



October 20, 2009

Mr. Frank Hagar  
Northgate Environmental Management, Inc.  
1100 Quail St., Suite 102  
Newport Beach, California 92660

Re: Tronox Henderson  
Work Order: 237521

Dear Mr. Hagar:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2009 and September 22, 2009. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,

Edith Kent  
Project Manager

Chain of Custody: 2027.001.00576, 2027.001.00759, 2027.001.00786, 2027.001.00815 and 2027.001.00819  
Enclosures

**Tronox LLC**  
**Tronox Henderson**  
**SDG:237521**

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# **Case Narrative**



**CASE NARRATIVE**  
**for**  
**Tronox LLC**  
**Tronox Henderson**  
**SDG:237521**

**October 20, 2009**

**Laboratory Identification:**

GEL Laboratories LLC  
2040 Savage Road  
Charleston, South Carolina 29407  
(843) 556-8171

**Summary**

**Sample receipt**

The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on September 19, 2009 and September 22, 2009 for analysis. Shipping container temperatures were checked, documented, and within specifications. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

**Items of Note**

All samples under this SDG were logged as an open SDG until a sufficient amount of samples were received by the lab. The client was notified that the SDG was closed on September 22, 2009 and the turnaround time would start from then.

**QC Issues**

The following samples did not meet the Tronox QA program sample result uncertainty limit of <30% for Ra-226 with the results between 2 and 5 times the MDA and were counted for the maximum time: 237521001, 237521002, 237521004, 237521005, 237521011, 237521012 and 237521015. The following samples did not meet the Tronox QA program sample result uncertainty limit of <30% for Alpha Spec Uranium with the results between 2 and 5 times the MDA and were counted for the maximum time: 237521003, 237521011, 237521017 and 237521018. The following samples did not meet the Tronox QA program sample result uncertainty limit of <30% for Alpha Spec Thorium with the results between 2 and 5 times the MDA and were counted for the maximum time: and 237521010. The following samples did not meet the Tronox QA program sample tracer yield requirements of 70-120% for Alpha Spec Uranium due to matrix issues: and 237521004. The following samples did not meet the Tronox QA program sample result uncertainty limit of <30% for Alpha Spec Uranium with the results greater than 5 times the MDA and were counted for the maximum time: 237521009 and 237521014. The lab DUP did not meet the Tronox QA program sample result uncertainty limit of <30% for Ra-226 with the results between 2 and 5 times the MDA and was counted for the maximum time. The lab DUP did not meet the Tronox QA program sample result uncertainty limit of <30% for Alpha Spec Uranium with the results between 2 and 5 times the MDA and was counted for the maximum time. Please refer to the attached e-mail for further details.

**Sample Identification**

The laboratory received the following samples:

<b><u>Laboratory ID</u></b>	<b><u>Client ID</u></b>
237521001	SA117-0.5B
237521002	SA117-9B
237521003	SA117-25B
237521004	SA117-41B

237521005	SA161-0.5B
237521006	SA161-10B
237521007	SA161-25B
237521008	SA161009-25B
237521009	SA161-37B
237521010	EB091809-SO1
237521011	RSAT4-0.5B
237521012	RSAT4-10B
237521013	RSAT4-25B
237521014	RSAT4-40B
237521015	RSAT4-53B
237521016	SA32-0.5B
237521017	SA32-9B
237521018	SA32-25B
237521019	SA32009-25B
237521020	SA32-37B

### **Case Narrative**

Sample analyses were conducted using methodology as outlined in GEL Laboratories, LLC (GEL) Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

### **Data Package**

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.



Edith Kent

Project Manager

**Chain of Custody  
and  
Supporting  
Documentation**

2375211



1100 Quail Street, Suite 102, Newport Beach, CA 92660 (949) 260-9293

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

COC No. 2027.001.00786 Page: 1 of 1 Cooler # 1 of 1 Collection Area: JL

Required Ship to Lab: GEL Laboratories, LLC. Required Project Information: TRONOX LLC, HENDERSON. Required Invoice Information: Srean Crowley Tronox LLC. Sample ID #, Project #, Site Address, City, State, Reimbursement project?, etc.

Table with 13 columns: ITEM #, SAMPLE ID, Matrix, Matrix Codes, Matrix, Matrix Codes, Matrix, Matrix Codes, Matrix, Matrix Codes, Matrix, Matrix Codes, Matrix, Matrix Codes, Matrix, Matrix Codes. Includes sample IDs SA117-0.5B through SA117-41B.

Additional Comments/Special Instructions: FULL DIGESTION SPECIFICATION Radionuclides\* includes Thorium (isotopic) and Uranium (isotopic) by EML HASL 300 modified(alpha spectroscopy). Shipping Method: (mark as appropriate) UPS COURIER. Signature: Patrick Ferringer. Date: 9/18/2009. Time: 5:41.



1100 Quail Street, Suite 102, Newport Beach, CA 92660  
(949) 260-9293

### CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

COC No. 2027.001.00815

Page: 1 of 1

Cooler # 1 of 1

Collection Area: II

Required Ship to Lab:		Required Project Information:		Required Invoice Information:		TAT: Standard 30 day		Rush		Mark One																	
Lab Name: GEL Laboratories, LLC		Site ID #: TRONOX LLC, HENDERSON		Send Invoice to: Susan Crowley Trenox LLC		Address: PO Box 55		If Rush, Date due																			
Address: 2040 Savage Road		Project #: 2027.001		City/State: Henderson, NV 89009		Phone #: (949) 260-9293		QC level Required: Standard		Special EPA Stage Mark one																	
Charleston, SC 29407		Site Address: 560 W. Lake Mead Drive		Reimbursement project? <input checked="" type="checkbox"/>		Non-reimbursement project? <input type="checkbox"/>		NJ Reduced Deliverable Package?																			
Lab PM: Edith M. Kent		City: Henderson		State: NV		Send EDD to: Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com		MA MCP Cert? <input type="checkbox"/>		CT RCP Cert? <input type="checkbox"/>																	
Phone/Fax: (843) 566-8171		Site PM Name: Derrick Willis		Phone/Fax: (949) 375-7004		CC Hardcopy report to: derrick.willis@ngem.com		Lab Project ID (lab use)																			
Lab PM email: emk@gel.com		Site PM Email: derrick.willis@ngem.com		CC Hardcopy report to: see additional comments below																							
ITEM #	SAMPLE ID	MATRIX	MATRIX CODE	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	ACCEPTED BY / AFFILIATION	DATE	TIME	DATE	TIME	Temp in OC	Samples on Ice?	Sample Intact?	Temp Blank?										
1	SA161-0.5B	WATER	W	G	9/18/2009	11:23	1	N		9/18/09	17:00	9-19-09	0930	22°	Y/N	Y/N	Y/N										
2	SA161-10B	SURFACE WATER	WF	G	9/18/2009	11:38	1	N							Y/N	Y/N	Y/N										
3	SA161-25B	GROUNDWATER	WG	G	9/18/2009	12:10	1	N							Y/N	Y/N	Y/N										
4	SA161009-25B	SLUDGE	SL	G	9/18/2009	12:10	1	N							Y/N	Y/N	Y/N										
5	SA161-37B	OTHER	OT	G	9/18/2009	12:43	1	N							Y/N	Y/N	Y/N										
6																											
7																											
8																											
9																											
10																											
11																											
12																											
13																											
<p>Additional Comments/Special Instructions:  <b>FULL DIGESTION SPECIFICATION</b>  <b>Radionuclides* includes Thorium (isotopic) and Uranium (isotopic)</b>  <b>by EML HASL 300 modified(alpha spectroscopy)</b></p> <p>All PDF reports and EDDs will be uploaded to:            Northgate Environmental Management, Inc.            FTP site address provided to labs            Notifications provided to:            cindy.armold@ngem.com &amp; frank.hagar@ngem.com</p>																											
<p>RELINQUISHED BY / AFFILIATION: <i>Patrick Ferring</i></p>										DATE: 9/18/09		TIME: 17:00		ACCEPTED BY / AFFILIATION: <i>Mike Federal Cel</i>		DATE: 9-19-09		TIME: 0930		TEMP IN OC: 22°		SAMPLES ON ICE: Y/N					
<p>SHIPPING METHOD: (mark as appropriate)  <b>UPS COURIER</b></p>										DATE SIGNED: 9/18/2009		TIME: 1541		<p>SAMPLER NAME AND SIGNATURE: <i>Patrick Ferring</i></p>													
<p>US MAIL</p>										DATE SIGNED: 9/18/2009		TIME: 1541		<p>SIGNATURE # OF SAMPLER: <i>Patrick Ferring</i></p>													



Client: Kell/Northeast SDG/ARCOC/Work Order: 237521

Received By: ML Date Received: 9-19-09

<b>Suspected Hazard Information</b>	Yes	No	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.
COC/Samples marked as radioactive?		<input checked="" type="checkbox"/>	Maximum Counts Observed*: <u>6m 20</u>
Classified Radioactive II or III by RSO?		<input checked="" type="checkbox"/>	
COC/Samples marked containing PCBs?		<input checked="" type="checkbox"/>	
Shipped as a DOT Hazardous?		<input checked="" type="checkbox"/>	Hazard Class Shipped: _____ UN#: _____
Samples identified as Foreign Soil?		<input checked="" type="checkbox"/>	

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Circle Applicable: seals broken    damaged container    leaking container    other (describe)
2	Samples requiring cold preservation within 0 ≤ 6 deg. C?		<input checked="" type="checkbox"/>		ice bags    blue ice    dry ice <u>none</u> other (describe) <u>2de</u>
3	Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
4	Sample containers intact and sealed?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Circle Applicable: seals broken    damaged container    leaking container    other (describe)
5	Samples requiring chemical preservation at proper pH?		<input checked="" type="checkbox"/>		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		<input checked="" type="checkbox"/>		Sample ID's and containers affected:
7	Are Encore containers present?		<input checked="" type="checkbox"/>		(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Sample ID's affected:
11	Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

Comments:  
  
Fx 7969 5945 7712

PM (or PMA) review: Initials DS Date 9-19-09





# SAMPLE RECEIPT & REVIEW FORM

Client: <u>Yelp/Workate</u>		SDG/ARCO/Work Order: <u>237521</u>	
Received By: <u>MK</u>		Date Received: <u>9-19-09</u>	
Suspected Hazard Information	Yes	No	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.
COC/Samples marked as radioactive?		<input checked="" type="checkbox"/>	Maximum Counts Observed*: <u>open 20</u>
Classified Radioactive II or III by RSO?		<input checked="" type="checkbox"/>	
COC/Samples marked containing PCBs?		<input checked="" type="checkbox"/>	
Shipped as a DOT Hazardous?		<input checked="" type="checkbox"/>	Hazard Class Shipped: _____ UN#: _____
Samples identified as Foreign Soil?		<input checked="" type="checkbox"/>	

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: seals broken    damaged container    leaking container    other (describe)
2	Samples requiring cold preservation within 0 ≤ 6 deg. C?		<input checked="" type="checkbox"/>		ice bags    blue ice    dry ice <u>none</u> other (describe) <u>27°C</u>
3	Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>			
4	Sample containers intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: seals broken    damaged container    leaking container    other (describe)
5	Samples requiring chemical preservation at proper pH?	<input checked="" type="checkbox"/>			Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		<input checked="" type="checkbox"/>		Sample ID's and containers affected:
7	Are Encore containers present?			<input checked="" type="checkbox"/>	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	<input checked="" type="checkbox"/>			Id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>			Sample ID's affected:
11	Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>			

Comments:

Fx 7969 5946 9050

PM (or PMA) review: Initials NS Date 9-19-09



2375211



1100 Quail Street, Suite 102, Newport Beach, CA 92660  
(949) 280-9293

**CHAIN-OF-CUSTODY / Analytical Request Document**  
The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

COC No. 2027.001.00576  
Page: 1 of 1  
Cooler # \_\_\_\_\_ of \_\_\_\_\_  
Collection Area: **IV**

Required Ship to Lab:		Required Project Information:		Required Invoice Information:		TAT: Standard 30 day		Rush		Mark One									
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC, HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	Address:	PO Box 65	City/State:	Henderson, NV 89009	Phone #:	(949)260-6283	QC level Required:	Standard	Special	EPA Stage 4	Mark one			
Address:	2040 Savage Road Charleston, SC 29407	Project #:	2027.001	City/State:	Henderson, NV 89009	Reimbursement project?	X	Non-reimbursement project?		Send EDD to:	frank.hagar@ngem.com	MA MCP Cert?		CT RCP Cert?		Mark One			
Lab PM:	Edith M. Kent	City:	Henderson	State:	NV	Site PM Name:	Derrick Willis	Phone/Fax:	949-376-7004	CC Hardcopy report to:	PDF Electronic Version Only	Lab Project ID (lab use)							
Phone/Fax:	(843)558-8171	Site PM Email:	demrick.willis@ngem.com	CC Hardcopy report to:	see additional comments below	Matrix Code:	SO	Matrix:	SO	Sample Type:	G-RAB O-COMP	Requested							
Lab PM email:	emk@gel.com	Applicable Lab Quota #:		Matrix Code:	SO	Matrix:	SO	Sample Type:	G	Sample Date:	9/21/2009	Sample Time:	07:38	Field Filtered? (Y/N)	N	Preservatives:	None	Comments/Lab Sample I.D.	9 oz Glass jar
SAMPLE ID		One		MATRIX		MATRIX		MATRIX		MATRIX		MATRIX		MATRIX		MATRIX		MATRIX	
Character per box.		(A-Z, 0-9, /, -)		SAMPLE TYPE		SAMPLE DATE		SAMPLE TIME		NOF CONTAINERS		FIELD FILTERED? (Y/N)		PRESERVATIVES		OTHER		Comments/Lab Sample I.D.	
Samples IDs MUST BE UNIQUE				G-RAB O-COMP		9/21/2009		07:38		1		N		None		None			
1	RSAT4-0.5B																		
2	RSAT4-10B																		
3	RAST4-25B																		
4	RSAT4-40B																		
5	RSAT4-53B																		
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
Additional Comments/Special Instructions:		Samples collected in Area IV.		Signature of Sampler:		Signature of Analyst:		Signature of Receiver:		Signature of Shipper:		Signature of Lab:		Signature of Client:		Signature of Other:		Signature of Other:	
FULL DIGESTION SPECIFICATION		Radionuclides* Includes Thorium (isotopic) and Uranium (isotopic) by EML		Dana R. Brown, NGEM 21-Sep 10:10		Darren Qualls, GES 21-Sep 10:10		Darren Qualls, GES 9/21/2009 10:10		Darren Qualls, GES 9/21/2009 10:10		Dana R. Brown, NGEM 21-Sep 10:10		Darren Qualls, GES 21-Sep 10:10		Darren Qualls, GES 9/21/2009 10:10		Darren Qualls, GES 9/21/2009 10:10	
HASL 300 modified(alpha spectroscopy)				Dana R. Brown		Darren Qualls		Darren Qualls		Darren Qualls		Dana R. Brown		Darren Qualls		Darren Qualls		Darren Qualls	
All PDF reports and EDDs will be uploaded to:		Northgate Environmental Management, Inc.		UPS COURIER (FEDEX)		US MAIL		FEDEX		FEDEX		FEDEX		FEDEX		FEDEX		FEDEX	
FTP site address provided to labs		Notifications provided to:		DATE SIGNED		DATE SIGNED		DATE SIGNED		DATE SIGNED		DATE SIGNED		DATE SIGNED		DATE SIGNED		DATE SIGNED	
				9/21/2009		9/21/2009		9/21/2009		9/21/2009		9/21/2009		9/21/2009		9/21/2009		9/21/2009	
				Dana R. Brown		Darren Qualls		Darren Qualls		Darren Qualls		Dana R. Brown		Darren Qualls		Darren Qualls		Darren Qualls	
				Dana R. Brown		Darren Qualls		Darren Qualls		Darren Qualls		Dana R. Brown		Darren Qualls		Darren Qualls		Darren Qualls	



Client: <u>Kepp / Northgate</u>		SDG/ARCOC/Work Order: <u>2375211</u>	
Received By: <u>MK</u>		Date Received: <u>9-22-09</u>	
Suspected Hazard Information	Yes	No	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.
COC/Samples marked as radioactive?		<input checked="" type="checkbox"/>	Maximum Counts Observed*: <u>CRN-20</u>
Classified Radioactive II or III by RSO?		<input checked="" type="checkbox"/>	
COC/Samples marked containing PCBs?		<input checked="" type="checkbox"/>	
Shipped as a DOT Hazardous?		<input checked="" type="checkbox"/>	Hazard Class Shipped: _____ UN#: _____
Samples identified as Foreign Soil?		<input checked="" type="checkbox"/>	

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: seals broken    damaged container    leaking container    other (describe)
2	Samples requiring cold preservation within 0 ≤ 6 deg. C?		<input checked="" type="checkbox"/>		ice bags    blue ice    dry ice <u>none</u> other (describe) <u>22c</u>
3	Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>			
4	Sample containers intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: seals broken    damaged container    leaking container    other (describe)
5	Samples requiring chemical preservation at proper pH?		<input checked="" type="checkbox"/>		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		<input checked="" type="checkbox"/>		Sample ID's and containers affected:
7	Are Encore containers present?			<input checked="" type="checkbox"/>	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	<input checked="" type="checkbox"/>			id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>			Sample ID's affected:
11	Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>			

Comments:

FX 7979 5126 6305

PM (or PMA) review: Initials DS Date 9-22-09

**Subject:** GEL Closed SDGs 237521

**From:** Heather Shaffer <Heather.Shaffer@gel.com>

**Date:** Tue, 22 Sep 2009 10:57:48 -0400

**To:** Cindy Arnold <Cindy.Arnold@ngem.com>, Frank Hagar <Frank.Hagar@ngem.com>, Edie Kent <emk@gel.com>, Derrick Willis <Derrick.Willis@ngem.com>

**CC:** Heather Shaffer <hea01394@gel.com>

With today's receipts, we closed soil SDG 237521. Attached is a list of the samples in the SDG. As soon as we have completed the login review, you will receive the full receipt package for these SDG.

Thank you,  
Heather

--

Heather Shaffer  
Project Manager Assistant  
GEL Laboratories, LLC  
2040 Savage Road  
Charleston, SC (USA) 29407  
Main: 843.556.8171 x 4505  
Fax: 843.766.1178  
E-mail: [heather.shaffer@gel.com](mailto:heather.shaffer@gel.com)  
Web: [www.gel.com](http://www.gel.com)

<b>237521.xls</b>	<b>Content-Type:</b> application/msexcel <b>Content-Encoding:</b> base64
-------------------	---

**Subject:** SDG 237521 QC Issues - Alpha Spec Th, Alpha Spec U, Ra-226

**From:** Edie Kent <emk@gel.com>

**Date:** Tue, 20 Oct 2009 14:06:34 -0400

**To:** Cindy Arnold <Cindy.Arnold@ngem.com>, Derrick Willis <Derrick.Willis@ngem.com>, Team Kent <Team.Kent@gel.com>

**CC:** Martha Harrison <Martha.Harrison@gel.com>

The following are the QC issues regarding this SDG for Alpha Spec Th, Alpha Spec U and Ra 226:

**\*Soil Ra 226 Issues:\***

The following samples did not meet the Tronox QA program sample result uncertainty limit of <30% with activity between 2 and 5 times the MDA and were counted the maximum possible count time: 237521001, 237521002, 237521004, 237521005, 237521011, 237521012, 237521015, and lab DUP.

**\*Liquid Thorium Issues:\***

Sample 237521010 did not meet the Tronox QA program sample result uncertainty limit of <30% for Th-228 with activity between 2 and 5 times the MDA and was counted the maximum possible count time.

**\*Soil Uranium Issues:\***

The following samples did not meet the Tronox QA program sample result uncertainty limit of <30% for U-235/236 with activity greater than 5 times the MDA and were counted the maximum possible count time: 237521009, 237521014.

The following samples do not meet the Tronox QA program sample result uncertainty limit of <30% for U-235/236 with activity between 2 and 5 times the MDA and were counted the maximum possible count time: 237521003, 237521011, 237521017, 237521018, the lab DUP.

Sample 237521004 did not meet the Tronox QA program tracer yield requirement of 70-120%. The sample met GEL's standard tracer yield requirements. The blank and LCS met the contract tracer yield requirements.

This will be noted in the case narrative.

Edie

--

Edith M. Kent  
Project Manager  
GEL Laboratories, LLC  
2040 Savage Road  
Charleston, SC (USA) 29407  
Direct: 843.769.7385 x4453  
Main: 843.556.8171  
Fax: 843.766.1178  
E-mail: [emk@gel.com](mailto:emk@gel.com)  
Web: [www.gel.com](http://www.gel.com)



# **Laboratory Certifications**

**List of current GEL Certifications as of 20 October 2009**

<b>State</b>	<b>Certification</b>
Arizona	AZ0668
Arkansas	88-0651
CLIA	42D0904046
California – NELAP	01151CA
Colorado	GEL
Connecticut	PH-0169
Dept. of Navy	NFESC 413
EPA Region 5	WG-15J
Florida – NELAP	E87156
Georgia	E87156 (FL/NELAP)
Georgia DW	967
Hawaii	N/A
ISO 17025	2567.01
Idaho	SC00012
Illinois – NELAP	200029
Indiana	C-SC-01
Kansas – NELAP	E-10332
Kentucky	90129
Louisiana – NELAP	03046
Maryland	270
Massachusetts	M-SC012
Nevada	SC00012
New Jersey – NELAP	SC002
New Mexico	FL NELAP E87156
New York – NELAP	11501
North Carolina	233
North Carolina DW	45709
Oklahoma	9904
Pennsylvania – NELAP	68-00485
South Carolina	10120001/10120002
Tennessee	TN 02934
Texas – NELAP	T104704235-07B-TX
U.S. Dept. of Agriculture	S-52597
Utah – NELAP	GEL
Vermont	VT87156
Virginia	00151
Washington	C1641



# RADIOLOGICAL ANALYSIS

**Radiochemistry Case Narrative  
Tronox LLC (KERR)  
SDG 237521**

**Method/Analysis Information**

**Product:** Alphaspec Th, Liquid  
Analytical Method: DOE EML HASL-300, Th-01-RC Modified  
Analytical Batch Number: 905546

<b>Sample ID</b>	<b>Client ID</b>
237521010	EB091809-SO1
1201930820	Method Blank (MB)
1201930821	Laboratory Control Sample (LCS)
1201930822	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

**SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-038 REV# 12.

**Calibration Information:**

**Calibration Information**

All initial and continuing calibration requirements have been met.

**Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

**Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

**Quality Control (QC) Information:**

**Blank Information**

The blank volume is representative of the sample volumes in this batch.

**Designated QC**

A laboratory duplicate was not run with the analytical batch since it was designated by the client as a field QC. A laboratory control sample duplicate was analyzed for precision. 1201930821 (LCS) and

1201930822 (LCSD).

**QC Information**

All of the QC samples met the required acceptance limits.

**Technical Information:**

**Holding Time**

All sample procedures for this sample set were performed within the required holding time.

**Sample Re-prep/Re-analysis**

Samples 1201930820 (MB) and 237521010 (EB091809-SO1) were recounted due to high MDAs.

**Miscellaneous Information:**

**NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. The following NCR was generated for this SDG: NCR 742701 was generated due to Other. 1. Sample 237521010 has Thorium-228 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. 1. Samples were all counted the maximum count time of 1000 minutes to achieve the best possible uncertainties. PM notified, reporting results.

**Manual Integration**

No manual integrations were performed on data in this batch.

**Additional Comments**

The Th-228 blank result is greater than the MDA but less than the RDL.

**Qualifier information**

Manual qualifiers were not required.

**Method/Analysis Information**

<b>Product:</b>	<b>Alphaspec Th, Solid</b>
Analytical Method:	DOE EML HASL-300, Th-01-RC Modified
Prep Method:	Dry Soil Prep
Analytical Batch Number:	909125
Prep Batch Number:	905049

<b>Sample ID</b>	<b>Client ID</b>
237521001	SA117-0.5B
237521002	SA117-9B
237521003	SA117-25B
237521004	SA117-41B
237521005	SA161-0.5B
237521006	SA161-10B
237521007	SA161-25B
237521008	SA161009-25B
237521009	SA161-37B
237521011	RSAT4-0.5B
237521012	RSAT4-10B
237521013	RSAT4-25B
237521014	RSAT4-40B
237521015	RSAT4-53B
237521016	SA32-0.5B
237521017	SA32-9B
237521018	SA32-25B
237521019	SA32009-25B
237521020	SA32-37B
1201939560	Method Blank (MB)
1201939561	237521002(SA117-9B) Sample Duplicate (DUP)
1201939562	237521002(SA117-9B) Matrix Spike (MS)
1201939563	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

**SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-038 REV# 12.

**Calibration Information:**

**Calibration Information**

All initial and continuing calibration requirements have been met.

**Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

**Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

**Quality Control (QC) Information:**

**Blank Information**

The blank volume is representative of the sample volumes in this batch.

**Designated QC**

The following sample was used for QC: 237521002 (SA117-9B).

**QC Information**

All of the QC samples met the required acceptance limits.

**Technical Information:**

**Holding Time**

All sample procedures for this sample set were performed within the required holding time.

**Sample Re-prep/Re-analysis**

Samples 237521007 (SA161-25B) and 237521019 (SA32009-25B) were recounted due to high carrier/tracer yield. Samples were recounted due to a suspected blank false positive.

**Miscellaneous Information:**

**NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. A nonconformance report (NCR) was not generated for this SDG.

**Manual Integration**

No manual integrations were performed on data in this batch.

**Additional Comments**

The blank did not meet the detection limits for Th-228 and Th-230 due to keeping the blank volume consistent with the other sample aliquots. All other samples met the detection limits and all samples were counted for 1000 minutes to achieve the lowest MDA's possible.

**Qualifier information**

Manual qualifiers were not required.

**Method/Analysis Information**

**Product:** Alphaspec U, Liquid  
**Analytical Method:** DOE EML HASL-300, U-02-RC Modified  
**Analytical Batch Number:** 905548

<b>Sample ID</b>	<b>Client ID</b>
237521010	EB091809-SO1
1201930842	Method Blank (MB)
1201930843	Laboratory Control Sample (LCS)
1201930844	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

### **SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-011 REV# 17.

### **Calibration Information:**

#### **Calibration Information**

All initial and continuing calibration requirements have been met.

#### **Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

#### **Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

### **Quality Control (QC) Information:**

#### **Blank Information**

The blank volume is representative of the sample volume in this batch.

#### **Designated QC**

A laboratory duplicate was not run with the analytical batch since it was designated by the client as a field QC. A laboratory control sample duplicate was analyzed for precision. 1201930843 (LCS) and 1201930844 (LCSD).

#### **QC Information**

All of the QC samples met the required acceptance limits.

### **Technical Information:**

#### **Holding Time**

All sample procedures for this sample set were performed within the required holding time.

#### **Sample Re-prep/Re-analysis**

None of the samples in this sample set required reprep or reanalysis.

### **Miscellaneous Information:**

#### **NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. A nonconformance report (NCR) was not generated for this SDG.

#### **Manual Integration**

No manual integrations were performed on data in this batch.

#### **Additional Comments**

Additional comments were not required for this sample set.

**Qualifier information**

Manual qualifiers were not required.

**Method/Analysis Information**

**Product:** Alphaspec U, Solid  
Analytical Method: DOE EML HASL-300, U-02-RC Modified  
Prep Method: Dry Soil Prep  
Analytical Batch Number: 909129  
Prep Batch Number: 905049

<b>Sample ID</b>	<b>Client ID</b>
237521001	SA117-0.5B
237521002	SA117-9B
237521003	SA117-25B
237521004	SA117-41B
237521005	SA161-0.5B
237521006	SA161-10B
237521007	SA161-25B
237521008	SA161009-25B
237521009	SA161-37B
237521011	RSAT4-0.5B
237521012	RSAT4-10B
237521013	RSAT4-25B
237521014	RSAT4-40B
237521015	RSAT4-53B
237521016	SA32-0.5B
237521017	SA32-9B
237521018	SA32-25B
237521019	SA32009-25B
237521020	SA32-37B
1201939568	Method Blank (MB)
1201939569	237521002(SA117-9B) Sample Duplicate (DUP)
1201939570	237521002(SA117-9B) Matrix Spike (MS)
1201939571	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

**SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories

LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-011 REV# 17.

**Calibration Information:**

**Calibration Information**

All initial and continuing calibration requirements have been met.

**Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

**Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

**Quality Control (QC) Information:**

**Blank Information**

The blank volume is representative of the sample volume in this batch.

**Designated QC**

The following sample was used for QC: 237521002 (SA117-9B).

**QC Information**

Refer to Non-Conformance Report.

**Technical Information:**

**Holding Time**

All sample procedures for this sample set were performed within the required holding time.

**Sample Re-prep/Re-analysis**

None of the samples in this sample set required reprep or reanalysis.

**Miscellaneous Information:**

**NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. The following NCR was generated for this SDG: NCR 745091 was generated due to Failed Recovery for Surrogate or Tracer and Other. 1. Sample 237521004 does not meet the client's tracer yield requirement of 70 - 120%. 2. Samples 237521009 and 237521014 have Uranium-235/236 activity greater than five times the MDA and uncertainty greater than 30% of that activity. Samples 237521003, 237521011, 237521017, 237521018 and 1201939569 have Uranium-235/236 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. 1. The sample does meet the GEL standard yield requirements of 15 to 125% and the blank and LCS both meet the client's tracer requirements. PM notified, reporting results. 2. Samples were all counted the maximum count time of 1000 minutes to achieve the best possible uncertainties. PM notified, reporting results.

**Manual Integration**

No manual integrations were performed on data in this batch.



**Additional Comments**

Additional comments were not required for this sample set.

**Qualifier information**

Manual qualifiers were not required.

**Method/Analysis Information**

**Product:**                               **GFPC, Ra228, Liquid**

Analytical Method:                   EPA 904.0/SW846 9320 Modified

Analytical Batch Number:       905326

<b>Sample ID</b>	<b>Client ID</b>
237521010	EB091809-SO1
1201930326	Method Blank (MB)
1201930327	Laboratory Control Sample (LCS)
1201930328	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

**SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-009 REV# 15.

**Calibration Information:**

**Calibration Information**

All initial and continuing calibration requirements have been met.

**Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

**Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

**Quality Control (QC) Information:**

**Blank Information**

The blank volume is representative of the sample volume in this batch.

**Designated QC**

A laboratory duplicate was not run with the analytical batch since it was designated by the client as a field QC. A laboratory control sample duplicate was analyzed for precision. 1201930327 (LCS) and

1201930328 (LCSD).

**QC Information**

All of the QC samples met the required acceptance limits.

**Technical Information:**

**Holding Time**

All sample procedures for this sample set were performed within the required holding time.

**Sample Re-prep/Re-analysis**

Sample 1201930326 (MB) was recounted due to a suspected blank false positive.

**Chemical Recoveries**

All chemical recoveries meet the required acceptance limits for this sample set.

**Miscellaneous Information:**

**NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. A nonconformance report (NCR) was not generated for this SDG.

**Additional Comments**

Additional comments were not required for this sample set.

**Qualifier information**

Manual qualifiers were not required.

**Method/Analysis Information**

<b>Product:</b>	<b>Gas Flow Radium 228</b>
Analytical Method:	EPA 904.0/SW846 9320 Modified
Prep Method:	Dry Soil Prep
Analytical Batch Number:	907662
Prep Batch Number:	905049

<b>Sample ID</b>	<b>Client ID</b>
237521001	SA117-0.5B
237521002	SA117-9B
237521003	SA117-25B
237521004	SA117-41B
237521005	SA161-0.5B
237521006	SA161-10B
237521007	SA161-25B
237521008	SA161009-25B
237521009	SA161-37B
237521011	RSAT4-0.5B
237521012	RSAT4-10B
237521013	RSAT4-25B
237521014	RSAT4-40B
237521015	RSAT4-53B
237521016	SA32-0.5B
237521017	SA32-9B
237521018	SA32-25B
237521019	SA32009-25B
237521020	SA32-37B
1201935879	Method Blank (MB)
1201935880	237521002(SA117-9B) Sample Duplicate (DUP)
1201935881	237521002(SA117-9B) Matrix Spike (MS)
1201935882	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

**SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-009 REV# 15.

**Calibration Information:**

**Calibration Information**

All initial and continuing calibration requirements have been met.

**Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

**Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

**Quality Control (QC) Information:**

**Blank Information**

The blank volume is representative of the sample volume in this batch.

**Designated QC**

The following sample was used for QC: 237521002 (SA117-9B).

**QC Information**

All of the QC samples met the required acceptance limits.

**Technical Information:**

**Holding Time**

All sample procedures for this sample set were performed within the required holding time.

**Sample Re-prep/Re-analysis**

Samples 1201935880 (SA117-9B), 237521003 (SA117-25B), 237521005 (SA161-0.5B) and 237521012 (RSAT4-10B) were recounted due to client uncertainty requirements.

**Chemical Recoveries**

All chemical recoveries meet the required acceptance limits for this sample set.

**Miscellaneous Information:**

**NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. A nonconformance report (NCR) was not generated for this SDG.

**Additional Comments**

The blank result 1201935879 (MB) is greater than the MDC but less than the detection limit.

**Qualifier information**

Manual qualifiers were not required.

**Method/Analysis Information**

<b>Product:</b>	<b>Lucas Cell, Ra226, solid</b>
Analytical Method:	EPA 903.1 Modified
Prep Method:	Dry Soil Prep
Analytical Batch Number:	905702
Prep Batch Number:	905049

<b>Sample ID</b>	<b>Client ID</b>
237521001	SA117-0.5B
237521002	SA117-9B
237521003	SA117-25B
237521004	SA117-41B
237521005	SA161-0.5B
237521006	SA161-10B
237521007	SA161-25B
237521008	SA161009-25B
237521009	SA161-37B
237521011	RSAT4-0.5B
237521012	RSAT4-10B
237521013	RSAT4-25B
237521014	RSAT4-40B
237521015	RSAT4-53B
237521016	SA32-0.5B
237521017	SA32-9B
237521018	SA32-25B
237521019	SA32009-25B
237521020	SA32-37B
1201931196	Method Blank (MB)
1201931197	237521002(SA117-9B) Sample Duplicate (DUP)
1201931198	237521002(SA117-9B) Matrix Spike (MS)
1201931199	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on a "dry weight" basis.

**SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-008 REV# 12.

**Calibration Information:**

**Calibration Information**

All initial and continuing calibration requirements have been met.

**Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

**Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

**Quality Control (QC) Information:**

**Blank Information**

The blank volume is representative of the sample volume in this batch.

**Designated QC**

The following sample was used for QC: 237521002 (SA117-9B).

**QC Information=**

Refer to Non-Conformance Report.

**Technical Information:**

**Holding Time**

All sample procedures for this sample set were performed within the required holding time.

**Sample Re-prep/Re-analysis**

Samples 1201931198 (SA117-9B) and 1201931199 (LCS) were recounted due to low recovery. Samples 1201931197 (SA117-9B) and 237521002 (SA117-9B) were recounted due to high relative percent difference/relative error ratio. Sample 237521002 (SA117-9B) was recounted due to a suspected false positive.

**Miscellaneous Information:**

**NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. The following NCR was generated for this SDG: NCR 747317 was generated due to Other. 1. Samples 237521001, 237521002, 237521004, 237521005, 237521011, 237521012, 237521015, 1201931197 have Radium-226 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Samples were counted the maximum count time of 30 minutes to achieve the best possible uncertainties. 1. PM notified, reporting results.

**Additional Comments**

Additional comments were not required for this sample set.

**Qualifier information**

Manual qualifiers were not required.

**Method/Analysis Information**

**Product:** Lucas Cell, Ra226, liquid  
Analytical Method: EPA 903.1 Modified  
Analytical Batch Number: 911018

<b>Sample ID</b>	<b>Client ID</b>
237521010	EB091809-SO1
1201943894	Method Blank (MB)
1201943895	Laboratory Control Sample (LCS)
1201943896	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

### **SOP Reference**

Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-RAD-A-008 REV# 12.

### **Calibration Information:**

#### **Calibration Information**

All initial and continuing calibration requirements have been met.

#### **Standards Information**

Standard solution(s) for these analyses are NIST traceable and used before the expiration date(s).

#### **Sample Geometry**

All counting sources were prepared in the same geometry as the calibration standards.

### **Quality Control (QC) Information:**

#### **Blank Information**

The blank volume is representative of the sample volume in this batch.

#### **Designated QC**

A laboratory duplicate was not run with the analytical batch since it was designated by the client as a field QC. A laboratory control sample duplicate was analyzed for precision. 1201943895 (LCS) and 1201943896 (LCSD).

#### **QC Information**

All of the QC samples met the required acceptance limits.

### **Technical Information:**

#### **Holding Time**

All sample procedures for this sample set were performed within the required holding time.

#### **Sample Re-prep/Re-analysis**

None of the samples in this sample set required reprep or reanalysis.

### **Miscellaneous Information:**

#### **NCR Documentation**

Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. A nonconformance report (NCR) was not generated for this SDG.

#### **Additional Comments**

Additional comments were not required for this sample set.

**Qualifier information**

Manual qualifiers were not required.

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

**Review Validation:**

GEL requires all analytical data to be verified by a qualified data validator. In addition, all data designated for CLP or CLP-like packaging will receive a third level validation upon completion of the data package.

**The following data validator verified the information presented in this case narrative:**

**Reviewer/Date:** \_\_\_\_\_  10/20/09



**COMPANY - WIDE NONCONFORMANCE REPORT**

<b>Mo.Day Yr.</b> 07-OCT-09	<b>Division:</b> Radiochemistry	<b>Quality Criteria:</b> Specifications	<b>Type:</b> Process
<b>Instrument Type:</b> ALPHA SPECTROMETER	<b>Test / Method:</b> DOE EML HASL-300, Th-01-RC Modified	<b>Matrix Type:</b> Liquid	<b>Client Code:</b> KERR
<b>Batch ID:</b> 905546	<b>Sample Numbers:</b> See Below		
<b>Potentially affected work order(s)(SDG): 236699,236817,236938,237010,237170,237343,237521</b>			
<b>Application Issues:</b> Other			
<b>Specification and Requirements Nonconformance Description:</b>		<b>NRG Disposition:</b>	
1. Sample 237521010 has Thorium-228 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity.		1. Samples were all counted the maximum count time of 1000 minutes to achieve the best possible uncertainties. PM notified, reporting results.	

**Originator's Name:**  
Jessica Downey 07-OCT-09

**Data Validator/Group Leader:**  
Joseph Moulden 07-OCT-09

**COMPANY - WIDE NONCONFORMANCE REPORT**

<b>Mo.Day Yr.</b> 13-OCT-09	<b>Division:</b> Radiochemistry	<b>Quality Criteria:</b> Specifications	<b>Type:</b> Process
<b>Instrument Type:</b> ALPHA SPECTROMETER	<b>Test / Method:</b> DOE EML HASL-300, U-02-RC Modified	<b>Matrix Type:</b> Solid	<b>Client Code:</b> KERR
<b>Batch ID:</b> 909129	<b>Sample Numbers:</b> See Below		

**Potentially affected work order(s)(SDG): 237521**

**Application Issues:**

Failed Recovery for Surrogate or Tracer

Other

**Specification and Requirements  
Nonconformance Description:**

1. Sample 237521004 does not meet the client's tracer yield requirement of 70 - 120%.
2. Samples 237521009 and 237521014 have Uranium-235/236 activity greater than five times the MDA and uncertainty greater than 30% of that activity.  
Samples 237521003, 237521011, 237521017, 237521018 and 1201939569 have Uranium-235/236 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity.

**NRG Disposition:**

1. The sample does meet the GEL standard yield requirements of 15 to 125% and the blank and LCS both meet the client's tracer requirements. PM notified, reporting results.
2. Samples were all counted the maximum count time of 1000 minutes to achieve the best possible uncertainties. PM notified, reporting results.

**Originator's Name:**

Joseph Moulden      13-OCT-09

**Data Validator/Group Leader:**

Jessica Downey      16-OCT-09

**COMPANY - WIDE NONCONFORMANCE REPORT**

<b>Mo.Day Yr.</b> 17-OCT-09	<b>Division:</b> Radiochemistry	<b>Quality Criteria:</b> SOP	<b>Type:</b> Process
<b>Instrument Type:</b> LSC	<b>Test / Method:</b> EPA 903.1 Modified	<b>Matrix Type:</b> Solid	<b>Client Code:</b> KERR
<b>Batch ID:</b> 905702	<b>Sample Numbers:</b> 237521001, 237521002, 237521004, 237521005, 237521011, 237521012, 237521015, 1201931197		
<b>Potentially affected work order(s)(SDG): 237521</b>			
<b>Application Issues:</b> Other			
<b>Specification and Requirements</b> <b>Nonconformance Description:</b>		<b>NRG Disposition:</b>	
<p>1. Samples 237521001, 237521002, 237521004, 237521005, 237521011, 237521012, 237521015, 1201931197 have Radium-226 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Samples were counted the maximum count time of 30 minutes to achieve the best possible uncertainties.</p>		<p>1. PM notified, reporting results.</p>	

**Originator's Name:**  
Dana Hunt                      17-OCT-09

**Data Validator/Group Leader:**  
Lesley Anderson              19-OCT-09

# SAMPLE DATA SUMMARY

## GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

### Certificate of Analysis Report for

KERR003 Tronox LLC

Client SDG: 237521 GEL Work Order: 237521

**The Qualifiers in this report are defined as follows:**

\* A quality control analyte recovery is outside of specified acceptance criteria

\*\* Analyte is a surrogate compound

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the detection limit.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.



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Reviewed by

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA117-0.5B	Project:	KERRHenderson
Sample ID:	237521001	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 07:53		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.53	+/-0.192	0.100	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		0.785	+/-0.135	0.0705	0.050	pCi/g						
Thorium-232		1.33	+/-0.171	0.0172	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		0.934	+/-0.115	0.0508	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0567	+/-0.0331	0.0334	0.040	pCi/g						
Uranium-238		0.872	+/-0.109	0.027	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.13	+/-0.320	0.350	0.500	pCi/g		JXC5	10/15/09	1209	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.650	+/-0.260	0.300	0.500	pCi/g		KSD1	10/15/09	1915	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			120	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			100	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			100	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA117-9B	Project:	KERRHenderson
Sample ID:	237521002	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 08:11		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.32	+/-0.180	0.0963	0.050	pCi/g		CXM2	10/16/09	0955	909125	1
Thorium-230		0.798	+/-0.135	0.0554	0.050	pCi/g						
Thorium-232		1.17	+/-0.162	0.0174	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		0.926	+/-0.117	0.0499	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0552	+/-0.0361	0.0441	0.040	pCi/g						
Uranium-238		0.979	+/-0.123	0.0686	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.83	+/-0.454	0.552	0.500	pCi/g		JXC5	10/15/09	1209	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.854	+/-0.279	0.288	0.500	pCi/g		KSD1	10/15/09	2150	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			118	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			96.9	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			97.0	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA117-25B	Project:	KERRHenderson
Sample ID:	237521003	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 08:46		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.74	+/-0.219	0.109	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		1.85	+/-0.217	0.0503	0.050	pCi/g						
Thorium-232		1.29	+/-0.181	0.0197	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		2.04	+/-0.170	0.0516	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0843	+/-0.0398	0.0339	0.040	pCi/g						
Uranium-238		2.22	+/-0.175	0.0108	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.20	+/-0.223	0.308	0.500	pCi/g		JXC5	10/15/09	1425	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		1.64	+/-0.377	0.308	0.500	pCi/g		KSD1	10/15/09	1915	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			99.9	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			99.3	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			92.2	(25%-125%)



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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA117-41B	Project:	KERRHenderson
Sample ID:	237521004	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 09:51		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.34	+/-0.183	0.109	0.050	pCi/g		CXM2	10/16/09	1001	909125	1
Thorium-230		1.22	+/-0.165	0.0441	0.050	pCi/g						
Thorium-232		1.19	+/-0.163	0.0441	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.56	+/-0.206	0.102	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.124	+/-0.0666	0.0631	0.040	pCi/g						
Uranium-238		1.89	+/-0.220	0.020	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.01	+/-0.383	0.530	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.713	+/-0.230	0.235	0.500	pCi/g		KSD1	10/15/09	1915	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			117	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			54.9	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			98.0	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
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Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA161-0.5B	Project:	KERRHenderson
Sample ID:	237521005	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 11:23		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.65	+/-0.220	0.139	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		0.842	+/-0.149	0.0635	0.050	pCi/g						
Thorium-232		1.45	+/-0.193	0.0508	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		0.784	+/-0.113	0.0545	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0452	+/-0.0327	0.0384	0.040	pCi/g						
Uranium-238		0.894	+/-0.119	0.0311	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.17	+/-0.218	0.298	0.500	pCi/g		JXC5	10/15/09	1425	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.643	+/-0.215	0.162	0.500	pCi/g		KSD1	10/15/09	1915	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			103	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			88.4	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			90.5	(25%-125%)

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Company : Northgate Environmental  
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Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA161-10B	Project:	KERRHenderson
Sample ID:	237521006	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 11:38		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.38	+/-0.194	0.097	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		1.04	+/-0.161	0.0197	0.050	pCi/g						
Thorium-232		1.25	+/-0.178	0.0501	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.14	+/-0.129	0.0115	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0521	+/-0.0359	0.0454	0.040	pCi/g						
Uranium-238		1.07	+/-0.125	0.0115	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.30	+/-0.343	0.403	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.554	+/-0.246	0.299	0.500	pCi/g		KSD1	10/15/09	1950	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			109	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			95.8	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			113	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA161-25B	Project:	KERRHenderson
Sample ID:	237521007	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 12:10		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.03	+/-0.172	0.0997	0.050	pCi/g		CXM2	10/19/09	1228	909125	1
Thorium-230		5.00	+/-0.360	0.0643	0.050	pCi/g						
Thorium-232		0.852	+/-0.149	0.0513	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		4.11	+/-0.235	0.0427	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.206	+/-0.0606	0.0411	0.040	pCi/g						
Uranium-238		3.89	+/-0.228	0.0104	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		0.966	+/-0.445	0.665	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		2.85	+/-0.434	0.255	0.500	pCi/g		KSD1	10/15/09	1950	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			105	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			104	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			95.8	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA161009-25B	Project:	KERRHenderson
Sample ID:	237521008	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 12:10		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		0.835	+/-0.142	0.0666	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		4.03	+/-0.302	0.0448	0.050	pCi/g						
Thorium-232		0.679	+/-0.124	0.0176	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		4.45	+/-0.248	0.0343	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.208	+/-0.0608	0.0339	0.040	pCi/g						
Uranium-238		4.57	+/-0.251	0.0396	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.07	+/-0.404	0.560	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		2.65	+/-0.431	0.268	0.500	pCi/g		KSD1	10/15/09	1950	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			118	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			97.6	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			99.5	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
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Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA161-37B	Project:	KERRHenderson
Sample ID:	237521009	Client ID:	KERR003
Matrix:	SO		
Collect Date:	18-SEP-09 12:43		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		0.773	+/-0.138	0.0893	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		2.21	+/-0.221	0.0543	0.050	pCi/g						
Thorium-232		0.879	+/-0.139	0.0434	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		2.88	+/-0.199	0.0505	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.161	+/-0.0517	0.013	0.040	pCi/g						
Uranium-238		2.67	+/-0.190	0.0336	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.11	+/-0.321	0.353	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		1.98	+/-0.384	0.276	0.500	pCi/g		KSD1	10/15/09	1950	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			116	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			98.4	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			98.5	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	EB091809-SO1	Project:	KERRHenderson
Sample ID:	237521010	Client ID:	KERR003
Matrix:	W		
Collect Date:	18-SEP-09 13:12		
Receive Date:	19-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Liquid "As Received"</i>												
Thorium-228		0.0255	+/-0.0144	0.00637	0.030	pCi/L		AXD2	10/05/09	2051	905546	1
Thorium-230	U	-0.0125	+/-0.0108	0.030	0.030	pCi/L						
Thorium-232	U	0.00	+/-0.00409	0.00626	0.030	pCi/L						
<i>Alphaspec U, Liquid "As Received"</i>												
Uranium-233/234	U	0.00797	+/-0.00925	0.015	0.030	pCi/L		AXD2	10/02/09	2026	905548	2
Uranium-235/236	U	0.00967	+/-0.010	0.0148	0.030	pCi/L						
Uranium-238	U	0.00939	+/-0.0097	0.015	0.030	pCi/L						
<b>Rad Gas Flow Proportional Counting</b>												
<i>GFPC, Ra228, Liquid "As Received"</i>												
Radium-228	U	0.704	+/-1.00	1.74	3.00	pCi/L		MXS2	09/28/09	1942	905326	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, liquid "As Received"</i>												
Radium-226	U	0.127	+/-0.361	0.683	1.00	pCi/L		KSD1	10/15/09	0825	911018	4

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Liquid "As Received"			105	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			97.0	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			97.7	(15%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	RSAT4-0.5B	Project:	KERRHenderson
Sample ID:	237521011	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 07:38		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.28	+/-0.245	0.265	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		0.875	+/-0.185	0.170	0.050	pCi/g						
Thorium-232		1.16	+/-0.208	0.175	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.07	+/-0.131	0.0447	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0349	+/-0.0259	0.015	0.040	pCi/g						
Uranium-238		1.01	+/-0.126	0.0447	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		0.795	+/-0.454	0.689	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.771	+/-0.262	0.277	0.500	pCi/g		KSD1	10/15/09	1950	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			87.3	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			86.2	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			71.6	(25%-125%)



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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	RSAT4-10B	Project:	KERRHenderson
Sample ID:	237521012	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 07:59		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		2.12	+/-0.235	0.109	0.050	pCi/g		CXM2	10/15/09	2010	909125	1
Thorium-230		0.933	+/-0.152	0.060	0.050	pCi/g						
Thorium-232		1.61	+/-0.197	0.0479	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.01	+/-0.121	0.0581	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236	U	0.040	+/-0.0314	0.0426	0.040	pCi/g						
Uranium-238		1.01	+/-0.119	0.0344	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.49	+/-0.374	0.575	0.500	pCi/g		JXC5	10/15/09	1641	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.844	+/-0.259	0.257	0.500	pCi/g		KSD1	10/15/09	1950	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			103	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			100	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			101	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	RSAT4-25B	Project:	KERRHenderson
Sample ID:	237521013	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 08:24		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.70	+/-0.213	0.125	0.050	pCi/g		CXM2	10/15/09	2011	909125	1
Thorium-230		1.24	+/-0.172	0.0471	0.050	pCi/g						
Thorium-232		1.42	+/-0.184	0.0471	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.44	+/-0.144	0.061	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0533	+/-0.037	0.0492	0.040	pCi/g						
Uranium-238		1.16	+/-0.129	0.0518	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		2.70	+/-0.494	0.523	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		1.14	+/-0.280	0.163	0.500	pCi/g		KSD1	10/15/09	1950	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			112	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			101	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			103	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
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Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	RSAT4-40B	Project:	KERRHenderson
Sample ID:	237521014	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 09:11		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.39	+/-0.189	0.122	0.050	pCi/g		CXM2	10/15/09	2011	909125	1
Thorium-230		1.97	+/-0.215	0.0892	0.050	pCi/g						
Thorium-232		1.25	+/-0.167	0.0175	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		2.33	+/-0.212	0.0548	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.184	+/-0.0657	0.0184	0.040	pCi/g						
Uranium-238		2.38	+/-0.213	0.0379	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.37	+/-0.396	0.508	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		1.62	+/-0.362	0.290	0.500	pCi/g		KSD1	10/15/09	2025	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			114	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			72.2	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			105	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	RSAT4-53B	Project:	KERRHenderson
Sample ID:	237521015	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 09:55		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.44	+/-0.215	0.128	0.050	pCi/g		CXM2	10/15/09	2011	909125	1
Thorium-230		1.11	+/-0.179	0.0565	0.050	pCi/g						
Thorium-232		1.04	+/-0.177	0.0909	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.17	+/-0.130	0.0622	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.0564	+/-0.0371	0.048	0.040	pCi/g						
Uranium-238		1.18	+/-0.127	0.0388	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.52	+/-0.397	0.453	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.472	+/-0.200	0.227	0.500	pCi/g		KSD1	10/15/09	2025	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			91.6	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			102	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			94.6	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA32-0.5B	Project:	KERRHenderson
Sample ID:	237521016	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 12:55		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.46	+/-0.186	0.0797	0.050	pCi/g		CXM2	10/15/09	2011	909125	1
Thorium-230		0.951	+/-0.152	0.0937	0.050	pCi/g						
Thorium-232		1.34	+/-0.174	0.0555	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.10	+/-0.122	0.0457	0.040	pCi/g		CXM2	10/10/09	1532	909129	2
Uranium-235/236		0.059	+/-0.0351	0.0404	0.040	pCi/g						
Uranium-238		1.03	+/-0.118	0.042	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.38	+/-0.375	0.451	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		0.474	+/-0.238	0.306	0.500	pCi/g		KSD1	10/15/09	2025	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			115	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			107	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			107	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental Management, Inc.  
 Address : 1100 Quail St., Suite 102  
 Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
 Project: **Tronox Henderson**

Client Sample ID:	SA32-9B	Project:	KERRHenderson
Sample ID:	237521017	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 13:12		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.87	+/-0.215	0.0895	0.050	pCi/g		CXM2	10/15/09	2011	909125	1
Thorium-230		1.13	+/-0.167	0.0813	0.050	pCi/g						
Thorium-232		1.55	+/-0.192	0.0581	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		1.27	+/-0.107	0.037	0.040	pCi/g		CXM2	10/10/09	1522	909129	2
Uranium-235/236		0.0707	+/-0.0299	0.0271	0.040	pCi/g						
Uranium-238		1.07	+/-0.0973	0.0219	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.11	+/-0.304	0.306	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		1.18	+/-0.299	0.261	0.500	pCi/g		KSD1	10/15/09	2025	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			112	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			105	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			102	(25%-125%)

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## Certificate of Analysis

Company : Northgate Environmental  
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Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA32-25B	Project:	KERRHenderson
Sample ID:	237521018	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 13:44		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.22	+/-0.169	0.0461	0.050	pCi/g		CXM2	10/15/09	2011	909125	1
Thorium-230		2.17	+/-0.222	0.0449	0.050	pCi/g						
Thorium-232		1.36	+/-0.175	0.0176	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		2.23	+/-0.144	0.0367	0.040	pCi/g		CXM2	10/10/09	1522	909129	2
Uranium-235/236		0.122	+/-0.0431	0.0454	0.040	pCi/g						
Uranium-238		2.22	+/-0.145	0.0425	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.60	+/-0.356	0.327	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		2.37	+/-0.455	0.210	0.500	pCi/g		KSD1	10/15/09	2025	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			120	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			98.7	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			100	(25%-125%)

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID:	SA32009-25B	Project:	KERRHenderson
Sample ID:	237521019	Client ID:	KERR003
Matrix:	SO		
Collect Date:	21-SEP-09 13:44		
Receive Date:	22-SEP-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.87	+/-0.223	0.110	0.050	pCi/g		CXM2	10/19/09	1228	909125	1
Thorium-230		2.18	+/-0.231	0.0484	0.050	pCi/g						
Thorium-232		1.49	+/-0.192	0.0699	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		2.27	+/-0.147	0.0373	0.040	pCi/g		CXM2	10/10/09	1522	909129	2
Uranium-235/236		0.151	+/-0.0442	0.0333	0.040	pCi/g						
Uranium-238		2.10	+/-0.142	0.0413	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.96	+/-0.388	0.319	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		1.79	+/-0.332	0.148	0.500	pCi/g		KSD1	10/15/09	2025	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			110	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			94.5	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			98.6	(25%-125%)



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## Certificate of Analysis

Company : Northgate Environmental  
Management, Inc.  
Address : 1100 Quail St., Suite 102  
Newport Beach, California 92660

Report Date: October 20, 2009

Contact: Mr. Frank Hagar  
Project: **Tronox Henderson**

Client Sample ID: SA32-37B  
Sample ID: 237521020  
Matrix: SO  
Collect Date: 21-SEP-09 14:19  
Receive Date: 22-SEP-09  
Collector: Client

Project: KERRHenderson  
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Rad Alpha Spec Analysis</b>												
<i>Alphaspec Th, Solid "Dry Weight Corrected"</i>												
Thorium-228		1.34	+/-0.178	0.0184	0.050	pCi/g		CXM2	10/15/09	2011	909125	1
Thorium-230		1.78	+/-0.203	0.0458	0.050	pCi/g						
Thorium-232		1.15	+/-0.163	0.018	0.100	pCi/g						
<i>Alphaspec U, Solid "Dry Weight Corrected"</i>												
Uranium-233/234		2.56	+/-0.151	0.0309	0.040	pCi/g		CXM2	10/10/09	1522	909129	2
Uranium-235/236		0.160	+/-0.044	0.0316	0.040	pCi/g						
Uranium-238		2.17	+/-0.139	0.0284	0.040	pCi/g						
<b>Rad Gas Flow Proportional Counting</b>												
<i>Gas Flow Radium 228 "Dry Weight Corrected"</i>												
Radium-228		1.39	+/-0.372	0.427	0.500	pCi/g		JXC5	10/15/09	1210	907662	3
<b>Rad Radium-226</b>												
<i>Lucas Cell, Ra226, solid "Dry Weight Corrected"</i>												
Radium-226		1.26	+/-0.313	0.271	0.500	pCi/g		KSD1	10/15/09	2100	905702	4

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	CXC1	09/23/09	1109	905049

**The following Analytical Methods were performed**

Method	Description	Analyst Comments
1	DOE EML HASL-300, Th-01-RC Modified	
2	DOE EML HASL-300, U-02-RC Modified	
3	EPA 904.0/SW846 9320 Modified	
4	EPA 903.1 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Actinium-227 Tracer	Alphaspec Th, Solid "Dry Weight Corrected"			116	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			100	(15%-125%)
Barium-133 Tracer	Gas Flow Radium 228 "Dry Weight Corrected"			100	(25%-125%)

# QUALITY CONTROL DATA

# GEL LABORATORIES LLC

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## QC Summary

Report Date: October 20, 2009

Page 1 of 5

Northgate Environmental Management, Inc.

1100 Quail St., Suite 102  
Newport Beach, California

Contact: Mr. Frank Hagar

Workorder: 237521

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Alpha Spec</b>											
Batch	905546										
QC1201930821	LCS										
Thorium-228			U	0.0205 +/-0.0205	pCi/L				AXD2	10/02/09	09:19
Thorium-230	2.68			2.39 +/-0.137	pCi/L		89.2	(75%-125%)			
Thorium-232				0.0143 +/-0.0106	pCi/L			(75%-125%)			
QC1201930822	LCSD										
Thorium-228			U	0.00931 +/-0.019	pCi/L	75.0				10/02/09	09:19
Thorium-230	2.68			2.67 +/-0.138	pCi/L	11.2	99.6	(0%-20%)			
Thorium-232			U	0.00927 +/-0.0109	pCi/L	42.5*		(0%-20%)			
QC1201930820	MB										
Thorium-228				0.0287 +/-0.0168	pCi/L					10/05/09	20:51
Thorium-230			U	0.00439 +/-0.0086	pCi/L						
Thorium-232			U	0.00 +/-0.0043	pCi/L						
Batch	905548										
QC1201930843	LCS										
Uranium-233/234				2.89 +/-0.144	pCi/L				AXD2	10/02/09	13:49
Uranium-235/236				0.153 +/-0.0398	pCi/L						
Uranium-238	3.15			3.16 +/-0.151	pCi/L		100	(75%-125%)			
QC1201930844	LCSD										
Uranium-233/234				3.08 +/-0.151	pCi/L	6.43				10/02/09	13:49
Uranium-235/236				0.167 +/-0.0388	pCi/L	8.77					
Uranium-238	3.15			3.29 +/-0.156	pCi/L	3.97	104	(0%-20%)			
QC1201930842	MB										
Uranium-233/234			U	0.00785 +/-0.0134	pCi/L					10/02/09	13:49
Uranium-235/236			U	0.00669 +/-0.00978	pCi/L						
Uranium-238			U	0.0162	pCi/L						

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## QC Summary

Workorder: 237521

Page 2 of 5

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Alpha Spec</b>											
Batch	905548										
Batch	909125			+/-0.0146							
QC1201939561	237521002	DUP									
Thorium-228			1.32	1.34	pCi/g	1.92		(0% - 20%)	CXM2	10/15/09	20:11
			+/-0.180	+/-0.185							
Thorium-230			0.798	0.847	pCi/g	5.87		(0% - 20%)			
			+/-0.135	+/-0.149							
Thorium-232			1.17	1.37	pCi/g	15.1		(0% - 20%)			
			+/-0.162	+/-0.187							
QC1201939563	LCS										
Thorium-228				0.0813	pCi/g					10/15/09	20:11
				+/-0.051							
Thorium-230	8.05			7.13	pCi/g		88.6	(75%-125%)			
				+/-0.439							
Thorium-232			U	0.014	pCi/g			(75%-125%)			
				+/-0.0194							
QC1201939560	MB										
Thorium-228			U	0.0672	pCi/g					10/13/09	13:16
				+/-0.0737							
Thorium-230			U	0.00683	pCi/g						
				+/-0.0232							
Thorium-232			U	0.00	pCi/g						
				+/-0.0189							
QC1201939562	237521002	MS									
Thorium-228			1.32	1.58	pCi/g					10/15/09	20:11
			+/-0.180	+/-0.193							
Thorium-230	8.36		0.798	7.71	pCi/g		82.7	(75%-125%)			
			+/-0.135	+/-0.419							
Thorium-232			1.17	1.49	pCi/g			(75%-125%)			
			+/-0.162	+/-0.186							
Batch	909129										
QC1201939569	237521002	DUP									
Uranium-233/234			0.926	0.865	pCi/g	6.81		(0% - 20%)	CXM2	10/10/09	15:22
			+/-0.117	+/-0.0942							
Uranium-235/236			0.0552	0.0848	pCi/g	42.3		(0% - 100%)			
			+/-0.0361	+/-0.0336							
Uranium-238			0.979	0.843	pCi/g	14.9		(0% - 20%)			
			+/-0.123	+/-0.0916							
QC1201939571	LCS										
Uranium-233/234				4.60	pCi/g					10/10/09	15:22
				+/-0.226							
Uranium-235/236				0.622	pCi/g						
				+/-0.093							
Uranium-238	4.87			4.75	pCi/g		97.5	(75%-125%)			
				+/-0.229							

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## QC Summary

Workorder: 237521

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Alpha Spec</b>											
Batch	909129										
QC1201939568		MB									
Uranium-233/234			U	0.0146	pCi/g				CXM2	10/10/09	15:22
				+/-0.0211							
Uranium-235/236			U	0.0178	pCi/g						
				+/-0.0165							
Uranium-238			U	0.0024	pCi/g						
				+/-0.0194							
QC1201939570	237521002	MS									
Uranium-233/234				0.926	pCi/g					10/10/09	15:22
				+/-0.117							
Uranium-235/236				0.0552	pCi/g						
				+/-0.0361							
Uranium-238	5.01			0.979	pCi/g		97.3	(75%-125%)			
				+/-0.123							
<b>Rad Gas Flow</b>											
Batch	905326										
QC1201930327		LCS									
Radium-228	40.0			44.0	pCi/L		110	(75%-125%)	MXS2	09/28/09	19:41
				+/-4.24							
QC1201930328		LCSD									
Radium-228	40.0			38.2	pCi/L	14.1	95.7	(0%-20%)		09/28/09	19:41
				+/-4.13							
QC1201930326		MB									
Radium-228			U	2.76	pCi/L					09/28/09	20:55
				+/-1.83							
Batch	907662										
QC1201935880	237521002	DUP									
Radium-228				1.83	pCi/g	25.3		(0% - 100%)	JXC5	10/15/09	16:41
				+/-0.454							
QC1201935882		LCS									
Radium-228	7.76			8.48	pCi/g		109	(75%-125%)		10/15/09	12:12
				+/-0.796							
QC1201935879		MB									
Radium-228				0.468	pCi/g					10/15/09	12:09
				+/-0.279							
QC1201935881	237521002	MS									
Radium-228	67.3			1.83	pCi/g		113	(75%-125%)		10/15/09	12:06
				+/-0.454							
				+/-6.82							
<b>Rad Ra-226</b>											
Batch	905702										
QC1201931197	237521002	DUP									
Radium-226				0.854	pCi/g	8.65		(0% - 100%)	KSD1	10/15/09	21:50
				+/-0.279							
QC1201931199		LCS									
Radium-226	11.3			8.86	pCi/g		78.4	(75%-125%)		10/15/09	22:20
				+/-0.732							
QC1201931196		MB									

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## QC Summary

Workorder: 237521

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Rad Ra-226</b>											
Batch	905702										
Radium-226			U	0.235	pCi/g						10/15/09 21:00
				+/-0.163							
QC1201931198	237521002 MS										
Radium-226	11.6	0.854		11.4	pCi/g		91.2	(75%-125%)	KSD1	10/15/09 21:50	
		+/-0.279		+/-0.812							
Batch	911018										
QC1201943895	LCS										
Radium-226	24.2			23.8	pCi/L		98.4	(75%-125%)	KSD1	10/15/09 09:15	
				+/-1.84							
QC1201943896	LCSD										
Radium-226	24.2			23.0	pCi/L	3.46	95	(0%-20%)		10/15/09 09:45	
				+/-2.01							
QC1201943894	MB										
Radium-226			U	0.405	pCi/L						10/15/09 09:15
				+/-0.350							

Notes:

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.
- BD Results are either below the MDC or tracer recovery is low
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- F Estimated Value
- H Analytical holding time was exceeded
- J Value is estimated
- M M if above MDC and less than LLD
- M Matrix Related Failure
- N/A RPD or %Recovery limits do not apply.
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.
- UI Gamma Spectroscopy--Uncertain identification
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound

# GEL LABORATORIES LLC

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## QC Summary

Workorder: 237521

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Parmname	NOM	Sample Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
^										
RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.										
h										
Preparation or preservation holding time was exceeded										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

**RAW DATA**



# THORIUM

### Radiochemistry Batch Checklist, Rev 9

Batch# 909125 Product: Th Date: 10/20/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			NA
Samples have been blank corrected (if required)			NA
If activity less 10* MDA/ MDC, error is 150% or less of sample activity. If greater 10* MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	✓		
Instrument source check is within limits.	✓		
Instrument bkg check is within limits.	✓		
Method RDL/ LLD has been met.	✓		CASE NARRATIVE
If duplicate activities are less 5* MDA/ MDC, then RPD is 100% or less. If greater 5* MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%.	✓		
Or meets the client's required RER acceptance criteria.	✓		
Tracer yield is 15-125% . Carrier yield 25-125%.	✓		
Or meets the client's contract acceptance criteria.	✓		
Method blank is less than the RDL/ LLD. (If rad samples, < 5% of lowest activity)	✓		
Sample was run within hold time.	✓		
Sample was correctly preserved if required.			NA
Smears Taken for Radioactive batches.			NA
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	✓		
No blank spaces on data forms.	✓		
All line outs initialed and dated.	✓		
No transcription errors are apparent.	✓		
Aux data is correct.			NA
Client Special requirements page has been checked.	✓		
Raw Data and/ or spectrum are included and properly stated.	✓		
QC data entered into QC database and batch is in REVW	✓		
Hit notification complete (if necessary)			NA
Batch entered into Case Narrative.	✓		
Batch non-conformances completed, if applicable.			NA
Batch non-conformances second reviewed and disposition verified to be completed.			NA
Aliquot Correction completed if required.	✓		NA
Review sample historical results if available (If REMP, results above MDC have been verified by historical results, recount or re-analysis.)			

GEL Laboratories, LLC

revised 8/1/08

Primary Review Performed By: [Signature] 10/20/09

Secondary Review Performed By: [Signature] 10/20/09

10/19 (10/20)  
KGR

# Thorium (Ac-227 Tracer) Que Sheet

05-OCT-09

Batch #: 909125 Analyst: CXM2 First Client Due Date: 20-OCT-09 Internal Due Date: 09-OCT-09  
 Tracer Isotope: Ac-227 Expiration Date: 7/23/10 Vol: 0.1mL Ac-227 Separation Date/Time: 2030 10/7/09  
 LCS Isotope: Th-230 Expiration Date: 4/13/10 Vol: 0.1mL  
 Spike Isotope: Th-230 Expiration Date: 4/13/10 Vol: 0.1mL  
 Prep Date: 10/6/09 Initials: CMM Pipet ID: 2971058 Balance ID: 5041027 Z  
 Witness: ML 10/5/09

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Pos.	Label #	Wet/Dry Aliquot (g/l/f)	Th Det #
237521001-1	SA117-05B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	1	71	0.255	265 181
237521002-1	SA117-9B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	2	72	0.259	206 182
237521003-1	SA117-25B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	3	73	0.263	208 183
237521004-1	SA117-41B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	4	74	0.258	23 184
237521005-1	SA161-05B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	5	75	0.255	35 185
237521006-1	SA161-10B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	6	76	0.253	36 186
237521007-1	SA161-25B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	7	77	0.251	37 187
237521008-1	SA161009-25B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	8	78	0.253	38 188
237521009-1	SA161-37B	SAMPLE		.05 pCi/g	SOIL	KERR003	18-SEP-09	9	79	0.263	39 189
237521011-1	RSAT4-05B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	10	80	0.250	40 190
237521012-1	RSAT4-10B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	11	81	0.266	41 191
237521013-1	RSAT4-25B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	12	82	0.257	42 192
237521014-1	RSAT4-40B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	13	83	0.259	43 193
237521015-1	RSAT4-53B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	14	84	0.262	44 194
237521016-1	SA32-05B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	15	85	0.264	45 195
237521017-1	SA32-9B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	16	86	0.260	46 196
237521018-1	SA32-25B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	17	87	0.254	47 197
237521019-1	SA32009-25B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	18	88	0.253	48 198
237521020-1	SA32-37B	SAMPLE		.05 pCi/g	SOIL	KERR003	21-SEP-09	19	89	0.260	26 199
1201939560-1	MB for batch 909125	MB		.05 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	20	90	0.266	27 193
1201939561-1	SA117-9B(237521002DUP)	DUP		.05 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	21	91	0.260	28 200
1201939562-1	SA117-9B(237521002MS)	MS		.05 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	22	92	0.256	29 201
1201939563-1	LCS for batch 909125	LCS		.05 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	23	93	0.266	30 202

Choose SOP Used: GL-RAD-A-038  
 Solid Sample Dissolution by: LEACH or DIGESTION Data Reviewed By: Julia D. Dabo/09  
 Circle One

- GL-RAD-A-045
- GL-RAD-A-043
- GL-RAD-A-032

GEL Laboratories LLC, Radiochemistry Division

10/20/09

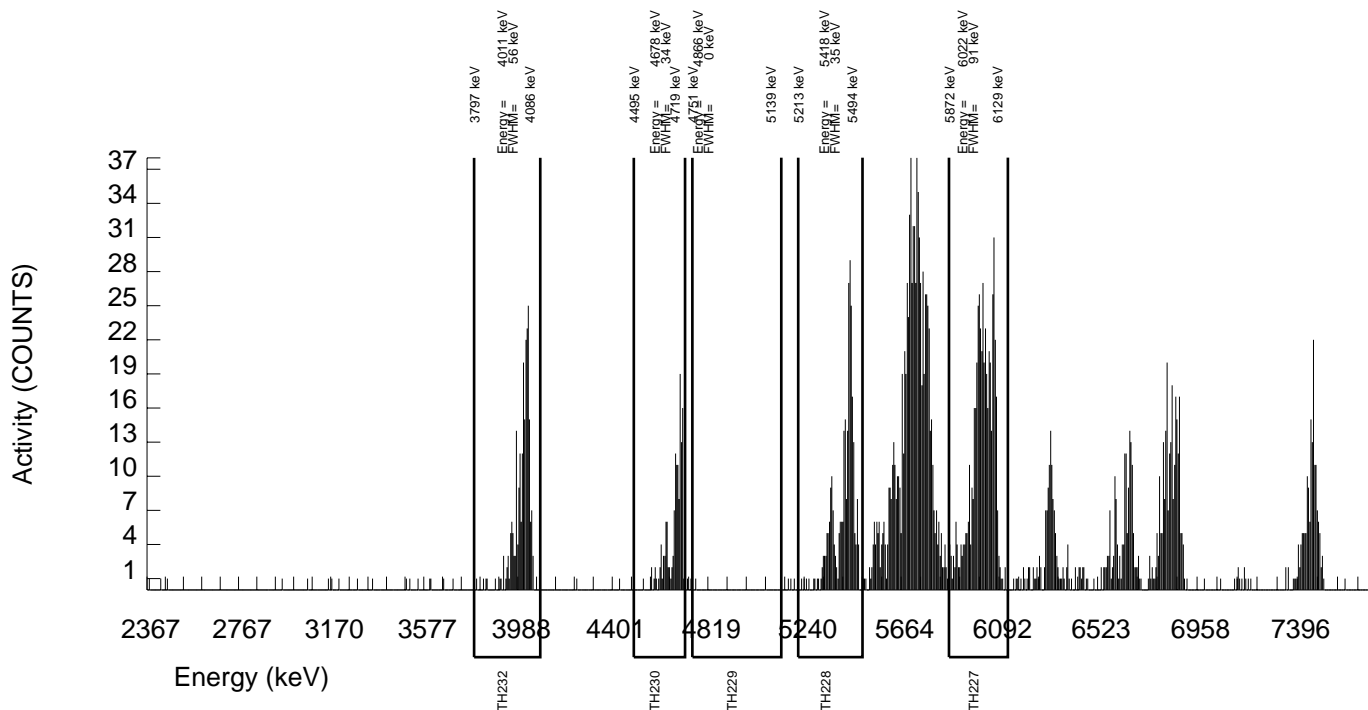
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521001_TH SAMPLE QTY: 0.255 G	
DETECTOR NUMBER :74439 AVERAGE %EFFICIENCY :25.6899 % YIELD : 119.995		COUNT DATE:15-OCT-2009 20:10:32 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.393E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.393E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.67767 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B181.CNF;134 BKG DATE : 11-OCT-2009 EFF FILE : W181.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	515.000	507.000	8.000	2.8284	57.44000	6.89E+00	7.33E-01	2.19E-01	8.94E-02	6.09E-01
TH-228	5363.000	278.000	259.424	9.000	3.0000	99.94000	1.53E+00	2.13E-01	1.00E-01	4.12E-02	1.92E-01
TH229	4900.000	3.000	-2.000	5.000	2.2361	99.52000	-1.15E-02	3.19E-02	7.72E-02	3.00E-02	3.19E-02
TH-230	4625.000	141.000	137.000	4.000	2.0000	100.0000	7.85E-01	1.43E-01	7.05E-02	2.67E-02	1.35E-01
TH-232	3972.000	232.000	232.000	0.000	0.0000	100.0000	1.33E+00	1.88E-01	1.72E-02	0.00E+00	1.71E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



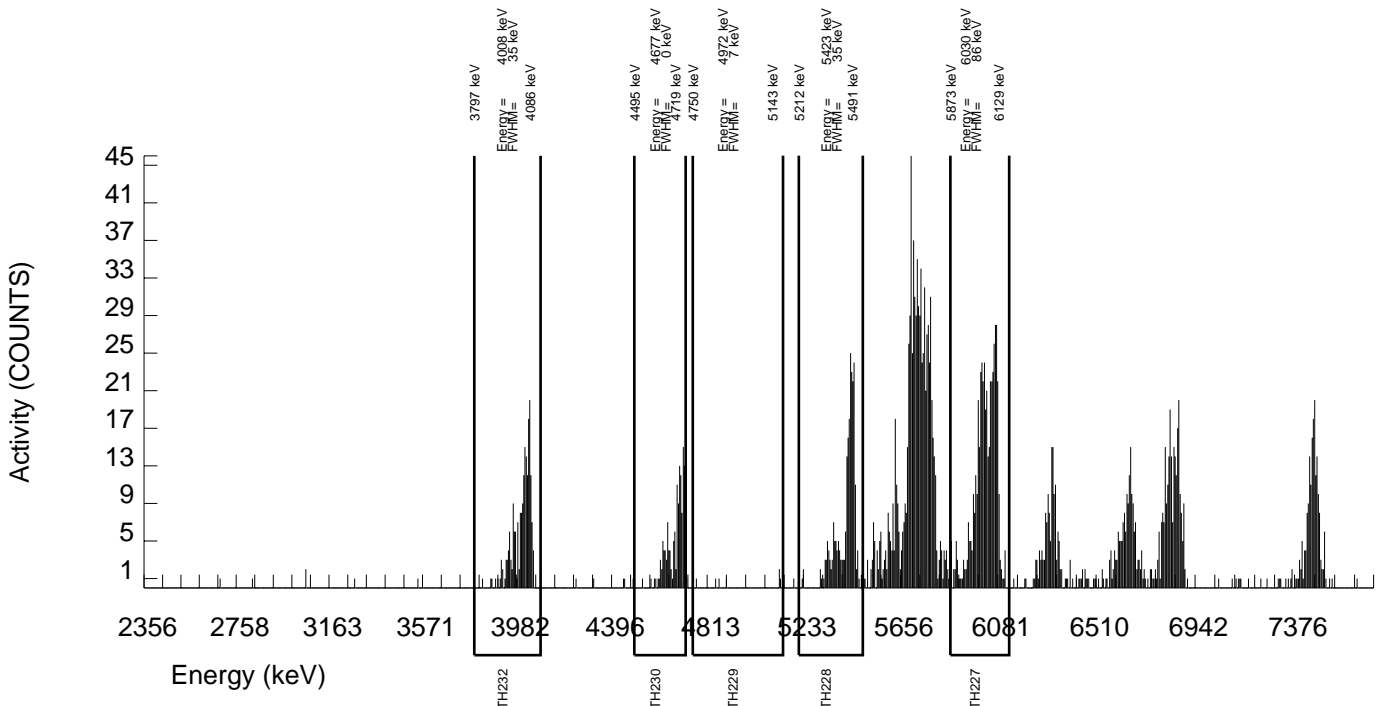
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521002_TH SAMPLE QTY: 0.259 G	
DETECTOR NUMBER :74440 AVERAGE %EFFICIENCY :25.5522 % YIELD : 117.637		COUNT DATE:16-OCT-2009 09:55:17 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.263E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.263E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.58578 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B182.CNF;134 BKG DATE : 11-OCT-2009 EFF FILE : W182.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	486.000	484.000	2.000	1.4142	57.44000	6.78E+00	7.28E-01	1.34E-01	4.61E-02	6.07E-01
TH-228	5363.000	239.000	221.294	8.000	2.8284	99.94000	1.32E+00	1.96E-01	9.63E-02	3.92E-02	1.80E-01
TH229	4900.000	7.000	3.000	4.000	2.0000	99.52000	1.74E-02	3.78E-02	7.15E-02	2.71E-02	3.78E-02
TH-230	4625.000	140.000	138.000	2.000	1.4142	100.0000	7.98E-01	1.43E-01	5.54E-02	1.90E-02	1.35E-01
TH-232	3972.000	203.000	203.000	0.000	0.0000	100.0000	1.17E+00	1.76E-01	1.74E-02	0.00E+00	1.62E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



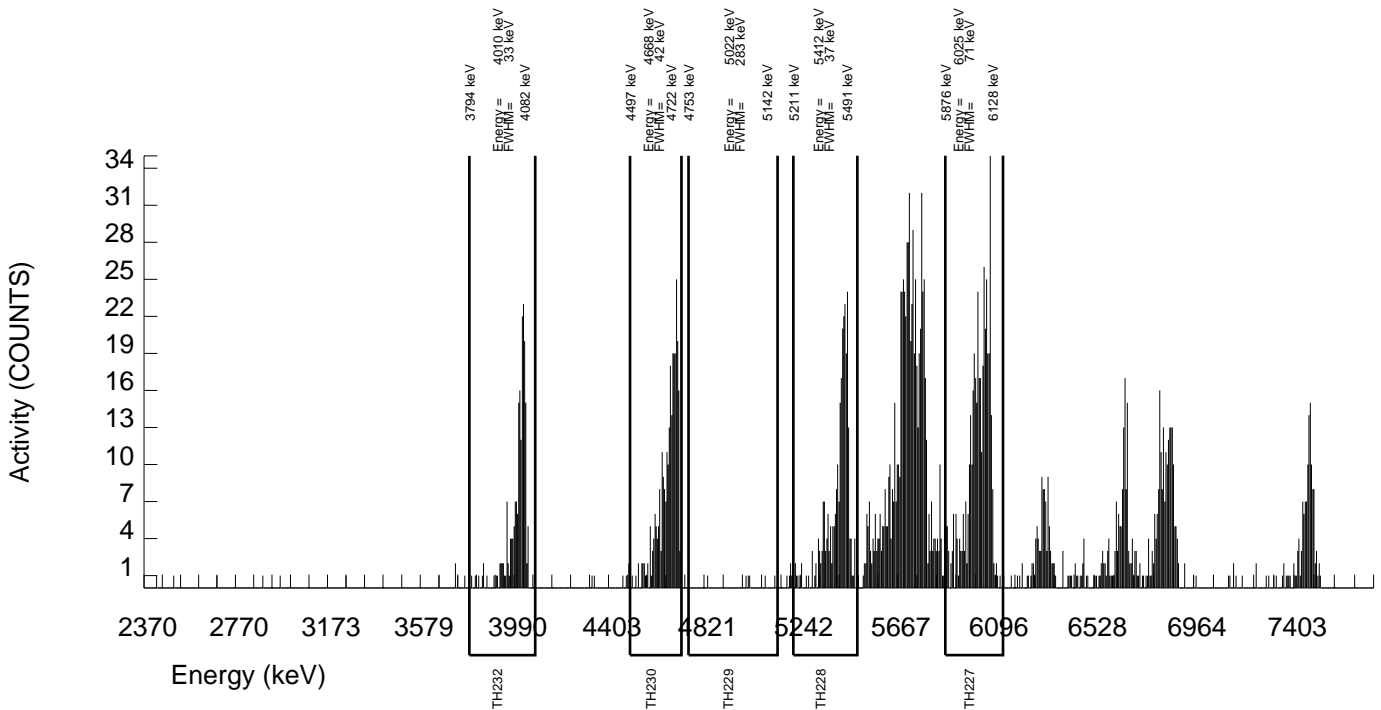
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521003_TH SAMPLE QTY: 0.263 G	
DETECTOR NUMBER :74441 AVERAGE %EFFICIENCY :26.1199 % YIELD : 99.863		COUNT DATE:15-OCT-2009 20:10:38 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.138E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.138E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 3.89290 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B183.CNF;134 BKG DATE : 11-OCT-2009 EFF FILE : W183.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	436.000	429.000	7.000	2.6458	57.44000	6.68E+00	7.54E-01	2.38E-01	9.58E-02	6.42E-01
TH-228	5363.000	274.000	257.898	8.000	2.8284	99.94000	1.74E+00	2.42E-01	1.09E-01	4.45E-02	2.19E-01
TH229	4900.000	6.000	2.000	4.000	2.0000	99.52000	1.32E-02	4.09E-02	8.12E-02	3.07E-02	4.09E-02
TH-230	4625.000	282.000	281.000	1.000	1.0000	100.0000	1.85E+00	2.42E-01	5.02E-02	1.53E-02	2.17E-01
TH-232	3972.000	197.000	197.000	0.000	0.0000	100.0000	1.29E+00	1.96E-01	1.97E-02	0.00E+00	1.81E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



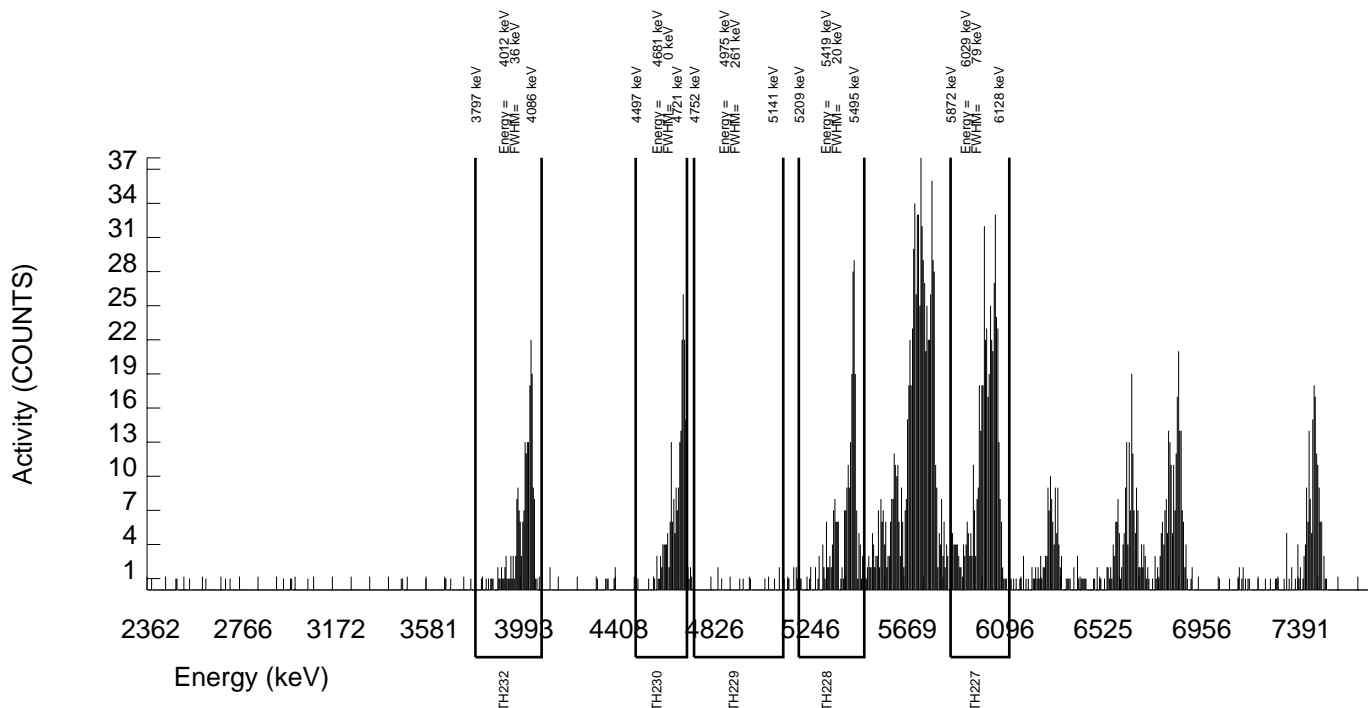
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521004_TH SAMPLE QTY: 0.258 G	
DETECTOR NUMBER :74442 AVERAGE %EFFICIENCY :25.8458 % YIELD : 117.279		COUNT DATE:16-OCT-2009 10:01:01 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.295E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.295E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.57181 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B184.CNF;136 BKG DATE : 11-OCT-2009 EFF FILE : W184.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	494.000	488.000	6.000	2.4495	57.44000	6.81E+00	7.32E-01	2.01E-01	7.95E-02	6.11E-01
TH-228	5363.000	247.000	226.210	11.000	3.3166	99.94000	1.34E+00	2.00E-01	1.09E-01	4.58E-02	1.83E-01
TH229	4900.000	11.000	9.000	2.000	1.4142	99.52000	5.21E-02	4.10E-02	5.54E-02	1.90E-02	4.09E-02
TH-230	4625.000	212.000	211.000	1.000	1.0000	100.0000	1.22E+00	1.80E-01	4.41E-02	1.34E-02	1.65E-01
TH-232	3972.000	208.000	207.000	1.000	1.0000	100.0000	1.19E+00	1.78E-01	4.41E-02	1.34E-02	1.63E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



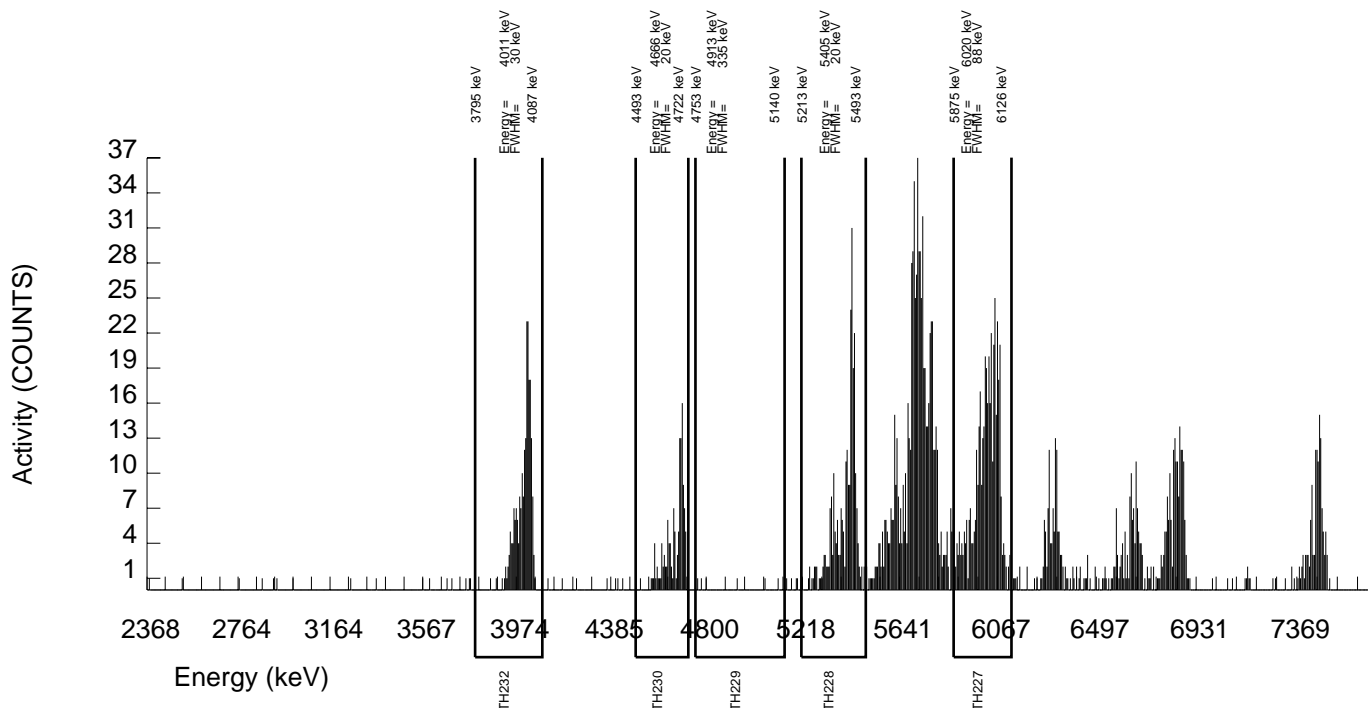
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521005_TH SAMPLE QTY: 0.255 G	
DETECTOR NUMBER :68615 AVERAGE %EFFICIENCY :25.7805 % YIELD : 103.300		COUNT DATE:15-OCT-2009 20:10:42 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.393E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.393E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.02689 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B185.CNF;116 BKG DATE : 11-OCT-2009 EFF FILE : W185.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	445.000	438.000	7.000	2.6458	57.44000	6.89E+00	7.73E-01	2.41E-01	9.68E-02	6.55E-01
TH-228	5363.000	264.000	241.728	14.000	3.7417	99.94000	1.65E+00	2.41E-01	1.39E-01	5.94E-02	2.20E-01
TH229	4900.000	6.000	5.000	1.000	1.0000	99.52000	3.33E-02	3.46E-02	5.10E-02	1.55E-02	3.46E-02
TH-230	4625.000	129.000	127.000	2.000	1.4142	100.0000	8.42E-01	1.57E-01	6.35E-02	2.18E-02	1.49E-01
TH-232	3972.000	220.000	219.000	1.000	1.0000	100.0000	1.45E+00	2.12E-01	5.08E-02	1.54E-02	1.93E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.





