2	0	0	1	0	0	0	0
569:	1	0	0	0	0	0	0	0
577:	0	0	1	1	0	0	0	0
585:	1	0	0	0	0	1	0	0
593:	0	1	0	1	0	1	0	1
601:	0	1	0	0	1	0	0	1
609:	0	1	1	3	0	0	1	0
617:	0	0	0	0	1	1	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	1	0
649:	1	0	0	0	0	0	0	1
657:	0	0	0	1	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	1	0	0
713:	0	0	0	0	0	0	0	0
721:	0	0	0	1	0	0	0	0
729:	0	1	0	0	0	0	0	0
737:	0	0	1	0	0	0	0	0
745:	0	0	0	0	0	0	0	0
753:	0	1	0	0	0	0	0	0
761:	0	0	0	1	0	1	0	0
769:	0	0	0	0	0	0	1	0
777:	0	0	0	0	0	0	0	0
785:	0	1	0	0	1	0	0	0
793:	0	0	0	1	1	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:	1	0	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	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	0
889:	0	0	0	0	1	0	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	1	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	0	0	0	0	0	0	0
945:	0	0	0	0	0	0	1	0
953:	0	0	1	1	0	0	0	0
961:	0	1	1	1	0	0	0	0
969:	0	0	0	0	0	0	0	0
977:	0	0	0	0	0	0	0	0
985:	0	0	0	0	0	0	0	0
993:	0	0	0	0	0	0	0	0
1001:	0	0	0	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0

KB 9/08/15

Apex-Alpha™

Sample Description: ENGWESA004
Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001281
Batch Identification: 1508106A-TH
Sample Identification: 07
Sample Geometry: Shelf 2
Procedure Description: Th iso

Detector Name: Alpha_034
Chamber Serial Number: 04026479B
Detector Serial Number: 91136
Env. Background: System Bkgd 128399
Reagent Blank: <not performed>

Sample Size: 3.920E-001 +/- 0.000E+000 sample
Sample Date/Time: 5/28/2015 6:18:53 AM
Acquisition Date/Time: 9/8/2015 8:25:51 AM
Acquisition Live Time: 170.0 minutes
Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
Tracer Quantity: 0.233 mL
Effective Efficiency: 0.2219 +/- 0.0172
Counting Efficiency: 0.1789 +/- 0.0031 on 10/25/2014 2:30:05 PM
Chem. Recovery Factor: 1.2406 +/- 0.0988

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		5.806	9.00	68.87	0.00	0.00E+000	3.0
TH-228		5.261	36.49	32.71	0.51	0.00E+000	3.0
TH-229	T	4.883	197.49	13.97	0.51	0.00E+000	14.9
TH-230		4.609	45.00	29.54	0.00	0.00E+000	4.5
TH-232		3.948	20.83	43.15	0.17	0.00E+000	3.0

