

AUXIER & ASSOCIATES, INC.

PAP-KAN

1428

**STANDARD LEVEL IV
REPORT OF ANALYSIS**

WORK ORDER #15-09136-OR

October 27, 2015

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

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STANDARD OPERATING PROCEDURE

Sample Receiving

MP-001, Rev. 13
Effective: 10/31/13
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**Eberline Services – Oak Ridge Laboratory
LABORATORY DATA SUPPORT CHECKLIST**


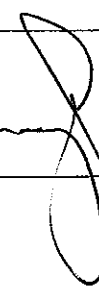
MP-001-3

Eberline Services Work Order # 15-09136

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

Date for Partial	Initials	Date	Initials	Checklist Items
		9-25-15	JEB	Sample Log-In
		10/13/15	JG	Data Compilation
		10-15-15	MLT	First Technical Data Review
		10/15/15	Ust	Second Technical Data Review
		10/26/15	EJT	Data Entry/Electronic Deliverable
		10/26/15	EJT	Case Narrative
		10/26/15	KBJ	Electronic Deliverable Proof
		10/27/15	Ust	Samples Analyzed within Holding Time Yes? <input checked="" type="checkbox"/> No? <input type="checkbox"/>
		10/27/15	Ust	QA/QC Review
		10/26/15	EJT	Client in Possession of Data Electronic or Hard Copy
				Invoiced by Laboratory

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

Date package approved by:   10/27/15
 Laboratory Manager Date

Copy No. _____

Radiochemistry Services

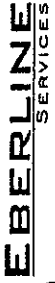
SECTION I
CHAIN OF CUSTODY
&
pH CHECK SHEET

#2

Chain of Custody Record

No 1604

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



Project Name: PAPIKAN		Project Number: 1428	
Send Report To: Cecilia Green/Auxier & Assoc.		Sampler (Print Name):	
Address:		Sampler (Print Name):	
9821 Cogdill Road, Suite 1		Shipment Method: Federal Express	
Knoxville, TN 37932		Airbill Number:	
Phone: 865-675-3669		Laboratory Receiving:	
Fax: 865-675-3677			

Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	Analysis Requested	QA/QC Level	Turnaround	Sample Receipt
KC85-035-L	9/17/15	16:32	water	1	Total Suspended Solids (TSS)	Level I	Routine	Total # Containers Received?
KC92-185-L	9/18/15	13:39	water	1	Total Dissolved Solids (TDS)	Level II	24 Hour	COC Seals Present?
KC85-035-U	9/18/15	8:42	water	1	Gross Alpha	Level III	1 Week	Received Containers Intact?
KC85-032-L	9/21/15	14:42	water	4	Gross Beta	Other	Other	Temperature?
KC85-032-M	9/21/15	13:25	water	1	Isotopic Uranium			
EJF 09/25/15					Isotopic Thorium			
					Gross Alpha			
					Gross Beta			
					Isotopic Uranium			
					Isotopic Thorium			

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
<i>[Signature]</i>	FedEx	9/21/15	6:30pm
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
<i>[Signature]</i>	<i>[Signature]</i>	9-22-15	1100
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
<i>[Signature]</i>	<i>[Signature]</i>		

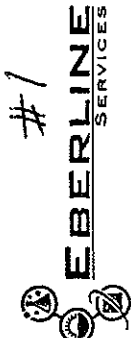
15-09136 Page 1 of 1
 15-09131-368
 REC'D SEP 22 2015

Comments, Special Instructions, etc.
 Analyze TSS/TDS
 contact ceiling
 filter as directed
 Analyze G A TGB
 contact ceiling
 Proceed as directed

Chain of Custody Record


No 1604

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

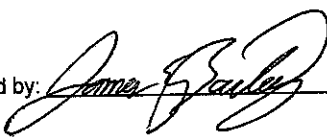


#1

Project Name: PAPIKAN		Project Number: 1428		Page 1 of 1			
Send Report To: Cecilia Green/Auxier & Assoc.		Sampler (Print Name):		RECD SEP 22 2015			
Address:		Sampler (Print Name):		Purchase Order #:			
9821 Cogdill Road, Suite 1		Shipment Method: Federal Express		15-09136			
Knoxville, TN 37902		Airbill Number:		15-09134			
Phone: 865-675-3669		Laboratory Receiving:		Comments, Special Instructions, etc			
Fax: 865-675-3677		Laboratory Receiving:		Lab Sample ID (to be completed by lab)			
Field Sample ID	Sample Date	Sample Time	Sample Matrix	Number of Containers	Analysts Requested	QA/QC Level	Sample Custodian Remarks (Completed By Laboratory):
6 KC94-199-U	9/18/15	9:56	Water	1	Total Suspended Solids (TSS)	Level I <input type="checkbox"/>	Turnaround Routine <input type="checkbox"/> 24 Hour <input type="checkbox"/> 1 Week <input type="checkbox"/> Other _____ Total # Containers Received? _____ COC Seals Present? _____ COC Seals Intact? _____ Received Containers Intact? _____ Temperature? _____
KC94-199-L	9/18/15	10:44	Water	1	Gross Alpha	Level II <input type="checkbox"/>	
KC97-209-L	9/18/15	16:42	Water	1	Gross Beta	Level III <input type="checkbox"/>	
KC97-209-U	9/19/15	11:15	Water	1	Total Dissolved Solids (TDS)	Other <input type="checkbox"/>	
KC-185-U	9/18/15	12:50	Water	1	Isotopic Uranium		
7					Isotopic Thorium		
					Gross Alpha		
					Gross Beta		
					Isotopic Uranium		
					Isotopic Thorium		
					Analysts Requested		
					Total Suspended Solids (TSS)		
					Total Dissolved Solids (TDS)		
					Gross Alpha		
					Gross Beta		
					Isotopic Uranium		
					Isotopic Thorium		
					Comments, Special Instructions, etc		
					Lab Sample ID (to be completed by lab)		
					Analyses Requested		
					Total Suspended Solids (TSS)		
					Total Dissolved Solids (TDS)		
					Gross Alpha		
					Gross Beta		
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					Isotopic Thorium		
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					Isotopic Thorium		
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					Analyses Requested		
					Total Suspended Solids (TSS)		
					Total Dissolved Solids (TDS)		
					Gross Alpha		
					Gross Beta		
					Isotopic Uranium		
					Isotopic Thorium		
					Analyses Requested	</	

	Sample Receiving Report (Volumes, pH, & CPM)	Internal Work Order
		15-09136
		Received By JBAILEY

FR	ClientID	# Btls	Comments	Matrix	Storage	Rec Vol Ttl	CPM Max
01	LCS	0		WA	U1.1		
02	BLANK	0		WA	U1.1		
03	DUP	0		WA	U1.1		
04	KC85-032-L	1		WA	U1.1	3.76	35
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	35
05	KC85-032-M	1		WA	U1.1	3.76	31
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	31
06	KC94-199-U	1		WA	U1.1	3.76	37
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	37
07	KC97-209-U	1		WA	U1.1	3.76	35
			Container Number	pH Orig	pH Final	Volume (L)	CPM
			1	7	7	3.7600	35

Received by:  Date: 9-25-15

SECTION II
SAMPLE ACKNOWLEDGEMENT
&
CORRESPONDENCE



Eberline Services – Oak Ridge Laboratory

SAMPLE RECEIPT CHECKLIST
MP-001-2

WORK ORDER # 15-09136

SAMPLE MATRIX/MATRICES:

(CIRCLE ONE OR BOTH)

AQUEOUS NON-AQUEOUS

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

WERE SAMPLES:

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

WERE CHAIN OF CUSTODY SEALS:

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

IF THE RESPONSE TO ANY OF THE ABOVE IS NO, A DISCREPANT SAMPLE RECEIPT REPORT (DSR) HAS BEEN ISSUED.

REMARKS: _____

SIGNATURE: *James Baulch* DATE: 9-25-15

Elizabeth Towery

From: Cecilia Greene <cgreene@auxier.com>
Sent: Friday, September 25, 2015 12:47 PM
To: Mike McDougall
Cc: Elizabeth Towery
Subject: additional analysis for 15-09131

Mike, the client has opted to analyze 4 samples for isotopic uranium and isotopic thorium. Mostly negative documentation.

KC85-032-M

KC85-032-L

KC97-209-U

KC94-199-U

Regards,

Cecilia Greene MPH, NRRPT
Auxier and Associates
865-675-3669 phone
865-675-3677 fax
cgreene@auxier.com

SECTION III
CASE NARRATIVE



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

EBS-OR-39851

October 27, 2015

Cecilia Greene
USA ENV LP/Auxier & Associates, Inc.
9821 Cogdill Road, Suite 1
Knoxville, TN 37932

CASE NARRATIVE
Work Order# 15-09136-OR

SAMPLE RECEIPT

This work order contains four water samples received 09/22/2015 and re-logged at the client's request 09/25/2015. These samples were analyzed for Isotopic Uranium and Isotopic Thorium.

<u>CLIENT ID</u>	<u>LAB ID</u>
KC85-032-L	15-09136-04
KC85-032-M	15-09136-05
KC94-199-U	15-09136-06
KC97-209-U	15-09136-07

ANALYTICAL METHODS

Isotopic Uranium was analyzed using Method EML U-02 Modified. Isotopic Thorium was analyzed using Method EML Th-01 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.

ISOTOPIC URANIUM

Samples were prepared by removing representative aliquots followed by mixed acid digestions as appropriate. 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.

ANALYTICAL RESULTS CONTINUED

ISOTOPIC URANIUM

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, Uranium-235 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-234 and Uranium-238 laboratory control sample demonstrated an acceptable percent recovery.

ISOTOPIC THORIUM

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

Samples demonstrated acceptable results for all Thorium analyses. Chemical recovery was acceptable for all samples. The Thorium-228, Thorium-230 and Thorium-232 method blank demonstrated acceptable results. Results for the Thorium-228 duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Thorium-230 and Thorium-232 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Thorium-228, Thorium-230 and Thorium-232 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: 10/27/2015

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

Cecilia Greene
Auxier & Associates, Inc.
 9821 Cogdill Road, Suite 1
 Knoxville, TN 37830

SDG:
 Purchase Order: PAP-KAN
 Analysis Category: ENVIRONMENTAL
 Sample Matrix: WA

Report To: **15-09136**

Work Order Details:

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-09136-01	LCS	KNOWN	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	4.86E+00	1.75E-01	1.04E+00	1.44E-01	6.21E-02	pCi/l
15-09136-01	LCS	SPIKE	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	5.65E+00	8.98E-01	4.50E-02	7.29E-02	9.83E-03	pCi/l
15-09136-02	MBL	BLANK	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	3.00E-02	4.49E-02	1.22E-01	1.77E-01	3.38E-02	pCi/l
15-09136-03	DUP	KC85-032-L	09/21/15 14:42	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	1.03E-01	1.10E-01	1.10E-01	1.52E-01	1.32E-02	pCi/l
15-09136-04	DO	KC85-032-L	09/21/15 14:42	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	8.45E-02	5.12E-02	5.12E-02	1.57E-01	2.98E-02	pCi/l
15-09136-05	TRG	KC85-032-M	09/21/15 13:25	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	-4.53E-03	2.01E-01	1.51E-01	1.26E-01	1.09E-02	pCi/l
15-09136-06	TRG	KC94-199-U	09/18/15 09:56	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	2.01E-01	3.56E-01	3.58E-01	4.89E-01	1.38E-01	pCi/l
15-09136-07	TRG	KC97-209-U	09/19/15 11:15	9/25/2015	10/7/2015	15-09136	Thorium-228	EML Th-01 Modified	3.54E-01	1.45E-01	1.30E+00	1.12E-01	1.06E-01	pCi/l
15-09136-01	LCS	KNOWN	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	5.37E+00	1.01E+00	7.39E-02	7.75E-02	6.91E-02	pCi/l
15-09136-01	LCS	SPIKE	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	6.58E+00	7.31E-02	1.54E-01	2.07E-01	1.97E-01	pCi/l
15-09136-02	MBL	BLANK	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	1.58E-01	1.79E-01	1.81E-01	1.64E-01	1.83E-01	pCi/l
15-09136-03	DUP	KC85-032-L	09/21/15 14:42	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	2.35E-01	9.44E-02	1.48E-01	1.55E-01	1.38E-01	pCi/l
15-09136-04	DO	KC85-032-L	09/21/15 14:42	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	7.40E-02	1.48E-01	3.80E-01	2.87E-01	3.42E-01	pCi/l
15-09136-05	TRG	KC85-032-M	09/21/15 13:25	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	1.81E-01	1.75E-01	1.05E+00	1.35E-01	5.22E-02	pCi/l
15-09136-06	TRG	KC94-199-U	09/18/15 09:56	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	5.20E-01	9.16E-01	4.41E-02	7.74E-02	9.18E-04	pCi/l
15-09136-07	TRG	KC97-209-U	09/19/15 11:15	9/25/2015	10/7/2015	15-09136	Thorium-230	EML Th-01 Modified	2.82E-02	4.40E-02	6.19E-02	2.17E-01	6.50E-02	pCi/l
15-09136-01	LCS	KNOWN	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	4.86E+00	1.75E-01	1.05E+00	1.35E-01	5.22E-02	pCi/l
15-09136-01	LCS	SPIKE	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	5.80E+00	9.16E-01	4.41E-02	7.74E-02	9.18E-04	pCi/l
15-09136-02	MBL	BLANK	09/25/15 00:00	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	2.58E-02	4.40E-02	6.19E-02	2.17E-01	6.50E-02	pCi/l
15-09136-03	DUP	KC85-032-L	09/21/15 14:42	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	-3.66E-02	1.26E-01	1.26E-01	1.97E-01	3.41E-02	pCi/l
15-09136-04	DO	KC85-032-L	09/21/15 14:42	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	9.32E-02	4.93E-02	4.93E-02	1.40E-01	2.18E-02	pCi/l
15-09136-05	TRG	KC85-032-M	09/21/15 13:25	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	-1.99E-02	5.20E-02	5.20E-02	1.23E-01	1.06E-02	pCi/l
15-09136-06	TRG	KC94-199-U	09/18/15 09:56	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	1.70E-02	1.77E-01	1.77E-01	4.26E-01	9.61E-02	pCi/l
15-09136-07	TRG	KC97-209-U	09/19/15 11:15	9/25/2015	10/7/2015	15-09136	Thorium-232	EML Th-01 Modified	2.82E-02	1.77E-01	1.77E-01	4.26E-01	9.61E-02	pCi/l

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



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EBERLINE ANALYTICAL CORPORATION
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Eberline Analytical

Final Report of Analysis

Cecilia Greene
Auxier & Associates, Inc.
9821 Cogdill Road, Suite 1
Knoxville, TN 37830

SDG: 15-09136
Purchase Order: PAP-KAN
Analysis Category: ENVIRONMENTAL
Sample Matrix: WA

Work Order Details:

Report To:

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	CV	Report Units
15-09136-01	LCS	KNOWN	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	8.08E+00	2.91E-01				pCi/l
15-09136-01	LCS	SPIKE	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	6.99E+00	1.12E+00	1.22E+00	1.08E-01	2.64E-03	pCi/l
15-09136-02	MBL	BLANK	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	1.33E-02	3.19E-02	3.19E-02	6.89E-02	5.05E-03	pCi/l
15-09136-03	DUP	KC85-032-L	09/21/15 14:42	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	1.90E-01	1.90E-01	1.90E-01	2.79E-01	1.10E-01	pCi/l
15-09136-04	DO	KC85-032-L	09/21/15 14:42	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	3.98E-01	2.48E-01	2.48E-01	2.48E-01	6.58E-02	pCi/l
15-09136-05	TRG	KC85-032-M	09/21/15 13:25	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	7.97E-01	3.25E-01	3.30E-01	1.49E-01	1.50E-02	pCi/l
15-09136-06	TRG	KC94-199-U	09/18/15 09:56	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	2.31E-01	1.78E-01	1.79E-01	1.41E-01	1.07E-02	pCi/l
15-09136-07	TRG	KC97-209-U	09/19/15 11:15	9/25/2015	10/12/2015	15-09136	Uranium-234	EML U-02 Modified	2.08E-01	1.85E-01	1.85E-01	2.20E-01	4.07E-02	pCi/l
15-09136-01	LCS	SPIKE	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-235	EML U-02 Modified	4.90E-01	2.18E-01	2.21E-01	1.34E-01	1.21E-03	pCi/l
15-09136-02	MBL	BLANK	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-235	EML U-02 Modified	5.26E-02	6.80E-02	6.81E-02	9.45E-02	6.50E-03	pCi/l
15-09136-03	DUP	KC85-032-L	09/21/15 14:42	9/25/2015	10/12/2015	15-09136	Uranium-235	EML U-02 Modified	1.21E-01	1.46E-01	1.46E-01	2.06E-01	2.21E-02	pCi/l
15-09136-04	DO	KC85-032-L	09/21/15 14:42	9/25/2015	10/12/2015	15-09136	Uranium-235	EML U-02 Modified	1.29E-02	8.37E-02	8.37E-02	2.28E-01	2.44E-02	pCi/l
15-09136-05	TRG	KC85-032-M	09/21/15 13:25	9/25/2015	10/12/2015	15-09136	Uranium-235	EML U-02 Modified	1.85E-01	1.70E-01	1.70E-01	1.60E-01	7.34E-03	pCi/l
15-09136-06	TRG	KC94-199-U	09/18/15 09:56	9/25/2015	10/12/2015	15-09136	Uranium-235	EML U-02 Modified	1.25E-01	1.64E-01	1.64E-01	2.50E-01	2.27E-03	pCi/l
15-09136-07	TRG	KC97-209-U	09/19/15 11:15	9/25/2015	10/12/2015	15-09136	Uranium-235	EML U-02 Modified	1.29E-01	1.69E-01	1.70E-01	2.56E-01	2.35E-03	pCi/l
15-09136-01	LCS	KNOWN	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	7.87E+00	2.83E-01				pCi/l
15-09136-01	LCS	SPIKE	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	7.06E+00	1.13E+00	1.24E+00	1.08E-01	1.28E-03	pCi/l
15-09136-02	MBL	BLANK	09/25/15 00:00	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	2.92E-02	4.47E-02	4.47E-02	6.66E-02	3.85E-03	pCi/l
15-09136-03	DUP	KC85-032-L	09/21/15 14:42	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	1.32E-01	1.31E-01	1.31E-01	1.54E-01	1.72E-02	pCi/l
15-09136-04	DO	KC85-032-L	09/21/15 14:42	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	2.56E-01	1.84E-01	1.85E-01	1.36E-01	7.88E-03	pCi/l
15-09136-05	TRG	KC85-032-M	09/21/15 13:25	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	3.14E-01	2.08E-01	2.07E-01	1.85E-01	2.85E-02	pCi/l
15-09136-06	TRG	KC94-199-U	09/18/15 09:56	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	2.58E-01	1.90E-01	1.91E-01	1.61E-01	1.39E-02	pCi/l
15-09136-07	TRG	KC97-209-U	09/19/15 11:15	9/25/2015	10/12/2015	15-09136	Uranium-238	EML U-02 Modified	1.62E-01	1.54E-01	1.55E-01	1.66E-01	1.43E-02	pCi/l

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



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EBERLINE ANALYTICAL CORPORATION

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SECTION V
ANALYTICAL STANDARDS

U-8

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

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

Radionuclide: U-238NAT
Half Life: (4.468 ± 0.005) x 10⁹ years
Catalog No.: 7338
Source No.: 479-50

Customer: TMA EBERLINE
P.O.No.: OR2778
Reference Date: January 1 1995 12:00 PST.
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



QUALITY CONTROL PROGRAM
MP-009

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

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

SOLUTION REFERENCE # IPL 479-50 CURRENT DATE 10/1/2015 0:00
SOLUTION # U-8

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

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

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 HNO₃

Dilution Instructions: Dilution Solvent Used 1M HNO₃

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 27, 2016

Verified & Approved By [Signature]

Date: 10/1/2015 0:00

QC Approval [Signature]

Date: 10/1/15



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 Date 10/1/2015 0:00
IPL 479-50 Solution # U-8a

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

Radionuclide of Interest 234, 235, 238 U Reference Date 1/1/1995 0:00
Parent Solution Conc. 1.7796E+04 dpm/ml

Chemical Composition of Standard Solution
Uranly Nitrate in 1M HNO₃

Dilution Instructions: Dilution Solvent Used 1M HNO₃

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 4.0000 ml
Total Activity: 7.1182E+04 dpm Final Activity Concentration: 7.1182E+01 dpm/ml
Final Volume: 1000.00 ml

NOTES:

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

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 27, 2016

Verified & Approved By [Signature]

Date: 10/1/2015 0:00

QC Approval [Signature]

Date: 10/1/15

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**

Accuracy Method of measurement (see reverse of this certificate)
Random uncertainty is: $\pm 0.7\%$ Systematic uncertainty: $\pm 0.5\%$
Overall uncertainty in the radioactive concentration quoted above: $\pm 1.7\%$
Overall uncertainty is defined on the reverse of this certificate.