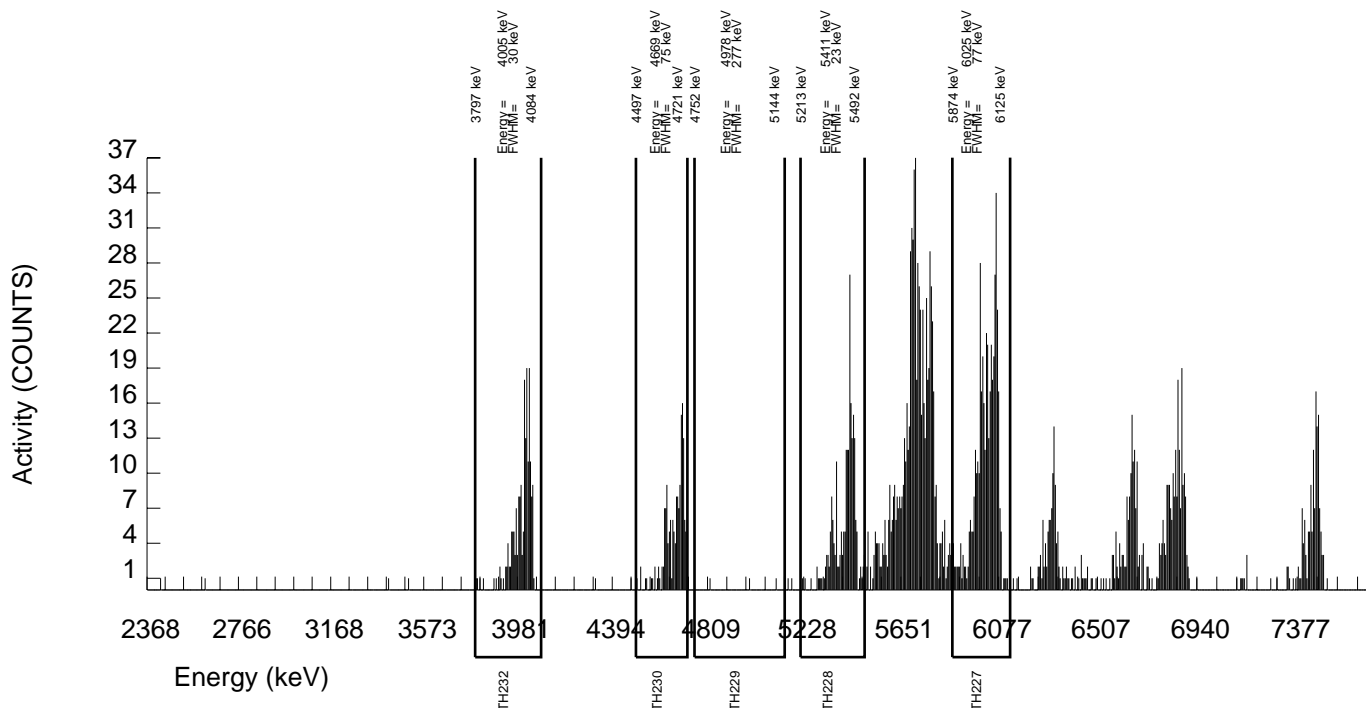
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521006_TH SAMPLE QTY: 0.253 G	
DETECTOR NUMBER :68616 AVERAGE %EFFICIENCY :24.8843 % YIELD : 109.220		COUNT DATE:15-OCT-2009 20:10:45 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.459E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.459E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.25764 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B186.CNF;116 BKG DATE : 11-OCT-2009 EFF FILE : W186.CNF;42 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	451.000	447.000	4.000	2.0000	57.44000	6.94E+00	7.70E-01	1.91E-01	7.22E-02	6.49E-01
TH-228	5363.000	219.000	204.558	6.000	2.4495	99.94000	1.38E+00	2.11E-01	9.70E-02	3.84E-02	1.94E-01
TH229	4900.000	3.000	0.000	3.000	1.7321	99.52000	0.00E+00	3.16E-02	7.28E-02	2.65E-02	3.16E-02
TH-230	4625.000	158.000	158.000	0.000	0.0000	100.0000	1.04E+00	1.73E-01	1.97E-02	0.00E+00	1.61E-01
TH-232	3972.000	192.000	191.000	1.000	1.0000	100.0000	1.25E+00	1.93E-01	5.01E-02	1.52E-02	1.78E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



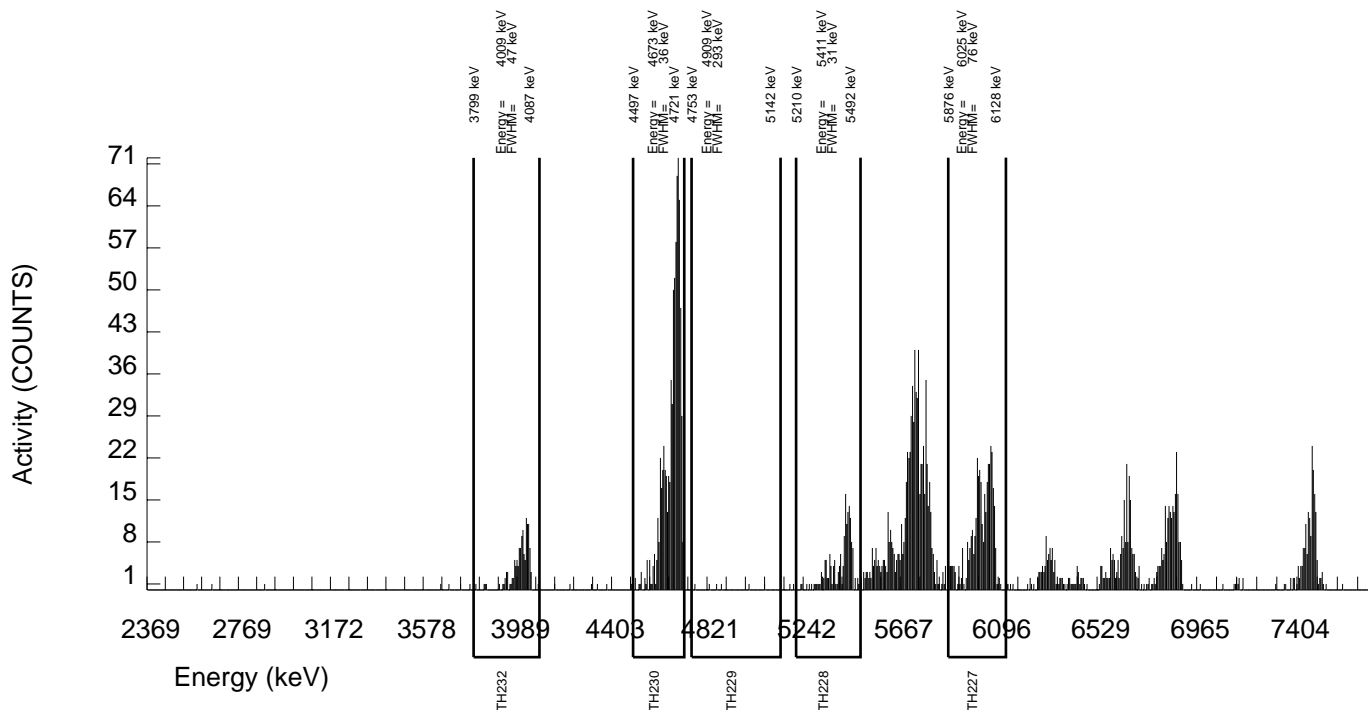
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521007_TH SAMPLE QTY: 0.251 G	
DETECTOR NUMBER :74433 AVERAGE %EFFICIENCY :25.4394 % YIELD : 105.174		COUNT DATE:19-OCT-2009 12:28:53 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.527E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.527E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.09993 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B175.CNF;136 BKG DATE : 18-OCT-2009 EFF FILE : W175.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	386.000	384.000	2.000	1.4142	57.44000	7.00E+00	8.18E-01	1.75E-01	5.99E-02	7.03E-01
TH-228	5363.000	165.000	148.971	6.000	2.4495	99.94000	1.03E+00	1.83E-01	9.97E-02	3.95E-02	1.72E-01
TH229	4900.000	6.000	1.000	5.000	2.2361	99.52000	6.74E-03	4.38E-02	9.03E-02	3.51E-02	4.38E-02
TH-230	4625.000	747.000	745.000	2.000	1.4142	100.0000	5.00E+00	4.67E-01	6.43E-02	2.21E-02	3.60E-01
TH-232	3972.000	128.000	127.000	1.000	1.0000	100.0000	8.52E-01	1.58E-01	5.13E-02	1.56E-02	1.49E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



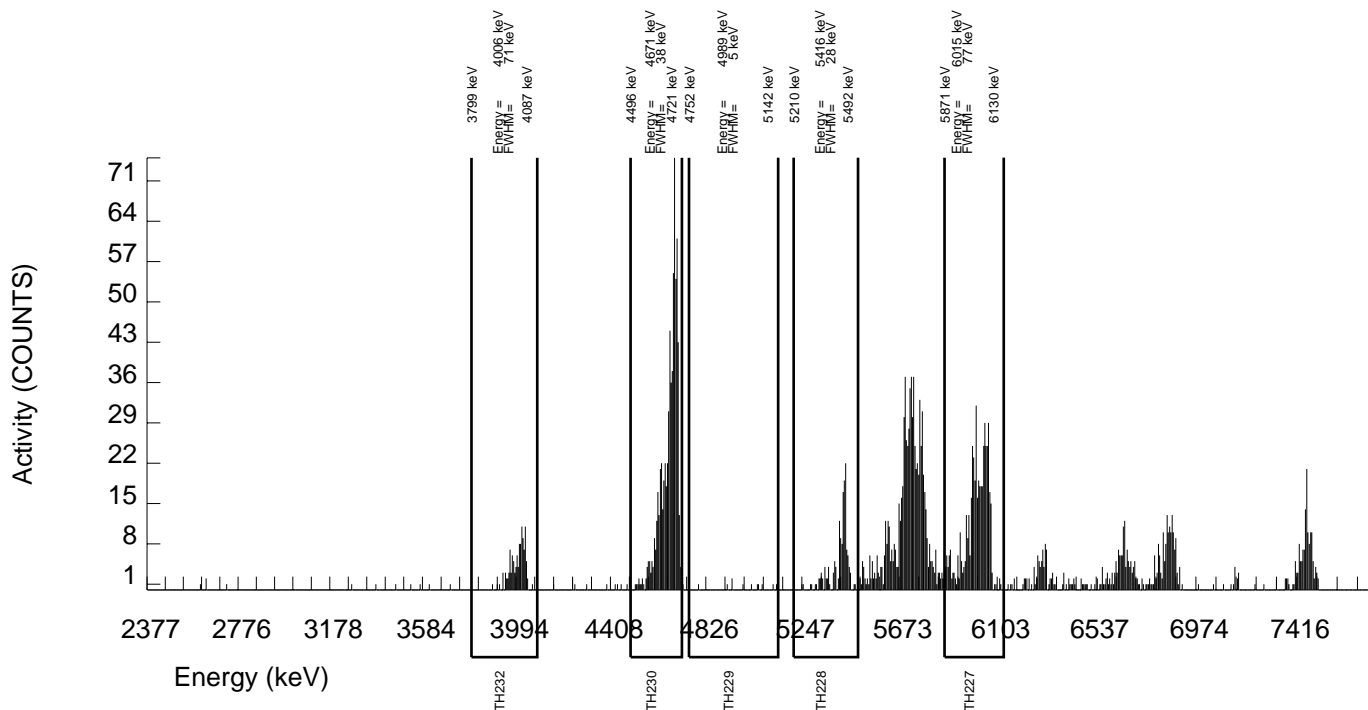
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521008_TH SAMPLE QTY: 0.253 G	
DETECTOR NUMBER :68621 AVERAGE %EFFICIENCY :25.7368 % YIELD : 118.123		COUNT DATE:15-OCT-2009 20:10:50 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.459E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.459E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.60472 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B188.CNF;116 BKG DATE : 11-OCT-2009 EFF FILE : W188.CNF;43 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	500.000	500.000	0.000	0.0000	57.44000	6.94E+00	7.36E-01	4.16E-02	0.00E+00	6.08E-01
TH-228	5363.000	151.000	138.556	3.000	1.7321	99.94000	8.35E-01	1.50E-01	6.66E-02	2.43E-02	1.42E-01
TH229	4900.000	12.000	10.000	2.000	1.4142	99.52000	5.88E-02	4.33E-02	5.64E-02	1.94E-02	4.32E-02
TH-230	4625.000	689.000	688.000	1.000	1.0000	100.0000	4.03E+00	3.85E-01	4.48E-02	1.36E-02	3.02E-01
TH-232	3972.000	116.000	116.000	0.000	0.0000	100.0000	6.79E-01	1.30E-01	1.76E-02	0.00E+00	1.24E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



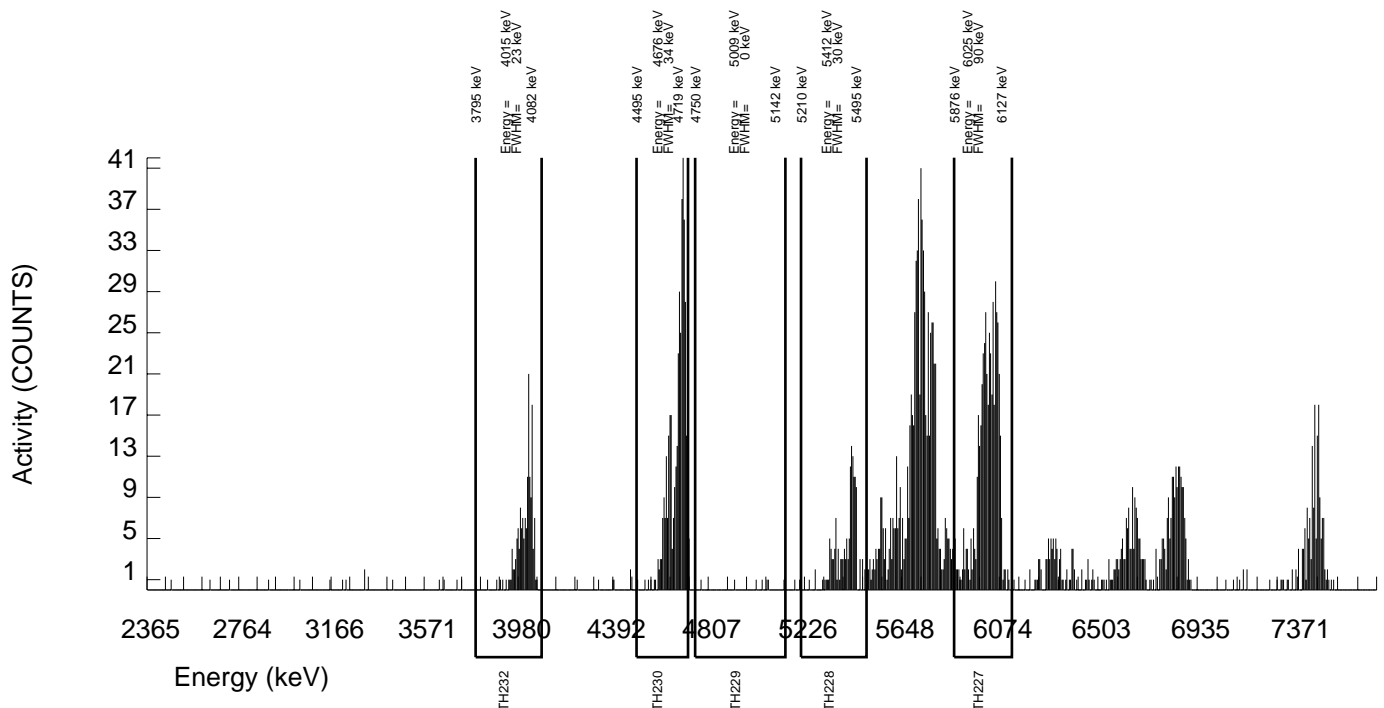
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521009_TH SAMPLE QTY: 0.263 G	
DETECTOR NUMBER :68622 AVERAGE %EFFICIENCY :26.1313 % YIELD : 115.642		COUNT DATE:15-OCT-2009 20:10:53 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.138E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.138E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.50801 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B189.CNF;116 BKG DATE : 11-OCT-2009 EFF FILE : W189.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	502.000	497.000	5.000	2.2361	57.44000	6.68E+00	7.24E-01	1.80E-01	6.99E-02	5.93E-01
TH-228	5363.000	149.000	132.613	7.000	2.6458	99.94000	7.73E-01	1.47E-01	8.93E-02	3.59E-02	1.38E-01
TH229	4900.000	7.000	0.000	7.000	2.6458	99.52000	0.00E+00	4.18E-02	8.72E-02	3.51E-02	4.18E-02
TH-230	4625.000	392.000	390.000	2.000	1.4142	100.0000	2.21E+00	2.60E-01	5.43E-02	1.86E-02	2.21E-01
TH-232	3972.000	156.000	155.000	1.000	1.0000	100.0000	8.79E-01	1.50E-01	4.34E-02	1.32E-02	1.39E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



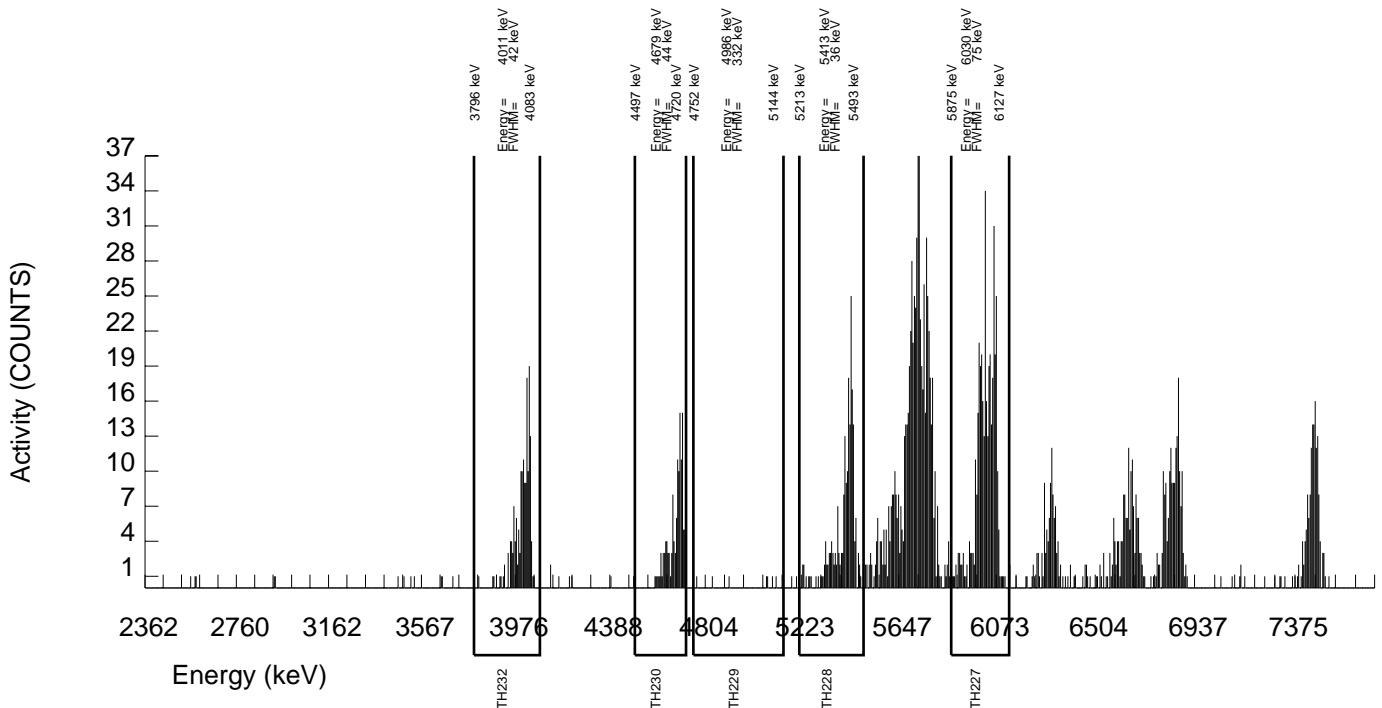
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521011_TH SAMPLE QTY: 0.250 G	
DETECTOR NUMBER :68623 AVERAGE %EFFICIENCY :26.1986 % YIELD : 87.263		COUNT DATE:15-OCT-2009 20:10:55 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.561E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.561E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 3.40172 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B190.CNF;116 BKG DATE : 11-OCT-2009 EFF FILE : W190.CNF;42 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	393.000	376.000	17.000	4.1231	57.44000	7.02E+00	8.52E-01	4.14E-01	1.79E-01	7.41E-01
TH-228	5363.000	206.000	157.898	41.000	6.4031	99.94000	1.28E+00	2.57E-01	2.65E-01	1.20E-01	2.45E-01
TH229	4900.000	7.000	-31.000	38.000	6.1644	99.52000	-2.46E-01	1.04E-01	2.51E-01	1.14E-01	1.04E-01
TH-230	4625.000	127.000	111.000	16.000	4.0000	100.0000	8.75E-01	1.92E-01	1.70E-01	7.33E-02	1.85E-01
TH-232	3972.000	164.000	147.000	17.000	4.1231	100.0000	1.16E+00	2.19E-01	1.75E-01	7.56E-02	2.08E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



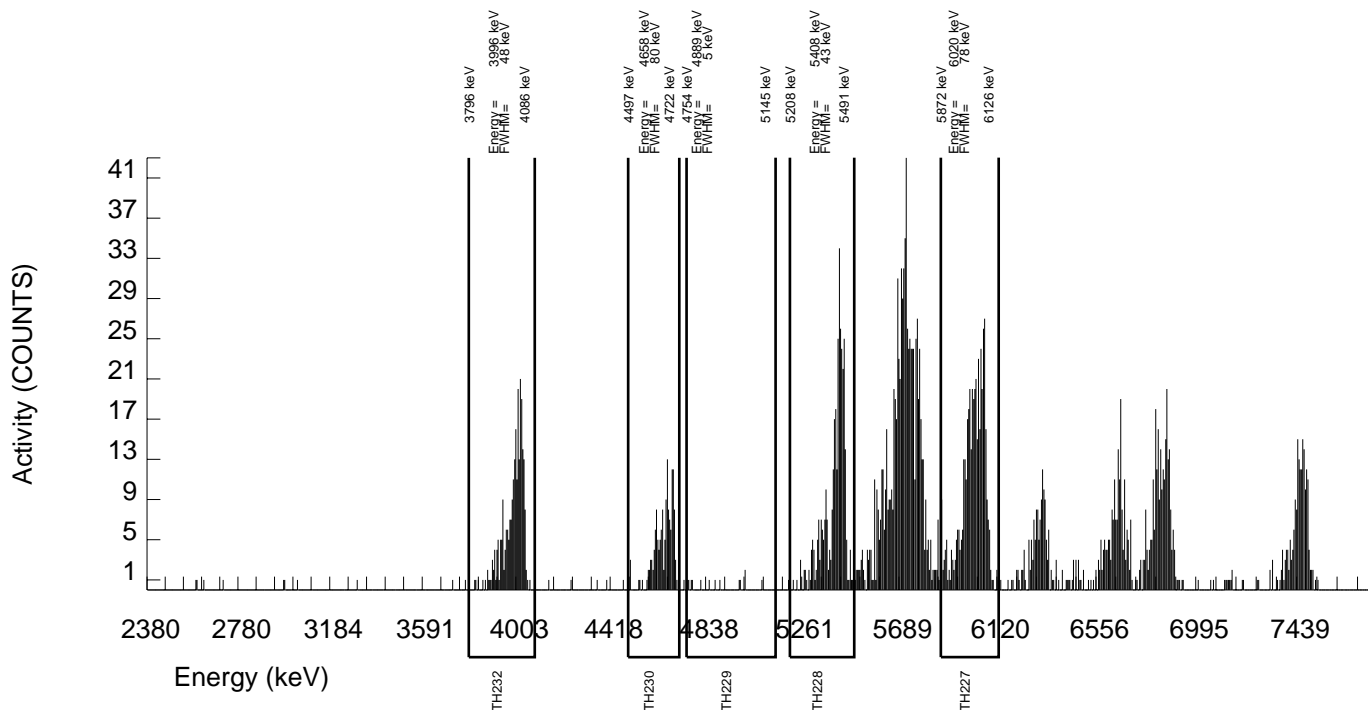
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521012_TH SAMPLE QTY: 0.266 G	
DETECTOR NUMBER :68624 AVERAGE %EFFICIENCY :26.2560 % YIELD : 103.051		COUNT DATE:15-OCT-2009 20:10:57 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.046E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.046E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.01718 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B191.CNF;118 BKG DATE : 11-OCT-2009 EFF FILE : W191.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	454.000	445.000	9.000	3.0000	57.44000	6.60E+00	7.48E-01	2.52E-01	1.04E-01	6.26E-01
TH-228	5363.000	348.000	330.595	9.000	3.0000	99.94000	2.12E+00	2.70E-01	1.09E-01	4.48E-02	2.35E-01
TH229	4900.000	14.000	14.000	0.000	0.0000	99.52000	8.80E-02	4.64E-02	1.89E-02	0.00E+00	4.61E-02
TH-230	4625.000	151.000	149.000	2.000	1.4142	100.0000	9.33E-01	1.62E-01	6.00E-02	2.06E-02	1.52E-01
TH-232	3972.000	258.000	257.000	1.000	1.0000	100.0000	1.61E+00	2.21E-01	4.79E-02	1.46E-02	1.97E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



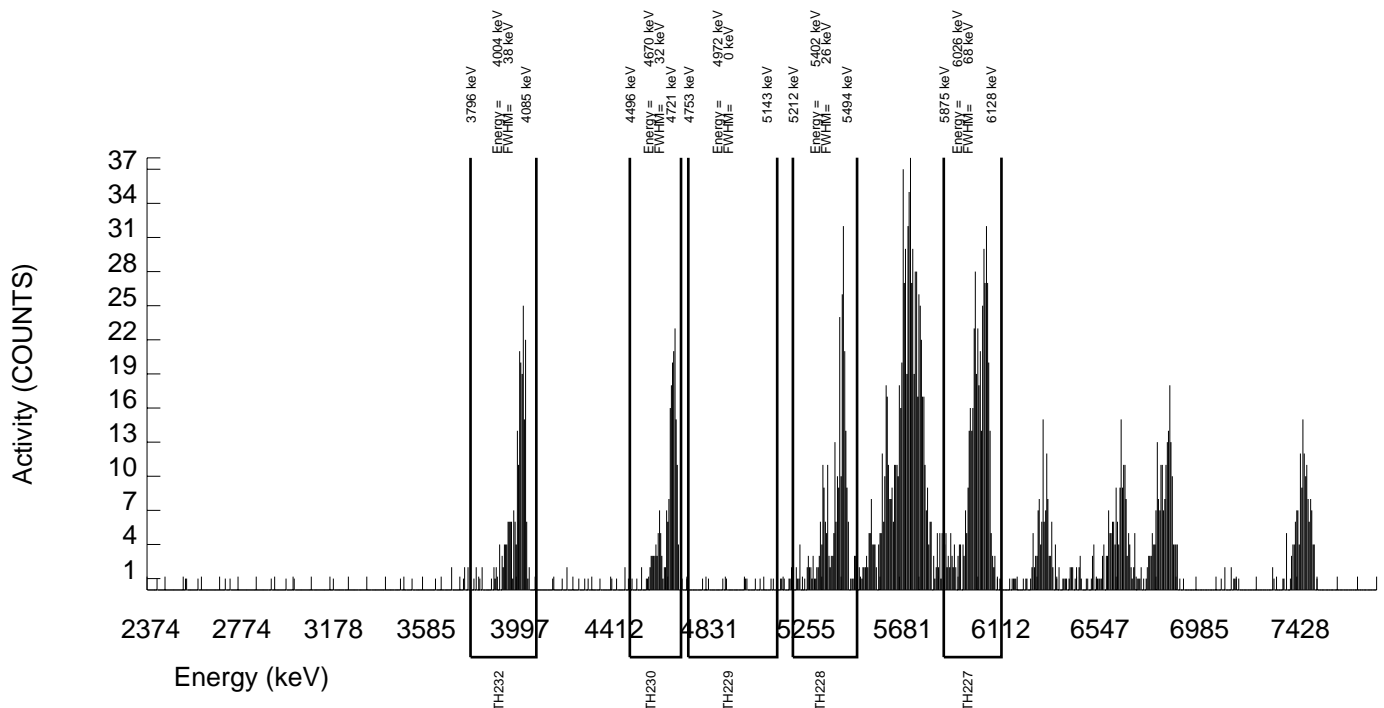
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521013_TH SAMPLE QTY: 0.257 G	
DETECTOR NUMBER :74430 AVERAGE %EFFICIENCY :25.4458 % YIELD : 111.829		COUNT DATE:15-OCT-2009 20:11:00 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.328E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.328E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.35935 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B192.CNF;116 BKG DATE : 11-OCT-2009 EFF FILE : W192.CNF;48 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	476.000	468.000	8.000	2.8284	57.44000	6.83E+00	7.49E-01	2.36E-01	9.61E-02	6.30E-01
TH-228	5363.000	291.000	269.161	13.000	3.6056	99.94000	1.70E+00	2.36E-01	1.25E-01	5.30E-02	2.13E-01
TH229	4900.000	12.000	8.000	4.000	2.0000	99.52000	4.95E-02	4.86E-02	7.62E-02	2.88E-02	4.85E-02
TH-230	4625.000	202.000	201.000	1.000	1.0000	100.0000	1.24E+00	1.87E-01	4.71E-02	1.43E-02	1.72E-01
TH-232	3972.000	231.000	230.000	1.000	1.0000	100.0000	1.42E+00	2.02E-01	4.71E-02	1.43E-02	1.84E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



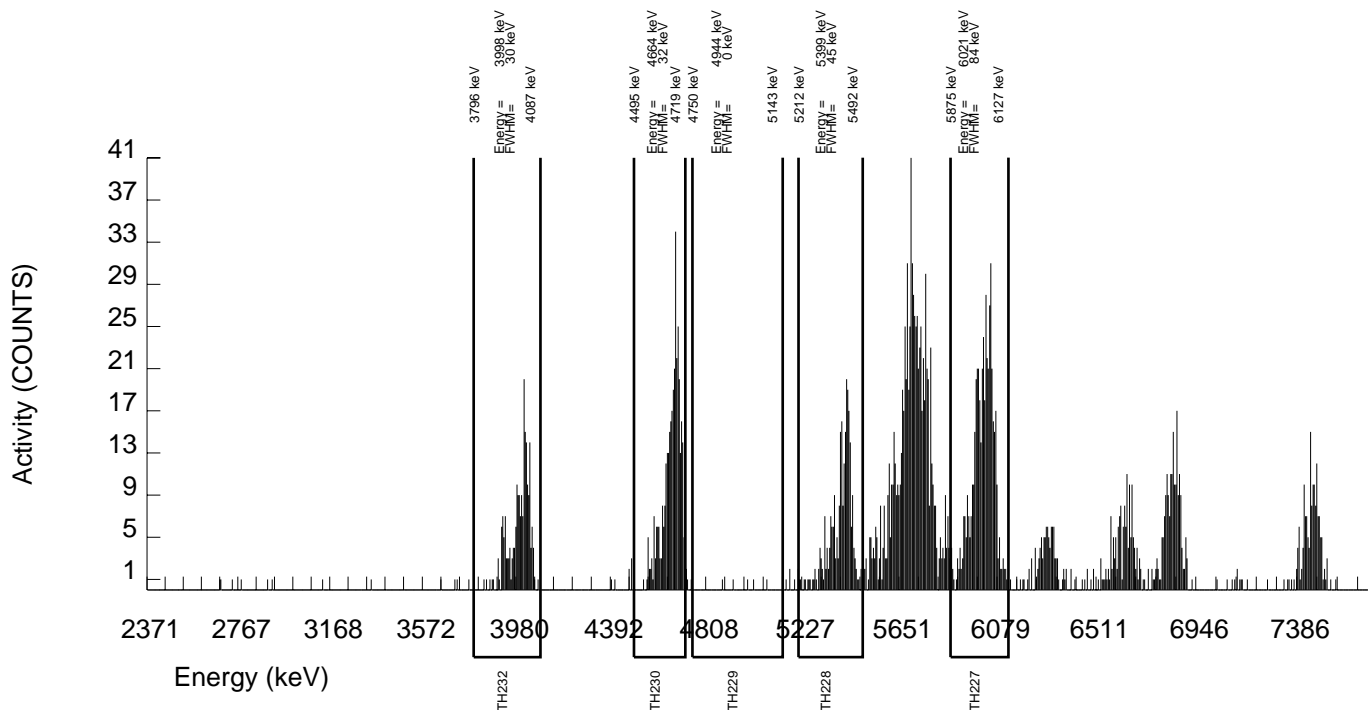
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521014_TH SAMPLE QTY: 0.259 G	
DETECTOR NUMBER :68627 AVERAGE %EFFICIENCY :26.1520 % YIELD : 114.156		COUNT DATE:15-OCT-2009 20:11:03 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.263E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.263E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.45008 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B193.CNF;118 BKG DATE : 11-OCT-2009 EFF FILE : W193.CNF;40 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	496.000	491.000	5.000	2.2361	57.44000	6.78E+00	7.39E-01	1.85E-01	7.18E-02	6.06E-01
TH-228	5363.000	256.000	232.726	14.000	3.7417	99.94000	1.39E+00	2.08E-01	1.22E-01	5.20E-02	1.89E-01
TH229	4900.000	6.000	-16.000	22.000	4.6904	99.52000	-9.37E-02	6.07E-02	1.45E-01	6.39E-02	6.07E-02
TH-230	4625.000	346.000	339.000	7.000	2.6458	100.0000	1.97E+00	2.47E-01	8.92E-02	3.59E-02	2.15E-01
TH-232	3972.000	215.000	215.000	0.000	0.0000	100.0000	1.25E+00	1.85E-01	1.75E-02	0.00E+00	1.67E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.





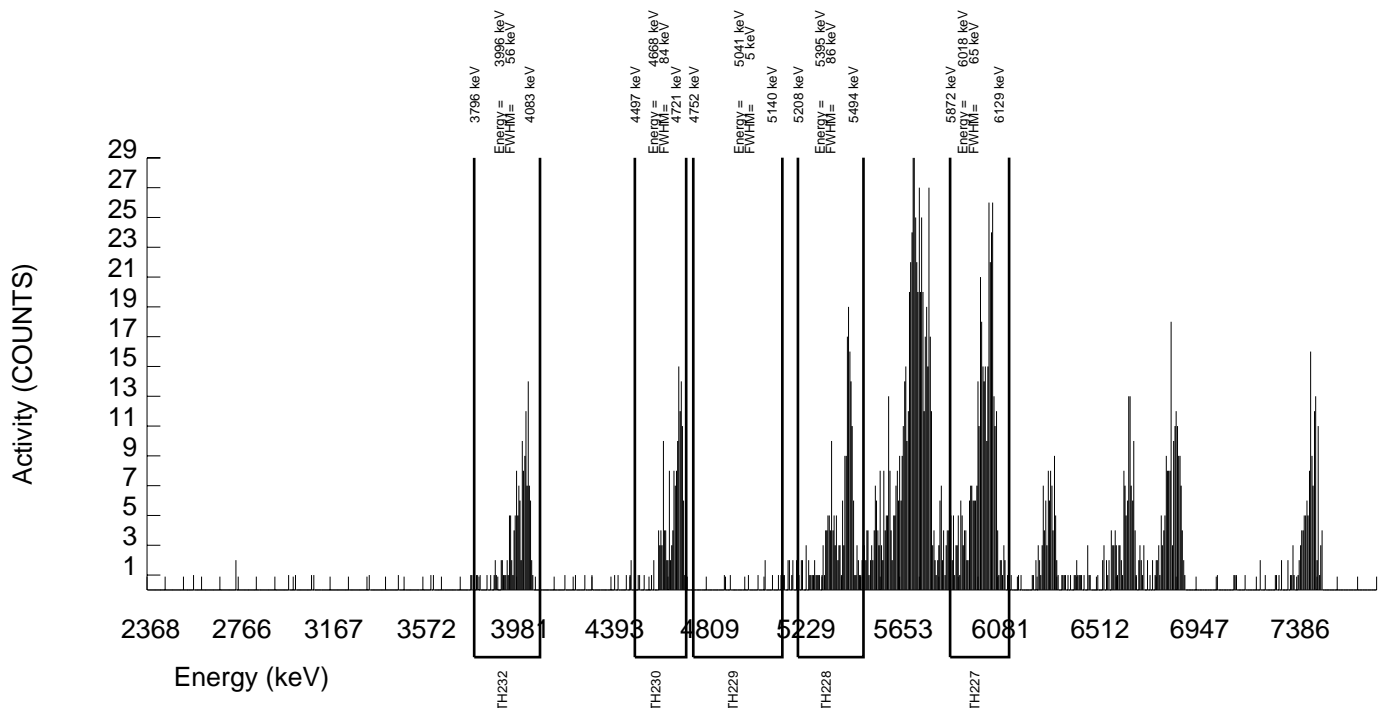
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521015_TH SAMPLE QTY: 0.262 G	
DETECTOR NUMBER :68635 AVERAGE %EFFICIENCY :25.4223 % YIELD : 91.602		COUNT DATE:15-OCT-2009 20:11:05 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.169E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.169E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 3.57087 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B194.CNF;116 BKG DATE : 11-OCT-2009 EFF FILE : W194.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	386.000	383.000	3.000	1.7321	57.44000	6.70E+00	7.84E-01	1.94E-01	7.05E-02	6.76E-01
TH-228	5363.000	207.000	190.766	9.000	3.0000	99.94000	1.44E+00	2.31E-01	1.28E-01	5.29E-02	2.14E-01
TH229	4900.000	9.000	8.000	1.000	1.0000	99.52000	5.93E-02	4.61E-02	5.68E-02	1.73E-02	4.60E-02
TH-230	4625.000	152.000	151.000	1.000	1.0000	100.0000	1.11E+00	1.91E-01	5.65E-02	1.72E-02	1.79E-01
TH-232	3972.000	145.000	141.000	4.000	2.0000	100.0000	1.04E+00	1.87E-01	9.08E-02	3.44E-02	1.77E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



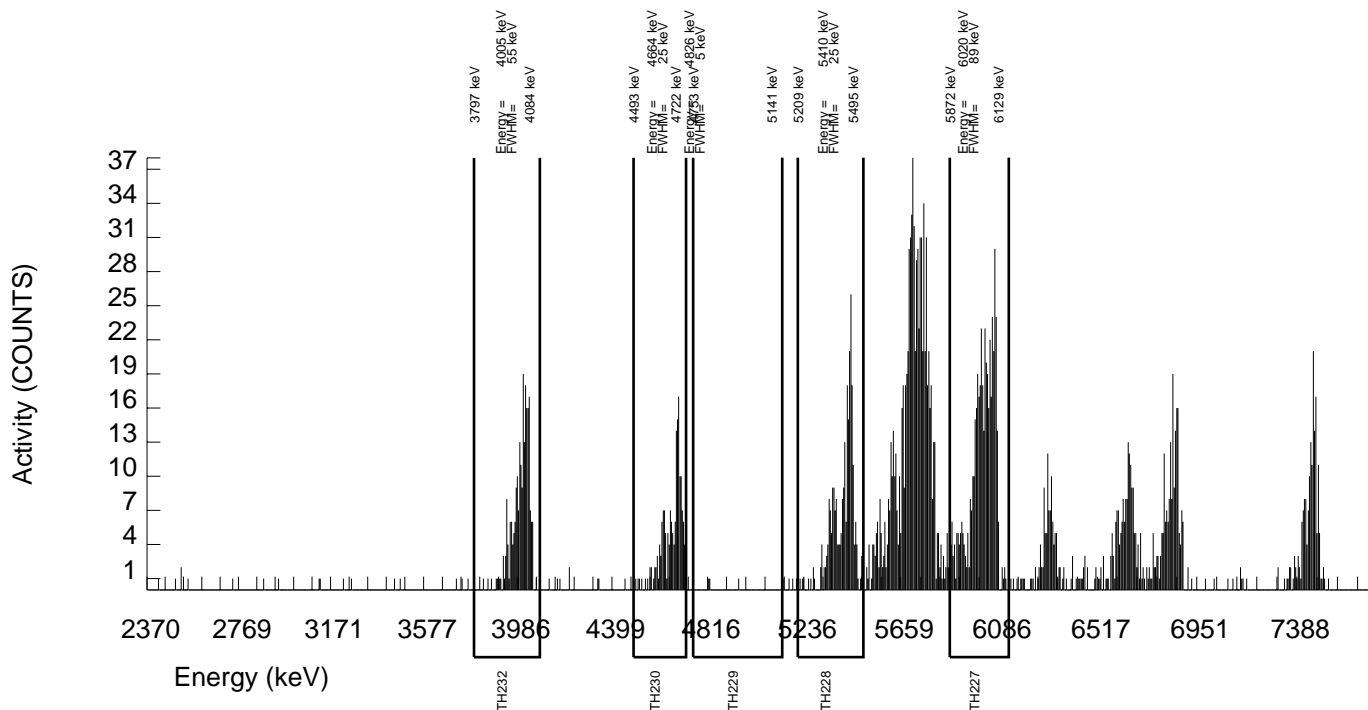
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521016_TH SAMPLE QTY: 0.264 G	
DETECTOR NUMBER :68636 AVERAGE %EFFICIENCY :25.5440 % YIELD : 115.207		COUNT DATE:15-OCT-2009 20:11:08 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.107E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.107E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.49105 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B195.CNF;123 BKG DATE : 11-OCT-2009 EFF FILE : W195.CNF;40 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	486.000	484.000	2.000	1.4142	57.44000	6.65E+00	7.25E-01	1.32E-01	4.52E-02	5.95E-01
TH-228	5363.000	260.000	245.858	5.000	2.2361	99.94000	1.46E+00	2.08E-01	7.97E-02	3.09E-02	1.86E-01
TH229	4900.000	5.000	-11.000	16.000	4.0000	99.52000	-6.41E-02	5.23E-02	1.26E-01	5.42E-02	5.23E-02
TH-230	4625.000	172.000	164.000	8.000	2.8284	100.0000	9.51E-01	1.64E-01	9.37E-02	3.82E-02	1.52E-01
TH-232	3972.000	233.000	231.000	2.000	1.4142	100.0000	1.34E+00	1.93E-01	5.55E-02	1.91E-02	1.74E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



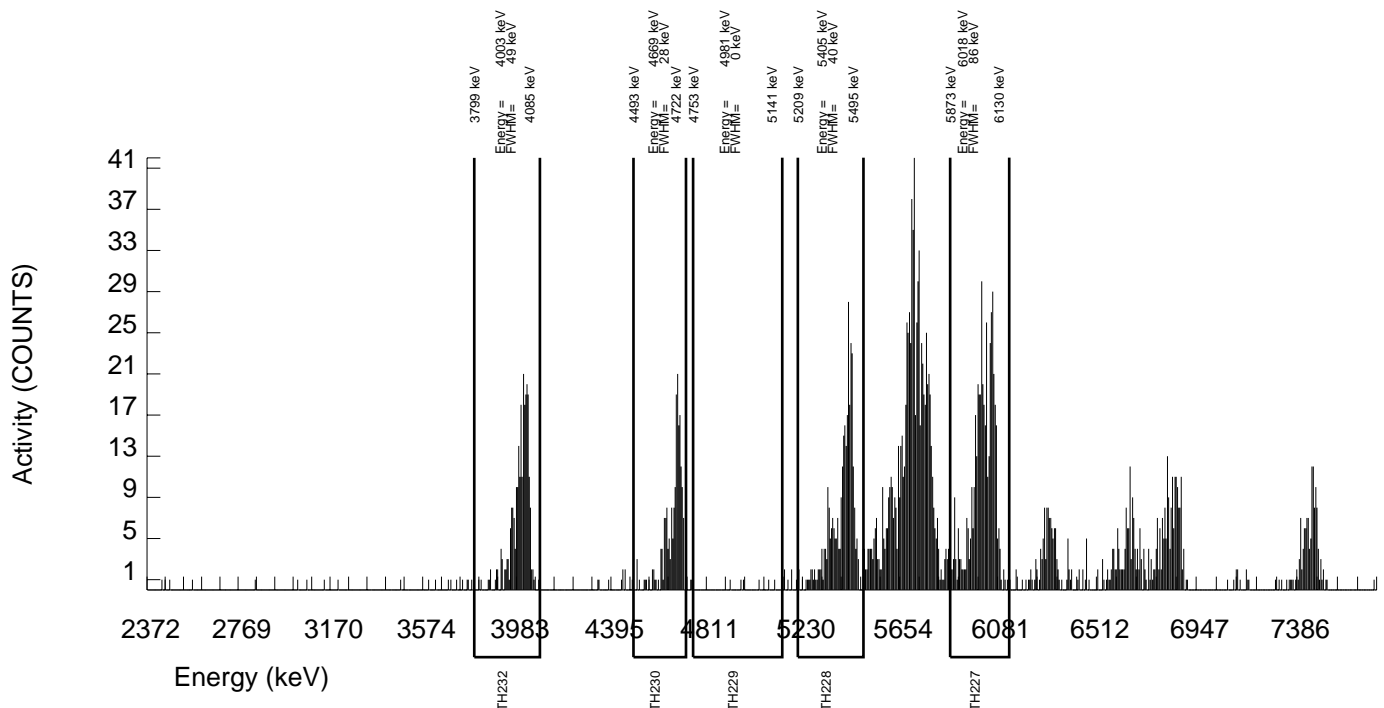
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521017_TH SAMPLE QTY: 0.260 G	
DETECTOR NUMBER :68637 AVERAGE %EFFICIENCY :25.6061 % YIELD : 111.603		COUNT DATE:15-OCT-2009 20:11:10 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.232E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.232E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.35057 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B196.CNF;117 BKG DATE : 11-OCT-2009 EFF FILE : W196.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	477.000	470.000	7.000	2.6458	57.44000	6.75E+00	7.38E-01	2.20E-01	8.84E-02	6.20E-01
TH-228	5363.000	315.000	300.123	6.000	2.4495	99.94000	1.87E+00	2.42E-01	8.95E-02	3.54E-02	2.15E-01
TH229	4900.000	7.000	3.000	4.000	2.0000	99.52000	1.83E-02	3.96E-02	7.50E-02	2.83E-02	3.96E-02
TH-230	4625.000	192.000	187.000	5.000	2.2361	100.0000	1.13E+00	1.80E-01	8.13E-02	3.15E-02	1.67E-01
TH-232	3972.000	258.000	256.000	2.000	1.4142	100.0000	1.55E+00	2.13E-01	5.81E-02	1.99E-02	1.92E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



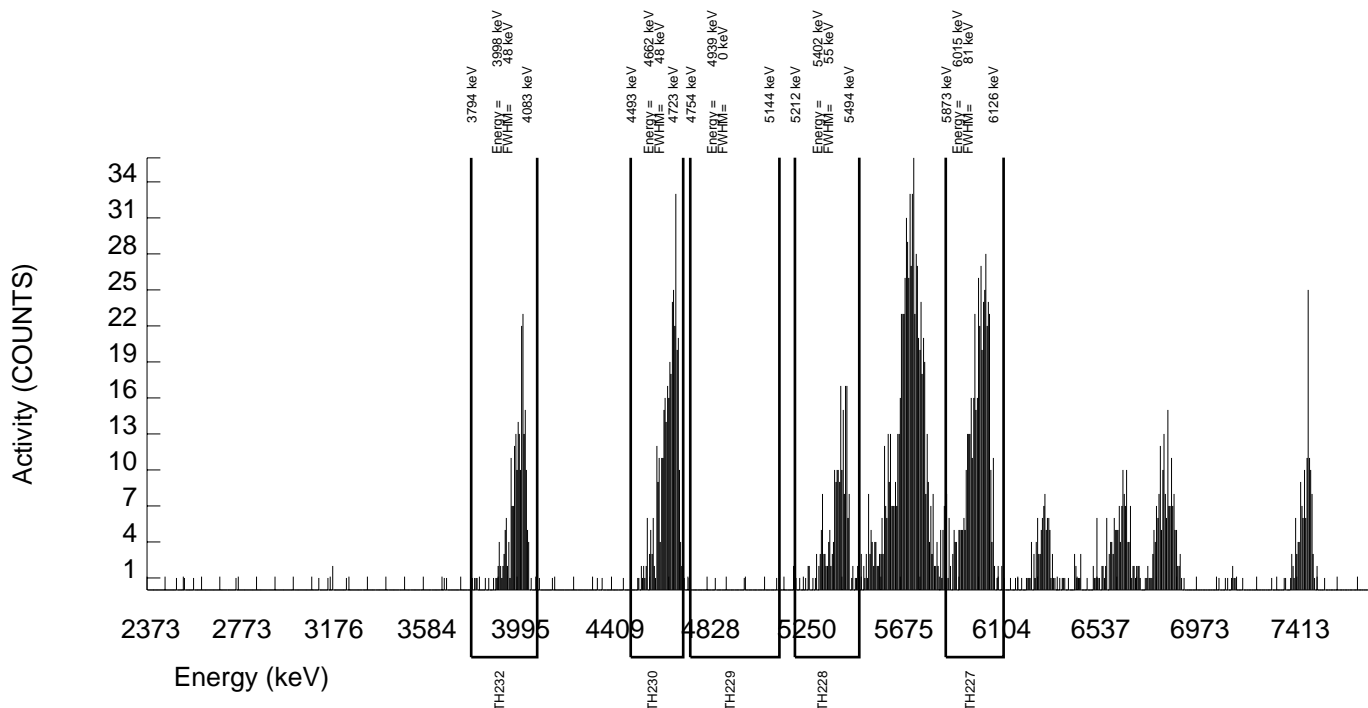
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521018_TH SAMPLE QTY: 0.254 G	
DETECTOR NUMBER :78894 AVERAGE %EFFICIENCY :25.2483 % YIELD : 119.688		COUNT DATE:15-OCT-2009 20:11:12 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.426E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.426E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.66571 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B197.CNF;62 BKG DATE : 11-OCT-2009 EFF FILE : W197.CNF;40 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	497.000	497.000	0.000	0.0000	57.44000	6.91E+00	7.34E-01	4.17E-02	0.00E+00	6.08E-01
TH-228	5363.000	213.000	202.613	1.000	1.0000	99.94000	1.22E+00	1.84E-01	4.61E-02	1.40E-02	1.69E-01
TH229	4900.000	4.000	3.000	1.000	1.0000	99.52000	1.77E-02	2.59E-02	4.51E-02	1.37E-02	2.58E-02
TH-230	4625.000	370.000	369.000	1.000	1.0000	100.0000	2.17E+00	2.56E-01	4.49E-02	1.37E-02	2.22E-01
TH-232	3972.000	231.000	231.000	0.000	0.0000	100.0000	1.36E+00	1.93E-01	1.76E-02	0.00E+00	1.75E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



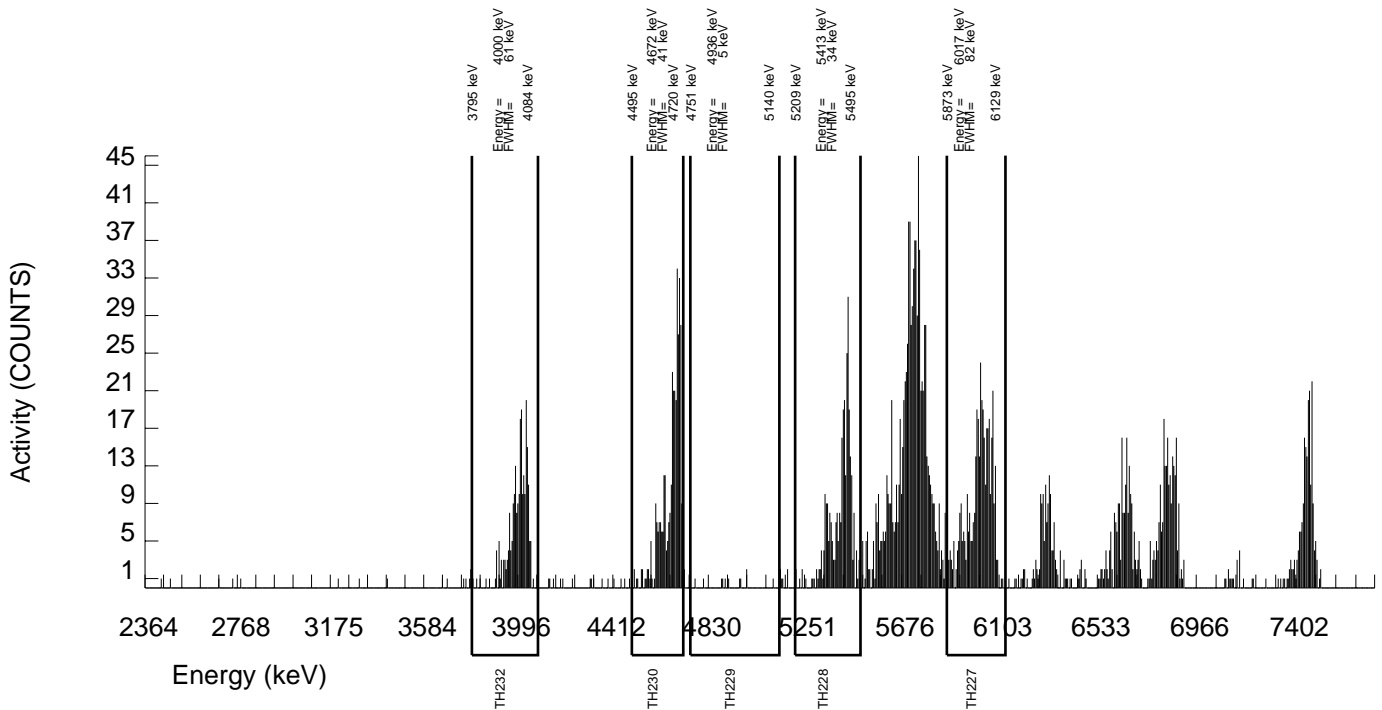
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521019_TH SAMPLE QTY: 0.253 G	
DETECTOR NUMBER :74434 AVERAGE %EFFICIENCY :25.4776 % YIELD : 110.486		COUNT DATE:19-OCT-2009 12:28:55 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.459E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.459E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89823 dpm RESULTS : 4.30700 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B176.CNF;136 BKG DATE : 18-OCT-2009 EFF FILE : W176.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	411.000	404.000	7.000	2.6458	57.44000	6.94E+00	8.03E-01	2.63E-01	1.06E-01	6.88E-01
TH-228	5363.000	306.000	286.449	9.000	3.0000	99.94000	1.87E+00	2.49E-01	1.10E-01	4.55E-02	2.23E-01
TH229	4900.000	11.000	6.000	5.000	2.2361	99.52000	3.81E-02	4.99E-02	8.52E-02	3.31E-02	4.98E-02
TH-230	4625.000	345.000	344.000	1.000	1.0000	100.0000	2.18E+00	2.64E-01	4.84E-02	1.47E-02	2.31E-01
TH-232	3972.000	238.000	235.000	3.000	1.7321	100.0000	1.49E+00	2.12E-01	6.99E-02	2.55E-02	1.92E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



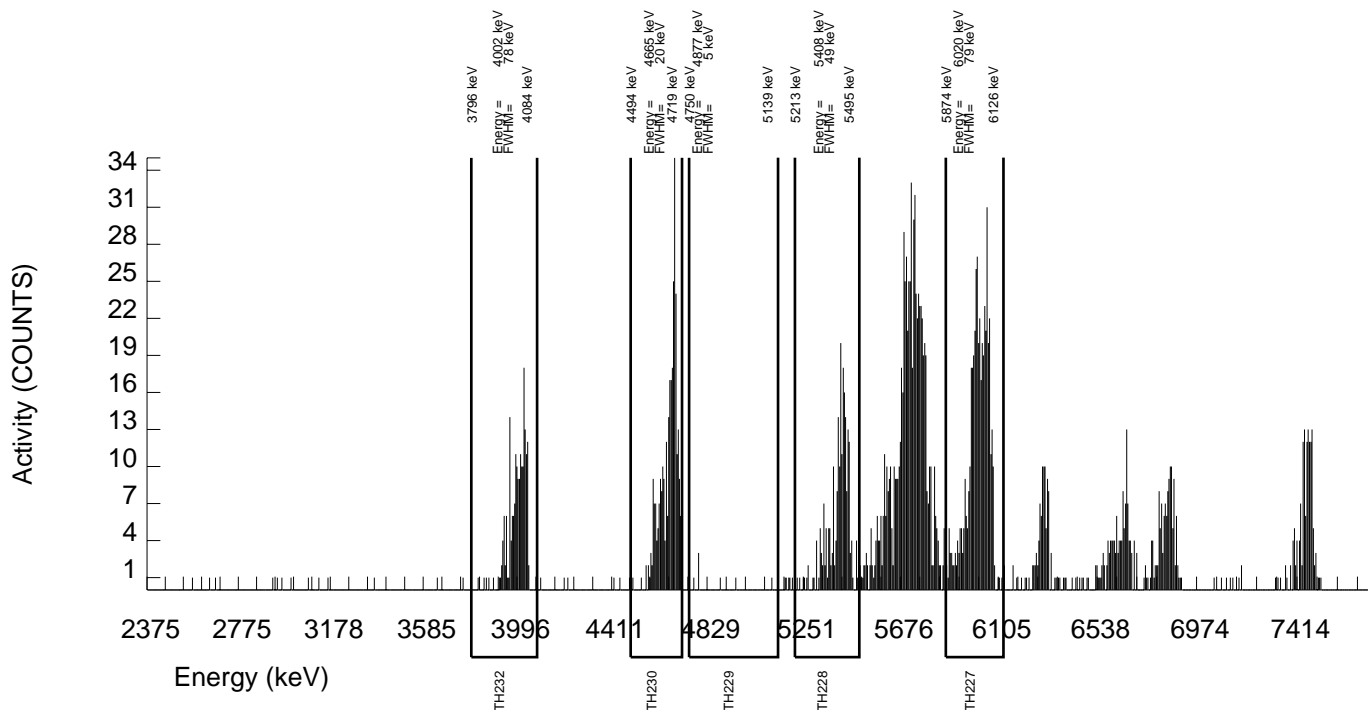
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 21-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S0237521020_TH SAMPLE QTY: 0.260 G	
DETECTOR NUMBER :78896 AVERAGE %EFFICIENCY :25.0185 % YIELD : 115.683		COUNT DATE:15-OCT-2009 20:11:17 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.232E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.232E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.50961 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B199.CNF;62 BKG DATE : 11-OCT-2009 EFF FILE : W199.CNF;38 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	477.000	476.000	1.000	1.0000	57.44000	6.75E+00	7.28E-01	1.09E-01	3.30E-02	6.08E-01
TH-228	5363.000	227.000	218.009	0.000	0.0000	99.94000	1.34E+00	1.95E-01	1.84E-02	0.00E+00	1.78E-01
TH229	4900.000	7.000	6.000	1.000	1.0000	99.52000	3.61E-02	3.34E-02	4.60E-02	1.40E-02	3.33E-02
TH-230	4625.000	299.000	298.000	1.000	1.0000	100.0000	1.78E+00	2.29E-01	4.58E-02	1.39E-02	2.03E-01
TH-232	3972.000	192.000	192.000	0.000	0.0000	100.0000	1.15E+00	1.76E-01	1.80E-02	0.00E+00	1.63E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



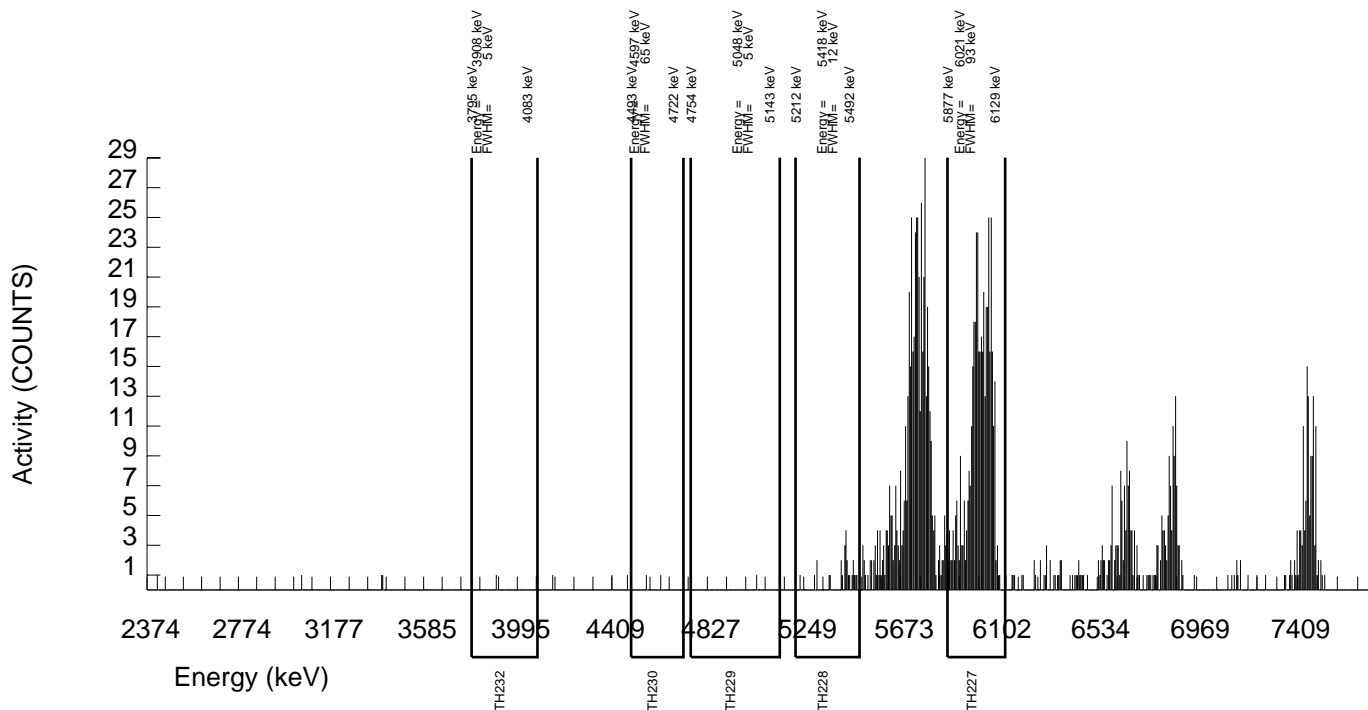
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 5-OCT-2009 00:00:00. AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S1201939560_TH SAMPLE QTY: 0.266 G	
DETECTOR NUMBER :74431 AVERAGE %EFFICIENCY :26.0299 % YIELD : 95.288		COUNT DATE:13-OCT-2009 13:16:07 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.046E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.046E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 3.71455 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B173.CNF;134 BKG DATE : 11-OCT-2009 EFF FILE : W173.CNF;41 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	447.000	444.000	3.000	1.7321	57.44000	6.60E+00	7.31E-01	1.64E-01	5.99E-02	6.18E-01
TH-228	5363.000	26.000	9.755	10.000	3.1623	99.94000	6.72E-02	7.38E-02	1.22E-01	5.07E-02	7.37E-02
TH229	4900.000	1.000	-2.000	3.000	1.7321	99.52000	-1.37E-02	2.69E-02	7.59E-02	2.76E-02	2.69E-02
TH-230	4625.000	2.000	1.000	1.000	1.0000	100.0000	6.83E-03	2.32E-02	5.22E-02	1.59E-02	2.32E-02
TH-232	3972.000	1.000	0.000	1.000	1.0000	100.0000	0.00E+00	1.89E-02	5.22E-02	1.59E-02	1.89E-02

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



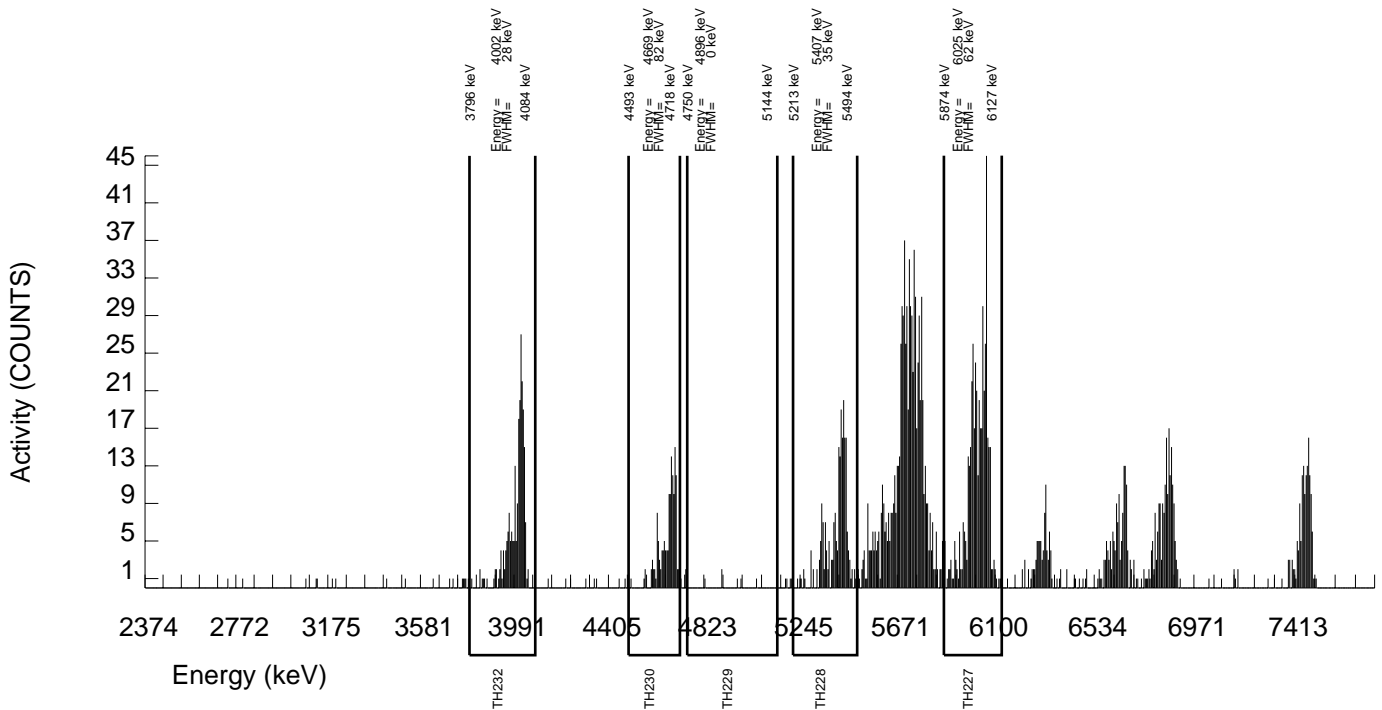
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S1201939561_TH SAMPLE QTY: 0.260 G	
DETECTOR NUMBER :78900 AVERAGE %EFFICIENCY :26.8240 % YIELD : 104.497		COUNT DATE:15-OCT-2009 20:11:20 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.232E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.232E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.07354 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B200.CNF;62 BKG DATE : 11-OCT-2009 EFF FILE : W200.CNF;38 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	465.000	461.000	4.000	2.0000	57.44000	6.75E+00	7.40E-01	1.80E-01	6.82E-02	6.22E-01
TH-228	5363.000	225.000	211.293	5.000	2.2361	99.94000	1.34E+00	2.02E-01	8.52E-02	3.31E-02	1.85E-01
TH229	4900.000	8.000	0.000	8.000	2.8284	99.52000	0.00E+00	4.87E-02	1.00E-01	4.09E-02	4.87E-02
TH-230	4625.000	144.000	137.000	7.000	2.6458	100.0000	8.47E-01	1.57E-01	9.46E-02	3.80E-02	1.49E-01
TH-232	3972.000	230.000	221.000	9.000	3.0000	100.0000	1.37E+00	2.04E-01	1.05E-01	4.31E-02	1.87E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.





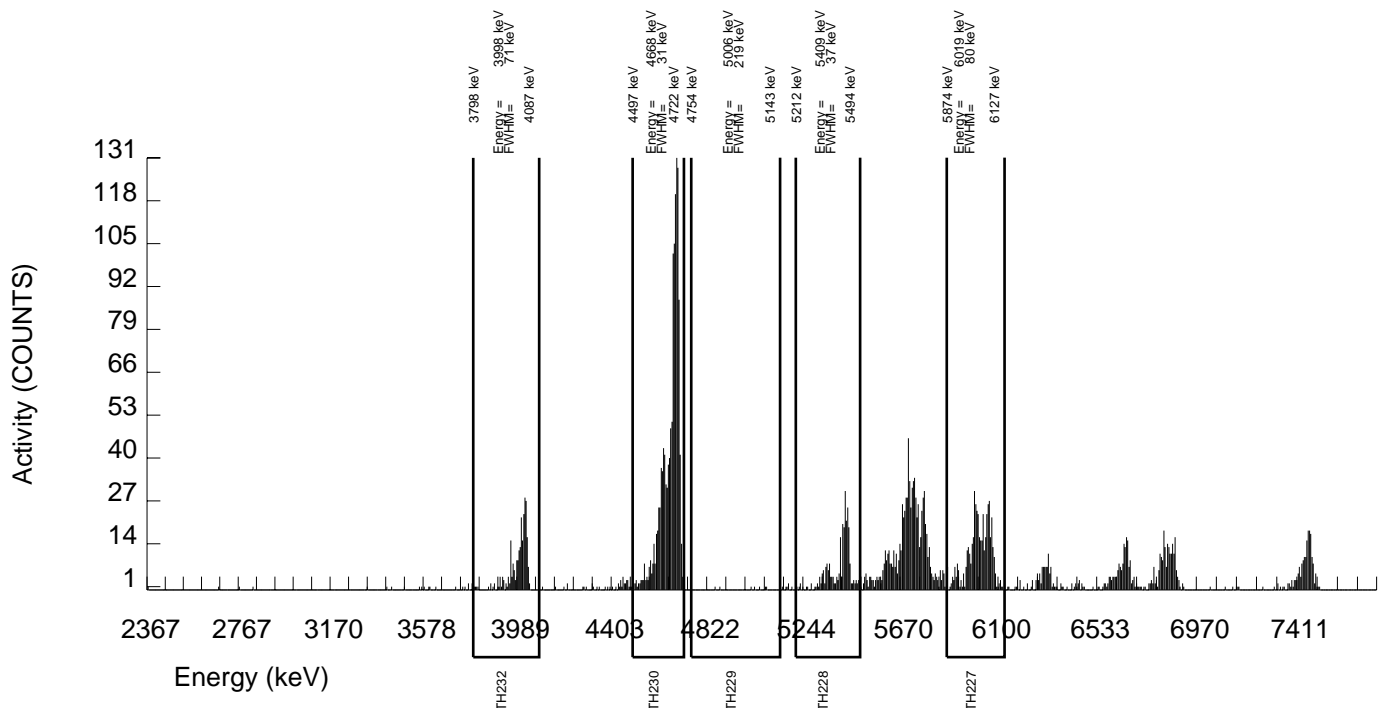
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S1201939562_TH SAMPLE QTY: 0.256 G	
DETECTOR NUMBER :78902 AVERAGE %EFFICIENCY :25.8989 % YIELD : 115.038		COUNT DATE:15-OCT-2009 20:11:23 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.360E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.360E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 4.48444 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B201.CNF;62 BKG DATE : 11-OCT-2009 EFF FILE : W201.CNF;38 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	491.000	490.000	1.000	1.0000	57.44000	6.86E+00	7.33E-01	1.07E-01	3.26E-02	6.09E-01
TH-228	5363.000	270.000	259.745	1.000	1.0000	99.94000	1.58E+00	2.14E-01	4.65E-02	1.41E-02	1.93E-01
TH229	4900.000	7.000	5.000	2.000	1.4142	99.52000	2.97E-02	3.49E-02	5.69E-02	1.95E-02	3.49E-02
TH-230	4625.000	1308.000	1306.000	2.000	1.4142	100.0000	7.71E+00	6.21E-01	5.66E-02	1.94E-02	4.19E-01
TH-232	3972.000	256.000	253.000	3.000	1.7321	100.0000	1.49E+00	2.06E-01	6.53E-02	2.38E-02	1.86E-01

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



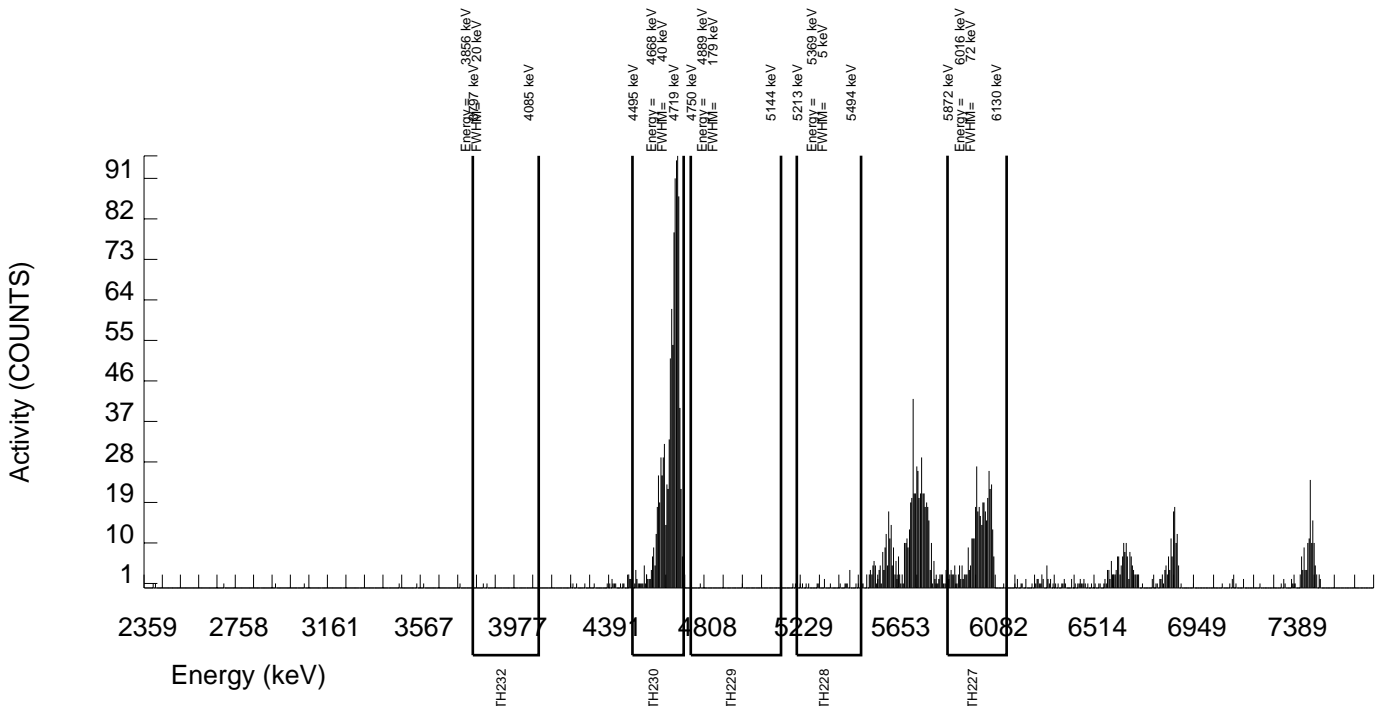
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909125 SAMPLE DATE : 5-OCT-2009 00:00:00. AC-227 SEPARATION : 7-OCT-2009 20:30:00.		SAMPLE ID : S1201939563_TH SAMPLE QTY: 0.266 G	
DETECTOR NUMBER :78903 AVERAGE %EFFICIENCY :26.6527 % YIELD : 90.796		COUNT DATE:15-OCT-2009 20:11:25 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.046E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/G : 8.046E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.89824 dpm RESULTS : 3.53946 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B202.CNF;62 BKG DATE : 11-OCT-2009 EFF FILE : W202.CNF;38 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
AC-227	5994.040	398.000	398.000	0.000	0.0000	57.44000	6.60E+00	7.57E-01	4.98E-02	0.00E+00	6.49E-01
TH-228	5363.000	20.000	11.483	1.000	1.0000	99.94000	8.13E-02	5.12E-02	5.42E-02	1.65E-02	5.10E-02
TH229	4900.000	2.000	1.000	1.000	1.0000	99.52000	7.03E-03	2.39E-02	5.38E-02	1.64E-02	2.39E-02
TH-230	4625.000	1021.000	1019.000	2.000	1.4142	100.0000	7.13E+00	6.08E-01	6.70E-02	2.30E-02	4.39E-01
TH-232	3972.000	2.000	2.000	0.000	0.0000	100.0000	1.40E-02	1.94E-02	2.10E-02	0.00E+00	1.94E-02

NOTE: Ac-227 results decay corrected to separation date/time.  
NOTE: Corrections made to Th-228 net area due to Ra-223 ingrowth from tracer.



**Radiochemistry Batch Checklist, Rev 9**

Batch# 908846      Product: Th      Date: 10/7/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			NA
Samples have been blank corrected (if required)			NA
If activity less 10* MDA/ MDC, error is 150% or less of sample activity. If greater 10* MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	/		
Instrument source check is within limits.	/		
Instrument bkg check is within limits.	/		
Method RDL/ LLD has been met.	/		
If duplicate activities are less 5* MDA/ MDC, then RPD is 100% or less. If greater 5* MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%.	/		
Or meets the client's required RER acceptance criteria.	/		
Tracer yield is 15-125% . Carrier yield 25-125%.	/		
Or meets the client's contract acceptance criteria.	/		
Method blank is less than the RDL/ LLD. (If rad samples, < 5% of lowest activity)	/		CASE NARRATIVE
Sample was run within hold time.	/		
Sample was correctly preserved if required.	/		
Smears Taken for Radioactive batches.			NA
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	/		
No blank spaces on data forms.	/		
All line outs initialed and dated.	/		
No transcription errors are apparent.	/		
Aux data is correct.			NA
Client Special requirements page has been checked.	/		
Raw Data and/ or spectrum are included and properly stated.	/		
QC data entered into QC database and batch is in REVW	/		
Hit notification complete (if necessary)			NA
Batch entered into Case Narrative.	/		
Batch non-conformances completed, if applicable.	/		NCL# 742701
Batch non-conformances second reviewed and disposition verified to be completed.	✓		NCL# 742701
Aliquot Correction completed if required.			NA
Review sample historical results if available (If REMF, results above MDC have been verified by historical results, recount or re-analysis.)	/		

GEL Laboratories, LLC

revised 8/1/08

Primary Review Performed By: [Signature] 10/7/09

Secondary Review Performed By: [Signature] 10/7/09

9/27 (10/8)  
KERR

# Thorium (Ac-227 Tracer) Que Sheet

23-SEP-09

Batch #: 905546

Analyst: AXD2

Internal Due Date: 27-SEP-09

Tracer Isotope: Ac-227

Expiration Date: 7/23/10

Ac-227 Separation Date/Time: 9/30/09 1115

LCS Isotope: Th-230

Expiration Date: 4/13/10

Spike Isotope: Th-230

Expiration Date: ---

Prep Date: 9/29/09

Pipet ID: 2971058

Balance ID: 16750207

Witness: ~~AKED~~ 9/29/09

Wet  Dry

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Pos.	Label #	Aliquot (g) (f)	Th Det #
236699016-1	EB090309-SO2	SAMPLE		.03 pCi/L	WATER	KERR003	03-SEP-09	1	1	0.800	35 197
236817014-1	EB090809-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	08-SEP-09	2	2	0.800	36 42
236938020-1	EB091009-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	10-SEP-09	3	3	0.800	27 198
237010013-1	EB091009-SO2	SAMPLE		.03 pCi/L	WATER	KERR003	10-SEP-09	4	4	0.800	27 198
237170005-1	EB091409-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	14-SEP-09	5	5	0.800	28 198
237170020-1	EB091509-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	15-SEP-09	6	6	0.800	29 199
237343006-1	EB091609-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	16-SEP-09	7	7	0.800	30 201
237521010-1	EB091809-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	18-SEP-09	8	8	0.800	31 202
1201930820-1	MB for batch 905546	MB		.03 pCi/L	WATER	QC ACCOUNT	03-SEP-09	9	9	0.800	38 203
1201930821-1	LCS for batch 905546	LCS		.03 pCi/L	WATER	QC ACCOUNT	03-SEP-09	10	10	0.800	39 205
1201930822-1	LCSD for batch 905546	LCSD		.03 pCi/L	WATER	QC ACCOUNT	03-SEP-09	11	11	0.800	40 41

Choose SOP Used: GL-RAD-A-038

- GL-RAD-A-045
- GL-RAD-A-043
- GL-RAD-A-032

Solid Sample Dissolution by: LEACH or DIGESTION

Circle One

Signature: [Handwritten Signature] Date: 9/29/09

Data Reviewed By: [Handwritten Signature]

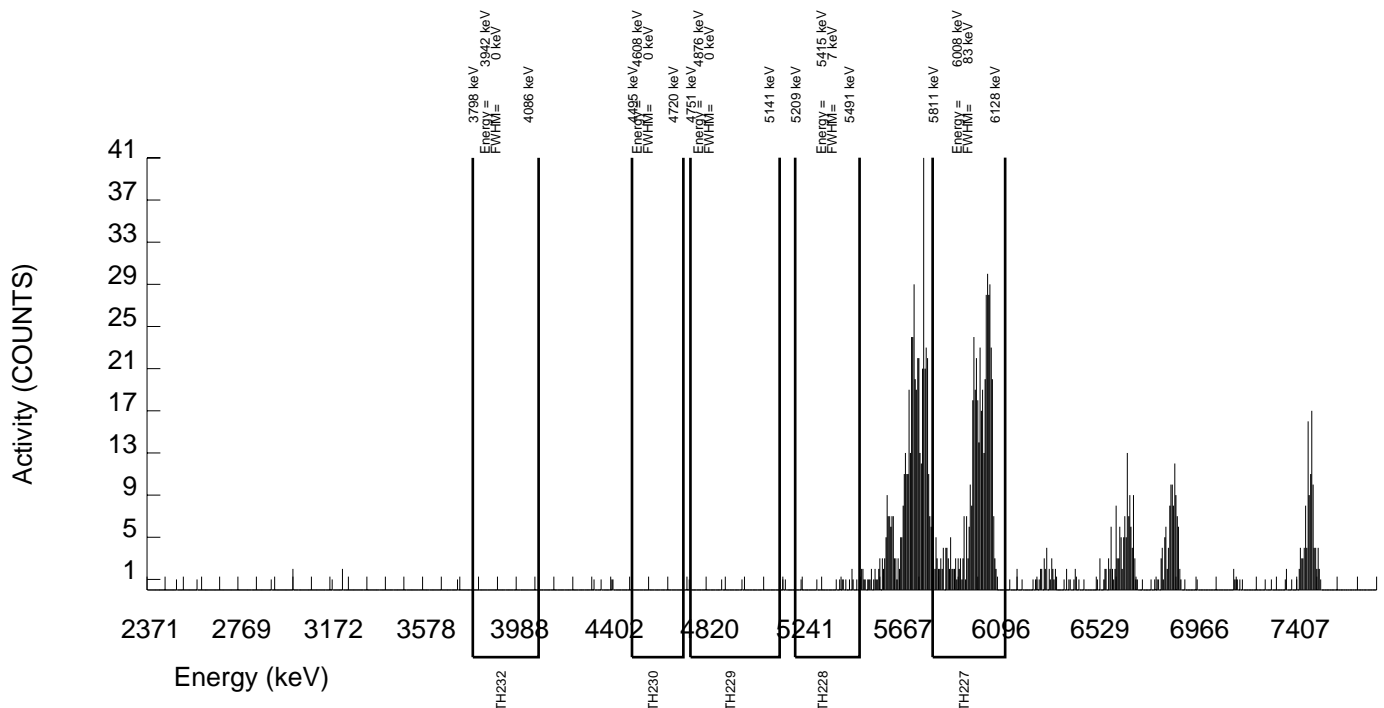
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905546 SAMPLE DATE : 18-SEP-2009 00:00:00 AC-227 SEPARATION : 30-SEP-2009 11:15:00		SAMPLE ID : S0237521010_TH SAMPLE QTY: 0.800 L	
DETECTOR NUMBER :78905 AVERAGE %EFFICIENCY :25.8288 % YIELD : 104.534		COUNT DATE: 5-OCT-2009 20:51:38 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :AXD2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.90075 dpm RESULTS : 4.07760 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B203.CNF;60 BKG DATE : 4-OCT-2009 EFF FILE : W203.CNF;39 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
AC-227	5994.040	499.000	489.000	10.000	3.1623	57.44000	2.20E+00	2.31E-01	7.96E-02	3.30E-02	1.99E-01
TH-228	5363.000	12.000	12.000	0.000	0.0000	99.94000	2.55E-02	1.45E-02	6.37E-03	0.00E+00	1.44E-02
TH229	4900.000	3.000	-5.000	8.000	2.8284	99.52000	-1.05E-02	1.36E-02	3.39E-02	1.38E-02	1.36E-02
TH-230	4625.000	0.000	-6.000	6.000	2.4495	100.0000	-1.25E-02	1.08E-02	3.00E-02	1.19E-02	1.08E-02
TH-232	3972.000	0.000	0.000	0.000	0.0000	100.0000	0.00E+00	4.09E-03	6.26E-03	0.00E+00	4.09E-03

NOTE: Ac-227 results decay corrected to separation date/time.



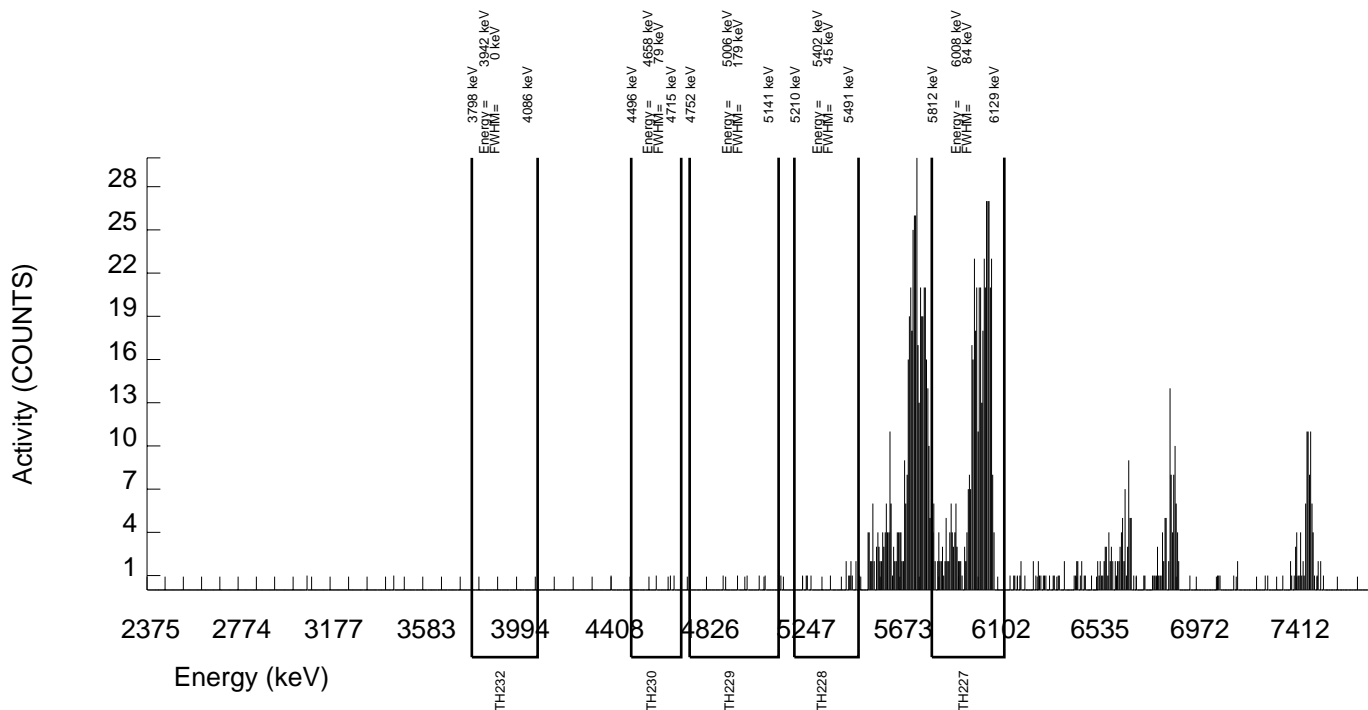
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905546 SAMPLE DATE : 29-SEP-2009 00:00:00 AC-227 SEPARATION : 30-SEP-2009 11:15:00		SAMPLE ID : S1201930820_TH SAMPLE QTY: 0.800 L	
DETECTOR NUMBER :78908 AVERAGE %EFFICIENCY :25.4940 % YIELD : 100.709		COUNT DATE: 5-OCT-2009 20:51:40 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :AXD2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	TRACER ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.90075 dpm RESULTS : 3.92840 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B205.CNF;60 BKG DATE : 4-OCT-2009 EFF FILE : W205.CNF;38 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
AC-227	5994.040	476.000	465.000	11.000	3.3166	57.44000	2.20E+00	2.36E-01	8.71E-02	3.64E-02	2.04E-01
TH-228	5363.000	14.000	13.000	1.000	1.0000	99.94000	2.87E-02	1.68E-02	1.69E-02	5.14E-03	1.68E-02
TH229	4900.000	5.000	3.000	2.000	1.4142	99.52000	6.61E-03	1.14E-02	2.11E-02	7.25E-03	1.14E-02
TH-230	4625.000	3.000	2.000	1.000	1.0000	100.0000	4.39E-03	8.60E-03	1.68E-02	5.10E-03	8.60E-03
TH-232	3972.000	0.000	0.000	0.000	0.0000	100.0000	0.00E+00	4.30E-03	6.58E-03	0.00E+00	4.30E-03

NOTE: Ac-227 results decay corrected to separation date/time.