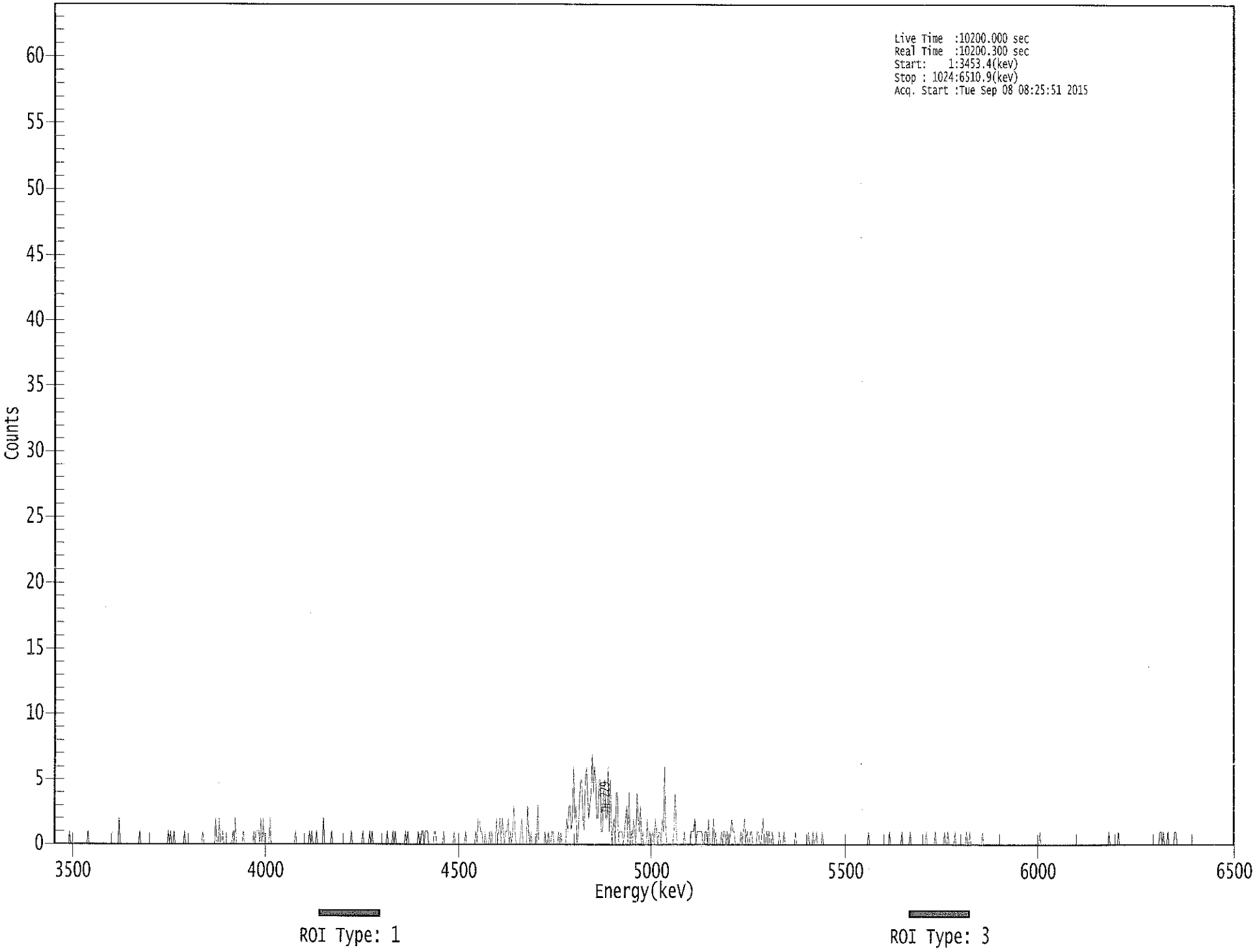
T = Tracer Peak used for Effective Efficiency

NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/sample)	MDA (pCi/sample)
TH-227	0.990	5850.00*	2.84E-001 +/- 2.00E-001	1.89E-001 +/- 2.88E-002
TH-228	0.904	5400.00*	1.23E+000 +/- 4.45E-001	1.77E-001 +/- 2.70E-002
TH-229	0.999	4872.00*	6.05E+000 +/- 9.21E-001	1.61E-001 +/- 2.45E-002
TH-230	0.979	4672.00*	1.37E+000 +/- 4.56E-001	1.83E-001 +/- 2.79E-002
TH-232	0.988	3997.00*	6.35E-001 +/- 2.90E-001	1.27E-001 +/- 1.94E-002

AG 9/8/15

0000128119.CNF



00219

****
***** 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:	1	0	0	0	0	0	0	0
9:	0	0	0	0	0	1	0	0
17:	0	0	0	0	0	0	0	0
25:	0	0	0	0	0	1	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:	2	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	1	0	1	0	0
105:	1	0	0	0	0	0	0	0
113:	0	1	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	1	0	0	0	0	0	0
137:	0	0	0	0	2	0	0	2
145:	0	0	1	0	0	0	0	0
153:	0	0	0	1	0	2	0	0
161:	0	0	0	0	1	0	0	0
169:	0	0	0	0	0	1	0	1
177:	1	1	0	2	0	2	0	0
185:	0	0	0	2	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	1	0	1
225:	0	0	0	1	0	0	0	0
233:	0	2	0	0	0	0	0	0
241:	1	0	0	0	0	0	0	0
249:	0	0	0	0	0	0	0	0
257:	0	1	0	0	0	0	0	0
265:	0	0	0	1	0	0	0	0
273:	0	1	0	1	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	1	0	0	0	0	1	0	1
297:	0	0	0	0	0	0	0	0
305:	1	0	1	0	0	0	0	0
313:	0	0	0	1	0	0	1	1
321:	0	1	1	1	0	0	0	0
329:	0	1	1	0	0	0	0	0
337:	0	1	0	0	0	0	0	0
345:	0	0	1	0	0	0	0	0
353:	0	0	0	0	1	0	0	0
361:	0	0	0	0	0	1	0	2