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

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

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

Not measured

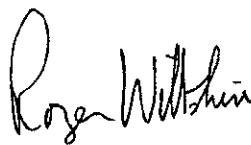
Chemical Composition Calculated weight of U-232, 4.42E-08 grams, as 2M HNO3 solution in a flame sealed glass vial.
This Tracer solution has been produced 'carrier free'.

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

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

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

Approved
Signatory



Roger Wiltshire

Project Ref. AE2315

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



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 92/232/87

SOLUTION # U-10

Principal Radionuclide

Half Life, Years

Half Life, Days

²³²U

7.200E+01

2.630E+04

Radionuclide

²³²U

Reference Date

3/1/2000 0:00

Certified Activity 9.760E-01 μ Ci

Certified Concentration μ Ci per gram

Ampoule /Solution Gross

Weight, Grams

Empty Ampoule

Weight, Grams

Solution Net

Weight, Grams

Total Activity in Ampoule 0.9760 μ Ci

Chemical Composition of Standard Solution

²³²U(NO₃)₆ in 2M HNO₃

Dilution Instructions:

Dilution Solvent Used

2M HNO₃

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 0.9760 μ Ci

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



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 Date 11/11/2014 0:00
AEA/Amersham 92/232/67 Solution # U-10a

Principal Radionuclide	Half Life, Years	Half Life, Days
<u>²³²U</u>	<u>7.200E+01</u>	<u>2.630E+04</u>

Radionuclide of Interest ²³²U Reference Date 3/1/2000 0:00
Parent Solution Conc. 2.167E+03 dpm/ml

Chemical Composition of Standard Solution
²³²U(NO₃)₆ in 2M HNO₃

Dilution Instructions: Dilution Solvent Used 2M HNO₃

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 10.0000 ml
Total Activity: 2.1670E+04 dpm Final Activity Concentration: 2.1670E+01 dpm/ml
Final Volume: 1000.00 ml

NOTES:

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

Expiration Date: November 4, 2015

Verified & Approved By [Signature]

Date: 11/11/2014 0:00

QC Approval [Signature]

Date: 11/13/14

QA/QC REVIEWED

Date 10/14/91 Initials wt

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

Received
OCT 14 1991
TMA/Eberline
Oak Ridge Lab

Radionuclide Th-230
Half Life: $(7.54 \pm 0.03) \times 10^4$ years
Catalog No.: 7230
Source No.: 388-116

Customer: TMA EBERLINE
P.O.No.: TT4944
Reference Date: November 1 1991 12:00 PST.
Contained Radioactivity: 1.036 μ Ci.

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 μ Ci/gram.

Method of Calibration

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

Uncertainty of Measurement

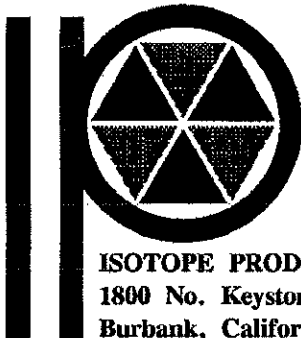
- a. Systematic uncertainty in instrument calibration: $\pm 2.0\%$
- b. Random uncertainty in assay: $\pm 0.5\%$
- c. Random uncertainty in weighing(s): $\pm 0.2\%$
- d. Total uncertainty at the 99% confidence level: $\pm 2.7\%$

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)



ISOTOPE PRODUCTS LABORATORIES
 1800 No. Keystone Street.,
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[Signature]
QUALITY CONTROL



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

SOLUTION REFERENCE # IPL 388-116 CURRENT DATE 4/15/2015 0:00
SOLUTION # Th-1

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

Radionuclide ²³⁰Thorium Reference Date 11/1/1991 0:00
Certified Activity 1.036E+00 μ Ci
Certified Concentration μ Ci 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 μ Ci

Chemical Composition of Standard Solution
²³⁰Th(NO₃)₄ in 0.1N HNO₃

Dilution Instructions: Dilution Solvent Used 0.1N HNO₃

Dilute to a volume of 1000.00 milliliters

Certified Total Activity of 1.0360 μ Ci 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



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 ²³⁰Th Half Life, Years 7.540E+04 Half Life, Days 2.754E+07

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

Chemical Composition of Standard Solution
²³⁰Th(NO₃)₄ in 0.1N HNO₃

Dilution Instructions: Dilution Solvent Used 0.1N HNO₃

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 10.0000 ml
Total Activity: 2.2999E+04 dpm Final Activity Concentration: 2.2999E+01 dpm/ml
Final Volume: 1000.00 ml

NOTES:

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

Expiration Date: February 12, 2016

Recertified By [Signature]

Date: 4/15/2015 0:00

QC Approval [Signature]

Date: 4/15/15

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

Radionuclide:	Th-232	Customer:	TMA EBERLINE
Half Life:	$(1.405 \pm 0.006) \times 10^{10}$ 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 μ Ci.
		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 μ Ci/g.

Method of Calibration

Activity calculations are based upon known specific activity and mass.

Uncertainty of Measurement

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

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).



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

Anna U. Khan

 QUALITY CONTROL

Nov. 8, 1993

 Date Signed



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

SOLUTION REFERENCE # IPL 435-104-2 CURRENT DATE 9/29/2015 0:00
SOLUTION # Th-8

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

Radionuclide ²³² & ²²⁸ Th Reference Date 11/1/1993 0:00
Certified Activity 9.330E-02 μ Ci
Certified Concentration μ Ci per gram

Ampoule /Solution Gross	<u>18.8415</u>	Weight, Grams
Empty Ampoule	<u>6.9296</u>	Weight, Grams
Solution Net	<u>11.9119</u>	Weight, Grams
Total Activity in Ampoule	<u>0.0933</u>	μ Ci

Chemical Composition of Standard Solution
Th(NO₃)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 μ Ci 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 25, 2016

Verified & Approved By [Signature] Date: 9/29/2015 0:00
QC Approval [Signature] Date: 9/30/15



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

Solution Reference # MP-009 IPL-435-104-2 Date 9/29/2015 0:00
Solution # Th-8b

Principal Radionuclide ^{226 & 232}Th Half Life, Years 1.405E+10 Half Life, Days 5.132E+12

Radionuclide of Interest ^{226 & 232}Th Reference Date 11/1/1993 0:00
Parent Solution Conc. 2.07E+02 dpm/ml

Chemical Composition of Standard Solution
Th(NO₃)₄ in 1% HNO₃

Dilution Instructions: Dilution Solvent Used 1% Nitric Acid

SECONDARY VOLUMETRIC DILUTION

Vol. Parent Solution: 500.0000 ml
Total Activity: 1.0355E+05 dpm Final Activity Concentration: 1.0355E+02 dpm/ml
Final Volume: 1000.00 ml

NOTES:

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

Expiration Date: August 25, 2016

Verified & Approved By [Signature]

Date: 9/29/2015 0:00

QC Approval [Signature]

Date: 9/30/15



**Isotope Products
Laboratories**

An Eckert & Ziegler Company

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661•309•1010
Fax 661•257•8303

Th-18

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: 1.013 μCi 37.48 kBq (Th-229 only)

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.

Radiopurities:

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.

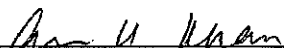
Peak energy used for integration: 193.5 keV
Branching ratio used: 0.0441 gammas per decay

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

ISO 9001 CERTIFIED

Medical Imaging Laboratory
24937 Avenue Tibbitts Valencia, California 91355

Industrial Gauging Laboratory
1800 North Keystone Street Burbank, California 91504

: 00033



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

SOLUTION REFERENCE # IPL 867-54 CURRENT DATE 9/29/2015 0:00
SOLUTION # Th-18

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

Radionuclide ²²⁹Th Reference Date 1/15/2002 0:00
Certified Activity 1.013E+00 μCi
Certified Concentration $\mu\text{Ci per gram}$

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
²²⁹Th(NO₃)₄ in 0.1M HNO₃

Dilution Instructions: Dilution Solvent Used 0.1 M HNO₃

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 24, 2016

Verified & Approved By [Signature]

Date: 9/29/2015 0:00

QC Approval [Signature]

Date: 9/30/15



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

Solution Reference #		MP-009	Date	9/29/2015 0:00
IPL 867-54		Solution #	Th-18a	
Principal Radionuclide	Half Life, Years	Half Life, Days		
²²⁹ Th	7.340E+03	2.681E+06		
Radionuclide of Interest	Parent Solution Conc.	Reference Date		
²²⁹ Th	2.25E+03 dpm/ml	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 HNO₃

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 24, 2016

Verified & Approved By

Date: 9/29/2015 0:00

QC Approval

Date: 9/30/15

SECTION VI
QUALITY CONTROL SAMPLE RESULTS SUMMARY

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-09136	UUIISO	1	pCi	I	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	86.48%	17.53%	100.00%	3.60%	8.08E+00	2.91E-01	6.99E+00	1.22E+00	U-8a	3.52E+01	3.60E+00	5.09E-01
U-238	89.71%	17.49%	100.00%	3.60%	7.87E+00	2.83E-01	7.06E+00	1.24E+00	U-8a	3.44E+01	3.60E+00	5.09E-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)

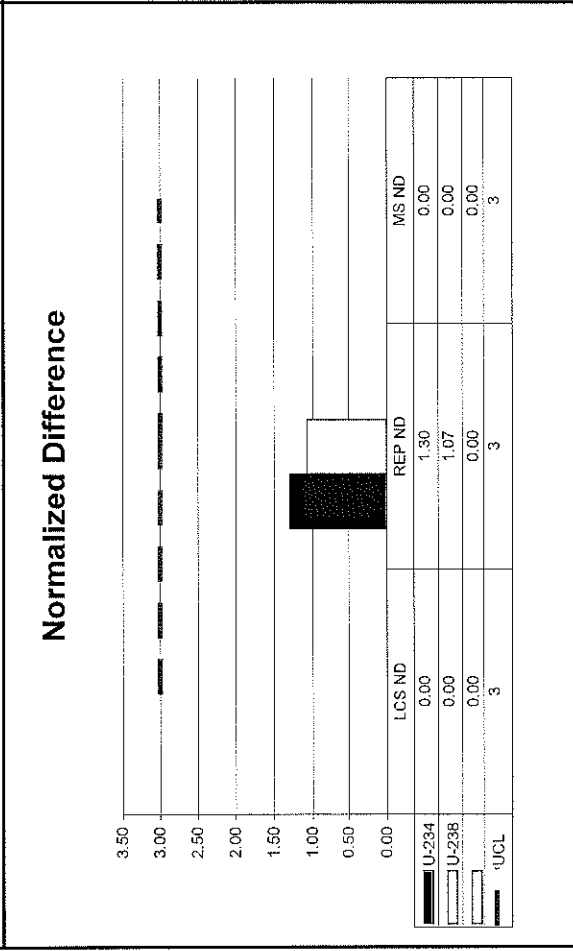
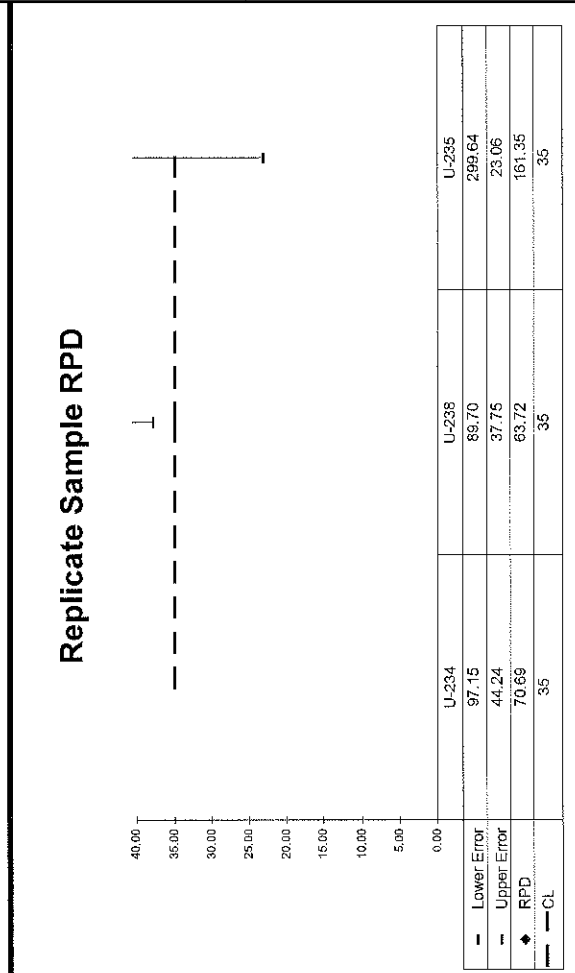
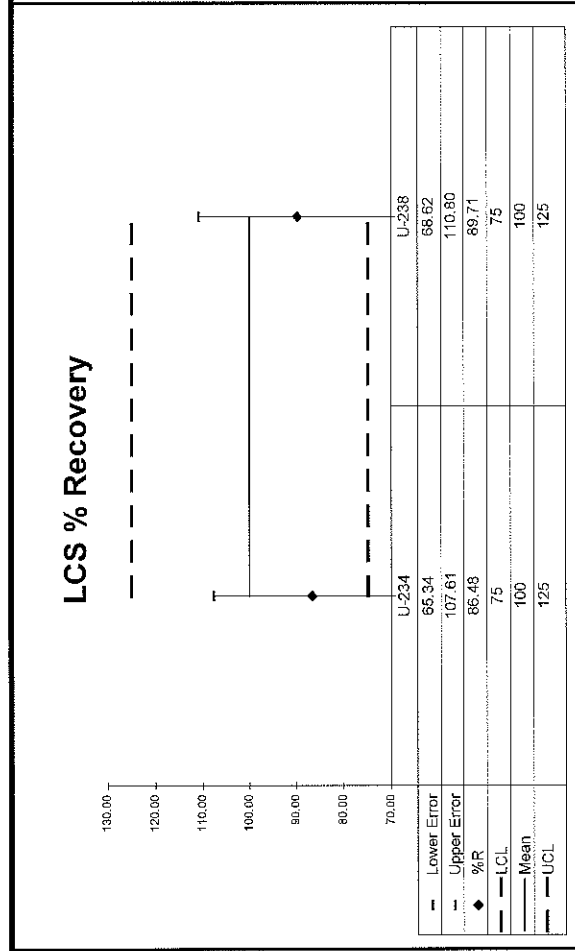
Replicate Sample

Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
U-234	1.30	70.69	3.98E-01	2.49E-01	1.90E-01	1.90E-01	0.86	OK			NA	OK
U-238	1.07	63.72	2.56E-01	1.85E-01	1.32E-01	1.31E-01	0.90	OK			NA	OK
U-235	1.26	161.35	1.29E-02	8.37E-02	1.21E-01	1.46E-01		OK			NA	OK

QC Summary

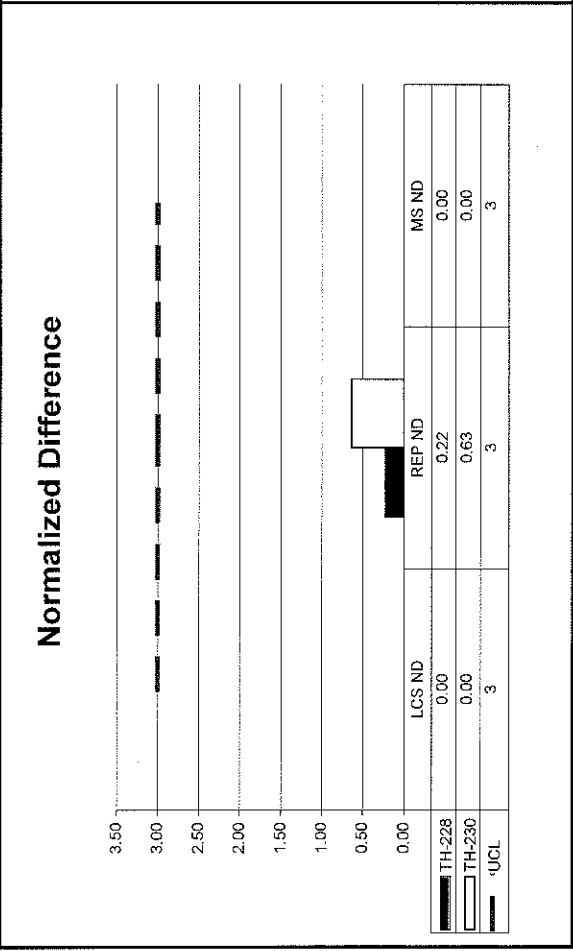
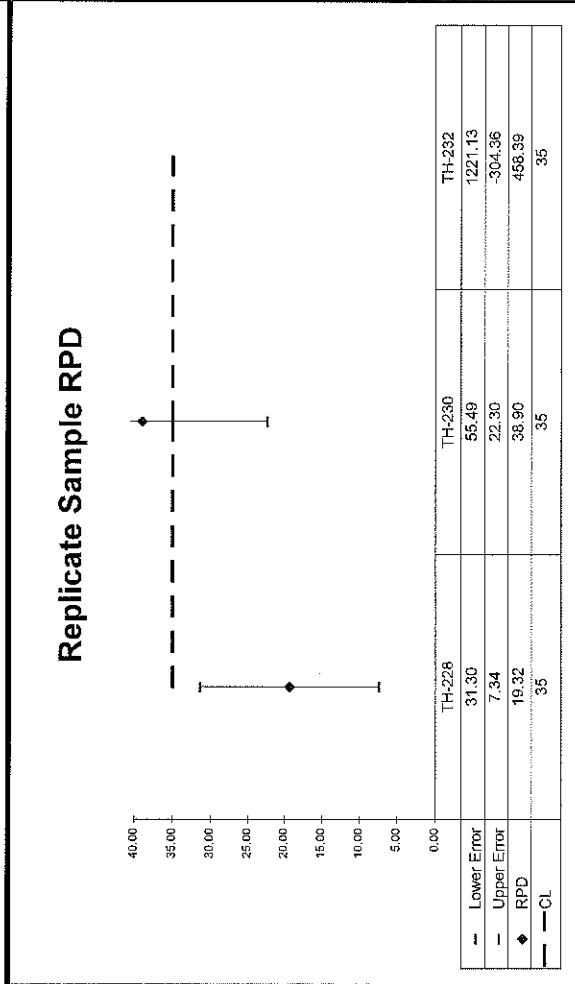
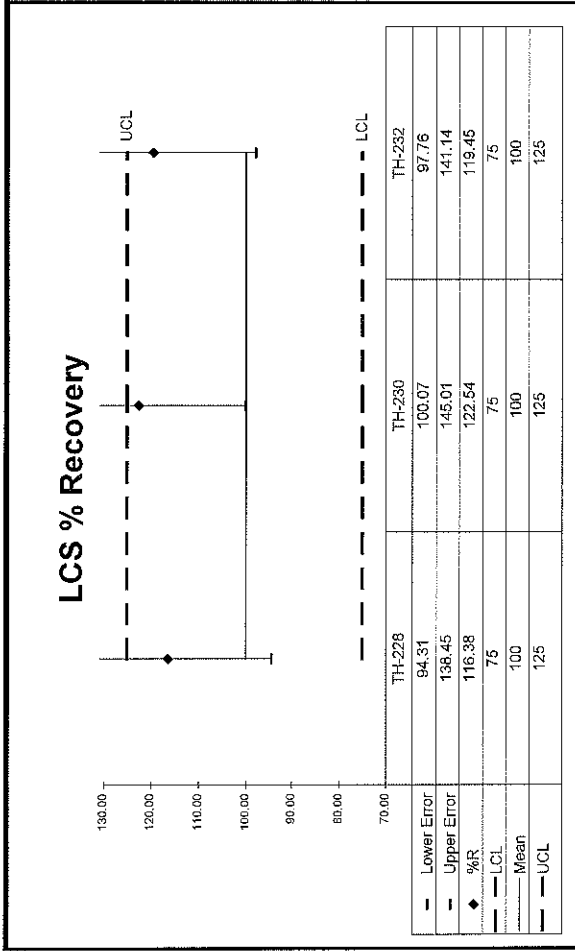
Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
U-234	1.30	70.69	3.98E-01	2.49E-01	1.90E-01	1.90E-01	0.86	OK			NA	OK
U-238	1.07	63.72	2.56E-01	1.85E-01	1.32E-01	1.31E-01	0.90	OK			NA	OK
U-235	1.26	161.35	1.29E-02	8.37E-02	1.21E-01	1.46E-01		OK			NA	OK

WO	Analysis	Run	Activity Units	Allquot Units	Client Name
15-09136	UUIISO	1	pCi	1	Auxier & Associates, Inc.



000030

WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-09136	ThISO	1	pCi	I	Auxier & Associates, Inc.