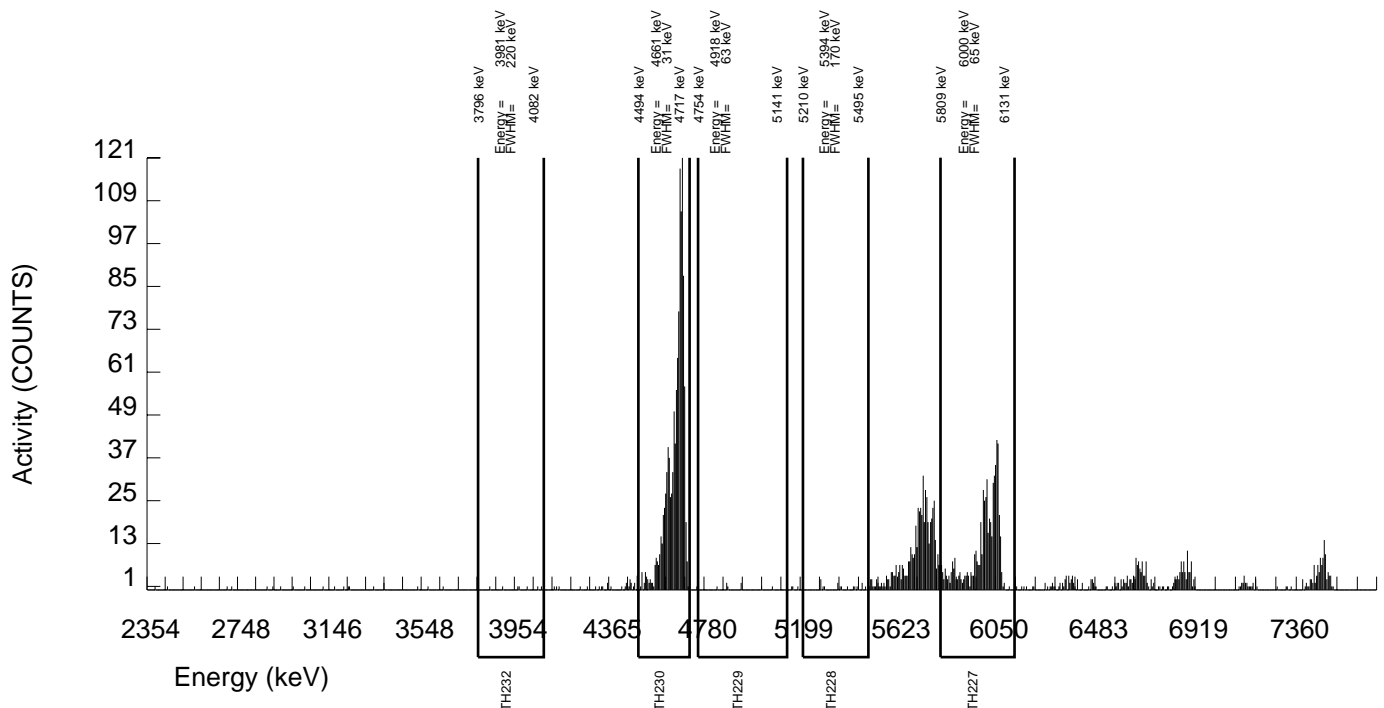
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905546 SAMPLE DATE : 29-SEP-2009 00:00:00 AC-227 SEPARATION : 30-SEP-2009 11:15:00		SAMPLE ID : S1201930821_TH SAMPLE QTY: 0.800 L	
DETECTOR NUMBER :78773 AVERAGE %EFFICIENCY :32.0737 % YIELD : 86.108		COUNT DATE: 2-OCT-2009 09:19:40 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :AXD2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	TRACER ID : 0387-B-102 ISOTOPE : AC227 NOMINAL : 3.90075 dpm RESULTS : 3.35887 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B040.CNF;1072 BKG DATE : 27-SEP-2009 EFF FILE : W040.CNF;306 CAL DATE : 5-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
AC-227	5994.040	607.000	569.000	38.000	6.1644	57.44000	2.20E+00	2.26E-01	1.22E-01	5.54E-02	1.92E-01
TH-228	5363.000	18.000	10.000	8.000	2.8284	99.94000	2.05E-02	2.05E-02	3.31E-02	1.35E-02	2.05E-02
TH229	4900.000	9.000	4.000	5.000	2.2361	99.52000	8.19E-03	1.50E-02	2.75E-02	1.07E-02	1.50E-02
TH-230	4625.000	1174.000	1171.000	3.000	1.7321	100.0000	2.39E+00	1.88E-01	2.25E-02	8.21E-03	1.37E-01
TH-232	3972.000	7.000	7.000	0.000	0.0000	100.0000	1.43E-02	1.06E-02	6.12E-03	0.00E+00	1.06E-02

NOTE: Ac-227 results decay corrected to separation date/time.



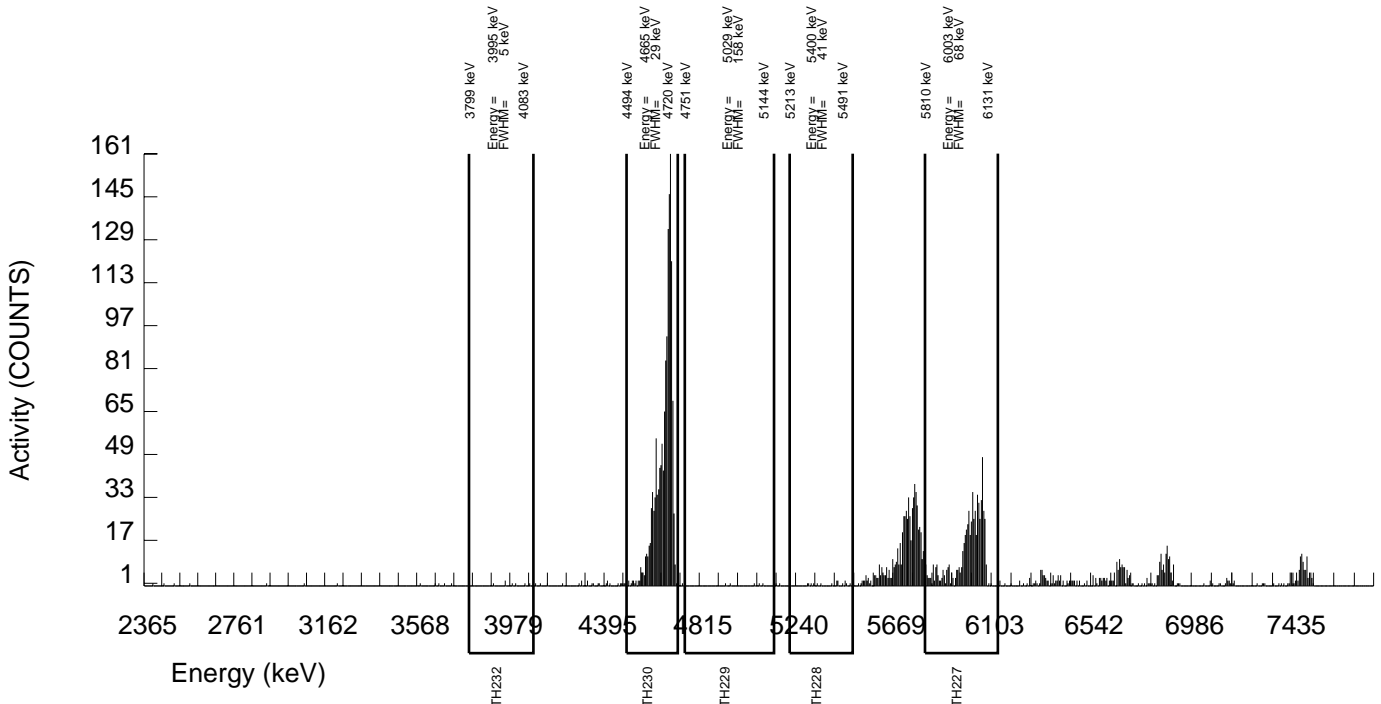
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905546 SAMPLE DATE : 29-SEP-2009 00:00:00 AC-227 SEPARATION : 30-SEP-2009 11:15:00		SAMPLE ID : S1201930822_TH SAMPLE QTY: 0.800 L	
DETECTOR NUMBER :78205 AVERAGE %EFFICIENCY :32.9883 % YIELD : 92.108		COUNT DATE: 2-OCT-2009 09:19:40 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :AXD2	
MS/MSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	LCS/LCSD ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	TRACER ID : 0387-B-102 ISOTOPE : AC227 NOMINAL : 3.90075 dpm RESULTS : 3.59290 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B041.CNF;1065 BKG DATE : 27-SEP-2009 EFF FILE : W041.CNF;310 CAL DATE : 5-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
AC-227	5994.040	660.000	626.000	34.000	5.8310	57.44000	2.20E+00	2.17E-01	1.06E-01	4.76E-02	1.81E-01
TH-228	5363.000	16.000	5.000	11.000	3.3166	99.94000	9.31E-03	1.90E-02	3.43E-02	1.44E-02	1.90E-02
TH229	4900.000	5.000	-4.000	9.000	3.0000	99.52000	-7.45E-03	1.37E-02	3.16E-02	1.30E-02	1.37E-02
TH-230	4625.000	1447.000	1441.000	6.000	2.4495	100.0000	2.67E+00	2.00E-01	2.67E-02	1.06E-02	1.38E-01
TH-232	3972.000	7.000	5.000	2.000	1.4142	100.0000	9.27E-03	1.09E-02	1.78E-02	6.10E-03	1.09E-02

NOTE: Ac-227 results decay corrected to separation date/time.





# URANIUM

**Radiochemistry Batch Checklist, Rev 9**

Batch# 908848 Product: 4 Date: 10/7/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			NA
Samples have been blank corrected (if required)			NA
If activity less 10* MDA/ MDC, error is 150% or less of sample activity. If greater 10* MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	/		
Instrument source check is within limits.	/		
Instrument bkg check is within limits.	/		
Method RDL/ LLD has been met.	/		
If duplicate activities are less 5* MDA/ MDC, then RPD is 100% or less. If greater 5* MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%.	/		
Or meets the client's required RER acceptance criteria.			
Tracer yield is 15-125% . Carrier yield 25-125%.		/	NCH# 742719
Or meets the client's contract acceptance criteria.			
Method blank is less than the RDL/ LLD.	/		
(If rad samples, < 5% of lowest activity)	/		
Sample was run within hold time.	/		
Sample was correctly preserved if required.	/		
Smears Taken for Radioactive batches.			NA
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	/		
No blank spaces on data forms.	/		
All line outs initialed and dated.	/		
No transcription errors are apparent.			
Aux data is correct.			NA
Client Special requirements page has been checked.	/		
Raw Data and/ or spectrum are included and properly stasured.	/		
QC data entered into QC database and batch is in REVW	/		
Hit notification complete (if necessary)			NA
Batch entered into Case Narrative.	/		
Batch non-conformances completed, if applicable.	/		NCH# 742719
Batch non-conformances second reviewed and disposition verified to be completed.			NCH# 742719
Aliquot Correction completed if required.			NA
Review sample historical results if available (if REMP, results above MDC have been verified by historical results, recount or re-analysis.)	/		

GEL Laboratories, LLC

revised 8/1/08

Primary Review Performed By: [Signature] 10/7/09

Secondary Review Performed By: [Signature] 10/7/09

9/22 (10/8)  
KEROL

# Uranium Que Sheet

23-SEP-09

Batch #: 905548 Analyst: AXD2 First Client Due Date: 08-OCT-09 Internal Due Date: 27-SEP-09

Tracer Isotope: U-232J-236 Tracer Code: 1283-E Expiration Date: 4/15/10 Vol: 0.1  
 LCS Isotope: U-238 LCS Code: 1163-G Expiration Date: 4/16/10 Vol: 0.1  
 Spike Isotope: U-238 Spike Code: Expiration Date: Vol:   
 Prep Date: 9/29/09 Initials: APW Pipet ID: 2971058 Balance ID: 16750207

Witness: MARK 9/29/09

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Pos.	Label #	Wet/Dry Aliquot (g (D/F))	Det #
236699016-1	EB090309-SO2	SAMPLE		.03 pCi/L	WATER	KERR003	03-SEP-09	1	1	0.800	114
236817014-1	EB090809-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	08-SEP-09	2	2	0.800	113
236938020-1	EB091009-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	10-SEP-09	3	3	0.800	145
237010013-1	EB091009-SO2	SAMPLE		.03 pCi/L	WATER	KERR003	10-SEP-09	4	4	0.800	146
237170005-1	EB091409-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	14-SEP-09	5	5	0.800	13a
237170020-1	EB091509-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	15-SEP-09	6	6	0.800	135
237343006-1	EB091609-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	16-SEP-09	7	7	0.800	161
237521010-1	EB091809-SO1	SAMPLE		.03 pCi/L	WATER	KERR003	18-SEP-09	8	8	0.800	162
1201930842-1	MB for batch 905548	MB		.03 pCi/L	WATER	QC ACCOUNT	03-SEP-09	9	9	0.800	22
1201930843-1	LCS for batch 905548	LCS		.03 pCi/L	WATER	QC ACCOUNT	03-SEP-09	10	10	0.800	23
1201930844-1	LCS for batch 905548	LCS		.03 pCi/L	WATER	QC ACCOUNT	03-SEP-09	11	11	0.800	24

100

APW 9/29/09

APW 9/29/09

Data Reviewed By:

Solid Sample Dissolution by: LEACH or DIGESTION  
 Circle One

Choose SOP used: GL-RAD-A-011  
 GL-RAD-A-038  
 GL-RAD-A-045  
 GL-RAD-A-043

GEL Laboratories LLC, Radiochemistry Division

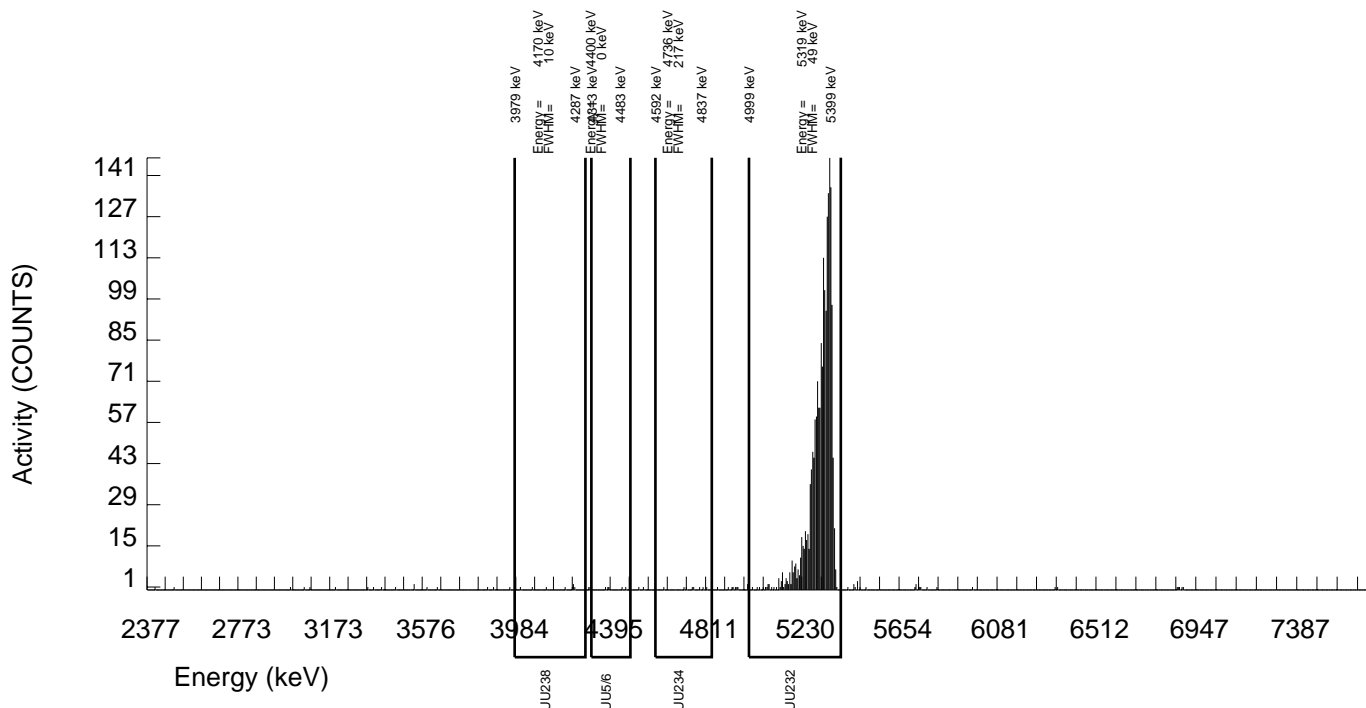
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905548 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521010_UU SAMPLE QTY: 0.800 L	
DETECTOR NUMBER :70323 AVERAGE %EFFICIENCY :37.1149 % YIELD : 96.953		COUNT DATE: 2-OCT-2009 20:26:03 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :AXD2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.09704 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B162.CNF;130 BKG DATE : 27-SEP-2009 EFF FILE : W162.CNF;55 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
U-3/4	4763.020	9.000	5.094	2.000	1.4142	100.0000	7.97E-03	9.31E-03	1.50E-02	5.15E-03	9.25E-03
U232	5302.100	1894.000	1891.000	3.000	1.7321	100.0000	2.96E+00	4.13E-01	1.73E-02	6.31E-03	1.34E-01
U-235	4391.000	6.000	5.000	1.000	1.0000	80.90000	9.67E-03	1.01E-02	1.48E-02	4.50E-03	1.00E-02
U-238	4184.730	8.000	6.000	2.000	1.4142	100.0000	9.39E-03	9.78E-03	1.50E-02	5.15E-03	9.70E-03

NOTE: Corrections made to U-3/4 net area due to tracer impurity



GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905548  
SAMPLE DATE : 29-SEP-2009 00:00:00

SAMPLE ID : S1201930842\_UU  
SAMPLE QTY: 0.800 L

DETECTOR NUMBER :72530  
AVERAGE %EFFICIENCY :31.6755  
% YIELD : 98.463

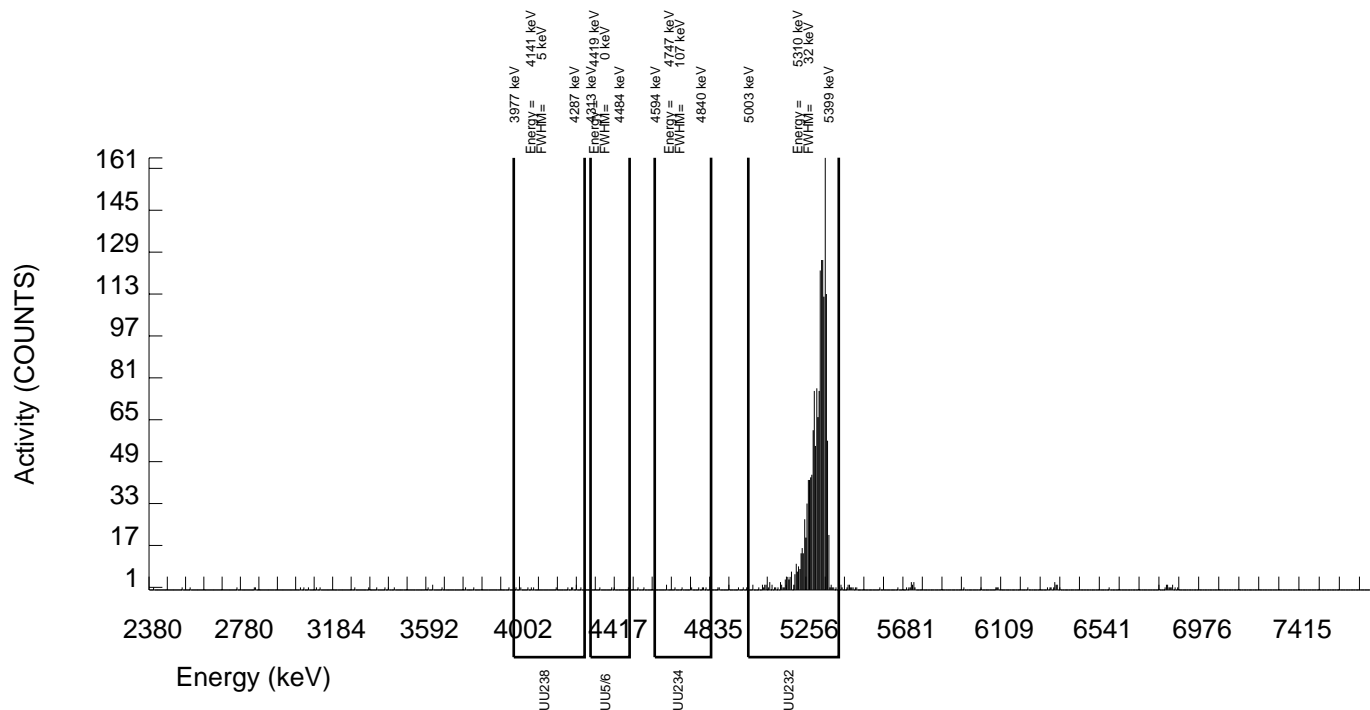
COUNT DATE: 2-OCT-2009 13:49:11  
ELAPSED LIVE TIME(SEC): 59999.99  
ANALYST :AXD2

MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25568 dpm RESULTS : 5.17488 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B022.CNF;1063 BKG DATE : 27-SEP-2009 EFF FILE : W022.CNF;304 CAL DATE : 4-SEP-2009
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NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
U-3/4	4763.020	11.000	4.348	5.000	2.2361	100.0000	7.85E-03	1.34E-02	2.42E-02	9.39E-03	1.34E-02
U232	5302.100	1651.000	1639.000	12.000	3.4641	100.0000	2.96E+00	4.21E-01	3.45E-02	1.46E-02	1.44E-01
U-235	4391.000	4.000	3.000	1.000	1.0000	80.90000	6.69E-03	9.82E-03	1.71E-02	5.19E-03	9.78E-03
U-238	4184.730	13.000	9.000	4.000	2.0000	100.0000	1.62E-02	1.47E-02	2.22E-02	8.40E-03	1.46E-02

NOTE: Corrections made to U-3/4 net area due to tracer impurity



GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905548  
SAMPLE DATE : 29-SEP-2009 00:00:00

SAMPLE ID : S1201930843\_UU  
SAMPLE QTY: 0.800 L

DETECTOR NUMBER :78264  
AVERAGE %EFFICIENCY :33.1983  
% YIELD : 91.825

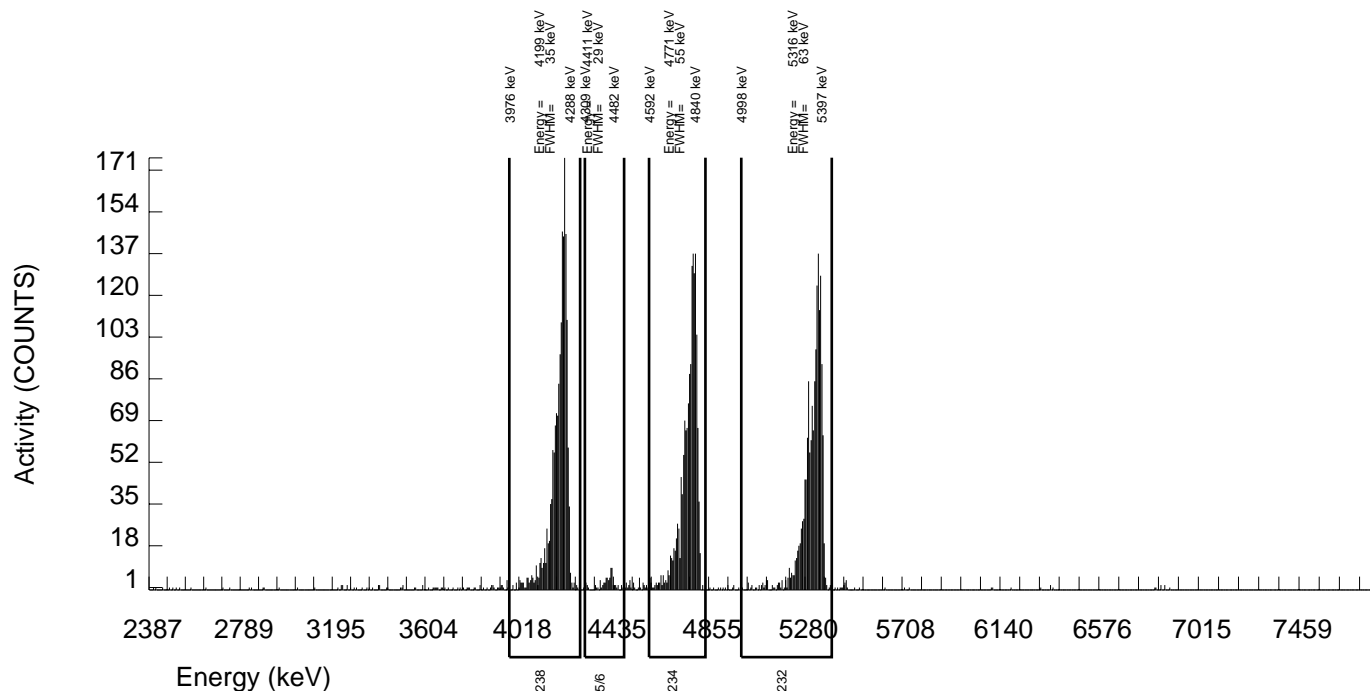
COUNT DATE: 2-OCT-2009 13:49:11  
ELAPSED LIVE TIME(SEC): 59999.99  
ANALYST :AXD2

MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25568 dpm RESULTS : 4.82605 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B023.CNF;1065 BKG DATE : 27-SEP-2009 EFF FILE : W023.CNF;290 CAL DATE : 4-SEP-2009
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NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
U-3/4	4763.020	1577.000	1565.385	10.000	3.1623	100.0000	2.89E+00	4.12E-01	3.27E-02	1.36E-02	1.44E-01
U232	5302.100	1612.000	1602.000	10.000	3.1623	100.0000	2.96E+00	4.21E-01	3.27E-02	1.36E-02	1.46E-01
U-235	4391.000	73.000	67.000	6.000	2.4495	80.90000	1.53E-01	4.47E-02	3.29E-02	1.30E-02	3.98E-02
U-238	4184.730	1726.000	1712.000	14.000	3.7417	100.0000	3.16E+00	4.49E-01	3.77E-02	1.61E-02	1.51E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 905548  
SAMPLE DATE : 29-SEP-2009 00:00:00

SAMPLE ID : S1201930844\_UU  
SAMPLE QTY: 0.800 L

DETECTOR NUMBER :76542  
AVERAGE %EFFICIENCY :32.8288  
% YIELD : 90.135

COUNT DATE: 2-OCT-2009 13:49:11  
ELAPSED LIVE TIME(SEC): 59999.99  
ANALYST :AXD2

MS/MSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/L : 3.149E+00

LCS/LCSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/L : 3.149E+00

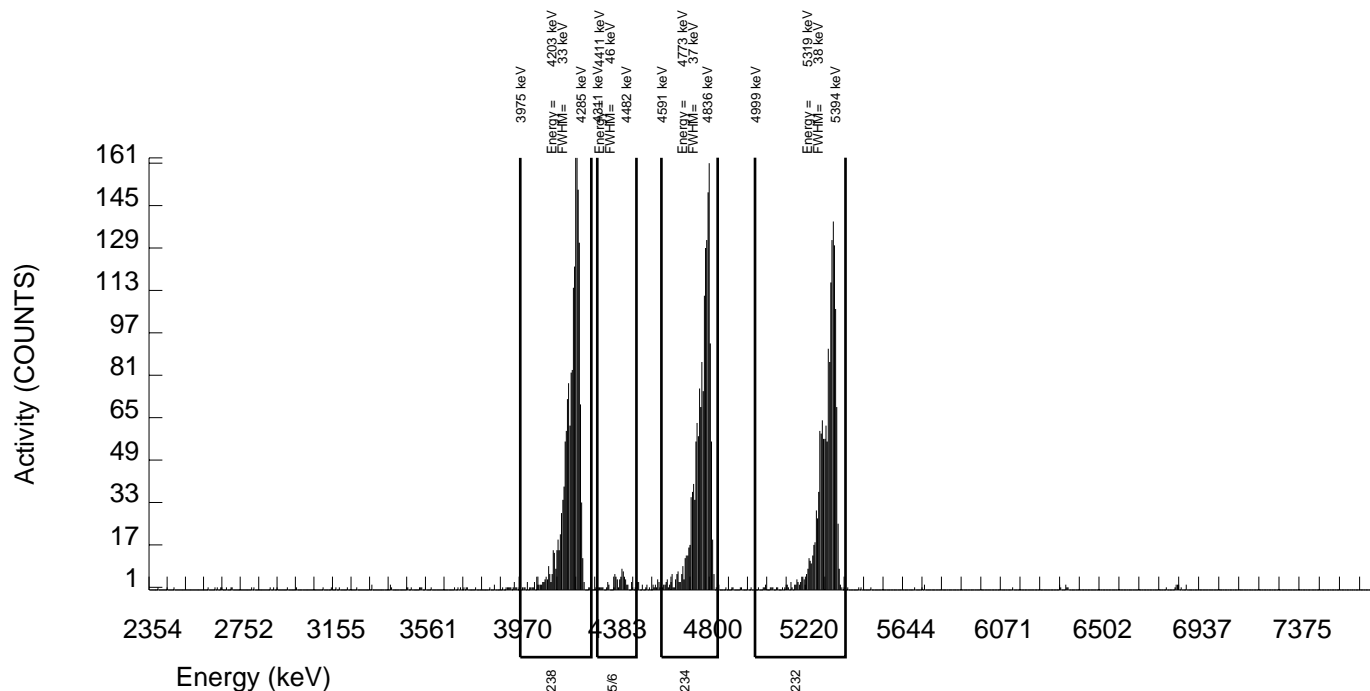
TRACER  
ID : 1283-E  
ISOTOPE : U232  
NOMINAL : 5.25568 dpm  
RESULTS : 4.73719 dpm

LIB FILE : ENV\_ALPHA\_UU.N  
BKG FILE : B024.CNF;1058  
BKG DATE : 27-SEP-2009  
EFF FILE : W024.CNF;289  
CAL DATE : 4-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/L	TPU 1.96-SIGMA	MDA pCi/L	Lc pCi/L	UNC pCi/L
U-3/4	4763.020	1629.000	1620.433	7.000	2.6458	100.0000	3.08E+00	4.40E-01	2.91E-02	1.17E-02	1.51E-01
U232	5302.100	1563.000	1555.000	8.000	2.8284	100.0000	2.96E+00	4.23E-01	3.08E-02	1.25E-02	1.48E-01
U-235	4391.000	71.000	71.000	0.000	0.0000	80.90000	1.67E-01	4.48E-02	7.06E-03	0.00E+00	3.88E-02
U-238	4184.730	1737.000	1729.000	8.000	2.8284	100.0000	3.29E+00	4.67E-01	3.08E-02	1.25E-02	1.56E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



### Radiochemistry Batch Checklist, Rev 9

Batch# 909129 Product: ✓ Date: 10/13/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			N/A
Samples have been blank corrected (if required)			N/A
If activity less 10* MDA/ MDC, error is 150% or less of sample activity. If greater 10* MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	✓		
Instrument source check is within limits.	✓		
Instrument bkg check is within limits.	✓		
Method RDL/ LLD has been met.	✓		
If duplicate activities are less 5* MDA/ MDC, then RPD is 100% or less. If greater 5* MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%.	✓		
Or meets the client's required RER acceptance criteria.			
Tracer yield is 15-125% . Carrier yield 25-125%.		✓	NCR 745091
Or meets the client's contract acceptance criteria.			
Method blank is less than the RDL/ LLD. (If rad samples. < 5% of lowest activity)	✓		
Sample was run within hold time.	✓		
Sample was correctly preserved if required.			N/A
Smears Taken for Radioactive batches.	✓		
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	✓		
No blank spaces on data forms.			
All line outs initialed and dated.	✓		
No transcription errors are apparent.	✓		
Aux data is correct.			N/A
Client Special requirements page has been checked.	✓		
Raw Data and/ or spectrum are included and properly stasured.	✓		
QC data entered into QC database and batch is in REVW	✓		
Hit notification complete (if necessary)			N/A
Batch entered into Case Narrative.	✓		
Batch non-conformances completed, if applicable.	✓		NCR 745091
Batch non-conformances second reviewed and disposition verified to be completed.	✓		NCR 745091
Aliquot Correction completed if required.			N/A
Review sample historical results if available (If REMP, results above MDC have been verified by historical results, recount or re-analysis.)	✓		

GEL Laboratories, LLC

revised 8/1/08

Primary Review Performed By: JopLM 10/13/09

Secondary Review Performed By: [Signature] 10/14/09

10/9  
10/20  
VSR



# Uranium Que Sheet

05-OCT-09

Batch #: 909129 Analyst: CXM2 First Client Due Date: 20-OCT-09 Internal Due Date: 09-OCT-09  
 Tracer Isotope: U-232 Tracer Code: 1753-6 Expiration Date: 1/15/10 Vol: 0.1mL  
 LCS Isotope: U-238 LCS Code: 1163-6 Expiration Date: 4/16/10 Vol: 0.1mL  
 Spike Isotope: U-238 Spike Code: 1163-6 Expiration Date: 4/16/10 Vol: 0.1mL  
 Prep Date: 10/5/09 Initials: CMM Pipet ID: 2971058 Balance ID: 50410272

Witness: MADSKY

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Pos.	Label #	Wet/Dry Aliquot (g/l/l)	U Det #
237521001-1	SA117-0.5B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	1	101	0.505	146
237521002-1	SA117-9B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	2	102	0.507	147
237521003-1	SA117-25B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	3	103	0.511	148
237521004-1	SA117-41B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	4	104	0.504	149
237521005-1	SA161-0.5B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	5	105	0.502	150
237521006-1	SA161-10B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	6	106	0.502	151
237521007-1	SA161-25B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	7	107	0.505	152
237521008-1	SA161009-25B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	8	108	0.509	153
237521009-1	SA161-37B	SAMPLE		.04 pCi/g	SOIL	KERR003	18-SEP-09	9	109	0.508	154
237521011-1	RSAT4-0.5B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	10	110	0.506	155
237521012-1	RSAT4-10B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	11	111	0.509	156
237521013-1	RSAT4-25B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	12	112	0.502	157
237521014-1	RSAT4-40B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	13	113	0.505	158
237521015-1	RSAT4-53B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	14	114	0.504	159
237521016-1	SA32-0.5B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	15	115	0.505	160
237521017-1	SA32-9B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	16	116	0.508	161
237521018-1	SA32-25B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	17	117	0.503	162
237521019-1	SA32009-25B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	18	118	0.516	163
237521020-1	SA32-37B	SAMPLE		.04 pCi/g	SOIL	KERR003	21-SEP-09	19	119	0.502	164
1201939568-1	MB for batch 909129	MB		.04 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	20	120	0.517	165
1201939569-1	SA117-9B(237521002DUP)	DUP		.04 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	21	121	0.517	166
1201939570-1	SA117-9B(237521002MS)	MS		.04 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	22	122	0.503	167
1201939571-1	LCS for batch 909129	LCS		.04 pCi/g	SOIL	QC ACCOUNT	18-SEP-09	23	123	0.517	168

Choose SOP used: GL-RAD-A-011  
 GL-RAD-A-038  
 GL-RAD-A-045  
 GL-RAD-A-043

Solid Sample Dissolution by: LEACH or DIGESTION  
 Circle One

Data Reviewed By: Jarrel M - 10/13/09

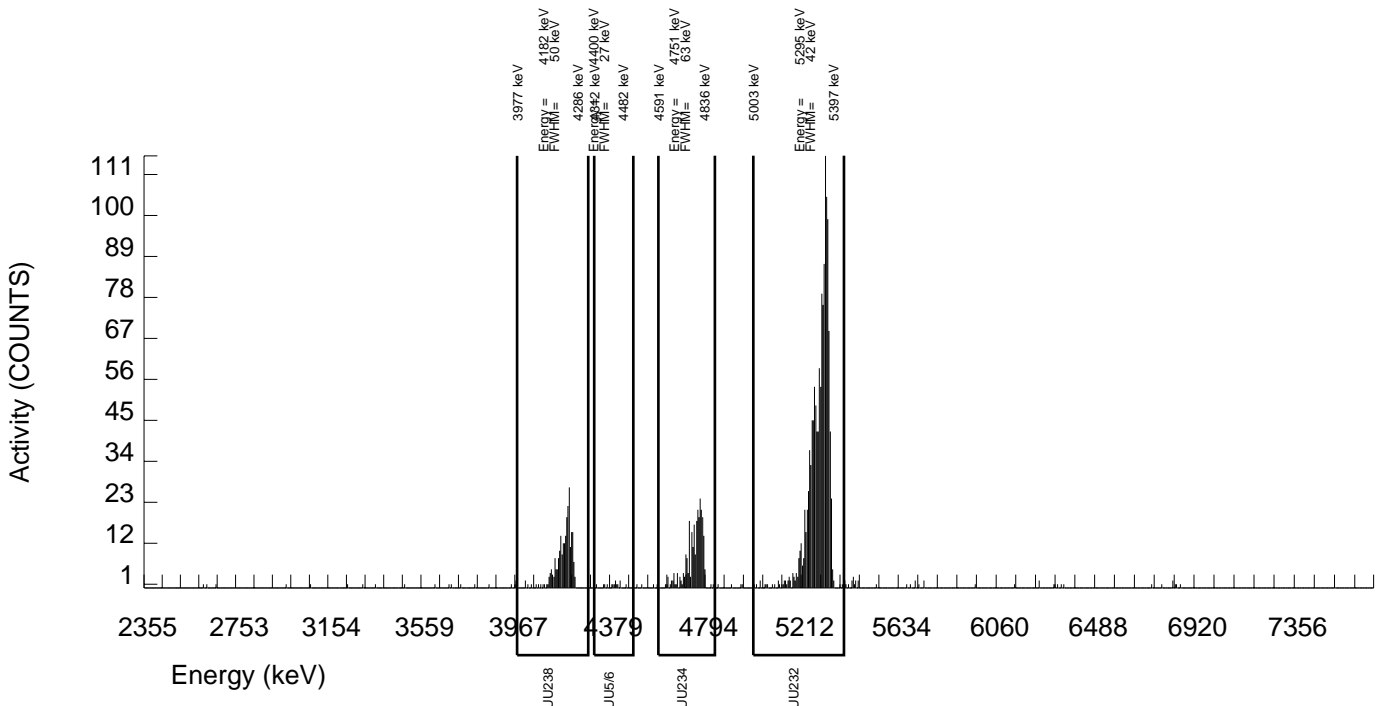
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521001_UU SAMPLE QTY: 0.505 G	
DETECTOR NUMBER :72527 AVERAGE %EFFICIENCY :25.2179 % YIELD : 100.230		COUNT DATE:10-OCT-2009 15:32:16 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.26929 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B146.CNF;357 BKG DATE : 4-OCT-2009 EFF FILE : W146.CNF;105 CAL DATE : 16-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	272.000	264.661	6.000	2.4495	100.0000	9.34E-01	1.72E-01	5.08E-02	2.01E-02	1.15E-01
U232	5302.100	1335.000	1328.000	7.000	2.6458	100.0000	4.69E+00	6.87E-01	5.41E-02	2.17E-02	2.54E-01
U-235	4391.000	14.000	13.000	1.000	1.0000	80.90000	5.67E-02	3.40E-02	3.34E-02	1.01E-02	3.31E-02
U-238	4184.730	248.000	247.000	1.000	1.0000	100.0000	8.72E-01	1.61E-01	2.70E-02	8.21E-03	1.09E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



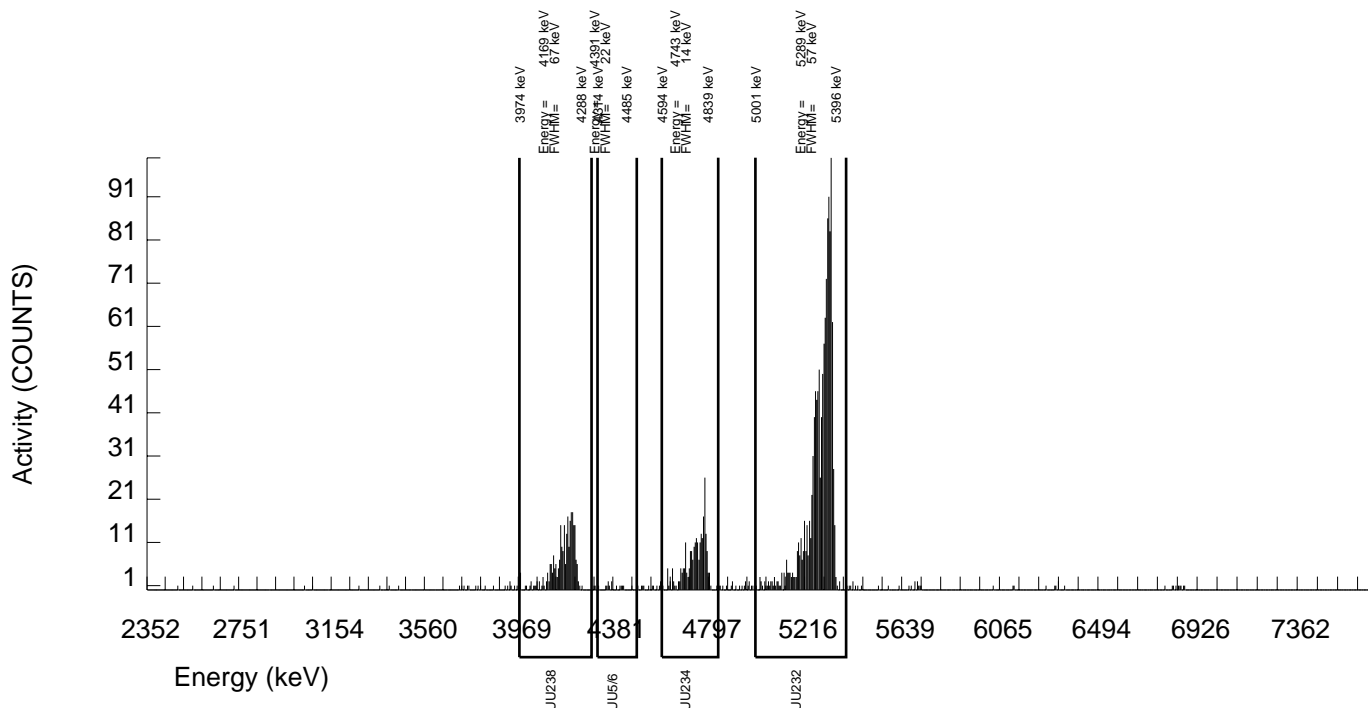
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521002_UU SAMPLE QTY: 0.507 G	
DETECTOR NUMBER :75550 AVERAGE %EFFICIENCY :24.6201 % YIELD : 96.943		COUNT DATE:10-OCT-2009 15:32:19 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.968E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.968E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.09649 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B147.CNF;357 BKG DATE : 4-OCT-2009 EFF FILE : W147.CNF;104 CAL DATE : 16-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	255.000	248.736	5.000	2.2361	100.0000	9.26E-01	1.75E-01	4.99E-02	1.94E-02	1.17E-01
U232	5302.100	1265.000	1254.000	11.000	3.3166	100.0000	4.67E+00	7.03E-01	6.87E-02	2.87E-02	2.61E-01
U-235	4391.000	14.000	12.000	2.000	1.4142	80.90000	5.52E-02	3.69E-02	4.41E-02	1.51E-02	3.61E-02
U-238	4184.730	274.000	263.000	11.000	3.3166	100.0000	9.79E-01	1.84E-01	6.86E-02	2.87E-02	1.23E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



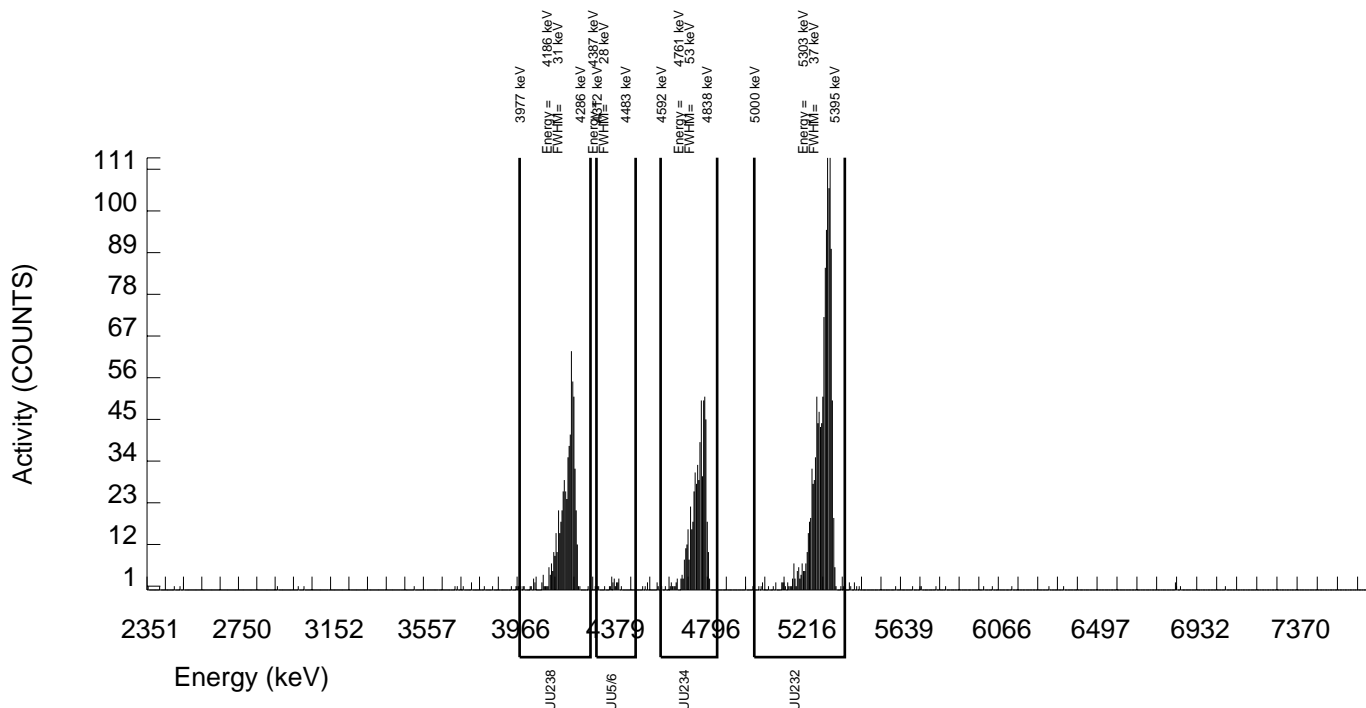
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521003_UU SAMPLE QTY: 0.511 G	
DETECTOR NUMBER :74429 AVERAGE %EFFICIENCY :24.7446 % YIELD : 99.301		COUNT DATE:10-OCT-2009 15:32:22 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.929E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.929E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.22046 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B148.CNF;356 BKG DATE : 4-OCT-2009 EFF FILE : W148.CNF;119 CAL DATE : 16-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	577.000	569.699	6.000	2.4495	100.0000	2.04E+00	3.26E-01	5.16E-02	2.04E-02	1.70E-01
U232	5302.100	1297.000	1291.000	6.000	2.4495	100.0000	4.63E+00	6.82E-01	5.17E-02	2.05E-02	2.54E-01
U-235	4391.000	20.000	19.000	1.000	1.0000	80.90000	8.43E-02	4.15E-02	3.39E-02	1.03E-02	3.98E-02
U-238	4184.730	618.000	618.000	0.000	0.0000	100.0000	2.22E+00	3.49E-01	1.08E-02	0.00E+00	1.75E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



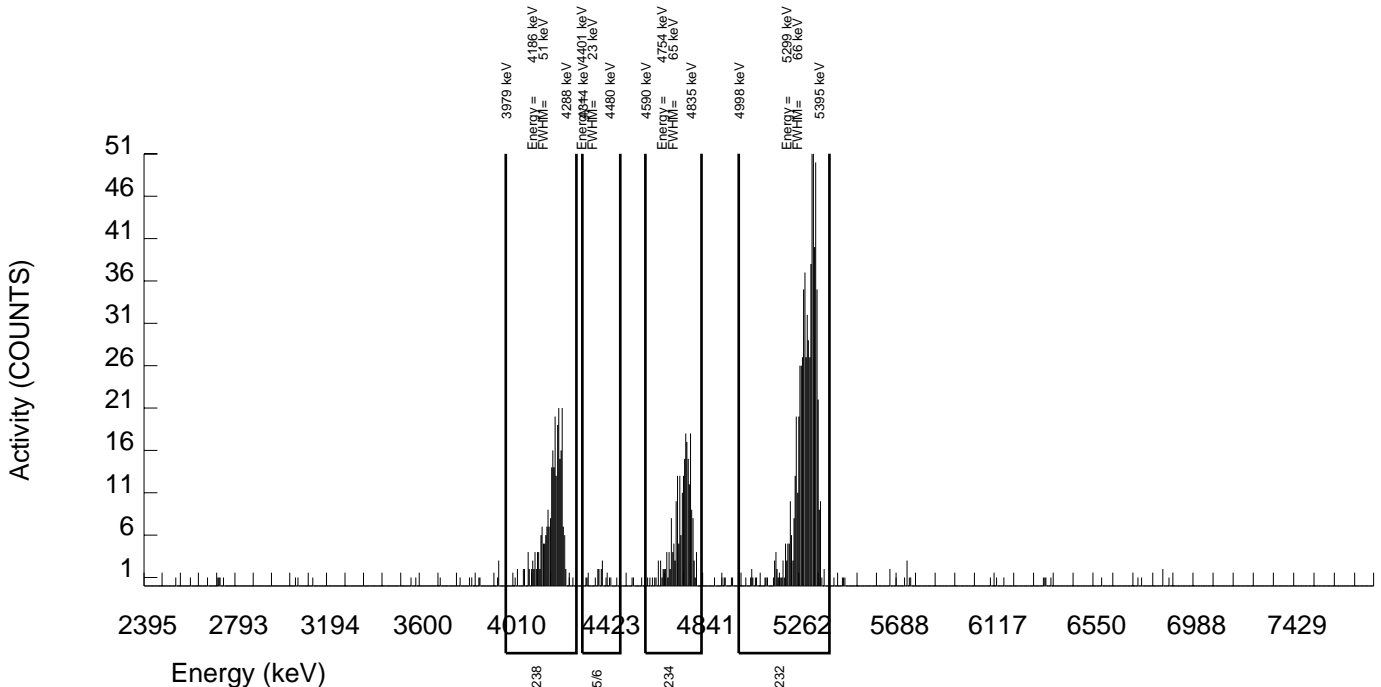
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521004_UU SAMPLE QTY: 0.504 G	
DETECTOR NUMBER :33449 AVERAGE %EFFICIENCY :24.4275 % YIELD : 54.853		COUNT DATE:10-OCT-2009 15:32:25 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.998E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.998E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 2.88375 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B149.CNF;360 BKG DATE : 4-OCT-2009 EFF FILE : W149.CNF;104 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	241.000	233.290	7.000	2.6458	100.0000	1.56E+00	3.06E-01	1.02E-01	4.11E-02	2.06E-01
U232	5302.100	712.000	704.000	8.000	2.8284	100.0000	4.70E+00	7.69E-01	1.08E-01	4.39E-02	3.51E-01
U-235	4391.000	16.000	15.000	1.000	1.0000	80.90000	1.24E-01	6.90E-02	6.31E-02	1.92E-02	6.66E-02
U-238	4184.730	283.000	283.000	0.000	0.0000	100.0000	1.89E+00	3.52E-01	2.00E-02	0.00E+00	2.20E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



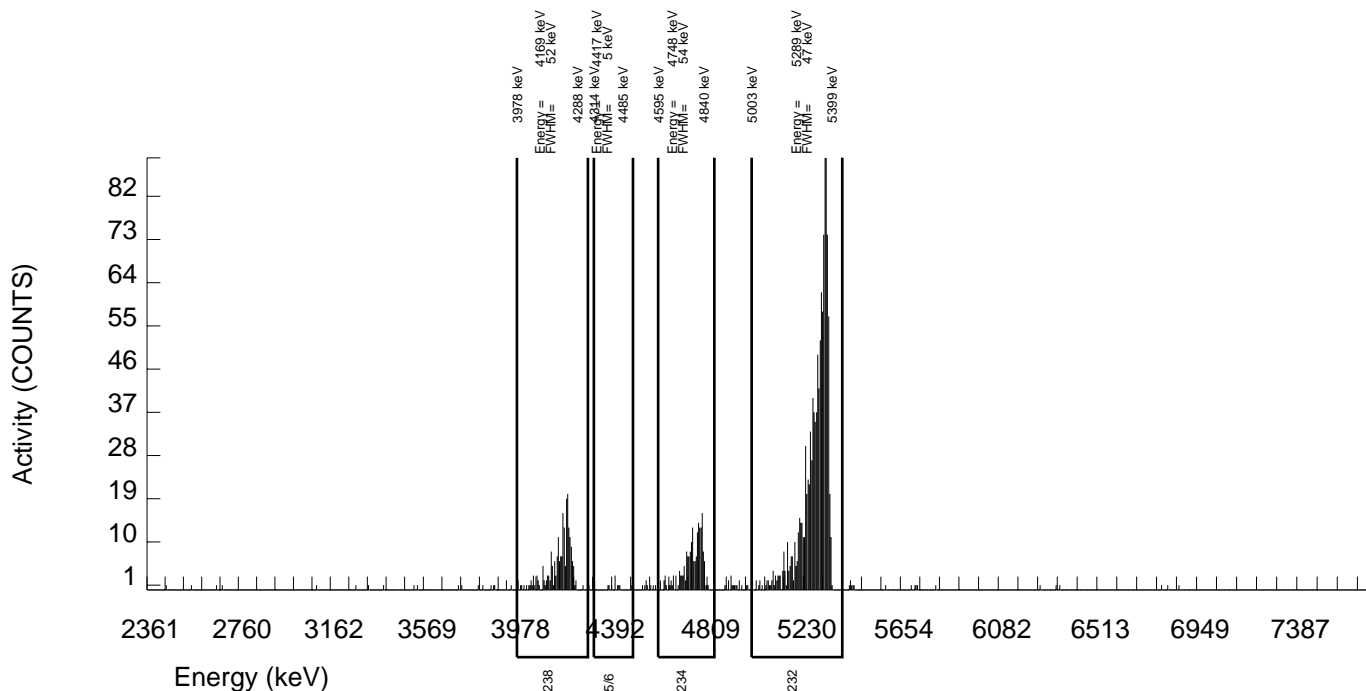
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521005_UU SAMPLE QTY: 0.502 G	
DETECTOR NUMBER :75552 AVERAGE %EFFICIENCY :24.9777 % YIELD : 88.392		COUNT DATE:10-OCT-2009 15:32:27 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 4.64696 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B150.CNF;361 BKG DATE : 4-OCT-2009 EFF FILE : W150.CNF;112 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	199.000	192.831	5.000	2.2361	100.0000	7.84E-01	1.57E-01	5.45E-02	2.11E-02	1.13E-01
U232	5302.100	1170.000	1160.000	10.000	3.1623	100.0000	4.72E+00	7.05E-01	7.20E-02	2.99E-02	2.74E-01
U-235	4391.000	10.000	9.000	1.000	1.0000	80.90000	4.52E-02	3.32E-02	3.84E-02	1.17E-02	3.27E-02
U-238	4184.730	221.000	220.000	1.000	1.0000	100.0000	8.94E-01	1.71E-01	3.11E-02	9.45E-03	1.19E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



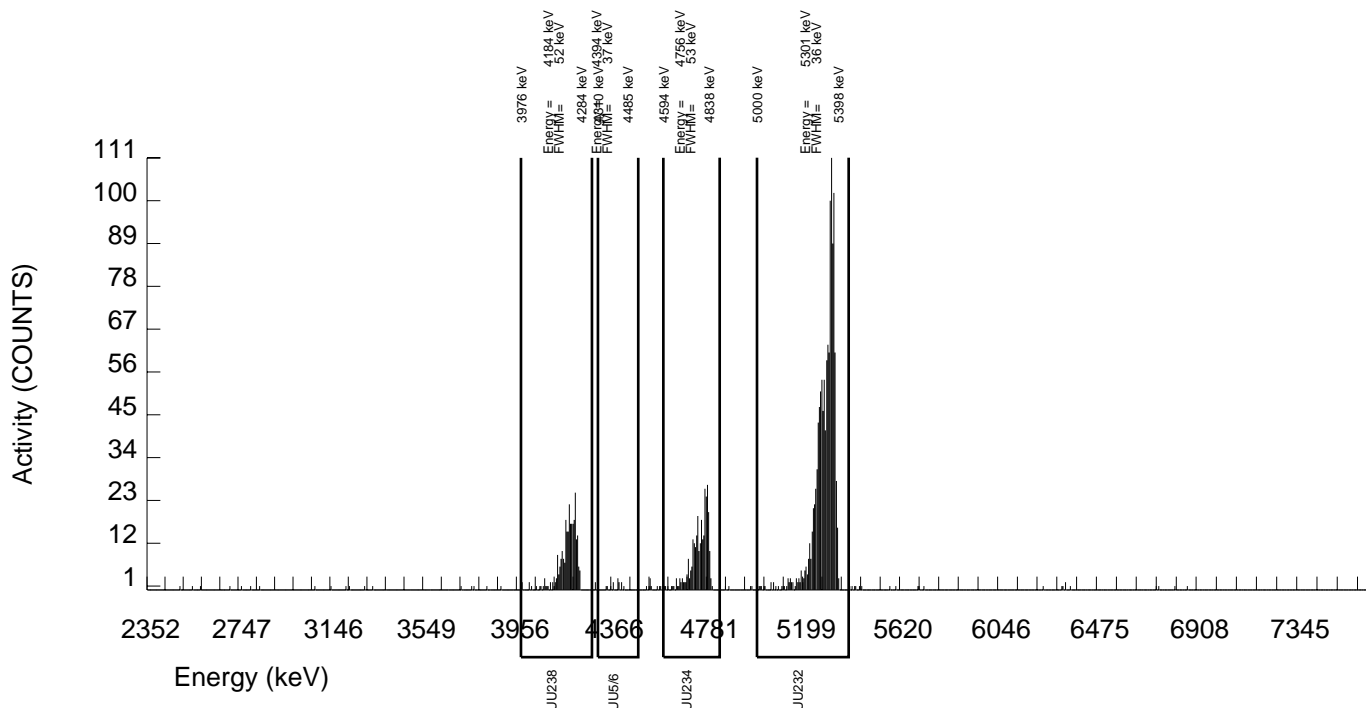
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521006_UU SAMPLE QTY: 0.502 G	
DETECTOR NUMBER :75556 AVERAGE %EFFICIENCY :24.4597 % YIELD : 95.789		COUNT DATE:10-OCT-2009 15:32:30 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.03581 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B151.CNF;356 BKG DATE : 4-OCT-2009 EFF FILE : W151.CNF;110 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	298.000	296.759	0.000	0.0000	100.0000	1.14E+00	2.02E-01	1.15E-02	0.00E+00	1.29E-01
U232	5302.100	1235.000	1231.000	4.000	2.0000	100.0000	4.72E+00	6.98E-01	4.72E-02	1.78E-02	2.64E-01
U-235	4391.000	13.000	11.000	2.000	1.4142	80.90000	5.21E-02	3.66E-02	4.54E-02	1.56E-02	3.59E-02
U-238	4184.730	279.000	279.000	0.000	0.0000	100.0000	1.07E+00	1.93E-01	1.15E-02	0.00E+00	1.25E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



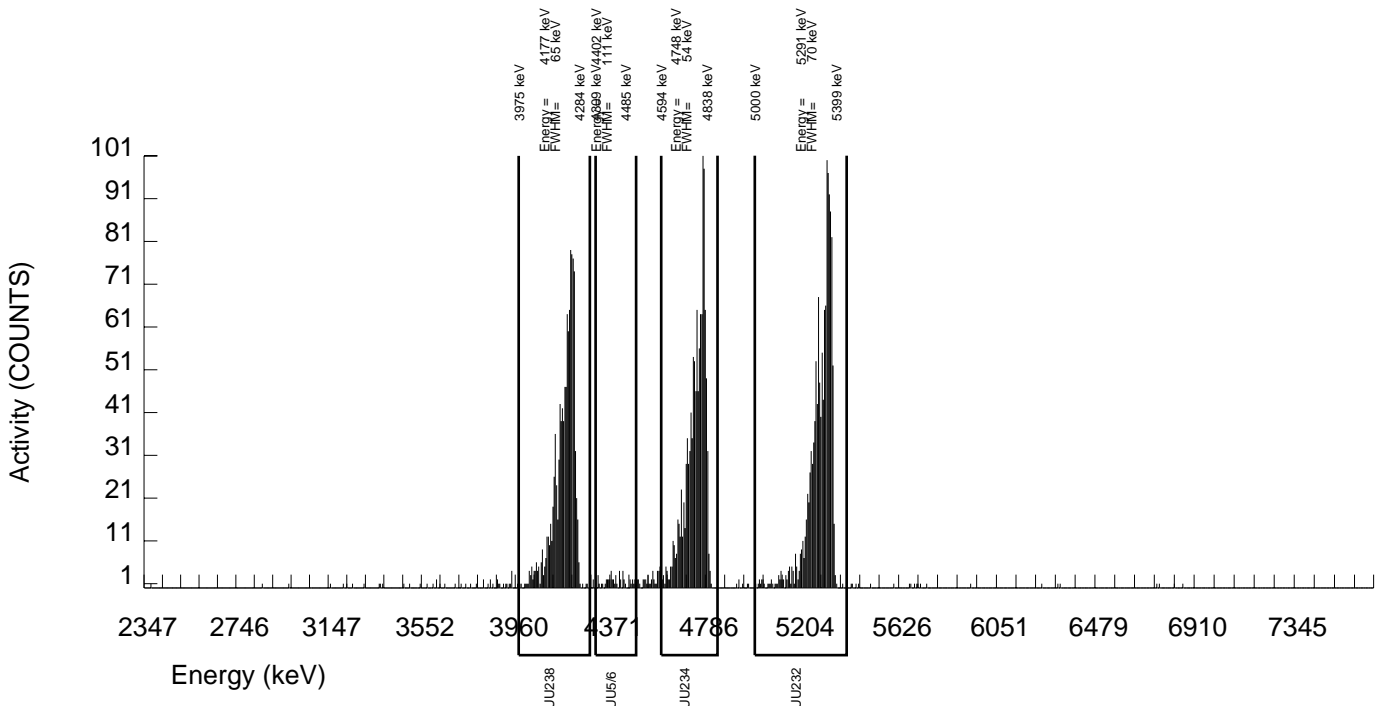
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521007_UU SAMPLE QTY: 0.505 G	
DETECTOR NUMBER :76222 AVERAGE %EFFICIENCY :24.6765 % YIELD : 104.126		COUNT DATE:10-OCT-2009 15:32:32 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.47411 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B152.CNF;353 BKG DATE : 4-OCT-2009 EFF FILE : W152.CNF;97 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	1190.000	1184.639	4.000	2.0000	100.0000	4.11E+00	6.07E-01	4.27E-02	1.62E-02	2.35E-01
U232	5302.100	1355.000	1350.000	5.000	2.2361	100.0000	4.69E+00	6.85E-01	4.66E-02	1.81E-02	2.51E-01
U-235	4391.000	50.000	48.000	2.000	1.4142	80.90000	2.06E-01	6.68E-02	4.11E-02	1.41E-02	6.06E-02
U-238	4184.730	1121.000	1121.000	0.000	0.0000	100.0000	3.89E+00	5.76E-01	1.04E-02	0.00E+00	2.28E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity





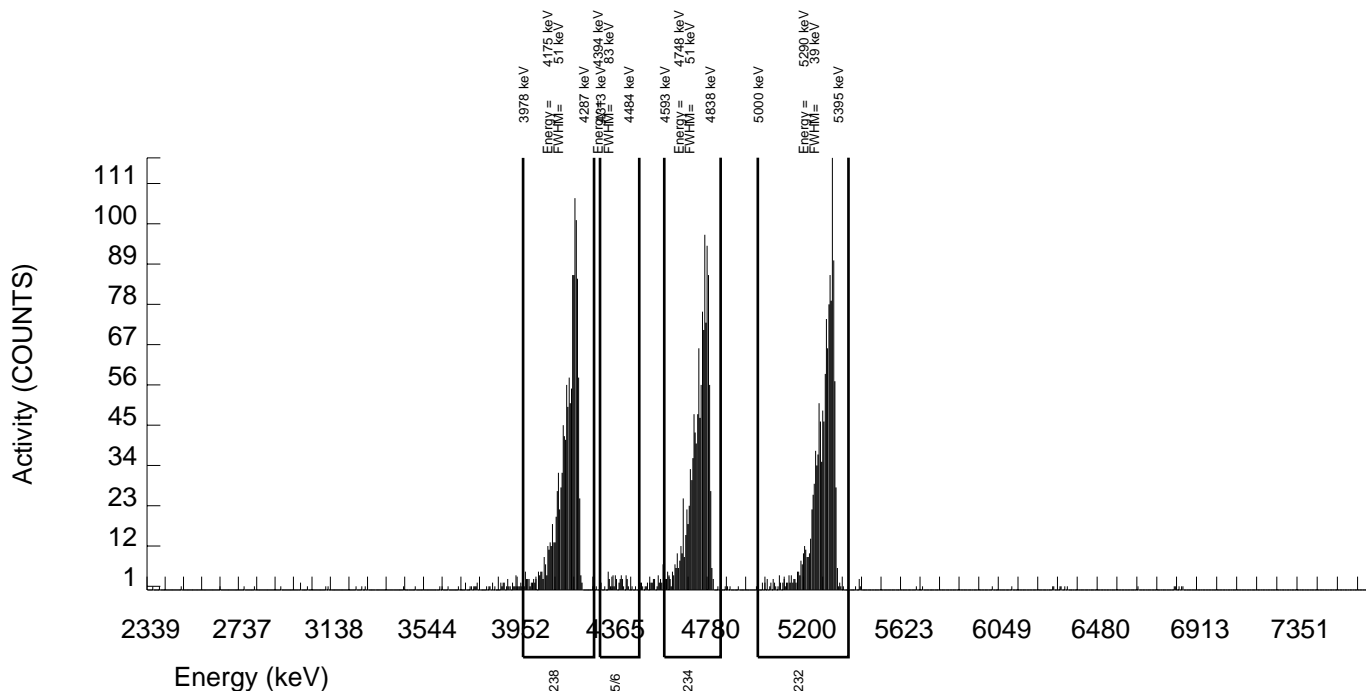
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521008_UU SAMPLE QTY: 0.509 G	
DETECTOR NUMBER :76223 AVERAGE %EFFICIENCY :25.3061 % YIELD : 97.624		COUNT DATE:10-OCT-2009 15:32:34 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.949E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.949E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.13230 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B153.CNF;348 BKG DATE : 4-OCT-2009 EFF FILE : W153.CNF;100 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	1246.000	1242.692	2.000	1.4142	100.0000	4.45E+00	6.57E-01	3.43E-02	1.18E-02	2.48E-01
U232	5302.100	1317.000	1298.000	19.000	4.3589	100.0000	4.65E+00	6.86E-01	8.34E-02	3.63E-02	2.57E-01
U-235	4391.000	48.000	47.000	1.000	1.0000	80.90000	2.08E-01	6.71E-02	3.39E-02	1.03E-02	6.08E-02
U-238	4184.730	1279.000	1276.000	3.000	1.7321	100.0000	4.57E+00	6.73E-01	3.96E-02	1.44E-02	2.51E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



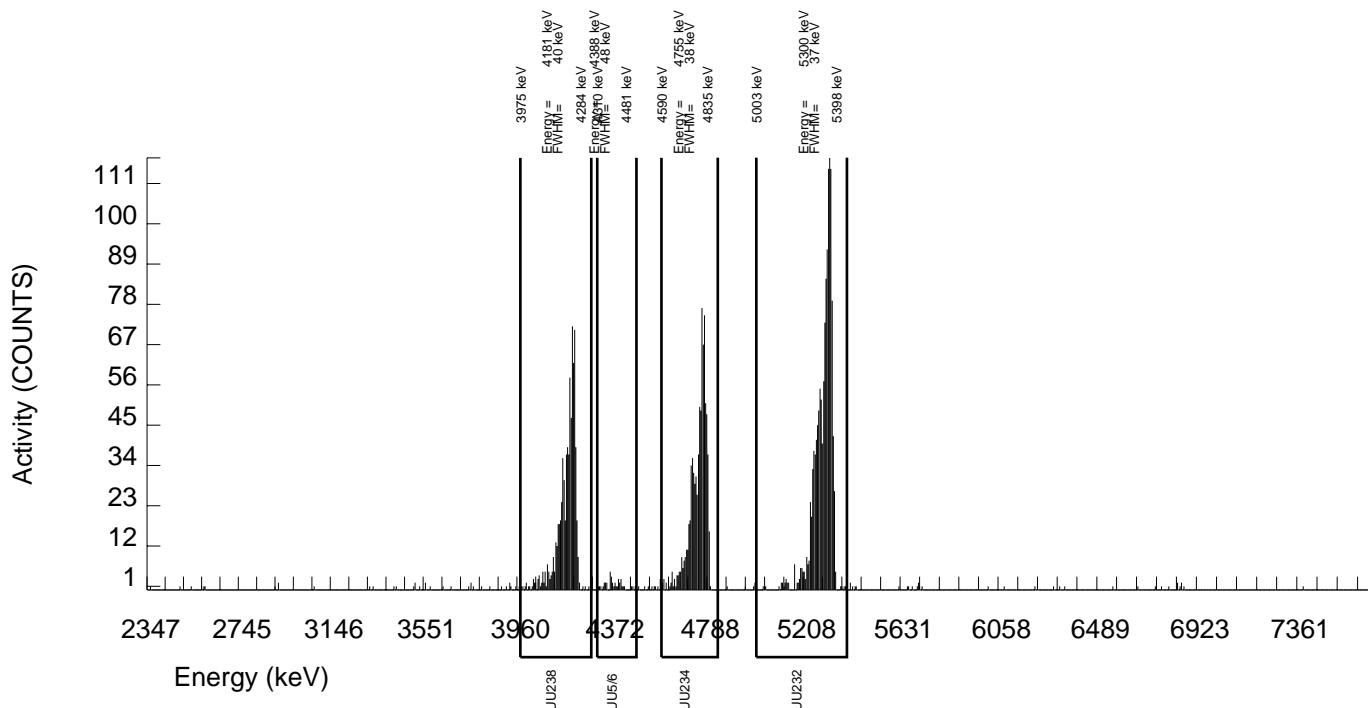
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S0237521009_UU SAMPLE QTY: 0.508 G	
DETECTOR NUMBER :76224 AVERAGE %EFFICIENCY :25.6606 % YIELD : 98.427		COUNT DATE:10-OCT-2009 15:32:38 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.958E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.958E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 5.17449 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B154.CNF;350 BKG DATE : 4-OCT-2009 EFF FILE : W154.CNF;98 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	829.000	821.662	6.000	2.4495	100.0000	2.88E+00	4.40E-01	5.05E-02	2.00E-02	1.99E-01
U232	5302.100	1330.000	1327.000	3.000	1.7321	100.0000	4.66E+00	6.83E-01	3.88E-02	1.42E-02	2.51E-01
U-235	4391.000	37.000	37.000	0.000	0.0000	80.90000	1.61E-01	5.62E-02	1.30E-02	0.00E+00	5.17E-02
U-238	4184.730	762.000	760.000	2.000	1.4142	100.0000	2.67E+00	4.10E-01	3.36E-02	1.16E-02	1.90E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



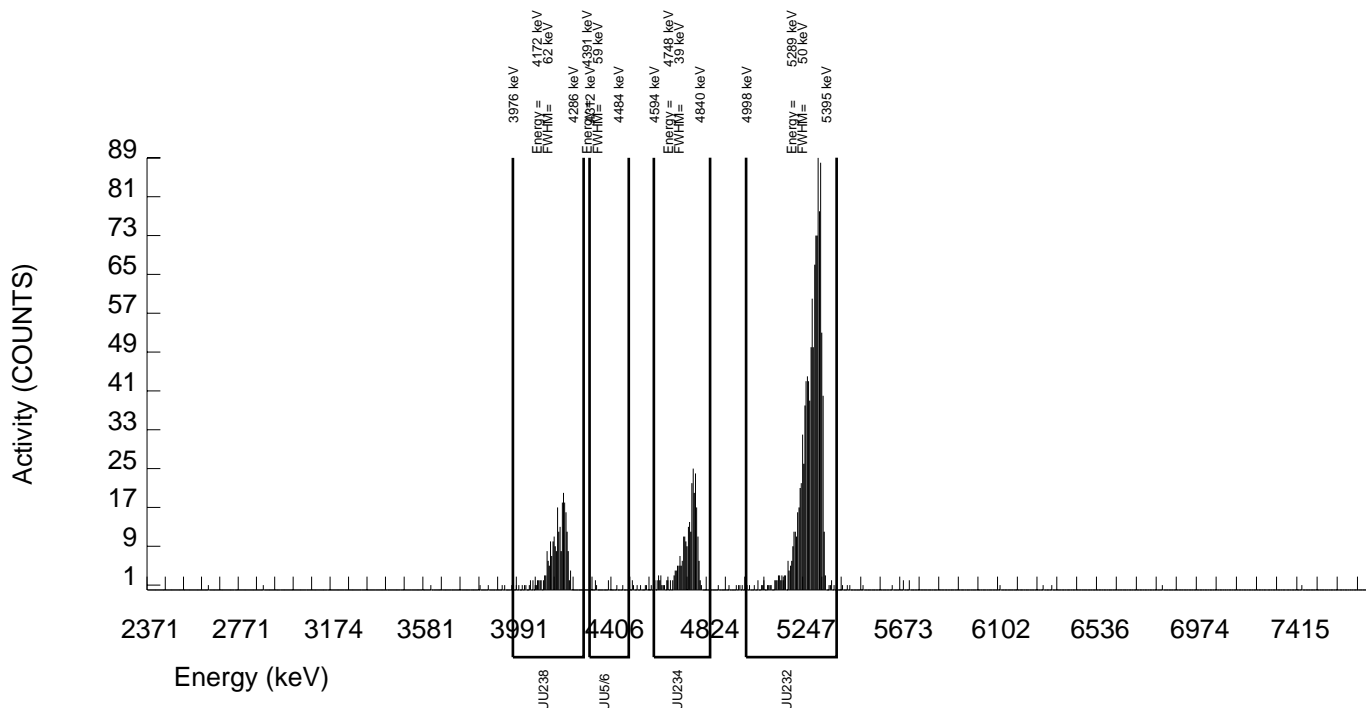
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521011_UU SAMPLE QTY: 0.500 G	
DETECTOR NUMBER :75553 AVERAGE %EFFICIENCY :25.8645 % YIELD : 86.245		COUNT DATE:10-OCT-2009 15:32:41 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.038E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.038E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 4.53370 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B155.CNF;357 BKG DATE : 4-OCT-2009 EFF FILE : W155.CNF;107 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	270.000	265.819	3.000	1.7321	100.0000	1.07E+00	1.97E-01	4.47E-02	1.63E-02	1.31E-01
U232	5302.100	1185.000	1172.000	13.000	3.6056	100.0000	4.74E+00	7.08E-01	7.99E-02	3.39E-02	2.74E-01
U-235	4391.000	7.000	7.000	0.000	0.0000	80.90000	3.49E-02	2.63E-02	1.50E-02	0.00E+00	2.59E-02
U-238	4184.730	252.000	249.000	3.000	1.7321	100.0000	1.01E+00	1.88E-01	4.47E-02	1.63E-02	1.26E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129  
SAMPLE DATE : 21-SEP-2009 00:00:00

SAMPLE ID : S0237521012\_UU  
SAMPLE QTY: 0.509 G

DETECTOR NUMBER :75554  
AVERAGE %EFFICIENCY :24.5835  
% YIELD : 100.184

COUNT DATE:10-OCT-2009 15:32:43  
ELAPSED LIVE TIME(SEC): 60000.00  
ANALYST :CXM2

MS/MSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/G : 4.949E+00

LCS/LCSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/G : 4.949E+00

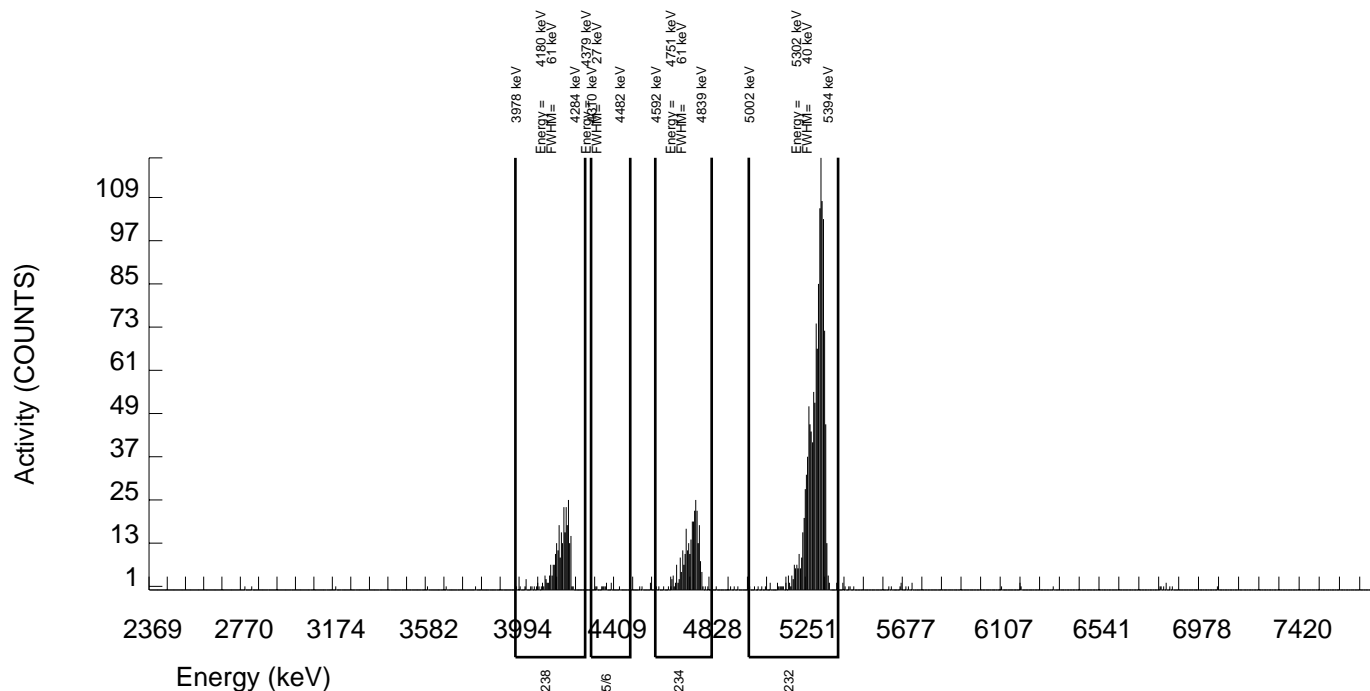
TRACER  
ID : 1283-E  
ISOTOPE : U232  
NOMINAL : 5.25679 dpm  
RESULTS : 5.26647 dpm

LIB FILE : ENV\_ALPHA\_UU.N  
BKG FILE : B156.CNF;358  
BKG DATE : 4-OCT-2009  
EFF FILE : W156.CNF;111  
CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	289.000	279.696	8.000	2.8284	100.0000	1.01E+00	1.83E-01	5.81E-02	2.36E-02	1.21E-01
U232	5302.100	1305.000	1294.000	11.000	3.3166	100.0000	4.65E+00	6.85E-01	6.63E-02	2.77E-02	2.56E-01
U-235	4391.000	11.000	9.000	2.000	1.4142	80.90000	4.00E-02	3.19E-02	4.26E-02	1.46E-02	3.14E-02
U-238	4184.730	282.000	280.000	2.000	1.4142	100.0000	1.01E+00	1.82E-01	3.44E-02	1.18E-02	1.19E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



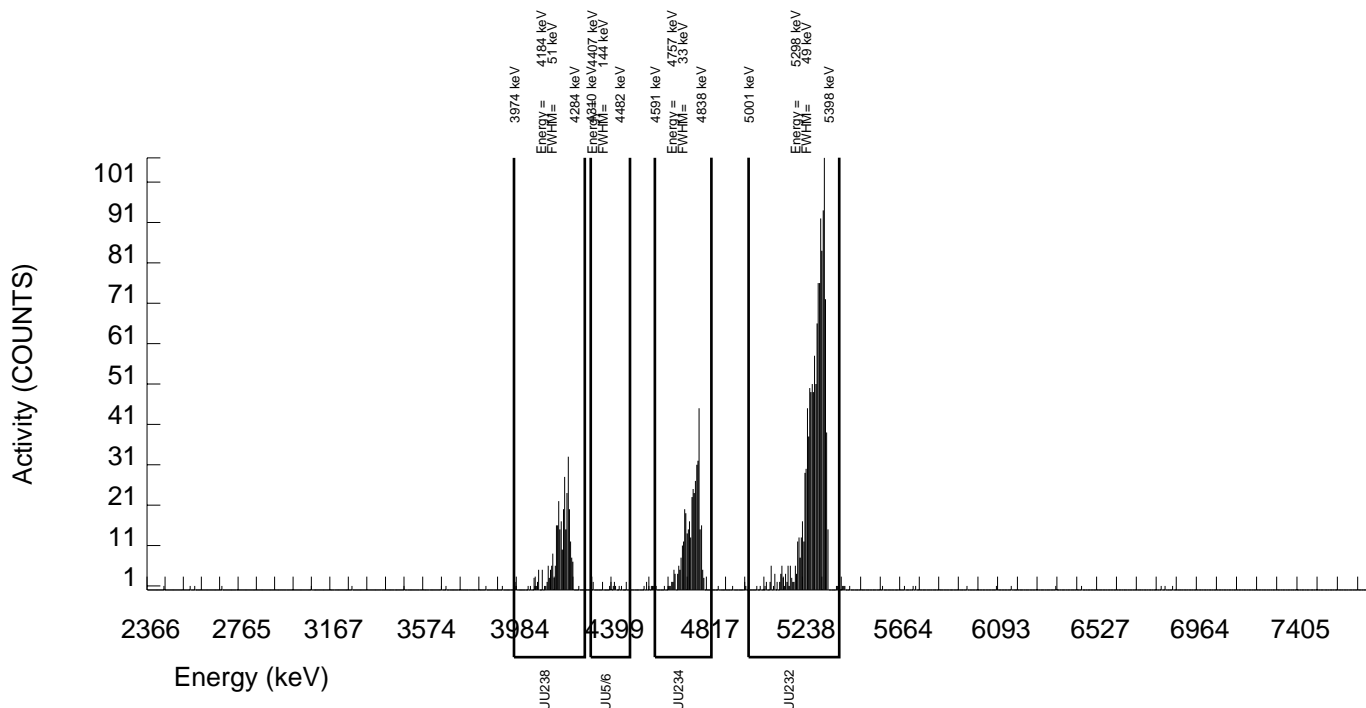
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521013_UU SAMPLE QTY: 0.502 G	
DETECTOR NUMBER :75555 AVERAGE %EFFICIENCY :24.7420 % YIELD : 100.850		COUNT DATE:10-OCT-2009 15:32:45 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 5.30147 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B157.CNF;358 BKG DATE : 4-OCT-2009 EFF FILE : W157.CNF;101 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	411.000	400.678	9.000	3.0000	100.0000	1.44E+00	2.44E-01	6.10E-02	2.51E-02	1.44E-01
U232	5302.100	1321.000	1311.000	10.000	3.1623	100.0000	4.72E+00	6.93E-01	6.37E-02	2.65E-02	2.57E-01
U-235	4391.000	15.000	12.000	3.000	1.7321	80.90000	5.33E-02	3.77E-02	4.92E-02	1.79E-02	3.70E-02
U-238	4184.730	328.000	322.000	6.000	2.4495	100.0000	1.16E+00	2.04E-01	5.18E-02	2.05E-02	1.29E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



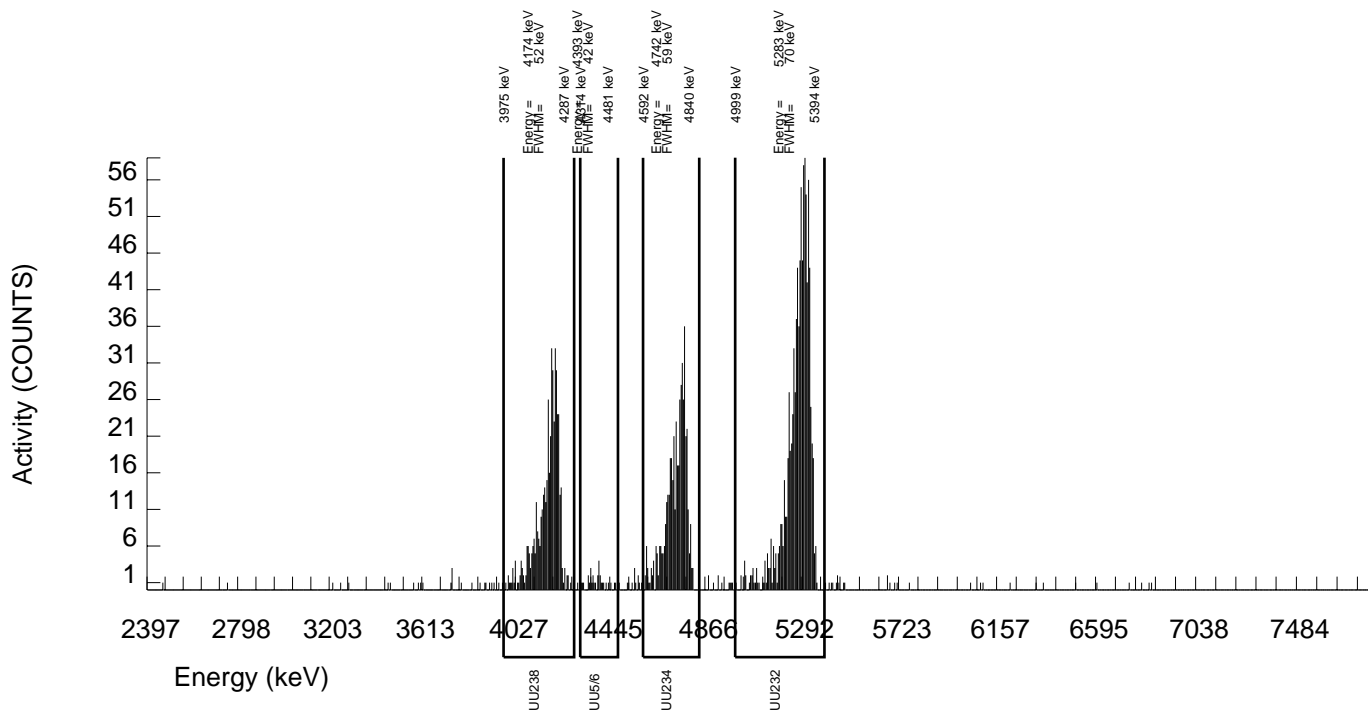
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521014_UU SAMPLE QTY: 0.505 G	
DETECTOR NUMBER :33451 AVERAGE %EFFICIENCY :24.9380 % YIELD : 72.200		COUNT DATE:10-OCT-2009 15:32:47 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 3.79541 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B158.CNF;359 BKG DATE : 4-OCT-2009 EFF FILE : W158.CNF;104 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	475.000	471.046	3.000	1.7321	100.0000	2.33E+00	3.91E-01	5.48E-02	2.00E-02	2.12E-01
U232	5302.100	953.000	946.000	7.000	2.6458	100.0000	4.69E+00	7.24E-01	7.59E-02	3.05E-02	3.01E-01
U-235	4391.000	30.000	30.000	0.000	0.0000	80.90000	1.84E-01	7.06E-02	1.84E-02	0.00E+00	6.57E-02
U-238	4184.730	481.000	480.000	1.000	1.0000	100.0000	2.38E+00	3.96E-01	3.79E-02	1.15E-02	2.13E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



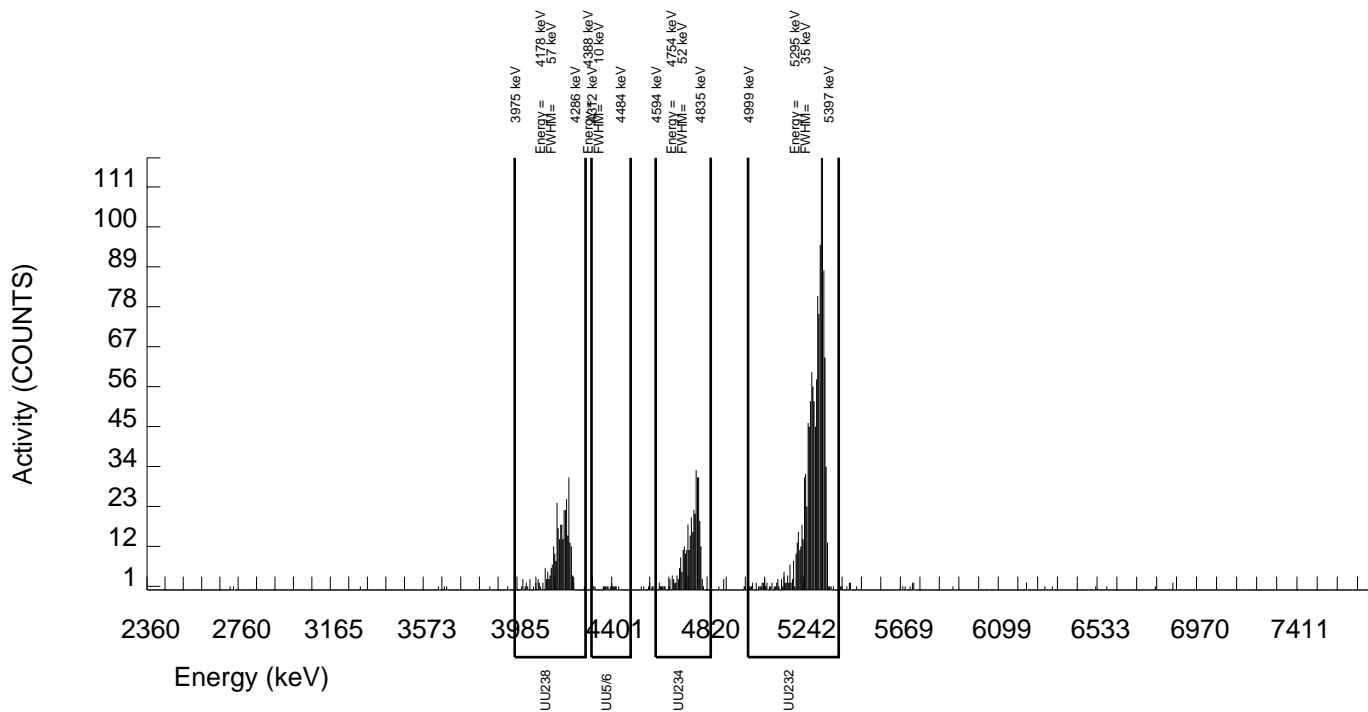
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521015_UU SAMPLE QTY: 0.504 G	
DETECTOR NUMBER :76225 AVERAGE %EFFICIENCY :25.0830 % YIELD : 101.528		COUNT DATE:10-OCT-2009 15:32:50 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.998E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.998E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 5.33710 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B159.CNF;332 BKG DATE : 4-OCT-2009 EFF FILE : W159.CNF;96 CAL DATE : 15-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	346.000	334.651	10.000	3.1623	100.0000	1.17E+00	2.06E-01	6.22E-02	2.58E-02	1.30E-01
U232	5302.100	1359.000	1338.000	21.000	4.5826	100.0000	4.70E+00	6.90E-01	8.54E-02	3.74E-02	2.56E-01
U-235	4391.000	16.000	13.000	3.000	1.7321	80.90000	5.64E-02	3.79E-02	4.80E-02	1.75E-02	3.71E-02
U-238	4184.730	339.000	336.000	3.000	1.7321	100.0000	1.18E+00	2.05E-01	3.88E-02	1.41E-02	1.27E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