No Matrix Spike



WO	Analysis	Run	Activity Units	Aliquot Units	Client Name
15-09136	ThISO	1	pCi	I	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	116.38%	18.47%	100.00%	3.60%	4.86E+00	1.75E-01	5.65E+00	1.04E+00	Th-8b	1.04E+02	3.60E+00	1.04E-01
TH-230	122.54%	19.77%	100.00%	2.70%	5.37E+00	1.45E-01	6.58E+00	1.30E+00	Th-1b	2.35E+01	2.70E+00	5.07E-01
TH-232	119.45%	18.09%	100.00%	3.60%	4.86E+00	1.75E-01	5.80E+00	1.05E+00	Th-8b	1.04E+02	3.60E+00	1.04E-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	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
TH-228	0.22	19.32	8.45E-02	1.10E-01	1.03E-01	1.22E-01	1.16	OK			NA	OK
TH-230	0.63	38.90	2.35E-01	1.81E-01	1.58E-01	1.54E-01	1.23	OK			NA	OK
TH-232	1.81	458.39	9.32E-02	1.26E-01	-3.66E-02	6.19E-02	1.19	OK			NA	OK

QC Summary

Analyte	Normalized Difference	RPD	Original Result	Original CSU	Replicate Result	Replicate CSU	LCS Relative Bias	LCS % R	MS % R	MS ND	Rep RPD	Rep ND
TH-228	0.22	19.32	8.45E-02	1.10E-01	1.03E-01	1.22E-01	1.16	OK			NA	OK
TH-230	0.63	38.90	2.35E-01	1.81E-01	1.58E-01	1.54E-01	1.23	OK			NA	OK
TH-232	1.81	458.39	9.32E-02	1.26E-01	-3.66E-02	6.19E-02	1.19	OK			NA	OK

SECTION VII
LABORATORY TECHNICIAN'S NOTES
& RUNLOGS

ISO U NOTES

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	15-09136
		Analysis Code	UUISO
		Run Number	1


#	Date	Dept	User	Notes
1	10/05/15 07:54	PREP	JWOLFE	ALIUQUOTED AND ADDED SPIKES AND TRACERS- ADDED HNO3 TO ACIDIFY SAMPLES AND DRIED SAMPLES DOWN- SUBMITTED SAMPLES TO SEPARATIONS

JWolfe
 10/5/15

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	15-09136
		Analysis Code	UUISO
		Run Number	1


#	Date	Dept	User	Notes
1	10/05/15 07:54	PREP	JWOLFE	ALIUQUOTED AND ADDED SPIKES AND TRACERS- ADDED HNO3 TO ACIDIFY SAMPLES AND DRIED SAMPLES DOWN- SUBMITTED SAMPLES TO SEPARATIONS
2	10/09/15 18:00	CHEM	JDEMELAS	Added concentrated HCl to sample beakers and heated to dryness; Added 20 ml 8N HCL to samples and transferred to new, labeled C-Tubes, rinsing with 8N HCl to bring volume to ~35 ml; Preconditioned resin columns with 35 ml 8N HCl; Centrifuged samples and loaded onto columns; Rinsed C-Tubes with 20 ml 8N HCl, centrifuged as needed and loaded onto columns; Rinsed columns with 35 ml 8N HCl - 0.1N NH4I, 35 ml of 6.5N HCl - 0.04N HF, and 10 ml of 6.5N HCl; Eluted Uranium with 50 ml of 0.5N HCl into clean, labeled 100-ml beakers; Dried-down samples on hotplate; Dissolved samples in ~10 ml of concentrated HCl; Transferred to new, labeled C-Tubes with DI H2O. Set samples aside for later precipitation and filtering.

[Handwritten Signature]
 10/9/15

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	15-09136
		Analysis Code	UUISO
		Run Number	1

#	Date	Dept	User	Notes
1	10/05/15 07:54	PREP	JWOLFE	ALIUQUOTED AND ADDED SPIKES AND TRACERS- ADDED HNO3 TO ACIDIFY SAMPLES AND DRIED SAMPLES DOWN- SUBMITTED SAMPLES TO SEPARATIONS
2	10/09/15 18:00	CHEM	JDEMELAS	Added concentrated HCl to sample beakers and heated to dryness; Added 20 ml 8N HCL to samples and transferred to new, labeled C-Tubes, rinsing with 8N HCl to bring volume to ~35 ml; Preconditioned resin columns with 35 ml 8N HCl; Centrifuged samples and loaded onto columns; Rinsed C-Tubes with 20 ml 8N HCl, centrifuged as needed and loaded onto columns; Rinsed columns with 35 ml 8N HCl - 0.1N NH4I, 35 ml of 6.5N HCl - 0.04N HF, and 10 ml of 6.5N HCl; Eluted Uranium with 50 ml of 0.5N HCl into clean, labeled 100-ml beakers; Dried-down samples on hotplate; Dissolved samples in ~10 ml of concentrated HCl; Transferred to new, labeled C-Tubes with DI H2O. Set samples aside for later precipitation and filtering.
3	10/12/15 08:52	CHEM	TSMITH	Followed steps 12.1.7 to 12.4.5 in AP-005 . (Precipitated and filtered samples for Uranium)

10-12-15
JM2

 Reagents Used in an Analysis		Internal Work Order		
		15-09136		
		Analysis Code	Run	
		UUISO		1
Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
016519P	Nitric Acid	Reagent Grade	JWOLFE	10/5/2015
016798P	Anion Exchange Resin	Reagent Grade	JDEMELAS	10/9/2015
016828S	HCl - HF	6.5N - 0.04N	JDEMELAS	10/9/2015
016889S	HCl - NH4I	8N - 0.1M	JDEMELAS	10/9/2015
016128D05	Hydrochloric Acid	0.5N	JDEMELAS	10/9/2015
016803S	Hydrochloric Acid	6.5N	JDEMELAS	10/9/2015
016872S	Hydrochloric Acid	8N	JDEMELAS	10/9/2015
016128P	Hydrochloric Acid	Reagent Grade	JDEMELAS	10/9/2015
016843S	Carbon substrate	Solution	TSMITH	10/12/2015
016569P	Hydrofluoric Acid	Reagent Grade	TSMITH	10/12/2015
016583S	Neodymium Carrier	1 mg/ml	TSMITH	10/12/2015
016514P	Reagent Alcohol	Reagent Grade	TSMITH	10/12/2015
016606P	Titanous Chloride	Reagent Grade	TSMITH	10/12/2015

Alpha # 3

Date	Sample #	Client	Analyst	CT Time	Analysis	Final
10/9	1510077A(1)	USA	0849	2h50	uut32	-
10/9/15	1510035A(2-4)	USA	1029	2hr50-	ISO-UU	KB
10/9/15	1510020A(1-4)	UCOR	1070	2hr50-	ISO-TH	KB
10/9/15	1510024A(1-5)	MDNR	1070	2hr50-	ISO-TH	KB
10/9/15	1510020A(1-4)	UCOR	1147	2hr50-	Np	KB
10/9/15	1510026A(1-4)	PCC	1148	2hr50-	ISO-TH	KB
10/9/15	1510025A(1-5)	PCC	1148	2hr50-	ISO-TH	KB
10/9/15	1509151A(1-3)	UCOR	1149	2hr50-	ISO-TH	KB
10/9/15	1509151A(4)	UCOR	1124	2hr50-	ISO-TH	KB
10/9/15	1509151A(1-4,6)	UCOR	1724	2hr50-	ISO-P4	KB
10/9/15	1510033A(1-4)	USA	1724	2hr50-	Rele	KB
10/9/15	1510035A(1-2)	USA	1724	2hr50-	Rele	KB
10/9/15	System B Iscd	Lab	KB 10/9/15	16.40 hr	NY	-
10/9/15	System B Iscd	Lab	1721	16.40 hr	α	KB
10/11/15	Daily Pulver	Lab	0945	10 mins	NA	KB
10/11/15	1509151A(1-4,6)	UCOR	0959	2hr50-	ISO-P4	KB
10/12	Daily Pulver	LAB	0526	-	NA	-
10/12/15	1509151A(1-4)	UCOR	1003	2hr50-	Am 241	KB
10/12/15	1509151A(1-4)	UCOR	1004	2hr50-	Am 243	KB
10/12/15	1510049A(1-4)	UCOR	1004	2hr50-	ISO-UU	KB
10/12/15	1510007A(1-4)	UCOR	1005	2hr50-	ISO-UU	KB
10/12/15	1509136A(1-7)	Auxin	1004	2hr50-	ISO-UU	KB
10/12/15	1509151A(4)	UCOR	1006	2hr50-	REU NT	KB
10/12/15	1509151A(1-4)	UCOR	1007	2hr50-	ISO-UU	KB
10/12/15	1509151A(1-4)	UCOR	1300	2hr50-	Pu 242	KB
10/12/15	1510007A(1-4)	UCOR	1301	2hr50-	Pu 242	KB
10/12/15	1509151A(1-4)	UCOR	1301	2hr50-	Th 229	KB
10/12/15	1510007A(1-4)	UCOR	1302	2hr50-	Th 229	KB
10/12/15	1509136A(1)	Auxin	1344	2hr50-	UU	KB

ISO TH NOTES


 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	15-09136
		Analysis Code	ThISO
		Run Number	1

#	Date	Dept	User	Notes
1	10/05/15 07:54	PREP	JWOLFE	ALIQOTED AND ADDED SPIKES AND TRACERS- ADDED HNO3 TO ACIDIFY SAMPLES AND DRIED SAMPLES DOWN- SUBMITTED SAMPLES TO SEPARATIONS

JWOLFE
10/5/15

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com	Internal Work Order	15-09136
		Analysis Code	ThISO
		Run Number	1

#	Date	Dept	User	Notes
1	10/05/15 07:54	PREP	JWOLFE	ALIQUOTED AND ADDED SPIKES AND TRACERS- ADDED HNO3 TO ACIDIFY SAMPLES AND DRIED SAMPLES DOWN- SUBMITTED SAMPLES TO SEPARATIONS
2	10/06/15 16:45	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 deionized water, bringing volume to ~15ml. Set samples aside for later precipitation and filtering.


 10/6/15

 EBERLINE <small>SERVICES</small> Work Order Analysis Notes	Oak Ridge Laboratory 601 Scarboro Rd. Oak Ridge, TN 37830 Voice: 865.481.0683 www.eberlineservices.com		Internal Work Order	15-09136
			Analysis Code	ThISO
			Run Number	1

#	Date	Dept	User	Notes
1	10/05/15 07:54	PREP	JWOLFE	ALIUQUOTED AND ADDED SPIKES AND TRACERS- ADDED HNO ₃ TO ACIDIFY SAMPLES AND DRIED SAMPLES DOWN- SUBMITTED SAMPLES TO SEPARATIONS
2	10/06/15 16:45	CHEM	JDEMELAS	Added concentrated HNO ₃ to sample beakers and heated to dryness; Added 20 ml 8N HNO ₃ to samples and transferred to new, labeled C-Tubes, adding 8N HNO ₃ to bring volume to ~35 ml; Preconditioned resin columns with 50 ml 8N HNO ₃ ; Centrifuged samples as needed, and passed through columns; Rinsed C-Tubes with 20 ml 8N HNO ₃ ; Centrifuged rinsates and loaded onto columns; Rinsed columns with 40 ml 8N HNO ₃ ; 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 deionized water, bringing volume to ~15ml. Set samples aside for later precipitation and filtering.
3	10/07/15 12:48	CHEM	JDEMELAS	Added 0.75 ml of 0.1 mg/ml Cerium Carrier and 1 ml HF to samples in C-Tubes and mixed; Immersed sample set in ice bath for minimum one hour; Setup filters by adding Alcohol and Carbon Substrate, then added samples; When samples were filtered, added 10 ml DI H ₂ O rinses from C-Tubes; When rinsates were filtered, removed filters and placed in new, labeled Petri Dishes; and Set T-0. Completed documentation, and sent set to the Count Room.

[Handwritten Signature]
 10/7/15



Reagents Used in an Analysis

Internal Work Order

15-09136

Analysis Code

Run

ThISO

1

Reagent ID	Reagent Name	Reagent Concentration	Analyst ID	Date Recorded
016519P	Nitric Acid	Reagent Grade	JWOLFE	10/5/2015
016843S	Carbon substrate	Solution	JDEMELAS	10/7/2015
016557S	Cerrium Carrier	0.1mg/ml	JDEMELAS	10/7/2015
016569P	Hydrofluoric Acid	Reagent Grade	JDEMELAS	10/7/2015
016514P	Reagent Alcohol	Reagent Grade	JDEMELAS	10/7/2015

Alpha #3

Date	Account #	Client	Trade #	CT Price	Strategy	Feed
10/6/15	1509121A(1-5)	Accountest	1621	2hr50-	Rule	KB
10/6/15	1509142A(1-5)	Texas Brine Co.	1622	2hr50-	Rule	KB
10/6/15	1509124A(1-4)	UCOR	1623	2hr50-	Rule	KB
10/6/15	1509141A(1-4)	Access	1624	2hr50mini	Rule	KB
10/7	Daily Pulse	LAB	0572			
10/7/15	1509139A(1-4)	Utility Serv.	1107	2hr50-	Rule	KB
10/7/15	1509140A(1-4)	Utility Serv.	1127	2hr50-	Rule	KB
10/7/15	1509169A(1-4)	Accountest	1220	2hr50-	Rule	KB
10/7/15	1509138A(1-4)	Test America	1221	2hr50-	Rule	KB
10/7/15	1509124A(1-4)	UCOR	1436	2hr50-	Np	KB
10/7/15	1509124A(1-4)	UCOR	1437	2hr50-	Am 241	KB
10/7/15	1510011A(1-5)	Unitech	1438	2hr50-	ISO-LU	KB
10/7/15	1509124A(1-4,6)	UCOR	1439	2hr50-	ISO-P4	KB
10/7/15	1509135A(1-4)	Brydges-Env.	1520	2hr50-	ISO-LU	KB
10/7/15	1509098B(1-4)	UCOR	1521	2hr50-	Am 243	KB
10/7/15	1509106A(1-5,7)	DOE	1731	11 hrs	ISO-P4	KB
10/7/15	1509135A(1-4)	Brydges-Env.	1750	2hr50-	ISO-TH	KB
10/7/15	1509124A(1-4)	UCOR	1751	2hr50-	ISO-TH	KB
10/7/15	1509124A(1-4)	UCOR	1752	2hr50-	Am 243	KB
10/7/15	1509136A(1-7)	Austin	1814	2hr50-	ISO-TH	KB

SECTION VIII
ANALYTICAL DATA (ISOTOPIC URANIUM)

Work Order	15-09136
Analysis Code	UUIISO
Run	1
Date Received	9/25/2015
Lab Deadline	10/16/2015
Client	Auxier & Associates, Inc.
Project	PAP-KAN
Report Level	4
Activity Units	pCi
Aliquot Units	I
Matrix	WA
Method	EML U-02 Modified
Instrument Type	Alpha Spectroscopy
Radiometric Tracer	U-232
Radiometric Sol#	U-10a
Tracer Act (dpm/g)	18.65
Carrier	
Carrier Conc (mg/ml)	

Internal Fraction	Sample Desc	Client ID	Login CPM	Sample Date	Sample Aliquot
01	LCS	LCS		09/25/15 00:00	1.0000E+00
02	MBL	BLANK		09/25/15 00:00	1.0000E+00
03	DUP	KC85-032-L	35	09/21/15 14:42	5.0000E-01
04	DO	KC85-032-L	35	09/21/15 14:42	5.0000E-01
05	TRG	KC85-032-M	31	09/21/15 13:25	5.0000E-01
06	TRG	KC94-199-U	37	09/18/15 09:56	5.0000E-01
07	TRG	KC97-209-U	35	09/19/15 11:15	5.0000E-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.

000001

10/12/15

Apex-Alpha™

Sample Description: SPIKE
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001308
 Batch Identification: 1509136A-UU
 Sample Identification: 01
 Sample Geometry: Shelf 2
 Procedure Description: U iso

Detector Name: Alpha_057
 Chamber Serial Number: 01017326A
 Detector Serial Number: 57
 Env. Background: System Bkgd 131198
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Sample Date/Time: 10/12/2015 1:42:25 PM
 Acquisition Date/Time: 10/12/2015 1:43:57 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
 Tracer Quantity: 0.608 mL
 Effective Efficiency: 0.1471 +/- 0.0094
 Counting Efficiency: 0.1577 +/- 0.0028 on 12/13/2014 2:27:38 PM
 Chem. Recovery Factor: 0.9327 +/- 0.0619

Control Certificate Name: NatU_U-8A
 Chem. Recov. of Control: U-238 0.874468 +/- 0.075914
 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 5.282	281.66	11.69	0.34	0.00E+000	26.0
U-234	4.733	387.00	9.98	0.00	0.00E+000	8.2
U-235	4.406	22.00	42.73	0.00	0.00E+000	3.0
U-238	4.157	393.00	9.90	0.00	0.00E+000	13.4

T = Tracer Peak used for Effective Efficiency

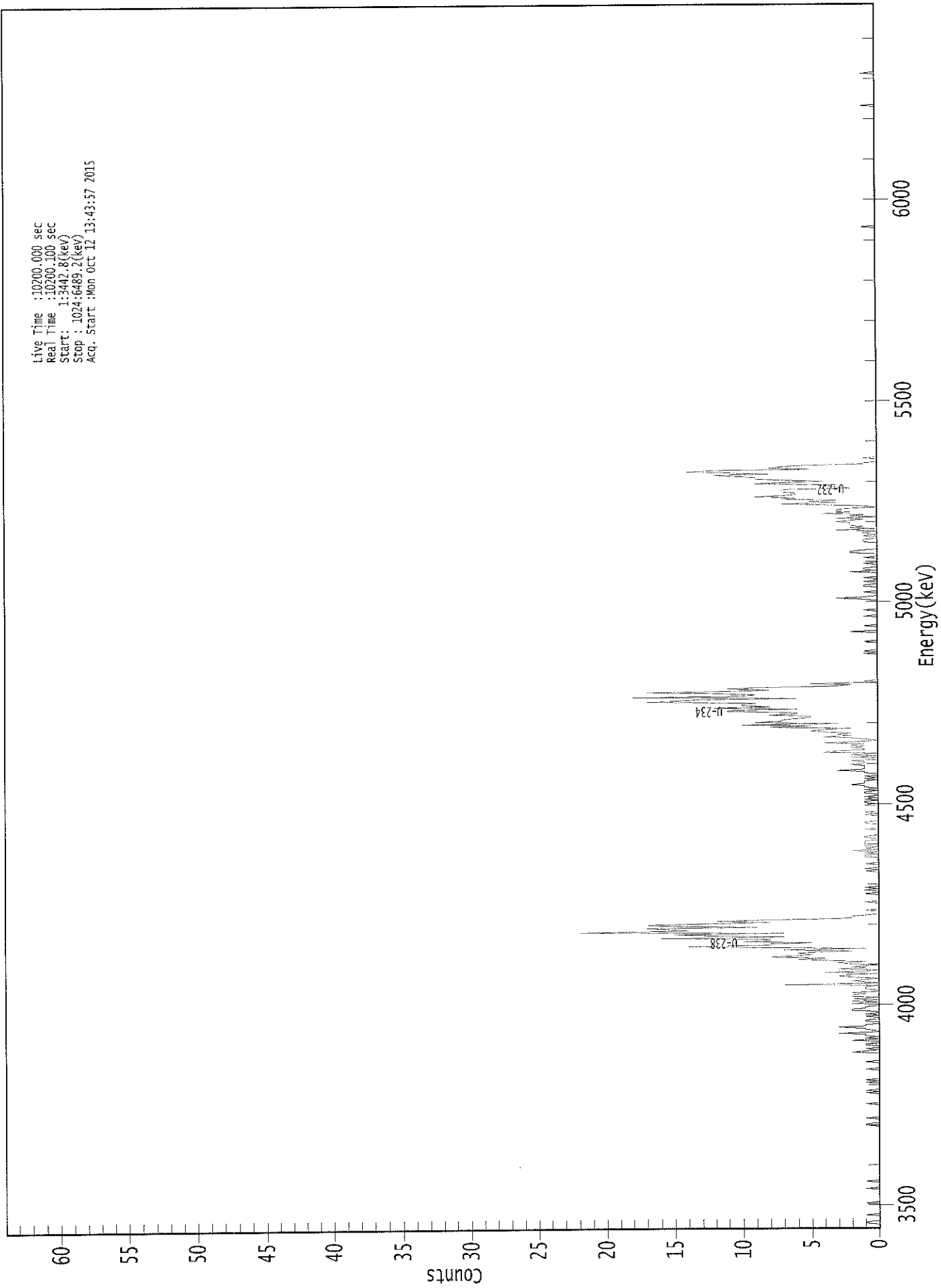
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.997	5302.50*	5.08E+000 +/- 6.37E-001	8.63E-002 +/- 1.08E-002
U-234	0.994	4761.50*	6.99E+000 +/- 1.12E+000	1.08E-001 +/- 1.36E-002
U-235	0.997	4385.50*	4.90E-001 +/- 2.18E-001	1.34E-001 +/- 1.67E-002
U-238	0.995	4184.40*	7.06E+000 +/- 1.13E+000	1.08E-001 +/- 1.35E-002

AG
 10/13/15

0000130811.CNF

Live Time : 10200.000 sec
Real Time : 10200.100 sec
Start : 1:3442.8(kev)
Stop : 1024:6489.2(kev)
Acq. Start : Mon Oct 12 13:43:57 2015



12000

ROI Type: 1

ROI Type: 3

369: 0 1 1 2 1 1 1 0

Sample Title: 01

Channel	1	2	3	4	5	6	7	8
377:	1	0	1	0	0	1	1	3
385:	1	1	1	1	2	1	1	2
393:	0	0	2	0	2	0	4	3
401:	1	1	2	1	2	1	4	1
409:	0	1	2	4	2	3	2	4
417:	5	4	2	8	5	10	3	9
425:	7	7	6	5	5	8	6	6
433:	11	11	6	12	8	10	10	9
441:	17	15	13	6	18	10	9	11
449:	17	11	8	11	9	3	2	5
457:	0	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:	1	0	1	0	0	0	0	0
489:	0	0	1	0	0	0	0	0
497:	0	0	2	0	0	0	0	1
505:	0	0	0	0	0	0	0	1
513:	0	0	0	0	1	0	0	0
521:	0	0	0	0	0	1	3	1
529:	0	0	0	1	0	0	0	0
537:	1	1	0	0	1	0	0	1
545:	0	0	0	0	2	0	1	1
553:	0	0	0	1	0	0	0	0
561:	1	0	0	0	2	2	1	0
569:	0	0	0	0	0	1	1	1
577:	0	0	1	0	1	1	0	3
585:	0	2	1	2	2	2	3	2
593:	1	3	0	2	1	4	2	3
601:	3	2	0	1	4	7	3	5
609:	3	7	6	9	7	6	6	7
617:	7	7	2	3	4	3	9	7
625:	4	7	9	9	10	12	8	11
633:	14	12	5	8	7	6	1	1
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 0

Sample Title: 01

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	1	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	1	0	0	0	0	0	0
945:	0	0	0	0	0	0	0	0
953:	0	0	0	0	0	0	0	0
961:	0	0	0	0	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

10/12

Sample Description: BLANK
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001307
 Batch Identification: 1509136A-UU
 Sample Identification: 02
 Sample Geometry: Shelf 2
 Procedure Description: U iso

Detector Name: Alpha_050
 Chamber Serial Number: 10006121B
 Detector Serial Number: 50
 Env. Background: System Bkgd 131191
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Sample Date/Time: 10/12/2015 9:23:36 AM
 Acquisition Date/Time: 10/12/2015 10:05:10 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
 Tracer Quantity: 0.607 mL
 Effective Efficiency: 0.1657 +/- 0.0101
 Counting Efficiency: 0.1428 +/- 0.0026 on 12/13/2014 2:43:59 PM
 Chem. Recovery Factor: 1.1608 +/- 0.0737

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	316.64	11.04	1.36	0.00E+000	22.1
U-234	4.666	0.83	239.53	0.17	0.00E+000	3.0
U-235	4.374	2.66	128.85	0.34	0.00E+000	3.0
U-238	4.075	1.83	152.56	0.17	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

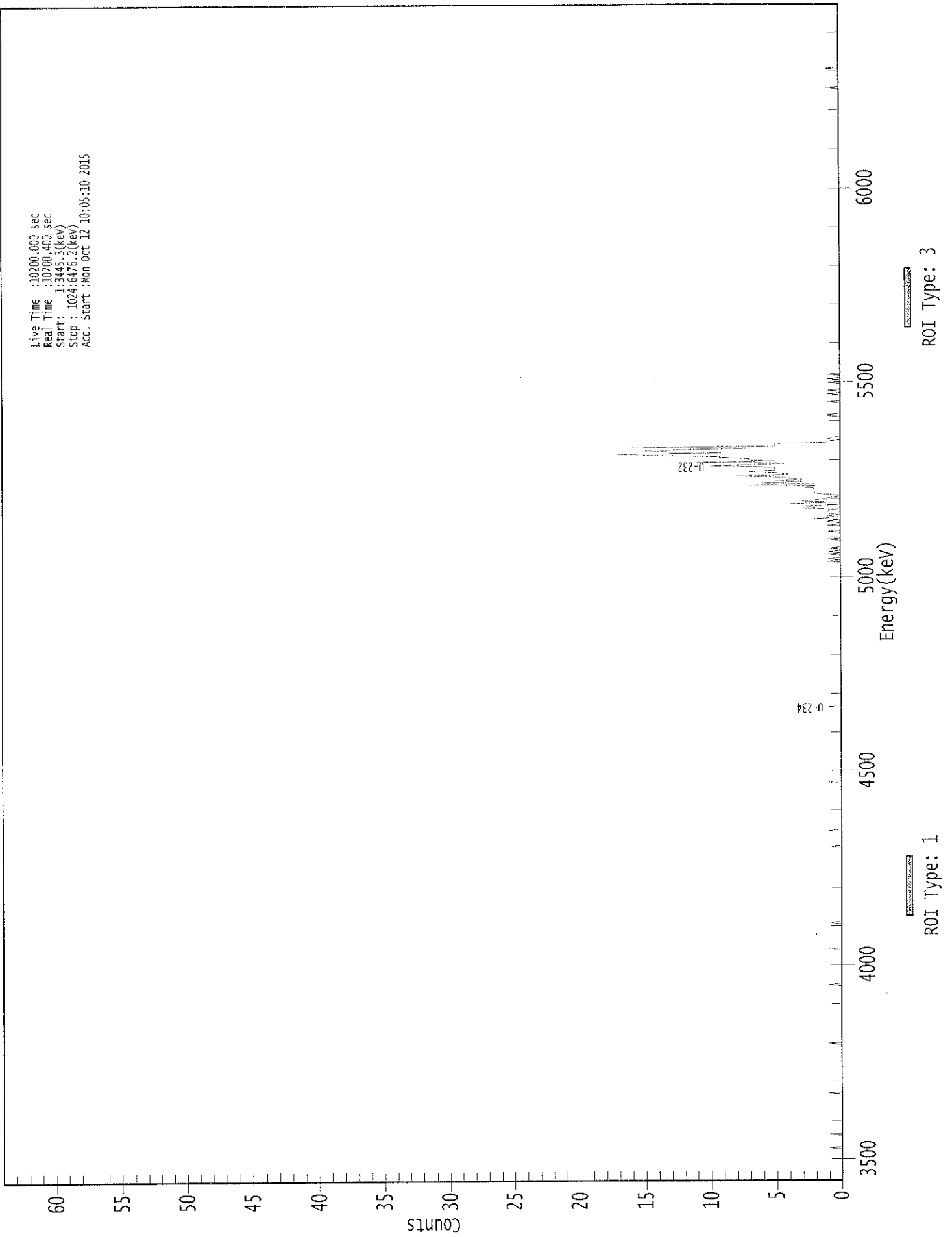
 ----- NUCLIDE ANALYSIS RESULTS -----

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.998	5302.50*	5.07E+000 +/- 6.05E-001	1.10E-001 +/- 1.31E-002
U-234	0.937	4761.50*	1.33E-002 +/- 3.19E-002	6.69E-002 +/- 7.98E-003
U-235	0.999	4385.50*	5.26E-002 +/- 6.80E-002	9.45E-002 +/- 1.13E-002
U-238	0.918	4184.40*	2.92E-002 +/- 4.47E-002	6.66E-002 +/- 7.94E-003

AG
10/13/15

0000130769.CNF

Live Time :10200.000 sec
Real Time :10200.400 sec
Start: 1:3445.3(keV)
Stop : 1024:0476.2(keV)
Acq. Start :Mon Oct 12 10:05:10 2015



: 00076

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

369: 0 0 0 0 0 0 0 0 0

Sample Title: 02

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

801: 0 0 0 0 0 0 0 0 0

Sample Title: 02

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

Apex-Alpha™

Sample Description: KC85-032-L-DUP
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001307
 Batch Identification: 1509136A-UU
 Sample Identification: 03
 Sample Geometry: Shelf 2
 Procedure Description: U iso

10/10

Detector Name: Alpha_051
 Chamber Serial Number: 10006123A
 Detector Serial Number: 51
 Env. Background: System Bkgd 131192
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/21/2015 9:23:36 AM
 Acquisition Date/Time: 10/12/2015 10:05:16 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: 0.1798 +/- 0.0106
 Counting Efficiency: 0.1524 +/- 0.0027 on 12/13/2014 2:42:37 PM
 Chem. Recovery Factor: 1.1795 +/- 0.0727

Peak Match Tolerance: 0.150 MeV

 PEAK AREA REPORT

Nuclide	Energy (MeV)	Net Pk Area	Pk Area Error %	Ambient Backgnd	Reagent Backgnd	FWHM (keV)
U-232	T 5.288	341.79	10.64	2.21	0.00E+000	39.2
U-234	4.730	6.43	99.27	3.57	0.00E+000	3.0
U-235	4.406	3.32	119.77	0.68	0.00E+000	3.0
U-238	4.178	4.49	98.45	0.51	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

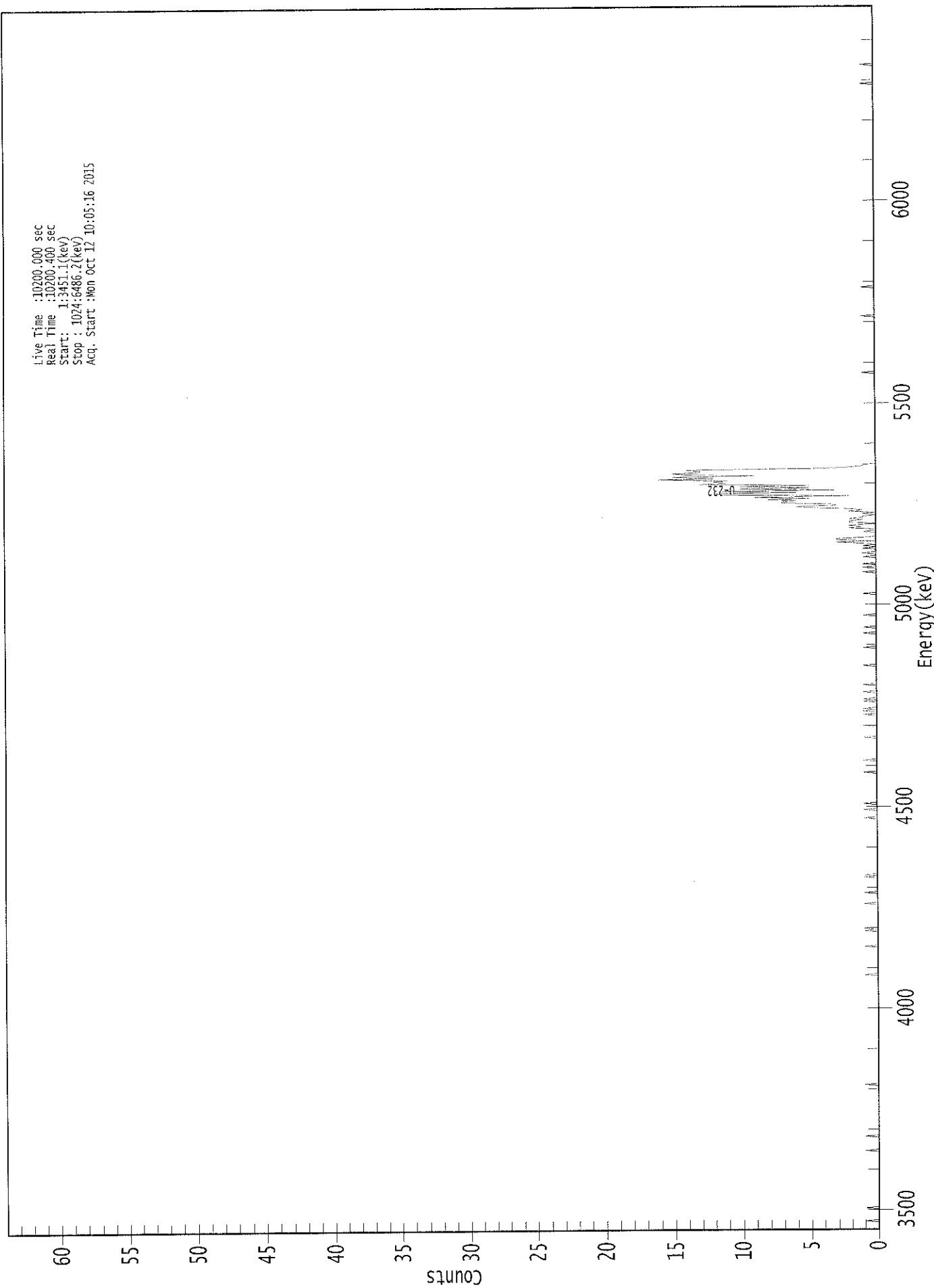
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.998	5302.50*	1.01E+001 +/- 1.17E+000	2.36E-001 +/- 2.73E-002
U-234	0.993	4761.50*	1.90E-001 +/- 1.90E-001	2.79E-001 +/- 3.22E-002
U-235	0.997	4385.50*	1.21E-001 +/- 1.46E-001	2.06E-001 +/- 2.38E-002
U-238	1.000	4184.40*	1.32E-001 +/- 1.31E-001	1.54E-001 +/- 1.78E-002

AG
10/13/15

0000130770.CNF

Live Time :10200.000 sec
Real Time :10200.400 sec
Start: 1:3451.1(kev)
Stop : 1024:6486.2(kev)
Acq. Start :Mon Oct 12 10:05:16 2015



10000

ROI Type: 1

ROI Type: 3

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

369: 0 0 0 0 0 0 0 0 0

Sample Title: 03

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	0	1	0	
385:	0	0	0	0	0	0	0	0	
393:	1	0	0	0	0	0	0	0	
401:	0	0	0	0	0	0	0	0	
409:	0	0	0	1	0	0	0	0	
417:	0	0	0	0	0	1	0	0	
425:	0	0	0	0	0	0	1	0	
433:	0	1	0	1	0	0	0	0	
441:	0	1	0	1	0	0	0	0	
449:	0	1	0	0	0	0	0	1	
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	1	0	
489:	0	0	0	0	0	0	0	0	
497:	0	0	1	0	0	0	0	1	
505:	0	0	0	0	0	0	0	0	
513:	0	1	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	0	0	0	0	0	0	0	
545:	0	0	0	0	0	1	0	0	
553:	0	1	0	0	1	0	0	0	
561:	0	0	1	0	0	1	0	0	
569:	0	1	0	1	0	1	3	0	
577:	3	3	1	0	0	0	0	1	
585:	0	0	2	1	2	1	0	2	
593:	2	1	2	1	1	0	1	0	
601:	2	1	2	5	6	3	3	7	
609:	7	6	8	5	9	2	11	12	
617:	6	12	3	10	5	10	5	13	
625:	11	12	11	16	12	15	9	14	
633:	15	13	13	14	4	2	1	1	
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	1	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	0	0	0	0	0	0	0	
785:	0	0	0	1	0	0	0	0	
793:	0	0	0	0	0	0	0	0	

801: 0 0 0 0 0 0 0 0 0

Sample Title: 03

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



10/12

Sample Description: KC85-032-L
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001307
 Batch Identification: 1509136A-UU
 Sample Identification: 04
 Sample Geometry: Shelf 2
 Procedure Description: U iso

Detector Name: Alpha_052
 Chamber Serial Number: 10006123B
 Detector Serial Number: 52
 Env. Background: System Bkgd 131193
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/21/2015 9:23:36 AM
 Acquisition Date/Time: 10/12/2015 10:05:11 AM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: U232_UU-10A
 Tracer Quantity: 0.605 mL
 Effective Efficiency: 0.1620 +/- 0.0100
 Counting Efficiency: 0.1607 +/- 0.0029 on 12/13/2014 2:40:57 PM
 Chem. Recovery Factor: 1.0082 +/- 0.0645

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	308.66	11.16	0.34	0.00E+000	20.6
U-234	4.741	12.13	61.14	1.87	0.00E+000	2.9
U-235	4.314	0.32	646.93	0.68	0.00E+000	2.9
U-238	4.136	7.83	70.93	0.17	0.00E+000	2.9

T = Tracer Peak used for Effective Efficiency

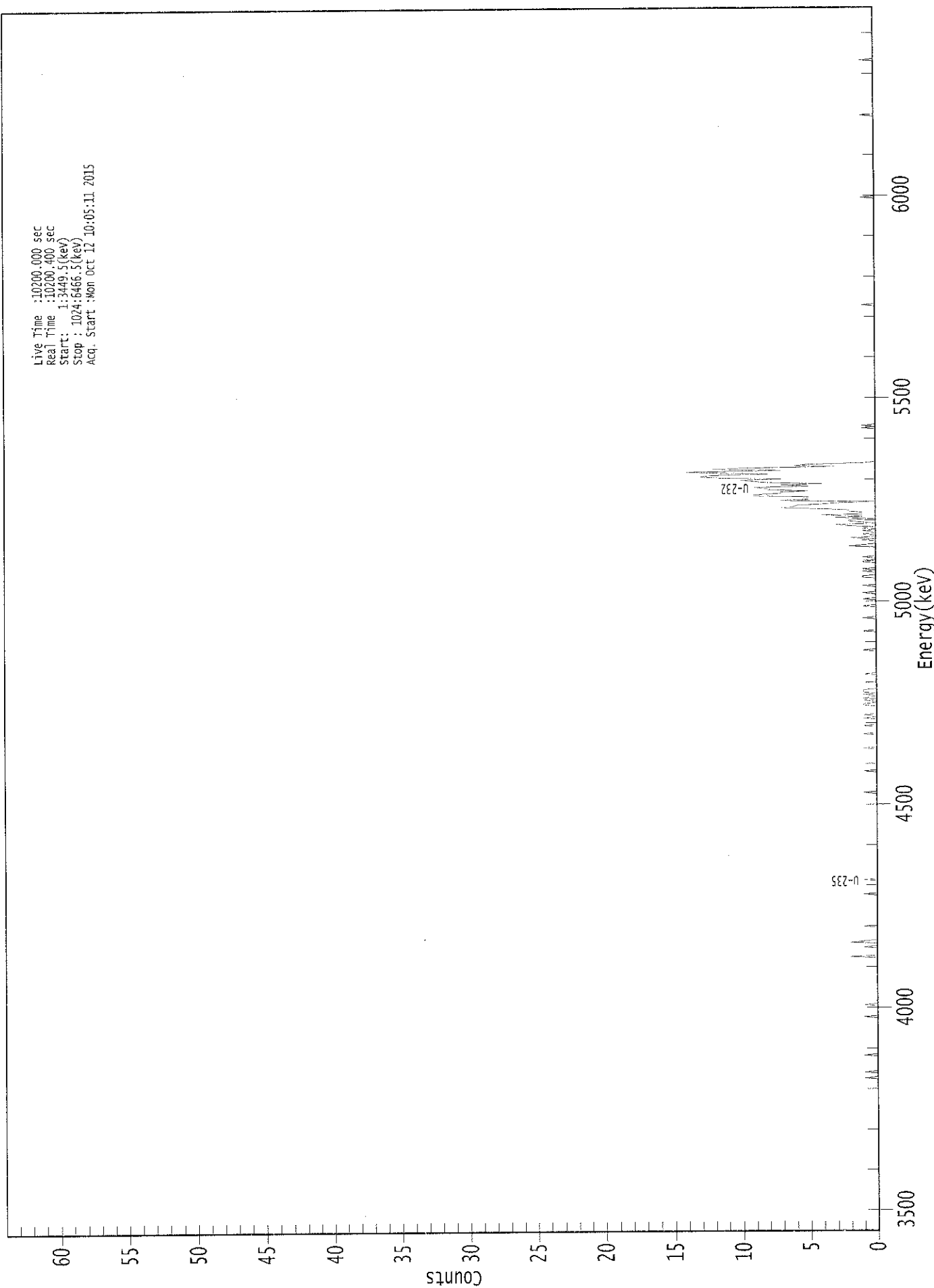
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.996	5302.50*	1.01E+001 +/- 1.22E+000	1.57E-001 +/- 1.89E-002
U-234	0.997	4761.50*	3.98E-001 +/- 2.48E-001	2.48E-001 +/- 2.99E-002
U-235	0.964	4385.50*	1.29E-002 +/- 8.37E-002	2.28E-001 +/- 2.75E-002
U-238	0.983	4184.40*	2.56E-001 +/- 1.84E-001	1.36E-001 +/- 1.64E-002

AG
10/13/15

0000130771.CNF

Live Time :10200.000 sec
Real Time :10200.400 sec
Start : 1:3449.5(keV)
Stop : 1024:6466.3(keV)
Acq. Start :Mon Oct 12 10:05:11 2015



ROI Type: 3

ROI Type: 1

000000

 ***** 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	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:	1	0	0	0	0	1	0	0
137:	0	0	0	0	0	0	0	0
145:	0	0	0	1	0	0	0	0
153:	0	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	1	0	0	0	0
185:	0	0	0	0	0	1	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	2	0	0
233:	0	0	0	0	0	1	0	0
241:	0	2	1	0	0	0	0	0
249:	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0
289:	0	0	0	0	0	1	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	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	1	0