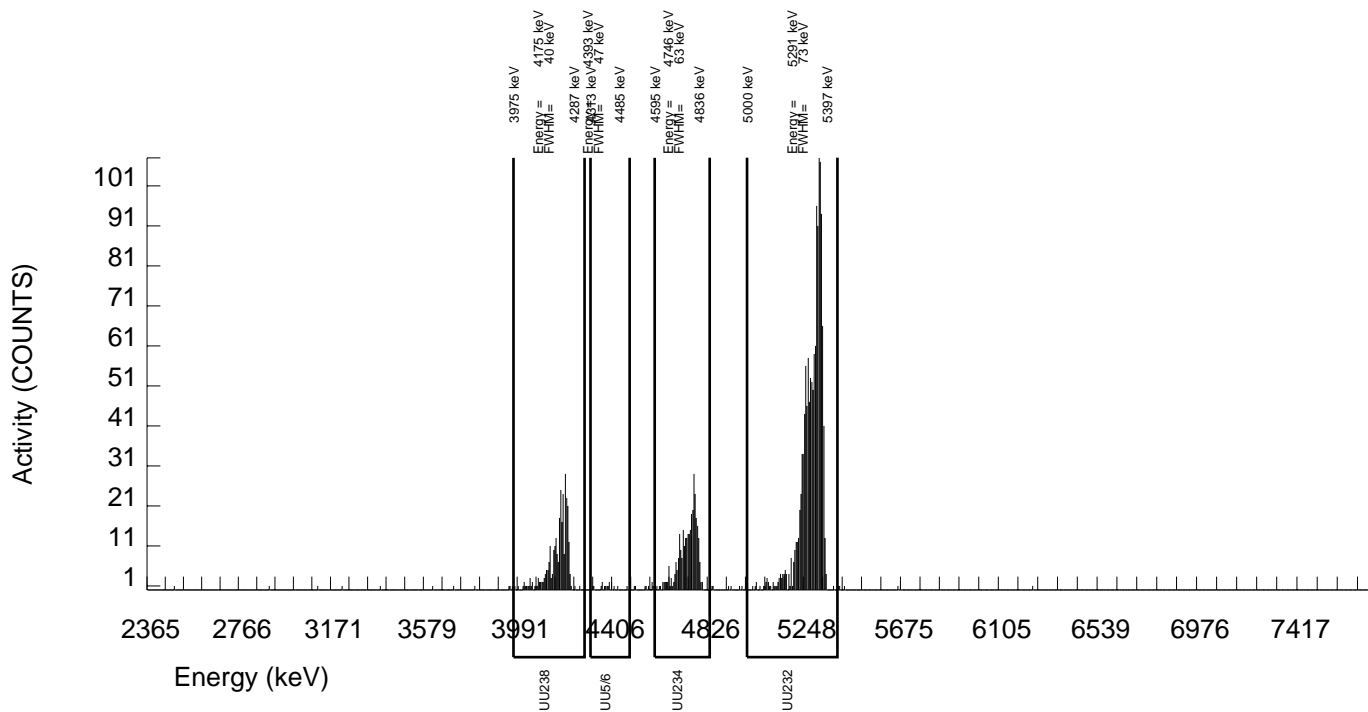
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521016_UU SAMPLE QTY: 0.505 G	
DETECTOR NUMBER :79994 AVERAGE %EFFICIENCY :24.4465 % YIELD : 106.974		COUNT DATE:10-OCT-2009 15:32:52 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.988E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 5.62341 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B160.CNF;334 BKG DATE : 4-OCT-2009 EFF FILE : W160.CNF;108 CAL DATE : 29-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	328.000	321.615	5.000	2.2361	100.0000	1.10E+00	1.92E-01	4.57E-02	1.77E-02	1.22E-01
U232	5302.100	1378.000	1374.000	4.000	2.0000	100.0000	4.69E+00	6.84E-01	4.20E-02	1.59E-02	2.49E-01
U-235	4391.000	16.000	14.000	2.000	1.4142	80.90000	5.90E-02	3.60E-02	4.04E-02	1.39E-02	3.51E-02
U-238	4184.730	307.000	303.000	4.000	2.0000	100.0000	1.03E+00	1.83E-01	4.20E-02	1.59E-02	1.18E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity





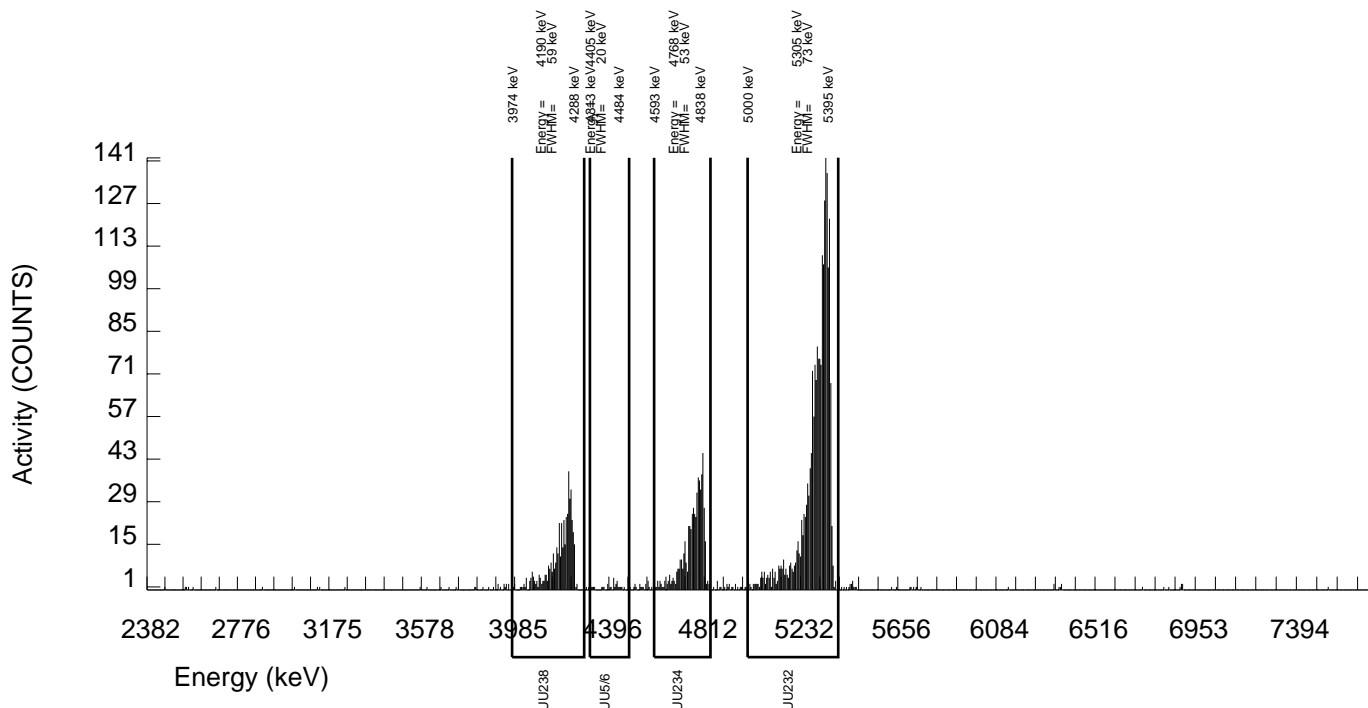
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521017_UU SAMPLE QTY: 0.508 G	
DETECTOR NUMBER :70321 AVERAGE %EFFICIENCY :36.8913 % YIELD : 104.990		COUNT DATE:10-OCT-2009 15:22:21 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.958E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.958E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 5.51911 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B161.CNF;130 BKG DATE : 4-OCT-2009 EFF FILE : W161.CNF;46 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	566.000	555.949	8.000	2.8284	100.0000	1.27E+00	2.00E-01	3.70E-02	1.51E-02	1.07E-01
U232	5302.100	2043.000	2035.000	8.000	2.8284	100.0000	4.66E+00	6.49E-01	3.70E-02	1.51E-02	2.03E-01
U-235	4391.000	27.000	25.000	2.000	1.4142	80.90000	7.07E-02	3.13E-02	2.71E-02	9.31E-03	2.99E-02
U-238	4184.730	468.000	466.000	2.000	1.4142	100.0000	1.07E+00	1.71E-01	2.19E-02	7.53E-03	9.73E-02

NOTE: Corrections made to U-3/4 net area due to tracer impurity



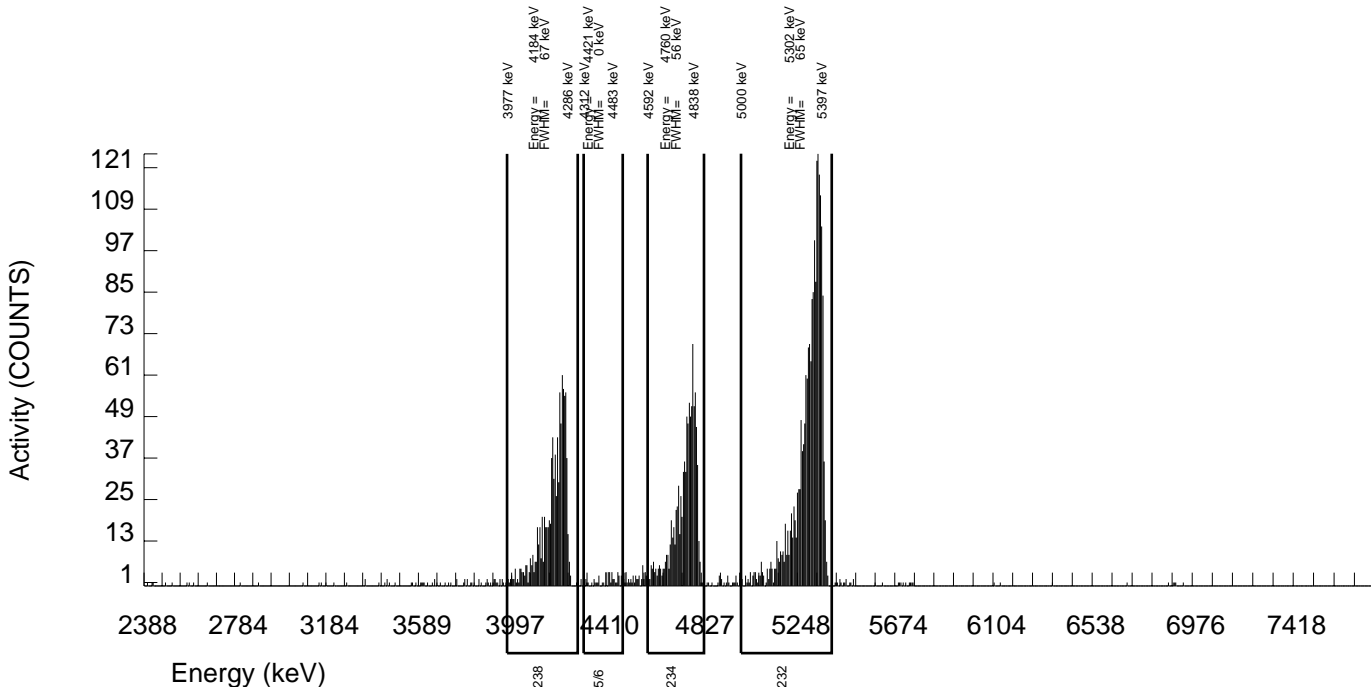
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521018_UU SAMPLE QTY: 0.503 G	
DETECTOR NUMBER :70324 AVERAGE %EFFICIENCY :37.8481 % YIELD : 98.665		COUNT DATE:10-OCT-2009 15:22:26 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.008E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.008E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 5.18661 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B163.CNF;133 BKG DATE : 4-OCT-2009 EFF FILE : W163.CNF;43 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	939.000	930.022	7.000	2.6458	100.0000	2.23E+00	3.29E-01	3.67E-02	1.48E-02	1.44E-01
U232	5302.100	1981.000	1962.000	19.000	4.3589	100.0000	4.71E+00	6.58E-01	5.59E-02	2.43E-02	2.10E-01
U-235	4391.000	48.000	41.000	7.000	2.6458	80.90000	1.22E-01	4.60E-02	4.54E-02	1.82E-02	4.31E-02
U-238	4184.730	936.000	926.000	10.000	3.1623	100.0000	2.22E+00	3.28E-01	4.25E-02	1.76E-02	1.45E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



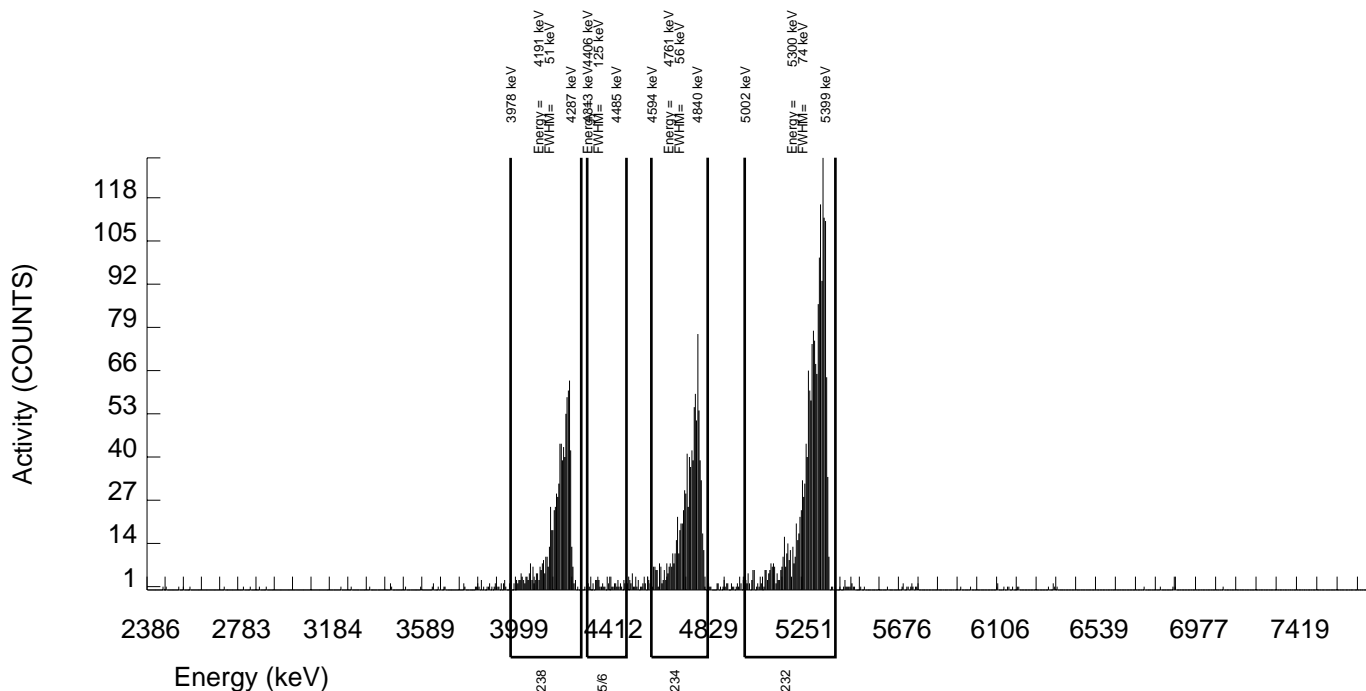
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521019_UU SAMPLE QTY: 0.516 G	
DETECTOR NUMBER :70325 AVERAGE %EFFICIENCY :37.9160 % YIELD : 94.523		COUNT DATE:10-OCT-2009 15:22:29 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.882E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.882E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 4.96886 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B164.CNF;130 BKG DATE : 4-OCT-2009 EFF FILE : W164.CNF;43 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	939.000	930.102	7.000	2.6458	100.0000	2.27E+00	3.35E-01	3.73E-02	1.50E-02	1.47E-01
U232	5302.100	1914.000	1883.000	31.000	5.5678	100.0000	4.59E+00	6.45E-01	7.04E-02	3.16E-02	2.11E-01
U-235	4391.000	53.000	50.000	3.000	1.7321	80.90000	1.51E-01	4.85E-02	3.33E-02	1.21E-02	4.42E-02
U-238	4184.730	870.000	861.000	9.000	3.0000	100.0000	2.10E+00	3.12E-01	4.13E-02	1.70E-02	1.42E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



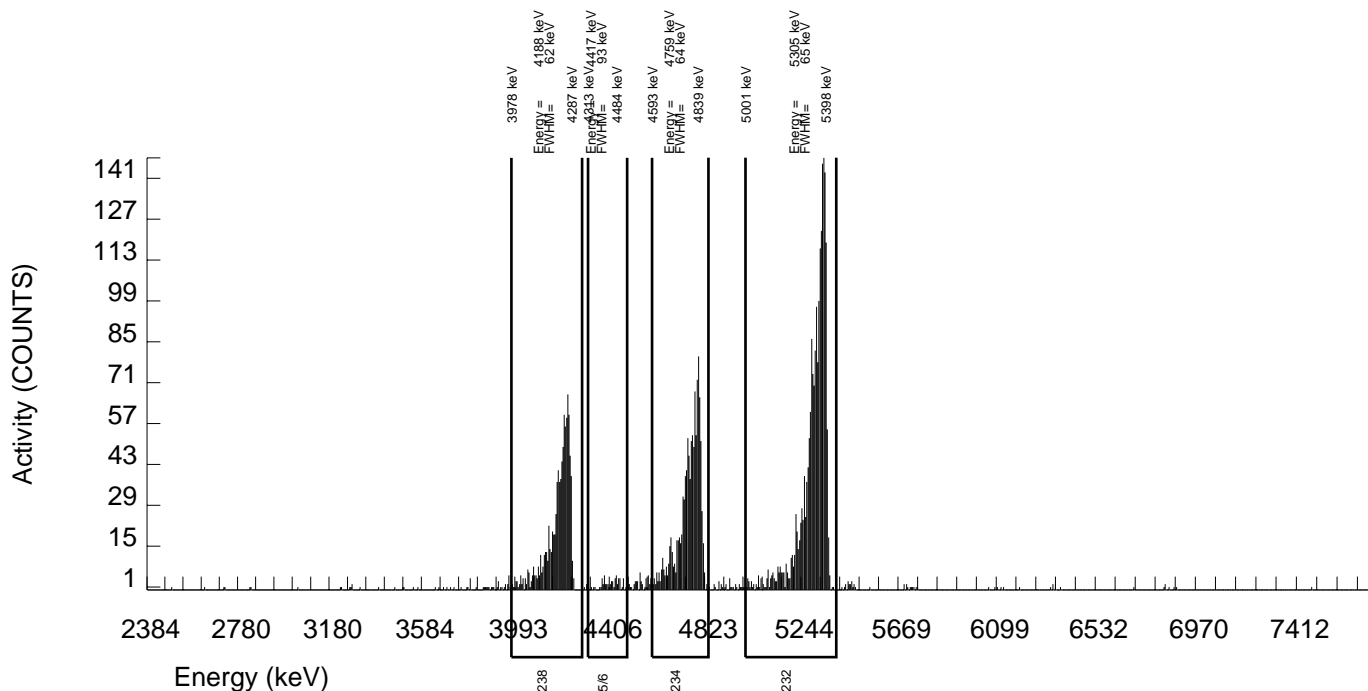
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 21-SEP-2009 00:00:00		SAMPLE ID : S0237521020_UU SAMPLE QTY: 0.502 G	
DETECTOR NUMBER :72546 AVERAGE %EFFICIENCY :38.7178 % YIELD : 100.382		COUNT DATE:10-OCT-2009 15:22:36 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.018E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25679 dpm RESULTS : 5.27685 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B167.CNF;131 BKG DATE : 4-OCT-2009 EFF FILE : W167.CNF;43 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	1116.000	1108.941	5.000	2.2361	100.0000	2.56E+00	3.70E-01	3.09E-02	1.20E-02	1.51E-01
U232	5302.100	2051.000	2042.000	9.000	3.0000	100.0000	4.72E+00	6.56E-01	3.92E-02	1.61E-02	2.05E-01
U-235	4391.000	59.000	56.000	3.000	1.7321	80.90000	1.60E-01	4.88E-02	3.16E-02	1.15E-02	4.40E-02
U-238	4184.730	943.000	939.000	4.000	2.0000	100.0000	2.17E+00	3.18E-01	2.84E-02	1.07E-02	1.39E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129  
SAMPLE DATE : 5-OCT-2009 00:00:00.

SAMPLE ID : S1201939568\_UU  
SAMPLE QTY: 0.517 G

DETECTOR NUMBER :72547  
AVERAGE %EFFICIENCY :38.9592  
% YIELD : 93.116

COUNT DATE:10-OCT-2009 15:22:39  
ELAPSED LIVE TIME(SEC): 60000.00  
ANALYST :CXM2

MS/MSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/G : 4.872E+00

LCS/LCSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/G : 4.872E+00

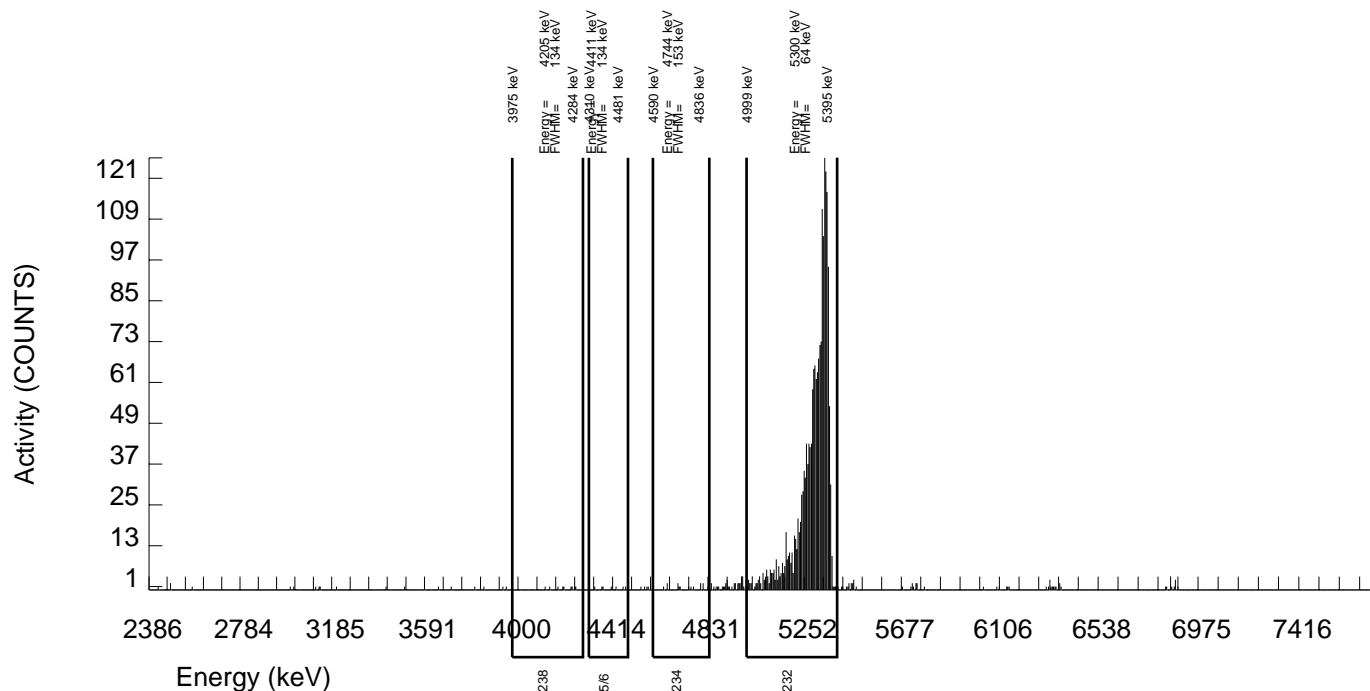
TRACER  
ID : 1283-E  
ISOTOPE : U232  
NOMINAL : 5.25485 dpm  
RESULTS : 4.89308 dpm

LIB FILE : ENV\_ALPHA\_UU.N  
BKG FILE : B168.CNF;131  
BKG DATE : 4-OCT-2009  
EFF FILE : W168.CNF;43  
CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	15.000	6.079	7.000	2.6458	100.0000	1.46E-02	2.12E-02	3.68E-02	1.48E-02	2.11E-02
U232	5302.100	1933.000	1906.000	27.000	5.1962	100.0000	4.58E+00	6.42E-01	6.53E-02	2.90E-02	2.08E-01
U-235	4391.000	7.000	6.000	1.000	1.0000	80.90000	1.78E-02	1.66E-02	2.27E-02	6.91E-03	1.65E-02
U-238	4184.730	9.000	1.000	8.000	2.8284	100.0000	2.40E-03	1.94E-02	3.88E-02	1.58E-02	1.94E-02

NOTE: Corrections made to U-3/4 net area due to tracer impurity



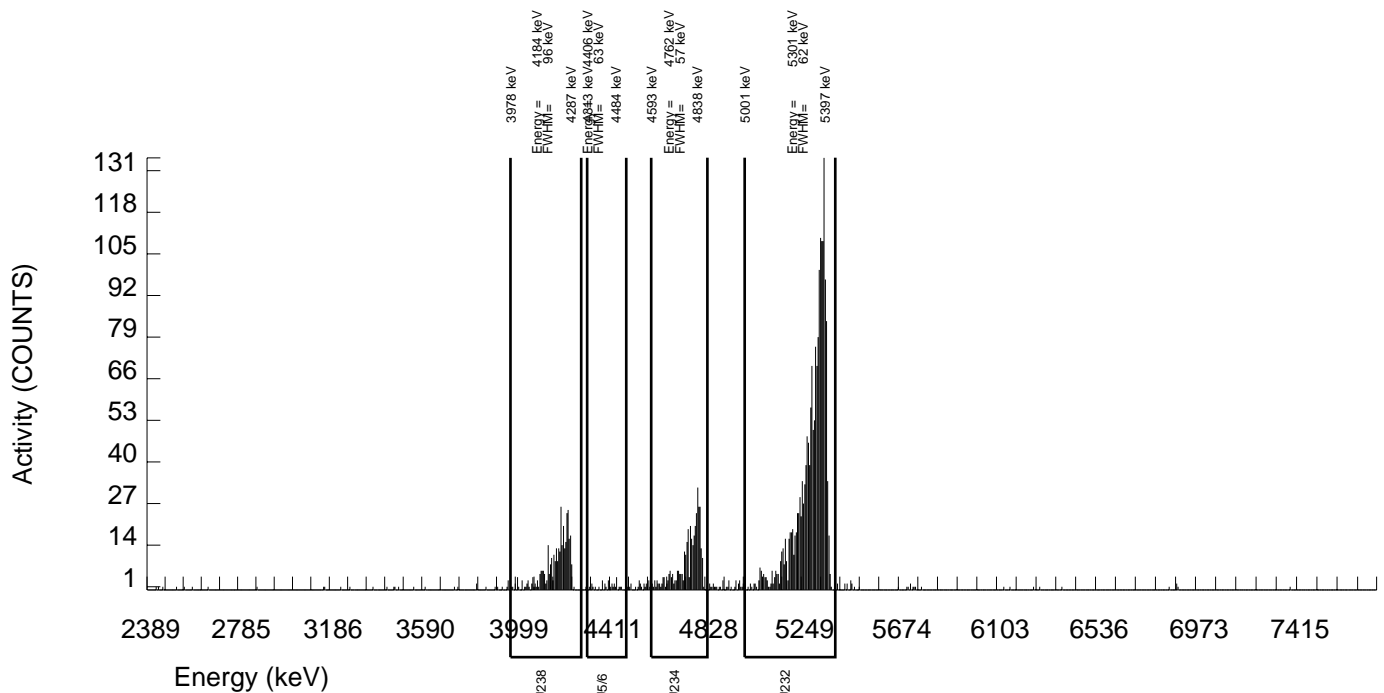
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S1201939569_UU SAMPLE QTY: 0.517 G	
DETECTOR NUMBER :72548 AVERAGE %EFFICIENCY :37.4227 % YIELD : 95.057		COUNT DATE:10-OCT-2009 15:22:42 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.872E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 4.872E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 4.99731 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B169.CNF;133 BKG DATE : 4-OCT-2009 EFF FILE : W169.CNF;53 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	371.000	353.116	16.000	4.0000	100.0000	8.65E-01	1.49E-01	5.29E-02	2.28E-02	9.42E-02
U232	5302.100	1888.000	1869.000	19.000	4.3589	100.0000	4.58E+00	6.43E-01	5.71E-02	2.49E-02	2.10E-01
U-235	4391.000	30.000	28.000	2.000	1.4142	80.90000	8.48E-02	3.54E-02	2.90E-02	9.96E-03	3.36E-02
U-238	4184.730	354.000	344.000	10.000	3.1623	100.0000	8.43E-01	1.45E-01	4.34E-02	1.80E-02	9.16E-02

NOTE: Corrections made to U-3/4 net area due to tracer impurity



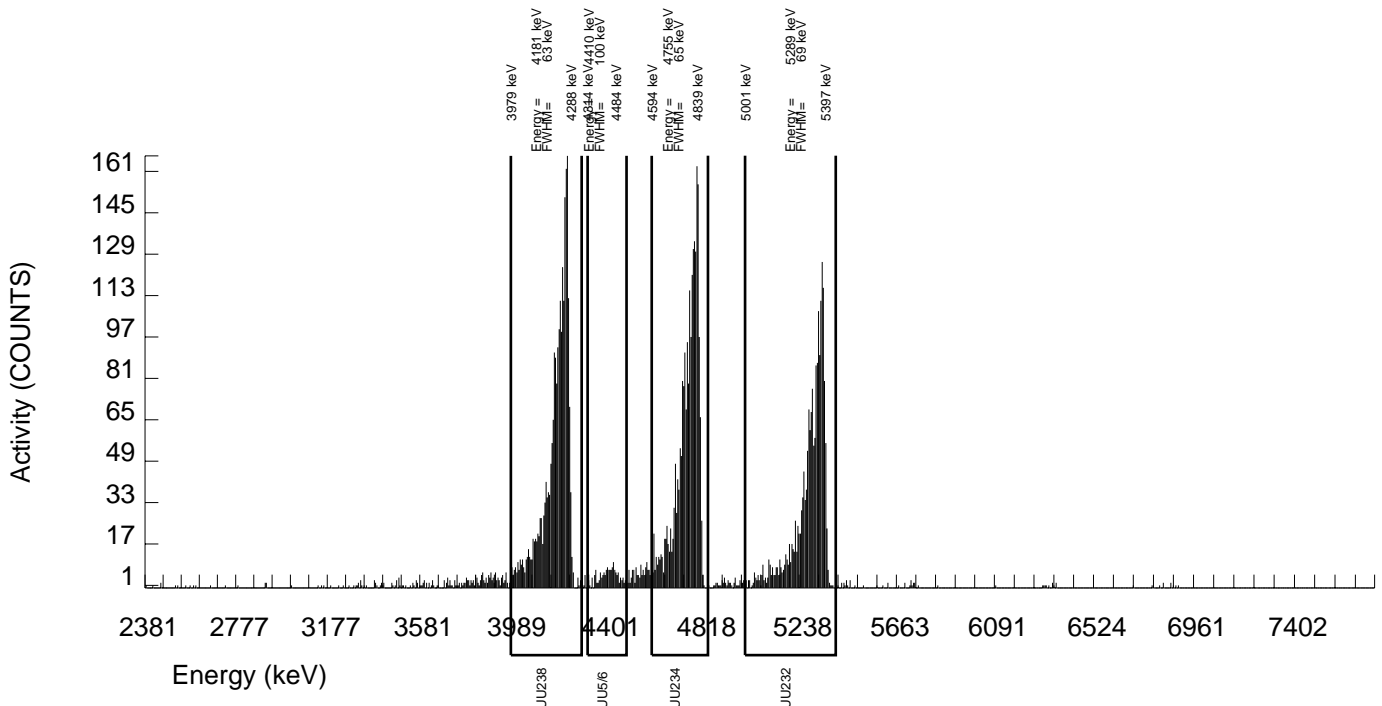
GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129 SAMPLE DATE : 18-SEP-2009 00:00:00		SAMPLE ID : S1201939570_UU SAMPLE QTY: 0.503 G	
DETECTOR NUMBER :78260 AVERAGE %EFFICIENCY :38.1061 % YIELD : 93.851		COUNT DATE:10-OCT-2009 15:22:46 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :CXM2	
MS/MSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.008E+00	LCS/LCSD ID : 1163-G ISOTOPE : U-238 PCI/G : 5.008E+00	TRACER ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25720 dpm RESULTS : 4.93396 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B171.CNF;137 BKG DATE : 4-OCT-2009 EFF FILE : W171.CNF;60 CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	2298.000	2282.106	14.000	3.7417	100.0000	5.71E+00	7.95E-01	5.11E-02	2.18E-02	2.36E-01
U232	5302.100	1900.000	1879.000	21.000	4.5826	100.0000	4.71E+00	6.61E-01	6.09E-02	2.67E-02	2.15E-01
U-235	4391.000	150.000	148.000	2.000	1.4142	80.90000	4.58E-01	9.64E-02	2.97E-02	1.02E-02	7.48E-02
U-238	4184.730	2360.000	2336.000	24.000	4.8990	100.0000	5.85E+00	8.13E-01	6.46E-02	2.85E-02	2.40E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity



GEL Laboratories LLC  
ALPHA SPECTROSCOPY REPORT

BATCH NUMBER: 909129  
SAMPLE DATE : 5-OCT-2009 00:00:00.

SAMPLE ID : S1201939571\_UU  
SAMPLE QTY: 0.517 G

DETECTOR NUMBER :78772  
AVERAGE %EFFICIENCY :38.2259  
% YIELD : 79.666

COUNT DATE:10-OCT-2009 15:22:49  
ELAPSED LIVE TIME(SEC): 60000.00  
ANALYST :CXM2

MS/MSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/G : 4.872E+00

LCS/LCSD  
ID : 1163-G  
ISOTOPE : U-238  
PCI/G : 4.872E+00

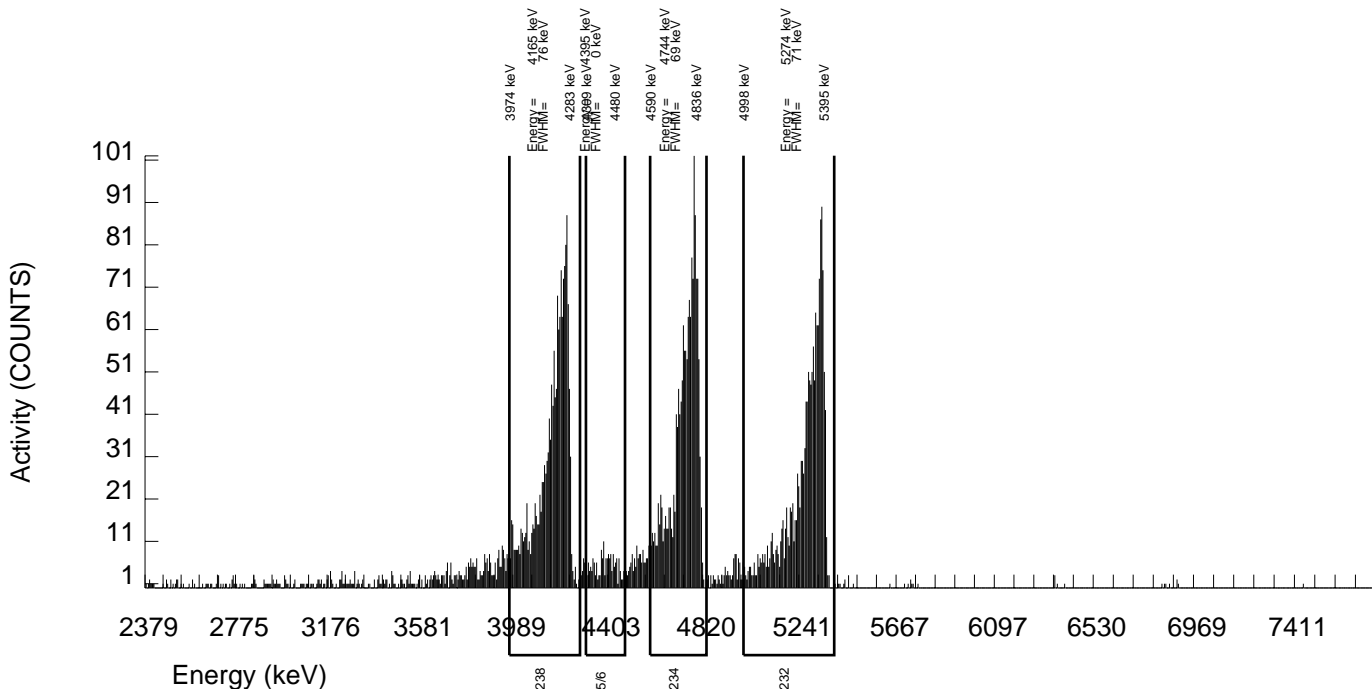
TRACER  
ID : 1283-E  
ISOTOPE : U232  
NOMINAL : 5.25485 dpm  
RESULTS : 4.18631 dpm

LIB FILE : ENV\_ALPHA\_UU.N  
BKG FILE : B172.CNF;135  
BKG DATE : 4-OCT-2009  
EFF FILE : W172.CNF;53  
CAL DATE : 21-SEP-2009

NUCLIDE ACTIVITY SUMMARY

NUCLIDE	ENERGY	GROSS AREA	NET AREA	BKG AREA	BKG Sg	%ABUN	ACTIVITY pCi/G	TPU 1.96-SIGMA	MDA pCi/G	Lc pCi/G	UNC pCi/G
U-3/4	4763.020	1618.000	1607.387	9.000	3.0000	100.0000	4.60E+00	6.56E-01	4.85E-02	2.00E-02	2.26E-01
U232	5302.100	1606.000	1600.000	6.000	2.4495	100.0000	4.58E+00	6.53E-01	4.12E-02	1.63E-02	2.25E-01
U-235	4391.000	178.000	176.000	2.000	1.4142	80.90000	6.22E-01	1.25E-01	3.39E-02	1.16E-02	9.30E-02
U-238	4184.730	1665.000	1661.000	4.000	2.0000	100.0000	4.75E+00	6.77E-01	3.52E-02	1.33E-02	2.29E-01

NOTE: Corrections made to U-3/4 net area due to tracer impurity





# RADIUM 226

### Radiochemistry Batch Checklist, Rev 9

Batch# 911018 Product: Radium 226 Date: 10-15-09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			NA
Samples have been blank corrected (if required)			NA
If activity less 10 <sup>+</sup> MDA/ MDC, error is 150% or less of sample activity. If greater 10 <sup>+</sup> MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	✓		
Instrument source check is within limits.	✓		
Instrument bkg check is within limits.	✓		
Method RDL/ LLD has been met.			
If duplicate activities are less 5 <sup>+</sup> MDA/ MDC, then RPD is 100% or less. If greater 5 <sup>+</sup> MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%.	✓		
Or meets the client's required RER acceptance criteria.			
Tracer yield is 15-125% . Carrier yield 25-125%.			NA
Or meets the client's contract acceptance criteria.			
Method blank is less than the RDL/ LLD. (If rad samples, < 5% of lowest activity)	✓		
Sample was run within hold time.	✓		
Sample was correctly preserved if required.			NA
Smears Taken for Radioactive batches.			NA
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	✓		
No blank spaces on data forms.			
All line outs initialed and dated.	✓		
No transcription errors are apparent.			
Aux data is correct.			NA
Client Special requirements page has been checked.	✓		
Raw Data and/ or spectrum are included and properly stashed.	✓		
QC data entered into QC database and batch is in REVW	✓		
Hit notification complete (if necessary)			NA
Batch entered into Case Narrative.	✓		
Batch non-conformances completed, if applicable.			NCR 746679
Batch non-conformances second reviewed and disposition verified to be completed.	✓		GEL 746679
Allquot Correction completed if required.			NA
Review sample historical results if available (If REMP, results above MDC have been verified by historical results, recount or re-analysis.)	✓		

GEL Laboratories, LLC

revised 8/1/08

Primary Review Performed By: JM

Secondary Review Performed By: Lyette Yu 10/16/09

KERR 10-20-09

# Radium-226 Que Sheet

12-OCT-09

GEL Laboratories, Radiochemistry Division

Batch #: 911018      Analyst: KSD1      First Client Due Date: 10/20/2009      Internal Due Date: 10/09/2009  
 Spike Isotope: Radium-226      Expiration Date: 11/11/10      Vol: 1  
 LCS Isotope: Radium-226      Expiration Date: 11/11/10      Vol: 1  
 Bkg Count Time: 30 (Min)      Sample Count Time: 30 (Min)      Start Count Date: 10/15/09  
 Pipet ID: 1011104      Balance ID: 5104803      Initials: VD      Witness: 738 10/12/09

Sample I	Client Description	Hazard Code	Type	Matrix	Min CRDL	Client	Position (Label)	Aliquot (mL or g)	End LN De-em Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
237521010-1	EB091809-SO1		SAMPLE	WATER	1 pCi/L	KERR003	1	500	0510	0825	104	1	8	11
237822006-1	EB092309-SO1A4		SAMPLE	WATER	1 pCi/L	KERR003	2	500	0510	0825	203	2	8	32
237941008-1	EB092509-SO1A2		SAMPLE	WATER	1 pCi/L	KERR003	3	500	0510	0825	303	3	8	14
237941009-1	EB092509-SO2A4		SAMPLE	WATER	1 pCi/L	KERR003	4	500	0510	0825	410	4	8	16
237941019-1	EB092809-SO2A4		SAMPLE	WATER	1 pCi/L	KERR003	5	500	0510	0825	502	5	2	27
238030010-1	EB092809-SO1A4		SAMPLE	WATER	1 pCi/L	KERR003	6	500	0510	0825	611	6	8	14
238030020-1	EB092909-SO1A4		SAMPLE	WATER	1 pCi/L	KERR003	7	500	0510	0825	701	7	3	10
238055012-1	EB092909-SO2A4		SAMPLE	WATER	1 pCi/L	KERR003	8	500	0550	0915	106	1	8	21
238199019-1	EB093009-SO1A4		SAMPLE	WATER	1 pCi/L	KERR003	9	500	0550	0915	202	2	8	27
238405013-1	EB100509-SO1A4		SAMPLE	WATER	1 pCi/L	KERR003	10	500	0550	0915	305	3	8	24
238405019-1	EB100609-SO1A4		SAMPLE	WATER	1 pCi/L	KERR003	11	500	0550	0915	404	4	8	14
1201943894-1	MB for batch 911018		MB	WATER	1 pCi/L	QC ACCOUNT	12	500	0550	0915	503	5	3	13
1201943895-1	LCS for batch 911018		LCS	WATER	1 pCi/L	QC ACCOUNT	13	500	0550	0915	607	6	8	20
1201943896-1	LCS for batch 911018		LCS	WATER	1 pCi/L	QC ACCOUNT	14	500	0550	0915	704	7	1	20
							15	500	0620	0915	102	1	8	526
								1011104						

dailies ✓

Comments: VD 10/12/09  
 Data Reviewed By: JW 17  
 10-15-09

# Radium-226 Liquid

Filename : RA226.XLS  
 File type : Excel  
 Version # : 1.2.4

Pipet, 0.1 ml Stdev : +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev : +/- 0.002564 ml  
 Pipet, 1 ml Stdev : +/- 0.005480 ml

Spike S/N : N/A  
 Spike Exp Date : N/A  
 Spike Activity (dpm/ml) : N/A  
 Spike Volume Added: N/A

Batch : 911018  
 Analyst : KSD1  
 Prep Date : 10/12/2009  
 Ra-226 Abundance : 1  
 Ra-226 Method Uncertainty : 0.0918

Procedure Code : LUC26RAL  
 Parmname : Radium-226  
 Required MDA : 1 pCi/L  
 Half-life of Ra-226 : 1600 years  
 Half-life of Rn-222 : 3.823 days  
 Batch counted on : LUCAS CELL DETECTOR  
 BKG Count time : 30 min

LCS S/N : 0638-H  
 LCS Exp Date : 7/17/2010  
 LCS Activity (dpm/ml) : 268.22  
 LCS Volume Added: 0.10

Pos.	Sample Characteristics		Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Count Raw Data			Weekly Background			Detector Efficiency (cpm/dpm)
	Sample ID	Sample Aliquot L				Cell Number	Time (min.)	Gross Counts	CPM	Counts	CPM	
1	237521010.1	0.5000	2.0256E-05	9/18/2009 13:12	104	30	11	0.367	8	0.267	30	1.9720
2	237822006.1	0.5000	2.0256E-05	9/23/2009 13:35	203	30	32	1.067	8	0.267	30	2.2540
3	237941008.1	0.5000	2.0256E-05	9/25/2009 8:05	303	30	14	0.467	8	0.267	30	2.1360
4	237941009.1	0.5000	2.0256E-05	9/25/2009 11:55	410	30	16	0.533	8	0.267	30	1.8860
5	237941019.1	0.5000	2.0256E-05	9/28/2009 12:25	502	30	27	0.900	2	0.067	30	1.8780
6	238030010.1	0.5000	2.0256E-05	9/28/2009 9:22	611	30	16	0.533	8	0.267	30	2.3070
7	238030020.1	0.5000	2.0256E-05	9/29/2009 11:05	701	30	10	0.333	3	0.100	30	2.1070
8	238055012.1	0.5000	2.0256E-05	9/29/2009 6:48	106	30	21	0.700	8	0.267	30	1.8360
9	238055022.1	0.5000	2.0256E-05	9/30/2009 11:38	202	30	27	0.900	8	0.267	30	2.2610
10	238199019.1	0.5000	2.0256E-05	10/2/2009 9:26	305	30	24	0.800	8	0.267	30	2.0570
11	238405013.1	0.5000	2.0256E-05	10/5/2009 12:55	404	30	18	0.600	8	0.267	30	1.9310
12	238405019.1	0.5000	2.0256E-05	10/6/2009 12:50	503	30	13	0.433	3	0.100	30	1.6010
13	1201943894.1	0.5000	2.0256E-05	10/12/2009 0:00	607	30	20	0.667	8	0.267	30	2.4500
14	1201943895.1	0.5000	2.0256E-05	10/12/2009 0:00	704	30	643	21.433	1	0.033	30	2.2350
15	1201943896.1	0.5000	2.0256E-05	10/12/2009 0:00	102	30	526	17.533	8	0.267	30	1.8550

Detector Efficiency Error (opm/dpm)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow		Count Start Date/Time	Rn-222 Corrections		Ra-226 Decay	
				End Date/Time	De-Gas Date/Time		De-Gas to Ingrow	Ingrow to Count		During Count
0.05303	8/31/2009	8/31/2010	10/12/2009 16:20	10/15/2009 5:10	10/15/2009 8:25	10/15/2009 8:25	0.368	0.976	1.002	1.000
0.07722	12/19/2008	12/19/2009	10/12/2009 16:20	10/15/2009 5:10	10/15/2009 8:25	10/15/2009 8:25	0.368	0.976	1.002	1.000
0.06082	2/4/2009	2/4/2010	10/12/2009 16:20	10/15/2009 5:10	10/15/2009 8:25	10/15/2009 8:25	0.368	0.976	1.002	1.000
0.12371	3/2/2009	3/2/2010	10/12/2009 16:20	10/15/2009 5:10	10/15/2009 8:25	10/15/2009 8:25	0.368	0.976	1.002	1.000
0.14377	3/25/2009	3/25/2010	10/12/2009 16:20	10/15/2009 5:10	10/15/2009 8:25	10/15/2009 8:25	0.368	0.976	1.002	1.000
0.06605	8/4/2009	8/4/2010	10/12/2009 16:20	10/15/2009 5:10	10/15/2009 8:25	10/15/2009 8:25	0.368	0.976	1.002	1.000
0.06519	9/30/2009	9/30/2010	10/12/2009 16:20	10/15/2009 5:10	10/15/2009 8:25	10/15/2009 8:25	0.368	0.976	1.002	1.000
0.05303	8/31/2009	8/31/2010	10/12/2009 16:20	10/15/2009 5:50	10/15/2009 9:15	10/15/2009 9:15	0.372	0.975	1.002	1.000
0.07722	12/19/2008	12/19/2009	10/12/2009 16:20	10/15/2009 5:50	10/15/2009 9:15	10/15/2009 9:15	0.372	0.975	1.002	1.000
0.06082	2/4/2009	2/4/2010	10/12/2009 16:20	10/15/2009 5:50	10/15/2009 9:15	10/15/2009 9:15	0.372	0.975	1.002	1.000
0.12371	3/2/2009	3/2/2010	10/12/2009 16:20	10/15/2009 5:50	10/15/2009 9:15	10/15/2009 9:15	0.372	0.975	1.002	1.000
0.14377	3/25/2009	3/25/2010	10/12/2009 16:20	10/15/2009 5:50	10/15/2009 9:15	10/15/2009 9:15	0.372	0.975	1.002	1.000
0.06605	8/4/2009	8/4/2010	10/12/2009 16:20	10/15/2009 5:50	10/15/2009 9:15	10/15/2009 9:15	0.372	0.975	1.002	1.000
0.06519	9/30/2009	9/30/2010	10/12/2009 16:20	10/15/2009 5:50	10/15/2009 9:15	10/15/2009 9:15	0.372	0.975	1.002	1.000
0.05303	8/31/2009	8/31/2010	10/12/2009 16:20	10/15/2009 6:20	10/15/2009 9:45	10/15/2009 9:45	0.374	0.975	1.002	1.000

- Notes:  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error pCi/L	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA		Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
									Counting Uncertainty pCi/L	Total Prop. Uncertainty pCi/L						
1	0.3940	0.2782	1	0.6632	0.1268	1.4539	0.1000	0.1453	0.3612	0.3622		SAMPLE				
2	0.3447	0.2434	1	0.5978	0.8878	0.2746	0.8000	0.2108	0.4585	0.5038		SAMPLE				
3	0.3638	0.2568	1	0.6308	0.2342	0.7841	0.2000	0.1563	0.3588	0.3624		SAMPLE				
4	0.4120	0.2909	1	0.7144	0.3537	0.6247	0.2667	0.1633	0.4245	0.4377		SAMPLE				
5	0.2069	0.1461	1	0.4253	1.1099	0.2590	0.8333	0.1795	0.4686	0.5977		SAMPLE				
6	0.3368	0.2378	1	0.5840	0.2891	0.6159	0.2667	0.1633	0.3470	0.3529		SAMPLE				
7	0.2258	0.1594	1	0.4376	0.2770	0.5192	0.2333	0.1202	0.2796	0.2862		SAMPLE				
8	0.4201	0.2966	1	0.7285	0.5860	0.4176	0.4333	0.1795	0.4758	0.4912		SAMPLE				
9	0.3412	0.2409	1	0.5916	0.6955	0.3208	0.6333	0.1972	0.4245	0.4549		SAMPLE				
10	0.3750	0.2648	1	0.6502	0.6438	0.3587	0.5333	0.1886	0.4461	0.4673		SAMPLE				
11	0.3995	0.2820	1	0.6926	0.4286	0.5247	0.3333	0.1700	0.4284	0.4475		SAMPLE				
12	0.2950	0.2083	1	0.5717	0.5170	0.4251	0.3333	0.1333	0.4053	0.4406		SAMPLE				
13	0.3148	0.2223	1	0.5459	0.4054	0.4459	0.4000	0.1764	0.3504	0.3617		MB				
14	0.1220	0.0861	1	0.2834	23.7743	0.0762	21.4000	0.8459	1.8419	5.5604		LCS			24.1639	98.4%
15	0.4132	0.2917	1	0.7165	22.9655	0.0693	17.2667	0.7703	2.0080	5.1773		LCS	3.5%		24.1639	95.0%

### Radiochemistry Batch Checklist, Rev 9

Batch# 906702 Product: Ra-224 Date: 10/16/2009

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			N/A
Samples have been blank corrected (if required)			N/A
If activity less 10* MDA/ MDC, error is 150% or less of sample activity. If greater 10* MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	✓		
Instrument source check is within limits.	✓		
Instrument bkg check is within limits.	✓		
Method RDL/ LLD has been met.			
If duplicate activities are less 5* MDA/ MDC, then RPD is 100% or less. If greater 5* MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%. Or meets the client's required RER acceptance criteria.	✓		
Tracer yield is 15-125% . Carrier yield 25-125%. Or meets the client's contract acceptance criteria.	✓		
Method blank is less than the RDL/ LLD. (If rad samples, < 5% of lowest activity)	✓		
Sample was run within hold time.	✓		
Sample was correctly preserved if required.	✓		
Smears Taken for Radioactive batches.			N/A
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	✓		
No blank spaces on data forms. All line outs initialed and dated. No transcription errors are apparent.	✓		
Aux data is correct.			N/A
Client Special requirements page has been checked.	✓		
Raw Data and/ or spectrum are included and properly stated.	✓		
QC data entered into QC database and batch is in REVW	✓		
Hit notification complete (if necessary)			N/A
Batch entered into Case Narrative.	✓		
Batch non-conformances completed, if applicable.	✓		N/A NCR 747317
Batch non-conformances second reviewed and disposition verified to be completed.	✓		N/A NCR 747317
Aliquot Correction completed if required.			N/A
Review sample historical results if available (If REMP, results above MDC have been verified by historical results, recount or re-analysis.)	✓		

GEL Laboratories, LLC  
revised 8/1/08

# dmm  
10/17/09

Primary Review Performed By: Nana Marie Huff

Secondary Review Performed By: Linda 10/17/09

KEEP 10/20/2009

# Radium-226 Que Sheet

24-SEP-09

GEL Laboratories, Radiochemistry Division

Batch #: 905702

Analyst: KSD1

First Client Due Date: 10/20/2009

Internal Due Date: 10/09/2009

Spike Isotope: Radium-226 Spike Code: 0026 H

Expiration Date: 7/17/10

Vol: 0.1

End Initial/Degas Date/Time: 10/11/09 1200

LCS Isotope: Radium-226 LCS Code: 002014

Expiration Date: 7/17/10

Vol: 0.1

End LN De-em Date: 10/15/09

Bkg Count Time: 30 (Min)

Sample Count Time: 30 (Min)

Start Count Date: 10/15/09

Pipet ID: 1472202

Balance ID: 50410272

Start Count Date: 10/15/09

Witness: En 10/9/09

Initials: AB

Sample I	Client Description	Hazard Code	Type	Matrix	Min CRDL	Client	Position (Label)	Aliquot (mL or g)	End LN De-em Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
237521001-1	SA117-0.5B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	1	1.002	1570	1915	307	3	8	43
237521002-1	SA117-9B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	2	1.011	1570	1915	414	4	8	58
237521003-1	SA117-25B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	3	1.005	1570	1915	500	5	8	94
237521004-1	SA117-41B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	4	1.051	1570	1915	600	6	8	57
237521005-1	SA161-0.5B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	5	1.008	1570	1915	701	7	2	40
237521006-1	SA161-10B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	6	1.004	1545	1950	112	1	8	38
237521007-1	SA161-25B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	7	1.003	1545	1950	206	2	8	188
237521008-1	SA161009-25B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	8	1.011	1545	1950	303	3	8	168
237521009-1	SA161-37B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	9	1.067	1545	1950	411	4	8	124
237521011-1	RSAT4-0.5B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	10	1.044	1545	1950	506	5	8	53
237521012-1	RSAT4-10B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	11	1.031	1545	1950	601	6	8	61
237521013-1	RSAT4-25B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	12	1.020	1545	1950	712	7	8	69
237521014-1	RSAT4-40B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	13	1.016	1550	2025	101	1	8	98
237521015-1	RSAT4-53B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	14	1.006	1550	2025	200	2	6	36
237521016-1	SA32-0.5B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	15	1.002	1550	2025	304	3	8	33
237521017-1	SA32-9B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	16	1.042	1550	2025	400	4	8	81
237521018-1	SA32-25B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	17	1.006	1550	2025	504	5	2	110
237521019-1	SA32009-25B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	18	1.030	1605	2025	711	7	2	118
237521020-1	SA32-37B	SAMPLE	SAMPLE	SOIL	.5 pCi/g	KERR003	19	1.070	1605	2100	107	1	8	83
1201931196-1	MB for batch 905702	MB	DUP	QC ACCOUNT	.5 pCi/g	QC ACCOUNT	20	1.070	1605	2100	207	2	8	24
1201931197-1	SA117-9B(237521002DUP)	DUP	DUP	QC ACCOUNT	.5 pCi/g	QC ACCOUNT	21	1.009	1605	2150	300	3	6	45
1201931198-1	SA117-9B(237521002MS)	MS	MS	QC ACCOUNT	.5 pCi/g	QC ACCOUNT	22	1.042	1605	2150	505	5	8	785
1201931199-1	LCS for batch 905702	LCS	LCS	QC ACCOUNT	.5 pCi/g	QC ACCOUNT	23	1.070	1605	2220	708	7	8	506

\* 14 10/12/09

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Comments:

Data Reviewed By: Anna M. Mettler



# Radium-226 Solid

Filename : RA226.XLS  
 File type : Excel  
 Version # : 1.2.4

Spike S/N : 0638-H  
 Spike Exp Date : 7/17/2010  
 Spike Activity (dpm/ml) : 268.22  
 Spike Volume Added: 0.10

Pipet, 0.1 ml Stdev : +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev : +/- 0.002564 ml  
 Pipet, 1 ml Stdev : +/- 0.005480 ml

Batch : 905702

Analyst : KSD1  
 Prep Date : 10/9/2009  
 Ra-226 Abundance : 1  
 Ra-226 Method Uncertainty : 0.1153

Procedure Code : LUC26RAS  
 Parmname : Radium-226  
 Required MDA : 0.5 pCi/G  
 Half-life of Ra-226 : 1600 years  
 Half-life of Rn-222 : 3.823 days  
 Batch counted on : LUCAS CELL DETECTOR  
 BKG Count time : 30 min

Pos.	Sample Characteristics		Sample Aliquot G	Sample Aliquot StDev. G	Sample Date/Time	Counting			Weekly Background			Detector Efficiency (cpm/dpm)
	Sample ID	Sample Aliquot G				Cell Number	Time (min.)	Gross Counts	Gross CPM	Counts	CPM	
1	237521001.1	1.0020	3.3235E-03	9/18/2009 7:53	307	30	43	1.433	8	0.267	30	1.9310
2	237521002.1	1.0110	3.3245E-03	9/18/2009 8:11	409	30	56	1.867	8	0.267	30	2.0360
3	237521003.1	1.0050	3.3239E-03	9/18/2009 8:46	502	30	94	3.133	8	0.267	30	1.8780
4	237521004.1	1.0510	3.3266E-03	9/18/2009 9:51	606	30	57	1.900	8	0.267	30	2.3480
5	237521005.1	1.0080	3.3242E-03	9/18/2009 11:23	701	30	40	1.333	2	0.067	30	2.1070
6	237521006.1	1.0040	3.3238E-03	9/18/2009 11:38	112	30	38	1.267	8	0.267	30	1.9310
7	237521007.1	1.0030	3.3237E-03	9/18/2009 12:10	206	30	188	6.267	8	0.267	30	2.2590
8	237521008.1	1.0110	3.3245E-03	9/18/2009 12:10	303	30	168	5.600	8	0.267	30	2.1360
9	237521009.1	1.0670	3.3303E-03	9/18/2009 12:43	412	30	124	4.133	8	0.267	30	1.9670
10	237521011.1	1.0440	3.3279E-03	9/21/2009 7:58	506	30	53	1.767	8	0.267	30	2.0040
11	237521012.1	1.0310	3.3266E-03	9/21/2009 7:59	601	30	61	2.033	8	0.267	30	2.1810
12	237521013.1	1.0200	3.3254E-03	9/21/2009 8:24	712	30	69	2.300	2	0.067	30	2.0690
13	237521014.1	1.0160	3.3250E-03	9/21/2009 9:11	101	30	98	3.267	8	0.267	30	1.9560
14	237521015.1	1.0060	3.3240E-03	9/21/2009 9:55	210	30	36	1.200	6	0.200	30	2.2530
15	237521016.1	1.0020	3.3235E-03	9/21/2009 12:55	309	30	33	1.100	8	0.267	30	1.8770
16	237521017.1	1.0420	3.3277E-03	9/21/2009 13:12	402	30	81	2.700	8	0.267	30	2.1180
17	237521018.1	1.0060	3.3240E-03	9/21/2009 13:44	504	30	110	3.667	2	0.067	30	1.6150
18	237521019.1	1.0300	3.3265E-03	9/21/2009 13:44	711	30	118	3.933	2	0.067	30	2.2420
19	237521020.1	1.0700	3.3306E-03	9/21/2009 14:19	107	30	83	2.767	8	0.267	30	1.9810
20	1201931196.1	1.0700	3.3306E-03	10/9/2009 0:00	202	30	24	0.800	8	0.267	30	2.2610
21	1201931197.1	1.0090	3.3243E-03	9/18/2009 8:11	312	30	49	1.633	6	0.200	30	1.9440
22	1201931198.1	1.0420	3.3277E-03	9/18/2009 8:11	505	30	785	26.167	8	0.267	30	2.3310
23	1201931199.1	1.0700	3.3306E-03	10/9/2009 0:00	708	30	586	19.533	8	0.267	30	2.1880

Detector Efficiency Error (cpm/dpm)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow End Date/Time	Count Start Date/Time	De-Gas to Ingrow	Rn-222 Corrections		Ra-226 Decay
							Ingrowth to Count	During Count	
0.06082	2/4/2009	2/4/2010	10/12/2009 13:00	10/15/2009 15:20	10/15/2009 19:15	0.430	0.971	1.002	1.000
0.12371	3/2/2009	3/2/2010	10/12/2009 13:00	10/15/2009 15:20	10/15/2009 21:50	0.430	0.952	1.002	1.000
0.14377	3/25/2009	3/25/2010	10/12/2009 13:00	10/15/2009 15:20	10/15/2009 19:15	0.430	0.971	1.002	1.000
0.06605	8/4/2009	8/4/2010	10/12/2009 13:00	10/15/2009 15:20	10/15/2009 19:15	0.430	0.971	1.002	1.000
0.06519	9/30/2009	9/30/2010	10/12/2009 13:00	10/15/2009 15:20	10/15/2009 19:15	0.430	0.971	1.002	1.000
0.05303	8/31/2009	8/31/2010	10/12/2009 13:00	10/15/2009 15:45	10/15/2009 19:50	0.431	0.970	1.002	1.000
0.07722	12/19/2008	12/19/2009	10/12/2009 13:00	10/15/2009 15:45	10/15/2009 19:50	0.431	0.970	1.002	1.000
0.06082	2/4/2009	2/4/2010	10/12/2009 13:00	10/15/2009 15:45	10/15/2009 19:50	0.431	0.970	1.002	1.000
0.12371	3/2/2009	3/2/2010	10/12/2009 13:00	10/15/2009 15:45	10/15/2009 19:50	0.431	0.970	1.002	1.000
0.14377	3/25/2009	3/25/2010	10/12/2009 13:00	10/15/2009 15:45	10/15/2009 19:50	0.431	0.970	1.002	1.000
0.06605	8/4/2009	8/4/2010	10/12/2009 13:00	10/15/2009 15:45	10/15/2009 19:50	0.431	0.970	1.002	1.000
0.06519	9/30/2009	9/30/2010	10/12/2009 13:00	10/15/2009 15:45	10/15/2009 19:50	0.431	0.970	1.002	1.000
0.05303	8/31/2009	8/31/2010	10/12/2009 13:00	10/15/2009 16:15	10/15/2009 20:25	0.434	0.969	1.002	1.000
0.07722	12/19/2008	12/19/2009	10/12/2009 13:00	10/15/2009 16:15	10/15/2009 20:25	0.434	0.969	1.002	1.000
0.06082	2/4/2009	2/4/2010	10/12/2009 13:00	10/15/2009 16:15	10/15/2009 20:25	0.434	0.969	1.002	1.000
0.12371	3/2/2009	3/2/2010	10/12/2009 13:00	10/15/2009 16:15	10/15/2009 20:25	0.434	0.969	1.002	1.000
0.14377	3/25/2009	3/25/2010	10/12/2009 13:00	10/15/2009 16:15	10/15/2009 20:25	0.434	0.969	1.002	1.000
0.06519	9/30/2009	9/30/2010	10/12/2009 13:00	10/15/2009 16:15	10/15/2009 20:25	0.434	0.969	1.002	1.000
0.05303	8/31/2009	8/31/2010	10/12/2009 13:00	10/15/2009 16:45	10/15/2009 21:00	0.436	0.968	1.002	1.000
0.07722	12/19/2008	12/19/2009	10/12/2009 13:00	10/15/2009 16:45	10/15/2009 21:00	0.436	0.968	1.002	1.000
0.06082	2/4/2009	2/4/2010	10/12/2009 13:00	10/15/2009 16:45	10/15/2009 21:50	0.436	0.962	1.002	1.000
0.14377	3/25/2009	3/25/2010	10/12/2009 13:00	10/15/2009 16:45	10/15/2009 21:50	0.436	0.962	1.002	1.000
0.06519	9/30/2009	9/30/2010	10/12/2009 13:00	10/15/2009 16:45	10/15/2009 22:20	0.436	0.959	1.002	1.000

- Notes:  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch P rep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

Pos.	Decision Level pCi/G	Critical Level pCi/G	Required MDA pCi/G	MDA pCi/G	Sample Act. Conc. pCi/G	Sample Act. Error pCi/G	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/G	2 SIGMA Total Prop. Uncertainty pCi/G	Sample QC	Sample Type	RPD	RER	Nominal pCi/G	Recovery
1	0.1731	0.1222	0.5	0.3001	0.6499	0.2129	1.1667	0.2380	0.2599	0.3084		SAMPLE				
2	0.1659	0.1171	0.5	0.2876	0.8543	0.2076	1.6000	0.2667	0.2791	0.3976		SAMPLE				
3	0.1774	0.1253	0.5	0.3076	1.6370	0.1857	2.8667	0.3367	0.3768	0.7013		SAMPLE				
4	0.1357	0.0958	0.5	0.2353	0.7134	0.1773	1.6333	0.2687	0.2301	0.2957		SAMPLE				
5	0.0788	0.0557	0.5	0.1621	0.6428	0.1826	1.2667	0.2160	0.2149	0.2721		SAMPLE				
6	0.1722	0.1216	0.5	0.2986	0.5543	0.2322	1.0000	0.2261	0.2456	0.2817		SAMPLE				
7	0.1474	0.1040	0.5	0.2555	2.8459	0.1097	6.0000	0.4667	0.4338	0.8875		SAMPLE				
8	0.1546	0.1092	0.5	0.2681	2.6542	0.1029	5.3333	0.4422	0.4313	0.8039		SAMPLE				
9	0.1591	0.1123	0.5	0.2758	1.9799	0.1585	3.8667	0.3830	0.3844	0.7606		SAMPLE				
10	0.1596	0.1127	0.5	0.2767	1.7705	0.2254	1.5000	0.2603	0.2621	0.3823		SAMPLE				
11	0.1485	0.1048	0.5	0.2574	0.8444	0.1701	1.7667	0.2769	0.2594	0.3401		SAMPLE				
12	0.0791	0.0558	0.5	0.1626	1.1373	0.1417	2.2333	0.2809	0.2803	0.4072		SAMPLE				
13	0.1673	0.1181	0.5	0.2900	1.6153	0.1261	3.0000	0.3432	0.3622	0.5410		SAMPLE				
14	0.1270	0.0897	0.5	0.2266	0.4721	0.2294	1.0000	0.2160	0.1999	0.2376		SAMPLE				
15	0.1768	0.1248	0.5	0.3065	0.4741	0.2633	0.8333	0.2134	0.2380	0.2671		SAMPLE				
16	0.1506	0.1063	0.5	0.2612	1.1798	0.1789	2.4333	0.3145	0.2988	0.4922		SAMPLE				
17	0.1023	0.0722	0.5	0.2103	2.3710	0.1740	3.6000	0.3528	0.4554	0.9701		SAMPLE				
18	0.0720	0.0508	0.5	0.1480	1.7917	0.1148	3.8667	0.3651	0.3316	0.5714		SAMPLE				
19	0.1562	0.1103	0.5	0.2708	1.2567	0.1378	2.5000	0.3180	0.3133	0.4426		SAMPLE				
20	0.1368	0.0966	0.5	0.2372	0.2349	0.3619	0.5333	0.1886	0.1628	0.1749		SAMPLE				
21	0.1471	0.1038	0.5	0.2623	0.7835	0.1829	1.4333	0.2472	0.2649	0.3320		DUP	0.2679		11.5953	91.2%
22	0.1371	0.0968	0.5	0.2378	11.4332	0.1483	25.9000	0.9387	0.8122	4.2095	237521002.1	MS	8.6%		11.2916	78.4%
23	0.1428	0.1008	0.5	0.2476	8.8570	0.0777	19.2667	0.8124	0.7320	2.4136	237521002.1	LCS				

# RADIUM 228

### Radiochemistry Batch Checklist, Rev 9

Batch# 907662      Product: Rg 228      Date: 10/16/05

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			NA
Samples have been blank corrected (if required)			NA
If activity less 10* MDA/ MDC, error is 150% or less of sample activity. If greater 10* MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	✓		
Instrument source check is within limits.	✓		
Instrument bkg check is within limits.	✓		
Method RDL/ LLD has been met.	✓		
If duplicate activities are less 5* MDA/ MDC, then RPD is 100% or less. If greater 5* MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%. Or meets the client's required RER acceptance criteria.	✓		
Tracer yield is 15-125% . Carrier yield 25-125%. Or meets the client's contract acceptance criteria.	✓		
Method blank is less than the RDL/ LLD. (If rad samples, < 5% of lowest activity)	✓		
Sample was run within hold time.	✓		
Sample was correctly preserved if required.	✓		
Smears Taken for Radioactive batches.	✓		
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	✓		
No blank spaces on data forms. All line outs initialed and dated. No transcription errors are apparent.	✓		
Aux data is correct.			NA
Client Special requirements page has been checked.	✓		
Raw Data and/ or spectrum are included and properly stasured.	✓		
QC data entered into QC database and batch is in REVW	✓		
Hit notification complete (if necessary)			NA
Batch entered into Case Narrative.	✓		
Batch non-conformances completed, if applicable.			NA
Batch non-conformances second reviewed and disposition verified to be completed.			NA
Aliquot Correction completed if required.			AA
Review sample historical results if available (If REMF, results above MDC have been verified by historical results, recount or re-analysis.)	✓		

GEL Laboratories, LLC

revised 8/1/08

Primary Review Performed By:

*[Signature]*

10/20  
KERR

Secondary Review Performed By:

*[Signature]*

10/19

# Radium-228 Que Sheet

09/30/2009

Batch #: 907662    Analyst: JXC5    First Client Due Date: 10/20/2009    Internal Due Date: 09/20/2009  
 Spike Isotope: Radium-228    Spike Code: 0503-b    Expiration Date: 9-11-10    Vol: 0.1 mL  
 LCS Isotope: Radium-228    LCS Code: 0503-b    Expiration Date: 9-11-10    Vol: 0.1 mL  
 Tracer Isotope: Barium-133    Tracer Code: 011-3    Expiration Date: 2-17-10    Vol: 0.1 mL  
 Prep Date: 10-2-09    Initials: NS    Pipet ID: 2164953    Balance ID: 19350208    Ac-228 Ingrow: 10-8-09    1150  
 Ac-228 Separation Date/Time: 10-15-09 | 1000    Witness: MCB 10-2-09

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collect Date & Time	Pos. #	Vol (mL)	Det #	Ba Yield (%)	Gamma Det. #
237521001-1	SA117-05B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 07:53 AM	1	1.027	2A	100.24	
237521002-1	SA117-9B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 08:11 AM	2	1.021	2B	97.01	
237521003-1	SA117-25B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 08:46 AM	3	1.021	2C	92.23	
237521004-1	SA117-41B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 09:51 AM	4	1.020	3C	98.03	
237521005-1	SA161-05B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 11:23 AM	5	1.008	3D	90.46	
237521006-1	SA161-10B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 11:38 AM	6	1.014	4A	112.79	
237521007-1	SA161-25B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 12:10 PM	7	1.009	4C	95.79	
237521008-1	SA161009-25B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 12:10 PM	8	1.005	4D	99.46	
237521009-1	SA161-37B	SAMPLE		.5 pCi/g	SOIL	KERR003	18-SEP-09 12:43 PM	9	1.003	5A	98.51	
237521011-1	RSAT4-05B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 07:38 AM	10	1.001	5B	71.60	
237521012-1	RSAT4-10B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 07:59 AM	11	1.006	5C	101.15	
237521013-1	RSAT4-25B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 08:24 AM	12	1.013	5D	102.78	
237521014-1	RSAT4-40B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 09:11 AM	13	1.017	6A	104.92	
237521015-1	RSAT4-53B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 09:55 AM	14	1.018	6B	94.57	
237521016-1	SA32-0.5B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 12:55 PM	15	1.006	6D	107.43	
237521017-1	SA32-9B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 01:12 PM	16	1.012	7A	101.53	
237521018-1	SA32-25B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 01:44 PM	17	1.001	7B	100.34	
237521019-1	SA32009-25B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 01:44 PM	18	1.001	7D	98.64	
237521020-1	SA32-37B	SAMPLE		.5 pCi/g	SOIL	KERR003	21-SEP-09 02:19 PM	19	1.003	8A	100.10	
1201935879-1	MB for batch 907662	/MB		.5 pCi/g	SOIL	QC ACCOUNT	18-SEP-09 08:11 AM	20	1.017	1D	88.56	
1201935880-1	SA117-9B(237521002DUP)	DUP		.5 pCi/g	SOIL	QC ACCOUNT	18-SEP-09 08:11 AM	21	1.021	H6P3	74.52	
1201935881-1	SA117-9B(237521002MS)	MS		.5 pCi/g	SOIL	QC ACCOUNT	18-SEP-09 08:11 AM	22	0.119	14A	92.20	
1201935882-1	LCS for batch 907662	✓LCS		.5 pCi/g	SOIL	QC ACCOUNT	18-SEP-09 08:11 AM	23	1.027	10D	91.79	

density 10/17/09

Data Reviewed By: *[Signature]*

# Radium-228 Solid

Filename : RA228.XLS  
 File type : Excel  
 Version # : 1.2.5

Batch : 907662  
 Analyst : JXC5  
 Prep Date : 10/2/2009

Ra-228 Abundance : 1  
 Ra-228 Method Uncertainty : 0

Spike SN : 0503-B  
 Spike Exp Date : 9/11/2010  
 Spike Activity (dpm/ml): 176.90  
 Spike Volume Added: 0.10

Pipet, 0.1 ml Stdev : +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev : +/- 0.002564 ml  
 Pipet, 1 ml Stdev : +/- 0.005480 ml

LCS SN : 0503-B  
 LCS Exp Date : 9/11/2010  
 LCS Activity (dpm/ml): 176.90  
 LCS Volume Added: 0.10

Procedure Code : GFC28RAS  
 Parname : Radium-228  
 Required MDA : 0.5 pCi/G  
 Half-life of Ra-228 : 5.75 years  
 Half-life of Ac-228 : 6.13 hours

Tracer SN : 0112-J  
 Tracer Exp Date : 2/17/2010  
 Tracer Volume Added: 0.10

Sample Characteristics			Tracer Calculations				Tracer Samp.		
Pos.	Sample ID	Sample Aliquot G	Sample Aliquot StDev. G	Tracer Concentration (Ba-133 Ref.) (cpm)	Tracer Ref. Count Uncertainty (cpm)	Tracer Concentration (Ba-133 Samp.) (cpm)	Tracer Count Uncertainty (cpm)	Tracer Aliquot (mL)	Tracer Aliquot StDev. (mL)
1	237521001.1	1.0270	3.3261E-03	294.7	3.58%	295.4	3.58%	0.1	0.000701
2	237521002.1	1.0270	3.3261E-03	294.7	3.58%	285.9	3.64%	0.1	0.000701
3	237521003.1	1.0240	3.3258E-03	294.7	3.58%	271.8	3.75%	0.1	0.000701
4	237521004.1	1.0200	3.3254E-03	294.7	3.58%	288.9	3.62%	0.1	0.000701
5	237521005.1	1.0080	3.3242E-03	294.7	3.58%	266.6	3.79%	0.1	0.000701
6	237521006.1	1.0140	3.3248E-03	294.7	3.58%	332.4	3.35%	0.1	0.000701
7	237521007.1	1.0090	3.3243E-03	294.7	3.58%	282.3	3.67%	0.1	0.000701
8	237521008.1	1.0050	3.3239E-03	294.7	3.58%	293.1	3.59%	0.1	0.000701
9	237521009.1	1.0030	3.3237E-03	294.7	3.58%	290.3	3.61%	0.1	0.000701
10	237521011.1	1.0010	3.3234E-03	294.7	3.58%	211.0	4.33%	0.1	0.000701
11	237521012.1	1.0060	3.3240E-03	294.7	3.58%	298.1	3.56%	0.1	0.000701
12	237521013.1	1.0130	3.3247E-03	294.7	3.58%	302.9	3.53%	0.1	0.000701
13	237521014.1	1.0170	3.3251E-03	294.7	3.58%	309.2	3.49%	0.1	0.000701
14	237521015.1	1.0180	3.3252E-03	294.7	3.58%	278.7	3.70%	0.1	0.000701
15	237521016.1	1.0060	3.3240E-03	294.7	3.58%	316.6	3.44%	0.1	0.000701
16	237521017.1	1.0120	3.3246E-03	294.7	3.58%	299.2	3.55%	0.1	0.000701
17	237521018.1	1.0010	3.3234E-03	294.7	3.58%	295.7	3.57%	0.1	0.000701
18	237521019.1	1.0010	3.3234E-03	294.7	3.58%	290.7	3.61%	0.1	0.000701
19	237521020.1	1.0030	3.3237E-03	294.7	3.58%	295.0	3.58%	0.1	0.000701
20	1201935879.1	1.0270	3.3261E-03	294.7	3.58%	261.0	3.84%	0.1	0.000701
21	1201935880.1	1.0210	3.3255E-03	294.7	3.58%	219.6	4.23%	0.1	0.000701
22	1201935881.1	0.1190	3.2314E-03	294.7	3.58%	271.7	3.75%	0.1	0.000701
23	1201935882.1	1.0270	3.3261E-03	294.7	3.58%	270.5	3.76%	0.1	0.000701

Counting		Gross Counts		Count		Separation		Ra-228		Ac-228		Ac-228		Calculated		Sample		Calibration Data		Detector		Weekly Bkg	
Pos.	ID	Time (min.)	Alpha	Beta	Start Date/Time	End Date/Time	Time	Decay	Decay	Decay	Correction	Recovery %	Recovery Error %	Counted on	Date	Due Date	Efficiency (cpm/dpm)	Error (cpm/dpm)	Count	Time (min.)	Efficiency (cpm/dpm)	Error (cpm/dpm)	cpm
1	2A	60	13	101	10/15/2009 12:09	10/15/2009 10:00	0.991	0.783	1.058	100.24%	2.72%	PIC	7/2/2009	7/31/2010	0.6172	0.00349	0.510	1000					
2	2B	60	9	189	10/15/2009 12:09	10/15/2009 10:00	0.991	0.783	1.058	97.01%	2.74%	PIC	7/2/2009	7/31/2010	0.6167	0.00383	1.320	1000					
3	11C	460	210	631	10/15/2009 14:25	10/15/2009 10:00	0.991	0.607	1.495	92.23%	2.78%	PIC	7/2/2009	7/31/2010	0.6352	0.00816	0.729	1000					
4	3C	60	12	134	10/15/2009 12:10	10/15/2009 10:00	0.991	0.783	1.058	98.03%	2.73%	PIC	7/2/2009	7/31/2010	0.6164	0.00535	1.215	1000					
5	14A	460	88	576	10/15/2009 14:25	10/15/2009 10:00	0.991	0.607	1.495	90.46%	2.79%	PIC	7/2/2009	7/31/2010	0.6383	0.00816	0.641	1000					
6	4A	60	18	144	10/15/2009 12:10	10/15/2009 10:00	0.991	0.782	1.058	112.79%	2.64%	PIC	7/2/2009	7/31/2010	0.6208	0.00744	0.903	1000					
7	4C	60	9	162	10/15/2009 12:10	10/15/2009 10:00	0.991	0.782	1.058	95.79%	2.75%	PIC	7/2/2009	7/31/2010	0.6052	0.00426	1.780	1000					
8	4D	60	23	135	10/15/2009 12:10	10/15/2009 10:00	0.991	0.782	1.058	99.46%	2.72%	PIC	7/2/2009	7/31/2010	0.5873	0.00816	1.232	1000					
9	5A	60	7	96	10/15/2009 12:10	10/15/2009 10:00	0.991	0.782	1.058	98.51%	2.73%	PIC	7/2/2009	7/31/2010	0.6258	0.00816	0.486	1000					
10	5B	60	14	100	10/15/2009 12:10	10/15/2009 10:00	0.992	0.782	1.058	71.60%	2.98%	PIC	7/2/2009	7/31/2010	0.6280	0.00816	1.084	1000					
11	D2	450	138	1125	10/15/2009 16:41	10/15/2009 10:00	0.992	0.469	1.483	101.15%	2.71%	LB4100	7/2/2009	7/31/2010	0.6361	0.03039	1.830	1000					
12	5D	60	8	251	10/15/2009 12:10	10/15/2009 10:00	0.992	0.782	1.058	102.76%	2.70%	PIC	7/2/2009	7/31/2010	0.6237	0.00816	1.326	1000					
13	6A	60	10	167	10/15/2009 12:10	10/15/2009 10:00	0.992	0.782	1.058	104.92%	2.69%	PIC	7/2/2009	7/31/2010	0.6221	0.00816	1.304	1000					
14	6B	60	22	135	10/15/2009 12:10	10/15/2009 10:00	0.992	0.782	1.058	94.57%	2.76%	PIC	7/2/2009	7/31/2010	0.6163	0.00816	0.785	1000					
15	6D	60	18	149	10/15/2009 12:10	10/15/2009 10:00	0.992	0.782	1.058	107.43%	2.67%	PIC	7/2/2009	7/31/2010	0.6120	0.00816	0.993	1000					
16	7A	60	17	91	10/15/2009 12:10	10/15/2009 10:00	0.992	0.782	1.058	101.53%	2.71%	PIC	7/2/2009	7/31/2010	0.6180	0.00816	0.372	1000					
17	7B	60	15	124	10/15/2009 12:10	10/15/2009 10:00	0.992	0.782	1.058	100.34%	2.72%	PIC	7/2/2009	7/31/2010	0.6280	0.00816	0.427	1000					
18	7D	60	15	141	10/15/2009 12:10	10/15/2009 10:00	0.992	0.781	1.058	98.64%	2.73%	PIC	7/2/2009	7/31/2010	0.6257	0.00816	0.384	1000					
19	8A	60	9	132	10/15/2009 12:10	10/15/2009 10:00	0.992	0.781	1.058	100.10%	2.72%	PIC	7/2/2009	7/31/2010	0.6247	0.00816	0.778	1000					
20	1D	60	12	57	10/15/2009 12:09	10/15/2009 10:00	0.996	0.783	1.058	88.56%	2.81%	PIC	7/2/2009	7/31/2010	0.6043	0.00511	0.529	1000					
21	D3	450	17	805	10/15/2009 16:41	10/15/2009 10:00	0.991	0.469	1.483	74.52%	2.94%	LB4100	7/2/2009	7/31/2010	0.6336	0.07231	0.998	1000					
22	14A	60	18	574	10/15/2009 12:06	10/15/2009 10:00	0.991	0.788	1.058	92.20%	2.78%	PIC	7/2/2009	7/31/2010	0.6393	0.00816	0.641	1000					
23	10D	60	34	554	10/15/2009 12:12	10/15/2009 10:00	0.996	0.779	1.058	91.79%	2.78%	PIC	7/2/2009	7/31/2010	0.6320	0.00816	1.017	1000					



- Notes:  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

Results Pos.	Decision Level pCi/G	Critical Level pCi/G	Required MDA pCi/G	MDA pCi/G	Sample Act. Conc. pCi/G	Sample Act. Error pCi/G	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA		Sample Type	RPD	RER	Nominal pCi/G	Recovery
									Counting Uncertainty pCi/G	Total Prop. Uncertainty pCi/G					
1	0.2138	0.1509	0.5	0.3502	1.1341	0.1467	1.1733	0.1690	0.3202	0.3260	SAMPLE				
2	0.3556	0.2511	0.5	0.5521	1.8291	0.1298	1.8300	0.2320	0.4545	0.4653	SAMPLE				
3	0.2093	0.1478	0.5	0.3077	1.2003	0.0991	0.6427	0.0609	0.2230	0.2333	SAMPLE				
4	0.3402	0.2402	0.5	0.5302	1.0148	0.1946	1.0183	0.1961	0.3829	0.3870	SAMPLE				
5	0.2020	0.1426	0.5	0.2978	1.1747	0.0993	0.6112	0.0580	0.2185	0.2286	SAMPLE				
6	0.2547	0.1798	0.5	0.4028	1.2954	0.1379	1.4970	0.2022	0.3430	0.3501	SAMPLE				
7	0.4340	0.3064	0.5	0.6853	0.9663	0.2368	0.9200	0.2163	0.4452	0.4484	SAMPLE				
8	0.3597	0.2540	0.5	0.5603	1.0653	0.1954	1.0180	0.1968	0.4037	0.4081	SAMPLE				
9	0.2146	0.1515	0.5	0.3527	1.1073	0.1507	1.1140	0.1648	0.3210	0.3270	SAMPLE				
10	0.4399	0.3106	0.5	0.6893	0.7949	0.2932	0.5827	0.1699	0.4543	0.4568	SAMPLE				
11	0.3970	0.2803	0.5	0.5753	1.4866	0.1346	0.6700	0.0859	0.3737	0.3922	SAMPLE				
12	0.3371	0.2380	0.5	0.5233	2.7013	0.0975	2.8573	0.2665	0.4939	0.5163	SAMPLE				
13	0.3272	0.2310	0.5	0.5083	1.3689	0.1503	1.4793	0.2184	0.3961	0.4033	SAMPLE				
14	0.2840	0.2005	0.5	0.4528	1.5166	0.1367	1.4650	0.1957	0.3970	0.4062	SAMPLE				
15	0.2865	0.2023	0.5	0.4510	1.3836	0.1410	1.4903	0.2059	0.3746	0.3823	SAMPLE				
16	0.1827	0.1290	0.5	0.3064	1.1074	0.1428	1.1447	0.1602	0.3037	0.3099	SAMPLE				
17	0.1971	0.1391	0.5	0.3270	1.5969	0.1174	1.6397	0.1867	0.3565	0.3675	SAMPLE				
18	0.1909	0.1348	0.5	0.3193	1.9556	0.1051	1.9660	0.1989	0.3877	0.4030	SAMPLE				
19	0.2676	0.1889	0.5	0.4269	1.3931	0.1390	1.4220	0.1935	0.3716	0.3797	SAMPLE				
20	0.2504	0.1768	0.5	0.4092	0.4681	0.3052	0.4210	0.1279	0.2787	0.2800	MB				
21	0.3941	0.2782	0.5	0.5763	2.3587	0.1186	0.7909	0.0705	0.4122	0.5481	DUP	25.3%			112.7%
22	2.1561	1.5222	0.5	3.4793	77.6160	0.0599	8.9257	0.4001	6.8193	9.1068	MS				109.3%
23	0.3222	0.2275	0.5	0.5066	8.4771	0.0561	8.2163	0.3936	0.7959	0.9316	LCS				

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine
237521001	2A	60	13	101	10/15/2009 12:09	10/15/2009 13:09	PIC
237521002	2B	60	9	189	10/15/2009 12:09	10/15/2009 13:09	PIC
237521003	11C	460	210	631	10/15/2009 14:25	10/15/2009 22:05	PIC
237521004	3C	60	12	134	10/15/2009 12:10	10/15/2009 13:10	PIC
237521005	14A	460	88	576	10/15/2009 14:25	10/15/2009 22:05	PIC
237521006	4A	60	18	144	10/15/2009 12:10	10/15/2009 13:10	PIC
237521007	4C	60	9	162	10/15/2009 12:10	10/15/2009 13:10	PIC
237521008	4D	60	23	135	10/15/2009 12:10	10/15/2009 13:10	PIC
237521009	5A	60	7	96	10/15/2009 12:10	10/15/2009 13:10	PIC
237521011	5B	60	14	100	10/15/2009 12:10	10/15/2009 13:10	PIC
237521012	D2	450	138	1125	10/15/2009 16:41	10/16/2009 0:11	LB4100
237521013	5D	60	8	251	10/15/2009 12:10	10/15/2009 13:10	PIC
237521014	6A	60	10	167	10/15/2009 12:10	10/15/2009 13:10	PIC
237521015	6B	60	22	135	10/15/2009 12:10	10/15/2009 13:10	PIC
237521016	6D	60	18	149	10/15/2009 12:10	10/15/2009 13:10	PIC
237521017	7A	60	17	91	10/15/2009 12:10	10/15/2009 13:10	PIC
237521018	7B	60	15	124	10/15/2009 12:10	10/15/2009 13:10	PIC
237521019	7D	60	15	141	10/15/2009 12:10	10/15/2009 13:10	PIC
237521020	8A	60	9	132	10/15/2009 12:10	10/15/2009 13:10	PIC
1201935879	1D	60	12	57	10/15/2009 12:09	10/15/2009 13:09	PIC
1201935880	D3	450	17	805	10/15/2009 16:41	10/16/2009 0:11	LB4100
1201935881	14A	60	18	574	10/15/2009 12:06	10/15/2009 13:06	PIC
1201935882	10D	60	34	554	10/15/2009 12:12	10/15/2009 13:12	PIC

ASSAY 9-Oct-09 6:04:05

Protocol id 9 228\_REC2  
Time limit 180  
Count limit 50000  
Isotope Ba-133  
Protocol date 9-Apr-07 10:02:22  
Run id. 15

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	72	1	180	975	294.7	3.58		06:04:12
2	72	2	180	977	295.4	3.58	100.24	06:07:24
3	72	3	180	949	285.9	3.64	97.01	06:10:35
4	72	4	180	907	271.8	3.75	92.23	06:13:46
5	72	5	180	958	288.9	3.62	98.03	06:16:58
6	99	6	180	891	266.6	3.79	90.46	06:20:22
7	99	7	180	1088	332.4	3.35	112.79	06:23:34
8	99	8	180	938	282.3	3.67	95.79	06:26:45
9	99	9	180	971	293.1	3.59	99.46	06:29:57
10	99	10	180	962	290.3	3.61	98.51	06:33:08
11	66	11	180	724	211	4.33	71.60	06:36:38
12	66	12	180	985	298.1	3.56	101.15	06:39:49
13	66	13	180	1000	302.9	3.53	102.78	06:43:01
14	66	14	180	1019	309.2	3.49	104.92	06:46:12
15	66	15	180	927	278.7	3.7	94.57	06:49:23
16	92	16	180	1041	316.6	3.44	107.43	06:52:42
17	92	17	180	989	299.2	3.55	101.53	06:55:53
18	92	18	180	978	295.7	3.57	100.34	06:59:05
19	92	19	180	963	290.7	3.61	98.64	07:02:16
20	92	20	180	976	295	3.58	100.10	07:05:28
21	73	21	180	874	261	3.84	88.56	07:08:52
22	73	22	180	750	219.6	4.23	74.52	07:12:04
23	73	23	180	906	271.7	3.75	92.20	07:15:15
24	73	24	180	903	270.5	3.76	91.79	07:18:26

END OF ASSAY

### Radiochemistry Batch Checklist, Rev 9

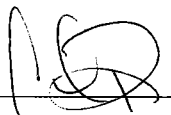
Batch# 905324 Product: RA 22B Date: 9/29/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to 100 mg for GAB.			N/A
Samples have been blank corrected (if required)			N/A
If activity less 10* MDA/ MDC, error is 150% or less of sample activity. If greater 10* MDA/ MDC, error is 40% or less. If below the MDA/ MDC, error is okay.	✓		
Instrument source check is within limits.	✓		
Instrument bkg check is within limits.	✓		
Method RDL/ LLD has been met.	✓		
If duplicate activities are less 5* MDA/ MDC, then RPD is 100% or less. If greater 5* MDA/ MDC, then RPD 20% or less. If below the MDA/ MDC, the RPD is 0%.	✓		
Or meets the client's required RER acceptance criteria.	✓		
Tracer yield is 15-125% . Carrier yield 25-125%.	✓		
Or meets the client's contract acceptance criteria.	✓		
Method blank is less than the RDL/ LLD. (If rad samples, < 5% of lowest activity)	✓		
Sample was run within hold time.	✓		
Sample was correctly preserved if required.	✓		
Smears Taken for Radioactive batches.			N/A
Method Spike and LCS are within 75-125% or meets the client's contract acceptance criteria.	✓		
No blank spaces on data forms. All line outs initialed and dated.	✓		
No transcription errors are apparent.			
Aux data is correct.			N/A
Client Special requirements page has been checked.	✓		
Raw Data and/ or spectrum are included and properly stated.	✓		
QC data entered into QC database and batch is in REVW	✓		
Hit notification complete (if necessary)	✓		
Batch entered into Case Narrative.	✓		
Batch non-conformances completed, if applicable.			N/A
Batch non-conformances second reviewed and disposition verified to be completed.			N/A
Aliquot Correction completed if required.			N/A
Review sample historical results if available (If REMP, results above MDC have been verified by historical results, recount or re-analysis.)	✓		


GEL Laboratories, LLC

revised 8/1/08

Primary Review Performed By: \_\_\_\_\_

 . 9/29/09

Secondary Review Performed By: \_\_\_\_\_




# Radium-228 Que Sheet

General Engineering Laboratories, Radiochemistry Division  
09/23/2009

Batch #: 905326 Analyst: MXS2 First Client Due Date: 10/09/2009 Internal Due Date: 09/28/2009 Ac-228 Ingrow: 92409/1030  
 Spike Isotope: Radium-228 Spike Code: \_\_\_\_\_ Expiration Date: \_\_\_\_\_  
 LCS Isotope: Radium-228 LCS Code: 0503-0 Expiration Date: 9-11-10 Vol: 0.1 mL  
 Tracer Isotope: Barium-133 Tracer Code: 0112-3 Expiration Date: 2-17-10 Vol: 0.1 mL  
 Prep Date: 9-23-09 Initials: HS Pipet ID: 2706953 Balance ID: 17955160 Witness: JLP 9-23-09  
 Ac-228 Separation Date/Time: 9-28-09 1700

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collect Date & Time	Pos. #	Vol (mL)	Det #	Ba Yield (%)	Gamma Det. #
236938020-1	EB091009-SO1	SAMPLE		3 pCi/L	WATER	KERR003	10-SEP-09 10:37 AM	1	200	1A	99.70	
237010013-1	EB091009-SO2	SAMPLE		3 pCi/L	WATER	KERR003	10-SEP-09 11:53 AM	2	200	1B	91.92	
237170005-1	EB091409-SO1	SAMPLE		3 pCi/L	WATER	KERR003	14-SEP-09 09:54 AM	3	200	1C	102.05	
237170020-1	EB091509-SO1	SAMPLE		3 pCi/L	WATER	KERR003	15-SEP-09 10:16 AM	4	200	1D	92.75	
237343006-1	EB091609-SO1	SAMPLE		3 pCi/L	WATER	KERR003	16-SEP-09 08:46 AM	5	200	2A	94.70	
237521010-1	EB091809-SO1	SAMPLE		3 pCi/L	WATER	KERR003	18-SEP-09 01:12 PM	6	200	2C	97.75	
1201930326-1	MB for batch 905326	MB		3 pCi/L	WATER	QC ACCOUNT	10-SEP-09 10:37 AM	7	200	3A	98.11	
1201930327-1	LCS for batch 905326	LCS		3 pCi/L	WATER	QC ACCOUNT	10-SEP-09 10:37 AM	8	200	3A	103.98	
1201930328-1	LCS for batch 905326	LCS		3 pCi/L	WATER	QC ACCOUNT	10-SEP-09 10:37 AM	9	200	3D	93.70	

10/6/09  
9/29/09  
20

Data Reviewed By:  9/29/09

Comments: \_\_\_\_\_

Instrument Used: (Circle One) PIC SN: 10751-4

# Radium-228 Liquid

Filename : RA228.XLS  
 File type : Excel  
 Version # : 1.2.5  
 Batch : 905326  
 Analyst : MXS2  
 Prep Date : 9/23/2009

Spike S/N : N/A  
 Spike Exp Date : N/A  
 Spike Activity (dpm/ml) : N/A  
 Spike Volume Added: N/A

Pipet, 0.1 ml Stdev : +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev : +/- 0.002564 ml  
 Pipet, 1 ml Stdev : +/- 0.005480 ml

LCS S/N : 0503-B  
 LCS Exp Date : 9/11/2010  
 LCS Activity (dpm/ml) : 177.43  
 LCS Volume Added: 0.10

Ra-228 Abundance : 1  
 Ra-228 Method Uncertainty : 0.1268  
 Geometry: CeF on 25mm Filler

Procedure Code : GFC28FAL  
 Parmname : Radium-228  
 Required MDA : 3 pCi/L  
 Half-life of Ra-228 : 5.75 years  
 Half-life of Ac-228 : 6.13 hours

Tracer S/N : 0112-J  
 Tracer Exp Date : 2/17/2010  
 Tracer Volume Added: 0.10

Pos.	Sample Characteristics			Sample Date/Time	Tracer Calculations			Tracer Samp.			Tracer Aliquot StDev. (mL)
	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L		Tracer Concentration (Ba-133 Ref.) (cpm)	Tracer Rel. Count Uncertainty (cpm)	Tracer Concentration (Ba-133 Samp.) (cpm)	Tracer Count Uncertainty (cpm)	Tracer Aliquot (mL)		
1	236938020.1	0.2000	1.6007E-05	9/10/2009 10:37	301.8	3.53%	300.9	3.54%	0.1	0.000701	
2	237010013.1	0.2000	1.6007E-05	9/10/2009 11:53	301.8	3.53%	274.7	3.73%	0.1	0.000701	
3	237170005.1	0.2000	1.6007E-05	9/14/2009 9:54	301.8	3.53%	308.0	3.49%	0.1	0.000701	
4	237170020.1	0.2000	1.6007E-05	9/15/2009 10:16	301.8	3.53%	278.4	3.70%	0.1	0.000701	
5	237343006.1	0.2000	1.6007E-05	9/16/2009 8:46	301.8	3.53%	285.8	3.64%	0.1	0.000701	
6	237521010.1	0.2000	1.6007E-05	9/18/2009 13:12	301.8	3.53%	295.0	3.58%	0.1	0.000701	
7	1201930326.1	0.2000	1.6007E-05	9/23/2009 0:00	301.8	3.53%	296.1	3.57%	0.1	0.000701	
8	1201930327.1	0.2000	1.6007E-05	9/23/2009 0:00	301.8	3.53%	313.8	3.46%	0.1	0.000701	
9	1201930328.1	0.2000	1.6007E-05	9/23/2009 0:00	301.8	3.53%	282.8	3.67%	0.1	0.000701	

Count raw Data										Calibration Data									
Pos.	Detector ID	Counting Time (min.)	Gross Alpha	Gross Beta	Beta cpm	Count Start Date/Time	Separation Date/Time	Ra-228 Decay	Ac-228 Decay	Ac-228 Count Correction	Calculated Sample Recovery %	Sample Recovery Error %	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Weekly Bkg Count Time (min.)	cpm
1	1A	60	2	49	0.817	9/28/2009 19:42	9/28/2009 17:00	0.994	0.737	1.058	99.70%	2.69%	PIC	7/2/2009	7/31/2010	0.6303	0.00600	500	0.410
2	1B	60	0	32	0.533	9/28/2009 19:42	9/28/2009 17:00	0.994	0.737	1.058	91.02%	2.75%	PIC	7/2/2009	7/31/2010	0.6282	0.00409	500	0.306
3	1C	60	6	77	1.283	9/28/2009 19:42	9/28/2009 17:00	0.995	0.737	1.058	102.05%	2.67%	PIC	7/2/2009	7/31/2010	0.6176	0.00344	500	0.870
4	1D	60	9	57	0.950	9/28/2009 19:42	9/28/2009 17:00	0.996	0.737	1.058	92.25%	2.74%	PIC	7/2/2009	7/31/2010	0.6043	0.00511	500	0.530
5	2A	60	6	55	0.917	9/28/2009 19:42	9/28/2009 17:00	0.996	0.737	1.058	94.70%	2.72%	PIC	7/2/2009	7/31/2010	0.6172	0.00349	500	0.558
6	2C	60	10	28	0.467	9/28/2009 19:42	9/28/2009 17:00	0.997	0.737	1.058	97.75%	2.70%	PIC	7/2/2009	7/31/2010	0.5969	0.00575	500	0.340
7	3A	100	20	158	1.580	9/28/2009 20:55	9/28/2009 17:00	0.998	0.642	1.097	98.11%	2.70%	PIC	7/2/2009	7/31/2010	0.5882	0.00943	500	1.182
8	3A	60	69	553	9.217	9/28/2009 19:41	9/28/2009 17:00	0.998	0.737	1.058	103.96%	2.66%	PIC	7/2/2009	7/31/2010	0.5682	0.00943	500	1.182
9	3D	60	29	471	7.850	9/28/2009 19:41	9/28/2009 17:00	0.998	0.737	1.058	93.70%	2.73%	PIC	7/2/2009	7/31/2010	0.5994	0.00464	500	1.218

- Notes:  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error pCi/L	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA		Sample QC	Sample Type	RER	RPD	Nominal pCi/L	Recovery
									Counting Uncertainty pCi/L	Total Prop. Uncertainty pCi/L						
1	1.0549	0.7448	3	1.7484	2.1047	0.2967	0.4067	0.1201	1.2186	1.3310		SAMPLE				
2	1.0015	0.7071	3	1.6986	1.2930	0.4297	0.2273	0.0975	1.0866	1.1353		SAMPLE				
3	1.5302	1.0803	3	2.4184	2.1301	0.3689	0.4133	0.1521	1.5362	1.6287		SAMPLE				
4	1.3500	0.9531	3	2.1975	2.4466	0.3107	0.4200	0.1300	1.4840	1.6093		SAMPLE				
5	1.3209	0.9326	3	2.1429	1.9923	0.3580	0.3587	0.1280	1.3940	1.4832		SAMPLE				
6	1.0323	0.7288	3	1.7356	0.7044	0.7266	0.1267	0.0920	1.0024	1.0183		SAMPLE				
7	1.9211	1.3563	3	2.9203	2.7554	0.3398	0.3980	0.1348	1.8288	1.9589		MB			39.9618	110.2%
8	1.8967	1.3391	3	2.9522	44.0329	0.0567	8.0347	0.3949	4.2422	11.9874		LCS			39.9618	95.7%
9	2.0255	1.4300	3	3.1483	38.2352	0.0616	6.6320	0.3651	4.1252	10.5654		LCSD	14.1%			



ASSAY 24-Sep-09 9:41:50

Protocol id 8 228\_REC  
Time limit 180  
Count limit 50000  
Isotope Ba-133  
Protocol date 9-Apr-07 10:03:07  
Run id. 5

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	98	1	180	997	301.8	3.53		09:41:57
2	98	2	180	994	300.9	3.54	99.70	09:45:09
3	98	3	180	915	274.7	3.73	91.02	09:48:20
4	98	4	180	1015	308	3.49	102.05	09:51:31
5	98	5	180	926	278.4	3.7	92.25	09:54:43
6	60	6	180	949	285.8	3.64	94.70	09:58:08
7	60	7	180	976	295	3.58	97.75	10:01:19
8	60	8	180	979	296.1	3.57	98.11	10:04:31
9	60	9	180	1032	313.8	3.46	103.98	10:07:42
10	60	10	180	940	282.8	3.67	93.70	10:10:53

END OF ASSAY

905326

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine
236938020	1A	60	2	49	9/28/2009 19:42	9/28/2009 20:42	PIC
237010013	1B	60	0	32	9/28/2009 19:42	9/28/2009 20:42	PIC
237170005	1C	60	6	77	9/28/2009 19:42	9/28/2009 20:42	PIC
237170020	1D	60	9	57	9/28/2009 19:42	9/28/2009 20:42	PIC
237343006	2A	60	6	55	9/28/2009 19:42	9/28/2009 20:42	PIC
237521010	2C	60	10	28	9/28/2009 19:42	9/28/2009 20:42	PIC
1201930326	3A	100	20	158	9/28/2009 20:55	9/28/2009 22:35	PIC
1201930327	3A	60	69	553	9/28/2009 19:41	9/28/2009 20:41	PIC
1201930328	3D	60	29	471	9/28/2009 19:41	9/28/2009 20:41	PIC

# METHOD CALIBRATION DATA

# LUCAS CELL COUNTERS

# General Engineering Laboratories

2040 Savage Road, Charleston, SC 29414  
(843)556-8171

## Lucas Cell Calibration Package

	YES	NO	Comments
1) Is all calibration standard information enclosed for: the primary standard certificate? the secondard standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	✓		
	✓		
	✓		
	✓		
2) Is the efficiency calibration report included ?	✓		
3) Is the raw count data included for: Cell constant determination? Plateau generation?	✓		
	✓		
4) Are the calibration verifications included?	✓		
5) Are the instrument settings included: HVPS settings?	✓		
6) Has the CELLEFF.xls file been updated ?	✓		
7) Have the calibration dates been updated in ALPHALIMS ?	✓		

Prepared By: Kelli Brown

Date: 8/31/09

Reviewed By: Angela G

Date: 8/31/09

Effective Date: 8/31/09

# Ra-226 Cell Constants

standard ID: 0299-H  
 Volume added (mL): 0.1  
 Standard Reference Activity (DPM/mL): 2483.21

Lucas cell #	Cell constant	Standard Source	Date/Time of count	Date/time flushed to cell	Date/time end of degas	Bkg Counts cpm	total counts	count time min	Known activity dpm	t1 (days) end-degas to flush	t2 (days) end-flush to count	t3 (days) Std Ref Date to count	Decay from Std Ref Date to count
101	1.846	cal 7	8/27/2009 16:35	8/27/2009 13:30	8/21/2009 11:30		4479	15	298.60	6.08333	0.12847	3544	0.9958
101	1.960	cal 9	8/24/2009 14:20	8/24/2009 9:30	8/18/2009 13:40		4581	15	305.40	5.82639	0.20139	3541	0.9958
101	2.060	cal 1	8/21/2009 15:00	8/21/2009 9:30	8/18/2009 13:40		2945	15	196.33	2.82639	0.22917	3538	0.9958
102	1.862	cal 5	8/27/2009 15:50	8/27/2009 12:40	8/21/2009 10:50		4510	15	300.67	6.07639	0.13194	3544	0.9958
102	1.850	cal 10	8/24/2009 14:45	8/24/2009 9:55	8/18/2009 13:40		4330	15	288.67	5.84375	0.20139	3541	0.9958
102	1.853	cal 2	8/21/2009 15:20	8/21/2009 9:50	8/18/2009 13:40		2659	15	177.27	2.84028	0.22917	3538	0.9958

104	2.073	Average	1.972	cal 1	8/27/2009 14:25	8/27/2009 9:35	8/24/2009 11:00		3070	15	204.67	2.94097	0.20139	3544	0.9958
104	1.855	Stdev	0.110	cal 11	8/24/2009 15:15	8/24/2009 10:15	8/18/2009 13:40		4343	15	289.53	5.85764	0.20833	3541	0.9958
104	1.987			cal 3	8/21/2009 15:50	8/21/2009 10:10	8/18/2009 13:40		2858	15	190.53	2.85417	0.23611	3538	0.9958

106	1.985	Average	1.836	cal 2	8/27/2009 14:55	8/27/2009 10:00	8/24/2009 11:20		2940	15	196.00	2.94444	0.20466	3544	0.9958
106	1.738	Stdev	0.131	cal 12	8/24/2009 15:35	8/24/2009 10:40	8/18/2009 13:40		4078	15	271.87	5.87500	0.20466	3541	0.9958
106	1.786			cal 4	8/21/2009 16:30	8/21/2009 10:30	8/18/2009 13:40		2572	15	171.47	2.86806	0.25000	3538	0.9958
107	2.025	Average	1.981	cal 8	8/27/2009 16:55	8/27/2009 13:50	8/21/2009 11:55		4910	15	327.33	6.07986	0.12847	3544	0.9958
107	2.054	Stdev	0.102	cal 1	8/24/2009 15:55	8/24/2009 11:00	8/21/2009 10:50		3090	15	206.00	3.00694	0.20466	3541	0.9958
107	1.864			cal 5	8/21/2009 16:45	8/21/2009 10:50	8/18/2009 13:40		2696	15	179.73	2.88194	0.24653	3538	0.9958
108	1.906	Average	1.946	cal 6	8/27/2009 16:05	8/27/2009 13:05	8/21/2009 11:15		4623	15	308.20	6.07639	0.12500	3544	0.9958
108	1.975	Stdev	0.036	cal 2	8/24/2009 16:25	8/24/2009 11:20	8/21/2009 10:50		2978	15	198.53	3.02083	0.21181	3541	0.9958
108	1.957			cia 6	8/21/2009 17:00	8/21/2009 11:15	8/18/2009 13:40		2846	15	189.73	2.89931	0.23958	3538	0.9958

111	2.162	Average	2.024	cal 3	8/27/2009 15:12	8/27/2009 10:20	8/24/2009 12:25		3177	15	211.80	2.91319	0.20278	3544	0.9958
111	2.051	Stdev	0.153	cal 3	8/24/2009 17:00	8/24/2009 12:25	8/21/2009 10:50		3139	15	209.27	3.06597	0.19097	3541	0.9958
111	1.859			cal 7	8/21/2009 17:15	8/21/2009 11:30	8/18/2009 13:40		2712	15	180.80	2.90872	0.23958	3538	0.9958
112	1.962	Average	1.931	cal 4	8/27/2009 15:30	8/27/2009 10:50	8/24/2009 12:40		2895	15	193.00	2.92361	0.19444	3544	0.9958
112	1.967	Stdev	0.059	cal 4	8/24/2009 17:15	8/24/2009 12:40	8/21/2009 10:50		3019	15	201.27	3.07639	0.19097	3541	0.9958
112	1.863			cal 8	8/21/2009 17:35	8/21/2009 11:55	8/18/2009 13:40		2731	15	182.07	2.92708	0.23611	3538	0.9958

EffErr 0.053028 <- Put in Machines.xls (Lucas Cell Tab)

8/13/09

VW 8/13/109

# Ra-226 Calibration Sheet

Standard ID: 0229-H

Volume Added (mL): 0.1

Expiration Date: 8/1/10

$\frac{219}{8/13/109} = 900$   
 $\frac{2945}{8/13/109} = 900$   
 $\frac{2659}{8/13/109} = 900$   
 $\frac{2858}{8/13/109} = 900$

\* count time 15 min

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 1	500	8/18/09 1340	8/21/09 0930	8/21/09 1500 <del>8/21/09 1430</del>	101	1	<del>3142</del> 2945
Cal 2	500	8/18/09 1340	8/21/09 0950	8/21/09 1500 <del>8/21/09 1425</del>	102	1	<del>2778</del> 2659
Cal 3	500	8/18/09 1340	8/21/09 1010	8/21/09 1550 <del>8/21/09 1445</del>	104	1	<del>2182</del> 2858
Cal 4	500	8/18/09 1340	8/21/09 1030	8/21/09 1630	106	1	2572
Cal 5	500	8/18/09 1340	8/21/09 1050	8/21/09 1645	107	1	2696
Cal 6	500	8/18/09 1340	8/21/09 1115	8/21/09 1700	108	1	2846
Cal 7	500	8/18/09 1340	8/21/09 1130	8/21/09 1715	111	1	2712
Cal 8	500	8/18/09 1340	8/21/09 1155	8/21/09 1735	112	1	2731
Cal 9							
Cal 10							
Cal 11							
Cal 12							

WMS/2/8/10

8/13/109

8/28/105

Voltage - 0.9

**Ra-226 Calibration Sheet**

Standard ID: Q224-A  
 Volume Added (mL): 0.1  
 Expiration Date: 01/11/10

Count time = 15 mins

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 9	500	8/18/09 1340	8/24/09 0950	8/24/09 <sup>1420</sup> 1435	101	1	8434 <del>8434</del>
Cal 10	500	8/18/09 1340	8/24/09 0955	8/24/09 <sup>1445</sup> 1455	102	1	8444 <del>8444</del> 4330
Cal 11	500	8/18/09 1340	8/24/09 1015	8/24/09 <sup>1515</sup> 1455	104	1	4343
Cal 12	500	8/18/09 1340	8/24/09 1040	8/24/09 1535	106	1	4078
Cal 1	500	8/24/09 1050	8/24/09 1100	8/24/09 1555	107	1	3090
Cal 2	500	8/24/09 1050	8/24/09 1120	8/24/09 1625	108	1	2978
Cal 3	500	8/24/09 1050	8/24/09 1125	8/24/09 1700	111	1	3139
Cal 4	500	8/24/09 1050	8/24/09 1140	8/24/09 1715	112	1	3019
1019-20 AM							

4501

140 8/28/09

~~8/31/09~~



Voltage - 0.9

**Ra-226 Calibration Sheet**

Standard ID: D199-H

Volume Added (mL): 1.1

Expiration Date: 8/1/10

\* 15 min counts

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 1	500	8/24/09 1100	8/27/09 0435	8/27/09 1425	104	1	3070
Cal 2	500	8/24/09 1110	8/27/09 1000	8/27/09 1455	106	1	2940
Cal 3	500	8/24/09 1125	8/27/09 1020	8/27/09 1512	111	1	3177
Cal 4	500	8/24/09 1240	8/27/09 1050	8/27/09 1530	112	1	2895
Cal 5	500	8/24/09 1050	8/27/09 1240	8/27/09 1550	102	1	4510
Cal 6	500	8/24/09 1115	8/27/09 1305	8/27/09 1605	106	1	4623
Cal 7	500	8/24/09 1130	8/27/09 1330	8/27/09 1635	101	1	4479
Cal 8	500	8/24/09 1155	8/27/09 1350	8/27/09 1655	107	1	4910

NO CAPTION

8/23/09

8/23/09

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number GL-RAD-A-008 Isotope RA-226  
 Date Standards Prepared 4/5/05 Cocktail Type Used NA  
 Standard ID 0749-H Matrix of Vial/Planchett NA  
 Amount Used (g or ml) 0.1 NA  
 Standard Activity (DPM/g or mL) 2483.233 Type of Scintillation Vial NA  
 Reference Date 12/15/99 Pipette ID Used 1429303  
 Expiration Date 8/1/10 Balance ID Used 38080204  
 Residue/Carrier Agent D-1MHC1 Quenching Agent NA

	Standard Number	Quenching Vol (uL)/ Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	Cal 1				
2	Cal 2				
3	Cal 3				
4	Cal 4				
5	Cal 5				
6	Cal 6				
7	Cal 7				
8	Cal 8				
9	Cal 9				
10	Cal 10				
11	Cal 11				
12	Cal 12				
	<u>100502105</u>				

*W/ 8/31/09*

Prepared By: Kelli Dorego Date: 8/31/09  
 Reviewed By: Angela J Gh Date: 8/31/09

eev

8-21-00

Nycomed Amersham plc  
Amersham Laboratories

0299



CALIBRATION  
No. 0148



ISSUED BY: Nycomed Amersham plc  
Radiation & Radioactivity  
Calibration Laboratory  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

ISSUED FOR: AEA Technology plc  
Isotrak  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

Description Principal radionuclide: Radium-226

Product code: RAY44  
Solution number: R4/131/89

Measurement Reference time: 1200 GMT on 15 December 1999

Nuclear data Nuclear data quoted on this certificate are taken from the Joint European File, Version 2.2.

Expression of uncertainties The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , which for a  $t$ -distribution with  $\nu_{eff} = \infty$  effective degrees of freedom corresponds to a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Unless indicated, all other uncertainties are expressed at the confidence level associated with one standard uncertainty.

The format used for the uncertainties in the values of radionuclidic purity is illustrated in the following examples;

6.5(21)	-	6.5 ± 2.1
6.54(21)	-	6.54 ± 0.21
6.543(21)	-	6.543 ± 0.021

Approved  
Signature

Date of issue

17<sup>th</sup> December 1999

VO 8131105

Nycomed

# GEL Standard Traceability Log Rad

Source Material Info	
Parent Code:	0299
Prepared By:	Angela Johnson
Carrier Conc:	0.5 M HCL
Reference Date:	12/15/1999
Ampoule Mass (g):	5.0368 g
Uncertainty:	+/- 2.5 %
LogBook No:	RC S 027 128

A Solution Material Info	
Isotope:	Radium-226
Prepared By:	Angela Johnson
Prep Date:	09/15/2000
Verification Date:	01/23/2008
Expiration Date:	01/23/2009
Primary Code:	0299-A
Dilution(mL):	100 mL
Mass of Parent(g):	4.6634 g
Density(g/mL):	1.0012
Balance ID:	

### Calculations Converting parent activity to dpm/mL/dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (\text{conversion dpm to kBq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (100 \text{ mL}) = 122414.2500 \text{ dpm/mL}$
$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (1.0012 \text{ g/mL}) / (100 \text{ mL}) = 122273.3377 \text{ dpm/g}$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
08/26/2003	Angela Johnson	1.9909	100	0299-E	2434.34 dpm/mL	11/04/2004	11/04/2005
08/26/2003	Angela Johnson	1.9872	100	0299-F	2429.82 dpm/mL	08/26/2004	08/26/2005
04/05/2005	Amanda Fehr	5.0018	250	0299-G	2446.3471 dpm/mL	01/26/2009	01/26/2010
08/07/2009	Mary Aders	5.0767	250	0299-H	2483.2133 dpm/mL	08/07/2009	08/07/2010

GEL Laboratories LLC  
Version 1.0 9/18/2000

*WJ Spiller*

## Voltage Curve Ludlum #1

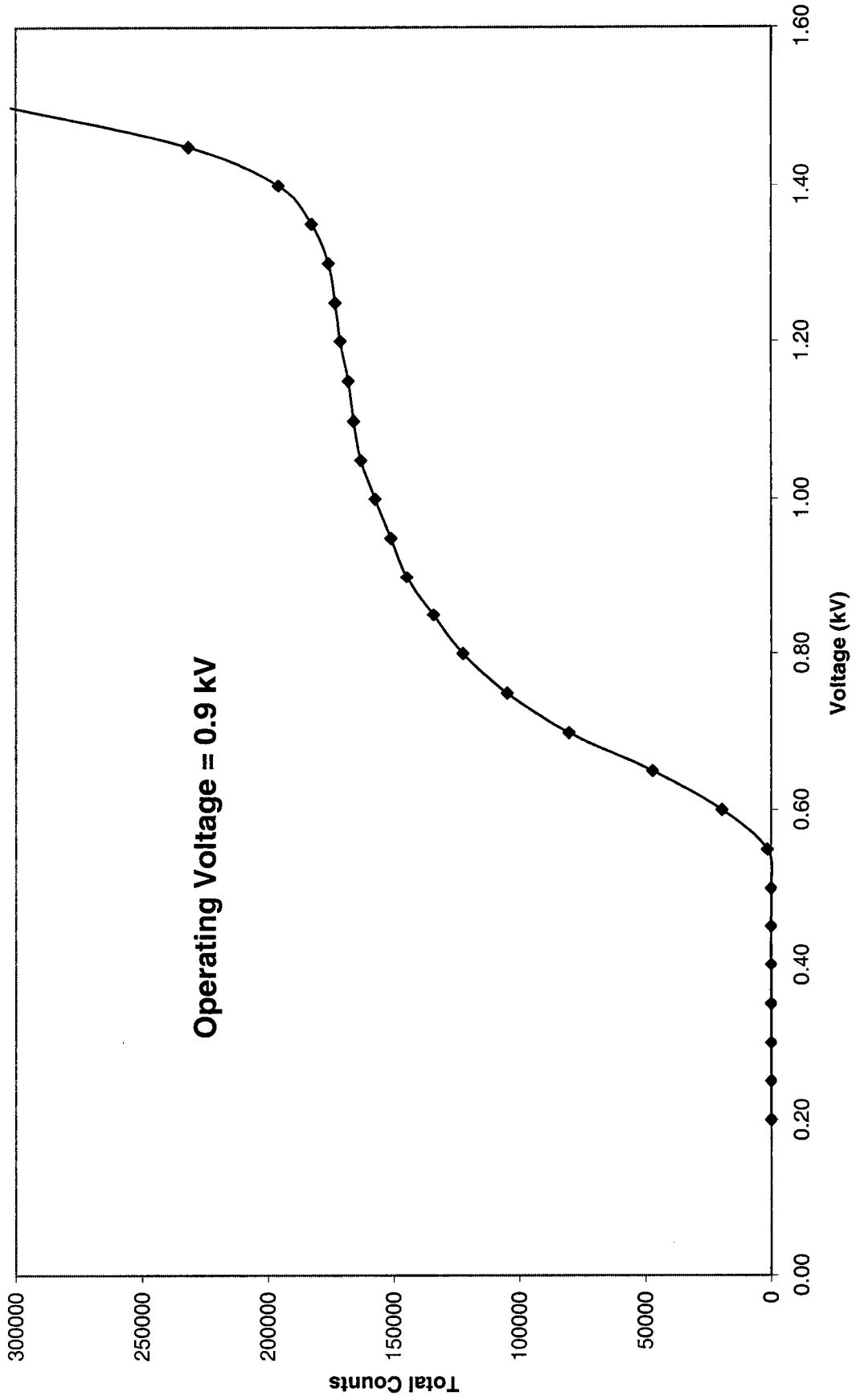
Voltage (kV)	Count Time (min)	Counts	Date/Time
0.20	1.00	0	8/21/09 13:20
0.25	1.00	0	8/21/09 13:21
0.30	1.00	0	8/21/09 13:22
0.35	1.00	0	8/21/09 13:23
0.40	1.00	0	8/21/09 13:24
0.45	1.00	0	8/21/09 13:25
0.50	1.00	0	8/21/09 13:26
0.55	1.00	1534	8/21/09 13:27
0.60	1.00	19637	8/21/09 13:28
0.65	1.00	47206	8/21/09 13:29
0.70	1.00	80410	8/21/09 13:30
0.75	1.00	104945	8/21/09 13:31
0.80	1.00	122514	8/21/09 13:32
0.85	1.00	134160	8/21/09 13:33
0.90	1.00	144753	8/21/09 13:34
0.95	1.00	151057	8/21/09 13:35
1.00	1.00	157429	8/21/09 13:36
1.05	1.00	163110	8/21/09 13:37
1.10	1.00	166034	8/21/09 13:38
1.15	1.00	168121	8/21/09 13:39
1.20	1.00	171347	8/21/09 13:40
1.25	1.00	173388	8/21/09 13:41
1.30	1.00	175958	8/21/09 13:42
1.35	1.00	182719	8/21/09 13:43
1.40	1.00	195871	8/21/09 13:44
1.45	1.00	231584	8/21/09 13:45
1.50	1.00	303021	8/21/09 13:46
1.55	1.00	387838	8/21/09 13:47

Detector set to operate at 0.90 kV

*Handwritten:* 8/31/09

# Ludlum Detector Voltage Curve

—◆— Voltage Curve Ludlum #1



8/19  
8/13/09

# Control Limits for Lucas Cell Counter #1

Analyst: KSD1  
Date: 8/31/2009

Count #	Detector #1
1	138383
2	138269
3	141307
4	140521
5	132825
6	135924
7	139231
8	138298
9	135342
10	138056
11	138123
12	139159
13	138410
14	138251
15	138438
16	138080
17	137814
18	137961
19	137248
20	137477

Average = 137955.9  
Std. Dev. = 1775.5

+3 S. D. = 143282.4266  
+2 S. D. = 141506.901  
Mean = 137955.9  
-2 S. D. = 134404.799  
-3 S. D. = 132629.2734

**Control Limits**      **8/31/2009**      \* Operating Voltage changed to 0.9 kV  
                                 **Detector #1**  
**Upper Limit**        **143282**  
**Lower Limit**        **132629**

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8/31/09

	<b>Eff</b>	<b>Cal Date</b>
101	1.956	8/31/2009
102	1.855	8/31/2009
104	1.972	8/31/2009
106	1.836	8/31/2009
107	1.981	8/31/2009
108	1.946	8/31/2009
111	2.024	8/31/2009
112	1.931	8/31/2009



<b>Lucas</b>	<b>Ra-226</b>	
Oldest Cal	01/23/2008	
<b>Detector</b>	<b>Eff Error</b>	<b>Cal Date</b>
1	0.0530	8/31/2009
2	0.0772	12/19/2008
3	0.0608	1/23/2008
4	0.1237	3/2/2009
5	0.1438	3/25/2009
6	0.0661	8/4/2009
7	0.0855	11/21/2008

# Ra-226 WATER

Batch : LCSVER  
 Date : 8/20/2008  
 Analyst : KSD1

Procedure Code : LUC26RAL  
 Parmname : Radium-226

MDA : 1 pCi/L  
 Instrument Used : LUCAS CELL DETECTOR

Bkg Count Time: 30 min

Sample ID	Sample Vol L	Count Time min	Gross counts cts	Cell # num	Cell Const. num	BKG cpm	BKG	Ra-226 MDA pCi/L	Ra-226 RESULT pCi/L	Ra-226 ERROR pCi/L	COUNT DATE/TIME
Ver 2	0.500	30	689	101	1.956	0.267	8	0.5907	25.3156	1.9236	8/31/2009 14:35
Ver 6	0.500	30	697	102	1.855	0.133	4	0.4721	27.1986	2.0367	8/31/2009 15:05
Ver 2	0.500	30	656	104	1.972	0.267	8	0.6303	25.7021	2.0032	8/28/2009 14:00
Ver 4	0.500	30	638	106	1.836	0.267	8	0.6304	24.9919	1.9762	8/31/2009 15:40
Ver 7	0.500	30	629	107	1.981	0.267	8	0.6257	24.4533	1.9479	8/28/2009 17:50
Ver 5	0.500	30	693	108	1.946	0.267	8	0.5959	25.6861	1.9459	8/31/2009 16:15
Ver 3	0.500	30	672	111	2.024	0.267	8	0.6129	25.6096	1.9713	8/28/2009 14:35
Ver 4	0.500	30	631	112	1.931	0.267	8	0.6411	25.1365	1.9990	8/28/2009 15:10

*JLQ*  
8/31/09

Sample ID	Sample Dup	Det #	Run Date	Sample Type	Standard ID	NC	NC units	Recovery/RPD
Ver 2		1	8/31/2009 14:35	LCS	0638-H	24.17	pCi/L	105%
Ver 3		1	8/31/2009 15:05	LCS	0638-H	24.17	pCi/L	113%
Ver 2		1	8/28/2009 14:00	LCS	0638-H	24.17	pCi/L	106%
Ver 4		1	8/31/2009 15:40	LCS	0638-H	24.17	pCi/L	103%
Ver 7		1	8/28/2009 17:50	LCS	0638-H	24.17	pCi/L	101%
Ver 8		1	8/31/2009 16:15	LCS	0638-H	24.17	pCi/L	106%
Ver 3		1	8/28/2009 14:35	LCS	0638-H	24.17	pCi/L	106%
Ver 4		1	8/28/2009 15:10	LCS	0638-H	24.17	pCi/L	104%

DEGASSING DATE/TIME	DE-EMAN. DATE/TIME	DEGASS-DE-EM	dE-EM-COUNT	constant	constant	constant	Net CPM	Ingrowth constant
8/28/2009 10:20	8/31/2009 11:10	72.83	3.42	0.4230	0.9745	1.0019	22.7000	0.4130
8/28/2009 10:40	8/31/2009 11:30	72.83	3.58	0.4230	0.9733	1.0019	23.1000	0.4125
8/25/2009 16:00	8/28/2009 10:20	66.33	3.67	0.3940	0.9727	1.0019	21.6000	0.3839
8/28/2009 11:00	8/31/2009 11:55	72.92	3.75	0.4234	0.9721	1.0019	21.0000	0.4123
8/25/2009 16:00	8/28/2009 12:00	68.00	5.83	0.4015	0.9569	1.0019	20.7000	0.3850
8/28/2009 11:20	8/31/2009 12:15	72.92	4.00	0.4234	0.9703	1.0019	22.8333	0.4115
8/25/2009 16:00	8/28/2009 10:40	66.67	3.92	0.3955	0.9709	1.0019	22.1333	0.3847
8/25/2009 16:00	8/28/2009 11:00	67.00	4.17	0.3970	0.9690	1.0019	20.7667	0.3854

8/31/09

062584 CAP: 11/11/10

Ra-226 Verification Sheet

\* 1 .9 voltage

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
V01	500	8/25/09 1600	8/28/09 0655	8/28/09 1310	101	1	8	525
V02	500	8/28/09 1600	8/28/09 1020	8/28/09 1400	104	1	8	654
V03	500	8/28/09 1600	8/28/09 1040	8/28/09 1435	111	1	8	672
V04	500	8/28/09 1600	8/28/09 1100	8/28/09 1510	112	1	8	631
V05	500	8/28/09 1600	8/28/09 1121	8/28/09 1540	106	1	8	678
V06	500	8/28/09 1600	8/28/09 1140	8/28/09 1610	109	1	4	654
V07	500	8/28/09 1600	8/28/09 1200	8/28/09 1750 1610 1750	107	1	8	629
V08	500	8/28/09 1600	8/28/09 1305	8/28/09 1820	108	1	8	736
V09	500	8/28/09 1020	8/31/09 1110	8/31/09 1435	101	1	8	689
V09	500	8/28/09 1040	8/31/09 1130	8/31/09 1505	102	1	4	697
V09	500	8/28/09 1050	8/31/09 1155	8/31/09 1540	106	1	8	638
V09	500	8/28/09 1120	8/31/09 1215	8/31/09 1615	108	1	8	693

Waters

173

Waters

Waters

Waters

**General Engineering Laboratories  
Verification Source Preparation Sheet**

Applicable SOP Number UL-DPP-A-106 Isotope U-236  
 Date Standards Prepared 7/23/08 Cocktail Type Used NA  
 Standard ID DC38H Matrix of Vial/Planchett NA  
 Amount Used (g or ml) 0.1 Type of Scintillation Vial NA  
 Standard Activity (DPM/g or ml) ~~60.4108~~ 208.8845 20813109 Pipette ID Used 1424303  
 Reference Date 1/23/04 Balance ID Used 38080104  
 Expiration Date 7/17/10 Quenching Agent NA  
 Residue/Carrier Agent NA

	Standard Number	Quenching Vol (uL)/ Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	Ver 1				
2	Ver 2				
3	Ver 3				
4	Ver 4				
5	Ver 5				
6	Ver 6				
7	Ver 7				
8	Ver 8				
<del>Ver 9/10/11</del>					

Prepared By: Kelli S. DeLoe Date: 8/31/09  
 Reviewed By: Angela D. Fisher Date: 8/31/09

Rev 1 RLM 9/10/97

**ANALYTICS**

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

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

0638

**CERTIFICATE OF CALIBRATION**  
**Standard Radionuclide Source**

67519-278

Ra-226 5 mL Liquid in Flame Sealed Vial

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

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

Analytics maintains traceability to the National Institute of Standards and Technology through participation in a Measurements Assurance Program as described in USNRC Reg. Guide 4.15, Revision 1, February 1979.

ISOTOPE:	Ra-226
ACTIVITY (dps):	2.353 E4
HALF-LIFE:	1.600 E3 years
CALIBRATION DATE:	January 23, 2004 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	3.3%

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%

5.01065 grams 0.1M HCl solution with 50  $\mu$ g/g Ba carrier.

P O NUMBER 3231RD, Item 5

SOURCE PREPARED BY:

M. D. Currie  
M. D. Currie, Radiochemist

Q A APPROVED:

ACUWA 1/26/04

W 8731105

## Standard Traceability Log Rad

**WARNING! Training must be completed!!**

**Alphalims will be locked out if training is not completed within 1 week of assignment Contact Quality if additional time is needed to complete training**

Source Material Info		A Solution Material Info	
Parent Code:	0638	Isotope:	Radium-226
Prepared By:	Amanda Fehr	Prepared By:	Amanda Fehr
Carrier Conc:	0.1M HCl	Prep Date:	01/16/2006
Reference Date:	01/23/2004	Verification Date:	04/09/2009
Ampoule Mass (g):	5.01065 g	Expiration Date:	04/09/2010
Uncertainty:	+/- 3.3 %	Primary Code:	0638-A
LogBook No:	RC-S-037-037	Dilution(mL):	100 mL
		Mass of Parent(g):	4.8398 g
		Density(g/mL):	1.0266
		Balance ID:	38080204

### Calculations Converting parent activity to dpm/mL/dpm/g

$$(\text{Mass of parent(g)}) * (\text{Parent Activity (dps)}) * (\text{conversion dpm to dps}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$$

$$(\text{Mass of parent(g)}) * (\text{Parent Activity (dps)}) * (\text{conversion dpm to dps}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$$

$$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) * (5.01065 \text{ g} * 100 \text{ mL}) = 13636.6133 \text{ dpm/mL}$$

$$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) / (1.0266 \text{ g/mL}) / (5.01065 \text{ g} * 100 \text{ mL}) = 13282.9676 \text{ dpm/g}$$

*W 8/28/09*

## Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
01/17/2006	Amanda Fehr	2.1041	100	0638-B	279.0211 dpm/mL	01/17/2007	01/17/2008
07/17/2006	Mary Aders	2.1313	100	0638-C	282.6281 dpm/mL	07/26/2006	07/26/2007
03/28/2007	Daniel Roy	2.1025	100	0638-D	279.2744 dpm/ml	04/08/2007	04/08/2008
03/28/2007	Daniel Roy	45.468	250	0638-E	2415.7999 dpm/ml	04/09/2009	04/09/2010
12/18/2007	Daniel Roy	2.014	100	0638-F	267.519 dpm/ml	02/02/2009	02/02/2010
02/12/2008	Daniel Roy	.5004	100	0638-G	66.468 dpm/ml	03/02/2009	03/02/2010
07/23/2008	Daniel Roy	5.0607	250	0638-H	268.8845 dpm/ml	07/17/2009	07/17/2010

GEL Laboratories LLC  
Version 1.0 9/18/2000

W 8/31/09



## Verification for Ra-226 Standard 0638-H

D. Roy 7/23/2008	Isotope	Value	Uncertainty
	0638-H	11.852	1.1079
	0638-H	12.092	1.1141
	0638-H	12.372	1.1216
<b>Mean Value (Counting) =</b>	12.106	100.13	<b>Pass</b>
<b>Stdev =</b>	0.260353631		<b>Rule 3 (Pass/Fail)</b>
<b>Target =</b>	12.09		
<b>Lower Limit =</b>	11.5848594		
<b>Upper Limit =</b>	12.62627393		
<b>Rule 1 Pass/Fail</b>	<b>Pass</b>		
<b>Two sigma =</b>	0.520707263		
<b>10 % of Mean =</b>	1.210556667		
<b>Rule 2 (Pass/Fail)</b>	<b>Pass</b>		

**Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements**

**Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.**

**Rule 3 = The determined mean value shall be within 5% of the certificate value.**

The analyst prepared three standard verification sources for Ra-226 source 0638-H by transferring portions of the degassed standard into tared glass liquid scintillation vials. 10 mL of DI Water and 10 mL of mineral oil were added to each vial and the vials were shaken. A Blank vial was prepared in a similar fashion using 10 mL of DI Water and 10 mL of mineral oil. The standard verification vials and Background source were dark adapted for two hours and counted on LSC RED using source standard verification. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

Reference RAD SOP M-001

*David D. Roy 8/14/08*  
*Ver. L. Jones 8/14/08*

# General Engineering Laboratories

2040 Savage Road, Charleston, SC 29414  
(843)556-8171

## Lucas Cell Calibration Package

	YES	NO	Comments
1) Is all calibration standard information enclosed for: the primary standard certificate? the secondary standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	✓	✓	
	✓	✓	
	✓	✓	
	✓	✓	
2) Is the efficiency calibration report included?	✓	✓	
3) Is the raw count data included for: Cell constant determination? Plateau generation?	✓	✓	
	✓	✓	
4) Are the calibration verifications included?	✓	✓	
5) Are the instrument settings included: HVPS settings?	✓	✓	
	✓	✓	
6) Has the CELLEFF.xls file been updated?	✓	✓	
7) Have the calibration dates been updated in ALPHALIMS?	✓	✓	

Prepared By: Kelli Donnell

Date: 12/19/08

Reviewed By: Mark G. Adams

Date: 12/19/08

Effective Date: 12/19/08

12/19/08

### Ra-226 Cell Constants

Standard Reference date: 12/15/1999  
 standard ID: 0299-G  
 Volume added (mL): 0.1  
 Standard Reference Activity (DPM/mL): 2446.35

Lucas cell #	Cell constant	Standard Source	Date/Time of count	Date/Time flushed to cell	Date/Time end of degas	bkg cpm	total counts	count time min	cpm	Known activity dpm	11 (days) end-degas to flush	12 (days) end-flush to count	13 (days) Std Ref Date to count	Decay from Std Ref Date to count		
201	2.021	Average	1.983	Cal 14	9/15/2008 15:45	9/15/2008 9:05	9/12/2008 13:20	0.267	5596	30	186.53	243.02	2.82292	0.27778	3198	0.9962
201	2.043	Sidev	0.068	Cal 14	9/18/2008 13:00	9/18/2008 8:10	9/15/2008 9:05	0.267	5949	30	198.30	243.02	2.96181	0.20139	3201	0.9962
201	1.915			Cal 14	9/25/2008 19:35	9/25/2008 9:15	9/22/2008 10:00	0.267	5361	30	178.70	243.02	2.96875	0.43056	3208	0.9962
202	2.436	Average	2.261	Cal 13	9/15/2008 16:20	9/15/2008 9:35	9/12/2008 13:20	0.267	6779	30	225.97	243.02	2.84375	0.28125	3198	0.9962
202	2.209	Sidev	0.156	Cal 13	9/18/2008 13:50	9/18/2008 8:45	9/15/2008 9:35	0.267	6425	30	214.17	243.02	2.96528	0.21181	3201	0.9962
202	2.137			Cal 14	10/21/2008 13:50	10/20/2008 13:45	10/19/2008 16:00	0.267	9248	30	308.27	243.02	6.90625	1.00347	3234	0.9962
203	2.255	Average	2.254	Cal 43	9/15/2008 16:50	9/15/2008 10:00	9/12/2008 13:20	0.267	6300	30	210.00	243.02	2.86111	0.28472	3198	0.9962
203	2.273	Sidev	0.019	Cal 43	9/18/2008 14:25	9/18/2008 9:15	9/15/2008 10:00	0.267	6613	30	220.43	243.02	2.96875	0.21528	3201	0.9962
203	2.234			Cal 43	9/25/2008 21:00	9/25/2008 10:15	9/22/2008 10:00	0.267	6298	30	209.93	243.02	3.01042	0.44782	3208	0.9962
204	2.184	Average	2.183	Cal 15	9/15/2008 17:25	9/15/2008 10:30	9/12/2008 13:20	0.267	6132	30	204.40	243.02	2.88194	0.28819	3198	0.9962
204	2.300	Sidev	0.102	Cal 15	9/18/2008 14:55	9/18/2008 9:35	9/15/2008 10:30	0.267	6671	30	222.37	243.02	2.96181	0.22222	3201	0.9962
204	2.096			Cal 15	9/30/2008 14:05	9/30/2008 9:10	9/28/2008 9:45	0.133	7535	30	251.17	243.02	3.97589	0.20486	3213	0.9962
205	1.677	Average	1.799	Cal 13	10/21/2008 8:30	10/20/2008 14:05	10/19/2008 16:00	0.267	7584	30	252.80	243.02	6.92014	0.76736	3233	0.9962
205	1.730	Sidev	0.167	Cal 44	9/18/2008 16:00	9/18/2008 10:05	9/15/2008 10:55	0.167	4989	30	166.63	243.02	2.96528	0.24653	3201	0.9962
205	1.990			Cal 44	9/30/2008 14:45	9/30/2008 9:40	9/28/2008 9:45	0.187	7170	30	239.00	243.02	3.99653	0.21181	3213	0.9962
206	2.240	Average	2.259	Cal 46	9/15/2008 21:10	9/15/2008 11:25	9/12/2008 13:20	0.233	6216	30	207.20	243.02	2.92014	0.40825	3198	0.9962
206	2.293	Sidev	0.030	Cal 46	9/18/2008 16:35	9/18/2008 10:25	9/15/2008 11:25	0.267	6604	30	220.13	243.02	2.95833	0.25694	3201	0.9962
206	2.245			Cal 46	9/30/2008 15:20	9/30/2008 10:15	9/28/2008 9:45	0.267	8125	30	270.83	243.02	4.02083	0.21181	3213	0.9962
207	2.187	Average	2.146	Cal 36	9/15/2008 21:40	9/15/2008 11:50	9/12/2008 13:20	0.267	6084	30	203.13	243.02	2.93750	0.40872	3198	0.9962
207	2.141	Sidev	0.038	Cal 36	9/18/2008 17:55	9/18/2008 10:40	9/15/2008 11:50	0.267	6105	30	203.50	243.02	2.95159	0.30208	3201	0.9962
207	2.110			Cal 36	9/30/2008 16:00	9/30/2008 10:45	9/28/2008 9:45	0.233	7656	30	255.20	243.02	4.04167	0.21875	3213	0.9962
208	2.239	Average	2.283	Cal 36	9/15/2008 22:15	9/15/2008 12:15	9/12/2008 13:20	0.267	6288	30	208.60	243.02	2.85486	0.41667	3198	0.9962
208	2.243	Sidev	0.135	Cal 30	9/18/2008 18:30	9/18/2008 11:00	9/15/2008 12:15	0.133	6374	30	212.47	243.02	2.94782	0.41250	3201	0.9962
208	2.148			Cal 30	9/30/2008 16:35	9/30/2008 11:10	9/28/2008 9:45	0.665	7691	30	256.03	243.02	4.95989	0.23958	3213	0.9962
209	2.471	Average	2.291	Cal 19	9/15/2008 22:45	9/15/2008 13:50	9/12/2008 13:20	0.033	7073	30	235.77	243.02	3.02083	0.37153	3198	0.9962
209	2.212	Sidev	0.137	Cal 19	9/18/2008 19:15	9/18/2008 11:15	9/15/2008 13:50	0.067	6170	30	205.67	243.02	2.89236	0.33333	3201	0.9962
209	2.420			Cal 19	9/30/2008 17:25	9/30/2008 11:40	9/28/2008 9:45	0.100	8795	30	293.17	243.02	4.07996	0.23958	3213	0.9962
210	2.320	Average	2.253	Cal 47	9/15/2008 23:15	9/15/2008 14:15	9/12/2008 13:20	0.033	6685	30	222.17	243.02	3.03819	0.37500	3198	0.9962
210	2.210	Sidev	0.059	Cal 47	9/18/2008 19:45	9/18/2008 11:30	9/15/2008 14:15	0.100	6142	30	204.73	243.02	2.88542	0.34875	3201	0.9962
210	2.230			Cal 47	9/30/2008 18:00	9/30/2008 12:05	9/28/2008 9:45	0.033	8116	30	270.53	243.02	4.09722	0.24653	3213	0.9962
211	2.140	Average	2.171	Cal 37	9/15/2008 23:50	9/15/2008 14:30	9/12/2008 13:20	0.033	6150	30	205.00	243.02	3.04661	0.36889	3198	0.9962
211	2.238	Sidev	0.057	Cal 37	9/18/2008 22:20	9/18/2008 12:35	9/15/2008 14:30	0.133	6207	30	206.90	243.02	2.92014	0.40825	3201	0.9962
211	2.136			Cal 37	9/30/2008 18:30	9/30/2008 13:35	9/28/2008 9:45	0.100	7917	30	263.90	243.02	4.15972	0.20486	3213	0.9962
212	2.405	Average	2.322	Cal 42	9/15/2008 0:20	9/15/2008 14:50	9/12/2008 13:20	0.033	6926	30	230.87	243.02	3.06250	0.36563	3198	0.9962
212	2.315	Sidev	0.081	Cal 42	9/18/2008 22:55	9/18/2008 12:50	9/15/2008 14:50	0.267	6405	30	213.50	243.02	2.91667	0.42014	3201	0.9962
212	2.244			Cal 42	9/30/2008 19:50	9/30/2008 14:00	9/28/2008 9:45	0.267	8287	30	276.23	243.02	4.17708	0.24306	3213	0.9962

12/19/08  
12/19/08

12/19/08

12/19/08

### Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal14	500	9/25/08 1000	9/25/08 0015	9/25/08 1935	201	2	0	5361
<del>Cal13</del>	<del>500</del>	<del>9/25/08 1000</del>	<del>9/25/08 0015</del>	<del>9/25/08 2100</del>	<del>202</del>	<del>2</del>	<del>0</del>	<del>5845</del>
<del>Cal43</del>	<del>500</del>	<del>9/25/08 1000</del>	<del>9/25/08 1015</del>	<del>9/25/08 2100</del>	<del>203</del>	<del>2</del>	<del>0</del>	<del>6298</del>
Cal15	500	9/22/08 1000						
Cal144	500	9/22/08 1000						
Cal146	500	9/22/08 1000						
Cal136	500	9/22/08 1000						
Cal130	500	9/22/08 1000						
Cal119	500	9/22/08 1000						
Cal147	500	9/22/08 1000						
Cal137	500	9/22/08 1000						
Cal142	500	9/22/08 1000						
				KW				
				KW				
				KW				
				KW				
				KW				

140  
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12/19/08

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 14	500	9/12/08 1320	9/15/08 0905	9/15/08 1545	201	2	8	5596
Cal 13	500	9/12/08 1320	9/15/08 0935	9/15/08 1620	202	2	8	6779
Cal 43	500	9/12/08 1320	9/15/08 1000	9/15/08 1650	203	2	8	6300
Cal 15	500	9/12/08 1320	9/15/08 1030	9/15/08 1725	204	2	8	6132
<del>Cal 44</del>	<del>500</del>	<del>9/12/08 1320</del>	<del>9/15/08 1055</del>	<del>9/15/08 1805</del>	<del>205</del>	<del>2</del>	<del>5</del>	<del>6132</del>
Cal 46	500	9/12/08 1320	9/15/08 1115	9/15/08 2110	206	2	7	6216
Cal 36	500	9/12/08 1320	9/15/08 1150	9/15/08 2140	207	2	8	6094
<del>Cal 38</del>	<del>500</del>	<del>9/12/08 1320</del>	<del>9/15/08 1215</del>	<del>9/15/08 2215</del>	<del>208</del>	<del>2</del>	<del>8</del>	<del>6258</del>
Cal 19	500	9/12/08 1320	9/15/08 1350	9/15/08 2245	209	2	1	7073
Cal 47	500	9/12/08 1320	9/15/08 1415	9/15/08 2315	210	2	1	6665
Cal 37	500	9/12/08 1320	9/15/08 1430	9/15/08 2350	211	2	1	6150
Cal 42	500	9/12/08 1320	9/15/08 1450	9/16/08 0020	212	2	1	6926

140  
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140  
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Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
15	500	9/20/08 0945	9/20/08 0910	9/20/08 1405	204	2	4	7535
44	500	9/20/08 0945	9/20/08 0940	9/30/08 1445	205	2	5	7170
46	500	9/20/08 0945	9/30/08 1015	9/30/08 1520	206	2	8	8125
36	500	9/20/08 0945	9/30/08 1015	9/30/08 1410	207	2	7	7656
<del>30</del>	<del>500</del>	<del>9/20/08 0945</del>	<del>9/30/08 1110</del>	<del>9/30/08 1635</del>	<del>208</del>	<del>2</del>	<del>1</del>	<del>7681</del>
19	500	9/20/08 0945	9/30/08 1140	9.30.08 1725	209	2	3	8795
47	500	9/20/08 0945	9/30/08 1205	9.30.08 1800	210	2	1	8116
37	500	9/20/08 0945	9/30/08 1335	9.30.08 1830	211	2	3	7977
42	500	9/20/08 0945	9/30/08 1400	9.30.08 1950	212	2	8	8287

100 12/19/08

12/19/08  
12/19/08  
12/19/08

12/18/08  
140

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 14	500	9/15/08 09:15	9/18/08 08:10	9/18/08 13:00	201	2	8	59449
Cal 13	500	9/15/08 09:35	9/18/08 08:45	9/18/08 13:50	202	2	8	60425
Cal 43	500	9/15/08 10:00	9/18/08 09:15	9/18/08 14:25	203	2	8	60113
Cal 15	500	9/15/08 10:30	9/18/08 09:35	9/18/08 14:55	204	2	8	6671
Cal 44	500	9/15/08 10:55	9/18/08 10:05	9/18/08 16:00	205	2	5	49999
Cal 46	500	9/15/08 11:25	9/18/08 10:25	9/18/08 16:35	206	2	8	6604
Cal 36	500	9/15/08 11:50	9/18/08 10:40	9/18/08 17:55	207	2	8	6105
Cal 30	500	9/15/08 12:15	9/18/08 11:00	9/18/08 18:30	208	2	4	6374
Cal 19	500	9/15/08 13:50	9/18/08 11:15	9/18/08 19:15	209	2	2	6170
Cal 47	500	9/15/08 14:15	9/18/08 11:30	9/18/08 19:45	210	2	3	6142
Cal 37	500	9/15/08 14:30	9/18/08 12:35	9/18/08 22:20	211	2	4	6207
Cal 42	500	9/15/08 14:50	9/18/08 12:50	9/18/08 22:55	212	2	8	6405

1000  
12/19/08

1000  
12/19/08

1000  
12/19/08

9/18/08  
1000

Ra-226 Verification Sheet

100 17/11/08  
 12/28  
 12/19/08

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 14	500	10/19/08 1600	10/20/08 1345	10-21-08 13:50 <del>10/20/08</del> <del>13:50</del>	202	2	8	9748
13	500	10/19/08 1600	10/20/08 1405	10/20/08 1430	205	2	8	7584
43								
44								
15								
36								
46								
30								
19								
47								
37								
42								

100  
 12/18/08



# Verification for Ra-226 Standard 0299-G

4/2/2008	Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff	Standard Mass. Used (G)	Source DPM/G
D. Roy	0299-G N1	2536.9600	52.4000	2484.5600	1.917186	0.5057	2562.667649
	0299-G N2	2520.2500	52.4000	2467.8500	1.917186	0.5056	2545.935781
	0299-G N3	2532.5000	52.4000	2480.1000	1.917186	0.5042	2565.677715
						Average =	2558.093715

Mean Value (Counting) = 2558.093715  
 Stdev = 10.63610098

Certificate Value = 2437.6 dpm/mL  
 Lower Limit = 2536.821513 dpm/mL  
 Upper Limit = 2579.365917 dpm/mL  
 Rule 1 Pass/Fail = Fail \*exception taken due to full recovery of standard  
 Two sigma = 21.27220197 dpm/mL  
 10 % of Mean = 255.8093715 dpm/mL  
 Rule 2 (Pass/Fail) = Pass

### Verification Rules

- Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements
- Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
- Rule 3 = The determined mean value shall be within 10% of the certificate value.

The analyst prepared three standard verification sources for Ra-226 source 0299-G by transferring portions of the standard into tared glass liquid scintillation vials. One mL of DI Water and ten mLs of Ready Gel liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 1 mL of DI water and 10 mL of Ready Gel cocktail. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Gold for Radium source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 4/02/08 using source 0024-A (Ra-226). Calibration data is recorded in this logbook under Ra-226 0024. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

BAD.SOP.M-001

Net 12/19/08  
 11/19/08  
 Nancy E. Johnson 4/9/08  
 Daniel Dwyer 4/10/08



# Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0299	Isotope:	Radium-226
Prepared By:	Angela Johnson	Prepared By:	Angela Johnson
Carrier Conc:	0.5 M HCL	Prep Date:	09/15/2000
Reference Date:	12/15/1999	Verification Date:	01/23/2008
Ampoule Mass (g):	5.0368 g	Expiration Date:	01/23/2009
Uncertainty:	+/- 2.5 %	Primary Code:	0299-A
LogBook No:	RC S 027 128	Dilution(mL):	100 mL
		Mass of Parent(g):	4.6634 g
		Density(g/mL):	1.0012
		Balance ID:	

### Calculations Converting parent activity to dpm/mL|dpm/g

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$$

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (100 \text{ mL}) = 122414.2500 \text{ dpm/mL}$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (1.0012 \text{ g/mL}) / (100 \text{ mL}) = 122273.3377 \text{ dpm/g}$$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
08/26/2003	Angela Johnson	1.9909	100	0299-E	2434.34 dpm/mL	11/04/2004	11/04/2005
08/26/2003	Angela Johnson	1.9872	100	0299-F	2429.82 dpm/mL	08/26/2004	08/26/2005
04/05/2005	Amanda Fehr	5.0018	250	0299-G	2446.3471 dpm/mL	04/02/2008	04/02/2009

GEL Laboratories LLC  
Version 1.0 9/18/2000

*all ok 12/19/08  
len 12/19/08*

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number <u>GLRAD A-008</u>	Isotope <u>Ra-226</u>
Date Standards Prepared <u>4/15/08</u>	Cocktail Type Used <u>NA</u>
Standard ID <u>0299-G</u>	Matrix of Vial/Planchett <u>NA</u> <u>NA</u> <u>NA</u>
Amount Used (g or ml) <u>0.1</u>	Type of Scintillation Vial <u>NA</u>
Standard Activity (DPM/g or ml) <u>2446.347</u>	Pipette ID Used <u>1429303</u>
Reference Date <u>12/15/99</u>	Balance ID Used <u>36040216</u>
Expiration Date <u>4/12/09</u>	Quenching Agent <u>NA</u>
Residue/Carrier Agent <u>0.5 M HCl</u>	

	Standard Number	Quenching Vol (uL/ Residue Volume (mL))	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
14	Cal 14				
13	Cal 13				
43	Cal 43				
15	Cal 15				
44	Cal 44				
46	Cal 46				
36	Cal 36				
19	Cal 19				
47	Cal 47				
37	Cal 37				
42	Cal 42				

*See table*

Prepared By: <u>Kelli S. Deroso</u>	Date: <u>12/19/08</u>
Reviewed By: <u>M. G. Johnson</u>	Date: <u>12/19/08</u>

0299

UKAS ACCREDITED CALIBRATION LABORATORY No. 0146

Reference time for solution number R4/131/89:	1200 GMT on 15 December 1999
Radioactive concentration of radium-226:	43.75 kilobecquerels per gram of solution
which is equivalent to:	1.183 microcuries per gram of solution
Mass of solution:	5.0368 grams
Total activity of radium-226:	220.4 kilobecquerels
which is equivalent to:	5.956 microcuries
Recommended half life:	1600 years

Method of measurement:  
The activity of the solution was measured using a high pressure re-entrant ionisation chamber calibrated with a large number of absolutely standardised solutions.

Calibration date: 15 December 1999  
The calibration date is provided for added information only, and must not be confused with the reference date on pages 1 and 2 of the certificate. It is the reference date that must be used in all calculations relating to the values of activity.

- Expanded uncertainty in the radioactive concentration quoted above:  $\pm 2.5\%$
- Combined Type A uncertainty:  $\pm 0.2\%$
- Combined Type B uncertainty:  $\pm 1.3\%$

Radiochemical The estimated activities of any radioactive impurities found by high-resolution gamma ray spectrometry, or in any other examination of the solution, are listed below expressed as percentages of the activity of the principal radionuclide at the reference time.

Carrier free in 0.5M HCl

This product meets the quality assurance requirements for achieving traceability to NIST as defined in ANSI N42.22-1995.

1 year = 365.25 days

At the reference date radium-226 was shown to be in radioactive equilibrium with its daughter nuclides down the decay chain to polonium-214 and thallium-210, the precursors of lead-210. The ionisation chamber was calibrated using a standard supplied by the National Institute of Standards and Technology, Washington DC, USA.

*Handwritten:* 12/19/98  
12/19/98

# Ra-226 WATER

Batch : LCSVER  
 Date : 10/31/2008  
 Analyst : KSD1

Procedure Code : LUC26RAL

Parname : Radium-226

MDA : 1 pCi/L

Instrument Used : LUCAS CELL DETECTOR

Bkg Count Time: 30 min

Sample ID	Sample Vol L	Count Time min	Gross counts cts	Cell # num	Cell Const. num	BKG cpm	Ra-226 MDA pCi/L	Ra-226 RESULT pCi/L	Ra-226 ERROR pCi/L	COUNT DATE/TIME
VER 1	0.500	30	1014	201	1.993	0.267	0.3504	22.1841	1.3817	11/17/2008 15:10
VER 2	0.500	30	1056	202	2.261	0.267	0.3089	20.3702	1.2427	11/17/2008 15:45
VER 3	0.500	30	726	203	2.254	0.267	0.5419	24.4866	1.8110	10/30/2008 16:05
VER 4	0.500	30	737	204	2.193	0.267	0.5519	25.3188	1.8580	10/30/2008 18:20
VER 5	0.500	30	937	205	1.799	0.267	0.3882	22.6936	1.4718	11/17/2008 16:20
VER 6	0.500	30	780	206	2.259	0.267	0.5373	26.1045	1.8604	10/30/2008 20:20
VER 7	0.500	30	711	207	2.146	0.267	0.5705	25.2245	1.8858	10/30/2008 22:00
VER 3	0.500	30	593	208	2.283	0.267	0.5132	16.9552	1.4723	11/20/2008 16:40
VER 9	0.500	30	630	209	2.291	0.133	0.4042	21.0513	1.6596	10/30/2008 23:40
VER 10	0.500	30	691	210	2.253	0.033	0.2527	23.7356	1.7736	10/31/2008 1:15
VER 11	0.500	30	1067	211	2.171	0.267	0.3314	22.0840	1.3401	11/17/2008 21:55
VER 12	0.500	30	648	212	2.322	0.133	0.4223	22.6294	1.7586	10/31/2008 9:15

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Sample ID	Sample Dup	Det #	Run Date	Sample Type	Standard ID	NC	NC units	Recovery/RPD
201		2	11/17/2008 10:20	LCS	0638-F	24.10	pCi/L	92%
202		2	11/17/2008 10:45	LCS	0638-F	24.10	pCi/L	85%
203		2	10/30/2008 11:05	LCS	0638-F	24.10	pCi/L	102%
204		2	10/30/2008 12:30	LCS	0638-F	24.10	pCi/L	105%
205		2	11/17/2008 11:10	LCS	0638-F	24.10	pCi/L	94%
206		2	10/30/2008 13:10	LCS	0638-F	24.10	pCi/L	108%
207		2	10/30/2008 13:25	LCS	0638-F	24.10	pCi/L	105%
208		2	11/20/2008 11:45	LCS	0638-F	24.10	pCi/L	70% <i>VW</i>
209		2	10/30/2008 14:05	LCS	0638-F	24.10	pCi/L	87% <i>12/18/08</i>
210		2	10/30/2008 14:25	LCS	0638-F	24.10	pCi/L	98%
211		2	11/17/2008 12:20	LCS	0638-F	24.10	pCi/L	92%
212		2	10/30/2008 14:55	LCS	0638-F	24.10	pCi/L	94%

DEGASSING DATE/TIME	DE-EMAN. DATE/TIME	DEGASS-DE-EM	dE-EM-COUNT	constant	constant	constant	Net CPM	Ingrowth constant
11/10/2008 15:35	11/17/2008 10:20	162.75	4.83	0.7073	0.9642	1.0019	33.5333	0.6833
11/10/2008 15:35	11/17/2008 10:45	163.17	5.00	0.7083	0.9630	1.0019	34.9333	0.6833
10/27/2008 14:20	10/30/2008 11:05	68.75	5.00	0.4049	0.9630	1.0019	23.9333	0.3907
10/27/2008 14:20	10/30/2008 12:30	70.17	5.83	0.4113	0.9569	1.0019	24.3000	0.3943
11/10/2008 15:35	11/17/2008 11:10	163.58	5.17	0.7092	0.9617	1.0019	30.9667	0.6833
10/27/2008 14:20	10/30/2008 13:10	70.83	7.17	0.4142	0.9473	1.0019	25.7333	0.3931
10/27/2008 14:20	10/30/2008 13:25	71.08	8.58	0.4153	0.9373	1.0019	23.4330	0.3900
11/17/2008 11:10	11/20/2008 11:45	72.58	4.92	0.4219	0.9636	1.0019	17.5900	0.4073
10/27/2008 14:20	10/30/2008 14:05	71.75	9.58	0.4182	0.9302	1.0019	20.8670	0.3898
10/27/2008 14:20	10/30/2008 14:25	72.08	10.83	0.4197	0.9215	1.0019	23.0003	0.3875
11/10/2008 15:35	11/17/2008 12:20	164.75	9.58	0.7117	0.9302	1.0019	35.3000	0.6633
10/27/2008 14:20	10/30/2008 14:55	72.58	18.33	0.4219	0.8707	1.0019	21.4670	0.3681

*VW*  
*12/18/08*

*12/19/08*  
*VW*

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
<del>NEW 1</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 1020</del>	<del>11111108 1510</del>	<del>201</del>	<del>2</del>	<del>8</del>	<del>1014</del>
<del>2</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 1045</del>	<del>11111108 1545</del>	<del>202</del>	<del>2</del>	<del>8</del>	<del>1056</del>
<del>3</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 1110</del>	<del>11111108 1020</del>	<del>205</del>	<del>2</del>	<del>8</del>	<del>937</del>
<del>4</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 1145</del>	<del>11111108 2050</del>	<del>208</del>	<del>2</del>	<del>8</del>	<del>786</del>
<del>5</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 1150</del>	<del>11111108 2120</del>	<del>209</del>	<del>2</del>	<del>8</del>	<del>1200</del>
<del>6</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 1200</del>	<del>11111108 2155</del>	<del>211</del>	<del>2</del>	<del>8</del>	<del>1067</del>
<del>7</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 0845</del>	<del>11111108 1330</del>	<del>701</del>	<del>1</del>	<del>8</del>	<del>982</del>
<del>8</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 0900</del>	<del>11111108 1405</del>	<del>708</del>	<del>7</del>	<del>8</del>	<del>1194</del>
<del>9</del>	<del>500</del>	<del>11110108 1535</del>	<del>11111108 0930</del>	<del>11111108 1435</del>	<del>705</del>	<del>7</del>	<del>8</del>	<del>1121</del>
10								
11								
12								
NEW 3	500	11111108 1110	11111108 1145	11111108 1040	208	2	8	533

12/18/08  
VW

11/18/08  
VW  
192

VW  
12/18/08

VW  
12/18/08  
VW  
11/21/08

VW 12/19/08

VW 12/19/08  
VW 12/18/08

VW 12/18/08

VW  
12/18/08

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
<del>VEN 1</del>	<del>500</del>	<del>10/27/08 1420</del>	<del>10/30/08 1005</del>	<del>10/30/08 1500</del>	<del>201</del>	<del>2</del>	<del>4</del>	<del>152</del>
<del>VEN 2</del>	<del>500</del>	<del>10/27/08 1420</del>	<del>10/30/08 1005</del>	<del>10/30/08 1535</del>	<del>202</del>	<del>2</del>	<del>4</del>	<del>180</del>
VEN 3	500	10/27/08 1420	10/30/08 1105	10/30/08 1605	203	2	8	726
VEN 4	500	10/27/08 1420	10/30/08 1130	10/30/08 1820	204	2	8	737
<del>VEN 5</del>	<del>500</del>	<del>10/27/08 1420</del>	<del>10/30/08 1150</del>	<del>10/30/08 1900</del>	<del>205</del>	<del>2</del>	<del>6</del>	<del>663</del>
VEN 6	500	10/27/08 1420	10/30/08 1310	10/30/08 2020	206	2	8	780
VEN 7	500	10/27/08 1420	10/30/08 1425	10/30/08 2200	207	2	8	711
<del>VEN 8</del>	<del>500</del>	<del>10/27/08 1420</del>	<del>10/30/08 1545</del>	<del>10/30/08 2300</del>	<del>208</del>	<del>2</del>	<del>4</del>	<del>497</del>
VEN 9	500	10/27/08 1420	10/30/08 1405	10/30/08 2340	209	2	4	630
VEN 10	500	10/27/08 1420	10/30/08 1425	10/31/08 0115	210	2	1	691
<del>VEN 11</del>	<del>500</del>	<del>10/27/08 1420</del>	<del>10/30/08 1440</del>	<del>10/31/08 0835</del>	<del>211</del>	<del>2</del>	<del>3</del>	<del>423</del>
VEN 12	500	10/27/08 1420	10/30/08 1455	10/31/08 0915	212	2	4	648

VP 12/18/08

100 12/18/08

100 12/18/08

100 12/18/08

100 12/18/08

100 12/18/08

VP 12/18/08



# Verification for Ra-226 Standard 0638-F

D Roy  
12/27/2007

Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff Mass. Used (mL)	Source DPM/mL
0638-F N1	1239.9000	31.5000	1208.4000	4.624018	261.3311626
0638-F N2	1222.8000	31.5000	1191.3000	4.624018	257.6330801
0638-F N3	1219.4000	31.5000	1187.9000	4.624018	256.8977869
					Average =

Mean Value (Counting) = 258.6206772  
 Stdev = 2.375965421

96.8384646  
 0.00918707 Rule 3 (Pass/Fail)

Certificate Value = 267.1  
 Lower Limit = 253.8687464  
 Upper Limit = 263.3726081  
 Rule 1 Pass/Fail Fail  
 Two sigma = 4.751930843  
 10 % of Mean = 25.86206772  
 Rule 2 (Pass/Fail) Pass

\*exception taken due to full recovery of standard

## Verification Rules

- Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements
- Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
- Rule 3 = The determined mean value shall be within 5% of the certificate value.

The analyst prepared three standard verification sources for Ra-226 source 0638-F by transferring portions of the standard into tared glass liquid scintillation vials. One mL of DI Water and 10 mL Ready Gel liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 1 mL of DI water and 10 mL of Ready Gel cocktail. The standard verification vials and Background source were dark adapted for two hours and counted on LSC YELLOW using source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 12/27/07 using source 0024-A (Ra-226). Calibration data is recorded in this logbook under Ra-226 (0024-A). Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

Reference RAD SOP M-001

12/19/08

*Handwritten signature:*  
 Amanda L. Fehr 1/4/07

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number GE-RIAD-A-008 Isotope RA-226  
 Date Standards Prepared 12/18/07 Cocktail Type Used NA  
 Standard ID 0638-F Matrix of Vial/Planchett NA  
NA  
NA  
 Amount Used (g or ml) 0.1 Type of Scintillation Vial NA  
 Standard Activity (DPM/g or mL) 147.519 Pipette ID Used 1429303  
 Reference Date 1/23/04 Balance ID Used 3604046  
 Expiration Date 12/20/08 Quenching Agent NA  
 Residue/Carrier Agent 0.1M HCl

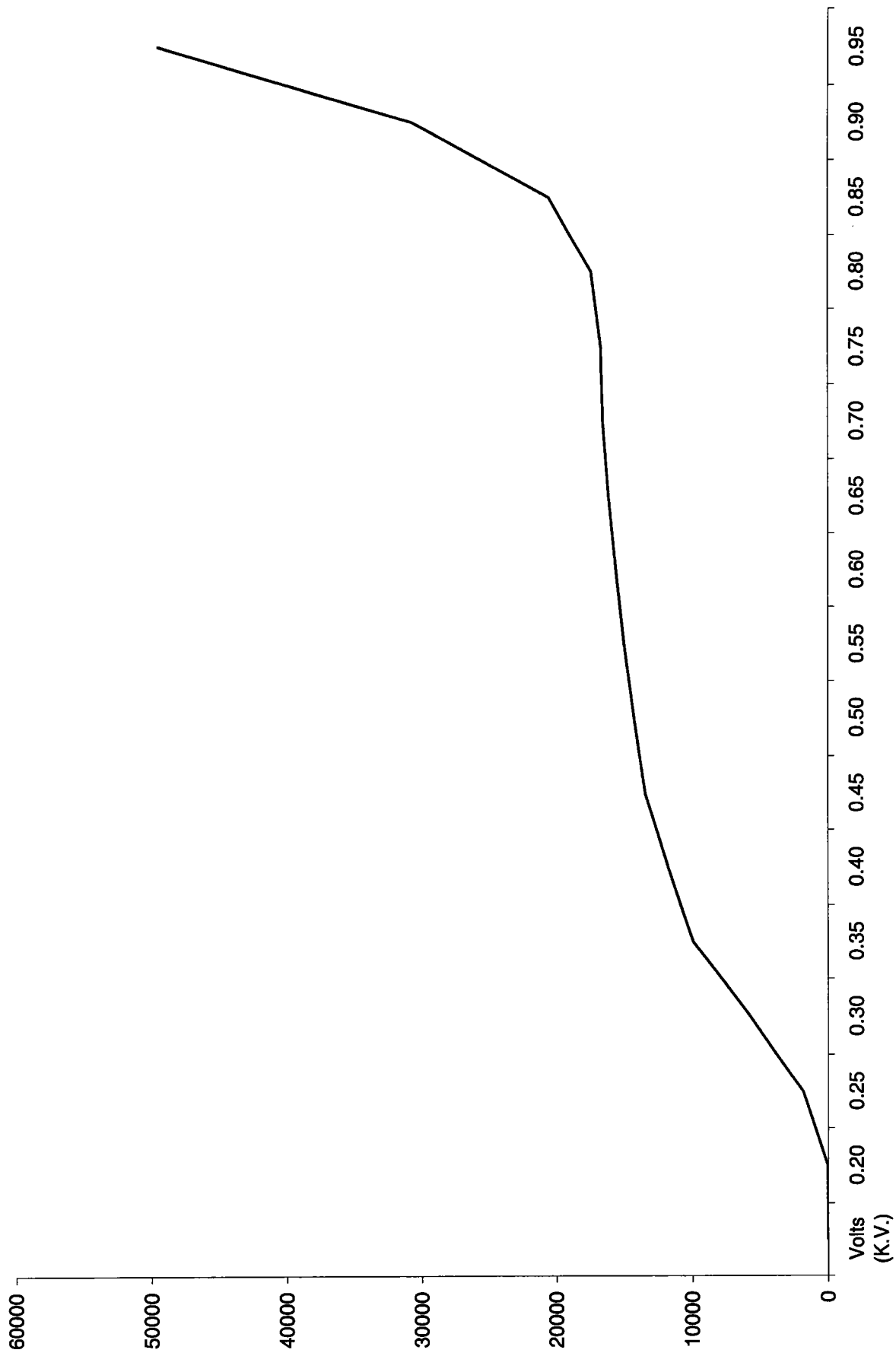
	Standard Number	Quenching Vol (uL) Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	Ver 1				
2	Ver 2				
3	Ver 3				
4	Ver 4				
5	Ver 5				
6	Ver 6				
7	Ver 7				
8	Ver 8				
9	Ver 9				
10	Ver 10				
11	Ver 11				
12	Ver 12				

12/19/08

Prepared By: Kelli Dieriel Date: 12/19/08  
 Reviewed By: Mary Jo Adams Date: 12/19/08

Voltage Curve Ludlum # 2				
Volts (K.V.)	Counts	Date	Time	Detector
0.20	0	9/19/2008	10:00	2
0.25	0	9/19/2008	10:00	2
0.30	0	9/19/2008	10:00	2
0.35	0	9/19/2008	10:00	2
0.40	0	9/19/2008	10:00	2
0.45	36	9/19/2008	10:00	2
0.50	1860	9/19/2008	10:00	2
0.55	5751	9/19/2008	10:00	2
0.60	9916	9/19/2008	10:00	2
0.65	11761	9/19/2008	10:00	2
0.70	13431	9/19/2008	10:00	2
0.75	14254	9/19/2008	10:00	2
0.80	14984	9/19/2008	10:00	2
0.85	15598	9/19/2008	10:00	2
0.90	16129	9/19/2008	10:00	2
0.95	16562	9/19/2008	10:00	2
1.00	16711	9/19/2008	10:00	2
1.05	17428	9/19/2008	10:00	2
1.10	20558	9/19/2008	10:00	2
1.15	30722	9/19/2008	10:00	2
1.20	49527	9/19/2008	10:00	2
1.25	71509	9/19/2008	10:00	2
1.30	115018	9/19/2008	10:00	2

12/19/08  
11/12/08



Mud 12/19/08  
V6 12/19/08

201	1.993	12/19/2008
202	2.261	12/19/2008
203	2.254	12/19/2008
204	2.193	12/19/2008
205	1.799	12/19/2008
206	2.259	12/19/2008
207	2.146	12/19/2008
209	2.291	12/19/2008
210	2.253	12/19/2008
211	2.171	12/19/2008
212	2.322	12/19/2008

*Next  
12/19/08*

# General Engineering Laboratories

2040 Savage Road, Charleston, SC 29414

(843)556-8171

## Lucas Cell Calibration Package

	YES	NO	Comments
1) Is all calibration standard information enclosed for: the primary standard certificate?	✓		
the second standard standard(s) documentation?	✓		
standard preparation information?	✓		
standard < 1 Year old or verified?	✓		
2) Is the efficiency calibration report included ?	✓		
3) Is the raw count data included for: Cell constant determination?	✓		
Plateau generation?	✓		
4) Are the calibration verifications included?	✓		
5) Are the instrument settings included: HVPS settings?	✓		
6) Has the CELLEFF.xls file been updated ?	✓		
7) Have the calibration dates been updated in ALPHALIMS ?	✓		

Prepared By: Kellipanel

Date: 2/3/09

Reviewed By: W. G. Hens

Date: 2/4/09

Effective Date: 2/4/09

# Ra-226 Cell Constants

Standard Reference date: 12/15/1999  
standard ID: 0299-G  
Volume added (mL): 0.1  
Standard Reference Activity (DPM/mL): 2446.35

Lucas cell #	Cell constant	Standard Source	Date/Time of count	Date/Time flushed to cell	Date/time end of degas	bkg cpm	total counts	count time min	Known activity dpm	t1 (days) end-degas to flush	t2 (days) end-flush to count	t3 (days) Std Ref Date to count	Decay from Std Ref Date to count
301	1.867	Average	1/20/2009 11:05	1/19/2009 10:10	1/9/2009 15:45	0.267	9355	30	311.83	9.76736	1.03819	3324	0.9961
301	2.184	Stdev	1/29/2009 11:50	1/28/2009 8:50	1/28/2009 13:00	0.267	6239	30	207.97	2.82639	0.12500	3333	0.9961
301	2.011		1/26/2009 14:35	1/26/2009 9:25	1/22/2009 9:10	0.267	7282	30	242.73	4.01042	0.21528	3331	0.9961
302	2.082	Average	1/30/2009 11:30	1/30/2009 8:30	1/28/2009 13:00	0.267	7401	30	246.70	3.81250	0.12500	3334	0.9961
302	2.225	Stdev	1/29/2009 13:30	1/29/2009 9:20	1/28/2009 13:00	0.233	6335	30	211.17	2.84722	0.17361	3334	0.9961
302	2.086		1/26/2009 15:30	1/26/2009 9:55	1/22/2009 9:10	0.267	7555	30	251.83	4.03125	0.23264	3331	0.9961
303	1.958	Average	1/20/2009 13:40	1/19/2009 11:00	1/9/2009 15:45	0.267	9695	30	323.17	9.80208	1.11111	3325	0.9961
303	2.218	Stdev	1/22/2009 20:35	1/22/2009 10:05	1/19/2009 15:00	0.267	5938	30	197.93	2.79514	0.43750	3327	0.9961
303	2.231		1/26/2009 17:20	1/26/2009 10:25	1/22/2009 9:10	0.267	8028	30	267.60	4.05208	0.28819	3331	0.9961

305	1.897	Average	1/20/2009 14:50	1/19/2009 11:35	1/9/2009 15:45	0.200	9357	30	311.90	9.82639	1.13542	3325	0.9961
305	2.191	Stdev	1/22/2009 21:50	1/22/2009 11:05	1/19/2009 15:00	0.267	5921	30	197.37	2.83681	0.44792	3327	0.9961
305	2.083		1/26/2009 23:00	1/26/2009 11:20	1/22/2009 9:10	0.267	7280	30	242.67	4.09028	0.48611	3331	0.9961
306	1.730	Average	1/20/2009 15:20	1/19/2009 11:50	1/9/2009 15:45	0.167	8521	30	284.03	9.89881	1.14593	3325	0.9961
306	1.891	Stdev	1/29/2009 14:30	1/29/2009 10:20	1/28/2009 13:00	0.233	4869	30	162.30	2.88889	0.17361	3334	0.9961
306	1.821		1/26/2009 23:30	1/26/2009 11:50	1/22/2009 9:10	0.267	6387	30	212.90	4.11111	0.48611	3331	0.9961
307	1.818	Average	1/20/2009 15:50	1/19/2009 12:05	1/9/2009 15:45	0.267	8944	30	298.13	9.84722	1.15625	3325	0.9961
307	2.095	Stdev	1/30/2009 12:55	1/30/2009 9:10	1/28/2009 13:00	0.267	7442	30	248.07	3.84028	0.15625	3335	0.9961
307	1.881		1/27/2009 0:05	1/26/2009 12:10	1/22/2009 9:10	0.267	6598	30	219.93	4.12500	0.49563	3331	0.9961
308	2.129	Average	1/29/2009 15:50	1/29/2009 11:05	1/28/2009 13:00	0.133	6149	30	204.97	2.92014	0.19792	3334	0.9961
308	1.858	Stdev	1/23/2009 9:35	1/22/2009 13:45	1/19/2009 15:00	0.267	4829	30	160.97	2.94792	0.82639	3327	0.9961
308	1.862		1/27/2009 8:30	1/26/2009 13:15	1/22/2009 9:10	0.267	6226	30	207.53	4.17014	0.80208	3331	0.9961
309	1.857	Average	1/20/2009 17:20	1/19/2009 13:35	1/9/2009 15:45	0.033	9149	30	304.97	9.90972	1.15625	3325	0.9961
309	1.964	Stdev	1/23/2009 10:30	1/22/2009 14:05	1/19/2009 15:00	0.267	5100	30	170.00	2.96181	0.85069	3327	0.9961
309	1.810		1/27/2009 9:05	1/26/2009 13:30	1/22/2009 9:10	0.267	6046	30	201.53	4.18056	0.81597	3331	0.9961

311	2.140	Average	1/29/2009 16:40	1/29/2009 11:20	1/28/2009 13:00	0.267	6176	30	205.87	2.93056	0.22222	3334	0.9961
311	2.212	Stdev	1/23/2009 12:20	1/22/2009 14:25	1/19/2009 15:00	0.267	5698	30	189.93	2.97569	0.91319	3328	0.9961
311	1.988		1/27/2009 10:15	1/26/2009 13:45	1/22/2009 9:10	0.267	6607	30	220.23	4.19097	0.85417	3331	0.9961
312	1.871	Average	1/20/2009 19:16	1/19/2009 14:10	1/9/2009 15:45	0.100	9135	30	304.50	9.93403	1.21250	3325	0.9961
312	2.014	Stdev	1/29/2009 17:10	1/29/2009 11:35	1/28/2009 13:00	0.167	5814	30	193.80	2.94097	0.28264	3334	0.9961
312	1.946		1/27/2009 11:10	1/26/2009 14:00	1/22/2009 9:10	0.267	6446	30	214.87	4.20139	0.88194	3331	0.9961

KW 213109

Ra-226 Verification Sheet

#3

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 13	500	1126109 1300	1120109 0820	1120109 1130	302	3	8	7401
Cal 28	500	1126105 1300	1120109 0855	1120109 1200	304	3	8	7101
Cal 34	500	1126105 1300	1120109 0910	1120109 1255	307	3	8	7442
<del>Cal 30</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 31</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 32</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 33</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 35</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 36</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 37</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 38</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 39</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 40</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 41</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 42</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 43</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 44</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 45</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 46</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 47</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 48</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 49</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>
<del>Cal 50</del>	<del>500</del>	<del>1126105 1300</del>	<del>1120109 0855</del>	<del>1120109 1200</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>7101</del>

KP 2/3/09

KP 2/3/09

MUA 2/4/09  
KP 2/3/09

2/3/09



#3

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Ca1143	500	11/26/09 1300	11/26/09 0850	11/26/09 1150	301	3	8	6239
Ca1147	500	11/26/09 1300	11/26/09 0920	11/26/09 1330	302	3	7	6335
<del>Ca1149</del>	<del>500</del>	<del>11/26/09 1300</del>	<del>11/26/09 0450</del>	<del>11/26/09 1450</del>	<del>304</del>	<del>3</del>	<del>2</del>	<del>6472</del>
Ca1130	500	11/26/09 1300	11/26/09 1020	11/26/09 1430	306	3	7	4869
<del>Ca1142</del>	<del>500</del>	<del>11/26/09 1300</del>	<del>11/26/09 1045</del>	<del>11/26/09 1515</del>	<del>307</del>	<del>3</del>	<del>3</del>	<del>6648</del>
Ca1144	500	11/26/09 1300	11/26/09 1105	11/26/09 1550	308	3	4	6149
Ca1145	500	11/26/09 1300	11/26/09 1120	1/29/09 1640	311	3	8	6176
Ca1144	500	11/26/09 1300	11/26/09 1135	1/29/09 1710	312	3	5	5814
Ca1113	500	11/26/09 1300						
Ca1128	500	11/26/09 1300						
Ca1136	500	11/26/09 1300						
Ca1137	500	11/26/09 1300						

100 2/13/09  
140 2/13/09

140 2/13/09  
140 2/13/09

100 2/13/09

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 43	500	11/9/09 1545	11/9/09 1010	11/20/09 1105	301	3	8	9355
<del>Cal 44</del>	<del>500</del>	<del>11/9/09 1545</del>	<del>11/9/09 1040</del>	<del>11/20/09 1150</del>	<del>302</del>	<del>3</del>	<del>8</del>	<del>8433</del>
Cal 49	500	11/9/09 1545	11/9/09 1100	11/20/09 1340	303	3	8	9095
<del>Cal 50</del>	<del>500</del>	<del>11/9/09 1545</del>	<del>11/9/09 1100</del>	<del>11/20/09 1440</del>	<del>304</del>	<del>3</del>	<del>8</del>	<del>1060</del>
Cal 42	500	11/9/09 1545	11/9/09 1135	11/20/09 1450	305	3	5	9357
Cal 44	500	11/9/09 1545	11/9/09 1150	11/20/09 1520 <del>1440</del>	306	3	7	8521
Cal 15	500	11/9/09 1545	11/9/09 1205	11/20/09 1550	307	3	8	8944
<del>Cal 14</del>	<del>500</del>	<del>11/9/09 1545</del>	<del>11/9/09 1315</del>	<del>11/20/09 1645</del>	<del>308</del>	<del>3</del>	<del>3</del>	<del>6938</del>
Cal 13	500	11/9/09 1545	11/9/09 1335	11/20/09 1720	309	3	1	9149
<del>Cal 28</del>	<del>500</del>	<del>11/9/09 1545</del>	<del>11/9/09 1355</del>	<del>11/20/09 1840</del>	<del>311</del>	<del>3</del>	<del>8</del>	<del>8648</del>
Cal 36	500	11/9/09 1545	11/9/09 1410	11/20/09 1916	312	3	1	9135
<del>Cal 37</del>	<del>500</del>	<del>11/9/09 1545</del>						

K-20  
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213109  
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213109

K-20  
213109

Ra-226 Verification Sheet

Cal for #3

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
<del>Cal 43</del>	500	<del>11/21/09 1500</del>	<del>11/22/09 0410</del>	<del>11/22/09 1525</del>	<del>301</del>	<del>3</del>	<del>8</del>	<del>6110</del>
<del>Cal 44</del>	500	<del>11/21/09 1500</del>	<del>11/22/09 0435</del>	<del>11/22/09 1605</del>	<del>302</del>	<del>3</del>	<del>8</del>	<del>6498</del>
Cal 119	500	11/19/09 1500	11/22/09 1005	11/22/09 2035	303	3	8	5938
Cal 130	500	11/19/09 1500	11/22/09 1035	11/22/09 2120	304	3	8	5240
Cal 142	500	11/19/09 1500	11/22/09 1105	11/22/09 2150	305	3	8	5921
<del>Cal 144</del>	500	<del>11/19/09 1500</del>	<del>11/22/09 1135</del>	<del>11/22/09 1840</del>	<del>306</del>	<del>3</del>	<del>8</del>	<del>5393</del>
<del>Cal 15</del>	500	<del>11/19/09 1500</del>	<del>11/22/09 1320</del>	<del>11/23/09 0960</del>	<del>307</del>	<del>3</del>	<del>8</del>	<del>5870</del>
Cal 114	500	11/19/09 1500	11/22/09 1345	11/23/09 0935	308	3	8	4824
Cal 13	500	11/19/09 1500	11/22/09 1405	11/23/09 1000	309	3	8	5100
Cal 28	500	11/19/09 1500	11/22/09 1425	11/23/09 1200	311	3	8	5098
<del>Cal 36</del>	500	<del>11/19/09 1500</del>	<del>11/22/09 1440</del>	<del>11/23/09 1335</del>	<del>312</del>	<del>3</del>	<del>8</del>	<del>5881</del>
<del>Cal 27</del>	500	<del>11/19/09 1500</del>	<del>11/22/09</del>	<del></del>				

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Ra-226 Verification Sheet

Call for #3

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Ca143	500	1122109 0910	1126109 0955	1126109 1455	301	3	8	7282
Ca147	500	1122109 0910	1126109 0955	1126109 1530	302	3	8	1555
Ca119	500	1122109 0910	1126109 1025	1126109 1600	303	3	8	8028
<del>Ca130</del>	<del>500</del>	<del>1122109 0910</del>	<del>1126109 1050</del>	<del>1.26.09 1645</del>	<del>304</del>	<del>3</del>		<del>5162</del>
Ca142	500	1122109 0910	1126109 1100	1.26.09 2300	305	3	8	7280
Ca144	500	1122109 0910	1126109 1150	1.26.09 2330	306	3	8	6387
Ca115	500	1122109 0910	1126109 1210	1.27.09 0005	307	3	8	6598
Ca114	500	1122109 0910	1126109 1315	1127109 0830	308	3	8	6226
Ca113	500	1122109 0910	1126109 1330	1127109 0905	309	3	8	6046
Ca128	500	1122109 0910	1126109 1345	1127109 1015	311	3	8	6607
Ca136	500	1122109 1910	1126109 1400	1127109 1110	312	3	8	6446
<del>Ca137</del>								

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# Verification for Ra-226 Standard 0299-G

4/2/2008	Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff	Standard Mass. Used (G)	Source DPM/G
D. Roy	0299-G N1	2536.9600	52.4000	2484.5600	1.917186	0.5057	2562.667649
	0299-G N2	2520.2500	52.4000	2467.8500	1.917186	0.5056	2545.935781
	0299-G N3	2532.5000	52.4000	2480.1000	1.917186	0.5042	2565.677715
						Average =	2558.093715

Mean Value (Counting) = 2558.093715  
 Stdev = 10.63610098

Certificate Value = 2437.6 dpm/mL  
 Lower Limit = 2536.821513 dpm/mL  
 Upper Limit = 2579.365917 dpm/mL

Rule 1 Pass/Fail **Fail**  
 Two sigma = 21.27220197 dpm/mL  
 10 % of Mean = 255.8093715 dpm/mL

Rule 2 (Pass/Fail) **Pass**

104.944421 **Pass**  
 0.00415782 **Rule 3 (Pass/Fail)**

\*exception taken due to full recovery of standard

**Verification Rules**

**Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements**

**Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.**

**Rule 3 = The determined mean value shall be within 10% of the certificate value.**

The analyst prepared three standard verification sources for Ra-226 source 0299-G by transferring portions of the standard into tared glass liquid scintillation vials. One mL of DI Water and ten mLs of Ready Gel liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 1 mL of DI water and 10 mL of Ready Gel cocktail. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Gold for Radium source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 4/02/08 using source 0024-A (Ra-226). Calibration data is recorded in this logbook under Ra-226 0024. Each verification source calculation was performed as follows:

Source dpm/g = (A - B)/(C)(D)  
 where:  
 A = Ver. source cpm,  
 B = BKG cpm,  
 C = System efficiency, (cpm/dpm), and  
 D = mass used for standard verification.