369: 0 0 0 0 0 0 0 0 0

Sample Title: 04

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

801: 0 0 0 0 0 0 0 0 0

Sample Title: 04

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



com

Sample Description: KC85-032-M
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001307
 Batch Identification: 1509136A-UU
 Sample Identification: 05
 Sample Geometry: Shelf 2
 Procedure Description: U iso

Detector Name: Alpha_053
 Chamber Serial Number: 10006122A
 Detector Serial Number: 53
 Env. Background: System Bkgd 131194
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/21/2015 9:23:36 AM
 Acquisition Date/Time: 10/12/2015 10:05:13 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: 0.1709 +/- 0.0103
 Counting Efficiency: 0.1455 +/- 0.0026 on 12/13/2014 2:39:33 PM
 Chem. Recovery Factor: 1.1744 +/- 0.0739

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 5.287	323.15	10.92	0.85	0.00E+000	16.8
U-234	4.741	25.66	38.99	0.34	0.00E+000	4.5
U-235	4.417	4.83	91.00	0.17	0.00E+000	5.9
U-238	4.144	10.15	64.46	0.85	0.00E+000	4.5

T = Tracer Peak used for Effective Efficiency

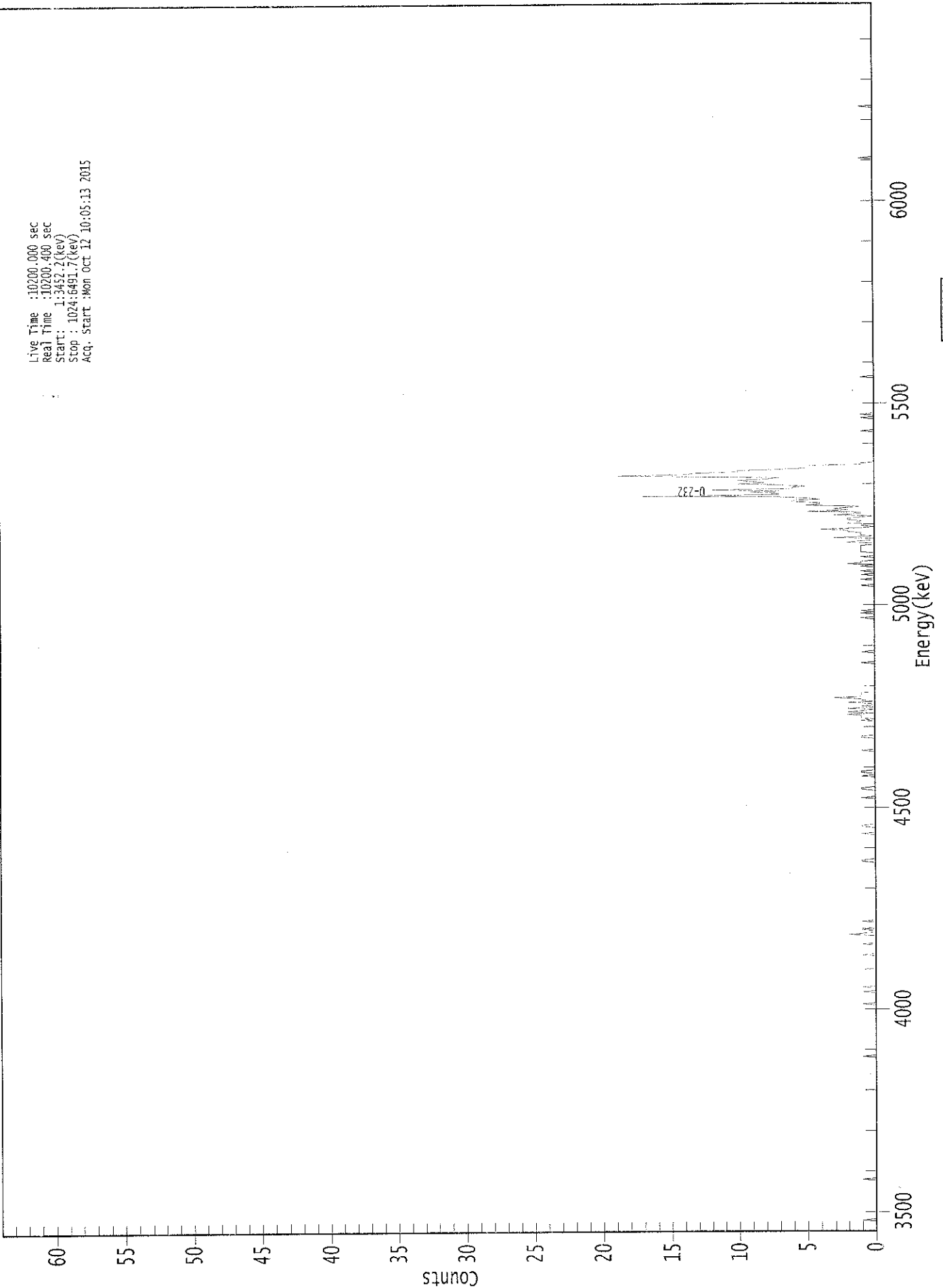
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.998	5302.50*	1.00E+001 +/- 1.19E+000	1.86E-001 +/- 2.20E-002
U-234	0.997	4761.50*	7.97E-001 +/- 3.25E-001	1.49E-001 +/- 1.76E-002
U-235	0.993	4385.50*	1.85E-001 +/- 1.70E-001	1.60E-001 +/- 1.89E-002
U-238	0.989	4184.40*	3.14E-001 +/- 2.06E-001	1.85E-001 +/- 2.19E-002

AG
10/13/15

0000130772.CNF

Live Time :10200.000 sec
Real Time :10200.400 sec
Start: 1:3452.2(rev)
Stop : 1024:6491.7(rev)
Acq. Start :Mon Oct 12 10:05:13 2015



ROI Type: 3

ROI Type: 1

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

Sample Title: 05

Elapsed Live time: 10200
Elapsed Real Time: 10200

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

369: 1 1 0 0 0 0 0 0

Sample Title: 05

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	1	0	0	1	1	
385:	0	0	0	0	0	0	0	0	
393:	0	0	0	0	0	0	0	0	
401:	1	0	0	0	0	0	0	0	
409:	0	0	0	1	1	0	0	0	
417:	0	0	0	0	0	0	0	0	
425:	0	1	0	1	1	1	2	0	
433:	2	1	0	2	0	1	0	0	
441:	2	0	1	1	3	1	1	1	
449:	1	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	1	0	0	0	0	0	0	
481:	0	0	1	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	1	0	
513:	0	0	1	0	1	0	0	0	
521:	0	0	0	0	0	0	0	0	
529:	0	0	0	0	0	0	0	0	
537:	0	1	0	0	0	0	1	0	
545:	0	0	1	0	0	1	0	0	
553:	0	1	0	2	1	1	0	0	
561:	0	1	0	0	0	1	1	1	
569:	1	1	1	0	0	2	1	0	
577:	0	3	0	1	1	1	2	2	
585:	4	1	0	1	0	2	1	1	
593:	2	2	1	0	3	1	1	5	
601:	2	3	2	1	5	4	4	6	
609:	6	4	5	7	17	7	7	9	
617:	7	12	6	6	5	7	10	8	
625:	9	10	8	7	12	19	14	13	
633:	10	10	7	5	5	5	1	1	
641:	0	0	0	0	0	0	0	0	
649:	0	0	0	0	0	0	0	0	
657:	0	0	0	0	0	0	0	0	
665:	0	0	1	0	0	0	0	0	
673:	0	0	0	0	0	1	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	1	
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 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	1	0	0
897:	0	0	0	0	0	0	0	0
905:	0	0	0	0	0	0	0	0
913:	0	0	0	0	0	0	0	0
921:	0	0	0	0	0	0	0	0
929:	0	0	0	0	0	0	0	0
937:	1	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

John

Sample Description: KC94-199-U
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001307
 Batch Identification: 1509136A-UU
 Sample Identification: 06
 Sample Geometry: Shelf 2
 Procedure Description: U iso

Detector Name: Alpha_054
 Chamber Serial Number: 10006122B
 Detector Serial Number: 54
 Env. Background: System Bkgd 131195
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/18/2015 9:23:36 AM
 Acquisition Date/Time: 10/12/2015 10:05:15 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: 0.1572 +/- 0.0098
 Counting Efficiency: 0.1452 +/- 0.0026 on 12/13/2014 2:38:19 PM
 Chem. Recovery Factor: 1.0826 +/- 0.0704

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	296.66	11.39	0.34	0.00E+000	29.9
U-234	4.739	6.83	76.08	0.17	0.00E+000	3.0
U-235	4.443	3.00	130.67	0.00	0.00E+000	3.0
U-238	4.127	7.66	72.63	0.34	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

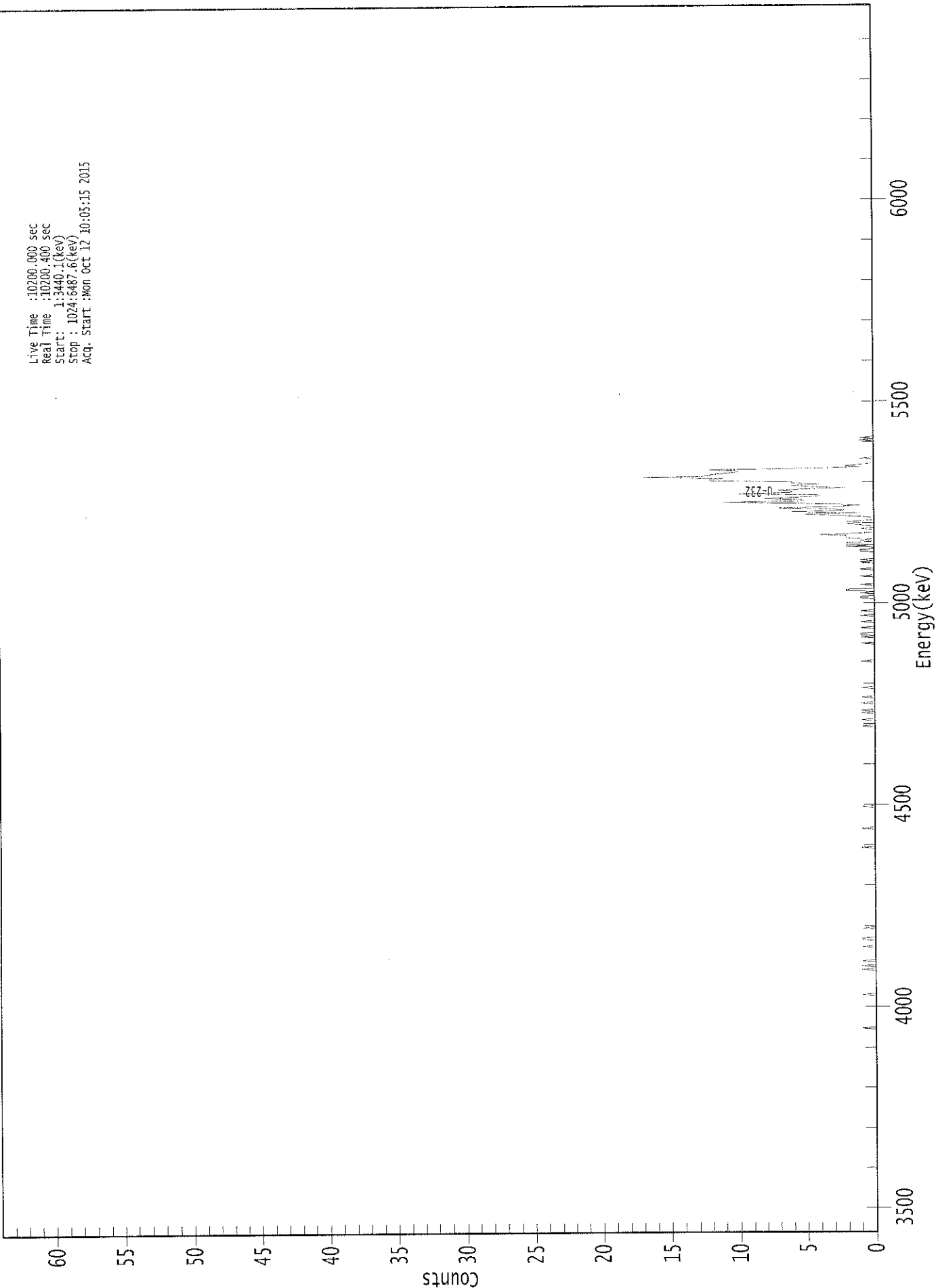
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.997	5302.50*	1.00E+001 +/- 1.23E+000	1.62E-001 +/- 1.98E-002
U-234	0.996	4761.50*	2.31E-001 +/- 1.78E-001	1.41E-001 +/- 1.73E-002
U-235	0.977	4385.50*	1.25E-001 +/- 1.64E-001	2.50E-001 +/- 3.06E-002
U-238	0.977	4184.40*	2.58E-001 +/- 1.90E-001	1.61E-001 +/- 1.97E-002

AG
10/13/15

0000130773.CNF

Live Time : 10200.000 sec
Real Time : 10200.400 sec
Start : 1:3440.1(keV)
Stop : 1024:6487.6(keV)
Acq. Start : Mon Oct 12 10:05:15 2015



ROI Type: 1

ROI Type: 3

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

369: 0 0 0 0 0 0 0 0 0

Sample Title: 06

Channel	1	2	3	4	5	6	7	8
377:	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	1	0	0
425:	0	0	1	0	0	0	0	0
433:	1	0	1	0	0	0	0	0
441:	1	0	0	0	0	1	0	0
449:	0	0	0	0	0	1	0	0
457:	0	0	0	0	0	0	0	0
465:	0	0	0	0	0	0	0	0
473:	0	0	0	1	0	0	0	0
481:	0	0	0	0	0	0	0	0
489:	0	0	1	0	0	0	0	1
497:	0	1	1	0	0	0	0	1
505:	0	0	0	0	1	0	0	0
513:	0	1	0	0	0	1	0	0
521:	0	0	0	0	0	0	0	0
529:	1	1	0	0	1	0	2	2
537:	0	0	0	1	0	0	0	0
545:	0	0	1	0	0	0	0	0
553:	1	0	0	0	0	0	1	0
561:	1	0	0	0	0	0	0	1
569:	1	0	0	2	0	2	2	0
577:	1	0	2	2	2	4	1	0
585:	0	0	1	0	0	1	2	1
593:	2	0	0	0	1	3	5	1
601:	6	2	3	7	3	1	2	6
609:	11	5	5	8	6	4	4	10
617:	6	6	7	5	2	5	6	4
625:	6	6	12	12	11	17	12	12
633:	11	10	10	12	4	1	2	1
641:	0	0	0	0	1	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	0	1	0	1	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: 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	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™

1016

Sample Description: KC97-209-U
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001307
 Batch Identification: 1509136A-UU
 Sample Identification: 07
 Sample Geometry: Shelf 2
 Procedure Description: U iso

Detector Name: Alpha_055
 Chamber Serial Number: 10006124A
 Detector Serial Number: 55
 Env. Background: System Bkgd 131196
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/19/2015 9:23:36 AM
 Acquisition Date/Time: 10/12/2015 10:05:18 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: 0.1523 +/- 0.0097
 Counting Efficiency: 0.1564 +/- 0.0028 on 12/13/2014 2:35:48 PM
 Chem. Recovery Factor: 0.9739 +/- 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 5.283	287.32	11.58	0.68	0.00E+000	8.2
U-234	4.767	5.98	87.78	1.02	0.00E+000	3.0
U-235	4.440	3.00	130.67	0.00	0.00E+000	3.0
U-238	4.140	4.66	94.59	0.34	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

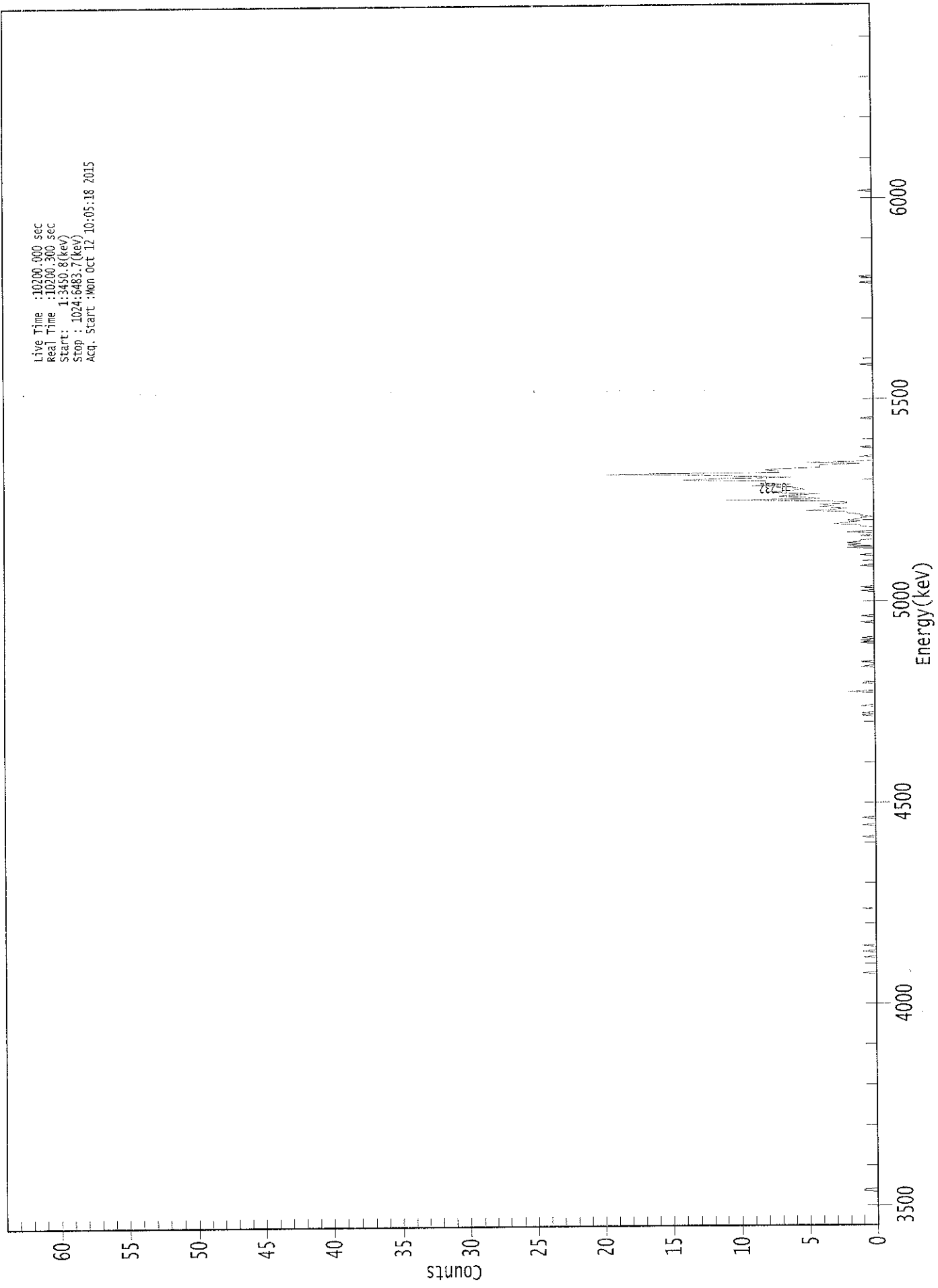
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
U-232	0.997	5302.50*	1.00E+001 +/- 1.25E+000	1.97E-001 +/- 2.45E-002
U-234	1.000	4761.50*	2.08E-001 +/- 1.85E-001	2.20E-001 +/- 2.73E-002
U-235	0.979	4385.50*	1.29E-001 +/- 1.69E-001	2.58E-001 +/- 3.20E-002
U-238	0.986	4184.40*	1.62E-001 +/- 1.54E-001	1.66E-001 +/- 2.06E-002

AG
10/13/15

0000130774.CNF

Live Time : 10200.000 sec
Real Time : 10200.300 sec
Start : 1:3450.8(kev)
Stop : 1024:6483.7(kev)
Acq. Start : Mon Oct 12 10:05:18 2015