IRAD.SOP.M-001

*Handwritten notes:*  
 5/23/08  
 1.5 ml water added



# Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0299	Isotope:	Radium-226
Prepared By:	Angela Johnson	Prepared By:	Angela Johnson
Carrier Conc:	0.5 M HCL	Prep Date:	09/15/2000
Reference Date:	12/15/1999	Verification Date:	01/23/2008
Ampoule Mass (g):	5.0368 g	Expiration Date:	01/23/2009
Uncertainty:	+/- 2.5 %	Primary Code:	0299-A
LogBook No:	RC S 027 128	Dilution(mL):	100 mL
		Mass of Parent(g):	4.6634 g
		Density(g/mL):	1.0012
		Balance ID:	

### Calculations Converting parent activity to dpm/mL|dpm/g

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$$

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (100 \text{ mL}) = 122414.2500 \text{ dpm/mL}$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (1.0012 \text{ g/mL}) / (100 \text{ mL}) = 122273.3377 \text{ dpm/g}$$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
08/26/2003	Angela Johnson	1.9909	100	0299-E	2434.34 dpm/mL	11/04/2004	11/04/2005
08/26/2003	Angela Johnson	1.9872	100	0299-F	2429.82 dpm/mL	08/26/2004	08/26/2005
04/05/2005	Amanda Fehr	5.0018	250	0299-G	2446.3471 dpm/mL	04/02/2008	04/02/2009

GEL Laboratories LLC  
Version 1.0 9/18/2000

LD 2/3/09  
ALLA 2/4/09

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number <u>GL-RAD-A-008</u>	Isotope <u>RA-226</u>
Date Standards Prepared <u>4/5/09</u>	Cocktail Type Used <u>NA</u>
Standard ID <u>02896</u>	Matrix of Vial/Planchett <u>NA</u> <u>NA</u> <u>NA</u>
Amount Used (g or ml) <u>0.1</u>	Type of Scintillation Vial <u>NA</u>
Standard Activity (DPM/g or mL) <u>2446.347</u>	Pipette ID Used <u>1429303</u>
Reference Date <u>12/15/99</u>	Balance ID Used <u>30040216</u>
Expiration Date <u>4/2/09</u>	Quenching Agent <u>NA</u>
Residue/Carrier Agent <u>0.5 M HCl</u>	

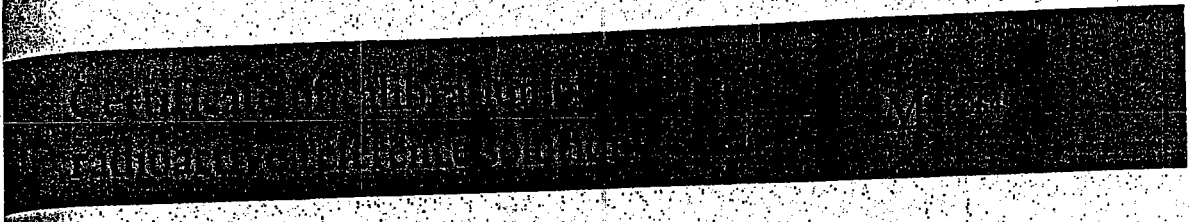
	Standard Number	Quenching Vol (uL)/ Residue Volume(mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
43	Cal 43				
47	Cal 47				
19	Cal 19				
30	Cal 30				
42	Cal 42				
44	Cal 44				
15	Cal 15				
14	Cal 14				
13	Cal 13				
28	Cal 28				
36	Cal 36				

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 213/09

Prepared By: <u>Kelli Brown</u>	Date: <u>2/3/09</u>
Reviewed By: <u>Raymond Jones</u>	Date: <u>2/4/09</u>

Rev 1 RLM 9/10/97

0299



UKAS ACCREDITED CALIBRATION LABORATORY No. 0146

Reference time for solution number R4/131/89:

1200 GMT on 15 December 1999

Radioactive concentration of radium-226:  
which is equivalent to:

43.75 kilobecquerels per gram of solution

1.183 microcuries per gram of solution

Mass of solution:

5.0368 grams

Total activity of radium-226:  
which is equivalent to:

220.4 kilobecquerels

5.956 microcuries

Recommended half life:

1600 years

Method of measurement:

The activity of the solution was measured using a high pressure re-entrant ionisation chamber calibrated with a large number of absolutely standardised solutions.

Calibration date: 15 December 1999

The calibration date is provided for added information only, and must not be confused with the reference date on pages 1 and 2 of the certificate. It is the reference date that must be used in all calculations relating to the values of activity.

Expanded uncertainty in the radioactive concentration quoted above:  $\pm 2.5\%$

Combined Type A uncertainty:  $\pm 0.2\%$

Combined Type B uncertainty:  $\pm 1.3\%$

The estimated activities of any radioactive impurities found by high-resolution gamma ray spectrometry, or in any other examination of the solution, are listed below expressed as percentages of the activity of the principal radionuclide at the reference time.

Carrier free in 0.5M HCL

This product meets the quality assurance requirements for achieving traceability to NIST as defined in ANSI N42.22-1995.

1 year = 365.25 days

At the reference date radium-226 was shown to be in radioactive equilibrium with its daughter nuclides down the decay chain to polonium-214 and thallium-210, the precursors of lead-210. The ionisation chamber was calibrated using a standard supplied by the National Institute of Standards and Technology, Washington DC, USA.

KB 213109  
UKAS 21/11/99



# Ra-226 WATER

Batch : LCSVER  
 Date : 1/2/2009  
 Analyst : KSD1

Procedure Code : LUC26RAL  
 Parname : Radium-226  
 MDA : 1 pCi/L

Instrument Used : LUCAS CELL DETECTOR

Bkg Count Time: 30 min

Sample ID	Sample Vol L	Count Time min	Gross counts cts	Cell # num	Cell Const. num	BKG cpm	Ra-226 MDA pCi/L	Ra-226 RESULT pCi/L	Ra-226 ERROR pCi/L	COUNT DATE/TIME
1	0.500	30	656	301	2.021	0.267	0.4919	20.0589	1.5634	1/30/2009 15:05
1	0.500	30	655	302	2.131	0.267	0.5554	22.6149	1.7640	2/2/2009 13:40
2	0.500	30	914	303	2.136	0.267	0.4647	26.4838	1.7397	1/30/2009 15:40
3	0.500	30	791	305	2.057	0.267	0.4845	23.8718	1.6891	1/30/2009 17:05
4	0.500	30	768	306	1.747	0.267	0.5709	27.2885	1.9605	1/30/2009 17:37
2	0.500	30	720	307	1.931	0.267	0.6113	27.3779	2.0335	2/2/2009 14:15
5	0.500	30	730	308	1.950	0.267	0.5149	23.3957	1.7254	1/30/2009 19:05
6	0.500	30	764	309	1.877	0.267	0.5908	28.0944	2.0238	1/31/2009 10:20
7	0.500	30	594	311	2.114	0.267	0.5510	20.3087	1.6667	1/31/2009 17:20
8	0.500	30	542	312	1.944	0.267	0.8009	26.8983	2.3154	2/2/2009 8:25

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 OK

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Sample ID	Cell #	Det #	Run Date	Sample Type	Standard ID	NC	NC units	Recovery/RPD
1	301	3	1/30/2009 10:40	LCS	0638-F	24.10	pCi/L	83%
2	302	3	2/2/2009 9:15	LCS	0638-F	24.10	pCi/L	94%
2	303	3	1/30/2009 11:05	LCS	0638-F	24.10	pCi/L	110%
3	305	3	1/30/2009 11:30	LCS	0638-F	24.10	pCi/L	99%
4	306	3	1/30/2009 11:45	LCS	0638-F	24.10	pCi/L	113%
2	307	3	2/2/2009 9:40	LCS	0638-F	24.10	pCi/L	114%
5	308	3	1/30/2009 12:00	LCS	0638-F	24.10	pCi/L	97%
3	309	3	1/30/2009 13:05	LCS	0638-F	24.10	pCi/L	117%
7	311	3	1/30/2009 13:20	LCS	0638-F	24.10	pCi/L	84%
8	312	3	1/30/2009 13:40	LCS	0638-F	24.10	pCi/L	112%

DEGASSING DATE/TIME	DE-EMAN. DATE/TIME	DEGASS-DE-EM	dE-EM-COUNT	constant	constant	Net CPM	Ingrowth constant
1/26/2009 16:05	1/30/2009 10:40	90.58	4.42	0.9672	1.0019	21.6000	0.4800
1/30/2009 10:00	2/2/2009 9:15	71.25	4.42	0.9672	1.0019	21.5667	0.4032
1/26/2009 16:05	1/30/2009 11:05	91.00	4.58	0.9660	1.0019	30.1997	0.4809
1/26/2009 16:05	1/30/2009 11:30	91.42	5.58	0.9587	1.0019	26.1000	0.4788
1/26/2009 16:05	1/30/2009 11:45	91.67	5.87	0.9567	1.0019	25.3330	0.4787
1/30/2009 10:00	2/2/2009 9:40	71.67	4.58	0.9660	1.0019	23.7330	0.4044
1/26/2009 16:05	1/30/2009 12:00	91.92	7.08	0.9479	1.0019	24.0667	0.4753
1/26/2009 16:05	1/30/2009 13:05	93.00	21.25	0.8518	1.0019	25.1997	0.4305
1/26/2009 16:05	1/30/2009 13:20	93.25	28.00	0.8095	1.0019	19.5330	0.4099
1/26/2009 16:05	1/30/2009 13:40	93.58	66.75	0.6041	1.0019	17.7997	0.3067

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Ra-226 Verification Sheet

#3

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Ver 1	500	11/20/09 1605	11/20/09 1740	11/20/09 1505	301	3	8	656
Ver 2	500	11/20/09 1605	11/20/09 1105	11/20/09 1540	303	3	8	914
Ver 3	500	11/20/09 1605	11/20/09 1130	11/30/09 1705	305	3	8	791
Ver 4	500	11/20/09 1605	11/20/09 1145	11/30/09 1737	306	3	8	768
Ver 5	500	11/20/09 1605	11/20/09 1200	11/30/09 1905	308	3	8	730
Ver 6	500	11/20/09 1605	11/20/09 1305	1.31.09 1020	309	3	8	764
Ver 7	500	11/20/09 1605	11/20/09 1320	13/09 1720	311	3	8	594
Ver 8	500	11/20/09 1605	11/20/09 1340	11/09 0805	312	3	8	542
<del>Ver 9</del>	500	11/20/09 1605						
Ver 10	500	11/20/09 1605						
Ver 11	500	11/20/09 1605						
Ver 12	500	11/20/09 1605						

Ver 12  
11/20/09

11/20/09

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
VUN 1	500	11/20/09 10:00	2/2/09 09:15	2/2/09 13:40	304	3	8	655
VUN 2	500	11/20/09 10:00	2/2/09 09:40	2/2/09 14:15	307	3	8	720
VUN 3	500	1/30/09 09:00	2/2/09 11:15	2/2/09 14:50	309	3	8	754

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## Verification for Ra-226 Standard 0638-F

	Isotope	Value	Uncertainty
D. Roy 2/2/2009	0638-F #1	24.629	1.7426
	0638-F #2	24.438	1.7557
	0638-F #3	22.791	1.6808
Mean Value (Counting) =	23.953	99.60	Pass
Stdev =	1.010781096		Rule 3 (Pass/Fail)
Target =	24.05		
Lower Limit =	21.93100448		
Upper Limit =	25.97412886		
Rule 1 Pass/Fail	Pass		
Two sigma =	2.021562191		
10 % of Mean =	2.395256667		
Rule 2 (Pass/Fail)	Pass		

- Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements
- Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
- Rule 3 = The determined mean value shall be within 5% of the certificate value.

The analyst prepared three standard verification sources for standard 0638-F using 0.1 mL for each source. Each source was counted using routine Lucas cell procedures. Calibration for 0299-G was used in this verification.

140 2/4/09  
*[Signature]* 2/2/09  
 Amanda L. Lehn  
 2/4/09

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number GL-RAD-008 Isotope Po-226  
 Date Standards Prepared <sup>Handwritten</sup> 12/13/2007 Cocktail Type Used N/A  
 Standard ID 0630-F Matrix of Vial/Planchett N/A  
 Amount Used (g or ml) 0.1 ml Type of Scintillation Vial N/A  
 Standard Activity (DPM/g or ml) 267.519 dpm/ml Pipette ID Used 1429303  
 Reference Date 1/23/2004 Balance ID Used N/A  
 Expiration Date 2/14/09 Quenching Agent N/A  
 Residue/Carrier Agent 0.1 ml H<sub>2</sub>O

	Standard Number	Quenching Vol (uL)/ Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	Ver 1				
2	Ver 2				
3	Ver 3				
4	Ver 4				
5	Ver 5				
6	Ver 6				
7	Ver 7				
8	Ver 8				
9	Ver 9				
10	Ver 10				
11	Ver 11				
12	Ver 12				

LO 2/13/09

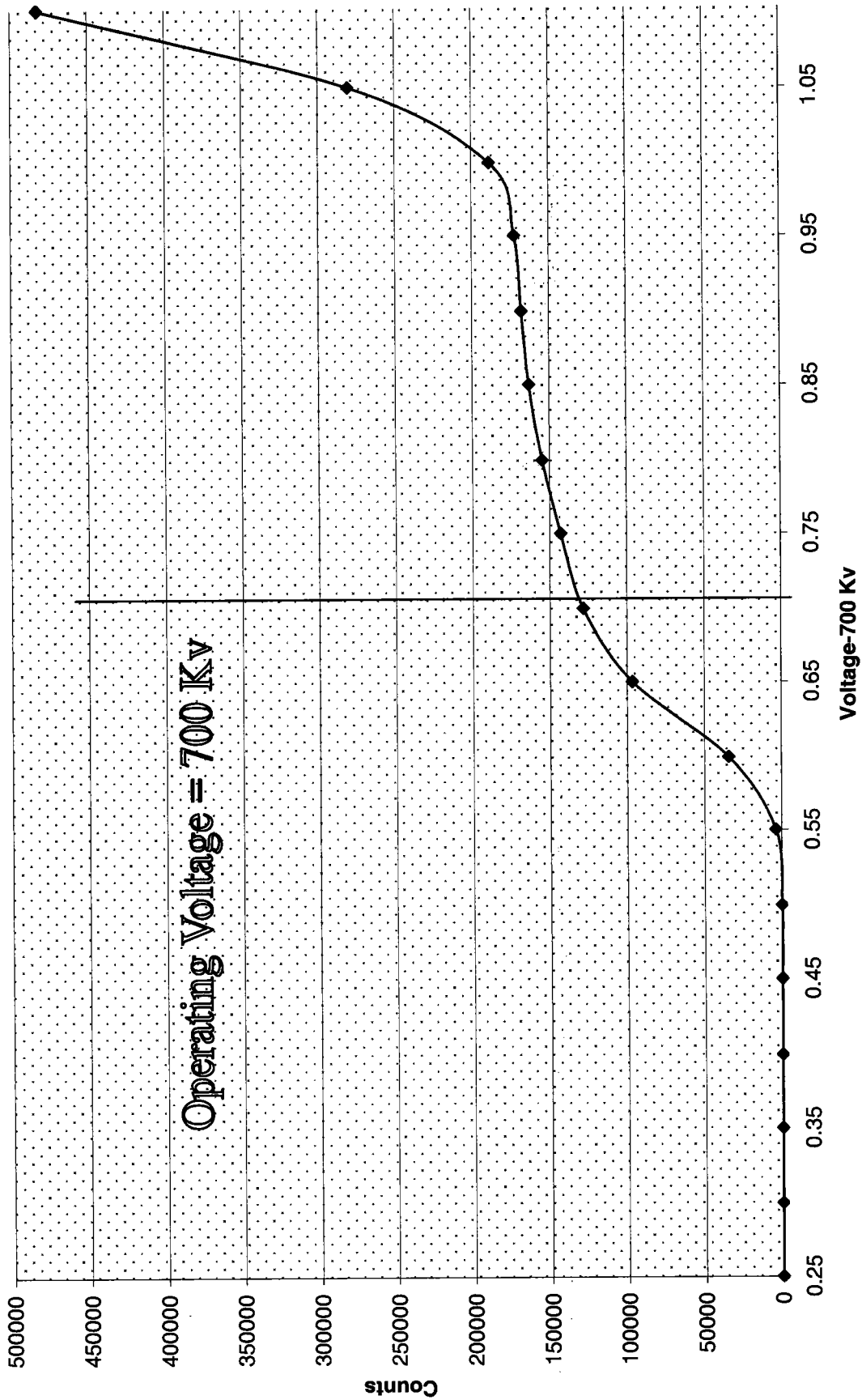
Prepared By: Kelli B. Nevel Date 2/13/09  
 Reviewed By: [Signature] Date 2/14/09

Voltage Curve 1-09

Voltage Curve Ludlum # 3				
Volts	Counts	Date	Time	Detector
0.00	0	1/20/2009	13:45	3
0.05	0	1/20/2009	13:46	3
0.10	0	1/20/2009	13:47	3
0.15	0	1/20/2009	13:48	3
0.20	0	1/20/2009	13:49	3
0.25	0	1/20/2009	14:00	3
0.30	0	1/20/2009	14:01	3
0.35	0	1/20/2009	14:02	3
0.40	0	1/20/2009	14:03	3
0.45	0	1/20/2009	14:04	3
0.50	0	1/20/2009	14:05	3
0.55	3914	1/20/2009	14:06	3
0.60	34392	1/20/2009	14:07	3
0.65	96643	1/20/2009	14:08	3
0.70	128361	1/20/2009	14:09	3
0.75	142888	1/20/2009	14:10	3
0.80	154583	1/20/2009	14:11	3
0.85	163087	1/20/2009	14:12	3
0.90	167801	1/20/2009	14:13	3
0.95	172317	1/20/2009	14:14	3
1.00	188508	1/20/2009	14:15	3

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# Ludlum 3 Voltage Curve



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301	2.021	2/4/2009
302	2.131	2/4/2009
303	2.136	2/4/2009
305	2.057	2/4/2009
306	1.747	2/4/2009
307	1.931	2/4/2009
308	1.950	2/4/2009
309	1.877	2/4/2009
311	2.114	2/4/2009
312	1.944	2/4/2009

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2/4/09

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2/4/09  
1/0 2/4/09

**General Engineering Laboratories**

2040 Savage Road, Charleston, SC 29414

(843)556-8171

**Lucas Cell Calibration Package**

	YES	NO	Comments
1) Is all calibration standard information enclosed for: the primary standard certificate? the secondary standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	✓		
	✓		
	✓		
	✓		
2) Is the efficiency calibration report included ?	✓		
3) Is the raw count data included for: Cell constant determination? Plateau generation?	✓		
	✓		
4) Are the calibration verifications included?	✓		
5) Are the instrument settings included: HVPS settings?	✓		
6) Has the CELLEFF.xls file been updated ?	✓		
7) Have the calibration dates been updated in ALPHALIMS ?	✓		

Prepared By: Kelli Dorrel

Date: 2/28/09

Reviewed By: Angela Johnson

Date: 3/2/09

Effective Date: 3/2/09

# Ra-226 Cell Constants

Standard Reference date: 12/15/1999  
 standard ID: 0.289-G  
 Volume added (mL): 0.1  
 Standard Reference Activity (DPM/mL): 2446.35

Lucas cell #	Call constant	Standard Source	Date/Time of count	Date/Time flushed to cell	Date/Time end of degas	bkg cpm	total counts	count time min	cpm	Known activity dpm	11 (days) end-degas to flush	12 (days) end-flush to count	13 (days) Std Ref Date to count	Decay from Std Ref Date to count
401	1.689	Average 1.574	2/23/2009 16:15	2/23/2009 10:30	2/20/2009 17:25	0.267	4580	30	152.67	243.66	2.71181	0.23958	3359	0.9960
401	1.585	Stdev 0.121	2/27/2009 13:15	2/27/2009 9:00	2/23/2009 16:05	0.267	5474	30	182.47	243.66	3.70486	0.17708	3363	0.9960
401	1.448		2/25/2009 14:40	2/25/2009 7:55	2/20/2009 17:25	0.267	5677	30	189.23	243.66	4.60417	0.28125	3361	0.9960
402	2.133	Average 2.118	2/23/2009 16:55	2/23/2009 11:05	2/20/2009 17:25	0.267	5817	30	193.90	243.66	2.73611	0.24306	3359	0.9960
402	2.173	Stdev 0.064	2/27/2009 14:10	2/27/2009 9:30	2/23/2009 16:05	0.267	7507	30	250.23	243.66	3.72569	0.19444	3363	0.9960
402	2.048		2/25/2009 15:25	2/25/2009 8:15	2/20/2009 17:25	0.267	8017	30	267.23	243.66	4.61806	0.29861	3361	0.9960
403	1.475	Average 1.463	2/23/2009 18:30	2/23/2009 11:30	2/20/2009 17:25	0.267	4011	30	133.70	243.66	2.75347	0.29167	3359	0.9960
403	1.495	Stdev 0.039	2/27/2009 14:50	2/27/2009 10:00	2/23/2009 16:05	0.267	5182	30	172.73	243.66	3.74653	0.20139	3363	0.9960
403	1.419		2/25/2009 15:55	2/25/2009 8:35	2/20/2009 17:25	0.267	5562	30	185.40	243.66	4.63194	0.30556	3361	0.9960
404	1.792	Average 1.931	2/23/2009 19:05	2/23/2009 13:10	2/20/2009 17:25	0.267	5005	30	166.83	243.66	2.82292	0.24653	3359	0.9960
404	2.142	Stdev 0.186	2/27/2009 15:25	2/27/2009 10:30	2/23/2009 16:05	0.267	7443	30	248.10	243.66	3.76736	0.20486	3363	0.9960
404	1.859		2/25/2009 20:20	2/25/2009 8:55	2/20/2009 17:25	0.267	7075	30	235.83	243.66	4.64583	0.47569	3361	0.9960
405	2.066	Average 1.903	3/2/2009 13:40	3/2/2009 10:30	2/25/2009 14:00	0.267	8602	30	286.73	243.66	4.85417	0.13194	3366	0.9960
405	1.899	Stdev 0.161	2/27/2009 16:00	2/27/2009 10:55	2/23/2009 16:05	0.267	6612	30	220.40	243.66	3.78472	0.21181	3363	0.9960
405	1.745		2/25/2009 20:55	2/25/2009 10:10	2/20/2009 17:25	0.267	6721	30	224.03	243.66	4.69792	0.44792	3361	0.9960
409	1.805	Average 2.036	2/24/2009 0:30	2/23/2009 15:20	2/20/2009 17:25	0.267	5039	30	167.97	243.66	2.91319	0.38194	3359	0.9960
409	2.153	Stdev 0.200	2/3/2009 21:10	2/3/2009 15:00	1/30/2009 10:50	0.267	7949	30	264.97	243.67	4.17361	0.25694	3339	0.9960
409	2.149		2/27/2009 16:35	2/27/2009 11:30	2/23/2009 16:05	0.267	7516	30	250.53	243.66	3.80903	0.21181	3363	0.9960
410	1.869	Average 1.886	2/26/2009 8:50	2/25/2009 13:05	2/20/2009 17:25	0.267	6838	30	227.93	243.66	4.81944	0.82292	3361	0.9960
410	1.965	Stdev 0.072	2/4/2009 8:30	2/3/2009 15:30	1/30/2009 10:50	0.267	6708	30	223.60	243.67	4.19444	0.70833	3339	0.9960
410	1.824		2/24/2009 8:00	2/23/2009 15:40	2/20/2009 17:25	0.267	4840	30	161.33	243.66	2.92708	0.68056	3359	0.9960
411	1.824	Average 1.824	2/24/2009 8:40	2/23/2009 15:55	2/20/2009 17:25	0.267	4839	30	161.30	243.66	2.93750	0.69792	3359	0.9960
411	1.911	Stdev 0.013	2/27/2009 17:45	2/27/2009 12:20	2/23/2009 16:05	0.267	6357	30	211.90	243.66	3.84375	0.22569	3363	0.9960
411	1.836		2/26/2009 9:30	2/25/2009 13:40	2/20/2009 17:25	0.267	6734	30	224.47	243.66	4.84375	0.82639	3361	0.9960
412	1.947	Average 1.967	2/26/2009 10:15	2/25/2009 14:05	2/20/2009 17:25	0.267	7137	30	237.90	243.66	4.86111	0.84028	3361	0.9960
412	2.131	Stdev 0.156	2/27/2009 18:20	2/27/2009 12:45	2/23/2009 16:05	0.267	7495	30	249.83	243.66	3.86111	0.23264	3363	0.9960
412	1.822		2/24/2009 9:40	2/23/2009 16:10	2/20/2009 17:25	0.267	4818	30	160.60	243.66	2.94792	0.72917	3359	0.9960

EffErr 0.123705 <- Put in Machines.xls (Lucas Cell Tab)

*Angela Johnson 3/2/09*  
*Muli Nouel 3/2/09*

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401	1.574	3/2/2009
402	2.118	3/2/2009
403	1.463	3/2/2009
404	1.931	3/2/2009
405	1.903	3/2/2009
409	2.036	3/2/2009
410	1.886	3/2/2009
411	1.824	3/2/2009
412	1.967	3/2/2009

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number GLRAD-A-008 Isotope Pu-239  
 Date Standards Prepared 4/15/09 Cocktail Type Used NA  
 Standard ID 02996 Matrix of Vial/Planchett NA  
 Amount Used (g or ml) 0.1 Type of Scintillation Vial NA  
 Standard Activity (DPM/g or mL) 2446.347 Pipette ID Used 1429303  
 Reference Date 4/15/09 Balance ID Used 3604026  
 Expiration Date 4/15/09 Quenching Agent NA  
 Residue/Carrier Agent 0.5 M HCl

	Standard Number	Quenching Vol (uL) Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
3	CA13				
43	CA143				
7	CA17				
42	CA142				
13	CA143				
44	CA144				
30	CA130				
48	CA148				
36	CA136				
35	CA135				
38	CA138				
15	CA115				
14	CA114				
46	CA146				
47	CA147				

*W 3/2/09*

Prepared By: Kell Develo Date 3/2/09  
 Reviewed By: Angie J. G... Date 3/2/09

Rev 1 RLM 9/10/97

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number GL-PAD-008 Isotope RA-226

Date Standards Prepared 4/5/09 Cocktail Type Used NA

Standard ID 0299G Matrix of Vial/Planchett NA

Amount Used (g or ml) 0.103109 0.1 Matrix of Vial/Planchett NA

Standard Activity (DPM/g or mL) 2.446.347 Type of Scintillation Vial NA

Reference Date 12/5/09 Pipette ID Used 1429305

Expiration Date 4/1/09 Balance ID Used 3604026

Residue/Carrier Agent 0.5M HCl Quenching Agent NA

	Standard Number	Quenching Vol (uL) Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
16	CA116				
25	CA125				
23	CA123				
18	CA128				
9	CA19				
34	CA134				

Prepared By: Valeri Doreno Date 3/2/09

Reviewed By: Ayle A. G... Date 3/2/09

Rev 1 RLM 9/10/97

# Standard Traceability Log Rad

A Solution Material Info	
Isotope:	Radium-226
Prepared By:	Angela Johnson
Prep Date:	09/15/2000
Verification Date:	01/23/2008
Expiration Date:	01/23/2009
Primary Code:	0299-A
Dilution(mL):	100 mL
Mass of Parent(g):	4.6634 g
Density(g/mL):	1.0012
Balance ID:	

Source Material Info	
Parent Code:	0299
Prepared By:	Angela Johnson
Carrier Conc:	0.5 M HCL
Reference Date:	12/15/1999
Ampoule Mass (g):	5.0368 g
Uncertainty:	+/- 2.5 %
LogBook No:	RC S 027 128

### Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (100 \text{ mL}) = 122414.2500 \text{ dpm/mL}$
$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (1.0012 \text{ g/mL}) / (100 \text{ mL}) = 122273.3377 \text{ dpm/g}$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
08/26/2003	Angela Johnson	1.9909	100	0299-E	2434.34 dpm/mL	11/04/2004	11/04/2005
08/26/2003	Angela Johnson	1.9872	100	0299-F	2429.82 dpm/mL	08/26/2004	08/26/2005
04/05/2005	Amanda Fehr	5.0018	250	0299-G	2446.3471 dpm/mL	04/02/2008	04/02/2009

8-21-00  
Nycomed Amersham plc  
Amersham Laboratories

0299



Nycomed Amersham plc  
Radiation & Radioactivity  
Calibration Laboratory  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

ISSUED  
FOR:

AEA Technology plc  
Isotrak  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

ion Principal radionuclide: Radium-226

Product code: RAY44  
Solution number: R4/131/89

ment Reference time: 1200 GMT on 15 December 1999

data Nuclear data quoted on this certificate are taken from the Joint European File, Version 2.2.

ion of The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , which  
inties for a  $t$ -distribution with  $\nu_{eff} = \infty$  effective degrees of freedom corresponds to a coverage probability of approximately  
95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Unless indicated, all other uncertainties are expressed at the confidence level associated with one standard  
uncertainty.

The format used for the uncertainties in the values of radionuclidic purity is illustrated in the following examples;

6.5(21)	-	6.5 ± 2.1
6.54(21)	-	6.54 ± 0.21
6.543(21)	-	6.543 ± 0.021

ved  
ory

Date of  
issue 225 17<sup>th</sup> December 1999

Nycomed  
Amersham  
Via 31/05



# Verification for Ra-226 Standard 0299-G

4/2/2008	Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff	Standard Mass. Used (G)	Source DPM/G
D. Roy	0299-G N1	2536.9600	52.4000	2484.5600	1.917186	0.5057	2562.667649
	0299-G N2	2520.2500	52.4000	2467.8500	1.917186	0.5056	2545.935781
	0299-G N3	2532.5000	52.4000	2480.1000	1.917186	0.5042	2565.677715
						Average =	2558.093715

Mean Value (Counting) = 2558.093715      **Pass**  
 Stdev = 10.63610098      0.00415782      **Rule 3 (Pass/Fail)**

Certificate Value = 2437.6      dpm/mL  
 Lower Limit = 2536.821513      dpm/mL  
 Upper Limit = 2579.365917      dpm/mL  
**Rule 1 Pass/Fail**      \*exception taken due to full recovery of standard  
 Two sigma = 21.27220197      dpm/mL  
 10 % of Mean = 255.8093715      dpm/mL  
**Rule 2 (Pass/Fail)**      **Pass**

### Verification Rules

- Rule 1 =** The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements
- Rule 2 =** The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
- Rule 3 =** The determined mean value shall be within 10% of the certificate value.

The analyst prepared three standard verification sources for Ra-226 source 0299-G by transferring portions of the standard into tared glass liquid scintillation vials. One mL of DI Water and ten mLs of Ready Gel liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 1 mL of DI water and 10 mL of Ready Gel cocktail. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Gold for Radium source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 4/02/08 using source 0024-A (Ra-226). Calibration data is recorded in this logbook under Ra-226 0024. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

RAD.SOP.M-001

*Handwritten:* Nancy Strickland 4/19/08  
 David Roy 4/10/08  
 WJ/MVS

Ra-226 Verification Sheet

Cal #4

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
41		11/30/09 1050	11/30/09 1350	2.3.09 1710	401	4	8	6763
47		11/30/09 1050	11/30/09 1310	2.3.09 1800	402	4	8	9067
49		11/30/09 1050	11/30/09 1335	2.3.09 1840	403	4	8	7092
50		11/30/09 1050	11/30/09 1400	2.3.09 1915	404	4	8	7877
42		11/30/09 1050	11/30/09 1435	2.3.09 2035	405	4	8	8700
44		11/30/09 1050	11/30/09 1500	2.3.09 2110	409	4	8	7949
15		11/30/09 1050	11/30/09 1530	2.14.09 0830 2.14.09 0830 2.14.09 0830	410	4	8	1108
44		11/30/09 1050	11/30/09 1545	2.14.09 1015 2.14.09 1015	411	4	8	1352
42		11/30/09 1050	11/30/09 1600	2.14.09 1100	412	4	8	9523
48								
36								

160  
3/2/09

160  
3/2/09

160  
3/2/09

160  
3/2/09

160  
3/2/09

160  
3/2/09

160  
3/2/09

160  
3/2/09

227

**Ra-226 Verification Sheet**

Cal #4

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 2	500	2/20/09 1725	2/23/09 1030	2/23/09 1615	401	4	0	4580
43	500	2/20/09 1725	2/23/09 1105	2/23/09 1655	402	4	0	5877 <del>4877</del>
7	500	2/20/09 1725	2/23/09 1130	2.22.09 1930	403	4	0	4011
42	500	2/20/09 1725	2/23/09 1310	2.23.09 1908	404	4	0	5005
<del>13</del>	<del>500</del>	<del>2/20/09 1725</del>	<del>2/23/09 1340</del>	<del>2.23.09 1955</del>	<del>405</del>	<del>4</del>	<del>0</del>	<del>4224</del>
3A	500	2/20/09 1725	2/23/09 1405	2.23.09 2250	406	4	0	2555
44	500	2/20/09 1725	2/23/09 1435	2.23.09 2330	407	4	0	2359
<del>4A</del>	<del>500</del>	<del>2/20/09 1725</del>	<del>2/23/09 1455</del>	<del>2.24.09 00:00</del>	<del>408</del>	<del>4</del>	<del>0</del>	<del>2598</del>
30	500	2/20/09 1725	2/23/09 1520	2.24.09 00:30	409	4	8	5827 <del>5087</del>
48	500	2/20/09 1725	2/23/09 1540	2.24.09 0800	410	4	8	4840
30	500	2/20/09 1725	2/23/09 1555	2/24/09 0840	411	4	8	4829
35	500	2/20/09 1725	2/23/09 1610	2/24/09 0940	412	4	8	4878

K40 2/23/09

K40 2/28/09  
K40 2/28/09

2/28/09-140  
K40 2/28/09

K40 2/24/09

3/12/09

K40 3/12/09

Ra-226 Verification Sheet

#4

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
018	500	2/25/09 1725	2/25/09 0755	2/25/09 1440	401	4	8	5677
15	500	2/25/09 1725	2/25/09 0815	2/25/09 1525	402	4	8	8017
14	500	2/25/09 1725	2/25/09 0835	2/25/09 1555	403	4	8	5562
40	500	2/25/09 1725	2/25/09 0855	2.25.09 20:20	404	4	8	7075
47	500	2/25/09 1725	2/25/09 1010	2.25.09 20:55	405	4	8	6721
10	500	2/25/09 1725	2/25/09 1040	2.25.09 21:22	406	4	8	7091
54	500	2/25/09 1725	2/25/09 1110	2.25.09 22:05	407	4	8	2827
22	500	2/25/09 1725	2/25/09 1145	2.25.09 22:45	408	4	8	5137
29	500	2/25/09 1725	2/25/09 1210	2.25.09 23:15	409	4	8	5169
28	500	2/25/09 1725	2/25/09 1305	2/26/09 0810	410	4	8	6838
9	500	2/25/09 1725	2/25/09 1310	2/26/09 0930	411	4	8	6734
34	500	2/25/09 1725	2/25/09 1405	2/26/09 1015	412	4	8	7137

Handwritten notes: 3/2/09, 3/2/09, 3/2/09, 3/2/09, 3/2/09, 3/2/09

Handwritten note: 3/2/09

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Handwritten notes: 100, 3/2/09

Cal # 4

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 43	500	2/23/09 1605	2/27/09 0930	2/27/09 1215	401	4	8	5474
Cal 43	500	2/23/09 1605	2/27/09 0930	2/27/09 1416	402	4	8	7507
Cal 4	500	2/23/09 1605	2/27/09 1050	2/28/09 1450	403	4	8	5182
Cal 42	500	2/23/09 1605	2/27/09 1030	2/27/09 1525	404	4	8	7443
Cal 13	500	2/23/09 1605	2/27/09 1055	2/27/09 1600	405	4	8	6612
Cal 44	500	2/23/09 1605	2/27/09 1130	2/27/09 1635	409	4	8	7516
Cal 4	500	2/23/09 1605	2/27/09 1150	2/27/09 1715	410	4	8	7850
Cal 40	500	2/23/09 1605	2/27/09 1220	2/27/09 1745	411	4	8	2357
Cal 46	500	2/23/09 1605	2/27/09 1245	2/27/09 1820	412	4	8	7495

160312109  
6357  
1600  
2/28/09

1600  
312109

NO WORK

Ra-226 Verification Sheet Cal # 4

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 78	500	11/25/09 14:00	3/2/09 10:30	3/2/09 13:40	405	4	8	8622

501218  
2/1/09

501218  
2/1/09

160  
2/1/09

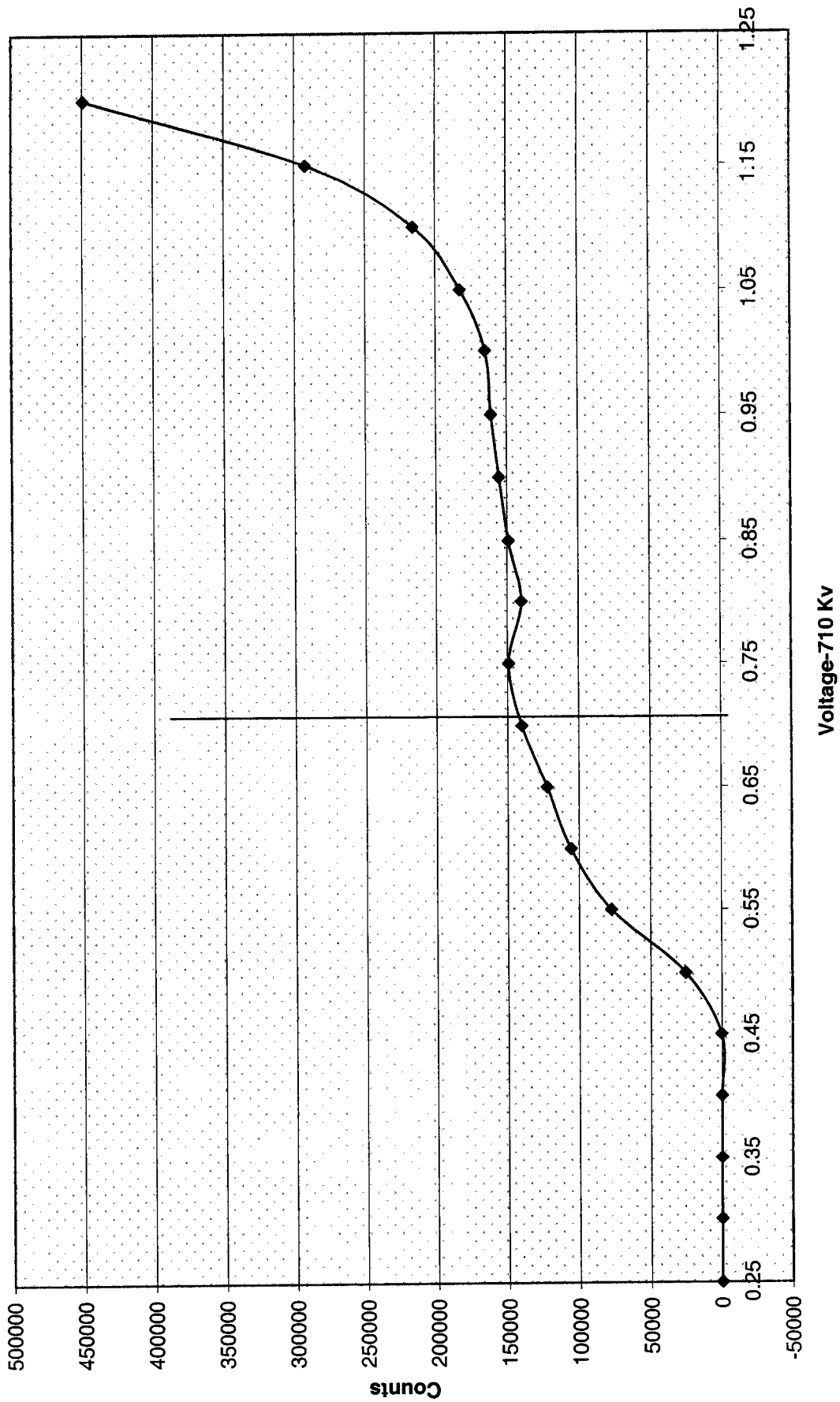
**Voltage Curve Ludlum # 4**

<b>Volts (K.V.)</b>	<b>Counts</b>	<b>Date</b>	<b>Time</b>	<b>Detector</b>
0.20	0	2/2/2009	9:00	4
0.25	0	2/2/2009	9:00	4
0.30	0	2/2/2009	9:00	4
0.35	0	2/2/2009	9:00	4
0.40	0	2/2/2009	9:00	4
0.45	473	2/2/2009	9:00	4
0.50	25577	2/2/2009	9:00	4
0.55	77365	2/2/2009	9:00	4
0.60	105618	2/2/2009	9:00	4
0.65	122379	2/2/2009	9:00	4
0.70	140073	2/2/2009	9:00	4
0.75	149183	2/2/2009	9:00	4
0.80	140046	2/2/2009	9:00	4
0.85	149183	2/2/2009	9:00	4
0.90	155553	2/2/2009	9:00	4
0.95	161020	2/2/2009	9:00	4
1.00	165182	2/2/2009	9:00	4
1.05	182720	2/2/2009	9:00	4
1.10	215932	2/2/2009	9:00	4
1.15	292211	2/2/2009	9:00	4
1.20	449383	2/2/2009	9:00	4

JH  
3/2/09

W 3/2/09

Ludlum 4 Voltage Curve



10/3/04



# General Engineering Laboratories

2040 Savage Road, Charleston, SC 29414  
 (843)556-8171

## Lucas Cell Calibration Package (501-512)

	YES	NO	Comments
1) Is all calibration standard information enclosed for: the primary standard certificate? the second standard standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
2) Is the efficiency calibration report included ?	<input checked="" type="checkbox"/>		
3) Is the raw count data included for: Cell constant determination? Plateau generation?	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
4) Are the calibration verifications included?	<input checked="" type="checkbox"/>		
5) Are the instrument settings included: HVPS settings?	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
6) Has the CELLEFF.xls file been updated ?	<input checked="" type="checkbox"/>		
7) Have the calibration dates been updated in ALPHALIMS ?	<input checked="" type="checkbox"/>		

Prepared By: Kelli Brancee

Date: 3/24/09

Reviewed By: Angela Johnson

Date: 3/25/09

Effective Date: 3/25/09

# Ra-226 Cell Constants

standard ID: 0299-E  
Volume added (mL): 0.1  
Standard Reference Activity (DPM/mL): 2434.34

Lucas cell #	Cell constant	Standard Source	Date/Time of count	Date/time flushed to cell	Date/time end of degas	total counts	count time min	cpm	Known activity dpm	t1 (days) end-degas to flush	t2 (days) end-flush to count	t3 (days) Std Ref Date to count	Decay from Std Ref Date to count
501	1.927	15	3/6/2009 7:50	3/3/2009 8:15	2/25/2009 14:00	5281	30	176.03	243.03	5.76042	2.98264	3369	0.9960
501	2.086	9	3/11/2009 10:40	3/10/2009 12:50	3/5/2009 14:00	7611	30	253.70	243.03	4.95139	0.90972	3374	0.9960
501	2.247	42	3/12/2009 13:30	3/12/2009 9:10	3/6/2009 15:25	10210	30	340.33	243.03	5.73958	0.18056	3376	0.9960
502	1.772	16	3/18/2009 8:25	3/17/2009 12:50	3/10/2009 14:00	7951	30	265.03	243.03	6.95739	0.81597	3381	0.9960
502	2.045	14	3/11/2009 11:15	3/10/2009 13:20	3/5/2009 14:00	7474	30	249.13	243.03	4.97222	0.91319	3374	0.9960
502	1.816	19	3/12/2009 14:20	3/12/2009 9:35	3/6/2009 15:25	8243	30	274.77	243.03	5.75694	0.19792	3376	0.9960
503	1.581	46	3/6/2009 9:20	3/5/2009 9:20	2/25/2009 14:00	7250	30	241.67	243.03	7.80556	1.00000	3369	0.9960
503	1.633	42	3/19/2009 20:15	3/19/2009 15:15	3/12/2009 12:10	8282	30	276.07	243.03	7.12847	0.20833	3383	0.9960
503	1.588	44	3/12/2009 14:50	3/12/2009 10:00	3/6/2009 15:25	7214	30	240.47	243.03	5.77431	0.20139	3376	0.9960
504	1.592	47	3/6/2009 10:30	3/5/2009 9:40	2/25/2009 14:00	7282	30	242.07	243.03	7.81944	1.03472	3369	0.9960
504	1.611	34	3/11/2009 12:30	3/10/2009 14:05	3/5/2009 14:00	5889	30	196.30	243.03	5.00347	0.93403	3375	0.9960
504	1.641	19	3/19/2009 20:50	3/19/2009 15:30	3/12/2009 12:10	8310	30	277.00	243.03	7.13889	0.22222	3383	0.9960
505	2.364	16	3/6/2009 12:40	3/5/2009 10:05	2/25/2009 14:00	10654	30	355.13	243.03	7.83681	1.10764	3370	0.9960
505	2.438	23	3/11/2009 13:00	3/10/2009 14:30	3/5/2009 14:00	8824	30	297.47	243.03	5.02083	0.93750	3375	0.9960
505	2.190	7	3/12/2009 17:01	3/12/2009 10:50	3/6/2009 15:25	9884	30	329.47	243.03	5.80903	0.25764	3376	0.9960
506	1.902	25	3/6/2009 13:10	3/5/2009 10:30	2/25/2009 14:00	8576	30	285.87	243.03	7.85417	1.11111	3370	0.9960
506	2.124	47	3/11/2009 13:30	3/10/2009 15:05	3/5/2009 14:00	7804	30	260.13	243.03	5.04514	0.93403	3375	0.9960
506	1.985	13	3/12/2009 17:40	3/12/2009 11:15	3/6/2009 15:25	8954	30	298.47	243.03	5.82639	0.26736	3376	0.9960
507	1.708	23	3/6/2009 13:45	3/5/2009 10:55	2/25/2009 14:00	7695	30	256.50	243.03	7.87153	1.11806	3370	0.9960
507	1.722	25	3/11/2009 14:20	3/10/2009 15:27	3/5/2009 14:00	6315	30	210.50	243.03	5.06042	0.95347	3375	0.9960
507	1.674	43	3/12/2009 18:30	3/12/2009 11:35	3/6/2009 15:25	7535	30	251.17	243.03	5.84028	0.28819	3376	0.9960
508	1.605	39	3/6/2009 14:20	3/5/2009 11:25	2/25/2009 14:00	7236	30	241.20	243.03	7.89236	1.12153	3370	0.9960
508	1.497	44	3/19/2009 21:30	3/19/2009 15:45	3/12/2009 12:10	7581	30	252.03	243.03	7.14931	0.23958	3383	0.9960
508	1.499	3	3/12/2009 20:45	3/12/2009 12:10	3/6/2009 15:25	6680	30	222.67	243.03	5.86458	0.35764	3376	0.9960
509	1.730	28	3/6/2009 14:50	3/5/2009 11:45	2/25/2009 14:00	7795	30	259.83	243.03	7.90625	1.12847	3370	0.9960
509	1.857	39	3/11/2009 15:25	3/10/2009 16:05	3/5/2009 14:00	6810	30	227.00	243.03	5.08681	0.97222	3375	0.9960
509	1.806	36	3/12/2009 21:20	3/12/2009 12:35	3/6/2009 15:25	8049	30	268.30	243.03	5.88194	0.36458	3376	0.9960
510	1.460	9	3/6/2009 15:25	3/5/2009 12:10	2/25/2009 14:00	6578	30	219.27	243.03	7.92361	1.13542	3370	0.9960
510	1.433	28	3/11/2009 16:05	3/10/2009 16:20	3/5/2009 14:00	5246	30	174.87	243.03	5.09722	0.98958	3375	0.9960
510	1.481	35	3/12/2009 21:55	3/12/2009 12:50	3/6/2009 15:25	6589	30	219.63	243.03	5.89236	0.37847	3376	0.9960
511	1.839	34	3/6/2009 16:30	3/5/2009 13:20	2/25/2009 14:00	8316	30	277.20	243.03	7.97222	1.13194	3370	0.9960
511	1.995	46	3/11/2009 16:50	3/10/2009 16:35	3/5/2009 14:00	7283	30	242.77	243.03	5.10764	1.01042	3375	0.9960
511	2.041	37	3/12/2009 22:40	3/12/2009 13:10	3/6/2009 15:25	9088	30	302.27	243.03	5.90625	0.39583	3376	0.9960
512	1.796	48	3/11/2009 17:35	3/10/2009 16:50	3/5/2009 14:00	6542	30	218.07	243.03	5.11806	1.03125	3375	0.9960
512	2.100	38	3/12/2009 23:15	3/12/2009 13:30	3/6/2009 15:25	9322	30	310.73	243.03	5.92014	0.40625	3376	0.9960
512	1.972	48	3/18/2009 13:00	3/17/2009 14:00	3/10/2009 14:00	8653	30	288.43	243.03	7.00000	0.95833	3382	0.9960

ERR 0.143768 <- Put in Machines.xls (Lucas Cell Tab)

\*Backgrounds are not significant enough to be considered in calculations. ANSI N42.25-1997 (B.2).

Calibration  
Ra-226 Verification-Sheet  
3/14/09

Cal #5

no 3124109  
3119109

3/19/09

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 15	500	2/25/09 1400	3/2/09 0815	3/6/09 0750	501	5	8	5281
<del>Cal 14</del>	<del>500</del>	<del>2/25/09 1400</del>	<del>2/27/09 0845</del>	<del>3/6/09 0840</del>	<del>502</del>	<del>5</del>	<del>1</del>	<del>4200</del>
		<del>2/25/09 1400</del>	<del>3/2/09</del>		<del>503</del>	<del>5</del>	<del>100 313109</del>	<del>6800</del>
Cal 46	500	2/25/09 1400	3/5/09 0920	3/6/09 0900	503	5	3	7250
Cal 47	500	2/25/09 1400	3/5/09 0940	3/6/09 1030	504	5	1	7262
Cal 48	500	2/25/09 1400	3/5/09 1005	3/6/09 1240	505	5	3	10654
Cal 45	500	2/25/09 1400	3/5/09 1030	3/6/09 1316	506	5	8	8576
Cal 23	500	2/25/09 1400	3/5/09 1055	3/6/09 1345	507	5	4	7695
Cal 39	500	2/25/09 1400	3/5/09 1125	3/6/09 1420	508	5	1	7236
Cal 28	500	2/25/09 1400	3/5/09 1145	3/6/09 1450	509	5	8	7795
Cal 9	500	2/25/09 1400	3/5/09 1210	3/6/09 1525	510	5	2	6578
Cal 34	500	2/25/09 1400	3/5/09 1220	3/6/09 1630	511	5	6	8316

Calibration

Ra-226 Verification Sheet

219 3116109

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 9	500	3/5/09 1400	3/10/09 1250	3/11/09 1040	501	5	8	7611
Cal 14	500	3/5/09 1400	3/10/09 1370	3/11/09 1115	502	5	5	7474
<del>Cal 15</del>	<del>500</del>	<del>3/5/09 1400</del>	<del>3/10/09 1345</del>	<del>3/11/09 1155</del>	<del>503</del>	<del>5</del>	<del>8</del>	<del>7352</del>
Cal 16	500	3/5/09 1400	3/10/09 1405	3/11/09 1230	504	5	4	5889
Cal 17	500	3/5/09 1400	3/10/09 1430	3/11/09 1300	505	5	2	8924
Cal 17	500	3/5/09 1400	3/10/09 1505	3/11/09 1530	506	5	8	7804
<del>Cal 18</del>	<del>500</del>	<del>3/5/09 1400</del>	<del>3/10/09 1527</del>	<del>3/11/09 1410</del>	<del>507</del>	<del>5</del>	<del>4</del>	<del>6315</del>
<del>Cal 19</del>	<del>500</del>	<del>3/5/09 1400</del>	<del>3/10/09 1550</del>	<del>3/11/09 1455</del>	<del>508</del>	<del>5</del>	<del>4</del>	<del>6443</del>
Cal 29	500	3/5/09 1400	3/10/09 1605	3/11/09 1525	509	5	8	6810
Cal 28	500	3/5/09 1400	3/10/09 1620	3/11/09 1610	510	5	3	5246
Cal 40	500	3/5/09 1400	3/10/09 1635	3/11/09 1650	511	5	8	7283
Cal 40	500	3/5/09 1400	3/10/09 1650	3/11/09 1735	512	5	8	6542

10 3124109

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10 3124109



Calibration  
 Ra-226 Verification Sheet  
 3/25/09  
 3/25/09  
 Cal # 5's

120  
 3122109  
 120  
 3122109

3/25/09  
 3/25/09

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 114	500	3/10/09 1400	3/17/09 1250	3/18/09 0825	502	5	5	7451
<del>Cal 119</del>	<del>500</del>	<del>3/10/09 1400</del>	<del>3/17/09 1325</del>	<del>3/18/09 0855</del>	<del>503</del>	<del>5</del>		<del>6855</del>
<del>Cal 128</del>	<del>500</del>	<del>3/10/09 1400</del>	<del>3/17/09 1345</del>	<del>3/18/09 1005</del>	<del>504</del>	<del>5</del>		<del>6804</del>
Cal 140	500	3/10/09 1400	3/17/09 1400	3/18/09 1300	512	5	8	8053
Cal 125	500	3/5/09 1400	3/10/09 1527	3/11/09 1420	507	5	4	6315

3/25/09  
 3/25/09

# Ra-226 Calibration Sheet

Standard ID: 0747-0  
 Volume Added (mL): 1.1  
 Expiration Date: 4/12/09

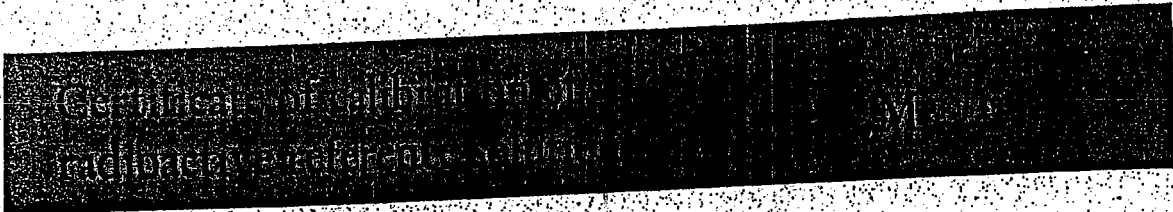
Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 42	500	3/12/09 1210	3/12/09 1515	3/19/09 2015	503	85	8282
Cal 19	500	3/12/09 1210	3/14/09 1530	3/19/09 2050	504	5	8310
Cal 44	500	3/12/09 1210	3/14/09 1545	3/19/09 2130	508	5	7561
<del>Cal 30</del>	<del>500</del>	<del>3/12/09 1210</del>	<del>3/14/09 1600</del>	<del>3/19/09 2200</del>	<del>509</del>	<del>5</del>	<del>9442</del>

3/25/09  
 3125109

8-21-00

Nycomed Amersham plc  
Amersham Laboratories

0299



Nycomed Amersham plc  
Radiation & Radioactivity  
Calibration Laboratory  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

ISSUED  
FOR:

AEA Technology plc  
Isotrak  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

ion Principal radionuclide: Radium-226

Product code: RAY44  
Solution number: R4/131/89

ment Reference time: 1200 GMT on 15 December 1999

data Nuclear data quoted on this certificate are taken from the Joint European File, Version 2.2.

ion of The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , which  
inties for a  $t$ -distribution with  $\nu_{eff} = \infty$  effective degrees of freedom corresponds to a coverage probability of approximately  
95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Unless indicated, all other uncertainties are expressed at the confidence level associated with one standard  
uncertainty.

The format used for the uncertainties in the values of radionuclidic purity is illustrated in the following examples;

6.5(21)	-	6.5 ± 2.1
6.54(21)	-	6.54 ± 0.21
6.543(21)	-	6.543 ± 0.021

ved

Date of 241 17<sup>th</sup> December 1999





# Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0299	Isotope:	Radium-226
Prepared By:	Angela Johnson	Prepared By:	Angela Johnson
Carrier Conc:	0.5 M HCL	Prep Date:	09/15/2000
Reference Date:	12/15/1999	Verification Date:	01/23/2008
Ampoule Mass (g):	5.0368 g	Expiration Date:	01/23/2009
Uncertainty:	+/- 2.5 %	Primary Code:	0299-A
LogBook No:	RC S 027 128	Dilution(mL):	100 mL
		Mass of Parent(g):	4.6634 g
		Density(g/mL):	1.0012
		Balance ID:	

### Calculations Converting parent activity to dpm/mL|dpm/g

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$$

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (kBq/g)}) * (\text{conversion dpm to kBq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (100 \text{ mL}) = 122414.2500 \text{ dpm/mL}$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (1.0012 \text{ g/mL}) / (100 \text{ mL}) = 122273.3377 \text{ dpm/g}$$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
08/26/2003	Angela Johnson	1.9909	100	0299-E	2434.34 dpm/mL	11/04/2004	11/04/2005
08/26/2003	Angela Johnson	1.9872	100	0299-F	2429.82 dpm/mL	08/26/2004	08/26/2005
04/05/2005	Amanda Fehr	5.0018	250	0299-G	2446.3471 dpm/mL	04/02/2008	04/02/2009

GEL Laboratories LLC  
Version 1.0 9/18/2000

*Kelli Donnell*

# Verification for Ra-226 Standard 0299-G

4/2/2008	Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff	Standard Mass. Used (G)	Source DPM/G
D. Roy	0299-G N1	2536.9600	52.4000	2484.5600	1.917186	0.5057	2562.667649
	0299-G N2	2520.2500	52.4000	2467.8500	1.917186	0.5056	2545.935781
	0299-G N3	2532.5000	52.4000	2480.1000	1.917186	0.5042	2565.677715
						Average =	2558.093715

Mean Value (Counting) = 2558.093715  
 Stdev = 10.63610098

Certificate Value = 2437.6 dpm/mL  
 Lower Limit = 2536.821513 dpm/mL  
 Upper Limit = 2579.365917 dpm/mL  
 Rule 1 Pass/Fail = **Fail** \*exception taken due to full recovery of standard  
 Two sigma = 21.27220197 dpm/mL  
 10 % of Mean = 255.8093715 dpm/mL  
 Rule 2 (Pass/Fail) = **Pass**

### Verification Rules

- Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements
- Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
- Rule 3 = The determined mean value shall be within 10% of the certificate value.

The analyst prepared three standard verification sources for Ra-226 source 0299-G by transferring portions of the standard into tared glass liquid scintillation vials. One mL of DI Water and ten mLs of Ready Gel liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 1 mL of DI water and 10 mL of Ready Gel cocktail. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Gold for Radium source standard verification. The Ra-226 efficiency calibration which was used for verification calculations was performed on 4/02/08 using source 0024-A (Ra-226). Calibration data is recorded in this logbook under Ra-226 0024. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

BAD-SOP-M-001

*Handwritten notes:*  
 New Source 3/22/09  
 4/19/08  
 David Dreyer 4/10/08

**General Engineering Laboratories**  
**Verification Source Preparation Sheet**  
*Calibration*

Applicable SOP Number GL RAD-A-008 Isotope RA-226  
 Date Standards Prepared 4/15/09 Cocktail Type Used NA  
 Standard ID 0249-G Matrix of Vial/Planchett NA  
 Amount Used (g or ml) 0.1 NA  
 Standard Activity (DPM/g or ml) 2446.347 Type of Scintillation Vial NA  
 Reference Date 12/15/99 Pipette ID Used 1429303  
 Expiration Date 4/2/09 Balance ID Used 31240216  
 Residue/Carrier Agent D.S.M HCl Quenching Agent NA

	Standard Number	Quenching Vol (uL) Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
15	Ca115				
46	Ca146				
47	Ca147				
16	Ca116				
25	Ca125				
23	Ca123				
39	Ca139				
28	Ca128				
9	Ca19				
34	Ca134				
42	Ca142				
19	Ca119				
44	Ca144				
7	Ca17				
13	Ca113				

Prepared By: Kelli D'Amico Date 3/24/09  
 Reviewed By: \_\_\_\_\_ Date \_\_\_\_\_

Rev 1 RLM 9/10/97

**General Engineering Laboratories**  
**Verification Source Preparation Sheet**  
*3125109 Calibration*

Applicable SOP Number GLDMD-A-008 Isotope DIA 226

Date Standards Prepared 4/5/09 Cocktail Type Used NA

Standard ID 02946 Matrix of Vial/Planchett NA  
NA  
NA

Amount Used (g or ml) 0.1 Type of Scintillation Vial NA

Standard Activity (DPM/g or mL) 2146.347 Pipette ID Used 1425303

Reference Date 12/15/99 Balance ID Used 3604026

Expiration Date 4/2/09 Quenching Agent NA

Residue/Carrier Agent 0.5M HCl

	Standard Number	Quenching Vol (uL)/ Residue Volume(mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
43	Cal 43				
3	Cal 3				
36	Cal 36				
35	Cal 35				
37	Cal 37				
38	Cal 38				

*Handwritten in table: 160 3125109*

Prepared By: Kelli Dence Date: 3/24/09

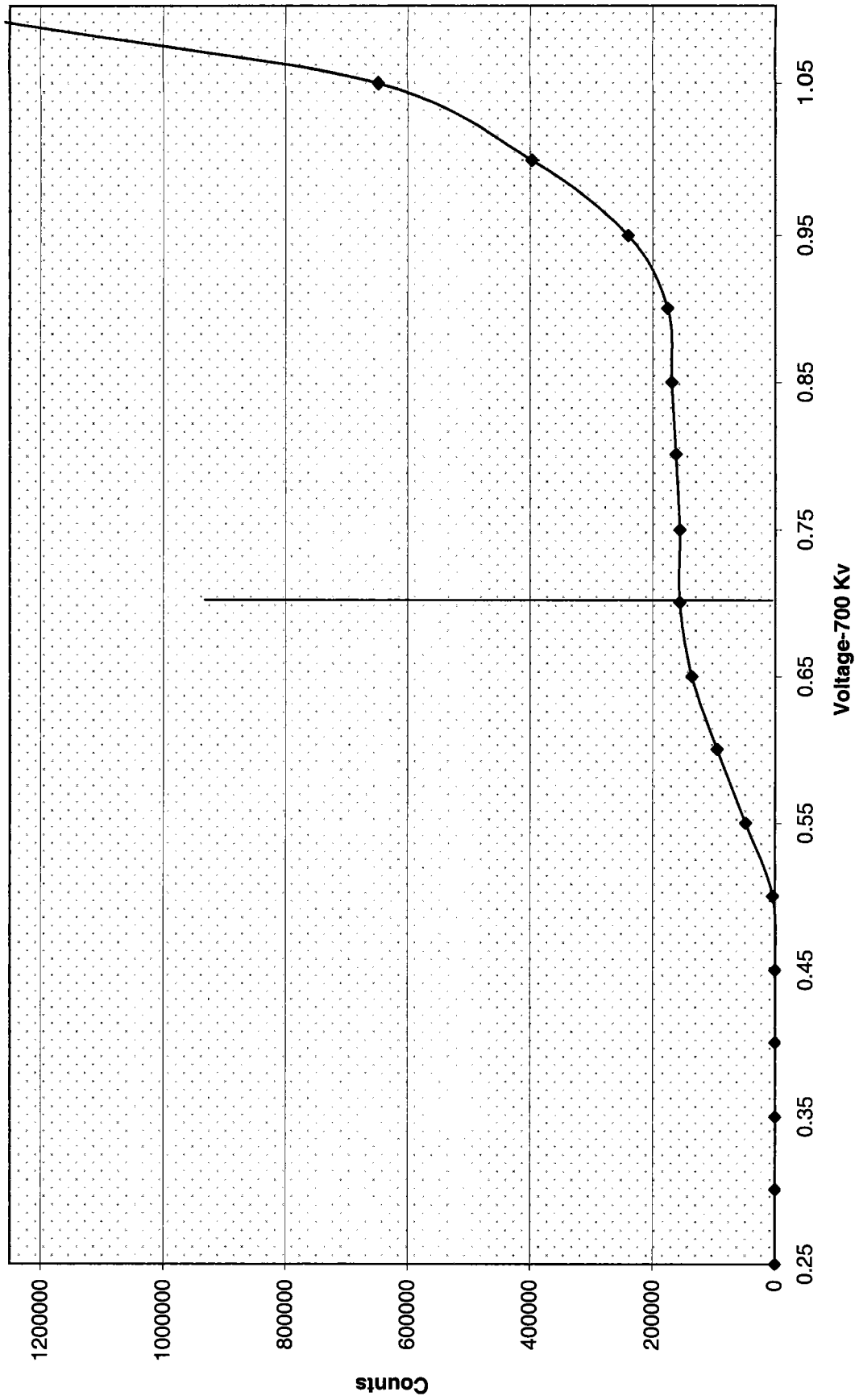
Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

Voltage

Voltage Curve Ludlum # 5				
Volts	Counts	Date	Time	Detector
0.00	0	2/25/2009	9:20	5
0.05	0	2/25/2009	9:20	5
0.10	0	2/25/2009	9:20	5
0.15	0	2/25/2009	9:20	5
0.20	0	2/25/2009	9:20	5
0.25	0	2/25/2009	9:20	5
0.30	0	2/25/2009	9:20	5
0.35	0	2/25/2009	9:20	5
0.40	0	2/25/2009	9:20	5
0.45	0	2/25/2009	9:20	5
0.50	3611	2/25/2009	9:20	5
0.55	47984	2/25/2009	9:20	5
0.60	94752	2/25/2009	9:20	5
0.65	135854	2/25/2009	9:20	5
0.70	155952	2/25/2009	9:20	5
0.75	155696	2/25/2009	9:20	5
0.80	161972	2/25/2009	9:20	5
0.85	168840	2/25/2009	9:20	5
0.90	175598	2/25/2009	9:20	5
0.95	239969	2/25/2009	9:20	5
1.00	397249	2/25/2009	9:20	5

UD 3/25/09

# Ludlum 5 Voltage Curve



KAP 3/24/09

# Ra-226 WATER

Batch : LCSVER  
 Date : 2/20/2008  
 Analyst : DXM2

Procedure Code : LUC26RAL

Parmname : Radium-226

MDA : 1 pCi/L

Instrument Used : LUCAS CELL DETECTOR

Bkg Count Time: 30 min

Sample ID	Sample Vol L	Count Time min	Gross counts cts	Cell #	Cell Const. num	BKG cpm	Ra-226 MDA pCi/L	Ra-226 RESULT pCi/L	Ra-226 ERROR pCi/L	COUNT DATE/TIME
Ver 1	0.500	30	766	501	2.087	0.267	0.6041	28.8142	2.0728	3/16/2009 15:10
Ver 2	0.500	30	537	502	1.878	0.167	0.5682	23.0223	1.9747	3/16/2009 19:25
Ver 3	0.500	30	518	503	1.601	0.267	0.8071	25.9035	2.2832	3/16/2009 20:20
Ver 4	0.500	30	701	504	1.615	0.267	0.6021	26.2570	1.9774	3/20/2009 19:00
Ver 5	0.500	30	680	505	2.331	0.033	0.2559	23.5744	1.7758	3/16/2009 22:00
Ver 6	0.500	30	893	506	2.004	0.267	0.4859	27.0593	1.7988	3/20/2009 19:40
Ver 7	0.500	30	488	507	1.701	0.267	0.7287	22.0004	2.0008	3/16/2009 23:00
Ver 8	0.500	30	544	508	1.534	0.033	0.3760	27.7023	2.3344	3/16/2009 23:30
Ver 9	0.500	30	768	509	1.798	0.267	0.5430	25.9694	1.8657	3/20/2009 20:50
Ver 10	0.500	30	432	510	1.458	0.033	0.3700	21.6379	2.0476	3/17/2009 5:00
Ver 11	0.500	30	577	511	1.959	0.267	0.5934	21.2369	1.7694	3/17/2009 5:35
Ver 12	0.500	30	723	512	1.956	0.267	0.5945	26.7349	1.9815	3/17/2009 6:10

Sample ID	Sample Dup	Det #	Run Date	Sample Type	Standard ID	NC	NC units	Recovery/RPD
501		5	3/16/2009 15:10	LCS	0638-F	24.05	pCi/L	120%
502		5	3/16/2009 19:25	LCS	0638-F	24.05	pCi/L	96%
503		5	3/16/2009 20:20	LCS	0638-F	24.05	pCi/L	108%
504		5	3/20/2009 19:00	LCS	0638-F	24.05	pCi/L	109%
505		5	3/16/2009 22:00	LCS	0638-F	24.05	pCi/L	98%
506		5	3/20/2009 19:40	LCS	0638-F	24.05	pCi/L	113%
507		5	3/16/2009 23:00	LCS	0638-F	24.05	pCi/L	91%
508		5	3/16/2009 23:30	LCS	0638-F	24.05	pCi/L	115%
509		5	3/20/2009 20:50	LCS	0638-F	24.05	pCi/L	108%
510		5	3/17/2009 5:00	LCS	0638-F	24.05	pCi/L	90%
511		5	3/17/2009 5:35	LCS	0638-F	24.05	pCi/L	88%
512		5	3/17/2009 6:10	LCS	0638-F	24.05	pCi/L	111%

DEGASSING DATE/TIME	DE-EMAN. DATE/TIME	DEGASS-DE-EM	dE-EM-COUNT	constant	constant	constant	Net CPM	Ingrowth constant
3/13/2009 15:30	3/16/2009 9:45	66.25	5.42	0.3936	0.9599	1.0019	25.2667	0.3785
3/13/2009 15:30	3/16/2009 10:10	66.67	9.25	0.3955	0.9325	1.0019	17.7333	0.3695
3/13/2009 15:30	3/16/2009 10:30	67.00	9.83	0.3970	0.9284	1.0019	17.0000	0.3693
3/16/2009 14:00	3/20/2009 13:05	95.08	5.92	0.5122	0.9563	1.0019	23.1000	0.4908
3/13/2009 15:30	3/16/2009 11:25	67.92	10.58	0.4012	0.9232	1.0019	22.6333	0.3711
3/16/2009 14:00	3/20/2009 13:20	95.33	6.33	0.5131	0.9533	1.0019	29.5000	0.4901
3/13/2009 15:30	3/16/2009 13:50	70.33	9.17	0.4120	0.9331	1.0019	15.9997	0.3852
3/13/2009 15:30	3/16/2009 13:50	70.33	9.67	0.4120	0.9296	1.0019	18.1000	0.3837
3/16/2009 14:00	3/20/2009 13:45	95.75	7.08	0.5147	0.9479	1.0019	25.3333	0.4888
3/13/2009 5:30	3/16/2009 14:25	80.92	14.58	0.4571	0.8957	1.0019	14.3667	0.4103
3/13/2009 5:30	3/16/2009 14:45	81.25	14.83	0.4585	0.8941	1.0019	18.9663	0.4107
3/13/2009 5:30	3/16/2009 15:00	81.50	15.17	0.4595	0.8918	1.0019	23.8330	0.4106



Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
NUN 1	500	3/12/09 1530	3/16/09 0945	3/16/09 1510 <del>3/17/09 1510</del> <del>3/16/09 1510</del>	501	5	8	766
NUN 2	500	3/13/09 1530	3/16/09 1010	3/16/09 1925	502	5	85 <del>140 3124109</del>	537
NUN 3	500	3/13/09 1530	3/16/09 1030	3/16/09 2020	503	5	8	518
<del>NUN 4</del>	<del>500</del>	<del>3/13/09 1530</del>	<del>3/16/09 1100</del>	<del>3/16/09 2115</del>	<del>504</del>	<del>5</del>	<del>8</del>	<del>577</del>
NUN 5	500	3/13/09 1530	3/16/09 1125	3/16/09 2200	505	5	8 <del>140 3124109</del>	680
<del>NUN 6</del>	<del>500</del>	<del>3/13/09 1530</del>	<del>3/16/09 1155</del>	<del>3/16/09 2230</del>	<del>506</del>	<del>5</del>	<del>8</del>	<del>707</del>
NUN 7	500	3/13/09 1530	3/16/09 1320	3/16/09 2300	507	5	8	488
NUN 8	500	3/13/09 1530	3/16/09 1350	3/16/09 2330	508	5	8 <del>140 3124109</del>	544
<del>NUN 9</del>	<del>500</del>	<del>3/13/09 1530</del>	<del>3/16/09 1410</del>	<del>3/17/09 0445</del> <del>3/17/09 0345</del> <del>3/17/09 0345</del>	<del>509</del>	<del>5</del>	<del>8</del>	<del>640</del>
NUN 10	500	3/13/09 1530	3/16/09 1425	3/17/09 0500	510	5	8 <del>140 3124109</del>	432
NUN 11	500	3/13/09 1530	3/16/09 1445	3/17/09 0535	511	5	8	577
NUN 12	500	3/13/09 1530	3/16/09 1500	3/17/09 0610	512	5	8	723

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3/25/09

3/17/09  
3/17/09

# Ra-226 Verification Sheet

Standard ID: 0638F  
 Volume Added (mL): 0.1  
 Expiration Date: 2/2/10

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background Counts	Total Counts
<del>VEN 1</del>	<del>500</del>	<del>3/16/09 1400</del>	<del>3/20/09 1245</del>	<del>3/20/09 1820</del>	<del>501</del>	<del>5</del>	<del>8</del>	<del>70</del>
VEN 2	500	3/16/09 1400	3/20/09 1305	3/20/09 1900	504	5	8	701
VEN 3	500	3/16/09 1400	3/20/09 1320	3/30/09 1940	506	5	8	893
VEN 4	500	3/16/09 1400	3/20/09 1345	3/30/09 2050	509	5	8	768

3/20/09

VEN 3/20/09

VEN 3/20/09

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number GL-AMP-13-008 Isotope PA-226

Date Standards Prepared 11/6/09 Cocktail Type Used NA

Standard ID 0638-F Matrix of Vial/Planchett NA

Amount Used (g or ml) 0.1 NA

Standard Activity (DPM/g or mL) 267.519 Type of Scintillation Vial NA

Reference Date 11/23/04 Pipette ID Used 1429303

Expiration Date 2/2/10 Balance ID Used 38080204

Residue/Carrier Agent NA Quenching Agent NA

	Standard Number	Quenching Vol (uL) Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	Ver 1				
2	Ver 2				
3	Ver 3				
4	Ver 4				
5	Ver 5				
6	Ver 6				
7	Ver 7				
8	Ver 8				
9	Ver 9				
10	Ver 10				
11	Ver 11				
12	Ver 12				

~~11/0 3/25/09~~

Prepared By: Kelli Denise Date: 3/24/09

Reviewed By: Angela A. G... Date: 3/25/09

# Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0638	Isotope:	Radium-226
Prepared By:	Amanda Fehr	Prepared By:	Amanda Fehr
Carrier Conc:	0.1M HCl	Prep Date:	01/16/2006
Reference Date:	01/23/2004	Verification Date:	03/04/2007
Ampoule Mass (g):	5.01065 g	Expiration Date:	03/04/2008
Uncertainty:	+/- 3.3 %	Primary Code:	0638-A
LogBook No:	RC-S-037-037	Dilution(mL):	100 mL
		Mass of Parent(g):	4.8398 g
		Density(g/mL):	1.0266
		Balance ID:	38080204

### Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$
$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) / (5.01065 \text{ g} * 100 \text{ mL}) = 13636.6133 \text{ dpm/mL}$
$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) / (1.0266 \text{ g/mL}) / (5.01065 \text{ g} * 100 \text{ mL}) = 13282.9676 \text{ dpm/g}$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
01/17/2006	Amanda Fehr	2.1041	100	0638-B	279.0211 dpm/mL	01/17/2007	01/17/2008
07/17/2006	Mary Aders	2.1313	100	0638-C	282.6281 dpm/mL	07/26/2006	07/26/2007
03/28/2007	Daniel Roy	2.1025	100	0638-D	279.2744 dpm/ml	04/08/2007	04/08/2008
03/28/2007	Daniel Roy	45.468	250	0638-E	2415.7999 dpm/ml	04/09/2008	04/08/2009
12/18/2007	Daniel Roy	2.014	100	0638-F	267.519 dpm/ml	02/02/2009	02/02/2010
02/12/2008	Daniel Roy	.5004	100	0638-G	66.468 dpm/ml	03/04/2008	03/04/2009
07/23/2008	Daniel Roy	5.0607	250	0638-H	268.8845 dpm/ml	07/23/2008	07/23/2009

## Verification for Ra-226 Standard 0638-F

D. Roy 2/2/2009	<b>Isotope</b>	<b>Value</b>	<b>Uncertainty</b>
	0638-F #1	24.629	1.7426
	0638-F #2	24.438	1.7557
	0638-F #3	22.791	1.6808
<b>Mean Value (Counting) =</b>	23.953	99.60	<b>Pass</b>
<b>Stdev =</b>	1.010781096		<b>Rule 3 (Pass/Fail)</b>
<b>Target =</b>	24.05		
<b>Lower Limit =</b>	21.93100448		
<b>Upper Limit =</b>	25.97412886		
<b>Rule 1 Pass/Fail</b>	<b>Pass</b>		
<b>Two sigma =</b>	2.021562191		
<b>10 % of Mean =</b>	2.395256667		
<b>Rule 2 (Pass/Fail)</b>	<b>Pass</b>		

**Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements**

**Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.**

**Rule 3 = The determined mean value shall be within 5% of the certificate value.**

The analyst prepared three standard verification sources for standard 0638-F using 0.1 mL for each source. Each source was counted using routine Lucas cell procedures. Calibration for 0299-G was used in this verification.

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.. CI - T: 2/2/09

# General Engineering Laboratories

2040 Savage Road, Charleston, SC 29414  
(843)556-8171

## Lucas Cell Calibration Package

	YES	NO	Comments
1) Is all calibration standard information enclosed for: the primary standard certificate? the second standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	✓		
	✓		
	✓		
	✓		
2) Is the efficiency calibration report included ?	✓		
3) Is the raw count data included for: Cell constant determination? Plateau generation?	✓		
	✓		
4) Are the calibration verifications included?	✓		
5) Are the instrument settings included: HVPS settings?	✓		
6) Has the CELLEFF.xls file been updated ?	✓		
7) Have the calibration dates been updated in ALPHALIMS ?	✓		

Prepared By: Kellie Dence

Date: 8/4/09

Reviewed By: Angela Ghe

Date: 8/6/09

Effective Date: 8/4/09

KD 8/6/09

# Ra-226 Cell Constants

Standard Reference date: 12/15/1999  
 Standard ID: 0299-G  
 Volume added (mL): 0.1  
 Standard Reference Activity (DPM/mL): 2446.3471

Lucas cell #	Cell constant	Standard Source	Date/Time of count	Date/time flushed to cell	Date/time end of degas	total counts	count time min	Known activity dpm	t1 (days) end-degas to flush	t2 (days) end-flush to count	t3 (days) Std Ref Date to count	Decay from Std Ref Date to count
601	2.164	Average	5/26/2009 13:30	5/26/2009 9:30	5/19/2009 14:00	10883	30	362.77	6.81250	0.16667	3451	0.9959
601	2.253	Stdev	5/22/2009 12:55	5/22/2009 9:15	5/19/2009 14:00	6378	30	212.60	2.80208	0.15278	3447	0.9959
601	2.126		5/29/2009 14:45	5/29/2009 9:50	5/22/2009 10:45	10735	30	357.83	6.96181	0.20486	3454	0.9959
602	2.007	Average	5/29/2009 15:20	5/29/2009 10:15	5/22/2009 10:45	10133	30	337.77	6.97917	0.21181	3454	0.9959
602	2.194	Stdev	5/26/2009 14:05	5/26/2009 9:55	5/19/2009 14:00	11033	30	367.77	6.82986	0.17361	3451	0.9959
602	2.304		6/2/2009 14:45	6/2/2009 11:30	5/29/2009 9:50	8575	30	285.83	4.06944	0.13542	3458	0.9959
604	2.244	Average	6/2/2009 15:50	6/2/2009 11:50	5/29/2009 9:50	8321	30	277.37	4.08333	0.16667	3458	0.9959
604	2.076	Stdev	5/29/2009 15:55	5/29/2009 10:45	5/22/2009 12:00	10451	30	348.37	6.94792	0.21528	3454	0.9959
604	2.079		5/26/2009 15:45	5/26/2009 10:20	5/19/2009 14:00	10372	30	345.73	6.84722	0.22569	3451	0.9959
605	2.096	Average	5/26/2009 16:15	5/26/2009 10:50	5/19/2009 14:00	10474	30	349.13	6.86806	0.22569	3451	0.9959
605	2.228	Stdev	5/22/2009 16:25	5/22/2009 10:45	5/19/2009 14:00	6318	30	210.60	2.86458	0.23611	3447	0.9959
605	2.122		5/29/2009 17:15	5/29/2009 11:05	5/22/2009 12:50	10587	30	352.90	6.92708	0.25694	3454	0.9959
606	2.543	Average	5/29/2009 17:45	5/29/2009 13:10	5/26/2009 9:30	7816	30	260.53	3.15278	0.19097	3454	0.9959
606	2.202	Stdev	5/26/2009 16:45	5/26/2009 12:25	5/22/2009 12:00	8057	30	268.57	4.01736	0.18056	3451	0.9959
606	2.298		6/2/2009 18:20	6/2/2009 12:55	5/29/2009 9:50	8495	30	283.17	4.12847	0.22569	3458	0.9959
607	2.454	Average	6/2/2009 19:00	6/2/2009 13:10	5/29/2009 9:50	9057	30	301.90	4.13889	0.24306	3458	0.9959
607	2.572	Stdev	5/29/2009 19:00	5/29/2009 13:25	5/26/2009 9:55	7832	30	261.07	3.14583	0.23264	3454	0.9959
607	2.325		5/26/2009 17:15	5/26/2009 12:50	5/22/2009 12:00	8527	30	284.23	4.03472	0.18403	3451	0.9959
609	2.277	Average	5/26/2009 19:20	5/26/2009 13:10	5/22/2009 12:00	8261	30	275.37	4.04861	0.25694	3451	0.9959
609	2.280	Stdev	5/22/2009 19:20	5/22/2009 12:00	5/19/2009 14:00	6473	30	215.77	2.91667	0.30556	3447	0.9959
609	2.392		5/29/2009 19:40	5/29/2009 13:45	5/26/2009 10:20	7261	30	242.03	3.14236	0.24653	3454	0.9959
611	2.488	Average	5/29/2009 20:20	5/29/2009 14:00	5/26/2009 10:50	7510	30	250.33	3.13194	0.26389	3454	0.9959
611	2.245	Stdev	5/26/2009 22:00	5/26/2009 13:25	5/22/2009 12:00	8010	30	267.00	4.05903	0.35764	3451	0.9959
611	2.187		6/2/2009 19:50	6/2/2009 13:25	5/29/2009 9:50	8052	30	268.40	4.14931	0.26736	3458	0.9959

EffEr 0.066051 <- Put in Machines.xls (Lucas Cell Tab)

Backgrounds are not significant enough to be included in calculations ANSI N42.25-1997 (B.2).

*Original of 9/16/09*  
*WJ 8/16/09*

601	2.181	8/4/2009
602	2.168	8/4/2009
604	2.133	8/4/2009
605	2.149	8/4/2009
606	2.348	8/4/2009
607	2.45	8/4/2009
609	2.316	8/4/2009
611	2.307	8/4/2009



<b>Lucas</b>	<b>Ra-226</b>	
Oldest Cal	01/23/2008	
<b>Detector</b>	<b>Eff Error</b>	<b>Cal Date</b>
1	0.0958	8/29/2008
2	0.0772	12/19/2008
3	0.0608	1/23/2008
4	0.1237	3/2/2009
5	0.1438	3/25/2009
6	0.0661	8/4/2009
7	0.0855	11/21/2008

**General Engineering Laboratories  
Calibration Source Preparation Sheet**

Applicable SOP Number GL-RAD-A-008

Isotope Ra226

Date Standards Prepared 4/5/05

Cocktail Type Used NA

Standard ID 0299-G

Matrix of Vial/Planchett NA

Amount Used (g or ml) 0.1

NA  
NA

Standard Activity (DPM/g or mL) 2446.3471

Type of Scintillation Vial NA

Reference Date 12/15/99

Pipette ID Used 1429303

Expiration Date 1/26/10

Balance ID Used 38080204

Residue/Carrier Agent 0.1M HCl

Quenching Agent NA

	Standard Number	Quenching Vol (uL)/ Residue Volume(mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	cal 1				
2	cal 2				
3	cal 3				
4	cal 4				
5	cal 5				
6	cal 6				
7	cal 7				
8	cal 8				
9	cal 9				
10	cal 10				
11	cal 11				
12	cal 12				

JBG  
8/4/09

JBG  
8/4/09

Prepared By: Kelli Rowell Date 8/4/09

Reviewed By: Angela Gh... Date 8/4/09

Rev 1 RLM 9/10/97

1/26/10

# Ra-226 Calibration Sheet

Standard ID: ~~4440-6~~ 0299-5  
 Volume Added (mL): 0.1

8/14/09

Expiration Date: ~~4/4/10~~

8/14/09

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 5	500	5/22/09 1045	5/24/09 0950	5/29/09 14:45	601	6	10735
Cal 6	500	5/22/09 1045	5/24/09 1015	5/29/09 15:20	602	6	10133
Cal 7	500	5/22/09 1200	5/24/09 1045	5/29/09 15:55	604	6	10451
Cal 8	500	5/22/09 1250	5/24/09 1105	5/29/09 17:15 <del>17:30</del>	605	6	10587
Cal 9	500	5/24/09 0930	5/24/09 1310	5/29/09 17:45	606	6	7816
Cal 10	500	5/24/09 0955	5/24/09 1325	5/29/09 19:00	607	6	7832
Cal 11	500	5/24/09 1000	5/24/09 1345	5/29/09 19:40	609	6	7241
Cal 12	500	5/24/09 1050	5/24/09 1400	5/29/09 20:20	611	6	7510
					608	6	

W 8/14/09  
 8/14/09

# Ra-226 Calibration Sheet

Standard ID: ~~0030-6~~ 0299-6  
 Volume Added (mL): 0.1 ~~19~~ 814109  
 Expiration Date: ~~11/26/10~~ 11/26/10  
 11/26/10

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 1	500	5/19/09 1400	5/22/09 0915	5/22/09 1255	601	6	6318
<del>Cal 2</del>	<del>500</del>	<del>5/19/09 1400</del>	<del>5/22/09 0945</del>	<del>5/22/09 1325</del>	<del>602</del>	<del>6</del>	<del>6358</del>
<del>Cal 3</del>	<del>500</del>	<del>5/19/09 1400</del>	<del>5/22/09 1010</del>	<del>5/22/09 1420</del>	<del>604</del>	<del>6</del>	<del>4600</del>
Cal 4	500	5/19/09 1400	5/22/09 1045	5/22/09 1625	605	6	6318
<del>Cal 5</del>	<del>500</del>	<del>5/19/09 1400</del>	<del>5/22/09 1115</del>	<del>5/22/09 1700</del>	<del>606</del>	<del>6</del>	<del>6494</del>
<del>Cal 6</del>	<del>500</del>	<del>5/19/09 1400</del>	<del>5/22/09 1140</del>	<del>5/22/09 1735</del>	<del>607</del>	<del>6</del>	<del>6428</del>
Cal 7	500	5/19/09 1400	5/22/09 1200	5/22/09 1920	609	6	6473
<del>Cal 8</del>	<del>500</del>	<del>5/19/09 1410</del>	<del>5/22/09 1250</del>	<del>5/22/09 2035</del>	<del>611</del>	<del>6</del>	<del>6455</del>
Cal 9							
Cal 10							
Cal 11							
Cal 12							

11/26/10  
11/26/10

11/26/10  
11/26/10

6162-110  
814109

11/26/10

814109  
11/26/10



# Ra-226 Calibration Sheet

Standard ID: ~~10386~~ 0299-G  
 Volume Added (mL): 0.1 419 814109  
 Expiration Date: ~~11/26/10~~ 419 814109

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 9	500	5/19/09 1400	5/20/09 1130	5/20/09 1330	601	6	10883
Cal 10	500	5/19/09 1400	5/20/09 0955	5/20/09 1405	602	6	11033
Cal 11	500	5/19/09 1400	5/20/09 1020	5/26/09 1545	604	6	10372
Cal 12	500	5/19/09 1400	5/20/09 1050	5/26/09 1615	605	6	10474
Cal 1	500	5/22/09 1200	5/26/09 1725	5/26/09 1645	606	6	8557
Cal 2	500	5/22/09 1200	5/26/09 1750	5/26/09 1715	607	6	8527
Cal 3	500	5/22/09 1200	5/26/09 1310	5/26/09 1920	609	6	8261
Cal 4	500	5/22/09 1200	5/26/09 1325	5/26/09 2200	611	6	8010
				608 814109			

419 814109  
 40 814109

ee'd

8-21-00

Nycomed Amersham plc  
Amersham Laboratories

0299

CALIBRATION  
No. 0146

ISSUED BY: Nycomed Amersham plc  
Radiation & Radioactivity  
Calibration Laboratory  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

ISSUED FOR: AEA Technology plc  
Isotrak  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

Description Principal radionuclide: Radium-226

Product code: RAY44  
Solution number: R4/131/89

Measurement Reference time: 1200 GMT on 15 December 1999

Nuclear data Nuclear data quoted on this certificate are taken from the Joint European File, Version 2.2.

Expression of uncertainties The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , which for a  $t$ -distribution with  $\nu_{\text{eff}} = \infty$  effective degrees of freedom corresponds to a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Unless indicated, all other uncertainties are expressed at the confidence level associated with one standard uncertainty.

The format used for the uncertainties in the values of radionuclidic purity is illustrated in the following examples;

6.5(21)	-	6.5 ± 2.1
6.54(21)	-	6.54 ± 0.21
6.543(21)	-	6.543 ± 0.021

Approved  
Signature

Date of issue

17<sup>th</sup> December 1999

## Verification for Ra-226 Standard 0299-G

M. Aders 1/26/2009	Isotope	Value DPM	Uncertainty
	0299-A #1	220.970	0.2670
	0299-A #2	241.730	0.2670
	0299-A #3	257.470	0.2670
<b>Mean Value (Counting) =</b>	240.057	98.52	<b>Pass</b>
<b>Stdev =</b>	18.30744475		<b>Rule 3 (Pass/Fail)</b>
<b>Target =</b>	243.67		
<b>Lower Limit =</b>	203.4417772		
<b>Upper Limit =</b>	276.6715562		
<b>Rule 1 Pass/Fail</b>	<b>Pass</b>		
<b>Two sigma =</b>	36.6148895		
<b>10 % of Mean =</b>	24.00566667		
<b>Rule 2 (Pass/Fail)</b>	<b>Fail</b>	<b>*exception taken due to full recovery of standard</b>	

- Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements**
- Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.**
- Rule 3 = The determined mean value shall be within 5% of the certificate value.**

The analyst prepared three standard verification sources for standard 0299-A using 0.1 mL for each source. Each standard was degassed and transferred according to SOP GL-RAD-A-008. Each source was counted using Ra-226 procedures.

*M. Aders 241.730*  
*August 9th 8/4/09*



# Ra-226 Cell Constants

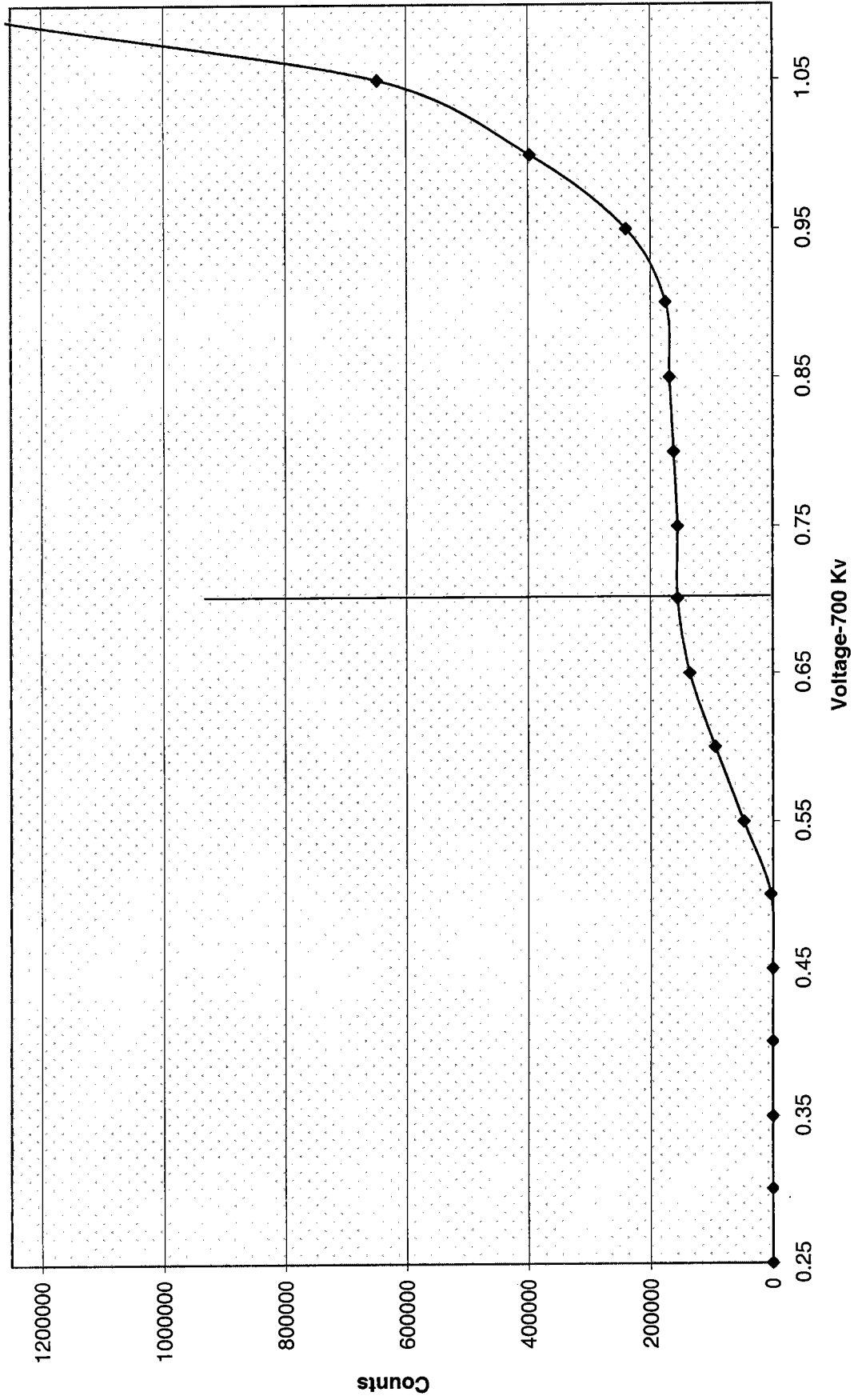
Standard Reference date: 12/15/1999  
Standard ID: 0299-G  
Volume added (mL): 0.1  
Standard Reference Activity (DPM/mL): 2446.35

Lucas cell #	Cell constant	Standard Source	Date/Time of count	Date/Time flushed to cell	Date/Time end of degas	bkp cpm	total counts	count time min	cpm	Known activity dpm	t1 (days) end-degas to flush	t2 (days) end-flush to count	t3 (days) Std Ref Date to count	Decay from Std Ref Date to count
301	2.021	43	39839.60764	39839.39236	39835.38194	0.267	7282	30	242.73	243.6698	4.01041667	0.2152778	3330.607639	0.996055555
302	2.131	47	39839.64583	39839.41319	39835.38194	0.267	7555	30	251.83	243.6698	4.03125	0.2326389	3330.645833	0.996055551
303	2.136	19	39839.72222	39839.43403	39835.38194	0.267	8028	30	267.60	243.6697	4.05208333	0.2881944	3330.722222	0.996055419

Voltage Curve Ludlum # 6				
Volts	Counts	Date	Time	Detector
0.00	0	5/20/2009	9:00	6
0.05	0	5/20/2009	9:01	6
0.10	0	5/20/2009	9:02	6
0.15	0	5/20/2009	9:03	6
0.20	0	5/20/2009	9:04	6
0.25	0	5/20/2009	9:05	6
0.30	0	5/20/2009	9:06	6
0.35	0	5/20/2009	9:07	6
0.40	0	5/20/2009	9:08	6
0.45	512	5/20/2009	9:09	6
0.50	3625	5/20/2009	9:10	6
0.55	47990	5/20/2009	9:11	6
0.60	94752	5/20/2009	9:12	6
0.65	135854	5/20/2009	9:13	6
0.70	155952	5/20/2009	9:14	6
0.75	155700	5/20/2009	9:15	6
0.80	161972	5/20/2009	9:16	6
0.85	168860	5/20/2009	9:17	6
0.90	175598	5/20/2009	9:18	6
0.95	239969	5/20/2009	9:19	6
1.00	397270	5/20/2009	9:20	6

*W 8/4/09*

Ludlum 6 Voltage Curve



WGS/105

# Ra-226 WATER

Batch : LCSVER  
Date : 6/2/2009  
Analyst : KSD1

Procedure Code : LUC26RAL  
Parmname : Radium-226  
MDA : 1 pCi/L

Instrument Used : LUCAS CELL DETECTOR

Bkg Count Time: 30 min

Sample ID	Sample Vol L	Count Time min	Gross counts cts	Cell # num	Cell Const. num	BKG cpm	Ra-226 MDA pCi/L	Ra-226 RESULT pCi/L	Ra-226 ERROR pCi/L	COUNT DATE/TIME
ver 1	0.800	30	1018	601	2.181	0.267	0.2115	13.4431	0.8356	6/8/2009 15:35
ver 2	0.800	30	994	602	2.168	0.100	0.1442	13.2563	0.8279	6/8/2009 16:05
ver 3	0.800	30	955	604	2.133	0.167	0.1786	12.9119	0.8254	6/8/2009 16:40
ver 4	0.800	30	1144	605	2.149	0.267	0.2143	15.3201	0.8971	6/8/2009 17:15
ver 5	0.800	30	1046	606	2.348	0.233	0.1867	12.8971	0.7895	6/8/2009 18:30
ver 6	0.800	30	1001	607	2.450	0.267	0.1893	11.8239	0.7413	6/8/2009 19:15
ver 7	0.800	30	1060	609	2.316	0.267	0.2007	13.2848	0.8089	6/8/2009 20:05
ver 8	0.800	30	943	611	2.307	0.267	0.2053	12.0754	0.7806	6/8/2009 23:10

28/6/09  
W 8/16/09

Sample ID	Cell #	Det #	Run Date	Sample Type	Standard ID	NC	NC units	Recovery/RPD
ver 1	601	6	6/8/2009 15:35	LCS	0638-F	15.03	pCi/L	89%
ver 2	602	6	6/8/2009 16:05	LCS	0638-F	15.03	pCi/L	88%
ver 3	604	6	6/8/2009 16:40	LCS	0638-F	15.03	pCi/L	86%
ver 4	605	6	6/8/2009 17:15	LCS	0638-F	15.03	pCi/L	102%
ver 5	606	6	6/8/2009 18:30	LCS	0638-F	15.03	pCi/L	86%
ver 6	607	6	6/8/2009 19:15	LCS	0638-F	15.03	pCi/L	79%
ver 7	609	6	6/8/2009 20:05	LCS	0638-F	15.03	pCi/L	88%
ver 8	611	6	6/8/2009 23:10	LCS	0638-F	15.03	pCi/L	80%

DEGASSING DATE/TIME	DE-EMAN. DATE/TIME	DEGASS-DE-EM	dE-EM-COUNT	constant	constant	constant	Net CPM	Ingrowth constant
6/2/2009 12:40	6/8/2009 12:15	143.58	3.33	0.6618	0.9751	1.0019	33.6667	0.6466
6/2/2009 12:40	6/8/2009 12:40	144.00	3.42	0.6628	0.9745	1.0019	33.0333	0.6472
6/2/2009 12:40	6/8/2009 13:05	144.42	3.58	0.6639	0.9733	1.0019	31.6663	0.6474
6/2/2009 12:40	6/8/2009 13:30	144.83	3.75	0.6650	0.9721	1.0019	37.8667	0.6476
6/2/2009 12:40	6/8/2009 13:50	145.17	4.67	0.6658	0.9654	1.0019	34.6333	0.6440
6/2/2009 12:40	6/8/2009 14:15	145.58	5.00	0.6668	0.9630	1.0019	33.0997	0.6434
6/2/2009 12:40	6/8/2009 14:35	145.92	5.50	0.6677	0.9593	1.0019	35.0667	0.6417
6/2/2009 12:40	6/8/2009 15:00	146.33	8.17	0.6687	0.9402	1.0019	31.1663	0.6299

Handwritten notes:   
 8/16/09   
 11/18/10/09

Re-226 Verification Sheet

VEN

#6

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
VEN 1	500	6/21/09 1240	6/18/09 1415	6-8-09 1535	601	6	8	1018
VEN 2	500	6/21/09 1240	6/18/09 1240	6-8-09 1605	602	6	3	994
VEN 3	500	6/21/09 1240	6/18/09 1305	6-8-09 1640	604	6	5	955
VEN 4	500	6/21/09 1240	6/18/09 1330	6-8-09 1715	605	6	8	1144
VEN 5	500	6/21/09 1240	6/18/09 1350	6-8-09 1830	606	6	7	1046
VEN 6	500	6/21/09 1240	6/18/09 1415	6-8-09 1915	607	6	8	1001
VEN 7	500	6/21/09 1240	6/18/09 1435	6-8-09 2005	609	6	8	1060
VEN 8	500	6/21/09 1240	6/18/09 1500	6-8-09 2310	611	6	8	943
VEN 9	500							
VEN 10	500							
VEN 11	500							
VEN 12	500							

NO SIGNATURE

Shirley

10/18/09  
8/11/09

# General Engineering Laboratories Verification Source Preparation Sheet

*A W 8/4/09*

Applicable SOP Number *OL 227-008* Isotope *Yb-226*  
 Date Standards Prepared *11/10/09* Cocktail Type Used *NA*  
 Standard ID *6038-F* Matrix of Vial/Planchett *NA*  
 Amount Used (g or ml) *0.1* Type of Scintillation Vial *NA*  
 Standard Activity (DPM/g or mL) *267.519* Pipette ID Used *1125203*  
 Reference Date *1/23/04* Balance ID Used *38080104*  
 Expiration Date *2/1/10* Quenching Agent *NA*  
 Residue/Carrier Agent *NA*

	Standard Number	Quenching Vol (uL)/ Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	<i>Ver 1</i>				
2	<i>Ver 2</i>				
3	<i>Ver 3</i>				
4	<i>Ver 4</i>				
5	<i>Ver 5</i>				
6	<i>Ver 6</i>				
7	<i>Ver 7</i>				
8	<i>Ver 8</i>				

*W 8/4/09*

Prepared By: *Willy Adams* Date *8/4/09*  
 Reviewed By: *Angela G...* Date *8/4/09*

*W 8/4/09*

0638

**CERTIFICATE OF CALIBRATION**  
**Standard Radionuclide Source**

67519-278

Ra-226 5 mL Liquid in Flame Sealed Vial

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

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

Analytics maintains traceability to the National Institute of Standards and Technology through participation in a Measurements Assurance Program as described in USNRC Reg. Guide 4.15, Revision 1, February 1979.

ISOTOPE:	Ra-226
ACTIVITY (dps):	2.353 E4
HALF-LIFE:	1.600 E3 years
CALIBRATION DATE:	January 23, 2004 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	3.3%

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%

5.01065 grams 0.1M HCl solution with 50  $\mu\text{g/g}$  Ba carrier.

P O NUMBER 3231RD, Item 5

SOURCE PREPARED BY:

M. D. Currie  
M. D. Currie, Radiochemist

Q A APPROVED:

RCUW 1/26/04



# Standard Traceability Log Rad

Source Material Info	
Parent Code:	0638
Prepared By:	Amanda Fehr
Carrier Conc:	0.1M HCl
Reference Date:	01/23/2004
Ampoule Mass (g):	5.01065 g
Uncertainty:	+/- 3.3 %
LogBook No:	RC-S-037-037

A Solution Material Info	
Isotope:	Radium-226
Prepared By:	Amanda Fehr
Prep Date:	01/16/2006
Verification Date:	04/09/2009
Expiration Date:	04/09/2010
Primary Code:	0638-A
Dilution(mL):	100 mL
Mass of Parent(g):	4.8398 g
Density(g/mL):	1.0266
Balance ID:	38080204

## Calculations Converting parent activity to dpm/mL|dpm/g

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$$

$$(\text{Mass of parent(g)}) * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$$

$$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) / (5.01065 \text{ g} * 100 \text{ mL}) = 13636.6133 \text{ dpm/mL}$$

$$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) / (1.0266 \text{ g/mL}) / (5.01065 \text{ g} * 100 \text{ mL}) = 13282.9676 \text{ dpm/g}$$

WMS 8/14/09

## Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
01/17/2006	Amanda Fehr	2.1041	100	0638-B	279.0211 dpm/mL	01/17/2007	01/17/2008
07/17/2006	Mary Aders	2.1313	100	0638-C	282.6281 dpm/mL	07/26/2006	07/26/2007
03/28/2007	Daniel Roy	2.1025	100	0638-D	279.2744 dpm/ml	04/08/2007	04/08/2008
03/28/2007	Daniel Roy	45.468	250	0638-E	2415.7999 dpm/ml	04/09/2009	04/09/2010
12/18/2007	Daniel Roy	2.014	100	0638-F	267.519 dpm/ml	02/02/2009	02/02/2010
02/12/2008	Daniel Roy	.5004	100	0638-G	66.468 dpm/ml	03/02/2009	03/02/2010
07/23/2008	Daniel Roy	5.0607	250	0638-H	268.8845 dpm/ml	07/17/2009	07/17/2010

GEL Laboratories LLC  
Version 1.0 9/18/2000

W0 84116

# Verification for Ra-226 Standard 0638-F

	Isotope	Value	Uncertainty
D. Roy	0638-F #1	24.629	1.7426
2/2/2009	0638-F #2	24.438	1.7557
	0638-F #3	22.791	1.6808
<b>Mean Value (Counting) =</b>	23.953	99.60	<b>Pass</b>
<b>Stdev =</b>	1.010781096		<b>Rule 3 (Pass/Fail)</b>
<b>Target =</b>	24.05		
<b>Lower Limit =</b>	21.93100448		
<b>Upper Limit =</b>	25.97412886		
<b>Rule 1 Pass/Fail</b>	<b>Pass</b>		
<b>Two sigma =</b>	2.021562191		
<b>10 % of Mean =</b>	2.395256667		
<b>Rule 2 (Pass/Fail)</b>	<b>Pass</b>		

Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements

Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.

Rule 3 = The determined mean value shall be within 5% of the certificate value.

The analyst prepared three standard verification sources for standard 0638-F using 0.1 mL for each source. Each source was counted using routine Lucas cell procedures. Calibration for 0299-G was used in this verification.

*Handwritten notes:*  
 KUS 8/2/09  
 2/2/2009  
 Amanda [Signature]

# Radium-226 Que Sheet

General Engineering Laboratories, Radiochemistry Division

Batch #: 838839

02/03/2009

Analyst: KSDI

First Client Due Date:

Internal Due Date: 02/07/2009

Spike Isotope: Radium-226 Spike Code: 663-2

Expiration Date: 12/27/08 Vol: 1

Nom Conc:

LCS Isotope: Radium-226 LCS Code: 663-2

Expiration Date: 12/27/08 Vol: 1

Nom Conc:

Prep Date: 12/27/08

Pipet ID:

Initials: VSP

Witness:

Sample Count Time: 30 (Min)

Bkg Count Time: 30 (Min)

Sample I	Client Description	Type	Hazard Code	Matrix	Min CRDL	Client	Vol (mL)	End Init Degas Date/Tin	End LN Date/Time	De-em Date/Time	Start Count Date/Time	Cell #	Det #	Bkg counts	Total Counts
1201770521-1	LCS for batch 838839	LCS	GROUND	WAJ 1	1 pCi/L	QC ACCOUNT	5.0	1/26/09 10:05	1/26/09 11:30	1/26/09 13:05	1/26/09 17:05	305	3	9	741
1201770522-1	LCS for batch 838839	LCS	GROUND	WAJ 1	1 pCi/L	QC ACCOUNT	5.0	1/26/09 10:05	1/26/09 11:45	1/26/09 13:10	1/26/09 17:57	304	3	9	748
1201770523-1	LCS for batch 838839	LCS	GROUND	WAJ 1	1 pCi/L	QC ACCOUNT	5.0	1/26/09 10:05	1/26/09 12:00	1/26/09 13:10	1/26/09 17:05	305	3	9	743

Comments:

Instrument ID's:

LUCAS-56938, LUCAS-2136417, LUCAS-90989, LUCAS-162753, LUC-132286, LUC-179055

Data Reviewed By:

VO 8/16/09

# Radium-226 Liquid

Filename : RA226.XLS  
 File type : Excel  
 Version # : 1.2.3

Spike S/N : N/A  
 Spike Exp Date : N/A  
 Spike Activity (dpm/ml): N/A  
 Spike Volume Added: N/A

Pipet, 0.1 ml Stdev : +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev : +/- 0.002564 ml  
 Pipet, 1 ml Stdev : +/- 0.005480 ml

Batch : 838839  
 Analyst : KSD1  
 Prep Date : 1/26/2009  
 Ra-226 Abundance : 1  
 Ra-226 Method Uncertainty : 0.0918

Procedure Code : LUC26RAL  
 Parmname : Radium-226  
 Required MDA : 1 pCi/L  
 Half-life of Ra-226 : 1600 years  
 Half-life of Rn-222: 3.823 days  
 Batch counted on : LUCAS CELL DETECTOR  
 BKG Count time : 30 min

LCS S/N : 0638-F  
 LCS Exp Date : 12/20/2008  
 LCS Activity (dpm/ml): 266.94  
 LCS Volume Added: 0.10

Sample Characteristics		Count Raw Data				Weekly Background			Detector Efficiency		
Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Cell Number	Counting Time (min.)	Gross Counts	Gross CPM	Counts	CPM	Count Time (min.)	(cpm/dpm)
1201770521.1	0.5000	2.0256E-05	1/26/2009 0:00	305	30	791	26.367	8	0.267	30	1.9930
1201770522.1	0.5000	2.0256E-05	1/26/2009 0:00	306	30	768	25.600	8	0.267	30	1.9500
1201770523.1	0.5000	2.0256E-05	1/26/2009 0:00	308	30	730	24.333	8	0.267	30	2.0010

UNSM/05

Detector Efficiency Error (cpm/dpm)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrowth		Count Start Date/Time	Rn-222 Corrections		Ra-226 Decay
				End Date/Time	De-Gas to Ingrowth		Ingrowth to Count	During Count	
0.06082	1/23/2008	1/22/2009	1/26/2009 16:05	1/30/2009 11:30	1/30/2009 17:05	0.499	0.959	1.002	1.000
0.06082	1/23/2008	1/22/2009	1/26/2009 16:05	1/30/2009 11:45	1/30/2009 17:37	0.500	0.957	1.002	1.000
0.06082	1/23/2008	1/22/2009	1/26/2009 16:05	1/30/2009 12:00	1/30/2009 19:05	0.501	0.948	1.002	1.000

K0816104  
04/21/09

- Notes.  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

Results Decision Level pCi/L	Critical Level pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error pCi/L	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA		Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
							Counting Uncertainty pCi/L	Total Prop. Uncertainty pCi/L						
0.2932	0.2070	0.5083	24.6287	0.0707	26.1000	0.9422	1.7426	5.5940		LCS			24.0486	102.4%
0.2997	0.2116	0.5196	24.4384	0.0710	25.3333	0.9286	1.7557	5.5591		LCS			24.0486	101.6%
0.2942	0.2077	0.5101	22.7906	0.0715	24.0667	0.9055	1.6808	5.1982		LCS			24.0486	94.8%

W8816106  
(15)

# General Engineering Laboratories

2040 Savage Road, Charleston, SC 29414  
 (843)556-8171

## Lucas Cell Calibration Package

(701-712)

	YES	NO	Comments
1) Is all calibration standard information enclosed for: the primary standard certificate? the secondary standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	✓		
	✓		
	✓		
	✓		
2) Is the efficiency calibration report included ?	✓		
3) Is the raw count data included for: Cell constant determination? Plateau generation?	✓		
	✓		
4) Are the calibration verifications included?	✓		
5) Are the instrument settings included: HVPS settings?	✓		
6) Has the CELLEFF.xls file been updated ?	✓		
7) Have the calibration dates been updated in ALPHALIMS ?	✓		

Prepared By: Kelli Spence

Date: 9/30/09

Reviewed By: Angela G

Date: 9/30/09

Effective Date: 9/30/09



# Ra-226 Cell Constants

Standard Reference date : 12/15/1999  
 standard ID : 0299-H  
 Volume added (mL) : 0.1  
 Standard Reference Activity (DPM/mL) : 2483.21

Lucas cell #	Cell constant	Standard Source	Date/Time of count	Date/Time flushed to cell	Date/Time end of degas	cpm	total counts	count time min	cpm	Known activity dpm	t1 (days) end-degas to flush	t2 (days) end-flush to count	t3 (days) Std Ref Date to count	Decay from Std Ref Date to count	
701	2.180	Average	2.107	Cal 12	9/21/2009 17:00	9/21/2009 12:55	9/18/2009 17:00	6158	30	205.27	243.02	2.82986	0.17014	3569	0.9958
701	2.025	Stdev	0.078	Cal 1	9/15/2009 17:45	9/15/2009 13:45	9/1/2009 10:30	6595	15	439.67	243.02	14.13542	0.16667	3563	0.9958
701	2.117	Cal 1	9/18/2009 18:15	9/18/2009 13:20	9/15/2009 10:00	3219	15	214.60	243.02	3.13889	0.20486	0.16667	3566	0.9958	
702	2.101	Average	2.033	Cal 2	9/24/2009 18:05	9/24/2009 14:05	9/21/2009 17:00	3014	15	200.93	243.02	2.87847	0.16667	3572	0.9958
702	2.020	Stdev	0.063	Cal 2	9/15/2009 18:10	9/15/2009 14:10	9/1/2009 10:30	6583	15	438.87	243.02	14.15278	0.16667	3563	0.9958
702	1.977	Cal 11	9/21/2009 17:25	9/21/2009 13:20	9/18/2009 17:00	5611	30	187.03	243.02	2.84722	0.17014	0.16667	3569	0.9958	
703	2.218	Average	2.221	Cal 10	9/21/2009 18:00	9/21/2009 13:45	9/18/2009 17:00	6317	30	210.57	243.02	2.86458	0.17708	3569	0.9958
703	2.279	Stdev	0.057	Cal 3	9/24/2009 18:25	9/24/2009 14:35	9/21/2009 17:00	3282	15	219.47	243.02	2.89931	0.15972	3572	0.9958
703	2.165	Cal 3	9/18/2009 19:00	9/18/2009 14:55	9/15/2009 10:00	3364	15	224.27	243.02	3.20486	0.17014	0.16667	3566	0.9958	
704	2.302	Average	2.235	Cal 9	9/21/2009 18:35	9/21/2009 14:20	9/18/2009 17:00	6599	30	219.97	243.02	2.88889	0.17708	3569	0.9958
704	2.255	Stdev	0.079	Cal 4	9/24/2009 18:45	9/24/2009 15:00	9/21/2009 17:00	3274	15	218.27	243.02	2.91667	0.15625	3572	0.9958
704	2.148	Cal 4	9/18/2009 19:15	9/18/2009 15:20	9/15/2009 10:00	3356	15	223.73	243.02	3.22222	0.16319	0.16667	3566	0.9958	
705	2.032	Average	2.107	Cal 5	9/18/2009 19:40	9/18/2009 15:45	9/15/2009 10:00	3187	15	212.47	243.02	3.23958	0.16319	3566	0.9958
705	2.090	Stdev	0.084	Cal 5	9/24/2009 19:05	9/24/2009 15:25	9/21/2009 17:00	3050	15	203.33	243.02	2.93403	0.15278	3572	0.9958
705	2.198	Cal 8	9/21/2009 19:10	9/21/2009 14:45	9/18/2009 17:00	6321	30	210.70	243.02	2.90625	0.18403	0.16667	3569	0.9958	
706	2.093	Average	2.142	Cal 7	9/21/2009 20:07	9/21/2009 15:05	9/18/2009 17:00	6013	30	200.43	243.02	2.92014	0.20972	3569	0.9958
706	2.109	Stdev	0.071	Cal 6	9/24/2009 19:25	9/24/2009 15:45	9/21/2009 17:00	3089	15	205.93	243.02	2.94792	0.15278	3572	0.9958
706	2.223	Cal 6	9/18/2009 19:55	9/18/2009 16:10	9/15/2009 10:00	3505	15	233.67	243.02	3.25694	0.15625	0.16667	3566	0.9958	
707	2.154	Average	2.275	Cal 7	9/18/2009 20:15	9/18/2009 16:30	9/15/2009 10:00	3406	15	227.07	243.02	3.27083	0.15625	3566	0.9958
707	2.386	Stdev	0.116	Cal 7	9/24/2009 19:45	9/24/2009 16:05	9/21/2009 17:00	3506	15	233.73	243.02	2.96181	0.15278	3572	0.9958
707	2.287	Cal 6	9/21/2009 20:35	9/21/2009 15:25	9/18/2009 17:00	6586	30	219.53	243.02	2.93403	0.21528	0.16667	3569	0.9958	
708	2.253	Average	2.188	Cal 8	9/24/2009 20:00	9/24/2009 16:30	9/21/2009 17:00	3330	15	222.00	243.02	2.97917	0.14583	3572	0.9958
708	2.110	Stdev	0.180	Cal 1	9/28/2009 18:35	9/28/2009 15:05	9/24/2009 17:00	7591	30	253.03	243.02	3.92014	0.14583	3576	0.9958
708	1.923	Cal 8	9/18/2009 20:25	9/18/2009 16:50	9/15/2009 10:00	3055	15	203.67	243.02	3.28472	0.146931	0.16667	3566	0.9958	
709	2.088	Average	2.285	Cal 9	9/18/2009 21:03	9/18/2009 17:15	9/15/2009 10:00	3324	15	221.60	243.02	3.30208	0.15833	3566	0.9958
709	2.352	Stdev	0.168	Cal 4	9/21/2009 21:50	9/21/2009 16:20	9/18/2009 17:00	6823	30	227.43	243.02	2.97222	0.22917	3569	0.9958
709	2.400	Cal 9	9/24/2009 20:20	9/24/2009 16:45	9/21/2009 17:00	3554	15	236.93	243.02	2.98958	0.146931	0.16667	3572	0.9958	
710	2.512	Average	2.409	Cal 3	9/21/2009 22:21	9/21/2009 16:35	9/18/2009 17:00	7291	30	243.03	243.02	2.98264	0.24028	3569	0.9958
710	2.436	Stdev	0.119	cal 10	9/24/2009 20:50	9/24/2009 17:00	9/21/2009 17:00	3611	15	240.73	243.02	3.00000	0.15972	3572	0.9958
710	2.279	Cal 10	9/18/2009 21:20	9/18/2009 17:30	9/15/2009 10:00	3635	15	242.39	243.02	3.31250	0.15972	0.16667	3566	0.9958	
711	2.302	Average	2.242	Cal 11	9/24/2009 21:37	9/24/2009 17:45	9/15/2009 10:00	3536	15	235.73	243.02	3.32292	0.16111	3566	0.9958
711	2.302	Stdev	0.052	Cal 11	9/24/2009 22:05	9/24/2009 17:15	9/21/2009 17:00	3395	15	226.33	243.02	3.01042	0.20139	3572	0.9958
711	2.211	Cal 2	9/21/2009 22:52	9/21/2009 16:55	9/18/2009 17:00	6432	30	214.40	243.02	2.99653	0.24792	0.16667	3569	0.9958	
712	2.292	Average	2.069	Cal 1	9/21/2009 23:40	9/21/2009 17:10	9/18/2009 17:00	6657	30	221.90	243.02	3.00694	0.27083	3569	0.9958
712	1.928	Stdev	0.195	Cal 11	9/15/2009 22:15	9/15/2009 17:35	9/1/2009 10:30	6263	15	417.53	243.02	14.29514	0.19444	3563	0.9958
712	1.989	Cal 12	9/24/2009 22:27	9/24/2009 17:30	9/21/2009 17:00	2938	15	195.87	243.02	3.02083	0.20625	0.16667	3572	0.9958	

EffEr 0.065186 <- Put in Machines.xls (Lucas Cell Tab)

ADG  
9/30/09

#7

**Ra-226 Calibration Sheet**

Standard ID: 0299-H

Volume Added (mL): 0.1

Expiration Date: 8/1/10 \* 15 min

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 1	500	9/11/09 10:30	9/15/09 13:45	9/15/09 17:45	701	7	6595
Cal 2	500	9/11/09 10:30	9/15/09 14:10	9/15/09 18:10	702	7	6583
Cal 3	500	9/11/09 10:30	9/15/09 14:35	9/15/09 18:45	703	7	5672
Cal 4		9/11/09 10:30	9/15/09 15:15	9/15/09 19:00	704	7	6039
Cal 5		9/11/09 10:30	9/15/09 15:40	9/15/09 19:15	705	7	5579
Cal 6		9/11/09 10:30	9/15/09 16:05	9/15/09 19:45	706	7	5347
Cal 7		9/11/09 10:30	9/15/09 16:30	9/15/09 2:00	707	7	5376
Cal 8		9/11/09 10:30	9/15/09 16:45	9/15/09 2:30	708	7	6203
Cal 9		9/11/09 10:30	9/15/09 17:05	9/15/09 2:110	710	7	6458
Cal 10		9/11/09 10:30	9/15/09 17:20	9/15/09 2:155	711	7	5935
Cal 11	500	9/11/09 10:30	9/15/09 17:35	9/15/09 2:215	712	7	6263

9/13/09

9/13/09

9/13/09

9/13/09

9/13/09

9/13/09

9/13/09

9/13/09

9/13/09

9/13/09

# Ra-226 Calibration Sheet

Standard ID: 6MM-H

Volume Added (mL): 0.1

Expiration Date: 8/11/10

\* 15min

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
<del>Cal 1</del>	<del>500</del>	<del>9/18/09 1320</del>	<del>9/18/09 1425</del>	<del>9/18/09 1815</del>	<del>101</del>	<del>7</del>	<del>3219</del>
<del>Cal 2</del>	<del>500</del>	<del>9/15/09 1000</del>	<del>9/18/09 1425</del>	<del>9/18/09 1835</del>	<del>102</del>	<del>7</del>	<del>3420</del>
Cal 3	500	9/15/09 1000	9/18/09 1455	9/18/09 1900	103	7	3364
Cal 4	500	9/15/09 1000	9/18/09 1520	9/18/09 1915	104	7	3350
Cal 5	500	9/15/09 1000	9/18/09 1545	9/18/09 1940	105	7	3187
Cal 6	500	9/15/09 1000	9/18/09 1610	9/18/09 1965	106	7	3505
Cal 7	500	9/15/09 1000	9/18/09 1630	9/18/09 2015	107	7	3406
Cal 8	500	9/15/09 1000	9/18/09 1650	9/18/09 2025	108	7	3055
Cal 9	500	9/15/09 1000	9/18/09 1715	9/18/09 2103	109	7	3324
Cal 10	500	9/15/09 1000	9/18/09 1730	9/18/09 2120	110	7	3635
Cal 11	500	9/15/09 1000	9/18/09 1745	9/18/09 2137	111	7	3536
Cal 12	500	9/11/09 1000	9/18/09 1800	9/18/09 2218	112	7	5663

10/1/09

11/09/2010

9/30/09

11/09/2010

# Ra-226 Calibration Sheet

Standard ID: 02944

Volume Added (mL): 0.1

Expiration Date: 9/1/10

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 17	500	9/18/09 1700	9/21/09 1555	9/21/09 1700	701	7	6158
Cal 11	500	9/18/09 1700	9/21/09 1520	9/21/09 1725	702	7	5611
Cal 10	500	9/18/09 1700	9/21/09 1545	9/21/09 1800	703	7	6317
Cal 9	500	9/18/09 1700	9/21/09 1420	9/21/09 1835	704	7	6599
Cal 8	500	9/18/09 1700	9/21/09 1445	9/21/09 1910	705	7	6321
Cal 7	500	9/18/09 1700	9/21/09 1505	9/21/09 2007	706	7	6013
Cal 6	500	9/18/09 1700	9/21/09 1525	9/21/09 2035	707	7	6586
<del>Cal 5</del>	<del>500</del>	<del>9/18/09 1700</del>	<del>9/21/09 1505</del>	<del>9/21/09 2112</del>	<del>708</del>	<del>7</del>	<del>7155</del>
Cal 4	500	9/18/09 1700	9/21/09 1620	9/21/09 2150	709	7	6823
Cal 3	500	9/18/09 1700	9/21/09 1635	9/21/09 2221	710	7	7291
Cal 2	500	9/18/09 1700	9/21/09 1655	9/21/09 2252	711	7	6432
Cal 1	500	9/18/09 1700	9/21/09 1710	9/21/09 2340	712	7	6657

9/21/09

9/21/09

9/21/09

# Ra-226 Calibration Sheet

Standard ID: D1119-1

Volume Added (mL): 0.1

Expiration Date: 07/10

\* 15 min counts

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
<del>Cal 1</del>	<del>500</del>	<del>9/24/09 1700</del>	<del>9/24/09 1730</del>	<del>9/24/09 1745</del>	<del>701</del>	<del>7</del>	<del>3125</del>
Cal 2	500	9/24/09 1700	9/24/09 1705	9/24/09 1805	702	7	3014
Cal 3	500	9/24/09 1700	9/24/09 1735	9/24/09 1825	703	7	3292
Cal 4	500	9/24/09 1700	9/24/09 1900	9/24/09 1845	704	7	3274
Cal 5	500	9/24/09 1700	9/24/09 1525	9/24/09 1905	705	7	3050
Cal 6	500	9/24/09 1700	9/24/09 1945	9/24/09 1925	706	7	3089
Cal 7	500	9/24/09 1700	9/24/09 1605	9/24/09 1945	707	7	3506
Cal 8	500	9/24/09 1700	9/24/09 1630	9/24/09 2000	708	7	3330
Cal 9	500	9/24/09 1700	9/24/09 1645	9/24/09 2020	709	7	3554
Cal 10	500	9/24/09 1700	9/24/09 1700	9/24/09 2050	710	7	3611
Cal 11	500	9/24/09 1700	9/24/09 1715	9/24/09 2205	711	7	3395
Cal 12	500	9/24/09 1700	9/24/09 1730	9/24/09 2227	712	7	2938

W/10/09/10/11/12

W/11/20/09

9/30/09



410  
9/30/09

# General Engineering Laboratories Verification Source Preparation Sheet Calibration

Applicable SOP Number ML RAD-A-208

Isotope RA-226

Date Standards Prepared 4/5/05

Cocktail Type Used NA

Standard ID 0219-H

Matrix of Vial/Planchett NA

NA

NA

Amount Used (g or ml) 0.1

Type of Scintillation Vial NA

Standard Activity (DPM/g or mL) 2483.2133

Pipette ID Used 1429303

Reference Date 12/15/99

Balance ID Used 38080204

Expiration Date 8/1/10

Residue/Carrier Agent 0.1 M KCl

Quenching Agent NA

	Standard Number	Quenching Vol (uL) Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	Cal 1				
2	Cal 2				
3	Cal 3				
4	Cal 4				
5	Cal 5				
6	Cal 6				
7	Cal 7				
8	Cal 8				
9	Cal 9				
10	Cal 10				
11	Cal 11				
12	Cal 12				

NO 9/30/09

Prepared By: Kelli S. Dorsey

Date 9/30/09

Reviewed By: Angela Johnson

Date 9/30/09

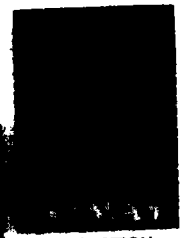
Rev 1 RLM 9/10/97

ee'd

8-21-00

Nycomed Amersham plc  
Amersham Laboratories

0299



CALIBRATION  
No. 0148



ISSUED  
BY:

Nycomed Amersham plc  
Radiation & Radioactivity  
Calibration Laboratory  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

ISSUED  
FOR:

AEA Technology plc  
Isotrak  
Amersham Laboratories  
White Lion Road  
Amersham  
Buckinghamshire  
HP7 9LL

Description Principal radionuclide: Radium-226

Product code: RAY44  
Solution number: R4/131/89

Measurement Reference time: 1200 GMT on 15 December 1999

Nuclear data Nuclear data quoted on this certificate are taken from the Joint European File, Version 2.2.

Expression of uncertainties The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , which for a  $t$ -distribution with  $v_{eff} = \infty$  effective degrees of freedom corresponds to a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Unless indicated, all other uncertainties are expressed at the confidence level associated with one standard uncertainty.

The format used for the uncertainties in the values of radionuclidic purity is illustrated in the following examples;

6.5(21)	-	6.5 ± 2.1
6.54(21)	-	6.54 ± 0.21
6.543(21)	-	6.543 ± 0.021

Approved  
Signature

Date of  
issue  
289

17<sup>th</sup> December 1999

WD9130109

Nycomed



# GEL Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0299	Isotope:	Radium-226
Prepared By:	Angela Johnson	Prepared By:	Angela Johnson
Carrier Conc:	0.5 M HCL	Prep Date:	09/15/2000
Reference Date:	12/15/1999	Verification Date:	01/23/2008
Ampoule Mass (g):	5.0368 g	Expiration Date:	01/23/2009
Uncertainty:	+/- 2.5 %	Primary Code:	0299-A
LogBook No:	RC S 027 128	Dilution(mL):	100 mL
		Mass of Parent(g):	4.6634 g
		Density(g/mL):	1.0012
		Balance ID:	

## Calculations Converting parent activity to dpm/mL/dppm/g

$$(\text{Mass of parent(g)} * (\text{Parent Activity (kBq/g)} * (\text{conversion dpm to kBq}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)})$$

$$(\text{Mass of parent(g)} * (\text{Parent Activity (kBq/g)} * (\text{conversion dpm to kBq}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)})$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (100 \text{ mL}) = 122414.2500 \text{ dpm/mL}$$

$$(4.6634 \text{ g}) * (43.75 \text{ kBq/g}) * (60000 \text{ dpm/kBq}) / (1.0012 \text{ g/mL}) / (100 \text{ mL}) = 122273.3377 \text{ dpm/g}$$

## Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
08/26/2003	Angela Johnson	1.9909	100	0299-E	2434.34 dpm/mL	11/04/2004	11/04/2005
08/26/2003	Angela Johnson	1.9872	100	0299-F	2429.82 dpm/mL	08/26/2004	08/26/2005
04/05/2005	Amanda Fehr	5.0018	250	0299-G	2446.3471 dpm/mL	01/26/2009	01/26/2010
08/07/2009	Mary Aders	5.0767	250	0299-H	2483.2133 dpm/mL	08/07/2009	08/07/2010

GEL Laboratories LLC  
Version 1.0 9/18/2000

## Verification for Ra-226 Standard 0299-H

M. Aders 8/7/2009	Isotope	Value	Uncertainty
	0299-H	111.440	2.5408
	0299-H	115.924	2.5878
	0299-H	111.780	2.5407
<b>Mean Value (Counting) =</b>	113.048	101.49	<b>Pass</b>
<b>Stdev =</b>	2.496414563		<b>Rule 3 (Pass/Fail)</b>
<b>Target =</b>	111.39		
<b>Lower Limit =</b>	108.0550709		
<b>Upper Limit =</b>	118.0407291		
<b>Rule 1 Pass/Fail</b>	<b>Pass</b>		
<b>Two sigma =</b>	4.992829126		
<b>10 % of Mean =</b>	11.30479		
<b>Rule 2 (Pass/Fail)</b>	<b>Pass</b>		

**Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements**

**Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.**

**Rule 3 = The determined mean value shall be within 5% of the certificate value.**

The analyst prepared three standard verification sources for Ra-226 source 0299-H by transferring portions of the degassed standard into tared glass liquid scintillation vials. 10 mL of DI Water and 10 mL of mineral oil were added to each vial and the vials were shaken. A Blank vial was prepared in a similar fashion using 10 mL of DI Water and 10 mL of mineral oil. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Red using source standard verification. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

Reference RAD SOP M-001

*Handwritten signature: Amanda L. Fein 8/13/09*

# Radon-222 Liquid

Filename : RN222.XLS  
 File type : Excel  
 Version # : 1.2.4

Spike S/N : N/A  
 Spike Exp Date : N/A  
 Spike Activity (dpm/ml) : N/A  
 Spike Volume Added : N/A  
 Spike Date/Time : 8/7/2009 14:00

LCS S/N : 0299-H  
 LCS Exp Date : 8/7/2010  
 LCS Activity (dpm/ml) : 2472.85  
 LCS Volume Added : 0.10

Batch : 891920  
 Analyst : MLA  
 Prep Date : 8/7/2009

Procedure Code : LSC222RNL  
 Parmname : Radon-222  
 Required MDA : 200 pCi/L  
 Half-life of Radon-222 : 3.823 days

Rn-222 Abundance : 1  
 Rn-222 Method Uncertainty : 0.1111  
 Geometry : 10ML MINERAL OIL/10ML  
 Pipet, 0.1 ml Stdev : +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev : +/- 0.002564 ml

Sample Characteristics		Sample Aliquot		Sample Date/Time	Count raw Data							
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Rack Position #	Counting Time (min.)	Quench#	Gross cpm	Background Count Time (min.)	Count Start Date/Time	Sample Decay	
1	1201897268.1	1.0000	2.0399E-05	8/7/2009 0:00	8-2	15	43.3	517.53	8.47	15	8/12/2009 7:48	0.380
2	1201897269.1	1.0000	2.0399E-05	8/7/2009 0:00	8-3	15	44.6	538.8	8.47	15	8/12/2009 8:04	0.380
3	1201897270.1	1.0000	2.0399E-05	8/7/2009 0:00	8-4	15	45	520.6	8.47	15	8/12/2009 8:20	0.379

0.379

Calibration Data				Detector				Backgrounds			Correction Factors			Net Sample	
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Rack Position #	Count Start Date/Time	Spike Date/Time	Rn-222 Ingrowth	Rn-222 Count Correction	Net Sample Activity for MS pCi/L				
1	LSCRED	7/28/2009	7/31/2010	3.5654	0.00792	8-1	8/12/2009 7:31	8/7/2009 14:00	0.577	0.577					
2	LSCRED	7/28/2009	7/31/2010	3.5654	0.00792	8-1	8/12/2009 7:31	8/7/2009 14:00	0.578	0.578					
3	LSCRED	7/28/2009	7/31/2010	3.5654	0.00792	8-1	8/12/2009 7:31	8/7/2009 14:00	0.579	0.579					

8/13/09

- Notes:  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

Results Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error pCi/L	Net Count Rate CPM	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA		Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
										Counting Uncertainty pCi/L	Total Prop. Uncertainty pCi/L						
1	0.5420	0.3827	200	0.8092	111.4397	0.0141	509.0600	592.17	5.9217	2.5408	24.4606		LCS			111.3896	100.0%
2	0.5412	0.3821	200	0.8080	115.9238	0.0139	530.3300	6.0403	6.0403	2.5678	25.4391		LCS			111.3896	104.1%
3	0.5404	0.3816	200	0.8068	111.7802	0.0140	512.1300	5.9390	5.9390	2.5407	24.5345		LCS			111.3896	100.4%

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2/1/04

ID: R14-232

12 AUG 2009 07:42

USER: LC COMMENT: RED

PRESET TIME : 15.00

DATA CALC : CPM HH : YES SAMPLE REPEATS: 1 PRINTER : EDIT

COUNT BLANK : NO ID# : NO REPLICATES : 1 RS232 : EDIT

TWO PHASE : NO AQ# : NO CYCLE REPEATS : 1 DISK : OFF

SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE RES: 0

LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

CHAN: 600.0 - 975.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

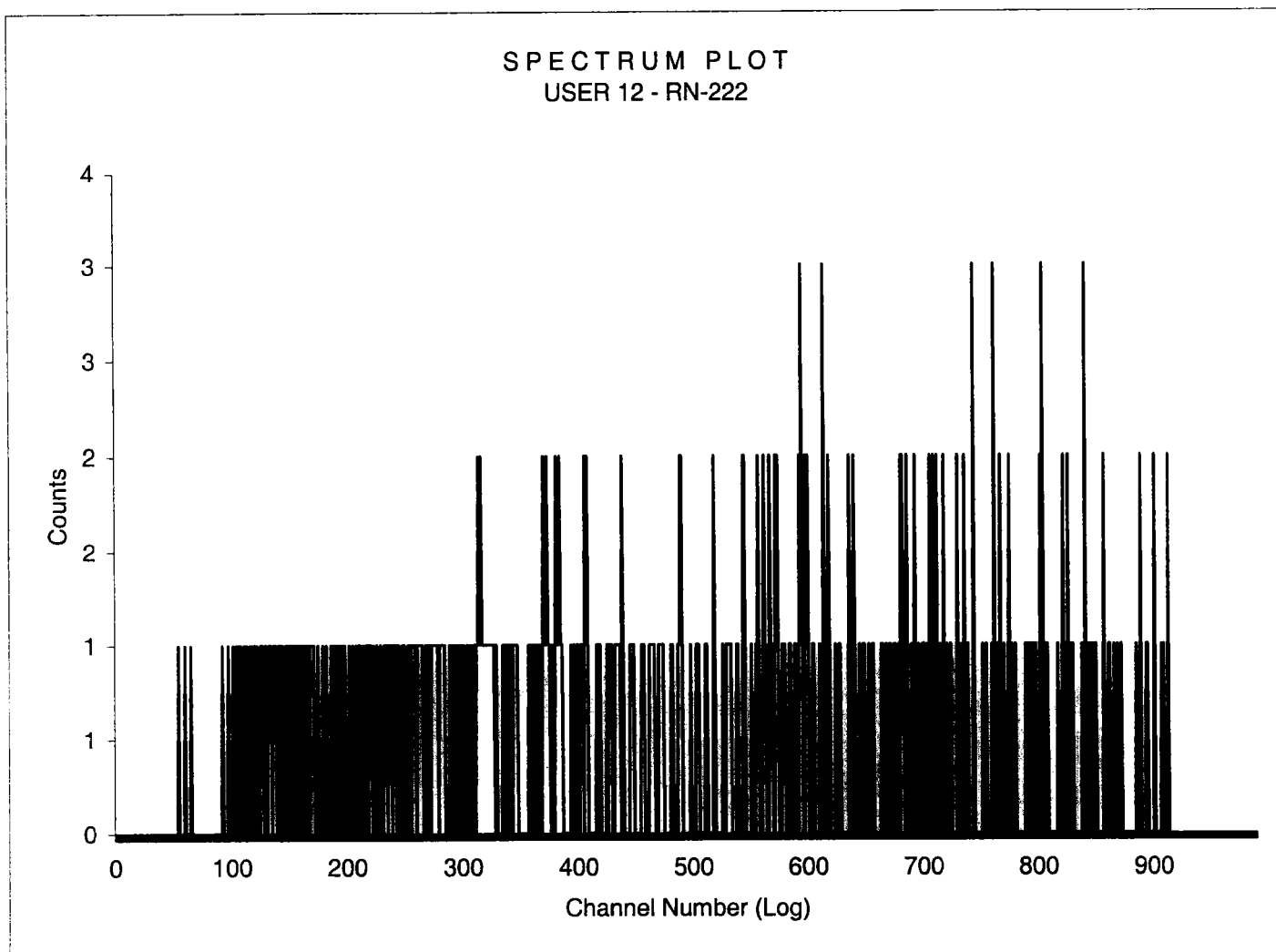
CHAN: 0.0 - 900.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	HH	WIND1 RAW CPM	WIND2 RAW CPM	WIND1		WIND2		LUMEX %	ELAPSED TIME
						CPM	%ERROR	CPM	%ERROR		
1	3-1	15.00	39.1	9.47	27.73	9.47	17.75	27.73	9.81	0.67	13.11
2	3-2	15.00	43.3	517.53	607.33	517.53	2.27	607.33	2.10	0.97	13.11
3	3-3	15.00	44.6	538.80	628.67	538.80	2.22	628.67	2.06	0.97	13.11
4	3-4	15.00	45.0	520.60	610.00	520.60	2.26	610.00	2.09	0.97	13.11

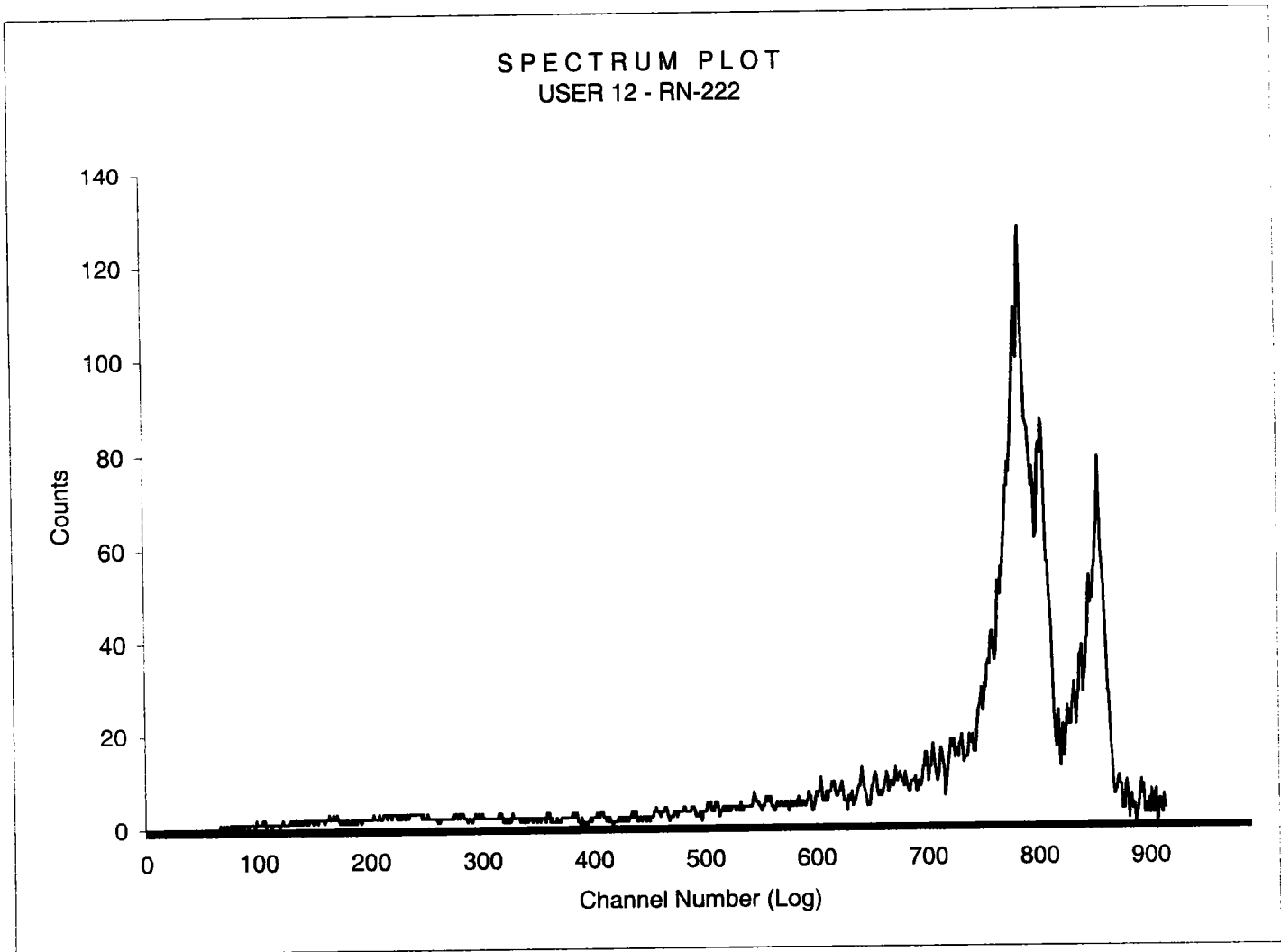
Handwritten signature

Sample Count Start Time:	12 Aug 2009 07:31:52		
Data Capture Date	12 Aug 2009 07:47:25		
User Filename	S12081208-1A.XLS		
	U12081208-1A.XLS		
Spectrum Type	Log Counts		
User Number	12		
User Id	RN-222		
User Comment	RED		
Isotope Name	14C		
Scintillator	LIQUID		
Sample, Rack-Pos, Time:	1	8-1	15.00
H#, Total Counts:	39.1	422	
Start, End, X-Axis:	0	990	Channel Number



*Handwritten:* 31:31:09

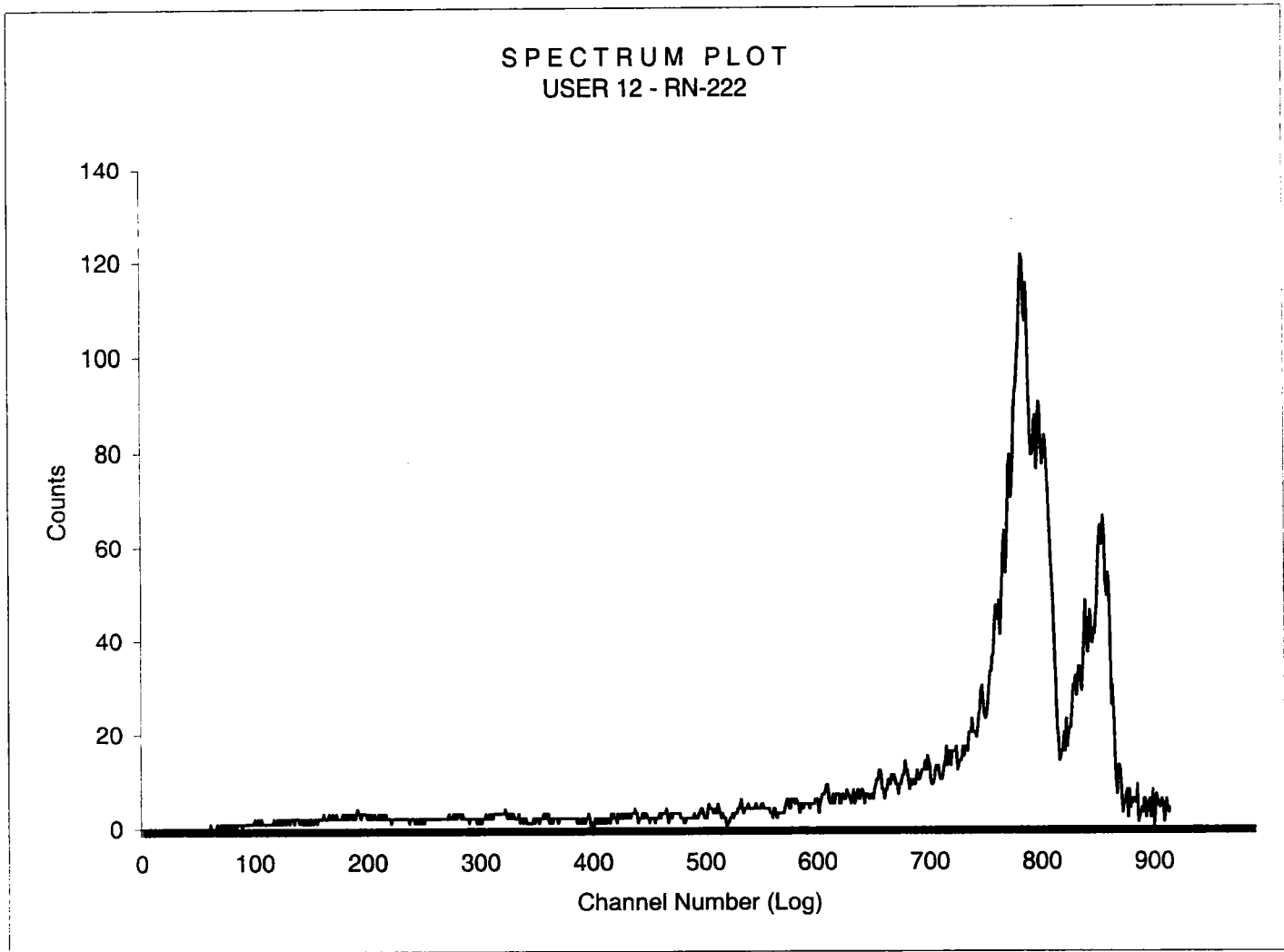
Sample Count Start Time: 12 Aug 2009 07:48:04  
Data Capture Date: 12 Aug 2009 08:03:28  
User Filename: S12081208-2A.XLS  
U12081208-1A.XLS  
Spectrum Type: Log Counts  
User Number: 12  
User Id: RN-222  
User Comment: RED  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 2 8-2 15.00  
H#, Total Counts: 43.3 9166  
Start, End, X-Axis: 0 990 Channel Number



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3/13/07

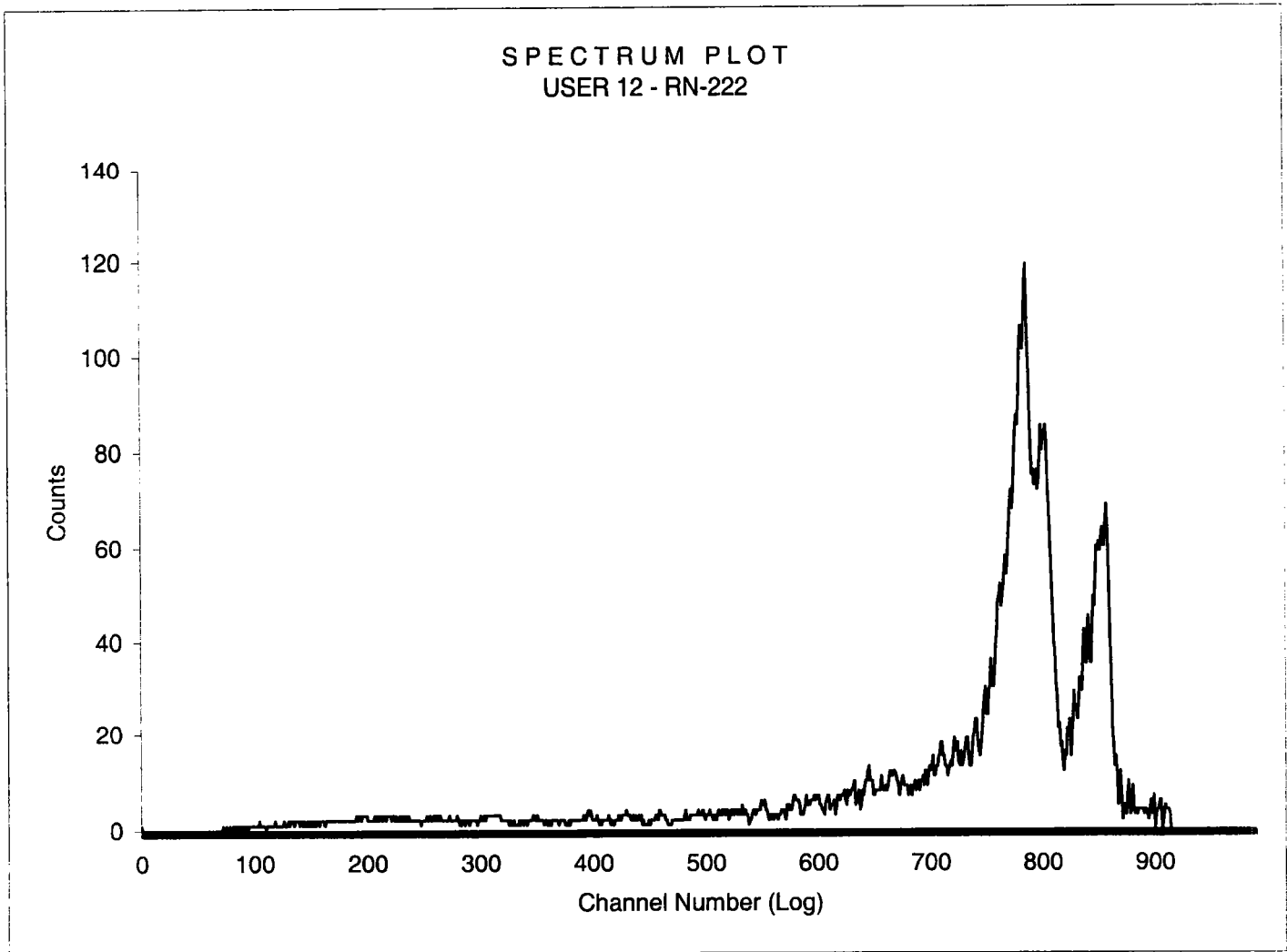


Sample Count Start Time: 12 Aug 2009 08:04:11  
Data Capture Date 12 Aug 2009 08:19:35  
User Filename S12081208-3A.XLS  
U12081208-1A.XLS  
Spectrum Type Log Counts  
User Number 12  
User Id RN-222  
User Comment RED  
Isotope Name  $^{14}\text{C}$   
Scintillator LIQUID  
Sample, Rack-Pos, Time: 3 8-3 15.00  
H#, Total Counts: 44.6 9492  
Start, End, X-Axis: 0 990 Channel Number



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8/13/09

Sample Count Start Time: 12 Aug 2009 08:20:17  
Data Capture Date: 12 Aug 2009 08:35:41  
User Filename: S12081208-4A.XLS  
U12081208-1A.XLS  
Spectrum Type: Log Counts  
User Number: 12  
User Id: RN-222  
User Comment: RED  
Isotope Name:  $^{14}\text{C}$   
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 4 8-4 15.00  
H#, Total Counts: 45.0 9197  
Start, End, X-Axis: 0 990 Channel Number



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3/12/09

# Radon 222 Que Sheet

08/07/2009

Batch #: 891920      Analyst: MLA      First Client Due Date: 8/17/2009      Internal Due Date: 8/17/2009  
 Spike Isotope: Radium-226      Spike Code: 0299-H      Expiration Date: 8/17/09      Vol: 1  
 LCS Isotope: Radium-226      LCS Code: 0299-H      Expiration Date: 8/17/09      Vol: 1  
 Prep Date: 8/7/09      Pipet ID: 270968      Initials: MLA      Witness: MLA      Comments:

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Label	Wet/Dry Sample Mass (g/mL)	LSC Rack #	Time Spike Added
1201897268-1	LCS for batch 891920	LCS	.2	pCi/mL	DRINKING	WATQC ACCOUNT	20-JUL-09 12:00 PM	<u>1700</u>			1700
1201897269-1	LCS for batch 891920	LCS	.2	pCi/mL	DRINKING	WATQC ACCOUNT	20-JUL-09 12:00 PM	<u>1400</u>			1400
1201897270-1	LCS for batch 891920	LCS	.2	pCi/mL	DRINKING	WATQC ACCOUNT	20-JUL-09 12:00 PM	<u>1400</u>			1400

Bkg Rack #:

Comments: \_\_\_\_\_ Data Reviewed By: \_\_\_\_\_

Instrument Used: LS6000 (Red) 7065155, LS6500 (Black) 7069123, LS6500 (Blue) 7067083, LS6500 (Green) 7067404  
 Wallac (Yellow) 4040127, Wallac (Pink) 2200082, Purple 7069123, Silver 7060656

GEL Laboratories LLC, Radiochemistry Division

*MLA*  
8/12/09

## Voltage Curve Ludlum #7

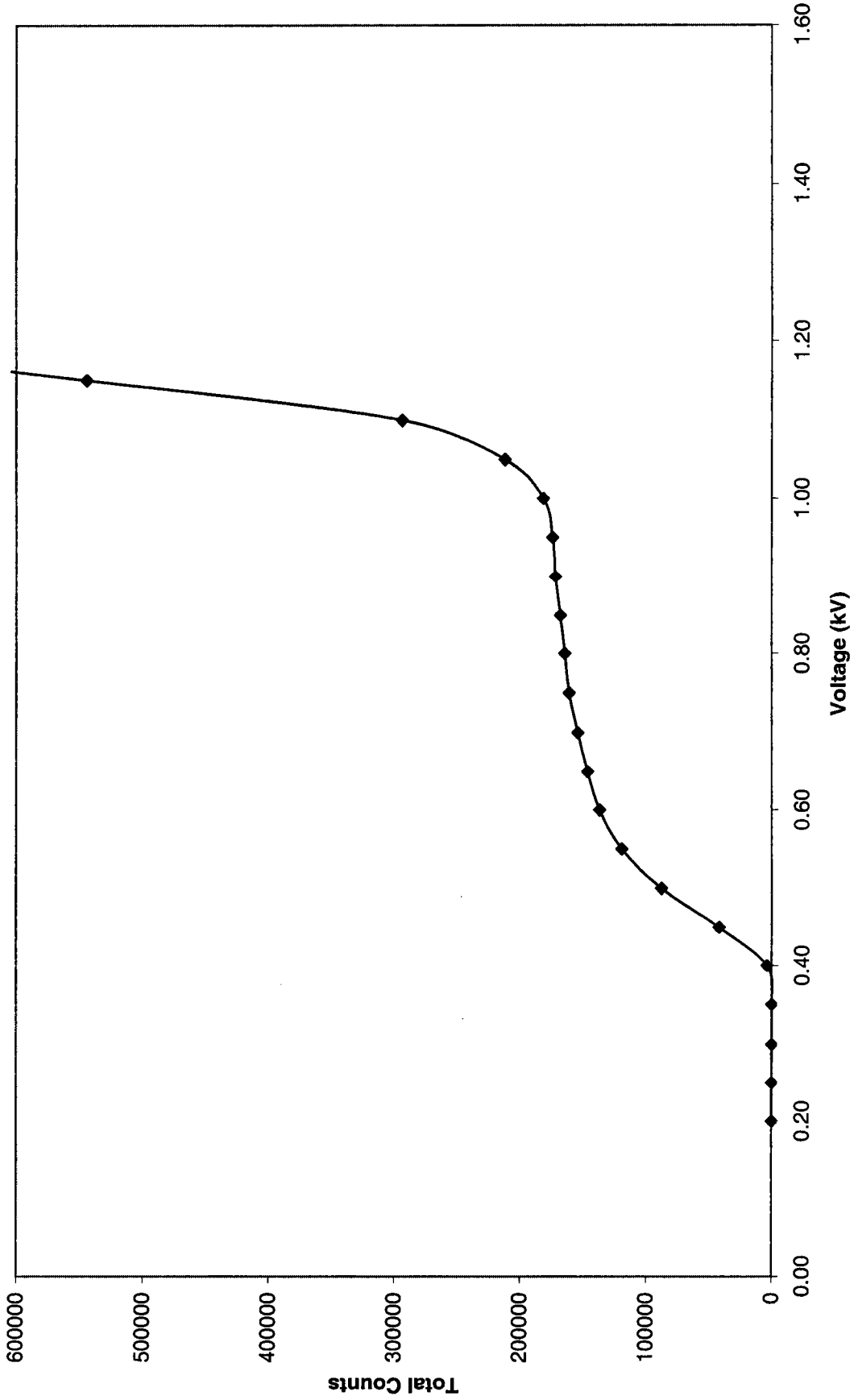
Voltage (kV)	Count Time (min)	Counts	Date/Time
0.20	1.00	0	9/15/09 12:13
0.25	1.00	0	9/15/09 12:14
0.30	1.00	0	9/15/09 12:15
0.35	1.00	0	9/15/09 12:16
0.40	1.00	3788	9/15/09 12:17
0.45	1.00	41827	9/15/09 12:18
0.50	1.00	87578	9/15/09 12:19
0.55	1.00	119153	9/15/09 12:20
0.60	1.00	136757	9/15/09 12:21
0.65	1.00	146242	9/15/09 12:22
0.70	1.00	154066	9/15/09 12:23
0.75	1.00	160997	9/15/09 12:24
0.80	1.00	164506	9/15/09 12:25
0.85	1.00	168023	9/15/09 12:26
0.90	1.00	171900	9/15/09 12:27
0.95	1.00	174082	9/15/09 12:28
1.00	1.00	181331	9/15/09 12:29
1.05	1.00	211928	9/15/09 12:30
1.10	1.00	293552	9/15/09 12:31
1.15	1.00	544079	9/15/09 12:32
1.20	1.00	827973	9/15/09 12:33
1.25	1.00	1214090	9/15/09 12:34

Detector set to operate at 0.70 kV

JH  
9/30/09

# Ludlum Detector Voltage Curve

—◆— Voltage Curve Ludlum #7



*OK  
9/30/09*

### DAILY CALIBRATION RANGE

Trial	Counts	Date	Time	Detector
1	154335	9/15/2009	13:30	7
2	153698	9/15/2009	13:31	7
3	153933	9/15/2009	13:32	7
4	154196	9/15/2009	13:33	7
5	154114	9/15/2009	13:34	7
6	153766	9/15/2009	13:35	7
7	154409	9/15/2009	13:36	7
8	154086	9/15/2009	13:37	7
9	153833	9/15/2009	13:38	7
10	153689	9/15/2009	13:39	7
11	148183	9/16/2009	10:25	7
12	148142	9/16/2009	10:35	7
13	148193	9/16/2009	10:36	7
14	147463	9/16/2009	10:37	7
15	147251	9/16/2009	10:39	7
16	146697	9/17/2009	4:25	7
17	146925	9/17/2009	5:45	7
18	147238	9/17/2009	6:00	7
19	147239	9/17/2009	6:15	7
20	146836	9/17/2009	6:30	7

STATISTICS	
Average	150711.30
St. Dev.	3407.47
+ 3 S.D.	160933.72
+ 2 S.D.	157526.25
Average	150711.30
- 2 S.D.	143896.35
- 3 S.D.	140488.88
<b>UPPER</b>	<b>160934</b>
<b>LOWER</b>	<b>140489</b>

*Handwritten:* 712  
9/30/09

701	2.107	9/30/2009
702	2.033	9/30/2009
703	2.221	9/30/2009
704	2.235	9/30/2009
705	2.107	9/30/2009
706	2.142	9/30/2009
707	2.275	9/30/2009
708	2.188	9/30/2009
709	2.285	9/30/2009
710	2.409	9/30/2009
711	2.242	9/30/2009
712	2.069	9/30/2009

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# Ra-226 WATER

Batch : LCSVER  
 Date : 9/22/2009  
 Analyst : KSD1

Procedure Code : LUC26RAL

Parname : Radium-226

MDA : 1 pCi/L

Instrument Used : LUCAS CELL DETECTOR

Bkg Count Time: 30 min

Sample ID	Sample Vol L	Count Time min	Gross counts cts	Cell # num	Cell Const. num	BKG cpm	Ra-226 MDA pCi/L	Ra-226 RESULT pCi/L	Ra-226 ERROR pCi/L	COUNT DATE/TIME
VER 1	0.500	15	636	701	2.107	0.267	0.5512	24.6163	1.9283	9/30/2009 9:20
VER 2	0.500	15	625	702	2.033	0.267	0.5247	27.0835	2.1404	9/29/2009 16:10
VER 3	0.500	15	625	703	2.221	0.267	0.4811	24.8342	1.9627	9/29/2009 16:45
VER 4	0.500	15	587	704	2.235	0.267	0.4786	23.1944	1.8925	9/29/2009 17:15
VER 5	0.500	15	511	705	2.107	0.267	0.5081	21.4146	1.8751	9/29/2009 17:50
VER 6	0.500	15	580	706	2.142	0.267	0.4998	23.9310	1.9645	9/29/2009 18:25
VER 7	0.500	15	539	707	2.275	0.267	0.4643	20.6372	1.7586	9/29/2009 18:40
VER 8	0.500	15	525	708	2.188	0.267	0.4816	20.8572	1.8013	9/29/2009 19:00
VER 9	0.500	15	559	709	2.285	0.267	0.4615	21.2888	1.7807	9/29/2009 19:40
VER 10	0.500	15	694	710	2.409	0.267	0.4093	23.4767	1.7593	9/30/2009 9:50
VER 11	0.500	15	537	711	2.242	0.267	0.4690	20.7776	1.7739	9/29/2009 20:20
VER 12	0.500	15	552	712	2.069	0.267	0.5096	23.2132	1.9542	9/29/2009 21:10

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Sample ID	Det #	Run Date	Sample Type	Standard ID	NC	NC units	Recovery/RPD
701	7	9/29/2009 15:35	LCS	0638-F	24.05	pCi/L	102%
702	7	9/29/2009 16:10	LCS	0638-F	24.05	pCi/L	113%
703	7	9/29/2009 16:45	LCS	0638-F	24.05	pCi/L	103%
704	7	9/29/2009 17:15	LCS	0638-F	24.05	pCi/L	96%
705	7	9/29/2009 17:50	LCS	0638-F	24.05	pCi/L	89%
706	7	9/29/2009 18:25	LCS	0638-F	24.05	pCi/L	100%
707	7	9/29/2009 18:40	LCS	0638-F	24.05	pCi/L	86%
708	7	9/29/2009 19:00	LCS	0638-F	24.05	pCi/L	87%
709	7	9/29/2009 19:40	LCS	0638-F	24.05	pCi/L	89%
710	7	9/29/2009 20:00	LCS	0638-F	24.05	pCi/L	98%
711	7	9/29/2009 20:20	LCS	0638-F	24.05	pCi/L	86%
712	7	9/29/2009 21:10	LCS	0638-F	24.05	pCi/L	97%

DEGASSING DATE/TIME	DE-EMAN. DATE/TIME	DEGASS-DE-EM	dE-EM-COUNT	constant	constant	Net CPM	Ingrowth constant
9/22/2009 14:30	9/30/2009 6:00	183.50	3.33	0.7498	0.9751	42.1333	0.7318
9/22/2009 14:30	9/29/2009 10:00	163.50	6.17	0.7090	0.9545	41.4000	0.6774
9/22/2009 14:30	9/29/2009 10:15	163.75	6.50	0.7095	0.9521	41.4000	0.6762
9/22/2009 14:30	9/29/2009 10:30	164.00	6.75	0.7101	0.9503	38.8667	0.6755
9/22/2009 14:30	9/29/2009 10:50	164.33	7.00	0.7108	0.9485	33.8000	0.6749
9/22/2009 14:30	9/29/2009 11:15	164.75	7.17	0.7117	0.9473	38.4000	0.6749
9/22/2009 14:30	9/29/2009 12:45	166.25	5.92	0.7150	0.9563	35.6663	0.6844
9/22/2009 14:30	9/29/2009 13:10	166.67	5.83	0.7159	0.9569	34.7333	0.6857
9/22/2009 14:30	9/29/2009 13:35	167.08	6.08	0.7168	0.9551	37.0000	0.6852
9/22/2009 14:30	9/30/2009 6:30	184.00	3.33	0.7507	0.9751	46.0000	0.7328
9/22/2009 14:30	9/29/2009 14:20	167.83	6.00	0.7184	0.9557	35.5333	0.6872
9/22/2009 14:30	9/29/2009 14:40	168.17	6.50	0.7191	0.9521	36.5333	0.6853

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Date: 9/30/09

Re-226 Verification Sheet

VNS #7

count time: 15 min

Sample ID	Volume (mL)	End Degas Date/Time	End De-rem Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
<del>VEN 1</del>	<del>500</del>	<del>9/22/09 1430</del>	<del>9/22/09 1040</del>	<del>9/29/09 1535</del>	<del>701</del>	<del>7</del>	<del>8</del>	<del>488</del>
VEN 2	500	9/22/09 1430	9/22/09 1000	9/29/09 1610	702	7	8	685
VEN 3	500	9/22/09 1430	9/22/09 1015	9/29/09 1645	703	7	1	685
VEN 4	500	9/22/09 1430	9/22/09 1030	9/29/09 1715	704	7	3	587
VEN 5	500	9/22/09 1430	9/22/09 1050	9/29/09 1750	705	7	1	511
VEN 6	500	9/22/09 1430	9/22/09 1115	9/29/09 1825	706	7	6	580
VEN 7	500	9/22/09 1430	9/22/09 1145	9/29/09 1840	707	7	1	539
VEN 8	500	9/22/09 1430	9/22/09 1310	9/29/09 1900	708	7	6	525
VEN 9	500	9/22/09 1430	9/22/09 1335	9/29/09 1940	709	7	5	559
<del>VEN 10</del>	<del>500</del>	<del>9/22/09 1430</del>	<del>9/22/09 1400</del>	<del>9/29/09 2000</del>	<del>710</del>	<del>7</del>	<del>4</del>	<del>322</del>
VEN 11	500	9/22/09 1430	9/22/09 1420	9/29/09 2020	711	7	7	537
VEN 12	500	9/22/09 1430	9/22/09 1440	9/29/09 2110	712	7	3	552

419  
9/30/09

419  
9/30/09

419  
9/30/09

\* COUNT 15 min

Ra-226 Verification Sheet

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
VER 16	500	9/22/09 1430	9/30/09 600	9/30/09 0920	701	7	3	636
VER 17	500	9/22/09 1430	9/30/09 630	9/30/09 0950	710	7	8	694

JAG 9/30/09

JAG 9/30/09

## General Engineering Laboratories Verification Source Preparation Sheet

Applicable SOP Number GL RAD-A-008 Isotope RA 226  
 Date Standards Prepared 7/23/09 Cocktail Type Used NA  
 Standard ID DL2814 Matrix of Vial/Planchett NA  
 Amount Used (g or ml) 0.1 Type of Scintillation Vial NA  
 Standard Activity (DPM/g or mL) 268.8845 Pipette ID Used 1429303  
 Reference Date 11/23/04 Balance ID Used 38080204  
 Expiration Date 7/17/10 Quenching Agent NA  
 Residue/Carrier Agent NA

	Standard Number	Quenching Vol (uL) Residue Volume (mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
1	VX 1				
2	VX 2				
3	VX 3				
4	VX 4				
5	VX 5				
6	VX 6				
7	VX 7				
8	VX 8				
9	VX 9				
10	VX 10				
11	VX 11				
12	VX 12				
13	VX 16				
14	VX 17				

*NO 7/23/09*

*9/30/09*

Prepared By: Kelli & Denise Date: 9/30/09  
 Reviewed By: Aggie A. G. Date: 9/30/09

Rev 1 RLM 9/10/97

**ANALYTICS**

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

0638

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

**CERTIFICATE OF CALIBRATION**  
**Standard Radionuclide Source**

67519-278

Ra-226 5 mL Liquid in Flame Sealed Vial

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

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

Analytics maintains traceability to the National Institute of Standards and Technology through participation in a Measurements Assurance Program as described in USNRC Reg. Guide 4.15, Revision 1, February 1979.

ISOTOPE:	Ra-226
ACTIVITY (dps):	2.353 E4
HALF-LIFE:	1.600 E3 years
CALIBRATION DATE:	January 23, 2004 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	3.3%

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%

5.01065 grams 0.1M HCl solution with 50  $\mu$ g/g Ba carrier.