: 00101

ROI Type: 3

ROI Type: 1

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

Sample Title: 07

Elapsed Live time: 10200
Elapsed Real Time: 10200

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

369: 0 0 0 0 0 0 0 0 0

Sample Title: 07

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	0	0	0	0
409:	0	0	0	0	0	0	0	0	0
417:	0	0	0	0	0	0	0	0	0
425:	0	0	0	1	0	1	0	0	0
433:	0	0	0	1	0	0	0	0	0
441:	0	0	0	0	0	0	0	0	2
449:	0	0	0	0	0	0	1	0	0
457:	0	0	0	0	0	0	0	0	0
465:	0	0	0	0	1	0	0	0	0
473:	1	0	0	0	0	0	0	0	0
481:	0	0	0	0	0	0	0	0	0
489:	1	0	1	0	1	0	0	0	0
497:	0	0	0	0	0	0	0	0	0
505:	0	1	0	0	0	0	1	0	0
513:	0	0	0	0	0	0	0	0	0
521:	0	0	0	0	0	0	0	0	0
529:	0	0	0	1	0	0	1	0	0
537:	0	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0	0
553:	1	0	0	0	0	0	0	0	0
561:	0	1	0	0	0	0	0	0	2
569:	0	2	1	2	1	1	0	0	0
577:	0	1	0	0	2	0	0	0	0
585:	0	1	1	3	2	1	2	1	1
593:	1	0	1	1	2	2	5	3	3
601:	2	4	3	4	2	2	4	11	11
609:	4	5	7	6	4	7	8	6	6
617:	5	6	6	9	6	8	8	8	8
625:	14	12	6	10	12	20	7	7	7
633:	8	7	4	4	4	1	5	1	1
641:	0	0	0	1	0	0	0	0	0
649:	0	0	0	1	0	0	0	0	0
657:	0	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0	0
673:	0	0	0	1	0	0	0	0	0
681:	0	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0	0
721:	1	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0	0
745:	0	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0	0
761:	0	0	0	0	0	0	0	0	0
769:	0	0	0	0	0	0	0	0	0
777:	0	0	0	0	0	0	0	0	0
785:	0	0	0	0	0	1	0	0	0
793:	0	0	1	0	0	0	0	0	0

801: 0 0 0 0 0 0 0 0 0

Sample Title: 07

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



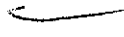
QA SUMMARY REPORT

Review Of QA Results - Pulser Check

Date : 10/12/2015
Time : 5:49:04 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	10/12/2015 5:27:32 AM
Alpha 004	21f	ALL	Passed	10/12/2015 5:27:33 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	10/12/2015 5:27:33 AM
Alpha 011	21f	ALL	Passed	10/12/2015 5:27:34 AM
Alpha 012	21f	ALL	Passed	10/12/2015 5:27:35 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	10/12/2015 5:27:36 AM
Alpha 015	21f	ALL	Passed	10/12/2015 5:27:37 AM
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:38 AM
Alpha 034	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:39 AM
Alpha 035	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:41 AM
Alpha 036	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:42 AM
Alpha 037	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:44 AM
Alpha -038	Alpha Analyst100DC	Peak Energy <i>all</i>	Action <i>2/1/12</i>	10/12/2015 5:27:46 AM
Alpha 039	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:47 AM
Alpha 040	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:49 AM
Alpha 041	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:51 AM
Alpha 042	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:53 AM
Alpha 043	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:54 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:55 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:57 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:27:59 AM
Alpha 047	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:00 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:02 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:03 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:05 AM
Alpha 051	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:07 AM
Alpha 052	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:09 AM
Alpha 053	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:11 AM
Alpha 054	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:12 AM
Alpha 055	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:15 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:16 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:18 AM
Alpha 058	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:20 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha_059	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:22 AM
Alpha_060	Alpha Analyst100DC	ALL	Passed	10/12/2015 5:28:24 AM

APPROVED BY: _____ 

APPROVAL DATE: 10/12

0105A

***** LIBRARY LISTING REPORT *****

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)

Work Order	15-09136
Analysis Code	ThISO
Run	1
Date Received	9/25/2015
Lab Deadline	10/16/2015
Client	Auxier & Associates, Inc.
Project	PAP-KAN
Report Level	4
Activity Units	pCi
Aliquot Units	I
Matrix	WA
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		09/25/15 00:00	1.0000E+00
02	MBL	BLANK		09/25/15 00:00	1.0000E+00
03	DUP	KC85-032-L	35	09/21/15 14:42	5.0000E-01
04	DO	KC85-032-L	35	09/21/15 14:42	5.0000E-01
05	TRG	KC85-032-M	31	09/21/15 13:25	5.0000E-01
06	TRG	KC94-199-U	37	09/18/15 09:56	5.0000E-01
07	TRG	KC97-209-U	35	09/19/15 11:15	5.0000E-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.

Internal Work Order		Run	Analysis Code	Date	Technician	Technician Initials	Witness Initials
15-09136		1	ThISO	10/5/2015 7:28	JWOLFE		
LCS & Matrix Spikes							
Isotope	Sol #	Activity dpm/g	Solution Date	Approx Addition	LCS Volume Used (g)	MS Volume Used (g)	MSD Volume Used (g)
Th-228	Th-8b	103.560	10/5/2015	0.100	0.1041		
Th-230	Th-1b	23.520	10/5/2015	0.500	0.5067		
Th-232	Th-8b	103.560	10/5/2015	0.100	0.1041		
Balance Printer Tapes							
fraction	Isotope	Sol #	Activity dpm/g	Solution Date	Volume Used (g)	Approx Addition	
01	Th-229	Th-18a	22.460	10/5/2015	0.4694	0.2200	
02	Th-229	Th-18a	22.460	10/5/2015	0.2341	0.2200	
03	Th-229	Th-18a	22.460	10/5/2015	0.2341	0.2200	
04	Th-229	Th-18a	22.460	10/5/2015	0.2312	0.2200	
05	Th-229	Th-18a	22.460	10/5/2015	0.2321	0.2200	
06	Th-229	Th-18a	22.460	10/5/2015	0.2314	0.2200	
07	Th-229	Th-18a	22.460	10/5/2015	0.2317	0.2200	
Tracers							
<p>0.4694 9</p> <p>0.2341 9</p> <p>0.2341 9</p> <p>0.2312 9</p> <p>0.2321 9</p> <p>0.2314 9</p> <p>0.2317 9</p>							
Matrix Spike							
LCS							

Apex-Alpha™

10/8

Sample Description: SPIKE
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001303
 Batch Identification: 1509136A-TH
 Sample Identification: 01
 Sample Geometry: Shelf 2
 Procedure Description: Th iso

Detector Name: Alpha_039
 Chamber Serial Number: 06027396A
 Detector Serial Number: 83109
 Env. Background: System Bkgd 130607
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Sample Date/Time: 10/7/2015 4:10:44 PM
 Acquisition Date/Time: 10/7/2015 6:15:05 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
 Tracer Quantity: 0.469 mL
 Effective Efficiency: 0.1852 +/- 0.0117
 Counting Efficiency: 0.1934 +/- 0.0034 on 10/25/2014 2:53:34 PM
 Chem. Recovery Factor: 0.9575 +/- 0.0628

Control Certificate Name: NatTh_Th-8
 Chem. Recov. of Control: TH-232 1.194491 +/- 0.102740
 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	5.795	19.79	46.85	2.21	0.00E+000	3.0
TH-228	5.350	394.75	9.93	4.25	0.00E+000	6.9
TH-229 T	4.860	331.94	10.82	3.06	0.00E+000	3.9
TH-230	4.609	458.96	9.17	2.04	0.00E+000	7.4
TH-232	3.937	405.43	9.78	3.57	0.00E+000	8.3

T = Tracer Peak used for Effective Efficiency

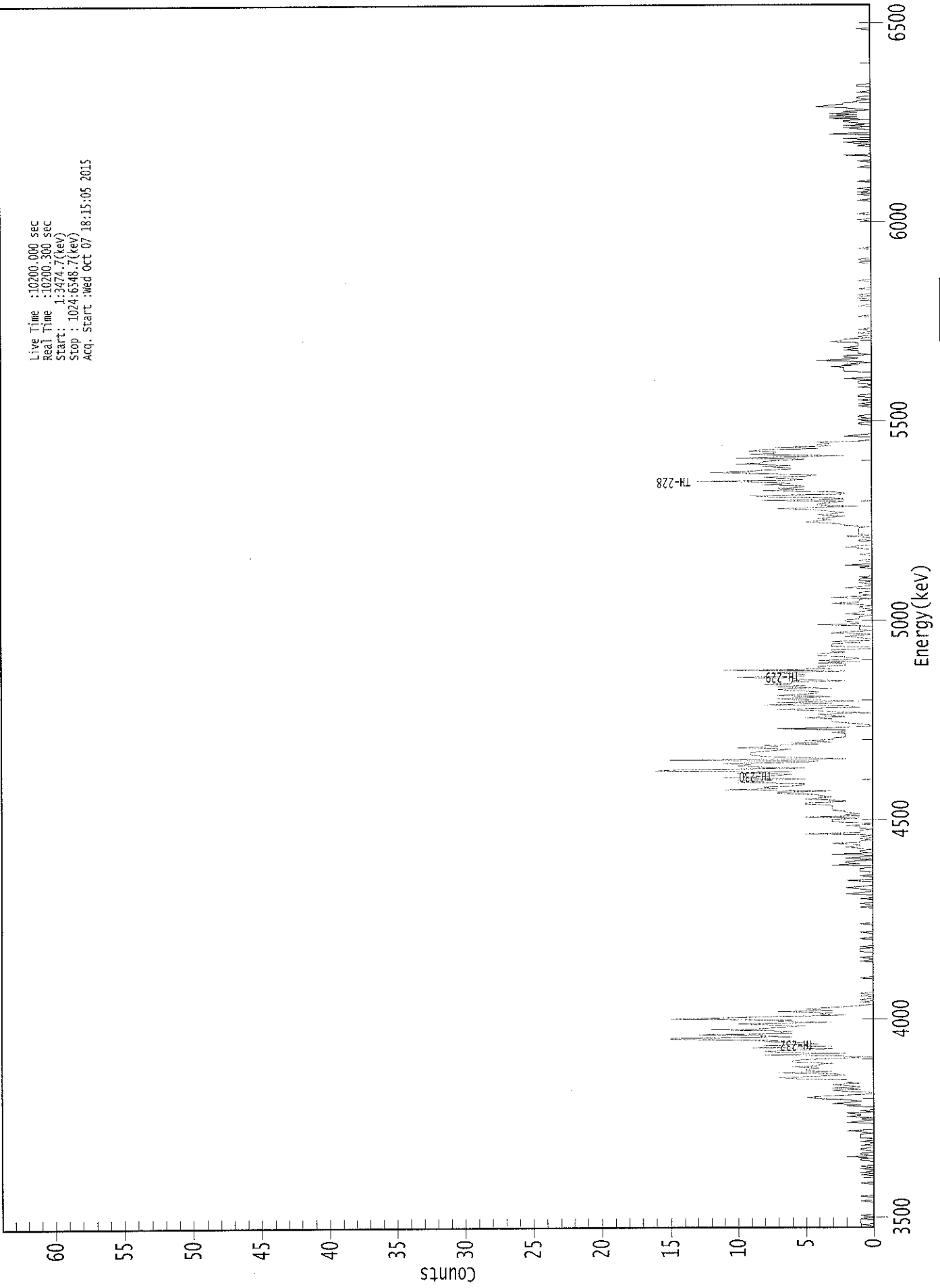
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.984	5850.00*	2.90E-001 +/- 1.41E-001	1.17E-001 +/- 1.46E-002
TH-228	0.987	5400.00*	5.65E+000 +/- 8.98E-001	1.44E-001 +/- 1.78E-002
TH-229	0.999	4872.00*	4.77E+000 +/- 5.92E-001	1.28E-001 +/- 1.59E-002
TH-230	0.980	4672.00*	6.58E+000 +/- 1.01E+000	1.12E-001 +/- 1.38E-002
TH-232	0.981	3997.00*	5.80E+000 +/- 9.16E-001	1.35E-001 +/- 1.67E-002

AG
 10/8/15

0000130385.CNF

Live Time :10200.000 sec
Real Time :10200.300 sec
Start : 1:3474.7(kev)
Stop : 1024:6548.7(kev)
Acq. Start :Wed Oct 07 18:15:05 2015



ROI Type: 1

ROI Type: 3

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

Sample Title: 01

Elapsed Live time: 10200

Elapsed Real Time: 10200

Channel	1	2	3	4	5	6	7	8	9
1:	0	0	1	0	0	0	0	1	
9:	0	0	1	0	0	0	0	0	
17:	0	0	0	0	0	0	1	0	
25:	0	0	1	0	0	0	0	0	
33:	0	0	0	0	0	1	0	0	
41:	0	0	0	0	1	0	1	0	
49:	0	1	0	1	0	0	0	0	
57:	1	1	0	2	0	1	1	0	
65:	0	1	1	0	0	1	0	0	
73:	1	0	0	1	1	1	1	0	
81:	1	2	0	0	0	0	0	0	
89:	2	1	0	1	0	2	1	1	
97:	2	0	1	0	0	0	2	1	
105:	3	2	1	2	4	5	4	2	
113:	0	0	2	3	1	3	1	2	
121:	3	1	2	2	2	6	7	4	
129:	2	3	7	3	5	5	4	6	
137:	4	4	3	6	6	5	2	0	
145:	3	8	2	7	8	5	3	9	
153:	3	8	4	5	8	7	15	15	
161:	6	8	13	6	7	6	12	8	
169:	7	5	8	10	3	7	6	15	
177:	11	7	2	4	3	7	3	5	
185:	4	2	1	0	0	1	0	1	
193:	0	0	1	0	1	0	0	0	
201:	0	0	0	0	0	0	0	0	
209:	0	1	0	0	0	0	0	0	
217:	0	0	0	0	0	0	0	1	
225:	0	0	1	0	0	0	0	1	
233:	1	1	0	1	0	0	0	0	
241:	0	0	1	0	0	0	0	1	
249:	0	0	0	0	0	0	1	0	
257:	0	0	0	0	0	0	0	0	
265:	0	0	0	0	1	0	0	1	
273:	0	0	0	1	0	0	0	2	
281:	1	0	0	1	2	1	0	0	
289:	0	0	2	0	0	0	1	0	
297:	0	0	1	1	1	0	0	3	
305:	1	2	2	0	1	2	0	0	
313:	3	0	1	1	0	1	2	1	
321:	1	3	1	1	0	1	0	1	
329:	0	5	1	1	1	0	1	1	
337:	2	0	0	3	3	3	1	5	
345:	1	2	1	2	2	3	3	3	
353:	3	3	5	5	2	2	5	4	
361:	3	4	4	7	7	3	11	7	

369: 8 6 5 5 10 8 10 5

Sample Title: 01

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

801: 0 0 0 0 0 0 0 1 0

Sample Title: 01

Channel	-----	-----	-----	-----	-----	-----	-----	-----
809:	0	1	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	1	0	0	0	0	1
849:	0	0	0	0	0	0	0	0
857:	0	0	1	0	0	0	0	1
865:	0	1	0	0	1	0	0	0
873:	0	0	1	0	0	0	0	0
881:	0	0	0	0	0	0	1	0
889:	0	0	0	1	0	0	0	0
897:	2	0	0	0	0	0	0	0
905:	1	0	1	2	0	0	2	0
913:	0	0	3	0	0	0	1	2
921:	0	2	0	1	2	2	0	3
929:	1	3	1	3	1	2	0	1
937:	2	4	3	2	2	1	1	0
945:	1	1	0	0	0	1	0	0
953:	0	0	1	1	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	1	0	0	0	0	0
1009:	0	0	0	0	0	0	0	0
1017:	0	0	0	0	0	0	0	0



Sample Description: BLANK
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001304
 Batch Identification: 1509136A-TH
 Sample Identification: 02
 Sample Geometry: Shelf 2
 Procedure Description: Th iso

Detector Name: Alpha_040
 Chamber Serial Number: 06027396B
 Detector Serial Number: 91135
 Env. Background: System Bkgd 130608
 Reagent Blank: <not performed>

Sample Size: 1.000E+000 +/- 0.000E+000 liter
 Sample Date/Time: 10/7/2015 4:10:44 PM
 Acquisition Date/Time: 10/7/2015 6:15:07 PM
 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: 0.2053 +/- 0.0165
 Counting Efficiency: 0.1856 +/- 0.0032 on 10/25/2014 2:57:14 PM
 Chem. Recovery Factor: 1.1062 +/- 0.0908

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	5.880	4.49	98.45	0.51	0.00E+000	3.0
TH-228	5.310	2.32	149.12	0.68	0.00E+000	3.0
TH-229 T	4.852	183.49	14.49	0.51	0.00E+000	7.0
TH-230	4.579	7.00	79.20	0.00	0.00E+000	3.0
TH-232	3.917	2.00	169.74	0.00	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

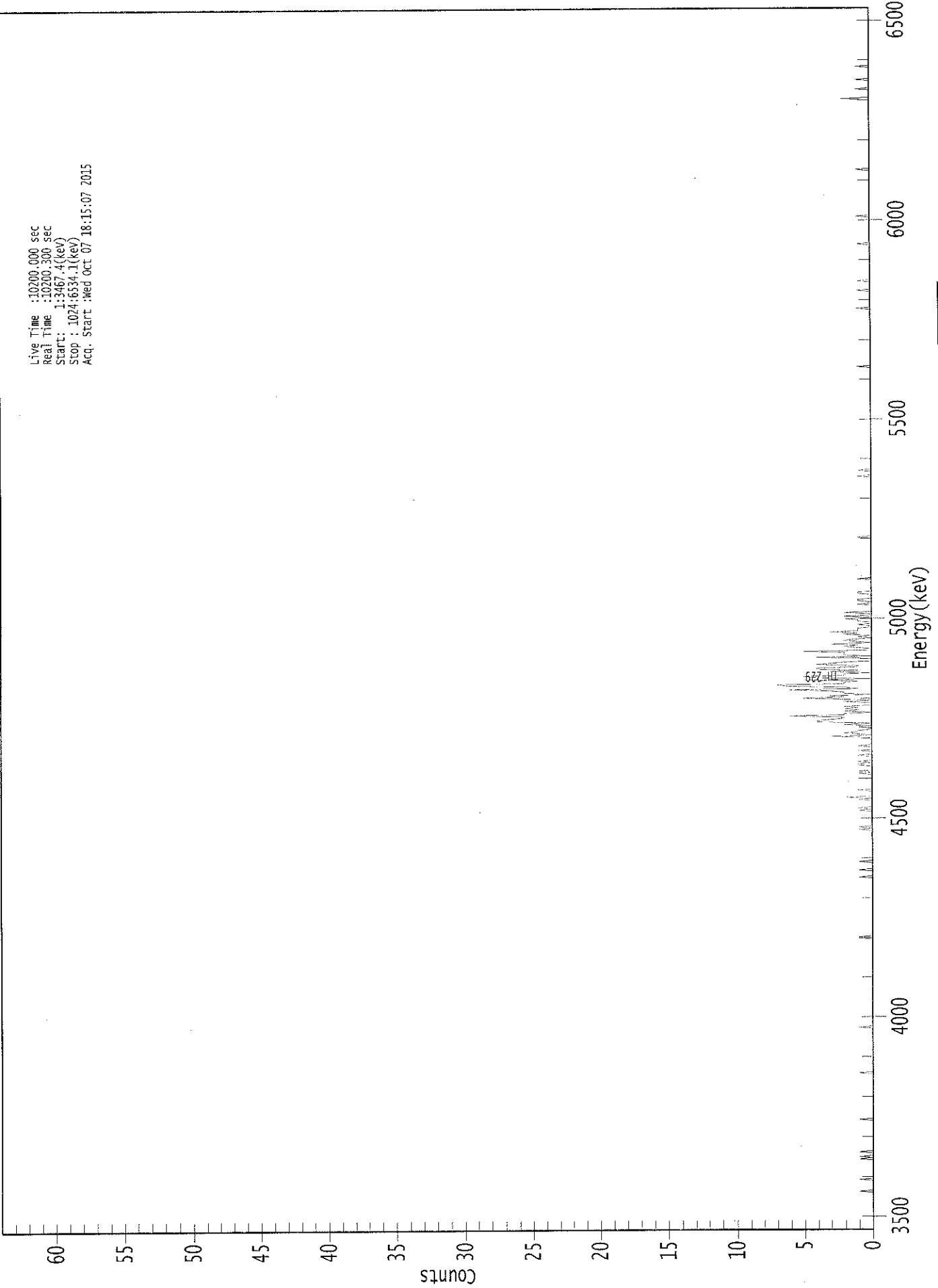
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.995	5850.00*	5.94E-002 +/- 5.93E-002	6.95E-002 +/- 1.09E-002
TH-228	0.959	5400.00*	3.00E-002 +/- 4.49E-002	7.29E-002 +/- 1.14E-002
TH-229	0.998	4872.00*	2.38E+000 +/- 3.74E-001	6.81E-002 +/- 1.07E-002
TH-230	0.956	4672.00*	9.05E-002 +/- 7.31E-002	7.75E-002 +/- 1.22E-002
TH-232	0.967	3997.00*	2.58E-002 +/- 4.40E-002	7.74E-002 +/- 1.22E-002

AG
 10/8/15

0000130386.CNF

Live Time :10200.000 sec
Real Time :10200.300 sec
Start : 1:3467.4(kev)
Stop : 1024:6534.1(kev)
Acq. Start :Wed Oct 07 18:15:07 2015



ROI Type: 1

ROI Type: 3

00120

 ***** 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:	1	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	1	0	1	0	0
65:	0	1	0	0	0	0	0	0
73:	0	0	0	0	0	0	0	0
81:	0	0	0	0	0	0	0	0
89:	0	0	0	0	1	0	0	0
97:	0	0	0	0	0	0	0	0
105:	0	0	0	0	0	0	0	0
113:	0	0	0	0	0	0	0	0
121:	0	0	0	0	0	0	0	0
129:	0	0	0	1	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	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	1	1	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	1
297:	0	0	0	0	0	1	0	0
305:	0	0	0	0	1	0	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	1
337:	0	1	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	1
353:	0	1	0	0	0	0	0	0
361:	1	0	2	0	0	0	0	0

369: 1 0 0 0 0 0 0 0 0

Sample Title: 02

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	1	0	0	0	1	0	
385:	1	0	0	0	0	1	1	0	
393:	1	0	0	0	0	1	0	0	
401:	0	1	0	0	0	1	0	0	
409:	0	0	0	0	0	3	0	1	
417:	2	1	1	0	0	1	0	2	
425:	0	4	4	3	2	2	6	2	
433:	2	0	2	1	2	1	2	0	
441:	0	0	2	0	2	5	2	3	
449:	0	2	2	3	6	1	2	6	
457:	7	2	2	1	5	0	4	5	
465:	2	2	0	3	1	4	4	1	
473:	1	4	3	2	0	0	0	4	
481:	0	2	2	2	5	0	0	1	
489:	2	1	3	0	1	2	1	0	
497:	1	0	2	1	3	1	1	1	
505:	0	0	1	0	0	1	1	2	
513:	0	2	0	0	2	0	0	0	
521:	0	0	0	1	0	0	1	1	
529:	0	0	0	0	1	1	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	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	1	0	0	0	0	
585:	0	0	0	0	0	0	0	0	
593:	0	0	0	0	0	0	0	0	
601:	0	0	0	0	0	0	0	0	
609:	0	0	0	0	0	0	0	0	
617:	0	0	0	0	0	0	0	0	
625:	0	0	0	0	0	0	1	0	
633:	0	0	0	1	0	0	0	0	
641:	0	0	0	0	0	0	0	0	
649:	0	0	0	0	0	0	0	0	
657:	0	0	0	0	0	0	0	0	
665:	0	0	0	0	0	0	0	0	
673:	0	0	0	0	0	0	0	0	
681:	0	0	0	0	0	0	0	0	
689:	0	0	0	0	0	0	0	0	
697:	0	0	0	0	0	0	0	0	
705:	0	0	0	0	0	0	0	0	
713:	0	0	0	0	0	0	0	0	
721:	0	0	1	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	1	0	0	0	0	
777:	0	0	0	0	0	0	0	0	
785:	0	0	1	0	0	0	0	0	
793:	0	0	1	0	0	0	0	0	

801: 0 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	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:	1	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	0	0	0	0
881:	0	0	0	0	0	0	0	1
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	2	0	0	0	0	0
953:	0	0	1	0	0	0	0	0
961:	0	0	1	0	0	0	0	0
969:	0	0	0	0	0	1	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: KC85-032-L DUP
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001303
 Batch Identification: 1509136A-TH
 Sample Identification: 03
 Sample Geometry: Shelf 2
 Procedure Description: Th iso

Detector Name: Alpha_041
 Chamber Serial Number: 05026930A
 Detector Serial Number: 91087
 Env. Background: System Bkgd 130609
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/21/2015 4:10:44 PM
 Acquisition Date/Time: 10/7/2015 6:15:09 PM
 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: 0.2000 +/- 0.0162
 Counting Efficiency: 0.1873 +/- 0.0033 on 10/25/2014 3:00:28 PM
 Chem. Recovery Factor: 1.0679 +/- 0.0887

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	5.767	1.98	176.34	1.02	0.00E+000	3.0
TH-228	5.323	3.81	117.34	1.19	0.00E+000	3.0
TH-229 T	4.890	178.81	14.71	1.19	0.00E+000	7.0
TH-230	4.609	5.96	95.01	2.04	0.00E+000	3.0
TH-232	4.067	-1.38	168.33	2.38	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

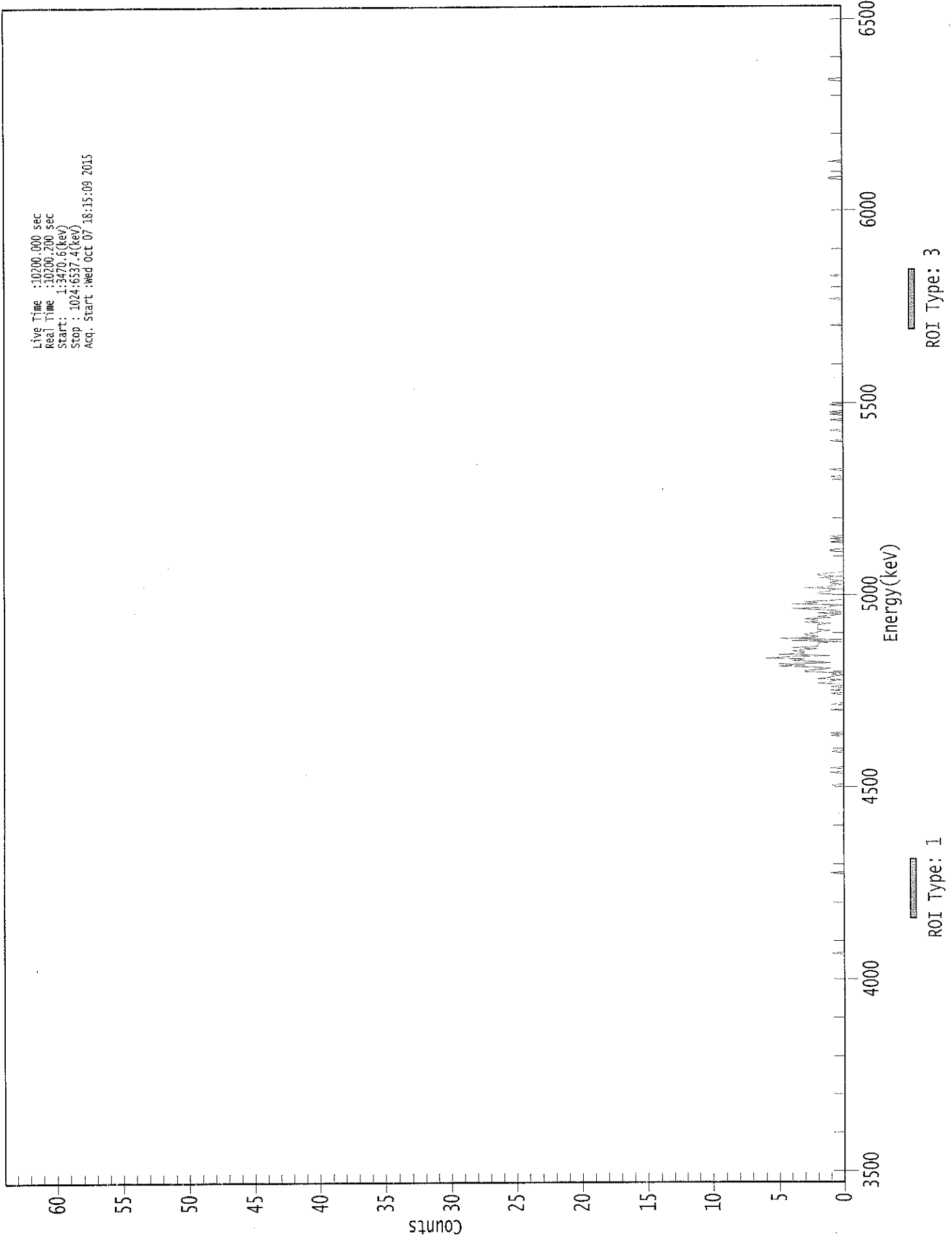
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.965	5850.00*	5.39E-002 +/- 9.54E-002	1.71E-001 +/- 2.73E-002
TH-228	0.970	5400.00*	1.03E-001 +/- 1.22E-001	1.77E-001 +/- 2.82E-002
TH-229	0.998	4872.00*	4.76E+000 +/- 7.58E-001	1.75E-001 +/- 2.79E-002
TH-230	0.980	4672.00*	1.58E-001 +/- 1.52E-001	2.07E-001 +/- 3.29E-002
TH-232	0.975	3997.00*	-3.66E-002 +/- 6.18E-002	2.17E-001 +/- 3.46E-002

AG
10/8/15

0000130383.CNF

Live Time : 10200.000 sec
Real Time : 10200.200 sec
Start : 1:3470.6(keV)
Stop : 1024:6537.4(keV)
Acq. Start : Wed Oct 07 18:15:09 2015



00104

369: 0 0 0 0 0 0 0 1 0

Sample Title: 03

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

801: 0 0 0 0 0 0 0 0 0

Sample Title: 03

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

Apex-Alpha™

✓
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Sample Description: KC85-032-L
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001303
 Batch Identification: 1509136A-TH
 Sample Identification: 04
 Sample Geometry: Shelf 2
 Procedure Description: Th iso

Detector Name: Alpha_042
 Chamber Serial Number: 05026930B
 Detector Serial Number: 84185
 Env. Background: System Bkgd 130610
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/21/2015 4:10:44 PM
 Acquisition Date/Time: 10/7/2015 6:15:12 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
 Tracer Quantity: 0.231 mL
 Effective Efficiency: 0.1695 +/- 0.0148
 Counting Efficiency: 0.1737 +/- 0.0030 on 10/25/2014 3:04:21 PM
 Chem. Recovery Factor: 0.9758 +/- 0.0871

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	5.791	6.83	76.08	0.17	0.00E+000	6.0
TH-228	5.287	2.66	128.85	0.34	0.00E+000	3.0
TH-229 T	4.879	149.66	16.04	0.34	0.00E+000	12.8
TH-230	4.657	7.49	74.41	0.51	0.00E+000	3.0
TH-232	3.968	2.98	134.36	1.02	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

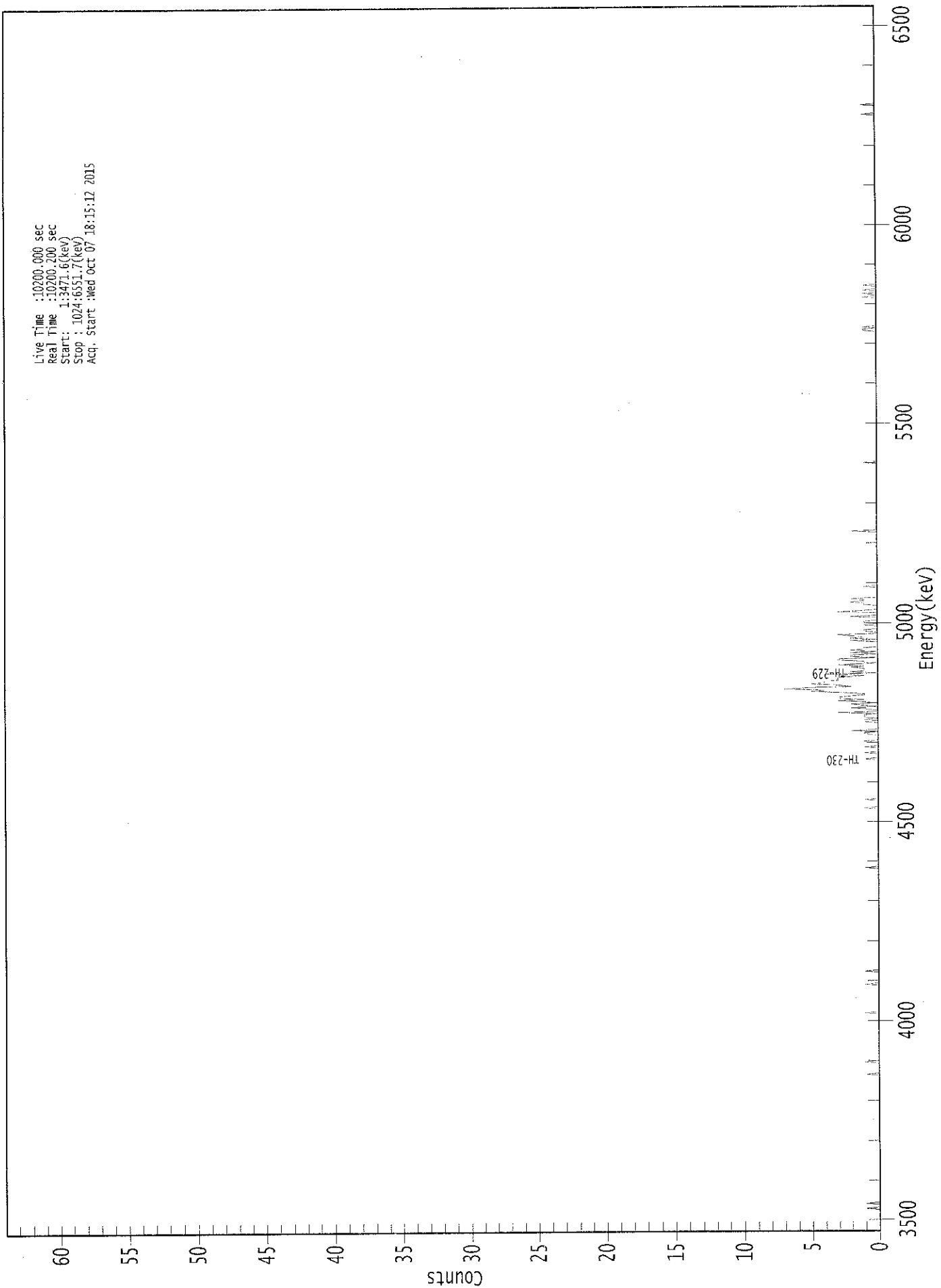
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.982	5850.00*	2.19E-001 +/- 1.71E-001	1.34E-001 +/- 2.30E-002
TH-228	0.936	5400.00*	8.45E-002 +/- 1.10E-001	1.52E-001 +/- 2.61E-002
TH-229	1.000	4872.00*	4.70E+000 +/- 8.06E-001	1.50E-001 +/- 2.58E-002
TH-230	0.999	4672.00*	2.35E-001 +/- 1.79E-001	1.64E-001 +/- 2.82E-002
TH-232	0.996	3997.00*	9.32E-002 +/- 1.26E-001	1.97E-001 +/- 3.38E-002

AG
10/8/15

0000130387.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start : 1:3471.6(keV)
Stop : 1024:6551.7(keV)
Acq. Start :Wed Oct 07 18:15:12 2015



ROI Type: 1

ROI Type: 3

001303

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

Sample Title: 04

Elapsed Live time: 10200
 Elapsed Real Time: 10200

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

369: 0 0 0 0 0 0 0 0 0

Sample Title: 04

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

801: 0 0 0 0 0 0 0 0 0

Sample Title: 04

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	0	0	0	0
833:	0	0	0	0	0	0	0	0
841:	0	0	0	0	0	0	0	0
849:	0	0	0	0	0	0	0	0
857:	0	0	0	0	0	0	0	0
865:	0	0	0	0	0	0	0	0
873:	0	0	0	0	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	1	0	0	0
937:	0	0	0	0	1	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: KC85-032-M
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001303
 Batch Identification: 1509136A-TH
 Sample Identification: 05
 Sample Geometry: Shelf 2
 Procedure Description: Th iso

Detector Name: Alpha_043
 Chamber Serial Number: 04026481A
 Detector Serial Number: 91088
 Env. Background: System Bkgd 130611
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/21/2015 4:10:44 PM
 Acquisition Date/Time: 10/7/2015 6:15:14 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
 Tracer Quantity: 0.232 mL
 Effective Efficiency: 0.2260 +/- 0.0175
 Counting Efficiency: 0.1998 +/- 0.0035 on 10/25/2014 3:08:45 PM
 Chem. Recovery Factor: 1.1312 +/- 0.0896

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	5.794	0.49	416.98	0.51	0.00E+000	3.0
TH-228	5.442	-0.19	1131.1	1.19	0.00E+000	3.0
TH-229 T	4.896	200.32	13.88	0.68	0.00E+000	5.0
TH-230	4.624	3.15	126.67	0.85	0.00E+000	3.0
TH-232	3.948	-0.85	246.69	0.85	0.00E+000	0.0

T = Tracer Peak used for Effective Efficiency

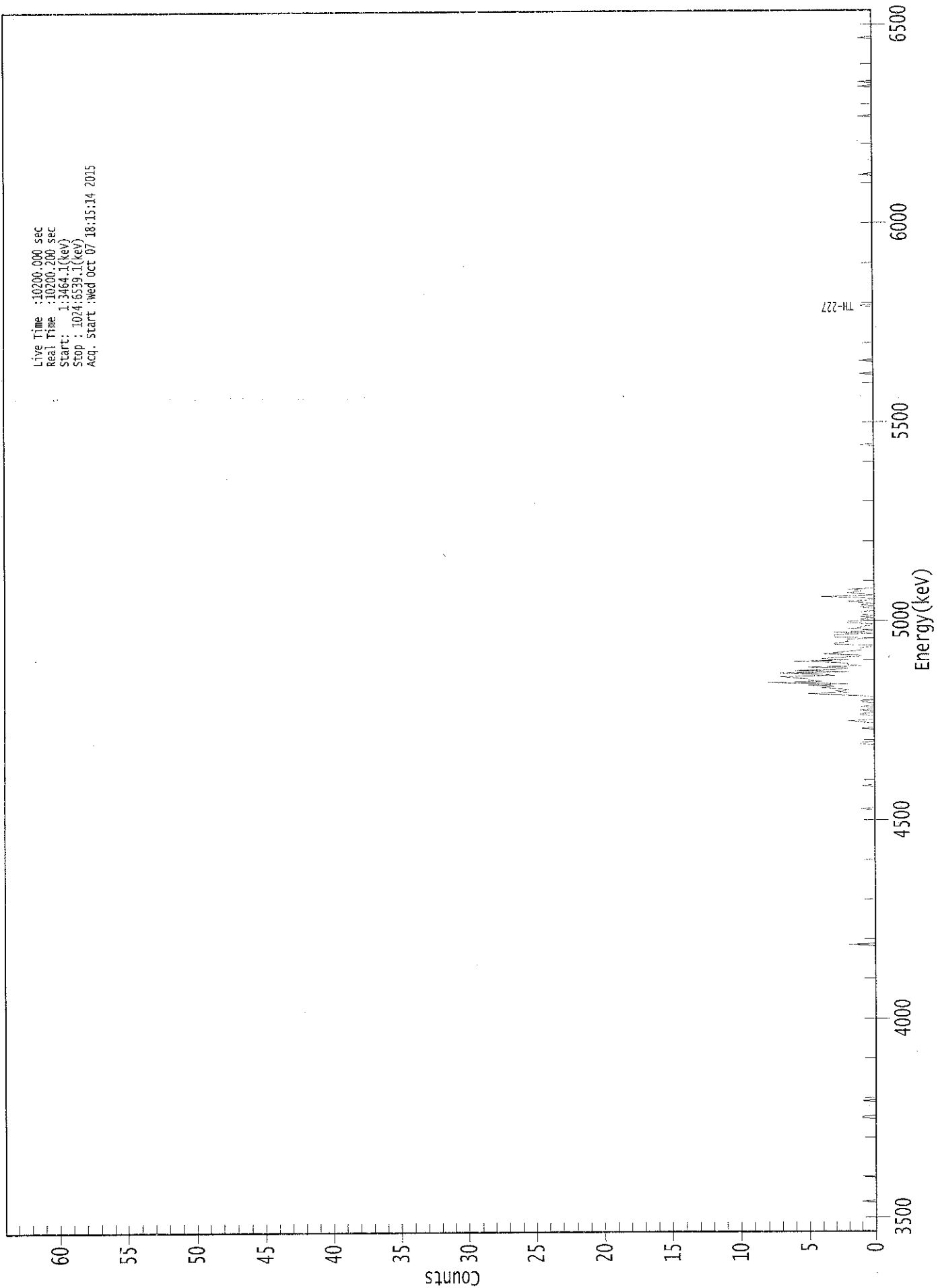
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.984	5850.00*	1.18E-002 +/- 4.92E-002	1.26E-001 +/- 1.91E-002
TH-228	0.991	5400.00*	-4.53E-003 +/- 5.12E-002	1.57E-001 +/- 2.38E-002
TH-229	0.997	4872.00*	4.72E+000 +/- 7.15E-001	1.33E-001 +/- 2.01E-002
TH-230	0.988	4672.00*	7.40E-002 +/- 9.44E-002	1.41E-001 +/- 2.13E-002
TH-232	0.988	3997.00*	-1.99E-002 +/- 4.93E-002	1.40E-001 +/- 2.13E-002

AG
10/8/15

0000130388.CNF

Live Time : 10200.000 sec
Real Time : 10200.200 sec
Start : 1:3464.1(kev)
Stop : 1024:6539.1(kev)
Acq. Start : Wed Oct 07 18:15:14 2015



1100

ROI Type: 1

ROI Type: 3

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

369: 0 0 0 0 0 0 1 0 0

Sample Title: 05

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	0	0	0	0
417:	0	0	0	0	0	1	0	0
425:	0	0	1	2	0	0	0	0
433:	1	1	0	0	1	0	0	1
441:	0	0	0	1	1	0	0	0
449:	1	3	5	2	3	2	3	4
457:	3	5	2	8	4	5	5	6
465:	7	3	4	7	2	6	3	2
473:	5	1	2	2	3	6	2	4
481:	3	1	1	4	3	2	1	1
489:	1	0	0	3	3	2	2	2
497:	0	3	3	3	0	3	0	0
505:	2	1	1	0	0	2	2	0
513:	1	0	1	0	1	1	1	0
521:	0	0	1	0	1	0	1	2
529:	0	0	1	4	0	1	2	1
537:	1	2	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	0
601:	0	0	0	0	0	0	0	0
609:	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0
641:	0	0	0	0	0	0	0	0
649:	0	0	0	0	0	0	0	0
657:	0	0	1	0	0	0	0	0
665:	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	1	0
721:	0	0	0	0	0	0	0	0
729:	0	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	1
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 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	1	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	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	1	0
961:	0	0	1	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	1
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: KC94-199-U
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001303
 Batch Identification: 1509136A-TH
 Sample Identification: 06
 Sample Geometry: Shelf 2
 Procedure Description: Th iso

C
10/8

Detector Name: Alpha_044
 Chamber Serial Number: 04026481B
 Detector Serial Number: 84168
 Env. Background: System Bkgd 130612
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/18/2015 4:10:44 PM
 Acquisition Date/Time: 10/7/2015 6:15:17 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
 Tracer Quantity: 0.231 mL
 Effective Efficiency: 0.2058 +/- 0.0165
 Counting Efficiency: 0.1837 +/- 0.0032 on 10/25/2014 3:13:11 PM
 Chem. Recovery Factor: 1.1204 +/- 0.0922

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	5.772	3.32	119.77	0.68	0.00E+000	3.0
TH-228	5.385	7.66	72.63	0.34	0.00E+000	3.0
TH-229 T	4.895	181.83	14.54	0.17	0.00E+000	8.2
TH-230	4.641	7.00	79.20	0.00	0.00E+000	3.0
TH-232	3.987	0.66	305.43	0.34	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

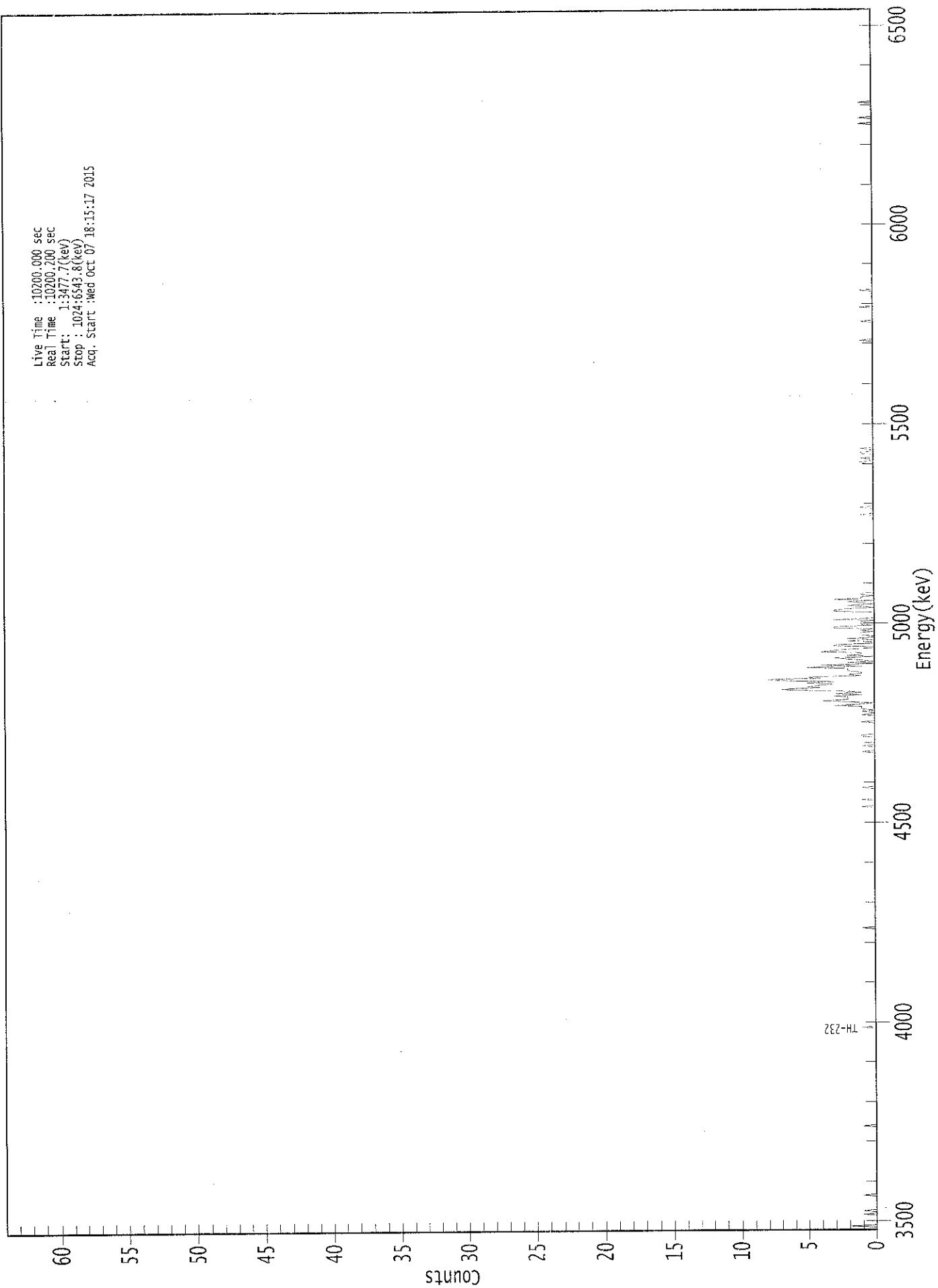
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.969	5850.00*	8.78E-002 +/- 1.06E-001	1.49E-001 +/- 2.35E-002
TH-228	0.999	5400.00*	2.01E-001 +/- 1.50E-001	1.26E-001 +/- 1.98E-002
TH-229	0.997	4872.00*	4.70E+000 +/- 7.42E-001	1.08E-001 +/- 1.70E-002
TH-230	0.995	4672.00*	1.81E-001 +/- 1.46E-001	1.55E-001 +/- 2.44E-002
TH-232	0.999	3997.00*	1.70E-002 +/- 5.20E-002	1.23E-001 +/- 1.94E-002

AG
10/8/15

0000130389.CNF

Live Time : 10200.000 sec
Real Time : 10200.200 sec
Start : 1:3477.7(kev)
Stop : 1024:6543.8(kev)
Acq. Start : Wed Oct 07 18:15:17 2015



ROI Type: 1

ROI Type: 3

 ***** 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	2	0	0	0	0
9:	0	0	0	0	0	1	0	0
17:	1	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:	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	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	1	0	0	0	0	0
177:	0	0	0	0	0	0	0	0
185:	0	0	0	0	0	0	0	0
193:	0	0	0	0	0	0	0	0
201:	0	0	0	0	0	0	0	0
209:	0	0	0	0	0	0	0	0
217:	0	0	0	0	0	0	0	0
225:	0	0	0	0	0	0	0	0
233:	0	0	0	0	0	0	0	0
241:	0	0	0	0	0	0	0	0
249:	0	0	0	0	0	1	0	0
257:	0	0	0	0	0	0	0	0
265:	0	0	0	0	0	0	0	0
273:	0	0	0	0	0	0	0	0
281:	0	0	0	0	0	0	0	0
289:	0	0	0	0	0	0	0	0
297:	0	0	0	0	0	0	0	0
305:	0	0	0	0	0	0	0	0
313:	0	0	0	0	0	0	0	0
321:	0	0	0	0	0	0	0	0
329:	0	0	0	0	0	0	0	0
337:	0	0	0	0	0	0	0	0
345:	0	0	0	0	0	0	0	0
353:	0	0	1	0	0	0	0	0
361:	1	0	0	0	0	0	0	0

369: 0 0 1 0 0 0 0 0 0

Sample Title: 06

Channel	1	2	3	4	5	6	7	8	9
377:	0	0	0	0	0	0	0	0	0
385:	0	0	0	0	0	0	0	0	0
393:	0	0	0	0	0	0	0	0	0
401:	1	0	0	0	0	1	0	0	0
409:	0	0	0	0	0	1	1	0	0
417:	0	0	0	0	0	0	0	0	0
425:	0	1	0	0	0	0	0	0	1
433:	0	0	1	0	1	1	1	1	3
441:	1	0	2	4	2	2	2	2	3
449:	1	3	1	2	6	7	4	5	5
457:	4	3	5	3	7	8	4	5	5
465:	1	2	1	1	2	2	2	5	5
473:	1	4	0	2	0	1	2	3	3
481:	0	2	1	1	4	3	2	0	0
489:	0	3	3	0	0	2	0	2	2
497:	0	0	1	1	1	0	1	0	0
505:	3	3	0	1	1	1	0	3	3
513:	0	0	0	0	0	0	3	3	3
521:	2	0	1	2	0	1	2	0	0
529:	3	1	1	0	1	1	0	0	0
537:	0	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	0	0
553:	0	0	0	0	0	0	0	0	0
561:	0	0	0	0	0	0	0	0	0
569:	0	0	0	0	0	0	0	0	0
577:	0	0	0	0	0	0	0	0	0
585:	0	0	0	0	0	0	0	0	0
593:	0	0	0	0	0	0	0	1	1
601:	0	0	0	0	0	1	0	0	0
609:	0	0	0	0	0	0	0	0	0
617:	0	0	0	0	0	0	0	0	0
625:	0	0	0	0	0	0	0	0	0
633:	0	0	0	0	0	0	0	0	0
641:	0	0	1	1	0	0	1	0	0
649:	0	0	1	1	0	0	1	0	0
657:	0	0	0	0	0	0	0	0	0
665:	0	0	0	0	0	0	0	0	0
673:	0	0	0	0	0	0	0	0	0
681:	0	0	0	0	0	0	0	0	0
689:	0	0	0	0	0	0	0	0	0
697:	0	0	0	0	0	0	0	0	0
705:	0	0	0	0	0	0	0	0	0
713:	0	0	0	0	0	0	0	0	0
721:	0	0	0	0	0	0	0	0	0
729:	0	0	0	0	0	0	0	0	0
737:	0	0	0	0	0	0	0	0	0
745:	1	0	0	0	0	0	0	0	0
753:	0	0	0	0	0	0	0	0	0
761:	1	0	0	0	0	0	0	0	0
769:	0	0	0	0	1	0	0	0	0
777:	0	0	0	0	0	0	0	0	0
785:	0	0	1	0	0	0	0	0	0
793:	0	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	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	1	0
929:	0	0	0	1	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

Apex-Alpha™

✓
(0/3)

Sample Description: KC97-209-U
 Spectrum File: \\OR-ALPHA1\Canberra\ApexAlpha\Root\Data\00001303
 Batch Identification: 1509136A-TH
 Sample Identification: 07
 Sample Geometry: Shelf 2
 Procedure Description: Th iso

Detector Name: Alpha_045
 Chamber Serial Number: 04026482A
 Detector Serial Number: 91131
 Env. Background: System Bkgd 130613
 Reagent Blank: <not performed>

Sample Size: 5.000E-001 +/- 0.000E+000 liter
 Sample Date/Time: 9/19/2015 4:10:44 PM
 Acquisition Date/Time: 10/7/2015 6:15:20 PM
 Acquisition Live Time: 170.0 minutes
 Acquisition Real Time: 170.0 minutes

Tracer Certificate: Th229_S_TH-18A
 Tracer Quantity: 0.232 mL
 Effective Efficiency: 0.0883 +/- 0.0104
 Counting Efficiency: 0.1760 +/- 0.0031 on 10/25/2014 3:16:42 PM
 Chem. Recovery Factor: 0.5019 +/- 0.0599

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	5.871	3.30	136.59	1.70	0.00E+000	3.0
TH-228	5.385	5.79	97.97	2.21	0.00E+000	3.0
TH-229 T	4.864	78.15	22.31	0.85	0.00E+000	15.0
TH-230	4.627	8.66	68.12	0.34	0.00E+000	3.0
TH-232	3.850	0.47	626.93	1.53	0.00E+000	3.0

T = Tracer Peak used for Effective Efficiency

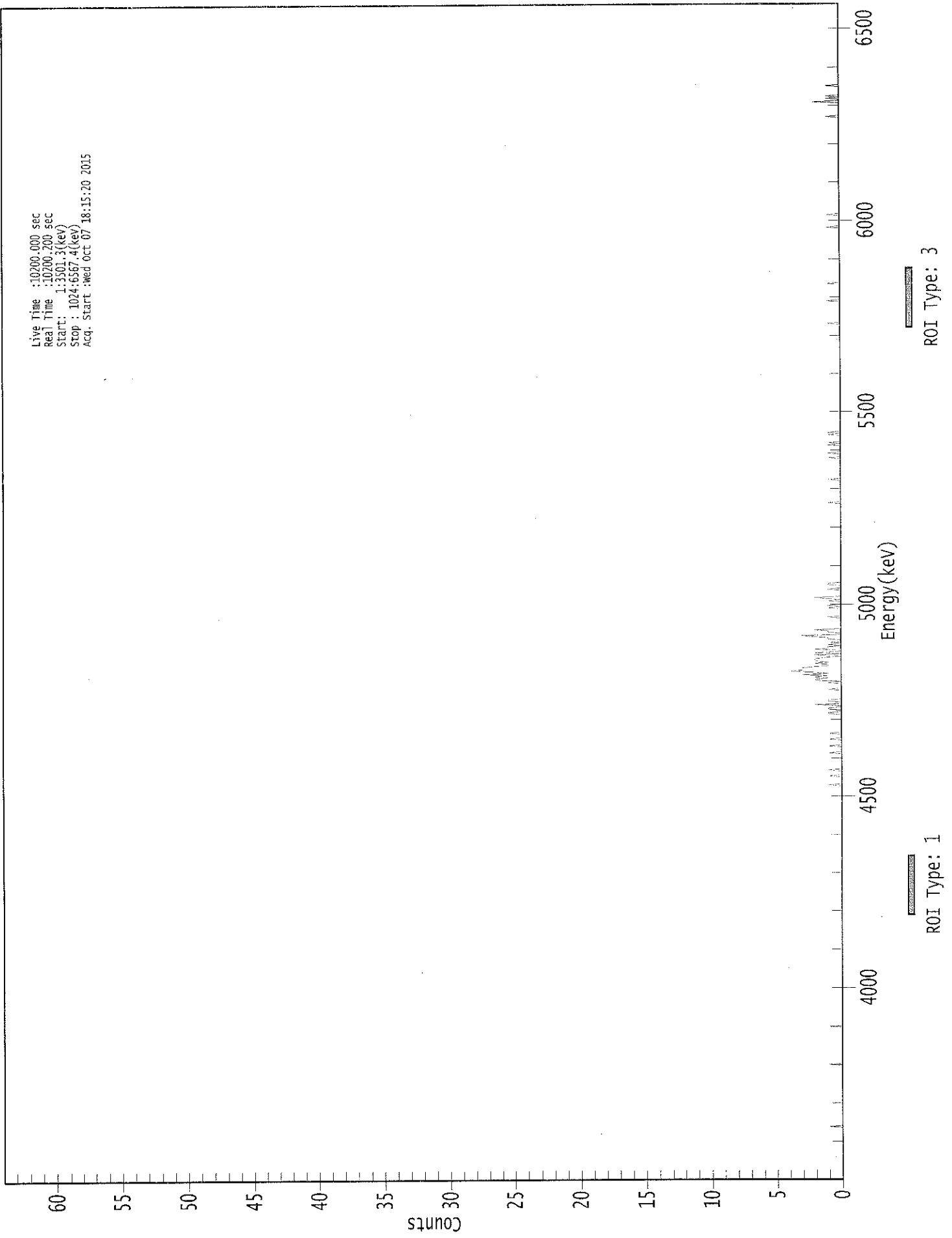
 NUCLIDE ANALYSIS RESULTS

Nuclide	Id Conf.	Energy (keV)	Activity (pCi/liter)	MDA (pCi/liter)
TH-227	0.998	5850.00*	2.03E-001 +/- 2.82E-001	4.53E-001 +/- 1.05E-001
TH-228	0.999	5400.00*	3.54E-001 +/- 3.56E-001	4.89E-001 +/- 1.13E-001
TH-229	1.000	4872.00*	4.71E+000 +/- 1.09E+000	3.61E-001 +/- 8.35E-002
TH-230	0.989	4672.00*	5.20E-001 +/- 3.74E-001	2.87E-001 +/- 6.64E-002
TH-232	0.894	3997.00*	2.82E-002 +/- 1.77E-001	4.26E-001 +/- 9.86E-002

AG
10/8/15

0000130384.CNF

Live Time :10200.000 sec
Real Time :10200.200 sec
Start: 1:3501.3(keV)
Stop : 1024:6567.4(keV)
Acq. Start :Wed Oct 07 18:15:20 2015



.. 00154

369: 0 0 0 1 0 0 0 0

Sample Title: 07

Channel								
377:	0	1	0	0	0	0	0	1
385:	0	0	0	0	1	0	0	0
393:	0	0	0	0	0	0	0	0
401:	0	0	0	0	0	1	1	0
409:	0	1	1	0	0	2	0	0
417:	1	1	0	0	0	0	0	0
425:	0	0	1	0	0	0	0	0
433:	1	0	2	2	1	2	1	3
441:	1	2	4	3	3	3	2	1
449:	1	2	1	2	2	2	1	0
457:	2	0	2	0	0	2	1	1
465:	0	1	0	0	0	0	1	1
473:	2	3	0	0	1	1	2	0
481:	0	0	0	0	0	0	0	0
489:	0	1	0	0	0	0	0	0
497:	0	1	0	1	0	0	0	1
505:	0	1	2	0	0	0	0	0
513:	0	1	0	0	0	1	1	0
521:	0	0	0	0	0	0	0	0
529:	0	0	0	0	0	0	0	0
537:	0	0	0	0	0	0	0	0
545:	0	0	0	0	0	0	0	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	1	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	0	0	0	0	0
617:	0	0	0	0	0	0	0	0
625:	0	0	0	1	0	0	0	1
633:	0	0	0	0	0	0	1	0
641:	1	0	0	0	0	0	0	1
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:	1	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	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: 07

Channel								
809:	0	0	0	0	0	0	0	0
817:	0	0	0	0	0	0	0	0
825:	0	0	0	0	1	0	0	0
833:	0	0	0	0	0	0	0	1
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	1	0	0	0
929:	0	0	0	0	0	0	0	0
937:	0	2	0	0	1	0	1	0
945:	0	0	0	0	0	0	0	1
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



QA SUMMARY REPORT

Review Of QA Results - Pulser Check

Date : 10/7/2015
Time : 5:53:15 AM

CHAMBER	DEVICE	PARAMETER	FLAG	DATE
Alpha 001	21f	ALL	Not Done	
Alpha 002	21f	ALL	Not Done	
Alpha 003	21f	ALL	Passed	10/7/2015 5:32:25 AM
Alpha 004	21f	ALL	Passed	10/7/2015 5:32:26 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	10/7/2015 5:32:27 AM
Alpha 011	21f	ALL	Passed	10/7/2015 5:32:28 AM
Alpha 012	21f	ALL	Passed	10/7/2015 5:32:28 AM
Alpha 013	21f	ALL	Not Done	
Alpha 014	21f	ALL	Passed	10/7/2015 5:32:29 AM
Alpha 015	21f	ALL	Passed	10/7/2015 5:32:30 AM
Alpha 016	21f	ALL	Not Done	
Alpha 033	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:31 AM
Alpha 034	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:33 AM
Alpha 035	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:34 AM
Alpha 036	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:36 AM
Alpha 037	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:37 AM
Alpha 038	Alpha Analyst100DC	Peak Energy $6 \frac{1}{2}$	Action	10/7/2015 5:32:38 AM
Alpha 039	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:40 AM
Alpha 040	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:42 AM
Alpha 041	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:43 AM
Alpha 042	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:45 AM
Alpha 043	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:47 AM
Alpha 044	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:49 AM
Alpha 045	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:52 AM
Alpha 046	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:54 AM
Alpha 047	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:55 AM
Alpha 048	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:57 AM
Alpha 049	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:32:59 AM
Alpha 050	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:01 AM
Alpha 051	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:02 AM
Alpha 052	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:04 AM
Alpha 053	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:06 AM
Alpha 054	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:09 AM
Alpha 055	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:11 AM
Alpha 056	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:14 AM
Alpha 057	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:17 AM
Alpha 058	Alpha Analyst100DC	ALL	Passed	10/7/2015 5:33:20 AM

 ***** LIBRARY LISTING REPORT *****

Nuclide Library Title: Thorium

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

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

* = key line

TOTALS: 5 Nuclides 5 Energy Lines