P O NUMBER 3231RD, Item 5

SOURCE PREPARED BY:

M. D. Currie  
M. D. Currie, Radiochemist

Q A APPROVED:

MCW 1/26/04

## Standard Traceability Log Rad

**WARNING! Training must be completed!!**  
**Alphalims will be locked out if training is not completed within 1 week of assignment Contact**  
**Quality if additional time is needed to complete training**

Source Material Info		A Solution Material Info	
Parent Code:	0638	Isotope:	Radium-226
Prepared By:	Amanda Fehr	Prepared By:	Amanda Fehr
Carrier Conc:	0.1M HCl	Prep Date:	01/16/2006
Reference Date:	01/23/2004	Verification Date:	04/09/2009
Ampoule Mass (g):	5.01065 g	Expiration Date:	04/09/2010
Uncertainty:	+/- 3.3 %	Primary Code:	0638-A
LogBook No:	RC-S-037-037	Dilution(mL):	100 mL
		Mass of Parent(g):	4.8398 g
		Density(g/mL):	1.0266
		Balance ID:	38080204

### Calculations Converting parent activity to dpm/mL/dpm/g

$$(\text{Mass of parent(g)} * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$$

$$(\text{Mass of parent(g)} * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$$

$$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) / (5.01065 \text{ g} * 100 \text{ mL}) = 13636.6133 \text{ dpm/mL}$$

$$(4.8398 \text{ g}) * (23530 \text{ dps}) * (60 \text{ dpm/dps}) / (1.0266 \text{ g/mL}) / (5.01065 \text{ g} * 100 \text{ mL}) = 13282.9676 \text{ dpm/g}$$

Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
01/17/2006	Amanda Fehr	2.1041	100	0638-B	279.0211 dpm/mL	01/17/2007	01/17/2008
07/17/2006	Mary Aders	2.1313	100	0638-C	282.6281 dpm/mL	07/26/2006	07/26/2007
03/28/2007	Daniel Roy	2.1025	100	0638-D	279.2744 dpm/ml	04/08/2007	04/08/2008
03/28/2007	Daniel Roy	45.468	250	0638-E	2415.7999 dpm/ml	04/09/2009	04/09/2010
12/18/2007	Daniel Roy	2.014	100	0638-F	267.519 dpm/ml	02/02/2009	02/02/2010
02/12/2008	Daniel Roy	.5004	100	0638-G	66.468 dpm/ml	03/02/2009	03/02/2010
07/23/2008	Daniel Roy	5.0607	250	0638-H	268.8845 dpm/ml	07/17/2009	07/17/2010

GEL Laboratories LLC  
Version 1.0 9/18/2000

VM 6/26/06

## Verification for Ra-226 Standard 0638-H

M. Aders 7/17/2009	<b>Isotope</b> 0638-H 0638-H 0638-H	<b>Value</b> 12.025 10.739 12.348	<b>Uncertainty</b> 1.2237 1.1752 1.2298
<b>Mean Value (Counting) =</b>	11.704	96.86	<b>Pass</b>
<b>Stdev =</b>	0.85081728		<b>Rule 3 (Pass/Fail)</b>
<b>Target =</b>	12.08		
<b>Lower Limit =</b>	10.00223211		
<b>Upper Limit =</b>	13.40550123		
<b>Rule 1 Pass/Fail</b>	<b>Pass</b>		
<b>Two sigma =</b>	1.701634559		
<b>10 % of Mean =</b>	1.170386667		
<b>Rule 2 (Pass/Fail)</b>	<b>Fail</b>		<b>*Exception taken due to full recovery of standard</b>

**Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements**

**Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.**

**Rule 3 = The determined mean value shall be within 5% of the certificate value.**

The analyst prepared three standard verification sources for Ra-226 source 0638-H by transferring portions of the degassed standard into tared glass liquid scintillation vials. 10 mL of DI Water and 10 mL of mineral oil were added to each vial and the vials were shaken. A Blank vial was prepared in a similar fashion using 10 mL of DI Water and 10 mL of mineral oil. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Green using source standard verification. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

Reference RAD SOP M-001

*Angela D. H. 7/30/09*  
*Henry J. Adams 7/20/09*  
*Manan Mehta 7/15/09*



# Radon-222 Liquid

Filename : RN222.XLS  
 File type : Excel  
 Version # : 1.2.4

Spike S/N : N/A  
 Spike Exp Date : N/A  
 Spike Activity (dpm/ml) : N/A  
 Spike Volume Added : N/A  
 Spike Date/Time : 7/17/2009 15:00

LCS S/N : 0638-H  
 LCS Exp Date : 7/23/2009  
 LCS Activity (dpm/ml) : 268.25  
 LCS Volume Added : 0.10

Batch : 886194  
 Analyst : MLA  
 Prep Date : 7/17/2009

Procedure Code : LSC99TCL  
 Parmname : Radon-222  
 Required MDA : 50 pCi/L  
 Half-life of Radon-222 : 3.823 days

Rn-222 Abundance : 1  
 Rn-222 Method Uncertainty : 0.0556  
 Geometry : 10ML MINERAL OIL/10ML  
 SAMPLE

Pipet, 0.1 ml Stdev. +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev. +/- 0.002564 ml

Sample Characteristics			Count raw Data				Background		Sample Decay	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Rack Position #	Counting Time (min.)	Quench#	Gross cpm	Count Time (min.)	Count Start Date/Time	Sample Decay
1	1201883284.1	1.0000	2.0399E-05	22-2	15	50.3	43.73	15	7/20/2009 11:53	0.594
2	1201883285.1	1.0000	2.0399E-05	22-3	15	50	38.2	15	7/20/2009 12:09	0.592
3	1201883286.1	1.0000	2.0399E-05	22-4	15	49.1	45.4	15	7/20/2009 12:26	0.591

Calibration Data				Correction Factors				Net Sample Activity for MS pCi/L		
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Rack Position #	Backgrounds Count Start Date/Time	Spike Date/Time	Rn-222 Ingrowth	Rn-222 Count Correction
1	LSCGREEN	3/25/2009	3/31/2010	3.4365	0.00792	22-1	7/20/2009 11:36	7/17/2009 15:00	0.406	0.406
2	LSCGREEN	3/25/2009	3/31/2010	3.4365	0.00792	22-1	7/20/2009 11:36	7/17/2009 15:00	0.408	0.408
3	LSCGREEN	3/25/2009	3/31/2010	3.4365	0.00792	22-1	7/20/2009 11:36	7/17/2009 15:00	0.409	0.409

- Notes:  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error pCi/L	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA		Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
									Counting Uncertainty pCi/L	Total Prop. Uncertainty pCi/L						
1	0.8104	0.5722	50	1.2114	12.0246	0.0525	35.8600	1.8619	1.2237	1.8026		LCS			12.0832	99.5%
2	0.8078	0.5703	50	1.2075	10.7393	0.0564	32.1300	1.7939	1.1752	1.6669		LCS			12.0832	88.9%
3	0.8053	0.5685	50	1.2037	12.3477	0.0514	37.0600	1.8833	1.2298	1.8330		LCS			12.0832	102.2%

# Radon 222 Que Sheet

07/17/2009

Batch #: 886194      Analyst: MLA      First Client Due Date: \_\_\_\_\_      Internal Due Date: 07/22/2009  
 Spike Isotope: Radium-226      Spike Code: 703285-1      Expiration Date: 7/23/09      Vol: 0.1 mL  
 LCS Isotope: Radium-226      LCS Code: \_\_\_\_\_      Expiration Date: \_\_\_\_\_      Vol: \_\_\_\_\_  
 Prep Date: 7/17/09      Pipet ID: 2977055      Initials: MLA      Witness: \_\_\_\_\_

Comments

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Label	Wet/Dry Sample Mass (g/mL)	LSC Rack #	Time Spike Added
1201883284-1	LCS for batch 886194	LCS	50	pCi/L	WATER	QC ACCOUNT	15-JUL-09 10:45 AM	1		22-2	
1201883285-1	LCS for batch 886194	LCS	50	pCi/L	WATER	QC ACCOUNT	15-JUL-09 10:45 AM	2		22-3	
1201883286-1	LCS for batch 886194	LCS	50	pCi/L	WATER	QC ACCOUNT	15-JUL-09 10:45 AM	3		22-4	

Bkg Rack #: 22-1

Comments: \_\_\_\_\_  
 Data Reviewed By: \_\_\_\_\_

Instrument Used: LS6000 (Red) 7065155, LS6500 (Black) 7069123, LS6500 (Blue) 7067083, LS6500 (Green) 7067404  
 Wallac (Yellow) 4040127, Wallac (Pink) 2200082, Purple 7069123, Silver 7060656

GEL Laboratories LLC, Radiochemistry Division

ID: RIV-222

20 JUL 2009 11:46

USER: LA COMMENT: GREEN

PREP TIME : 15.00  
 DATA CALC : CPM H# : YES SAMPLE REPEATS: 1 PRINTER : EDIT  
 COUNT BLANK : NO ID# : NO REPLICATES : 1 RS232 : EDIT  
 T&D PHASE : NO ADC : NO CYCLE REPEATS : 1 DISK : OFF  
 SCINTILLATOR: LIQUID LUMEX: YES LOW SAMPLE REJ: 0 RWM LIST : OFF  
 LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

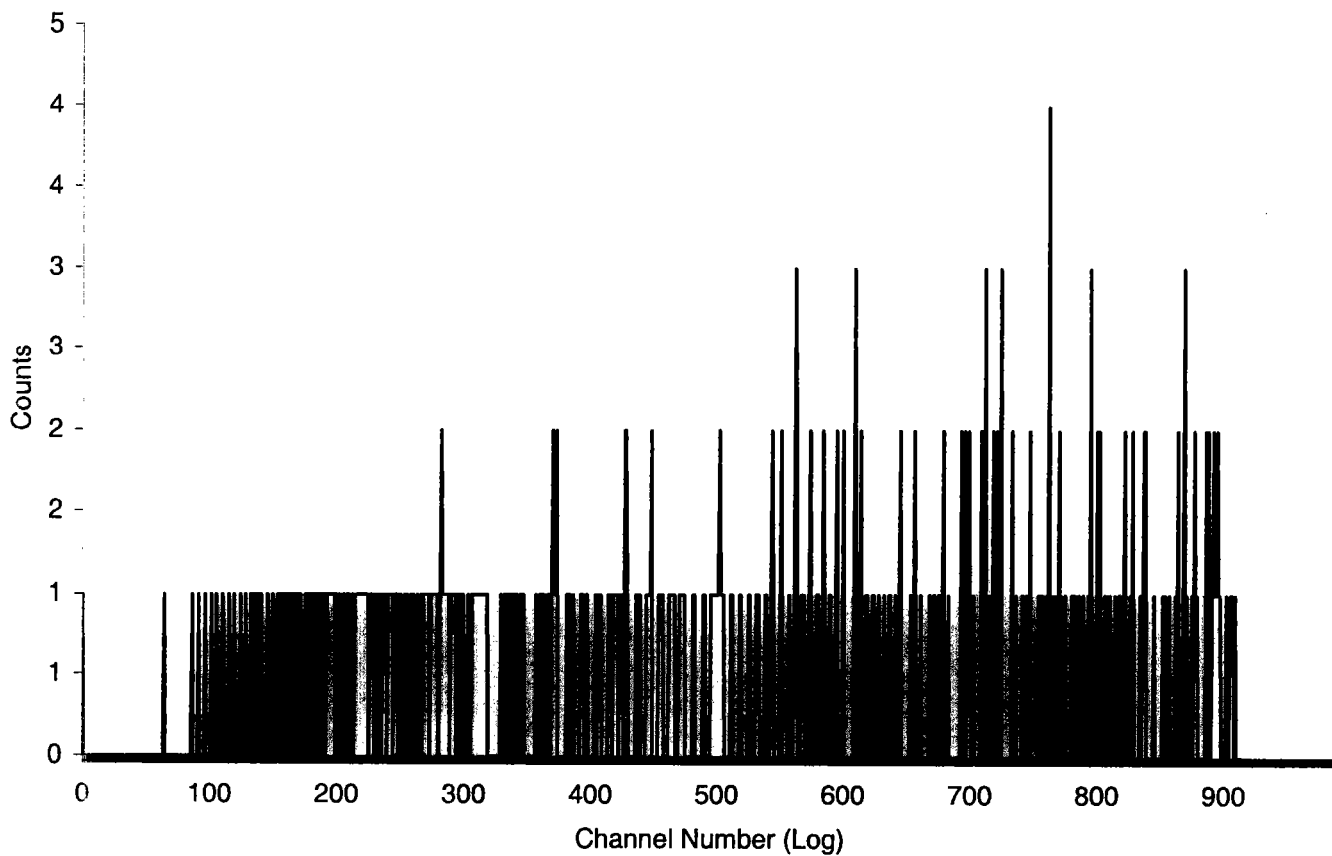
CHAN: 600.0 - 875.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0  
 CHAN: 300.0 - 900.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	20-1	15.00	47.9	8.20	18.03	19.13	11.81	0.38	15.92
2	20-2	15.00	50.3	43.73	7.81	60.67	6.63	0.16	32.28
3	20-3	15.00	50.0	38.20	8.36	52.27	7.14	0.17	48.64
4	20-4	15.00	49.1	45.40	7.66	62.93	6.51	0.15	65.03

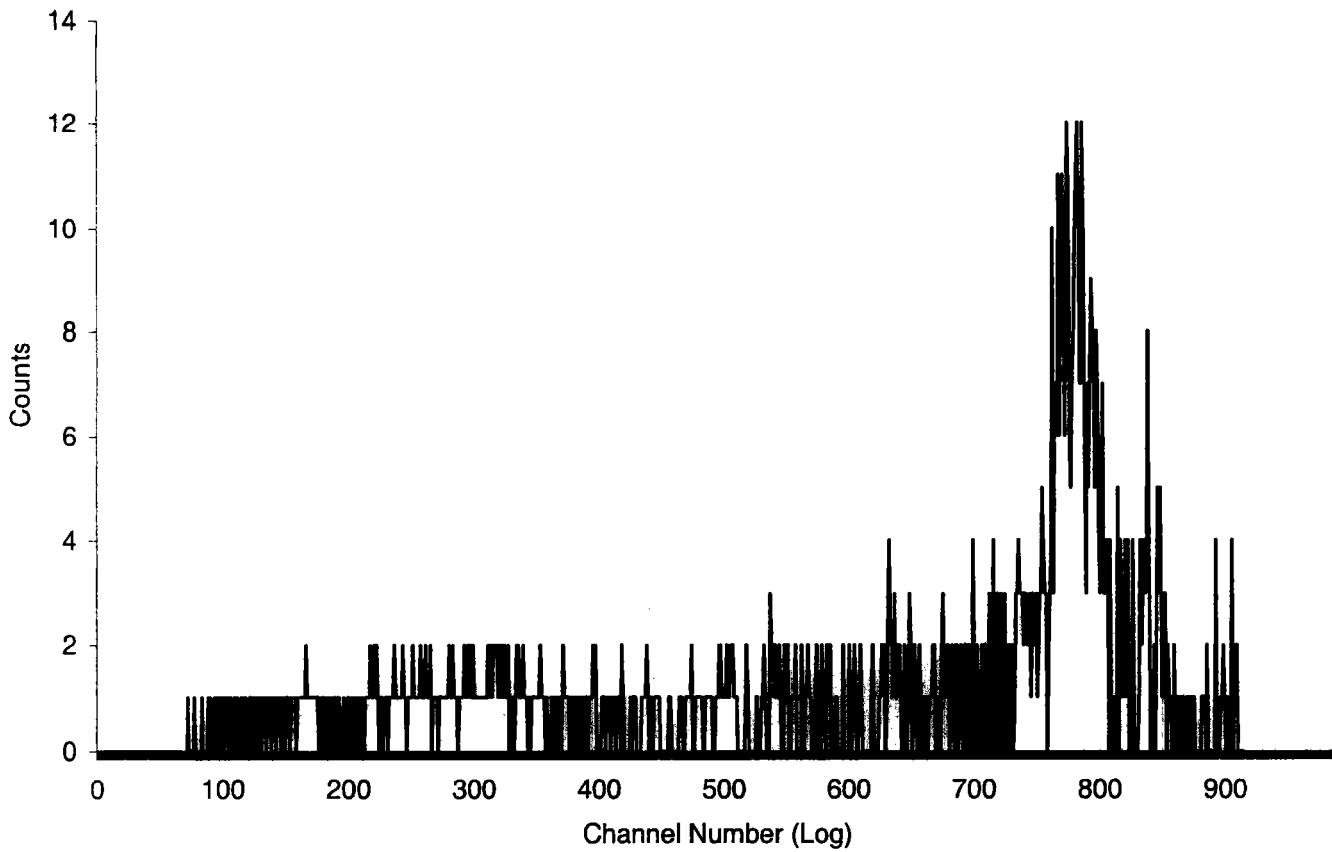
Sample Count Start Time:	20 Jul 2009 11:36:58		
Data Capture Date	20 Jul 2009 11:52:21		
User Filename	S16072022-1B.XLS		
	U16072022-1B.XLS		
Spectrum Type	Log Counts		
User Number	16		
User Id	RN-222		
User Comment	GREEN		
Isotope Name	14C		
Scintillator	LIQUID		
Sample, Rack-Pos, Time:	1	22-1	15.00
H#, Total Counts:	47.9	412	
Start, End, X-Axis:	0	990	Channel Number

SPECTRUM PLOT  
USER 16 - RN-222



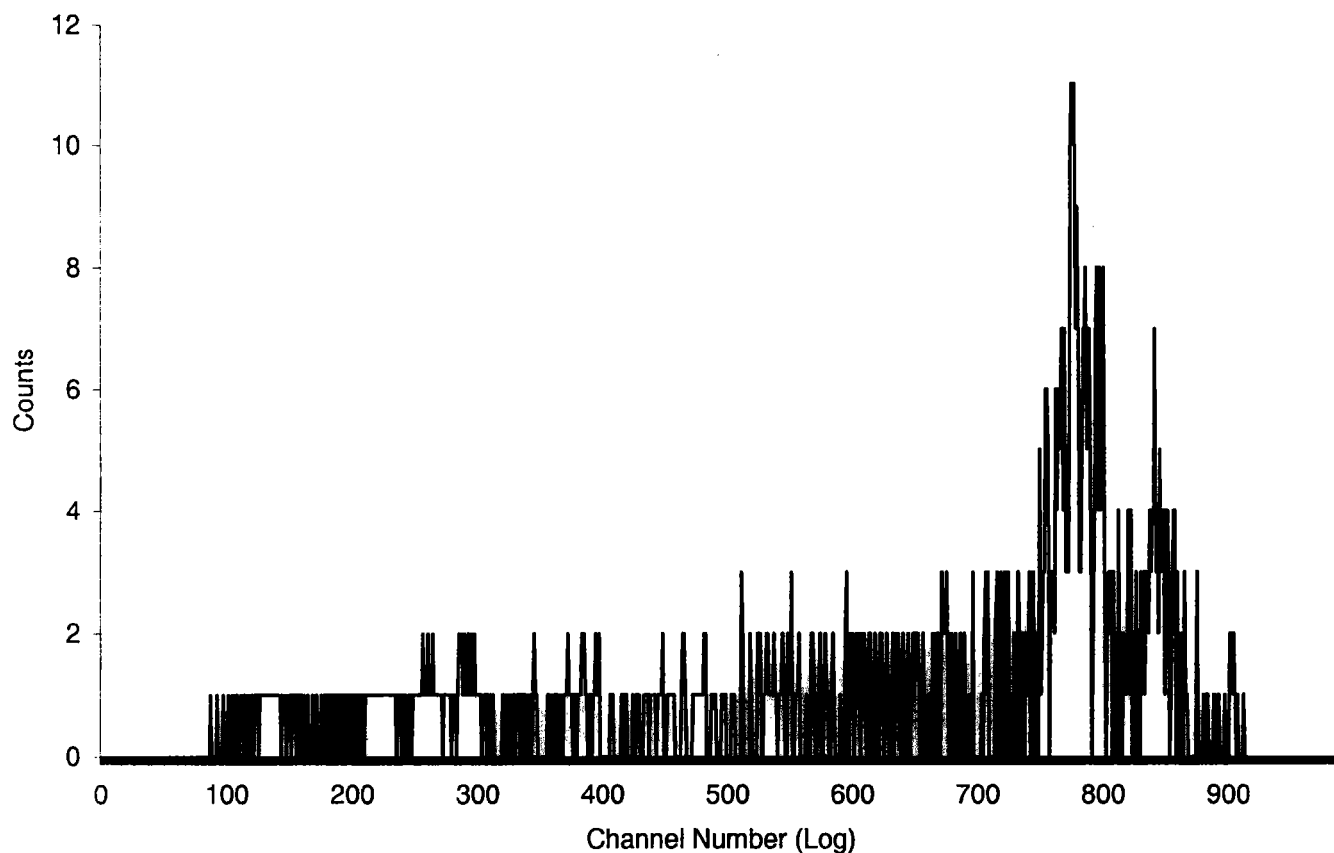
Sample Count Start Time: 20 Jul 2009 11:53:20  
Data Capture Date: 20 Jul 2009 12:08:43  
User Filename: S16072022-2B.XLS  
U16072022-1B.XLS  
Spectrum Type: Log Counts  
User Number: 16  
User Id: RN-222  
User Comment: GREEN  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 2 22-2 15.00  
H#, Total Counts: 50.3 1100  
Start, End, X-Axis: 0 990 Channel Number

SPECTRUM PLOT  
USER 16 - RN-222



Sample Count Start Time: 20 Jul 2009 12:09:43  
Data Capture Date: 20 Jul 2009 12:25:05  
User Filename: S16072022-3B.XLS  
U16072022-1B.XLS  
Spectrum Type: Log Counts  
User Number: 16  
User Id: RN-222  
User Comment: GREEN  
Isotope Name:  $^{14}\text{C}$   
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 3 22-3 15.00  
H#, Total Counts: 50.0 956  
Start, End, X-Axis: 0 990 Channel Number

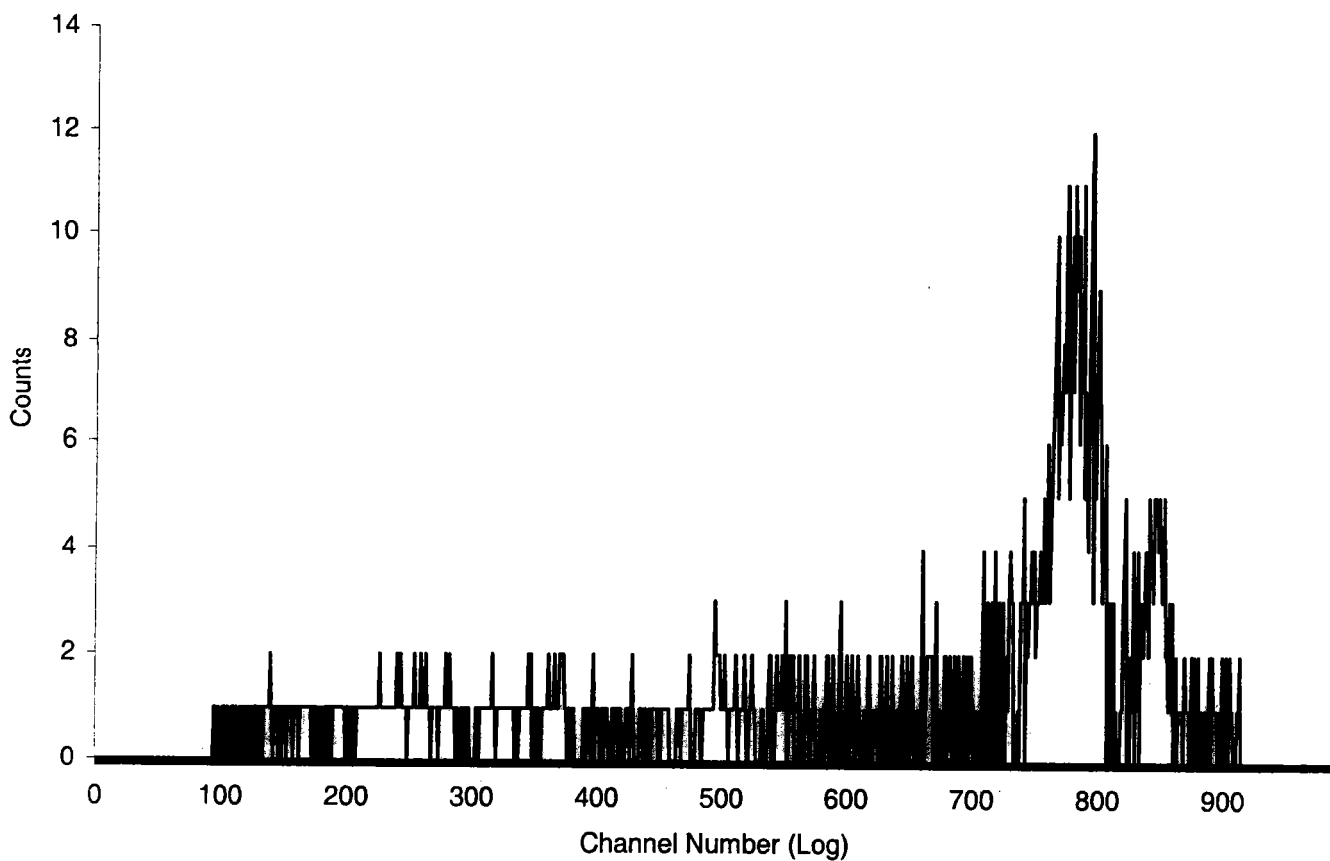
SPECTRUM PLOT  
USER 16 - RN-222





Sample Count Start Time: 20 Jul 2009 12:26:05  
Data Capture Date: 20 Jul 2009 12:41:28  
User Filename: S16072022-4B.XLS  
U16072022-1B.XLS  
Spectrum Type: Log Counts  
User Number: 16  
User Id: RN-222  
User Comment: GREEN  
Isotope Name:  $^{14}\text{C}$   
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 4 22-4 15.00  
H#, Total Counts: 49.1 1123  
Start, End, X-Axis: 0 990 Channel Number

SPECTRUM PLOT  
USER 16 - RN-222



# **GAS FLOW PROPORTIONAL COUNTERS**

# General Engineering Laboratories

2040 Savage Road, Charleston, SC 29414  
(843)556-8171

## Gas Flow Proportional Counter Calibration Package

Method: Ra-228 (LB4100)

	YES	NO	Comments
1) Is all calibration standard information enclosed for: primary standard certificate? secondary standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
2) Are the detector graphs included? beta absorption curves? beta plateau?		<input checked="" type="checkbox"/>	Average Efficiency
	<input checked="" type="checkbox"/>		
3) Is the raw count data included for: the plateau generation? the absorption curve generation? the calibration verification? the crosstalk calculations?	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
4) Are the calibration verification calculations included? are verification recoveries 100% +/- 25%	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
5) Is the method Carrier Standardization included?			n/m

Prepared By: 

Date: 7/2/09

Reviewed By: 

Date: 7/2/09

Effective Date: 7/2/09



E3	4	7/1/09 10:45	7/1/2009 23:35	0.2347	1.5	6363.2	9544.8	10524	10	1052.4	4483.747849	0.4698	0.4899
E4	1	7/1/09 10:45	7/1/2009 23:35	0.2347	1.5	6363.2	9544.8	12442	10	1244.2	5301.077419	0.5554	
E4	2	7/1/09 10:45	7/1/2009 23:06	0.2482	1.5	6363.2	9544.8	11506	8.5	1353.6	5453.675627	0.5714	
E4	3	7/1/09 10:45	7/1/2009 22:56	0.2528	1.5	6363.2	9544.8	11279	8.5	1326.9	5248.651009	0.5499	Average EFF
E4	4	7/1/09 10:45	7/1/2009 22:47	0.2573	1.5	6363.2	9544.8	11203	8.5	1318.0	5122.606728	0.5367	0.5533

\*Background is considered negligible

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine
1	1 A1	7	86	14312	7/1/2009 19:45	7/1/2009 19:52	LB4100
2	2 A1	7	80	13406	7/1/2009 20:23	7/1/2009 20:30	LB4100
3	3 A1	7	53	13510	7/1/2009 20:14	7/1/2009 20:21	LB4100
4	4 A1	7	87	13173	7/1/2009 20:06	7/1/2009 20:13	LB4100
1	1 A2	7	91	13044	7/1/2009 20:06	7/1/2009 20:13	LB4100
2	2 A2	7	78	13149	7/1/2009 19:45	7/1/2009 19:52	LB4100
3	3 A2	7	75	12665	7/1/2009 20:23	7/1/2009 20:30	LB4100
4	4 A2	7	107	12143	7/1/2009 20:14	7/1/2009 20:21	LB4100
1	1 A3	7	89	13110	7/1/2009 20:14	7/1/2009 20:21	LB4100
2	2 A3	7	80	12992	7/1/2009 20:06	7/1/2009 20:13	LB4100
3	3 A3	7	82	13187	7/1/2009 19:45	7/1/2009 19:52	LB4100
4	4 A3	7	99	12227	7/1/2009 20:23	7/1/2009 20:30	LB4100
1	1 A4	7	0	0	7/1/2009 20:23	7/1/2009 20:30	LB4100
2	2 A4	7	0	0	7/1/2009 20:14	7/1/2009 20:21	LB4100
3	3 A4	7	0	1	7/1/2009 20:06	7/1/2009 20:13	LB4100
4	4 A4	7	0	1	7/1/2009 19:45	7/1/2009 19:52	LB4100
1	1 B1	7	74	11346	7/1/2009 20:31	7/1/2009 20:38	LB4100
2	2 B1	7.5	97	11955	7/1/2009 20:59	7/1/2009 21:06	LB4100
3	3 B1	7.5	97	12374	7/1/2009 20:50	7/1/2009 20:57	LB4100
4	4 B1	7.5	142	11749	7/1/2009 20:39	7/1/2009 20:47	LB4100
1	1 B2	7.5	90	11855	7/1/2009 20:39	7/1/2009 20:47	LB4100
2	2 B2	7	104	11193	7/1/2009 20:31	7/1/2009 20:38	LB4100
3	3 B2	7.5	72	11275	7/1/2009 20:59	7/1/2009 21:06	LB4100
4	4 B2	7.5	152	11535	7/1/2009 20:50	7/1/2009 20:57	LB4100
1	1 B3	7.5	121	11857	7/1/2009 20:50	7/1/2009 20:57	LB4100
2	2 B3	7.5	94	11336	7/1/2009 20:39	7/1/2009 20:47	LB4100
3	3 B3	7	105	10797	7/1/2009 20:31	7/1/2009 20:38	LB4100
4	4 B3	7.5	150	10470	7/1/2009 20:59	7/1/2009 21:07	LB4100
1	1 B4	7.5	61	10999	7/1/2009 20:59	7/1/2009 21:07	LB4100
2	2 B4	7.5	101	11461	7/1/2009 20:50	7/1/2009 20:57	LB4100
3	3 B4	7.5	80	11008	7/1/2009 20:40	7/1/2009 20:47	LB4100
4	4 B4	7	100	9783	7/1/2009 20:31	7/1/2009 20:38	LB4100
1	1 C1	7.5	86	10578	7/1/2009 21:07	7/1/2009 21:15	LB4100
2	2 C1	8	78	10627	7/1/2009 21:35	7/1/2009 21:43	LB4100
3	3 C1	8	73	10782	7/1/2009 21:26	7/1/2009 21:34	LB4100
4	4 C1	7.5	144	10001	7/1/2009 21:16	7/1/2009 21:23	LB4100
1	1 C2	7.5	77	12199	7/1/2009 21:16	7/1/2009 21:23	LB4100
2	2 C2	7.5	72	12229	7/1/2009 21:07	7/1/2009 21:15	LB4100
3	3 C2	8	68	12414	7/1/2009 21:35	7/1/2009 21:43	LB4100
4	4 C2	8	98	11925	7/1/2009 21:26	7/1/2009 21:34	LB4100
1	1 C3	8	84	13141	7/1/2009 21:26	7/1/2009 21:34	LB4100
2	2 C3	7.5	82	12674	7/1/2009 21:16	7/1/2009 21:23	LB4100
3	3 C3	7.5	96	12199	7/1/2009 21:07	7/1/2009 21:15	LB4100
4	4 C3	8	110	12044	7/1/2009 21:35	7/1/2009 21:43	LB4100
1	1 C4	8	81	12658	7/1/2009 21:35	7/1/2009 21:43	LB4100
2	2 C4	8	101	13120	7/1/2009 21:26	7/1/2009 21:34	LB4100
3	3 C4	7.5	82	12240	7/1/2009 21:16	7/1/2009 21:23	LB4100
4	4 C4	7.5	125	11995	7/1/2009 21:07	7/1/2009 21:15	LB4100
1	1 D1	8	122	13008	7/1/2009 21:46	7/1/2009 21:54	LB4100
2	2 D1	7	94	10674	7/1/2009 22:19	7/1/2009 22:26	LB4100
3	3 D1	7	80	10924	7/1/2009 22:09	7/1/2009 22:16	LB4100
4	4 D1	7	169	10636	7/1/2009 21:58	7/1/2009 22:05	LB4100

1	1 D2	7	87	12055	7/1/2009 21:58	7/1/2009 22:05	LB4100
2	2 D2	8	125	14016	7/1/2009 21:46	7/1/2009 21:54	LB4100
3	3 D2	7	91	11697	7/1/2009 22:19	7/1/2009 22:26	LB4100
4	4 D2	7	139	11472	7/1/2009 22:09	7/1/2009 22:16	LB4100
1	1 D3	7	77	12072	7/1/2009 22:09	7/1/2009 22:16	LB4100
2	2 D3	7	124	12274	7/1/2009 21:58	7/1/2009 22:05	LB4100
3	3 D3	8	111	13577	7/1/2009 21:46	7/1/2009 21:54	LB4100
4	4 D3	7	138	11077	7/1/2009 22:19	7/1/2009 22:26	LB4100
1	1 D4	7	103	11753	7/1/2009 22:19	7/1/2009 22:26	LB4100
2	2 D4	7	113	12148	7/1/2009 22:09	7/1/2009 22:16	LB4100
3	3 D4	7	96	12137	7/1/2009 21:58	7/1/2009 22:05	LB4100
4	4 D4	8	148	13588	7/1/2009 21:46	7/1/2009 21:54	LB4100
1	1 E1	8.5	101	11061	7/1/2009 22:47	7/1/2009 22:55	LB4100
2	2 E1	10	119	11891	7/1/2009 23:35	7/1/2009 23:45	LB4100
3	3 E1	8.5	86	10666	7/1/2009 23:06	7/1/2009 23:14	LB4100
4	4 E1	8.5	136	10435	7/1/2009 22:56	7/1/2009 23:04	LB4100
1	1 E2	8.5	106	11785	7/1/2009 22:56	7/1/2009 23:04	LB4100
2	2 E2	8.5	121	11972	7/1/2009 22:47	7/1/2009 22:55	LB4100
3	3 E2	10	100	12860	7/1/2009 23:35	7/1/2009 23:45	LB4100
4	4 E2	8.5	139	11188	7/1/2009 23:06	7/1/2009 23:14	LB4100
1	1 E3	8.5	127	10133	7/1/2009 23:06	7/1/2009 23:14	LB4100
2	2 E3	8.5	132	10161	7/1/2009 22:56	7/1/2009 23:04	LB4100
3	3 E3	8.5	109	10256	7/1/2009 22:47	7/1/2009 22:55	LB4100
4	4 E3	10	157	10524	7/1/2009 23:35	7/1/2009 23:45	LB4100
1	1 E4	10	129	12442	7/1/2009 23:35	7/1/2009 23:45	LB4100
2	2 E4	8.5	118	11506	7/1/2009 23:06	7/1/2009 23:14	LB4100
3	3 E4	8.5	98	11279	7/1/2009 22:56	7/1/2009 23:04	LB4100
4	4 E4	8.5	123	11203	7/1/2009 22:47	7/1/2009 22:55	LB4100

# Radium-228 Liquid

Filename : RA228.XLS  
 File type : Excel  
 Version # : 1.2.3

Spike S/N : N/A  
 Spike Exp Date : N/A  
 Spike Activity (dpm/ml): N/A  
 Spike Volume Added: N/A

Pipet, 0.1 ml Stdev : +/- 0.000701 ml  
 Pipet, 0.5 ml Stdev : +/- 0.002564 ml  
 Pipet, 1 ml Stdev : +/- 0.005480 ml

Batch : 595514  
 Analyst : DXM2  
 Prep Date : 6/30/2009

LCS S/N : 0503-B  
 LCS Exp Date : 9/13/2009  
 LCS Activity (dpm/ml): 182.48  
 LCS Volume Added: 2.00

Procedure Code : GFC90SRL  
 Parname : Radium-228

Ra-228 Abundance : 1  
 Ra-228 Method Uncertainty : 0.0784

Required MDA : 3 pCi/L  
 Halfife of Ra-228 : 5.75 years  
 Halfife of Ac-228 : 6.13 hours  
 Batch counted on : LB4100  
 BKG Count time : 500 min

Calibration Date : 6/1/2008  
 Calibration Due Date : 3/1/2009

Sample Characteristics				Tracer Calculations				Tracer Samp.			
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot L StDev.	Tracer Concentration (Ba-133 Ref.) (cpm)	Tracer Ref. Count Uncertainty (cpm)	Tracer Concentration (Ba-133 Samp.) (cpm)	Tracer Count Uncertainty (cpm)	Tracer Aliquot (mL)	Tracer Aliquot (mL)	Tracer StDev. (mL)	Tracer Aliquot StDev. (mL)
1	1201245712.1	1.0000	2.0399E-05	229.3	4.13%	231.2	4.11%	0.1	0.1	0.000701	0.000701
2	1201245713.1	1.0000	2.0399E-05	229.3	4.13%	248.1	3.95%	0.1	0.1	0.000701	0.000701
3	1201245714.1	1.0000	2.0399E-05	229.3	4.13%	261.9	3.83%	0.1	0.1	0.000701	0.000701
4	1201245715.1	1.0000	2.0399E-05	229.3	4.13%	276.5	3.71%	0.1	0.1	0.000701	0.000701
5	1201245716.1	1.0000	2.0399E-05	229.3	4.13%	242.7	4.00%	0.1	0.1	0.000701	0.000701
6	1201245717.1	1.0000	2.0399E-05	229.3	4.13%	235.5	4.07%	0.1	0.1	0.000701	0.000701
7	1201245718.1	1.0000	2.0399E-05	229.3	4.13%	258.7	3.85%	0.1	0.1	0.000701	0.000701
8	1201245719.1	1.0000	2.0399E-05	229.3	4.13%	256.6	3.87%	0.1	0.1	0.000701	0.000701
9	1201245720.1	1.0000	2.0399E-05	229.3	4.13%	231.2	4.13%	0.1	0.1	0.000701	0.000701
10	1201245721.1	1.0000	2.0399E-05	229.3	4.13%	248.1	4.13%	0.1	0.1	0.000701	0.000701
11	1201245722.1	1.0000	2.0399E-05	229.3	4.13%	261.9	4.11%	0.1	0.1	0.000701	0.000701
12	1201245723.1	1.0000	2.0399E-05	229.3	4.13%	276.5	4.11%	0.1	0.1	0.000701	0.000701
13	1201245724.1	1.0000	2.0399E-05	229.3	4.13%	242.7	4.11%	0.1	0.1	0.000701	0.000701
14	1201245725.1	1.0000	2.0399E-05	229.3	4.13%	235.5	4.11%	0.1	0.1	0.000701	0.000701
15	1201245726.1	1.0000	2.0399E-05	229.3	4.13%	258.7	4.11%	0.1	0.1	0.000701	0.000701
16	1201245727.1	1.0000	2.0399E-05	229.3	4.13%	256.6	4.11%	0.1	0.1	0.000701	0.000701
17	1201245728.1	1.0000	2.0399E-05	229.3	4.13%	231.2	4.11%	0.1	0.1	0.000701	0.000701
18	1201245729.1	1.0000	2.0399E-05	229.3	4.13%	248.1	4.11%	0.1	0.1	0.000701	0.000701
19	1201245730.1	1.0000	2.0399E-05	229.3	4.13%	261.9	4.11%	0.1	0.1	0.000701	0.000701
20	1201245731.1	1.0000	2.0399E-05	229.3	4.13%	276.5	4.11%	0.1	0.1	0.000701	0.000701



Count raw Data		Counting		Gross Counts		Beta	Detector	Weekly Bkg		Count		Ra-228	Ac-228	Ac-228	Count	Calculated	Sample
Pos.	ID	Detector	Time (min.)	Alpha	Beta	cpm	Efficiency (cpm/dpm)	Efficiency Error (cpm/dpm)	cpm	Time (min.)	Separation Date/Time	Start Date/Time	Decay	Decay	Correction	Sample Recovery %	Recovery Error %
1	A1		15	6	1459	97.267	0.5861	0.01870	1.140	500	7/2/2009 5:40	7/2/2009 10:39	0.999	0.569	1.014	100.83%	3.08%
2	A2		15	17	1307	87.133	0.5495	0.01949	1.114	500	7/2/2009 5:40	7/2/2009 10:39	0.999	0.569	1.014	108.20%	3.02%
3	A3		15	15	1527	101.800	0.5551	0.02780	2.590	500	7/2/2009 5:40	7/2/2009 10:39	0.999	0.569	1.014	114.22%	2.99%
4	A4		15	0	16	1.067	0.0000	0.01530	42.454	500	7/2/2009 5:40	7/2/2009 10:39	0.999	0.569	1.014	120.58%	2.95%
5	B1		15	7	1097	73.133	0.5207	0.01808	1.336	500	7/2/2009 5:40	7/2/2009 11:54	0.999	0.494	1.014	105.84%	3.04%
6	B2		15	18	1335	89.000	0.5034	0.01942	2.462	500	7/2/2009 5:40	7/2/2009 10:39	0.999	0.569	1.014	102.70%	3.06%
7	B3		15	20	1329	88.600	0.4880	0.01849	1.260	500	7/2/2009 5:40	7/2/2009 10:39	0.999	0.569	1.014	112.82%	2.99%
8	B4		15	9	1187	79.133	0.4746	0.02075	1.002	500	7/2/2009 5:40	7/2/2009 10:39	0.999	0.569	1.014	111.91%	3.00%
9	C1		15	12	1185	79.000	0.4698	0.01902	1.310	500	7/2/2009 5:40	7/2/2009 10:57	0.999	0.550	1.014	100.83%	3.08%
10	C2		15	14	1345	89.667	0.5459	0.01220	16.594	500	7/2/2009 5:40	7/2/2009 11:53	0.999	0.495	1.014	108.20%	3.08%
11	C3		15	10	1504	100.267	0.5602	0.02111	1.088	500	7/2/2009 5:40	7/2/2009 10:57	0.999	0.550	1.014	114.22%	3.08%
12	C4		15	8	1616	107.733	0.5595	0.02048	2.848	500	7/2/2009 5:40	7/2/2009 10:57	0.999	0.550	1.014	120.58%	3.08%
13	D1		15	12	1482	98.800	0.5842	0.01320	1.034	500	7/2/2009 5:40	7/2/2009 11:02	0.999	0.545	1.014	105.84%	3.08%
14	D2		15	11	1609	107.267	0.6361	0.03039	1.404	500	7/2/2009 5:40	7/2/2009 11:02	0.999	0.545	1.014	102.70%	3.08%
15	D3		15	9	1689	112.600	0.6336	0.07231	0.950	500	7/2/2009 5:40	7/2/2009 11:02	0.999	0.545	1.014	112.82%	3.08%
16	D4		15	26	1662	110.800	0.6422	0.05596	2.518	500	7/2/2009 5:40	7/2/2009 11:02	0.999	0.545	1.014	111.91%	3.08%
17	E1		15	16	1210	80.667	0.5248	0.02284	1.590	500	7/2/2009 5:40	7/2/2009 11:18	0.999	0.529	1.014	100.83%	3.08%
18	E2		15	19	1768	117.867	0.5694	0.02185	1.000	500	7/2/2009 5:40	7/2/2009 11:18	0.999	0.529	1.014	108.20%	3.08%
19	E3		15	14	1169	77.933	0.4899	0.05054	2.006	500	7/2/2009 5:40	7/2/2009 11:18	0.999	0.529	1.014	114.22%	3.08%
20	E4		15	14	1547	103.133	0.5533	0.04966	0.914	500	7/2/2009 5:40	7/2/2009 11:18	0.999	0.529	1.014	120.58%	3.08%

- Notes:  
 1 - Results are decay corrected to Sample Date/Time  
 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date  
 3 - Spike Nominals are decay corrected to Sample Date/Time

\* indicates results calculated at 100% recovery

Pos.	Decision Level	Critical Level	Required MDA	MDA	Sample Act. Conc.	Sample Act. Error	Net Count Rate	Net Count Rate Error	2 SIGMA		Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
									Counting Uncertainty	Total Prop. Uncertainty						
	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	CPM	CPM	pCi/L	pCi/L						
1	* 0.8939	0.6311	3	1.5364	131.8069	0.0447	96.1267	2.5469	6.8448	23.3157		LCS			164.3951	80.2%
2	* 0.9424	0.6654	3	1.6232	125.7965	0.0456	86.0193	2.4106	6.9097	22.3632		LCS			164.3951	76.5%
3	* 1.4227	1.0045	3	2.2985	143.6471	0.0485	99.2100	2.6061	7.3959	25.9585		LCS			164.3951	87.4%
4	* #####	#####	3	#####	-1576311.1110	0.0346	-41.3873	0.3950	29486.2445	29489.2890		LCS			164.3951	#####
5	* 1.2556	0.8865	3	2.1288	127.7429	0.0469	71.7973	2.2087	7.7022	22.8713		LCS			164.3951	77.7%
6	* 1.5294	1.0798	3	2.4788	138.1498	0.0459	86.5380	2.4369	7.6248	24.6025		LCS			164.3951	84.0%
7	* 1.1287	0.7968	3	1.9230	143.8337	0.0449	87.3400	2.4309	7.8463	25.4633		LCS			164.3951	87.5%
8	* 1.0349	0.7306	3	1.8000	132.3002	0.0468	78.1313	2.2973	7.6244	23.6819		LCS			164.3951	80.5%
9	* 1.2369	0.8732	3	2.1004	137.5054	0.0468	77.6900	2.2955	7.9632	24.6016		LCS			164.3951	83.6%
10	* 4.2094	2.9719	3	6.2823	123.6725	0.0472	73.0727	2.4517	8.1329	22.1796		LCS			164.3951	75.2%
11	* 0.9453	0.6674	3	1.6316	147.2054	0.0455	99.1787	2.5859	7.5225	26.1588		LCS			164.3951	89.5%
12	* 1.5312	1.0810	3	2.4593	155.8638	0.0449	104.8853	2.6810	7.8089	27.6066		LCS			164.3951	94.8%
13	* 0.8917	0.6296	3	1.5464	140.4184	0.0426	97.7660	2.5669	7.2259	24.5506		LCS			164.3951	85.4%
14	* 0.9544	0.6738	3	1.6115	139.6581	0.0501	105.8627	2.6747	6.9159	25.4660		LCS			164.3951	85.0%
15	* 0.7882	0.5565	3	1.3779	147.8798	0.0823	111.6500	2.7402	7.1135	32.9508		LCS			164.3951	90.0%
16	* 1.2659	0.8937	3	2.0488	141.4812	0.0686	108.2820	2.7188	6.9626	28.8924		LCS			164.3951	86.1%
17	* 1.2685	0.8955	3	2.1206	130.2858	0.0483	79.0767	2.3197	7.4909	23.5097		LCS			164.3951	79.3%
18	* 0.9270	0.6545	3	1.6127	177.4443	0.0447	116.8667	2.8035	8.3432	31.3906		LCS			164.3951	107.9%
19	* 1.5261	1.0774	3	2.5078	133.9943	0.0664	75.9273	2.2803	7.8873	26.9746		LCS			164.3951	81.5%
20	* 0.9121	0.6439	3	1.6004	159.7213	0.0638	102.2193	2.6225	8.0315	31.6443		LCS			164.3951	97.2%

\* Detector AH will not be used during this calibration cycle. gl 7/2/09

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Total Counts	Count Start Time	Count End Time	Machine
1	A1	15	6	1459		7/2/2009 10:39	7/2/2009 10:54	LB4100
2	A2	15	17	1307		7/2/2009 10:39	7/2/2009 10:54	LB4100
3	A3	15	15	1527		7/2/2009 10:39	7/2/2009 10:54	LB4100
4	A4	15	0	16		7/2/2009 10:39	7/2/2009 10:54	LB4100
1	B1	15	7	1097		7/2/2009 11:54	7/2/2009 12:09	LB4100
6	B2	15	18	1335		7/2/2009 10:39	7/2/2009 10:54	LB4100
7	B3	15	20	1329		7/2/2009 10:39	7/2/2009 10:54	LB4100
8	B4	15	9	1187		7/2/2009 10:39	7/2/2009 10:54	LB4100
1	C1	15	12	1185		7/2/2009 10:57	7/2/2009 11:12	LB4100
2	C2	15	14	1345		7/2/2009 11:53	7/2/2009 12:08	LB4100
3	C3	15	10	1504		7/2/2009 10:57	7/2/2009 11:12	LB4100
4	C4	15	8	1616		7/2/2009 10:57	7/2/2009 11:12	LB4100
5	D1	15	12	1482		7/2/2009 11:02	7/2/2009 11:17	LB4100
6	D2	15	11	1609		7/2/2009 11:02	7/2/2009 11:17	LB4100
7	D3	15	9	1689		7/2/2009 11:02	7/2/2009 11:17	LB4100
8	D4	15	26	1662		7/2/2009 11:02	7/2/2009 11:17	LB4100
1	E1	15	16	1210		7/2/2009 11:18	7/2/2009 11:33	LB4100
2	E2	15	19	1768		7/2/2009 11:18	7/2/2009 11:33	LB4100
3	E3	15	14	1169		7/2/2009 11:18	7/2/2009 11:33	LB4100
4	E4	15	14	1547		7/2/2009 11:18	7/2/2009 11:33	LB4100

Ra-228 LB4100	Cal Date A0	7/2/2009 A1	Exp Date A2	7/31/2009 A3	A4
A1	5.86074E-01				
A2	5.49508E-01				
A3	5.55050E-01				
A4	2.11015E-05				
B1	5.20673E-01				
B2	5.03404E-01				
B3	4.87992E-01				
B4	4.74627E-01				
C1	4.69765E-01				
C2	5.45903E-01				
C3	5.60200E-01				
C4	5.59541E-01				
D1	5.84229E-01				
D2	6.36056E-01				
D3	6.33552E-01				
D4	6.42229E-01				
E1	5.24757E-01				
E2	5.69423E-01				
E3	4.89913E-01				
E4	5.53338E-01				
F1					
F2					
F3					
F4					
G1					
G2					
G3					
G4					
H1					
H2					
H3					
H4					

**Plateau Raw Data**

Detector #	Sample I.D.	Pgm time (min)	Total (counts)	Voltage	%slope/100V	Date/Time
A1	Sr-90'	0.11	1	750	1.2	7/1/2009 15:09
A1	Sr-90'	0.12	1	780	2.2	7/1/2009 15:09
A1	Sr-90'	0.5	71	810	3.6	7/1/2009 15:10
A1	Sr-90'	0.5	197	840	6.3	7/1/2009 15:11
A1	Sr-90'	0.5	436	870	9.1	7/1/2009 15:11
A1	Sr-90'	0.5	768	900	11.7	7/1/2009 15:12
A1	Sr-90'	0.5	1146	930	14.3	7/1/2009 15:12
A1	Sr-90'	0.5	1601	960	17.2	7/1/2009 15:13
A1	Sr-90'	0.5	2167	990	20.3	7/1/2009 15:14
A1	Sr-90'	0.5	2839	1020	23.6	7/1/2009 15:14
A1	Sr-90'	0.5	3575	1050	27.3	7/1/2009 15:15
A1	Sr-90'	0.5	4430	1080	33.0	7/1/2009 15:16
A1	Sr-90'	0.5	5461	1110	38.9	7/1/2009 15:16
A1	Sr-90'	0.5	6850	1140	44.3	7/1/2009 15:17
A1	Sr-90'	0.5	8198	1170	46.9	7/1/2009 15:18
A1	Sr-90'	0.5	9713	1200	44.5	7/1/2009 15:18
A1	Sr-90'	0.5	11070	1230	40.2	7/1/2009 15:19
A1	Sr-90'	0.5	12096	1260	32.3	7/1/2009 15:20
A1	Sr-90'	0.5	13036	1290	23.4	7/1/2009 15:20
A1	Sr-90'	0.5	13569	1320	14.3	7/1/2009 15:21
A1	Sr-90'	0.5	13839	1350	7.0	7/1/2009 15:21
A1	Sr-90'	0.5	13834	1380	5.3	7/1/2009 15:22
A1	Sr-90'	0.5	13947	1410	3.7	7/1/2009 15:23
A1	Sr-90'	0.5	14310	1440	4.9	7/1/2009 15:23
A1	Sr-90'	0.5	14159	1470	1.6	7/1/2009 15:24
A1	Sr-90'	0.5	14463	1500	-0.7	7/1/2009 15:25
A1	Sr-90'	0.5	14107	1530	0.8	7/1/2009 15:25
A1	Sr-90'	0.5	14237	1560	-1.5	7/1/2009 15:53
A1	Sr-90'	0.5	14392	1590	0.1	7/1/2009 15:53
A1	Sr-90'	0.5	14095	1620	16.5	7/1/2009 15:54
A1	Sr-90'	0.5	14197	1650	16.6	7/1/2009 15:55
A2	Sr-90'	0.11	5	750	16.4	7/1/2009 15:09
A2	Sr-90'	0.5	52	780	16.3	7/1/2009 15:09
A2	Sr-90'	0.5	164	810	5.3	7/1/2009 15:10
A2	Sr-90'	0.5	362	840	8.4	7/1/2009 15:11
A2	Sr-90'	0.5	643	870	11.5	7/1/2009 15:11
A2	Sr-90'	0.5	1065	900	15.3	7/1/2009 15:12
A2	Sr-90'	0.5	1537	930	19.4	7/1/2009 15:12
A2	Sr-90'	0.5	2206	960	23.9	7/1/2009 15:13
A2	Sr-90'	0.5	2982	990	29.1	7/1/2009 15:14
A2	Sr-90'	0.5	3922	1020	32.4	7/1/2009 15:14
A2	Sr-90'	0.5	5045	1050	38.2	7/1/2009 15:15
A2	Sr-90'	0.5	6034	1080	44.5	7/1/2009 15:16
A2	Sr-90'	0.5	7649	1110	49.6	7/1/2009 15:16
A2	Sr-90'	0.5	9297	1140	57.5	7/1/2009 15:17
A2	Sr-90'	0.5	10846	1170	55.5	7/1/2009 15:18
A2	Sr-90'	0.5	13066	1200	52.9	7/1/2009 15:18
A2	Sr-90'	0.5	14085	1230	46.3	7/1/2009 15:19
A2	Sr-90'	0.5	15618	1260	35.4	7/1/2009 15:20
A2	Sr-90'	0.5	16518	1290	29.3	7/1/2009 15:20
A2	Sr-90'	0.5	17153	1320	18.3	7/1/2009 15:21
A2	Sr-90'	0.5	17712	1350	9.3	7/1/2009 15:21
A2	Sr-90'	0.5	17772	1380	1.8	7/1/2009 15:22
A2	Sr-90'	0.5	17602	1410	-1.3	7/1/2009 15:23
A2	Sr-90'	0.5	17483	1440	-1.1	7/1/2009 15:23
A2	Sr-90'	0.5	17666	1470	1.0	7/1/2009 15:24
A2	Sr-90'	0.5	17571	1500	2.6	7/1/2009 15:25
A2	Sr-90'	0.5	17710	1530	2.0	7/1/2009 15:25
A2	Sr-90'	0.5	17851	1560	1.0	7/1/2009 15:53
A2	Sr-90'	0.5	17830	1590	-1.5	7/1/2009 15:53

Plateau Raw Data

A2	Sr-90'	0.5	17655	1620	20.6	7/1/2009 15:54
A2	Sr-90'	0.5	17586	1650	20.6	7/1/2009 15:55
A3	Sr-90'	0.12	2	750	20.5	7/1/2009 15:09
A3	Sr-90'	0.11	10	780	20.3	7/1/2009 15:09
A3	Sr-90'	0.5	158	810	6.3	7/1/2009 15:10
A3	Sr-90'	0.5	412	840	9.8	7/1/2009 15:11
A3	Sr-90'	0.5	752	870	13.1	7/1/2009 15:11
A3	Sr-90'	0.5	1186	900	16.1	7/1/2009 15:12
A3	Sr-90'	0.5	1743	930	20.3	7/1/2009 15:12
A3	Sr-90'	0.5	2332	960	24.4	7/1/2009 15:13
A3	Sr-90'	0.5	3228	990	28.2	7/1/2009 15:14
A3	Sr-90'	0.5	4102	1020	33.6	7/1/2009 15:14
A3	Sr-90'	0.5	5082	1050	38.9	7/1/2009 15:15
A3	Sr-90'	0.5	6439	1080	47.4	7/1/2009 15:16
A3	Sr-90'	0.5	7892	1110	54.0	7/1/2009 15:16
A3	Sr-90'	0.5	9804	1140	56.5	7/1/2009 15:17
A3	Sr-90'	0.5	11495	1170	55.1	7/1/2009 15:18
A3	Sr-90'	0.5	13109	1200	49.0	7/1/2009 15:18
A3	Sr-90'	0.5	14504	1230	41.8	7/1/2009 15:19
A3	Sr-90'	0.5	15649	1260	31.8	7/1/2009 15:20
A3	Sr-90'	0.5	16497	1290	21.3	7/1/2009 15:20
A3	Sr-90'	0.5	16882	1320	11.8	7/1/2009 15:21
A3	Sr-90'	0.5	17082	1350	6.1	7/1/2009 15:21
A3	Sr-90'	0.5	17120	1380	5.1	7/1/2009 15:22
A3	Sr-90'	0.5	17292	1410	4.4	7/1/2009 15:23
A3	Sr-90'	0.5	17541	1440	3.6	7/1/2009 15:23
A3	Sr-90'	0.5	17524	1470	1.1	7/1/2009 15:24
A3	Sr-90'	0.5	17542	1500	-0.5	7/1/2009 15:25
A3	Sr-90'	0.5	17462	1530	-0.2	7/1/2009 15:25
A3	Sr-90'	0.5	17501	1560	-0.4	7/1/2009 15:53
A3	Sr-90'	0.5	17517	1590	0.0	7/1/2009 15:53
A3	Sr-90'	0.5	17449	1620	-0.4	7/1/2009 15:54
A3	Sr-90'	0.5	17488	1650	-0.5	7/1/2009 15:55
A4	Sr-90'	0.12	0		1.3	7/1/2009 15:09
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:09
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:10
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:11
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:11
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:12
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:12
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:13
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:14
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:14
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:15
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:16
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:16
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:17
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:18
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:18
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:19
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:20
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:20
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:21
A4	Sr-90'	0.11	0		#DIV/0!	7/1/2009 15:21
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:22
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:23
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:23
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:24
A4	Sr-90'	0.13	0		#DIV/0!	7/1/2009 15:25
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:25
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:26
A4	Sr-90'	0.12	0		#DIV/0!	7/1/2009 15:53

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					#DIV/0!	
A4	Sr-90'	0.12	0			7/1/2009 15:54
A4	Sr-90'	0.12	0			7/1/2009 15:55
B1	Sr-90'	0.11	2	750	0.1	7/1/2009 15:09
B1	Sr-90'	0.12	5	780	1.2	7/1/2009 15:09
B1	Sr-90'	0.5	74	810	2.8	7/1/2009 15:10
B1	Sr-90'	0.5	259	840	4.9	7/1/2009 15:10
B1	Sr-90'	0.5	604	870	8.8	7/1/2009 15:10
B1	Sr-90'	0.5	1066	900	12.3	7/1/2009 15:11
B1	Sr-90'	0.5	1521	930	16.1	7/1/2009 15:12
B1	Sr-90'	0.5	2215	960	20.5	7/1/2009 15:12
B1	Sr-90'	0.5	3106	990	24.7	7/1/2009 15:13
B1	Sr-90'	0.5	3985	1020	29.4	7/1/2009 15:14
B1	Sr-90'	0.5	5047	1050	34.3	7/1/2009 15:14
B1	Sr-90'	0.5	6386	1080	39.2	7/1/2009 15:15
B1	Sr-90'	0.5	7782	1110	46.0	7/1/2009 15:16
B1	Sr-90'	0.5	9521	1140	53.3	7/1/2009 15:16
B1	Sr-90'	0.5	11467	1170	58.8	7/1/2009 15:17
B1	Sr-90'	0.5	13368	1200	61.3	7/1/2009 15:18
B1	Sr-90'	0.5	15059	1230	60.4	7/1/2009 15:18
B1	Sr-90'	0.5	16782	1260	52.4	7/1/2009 15:19
B1	Sr-90'	0.5	17615	1290	40.4	7/1/2009 15:20
B1	Sr-90'	0.5	18143	1320	27.3	7/1/2009 15:20
B1	Sr-90'	0.5	18471	1350	17.5	7/1/2009 15:21
B1	Sr-90'	0.5	18973	1380	17.1	7/1/2009 15:22
B1	Sr-90'	0.5	19758	1410	14.4	7/1/2009 15:22
B1	Sr-90'	0.5	19657	1440	12.4	7/1/2009 15:23
B1	Sr-90'	0.5	19984	1470	11.1	7/1/2009 15:24
B1	Sr-90'	0.5	20518	1500	5.9	7/1/2009 15:25
B1	Sr-90'	0.49	20518	1500	4.2	7/1/2009 15:26
B1	Sr-90'	0.47	20211	1530	1.5	7/1/2009 15:54
B1	Sr-90'	0.43	20172	1560	0.2	7/1/2009 15:55
B1	Sr-90'	0.41	20383	1590	1.5	7/1/2009 15:57
B1	Sr-90'	0.4	20465	1620		7/1/2009 15:58
B1	Sr-90'	0.39	20290	1650		7/1/2009 16:00
B2	Sr-90'	0.11	0	750		7/1/2009 15:09
B2	Sr-90'	0.11	9	780		7/1/2009 15:09
B2	Sr-90'	0.5	109	810	5.8	7/1/2009 15:10
B2	Sr-90'	0.5	325	840	9.8	7/1/2009 15:10
B2	Sr-90'	0.5	717	870	13.6	7/1/2009 15:11
B2	Sr-90'	0.5	1181	900	17.1	7/1/2009 15:12
B2	Sr-90'	0.5	1714	930	21.6	7/1/2009 15:12
B2	Sr-90'	0.5	2393	960	26.7	7/1/2009 15:13
B2	Sr-90'	0.5	3345	990	34.1	7/1/2009 15:14
B2	Sr-90'	0.5	4370	1020	41.0	7/1/2009 15:14
B2	Sr-90'	0.5	5845	1050	47.3	7/1/2009 15:15
B2	Sr-90'	0.5	7288	1080	53.3	7/1/2009 15:16
B2	Sr-90'	0.5	8981	1110	59.1	7/1/2009 15:16
B2	Sr-90'	0.5	10794	1140	66.4	7/1/2009 15:17
B2	Sr-90'	0.5	12959	1170	70.8	7/1/2009 15:18
B2	Sr-90'	0.5	15256	1200	68.7	7/1/2009 15:18
B2	Sr-90'	0.5	17372	1230	55.6	7/1/2009 15:19
B2	Sr-90'	0.5	18895	1260	39.3	7/1/2009 15:20
B2	Sr-90'	0.5	19482	1290	27.6	7/1/2009 15:20
B2	Sr-90'	0.49	20099	1320	15.3	7/1/2009 15:21
B2	Sr-90'	0.5	20913	1350	7.7	7/1/2009 15:22
B2	Sr-90'	0.48	20468	1380	0.8	7/1/2009 15:22
B2	Sr-90'	0.46	20449	1410	-1.9	7/1/2009 15:23
B2	Sr-90'	0.46	20458	1440	1.9	7/1/2009 15:24
B2	Sr-90'	0.45	20631	1470	-0.2	7/1/2009 15:25
B2	Sr-90'	0.43	20659	1500	-0.4	7/1/2009 15:26
B2	Sr-90'	0.4	20326	1530	-4.0	7/1/2009 15:54
B2	Sr-90'	0.37	20546	1560	-1.6	7/1/2009 15:55
B2	Sr-90'	0.35	20090	1590	1.1	7/1/2009 15:57

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B2	Sr-90'	0.34	20530	1620		7/1/2009 15:58
B2	Sr-90'	0.33	20505	1650		7/1/2009 16:00
B3	Sr-90'	0.16	4	750		7/1/2009 15:09
B3	Sr-90'	0.11	7	780		7/1/2009 15:09
B3	Sr-90'	0.5	123	810	5.1	7/1/2009 15:10
B3	Sr-90'	0.5	351	840	8.9	7/1/2009 15:10
B3	Sr-90'	0.5	602	870	12.1	7/1/2009 15:11
B3	Sr-90'	0.5	1104	900	16.3	7/1/2009 15:12
B3	Sr-90'	0.5	1561	930	20.0	7/1/2009 15:12
B3	Sr-90'	0.5	2320	960	23.4	7/1/2009 15:13
B3	Sr-90'	0.5	3001	990	28.5	7/1/2009 15:14
B3	Sr-90'	0.5	3889	1020	32.8	7/1/2009 15:14
B3	Sr-90'	0.5	5051	1050	39.8	7/1/2009 15:15
B3	Sr-90'	0.5	6217	1080	46.0	7/1/2009 15:16
B3	Sr-90'	0.5	7803	1110	53.0	7/1/2009 15:16
B3	Sr-90'	0.5	9410	1140	58.7	7/1/2009 15:17
B3	Sr-90'	0.5	11403	1170	61.2	7/1/2009 15:18
B3	Sr-90'	0.5	13228	1200	58.5	7/1/2009 15:18
B3	Sr-90'	0.5	15074	1230	47.7	7/1/2009 15:19
B3	Sr-90'	0.5	16346	1260	34.9	7/1/2009 15:20
B3	Sr-90'	0.5	17002	1290	21.9	7/1/2009 15:20
B3	Sr-90'	0.5	17498	1320	17.0	7/1/2009 15:21
B3	Sr-90'	0.5	17784	1350	19.0	7/1/2009 15:22
B3	Sr-90'	0.5	18505	1380	19.3	7/1/2009 15:22
B3	Sr-90'	0.5	19344	1410	19.5	7/1/2009 15:23
B3	Sr-90'	0.5	19614	1440	14.7	7/1/2009 15:24
B3	Sr-90'	0.5	20160	1470	8.1	7/1/2009 15:25
B3	Sr-90'	0.49	20302	1500	4.3	7/1/2009 15:26
B3	Sr-90'	0.46	20220	1530	0.7	7/1/2009 15:54
B3	Sr-90'	0.42	20225	1560	1.2	7/1/2009 15:55
B3	Sr-90'	0.4	20304	1590	1.4	7/1/2009 15:57
B3	Sr-90'	0.39	20442	1620		7/1/2009 15:58
B3	Sr-90'	0.38	20327	1650		7/1/2009 16:00
B4	Sr-90'	0.12	0	750		7/1/2009 15:09
B4	Sr-90'	0.11	6	780		7/1/2009 15:09
B4	Sr-90'	0.5	96	810	5.1	7/1/2009 15:10
B4	Sr-90'	0.5	302	840	8.3	7/1/2009 15:10
B4	Sr-90'	0.5	616	870	11.7	7/1/2009 15:11
B4	Sr-90'	0.5	992	900	15.1	7/1/2009 15:12
B4	Sr-90'	0.5	1511	930	18.6	7/1/2009 15:12
B4	Sr-90'	0.5	2118	960	22.1	7/1/2009 15:13
B4	Sr-90'	0.5	2837	990	26.1	7/1/2009 15:14
B4	Sr-90'	0.5	3650	1020	32.3	7/1/2009 15:14
B4	Sr-90'	0.5	4667	1050	38.3	7/1/2009 15:15
B4	Sr-90'	0.5	6052	1080	44.6	7/1/2009 15:16
B4	Sr-90'	0.5	7378	1110	51.6	7/1/2009 15:16
B4	Sr-90'	0.5	8977	1140	54.8	7/1/2009 15:17
B4	Sr-90'	0.5	10948	1170	57.4	7/1/2009 15:18
B4	Sr-90'	0.5	12490	1200	54.0	7/1/2009 15:18
B4	Sr-90'	0.5	14225	1230	42.7	7/1/2009 15:19
B4	Sr-90'	0.5	15436	1260	31.5	7/1/2009 15:20
B4	Sr-90'	0.5	15887	1290	20.5	7/1/2009 15:20
B4	Sr-90'	0.5	16380	1320	16.2	7/1/2009 15:21
B4	Sr-90'	0.5	16833	1350	18.5	7/1/2009 15:22
B4	Sr-90'	0.5	17391	1380	17.3	7/1/2009 15:22
B4	Sr-90'	0.5	18163	1410	16.2	7/1/2009 15:23
B4	Sr-90'	0.5	18306	1440	15.9	7/1/2009 15:24
B4	Sr-90'	0.5	18799	1470	17.1	7/1/2009 15:25
B4	Sr-90'	0.5	19464	1500	16.9	7/1/2009 15:53
B4	Sr-90'	0.48	20148	1530	13.5	7/1/2009 15:54
B4	Sr-90'	0.45	20170	1560	7.4	7/1/2009 15:55
B4	Sr-90'	0.43	20474	1590	1.8	7/1/2009 15:57



**Plateau Raw Data**

B4	Sr-90'	0.42	20404	1620	23.6	7/1/2009 15:58
B4	Sr-90'	0.4	20306	1650	23.8	7/1/2009 16:00
C1	Sr-90'	0.11	3	750	23.7	7/1/2009 15:09
C1	Sr-90'	0.12	8	780	23.5	7/1/2009 15:09
C1	Sr-90'	0.5	135	810	5.9	7/1/2009 15:10
C1	Sr-90'	0.5	353	840	9.2	7/1/2009 15:10
C1	Sr-90'	0.5	711	870	12.0	7/1/2009 15:11
C1	Sr-90'	0.5	1103	900	14.8	7/1/2009 15:11
C1	Sr-90'	0.5	1565	930	18.4	7/1/2009 15:12
C1	Sr-90'	0.5	2153	960	22.0	7/1/2009 15:13
C1	Sr-90'	0.5	2943	990	26.8	7/1/2009 15:13
C1	Sr-90'	0.5	3707	1020	31.9	7/1/2009 15:14
C1	Sr-90'	0.5	4809	1050	37.8	7/1/2009 15:15
C1	Sr-90'	0.5	6002	1080	44.8	7/1/2009 15:15
C1	Sr-90'	0.5	7464	1110	49.4	7/1/2009 15:16
C1	Sr-90'	0.5	9096	1140	54.5	7/1/2009 15:16
C1	Sr-90'	0.5	10669	1170	56.4	7/1/2009 15:17
C1	Sr-90'	0.5	12567	1200	51.0	7/1/2009 15:18
C1	Sr-90'	0.5	14181	1230	44.2	7/1/2009 15:18
C1	Sr-90'	0.5	14993	1260	33.0	7/1/2009 15:19
C1	Sr-90'	0.5	16093	1290	22.2	7/1/2009 15:20
C1	Sr-90'	0.5	16566	1320	14.2	7/1/2009 15:20
C1	Sr-90'	0.5	16722	1350	6.5	7/1/2009 15:21
C1	Sr-90'	0.5	16806	1380	5.5	7/1/2009 15:22
C1	Sr-90'	0.5	16948	1410	4.8	7/1/2009 15:22
C1	Sr-90'	0.5	17275	1440	1.1	7/1/2009 15:23
C1	Sr-90'	0.5	17203	1470	-0.4	7/1/2009 15:23
C1	Sr-90'	0.5	16846	1500	-1.1	7/1/2009 15:24
C1	Sr-90'	0.5	17103	1530	-1.1	7/1/2009 15:25
C1	Sr-90'	0.5	17160	1560	0.7	7/1/2009 15:25
C1	Sr-90'	0.5	16887	1590	-1.3	7/1/2009 15:26
C1	Sr-90'	0.5	17065	1620		7/1/2009 15:27
C1	Sr-90'	0.5	16958	1650		7/1/2009 15:27
C2	Sr-90'	0.11	0	750		7/1/2009 15:09
C2	Sr-90'	0.12	1	780		7/1/2009 15:09
C2	Sr-90'	0.5	47	810	3.2	7/1/2009 15:10
C2	Sr-90'	0.5	176	840	5.8	7/1/2009 15:10
C2	Sr-90'	0.5	397	870	9.0	7/1/2009 15:11
C2	Sr-90'	0.5	700	900	12.3	7/1/2009 15:11
C2	Sr-90'	0.5	1129	930	15.6	7/1/2009 15:12
C2	Sr-90'	0.5	1653	960	19.5	7/1/2009 15:13
C2	Sr-90'	0.5	2258	990	24.3	7/1/2009 15:13
C2	Sr-90'	0.5	3063	1020	28.9	7/1/2009 15:14
C2	Sr-90'	0.5	4071	1050	33.8	7/1/2009 15:15
C2	Sr-90'	0.5	5074	1080	39.0	7/1/2009 15:15
C2	Sr-90'	0.5	6319	1110	46.0	7/1/2009 15:16
C2	Sr-90'	0.5	7785	1140	53.8	7/1/2009 15:17
C2	Sr-90'	0.5	9615	1170	56.3	7/1/2009 15:17
C2	Sr-90'	0.5	11493	1200	55.4	7/1/2009 15:18
C2	Sr-90'	0.5	12903	1230	51.4	7/1/2009 15:18
C2	Sr-90'	0.5	14448	1260	43.4	7/1/2009 15:19
C2	Sr-90'	0.5	15845	1290	36.3	7/1/2009 15:20
C2	Sr-90'	0.5	16538	1320	26.0	7/1/2009 15:20
C2	Sr-90'	0.5	17303	1350	16.2	7/1/2009 15:21
C2	Sr-90'	0.5	17622	1380	8.3	7/1/2009 15:22
C2	Sr-90'	0.5	17729	1410	1.2	7/1/2009 15:22
C2	Sr-90'	0.5	17572	1440	-0.5	7/1/2009 15:23
C2	Sr-90'	0.5	17507	1470	0.5	7/1/2009 15:23
C2	Sr-90'	0.5	17657	1500	2.7	7/1/2009 15:24
C2	Sr-90'	0.5	17758	1530	1.4	7/1/2009 15:25
C2	Sr-90'	0.5	17852	1560	1.7	7/1/2009 15:25
C2	Sr-90'	0.5	17621	1590	0.7	7/1/2009 15:26

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C2	Sr-90'	0.5	17984	1620		7/1/2009 15:27
C2	Sr-90'	0.5	17797	1650		7/1/2009 15:27
C3	Sr-90'	0.11	0	750		7/1/2009 15:09
C3	Sr-90'	0.11	1	780		7/1/2009 15:09
C3	Sr-90'	0.11	5	810	3.3	7/1/2009 15:10
C3	Sr-90'	0.5	146	840	6.5	7/1/2009 15:10
C3	Sr-90'	0.5	419	870	10.9	7/1/2009 15:11
C3	Sr-90'	0.5	776	900	14.3	7/1/2009 15:11
C3	Sr-90'	0.5	1319	930	17.7	7/1/2009 15:12
C3	Sr-90'	0.5	1837	960	21.7	7/1/2009 15:13
C3	Sr-90'	0.5	2548	990	25.2	7/1/2009 15:13
C3	Sr-90'	0.5	3420	1020	31.1	7/1/2009 15:14
C3	Sr-90'	0.5	4313	1050	36.7	7/1/2009 15:15
C3	Sr-90'	0.5	5621	1080	42.8	7/1/2009 15:15
C3	Sr-90'	0.5	6946	1110	51.9	7/1/2009 15:16
C3	Sr-90'	0.5	8517	1140	58.5	7/1/2009 15:17
C3	Sr-90'	0.5	10649	1170	64.5	7/1/2009 15:17
C3	Sr-90'	0.5	12537	1200	67.2	7/1/2009 15:18
C3	Sr-90'	0.5	14612	1230	64.4	7/1/2009 15:18
C3	Sr-90'	0.5	16617	1260	56.7	7/1/2009 15:19
C3	Sr-90'	0.5	18266	1290	44.5	7/1/2009 15:20
C3	Sr-90'	0.5	19218	1320	30.5	7/1/2009 15:20
C3	Sr-90'	0.5	19990	1350	17.2	7/1/2009 15:21
C3	Sr-90'	0.5	20330	1380	9.3	7/1/2009 15:22
C3	Sr-90'	0.5	20293	1410	3.9	7/1/2009 15:22
C3	Sr-90'	0.5	20457	1440	1.2	7/1/2009 15:23
C3	Sr-90'	0.49	20504	1470	2.9	7/1/2009 15:23
C3	Sr-90'	0.49	20402	1500	-0.1	7/1/2009 15:24
C3	Sr-90'	0.5	20751	1530	-0.7	7/1/2009 15:25
C3	Sr-90'	0.49	20326	1560	1.1	7/1/2009 15:25
C3	Sr-90'	0.49	20435	1590	1.3	7/1/2009 15:26
C3	Sr-90'	0.5	20730	1620		7/1/2009 15:27
C3	Sr-90'	0.5	20748	1650		7/1/2009 15:27
C4	Sr-90'	0.12	0	750		7/1/2009 15:09
C4	Sr-90'	0.11	0	780		7/1/2009 15:09
C4	Sr-90'	0.11	2	810	2.1	7/1/2009 15:10
C4	Sr-90'	0.5	103	840	4.3	7/1/2009 15:10
C4	Sr-90'	0.5	259	870	6.9	7/1/2009 15:11
C4	Sr-90'	0.5	521	900	9.3	7/1/2009 15:11
C4	Sr-90'	0.5	831	930	11.9	7/1/2009 15:12
C4	Sr-90'	0.5	1216	960	14.4	7/1/2009 15:13
C4	Sr-90'	0.5	1699	990	17.6	7/1/2009 15:13
C4	Sr-90'	0.5	2244	1020	21.6	7/1/2009 15:14
C4	Sr-90'	0.5	2955	1050	25.8	7/1/2009 15:15
C4	Sr-90'	0.5	3821	1080	31.0	7/1/2009 15:15
C4	Sr-90'	0.5	4783	1110	35.5	7/1/2009 15:16
C4	Sr-90'	0.5	5977	1140	38.8	7/1/2009 15:17
C4	Sr-90'	0.5	7204	1170	43.3	7/1/2009 15:17
C4	Sr-90'	0.5	8425	1200	44.9	7/1/2009 15:18
C4	Sr-90'	0.5	10053	1230	42.6	7/1/2009 15:18
C4	Sr-90'	0.5	11280	1260	36.6	7/1/2009 15:19
C4	Sr-90'	0.5	12165	1290	28.3	7/1/2009 15:20
C4	Sr-90'	0.5	12855	1320	20.1	7/1/2009 15:20
C4	Sr-90'	0.5	13515	1350	13.9	7/1/2009 15:21
C4	Sr-90'	0.5	13616	1380	8.4	7/1/2009 15:22
C4	Sr-90'	0.5	13872	1410	4.0	7/1/2009 15:22
C4	Sr-90'	0.5	13942	1440	3.0	7/1/2009 15:23
C4	Sr-90'	0.5	13948	1470	1.3	7/1/2009 15:23
C4	Sr-90'	0.5	14027	1500	3.1	7/1/2009 15:24
C4	Sr-90'	0.5	14021	1530	2.0	7/1/2009 15:25
C4	Sr-90'	0.5	14373	1560	0.9	7/1/2009 15:25
C4	Sr-90'	0.5	14078	1590	0.1	7/1/2009 15:26

**Plateau Raw Data**

C4	Sr-90'	0.5	14134	1620		7/1/2009 15:27
C4	Sr-90'	0.5	14161	1650		7/1/2009 15:27
D1	Sr-90'	0.11	0	750		7/1/2009 15:09
D1	Sr-90'	0.11	1	780		7/1/2009 15:09
D1	Sr-90'	0.5	72	810	5.0	7/1/2009 15:10
D1	Sr-90'	0.5	270	840	8.8	7/1/2009 15:11
D1	Sr-90'	0.5	615	870	13.4	7/1/2009 15:11
D1	Sr-90'	0.5	1053	900	17.1	7/1/2009 15:12
D1	Sr-90'	0.5	1693	930	20.6	7/1/2009 15:13
D1	Sr-90'	0.5	2291	960	23.8	7/1/2009 15:14
D1	Sr-90'	0.5	3080	990	28.2	7/1/2009 15:15
D1	Sr-90'	0.5	3936	1020	34.8	7/1/2009 15:15
D1	Sr-90'	0.5	5093	1050	40.1	7/1/2009 15:16
D1	Sr-90'	0.5	6502	1080	48.6	7/1/2009 15:17
D1	Sr-90'	0.5	7816	1110	56.3	7/1/2009 15:18
D1	Sr-90'	0.5	9861	1140	62.6	7/1/2009 15:19
D1	Sr-90'	0.5	11853	1170	66.5	7/1/2009 15:19
D1	Sr-90'	0.5	13871	1200	63.1	7/1/2009 15:20
D1	Sr-90'	0.5	15783	1230	56.3	7/1/2009 15:21
D1	Sr-90'	0.5	17367	1260	45.6	7/1/2009 15:22
D1	Sr-90'	0.5	18552	1290	32.7	7/1/2009 15:22
D1	Sr-90'	0.5	19322	1320	19.4	7/1/2009 15:23
D1	Sr-90'	0.5	19713	1350	10.4	7/1/2009 15:24
D1	Sr-90'	0.5	19695	1380	5.3	7/1/2009 15:25
D1	Sr-90'	0.5	19923	1410	2.4	7/1/2009 15:26
D1	Sr-90'	0.5	20015	1440	-0.9	7/1/2009 15:26
D1	Sr-90'	0.5	19909	1470	-2.8	7/1/2009 15:27
D1	Sr-90'	0.5	19560	1500	-3.0	7/1/2009 15:28
D1	Sr-90'	0.5	19731	1530	-0.4	7/1/2009 15:29
D1	Sr-90'	0.5	19656	1560	1.3	7/1/2009 15:30
D1	Sr-90'	0.5	19805	1590	0.8	7/1/2009 15:30
D1	Sr-90'	0.5	19711	1620		7/1/2009 15:31
D1	Sr-90'	0.5	19827	1650		7/1/2009 15:32
D2	Sr-90'	0.11	2	750		7/1/2009 15:09
D2	Sr-90'	0.11	0	780		7/1/2009 15:09
D2	Sr-90'	0.12	8	810	3.7	7/1/2009 15:10
D2	Sr-90'	0.5	183	840	7.3	7/1/2009 15:11
D2	Sr-90'	0.5	461	870	11.1	7/1/2009 15:11
D2	Sr-90'	0.5	873	900	14.3	7/1/2009 15:12
D2	Sr-90'	0.5	1331	930	17.1	7/1/2009 15:13
D2	Sr-90'	0.5	1899	960	20.1	7/1/2009 15:14
D2	Sr-90'	0.5	2520	990	24.9	7/1/2009 15:15
D2	Sr-90'	0.5	3298	1020	30.4	7/1/2009 15:15
D2	Sr-90'	0.5	4359	1050	36.7	7/1/2009 15:16
D2	Sr-90'	0.5	5534	1080	42.9	7/1/2009 15:17
D2	Sr-90'	0.5	6912	1110	48.8	7/1/2009 15:18
D2	Sr-90'	0.5	8458	1140	55.7	7/1/2009 15:19
D2	Sr-90'	0.5	10221	1170	60.7	7/1/2009 15:19
D2	Sr-90'	0.5	12229	1200	59.3	7/1/2009 15:20
D2	Sr-90'	0.5	14132	1230	54.2	7/1/2009 15:21
D2	Sr-90'	0.5	15397	1260	44.8	7/1/2009 15:22
D2	Sr-90'	0.5	16761	1290	32.3	7/1/2009 15:22
D2	Sr-90'	0.5	17632	1320	23.4	7/1/2009 15:23
D2	Sr-90'	0.5	17862	1350	14.5	7/1/2009 15:24
D2	Sr-90'	0.5	18357	1380	8.4	7/1/2009 15:25
D2	Sr-90'	0.5	18569	1410	4.9	7/1/2009 15:26
D2	Sr-90'	0.5	18543	1440	-2.0	7/1/2009 15:26
D2	Sr-90'	0.5	18507	1470	-1.9	7/1/2009 15:27
D2	Sr-90'	0.5	18087	1500	-0.4	7/1/2009 15:28
D2	Sr-90'	0.5	18508	1530	1.2	7/1/2009 15:29
D2	Sr-90'	0.5	18487	1560	2.0	7/1/2009 15:30
D2	Sr-90'	0.5	18483	1590		7/1/2009 15:30

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D2	Sr-90'	0.5	18406	1620		7/1/2009 15:31
D2	Sr-90'	0.5	18558	1650		7/1/2009 15:32
D3	Sr-90'	0.11	0	750		7/1/2009 15:09
D3	Sr-90'	0.11	2	780		7/1/2009 15:09
D3	Sr-90'	0.11	13	810	3.5	7/1/2009 15:10
D3	Sr-90'	0.5	180	840	7.3	7/1/2009 15:11
D3	Sr-90'	0.5	443	870	11.9	7/1/2009 15:11
D3	Sr-90'	0.5	889	900	16.7	7/1/2009 15:12
D3	Sr-90'	0.5	1450	930	21.0	7/1/2009 15:13
D3	Sr-90'	0.5	2177	960	24.5	7/1/2009 15:14
D3	Sr-90'	0.5	2948	990	29.5	7/1/2009 15:15
D3	Sr-90'	0.5	3811	1020	35.9	7/1/2009 15:15
D3	Sr-90'	0.5	5065	1050	43.8	7/1/2009 15:16
D3	Sr-90'	0.5	6499	1080	51.6	7/1/2009 15:17
D3	Sr-90'	0.5	8172	1110	58.7	7/1/2009 15:18
D3	Sr-90'	0.5	10000	1140	67.5	7/1/2009 15:19
D3	Sr-90'	0.5	12119	1170	72.7	7/1/2009 15:19
D3	Sr-90'	0.5	14648	1200	75.0	7/1/2009 15:20
D3	Sr-90'	0.5	16756	1230	69.6	7/1/2009 15:21
D3	Sr-90'	0.5	18932	1260	50.7	7/1/2009 15:22
D3	Sr-90'	0.49	20419	1290	28.7	7/1/2009 15:22
D3	Sr-90'	0.47	20417	1320	7.9	7/1/2009 15:23
D3	Sr-90'	0.45	20316	1350	1.1	7/1/2009 15:24
D3	Sr-90'	0.44	20172	1380	-0.5	7/1/2009 15:25
D3	Sr-90'	0.45	20699	1410	3.2	7/1/2009 15:26
D3	Sr-90'	0.44	20157	1440	0.3	7/1/2009 15:26
D3	Sr-90'	0.45	20796	1470	-3.9	7/1/2009 15:27
D3	Sr-90'	0.44	20171	1500	-0.2	7/1/2009 15:28
D3	Sr-90'	0.44	20106	1530	0.5	7/1/2009 15:29
D3	Sr-90'	0.44	20476	1560	4.9	7/1/2009 15:30
D3	Sr-90'	0.45	20713	1590	3.7	7/1/2009 15:30
D3	Sr-90'	0.45	20599	1620		7/1/2009 15:31
D3	Sr-90'	0.45	20602	1650		7/1/2009 15:32
D4	Sr-90'	0.11	1	750		7/1/2009 15:09
D4	Sr-90'	0.11	1	780		7/1/2009 15:09
D4	Sr-90'	0.11	7	810	3.2	7/1/2009 15:10
D4	Sr-90'	0.5	147	840	7.0	7/1/2009 15:11
D4	Sr-90'	0.5	404	870	11.2	7/1/2009 15:11
D4	Sr-90'	0.5	853	900	15.0	7/1/2009 15:12
D4	Sr-90'	0.5	1327	930	17.8	7/1/2009 15:13
D4	Sr-90'	0.5	1936	960	20.5	7/1/2009 15:14
D4	Sr-90'	0.5	2527	990	24.2	7/1/2009 15:15
D4	Sr-90'	0.5	3323	1020	29.1	7/1/2009 15:15
D4	Sr-90'	0.5	4264	1050	36.1	7/1/2009 15:16
D4	Sr-90'	0.5	5435	1080	42.7	7/1/2009 15:17
D4	Sr-90'	0.5	6888	1110	51.1	7/1/2009 15:18
D4	Sr-90'	0.5	8412	1140	56.9	7/1/2009 15:19
D4	Sr-90'	0.5	10433	1170	59.9	7/1/2009 15:19
D4	Sr-90'	0.5	12204	1200	61.4	7/1/2009 15:20
D4	Sr-90'	0.5	13978	1230	56.9	7/1/2009 15:21
D4	Sr-90'	0.5	15844	1260	49.4	7/1/2009 15:22
D4	Sr-90'	0.5	17152	1290	38.6	7/1/2009 15:22
D4	Sr-90'	0.5	18022	1320	24.6	7/1/2009 15:23
D4	Sr-90'	0.5	18681	1350	14.6	7/1/2009 15:24
D4	Sr-90'	0.5	18775	1380	10.1	7/1/2009 15:25
D4	Sr-90'	0.5	18959	1410	5.8	7/1/2009 15:26
D4	Sr-90'	0.5	19392	1440	2.8	7/1/2009 15:26
D4	Sr-90'	0.5	19243	1470	-2.5	7/1/2009 15:27
D4	Sr-90'	0.5	19058	1500	-4.4	7/1/2009 15:28
D4	Sr-90'	0.5	18753	1530	-2.5	7/1/2009 15:29
D4	Sr-90'	0.5	18970	1560	2.3	7/1/2009 15:30
D4	Sr-90'	0.5	18909	1590	2.7	7/1/2009 15:30

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D4	Sr-90'	0.5	19318	1620		7/1/2009 15:31
D4	Sr-90'	0.5	18979	1650		7/1/2009 15:32
E1	Sr-90'	0.11	2	750		7/1/2009 16:53
E1	Sr-90'	0.11	5	780		7/1/2009 16:54
E1	Sr-90'	0.5	105	810	4.8	7/1/2009 16:54
E1	Sr-90'	0.5	272	840	7.7	7/1/2009 16:55
E1	Sr-90'	0.5	586	870	10.2	7/1/2009 16:55
E1	Sr-90'	0.5	917	900	12.7	7/1/2009 16:56
E1	Sr-90'	0.5	1310	930	15.1	7/1/2009 16:57
E1	Sr-90'	0.5	1822	960	17.8	7/1/2009 16:57
E1	Sr-90'	0.5	2394	990	21.9	7/1/2009 16:58
E1	Sr-90'	0.5	3047	1020	26.4	7/1/2009 16:59
E1	Sr-90'	0.5	3979	1050	30.7	7/1/2009 16:59
E1	Sr-90'	0.5	4991	1080	36.2	7/1/2009 17:00
E1	Sr-90'	0.5	6025	1110	40.8	7/1/2009 17:00
E1	Sr-90'	0.5	7460	1140	44.7	7/1/2009 17:01
E1	Sr-90'	0.5	8857	1170	46.7	7/1/2009 17:02
E1	Sr-90'	0.5	10283	1200	42.6	7/1/2009 17:02
E1	Sr-90'	0.5	11614	1230	36.4	7/1/2009 17:03
E1	Sr-90'	0.5	12474	1260	28.4	7/1/2009 17:04
E1	Sr-90'	0.5	13226	1290	20.6	7/1/2009 17:04
E1	Sr-90'	0.5	13737	1320	14.1	7/1/2009 17:05
E1	Sr-90'	0.5	14075	1350	7.7	7/1/2009 17:05
E1	Sr-90'	0.5	14159	1380	3.5	7/1/2009 17:06
E1	Sr-90'	0.5	14167	1410	2.0	7/1/2009 17:07
E1	Sr-90'	0.5	14219	1440	3.8	7/1/2009 17:07
E1	Sr-90'	0.5	14348	1470	3.2	7/1/2009 17:08
E1	Sr-90'	0.5	14643	1500	0.4	7/1/2009 17:09
E1	Sr-90'	0.5	14432	1530	-0.1	7/1/2009 17:09
E1	Sr-90'	0.5	14241	1560	-0.1	7/1/2009 17:10
E1	Sr-90'	0.5	14536	1590	2.5	7/1/2009 17:10
E1	Sr-90'	0.5	14569	1620		7/1/2009 17:11
E1	Sr-90'	0.5	14650	1650		7/1/2009 17:12
E2	Sr-90'	0.11	1	750		7/1/2009 16:53
E2	Sr-90'	0.11	3	780		7/1/2009 16:54
E2	Sr-90'	0.5	81	810	4.5	7/1/2009 16:54
E2	Sr-90'	0.5	238	840	7.9	7/1/2009 16:55
E2	Sr-90'	0.5	551	870	11.3	7/1/2009 16:55
E2	Sr-90'	0.5	958	900	15.1	7/1/2009 16:56
E2	Sr-90'	0.5	1416	930	18.1	7/1/2009 16:57
E2	Sr-90'	0.5	2066	960	21.2	7/1/2009 16:57
E2	Sr-90'	0.5	2713	990	25.8	7/1/2009 16:58
E2	Sr-90'	0.5	3496	1020	30.6	7/1/2009 16:59
E2	Sr-90'	0.5	4569	1050	37.2	7/1/2009 16:59
E2	Sr-90'	0.5	5734	1080	44.5	7/1/2009 17:00
E2	Sr-90'	0.5	7168	1110	50.7	7/1/2009 17:00
E2	Sr-90'	0.5	8866	1140	56.4	7/1/2009 17:01
E2	Sr-90'	0.5	10605	1170	58.5	7/1/2009 17:02
E2	Sr-90'	0.5	12472	1200	55.9	7/1/2009 17:02
E2	Sr-90'	0.5	14141	1230	48.8	7/1/2009 17:03
E2	Sr-90'	0.5	15488	1260	37.9	7/1/2009 17:04
E2	Sr-90'	0.5	16420	1290	27.4	7/1/2009 17:04
E2	Sr-90'	0.5	17015	1320	19.0	7/1/2009 17:05
E2	Sr-90'	0.5	17485	1350	12.1	7/1/2009 17:05
E2	Sr-90'	0.5	17805	1380	6.0	7/1/2009 17:06
E2	Sr-90'	0.5	17843	1410	2.5	7/1/2009 17:07
E2	Sr-90'	0.5	17729	1440	0.6	7/1/2009 17:07
E2	Sr-90'	0.5	17899	1470	0.2	7/1/2009 17:08
E2	Sr-90'	0.5	17869	1500	1.8	7/1/2009 17:09
E2	Sr-90'	0.5	17806	1530	0.0	7/1/2009 17:09
E2	Sr-90'	0.5	18040	1560	2.2	7/1/2009 17:10
E2	Sr-90'	0.5	17819	1590	1.9	7/1/2009 17:10

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E2	Sr-90'	0.5	18188	1620		7/1/2009 17:11
E2	Sr-90'	0.5	18023	1650		7/1/2009 17:12
E3	Sr-90'	0.11	6	750		7/1/2009 16:53
E3	Sr-90'	0.5	100	780		7/1/2009 16:54
E3	Sr-90'	0.5	299	810	8.2	7/1/2009 16:54
E3	Sr-90'	0.5	562	840	12.0	7/1/2009 16:55
E3	Sr-90'	0.5	998	870	15.3	7/1/2009 16:55
E3	Sr-90'	0.5	1557	900	18.2	7/1/2009 16:56
E3	Sr-90'	0.5	2103	930	21.5	7/1/2009 16:57
E3	Sr-90'	0.5	2734	960	25.7	7/1/2009 16:57
E3	Sr-90'	0.5	3637	990	32.2	7/1/2009 16:58
E3	Sr-90'	0.5	4648	1020	38.0	7/1/2009 16:59
E3	Sr-90'	0.5	5981	1050	43.0	7/1/2009 16:59
E3	Sr-90'	0.5	7264	1080	48.2	7/1/2009 17:00
E3	Sr-90'	0.5	8773	1110	52.4	7/1/2009 17:00
E3	Sr-90'	0.5	10478	1140	56.1	7/1/2009 17:01
E3	Sr-90'	0.5	12239	1170	54.1	7/1/2009 17:02
E3	Sr-90'	0.5	13953	1200	47.1	7/1/2009 17:02
E3	Sr-90'	0.5	15145	1230	37.8	7/1/2009 17:03
E3	Sr-90'	0.5	16088	1260	27.2	7/1/2009 17:04
E3	Sr-90'	0.5	16835	1290	18.2	7/1/2009 17:04
E3	Sr-90'	0.5	17187	1320	9.6	7/1/2009 17:05
E3	Sr-90'	0.5	17323	1350	4.3	7/1/2009 17:05
E3	Sr-90'	0.5	17281	1380	4.2	7/1/2009 17:06
E3	Sr-90'	0.5	17438	1410	2.2	7/1/2009 17:07
E3	Sr-90'	0.5	17763	1440	1.7	7/1/2009 17:07
E3	Sr-90'	0.5	17411	1470	-0.9	7/1/2009 17:08
E3	Sr-90'	0.5	17545	1500	-0.4	7/1/2009 17:09
E3	Sr-90'	0.5	17408	1530	2.9	7/1/2009 17:09
E3	Sr-90'	0.5	17704	1560	1.8	7/1/2009 17:10
E3	Sr-90'	0.5	17768	1590	0.6	7/1/2009 17:10
E3	Sr-90'	0.5	17641	1620		7/1/2009 17:11
E3	Sr-90'	0.5	17535	1650		7/1/2009 17:12
E4	Sr-90'	0.12	0	750		7/1/2009 16:53
E4	Sr-90'	0.12	1	780		7/1/2009 16:54
E4	Sr-90'	0.5	62	810	3.5	7/1/2009 16:54
E4	Sr-90'	0.5	205	840	6.0	7/1/2009 16:55
E4	Sr-90'	0.5	428	870	8.7	7/1/2009 16:55
E4	Sr-90'	0.5	712	900	12.1	7/1/2009 16:56
E4	Sr-90'	0.5	1114	930	15.5	7/1/2009 16:57
E4	Sr-90'	0.5	1670	960	17.6	7/1/2009 16:57
E4	Sr-90'	0.5	2269	990	21.0	7/1/2009 16:58
E4	Sr-90'	0.5	2774	1020	25.3	7/1/2009 16:59
E4	Sr-90'	0.5	3713	1050	30.9	7/1/2009 16:59
E4	Sr-90'	0.5	4742	1080	38.0	7/1/2009 17:00
E4	Sr-90'	0.5	5922	1110	41.9	7/1/2009 17:00
E4	Sr-90'	0.5	7364	1140	46.6	7/1/2009 17:01
E4	Sr-90'	0.5	8687	1170	48.0	7/1/2009 17:02
E4	Sr-90'	0.5	10345	1200	46.5	7/1/2009 17:02
E4	Sr-90'	0.5	11633	1230	42.6	7/1/2009 17:03
E4	Sr-90'	0.5	12867	1260	35.1	7/1/2009 17:04
E4	Sr-90'	0.5	13814	1290	27.5	7/1/2009 17:04
E4	Sr-90'	0.5	14521	1320	17.8	7/1/2009 17:05
E4	Sr-90'	0.5	14937	1350	11.4	7/1/2009 17:05
E4	Sr-90'	0.5	14976	1380	6.8	7/1/2009 17:06
E4	Sr-90'	0.5	15298	1410	4.0	7/1/2009 17:07
E4	Sr-90'	0.5	15356	1440	3.4	7/1/2009 17:07
E4	Sr-90'	0.5	15348	1470	2.5	7/1/2009 17:08
E4	Sr-90'	0.5	15467	1500	1.5	7/1/2009 17:09
E4	Sr-90'	0.5	15614	1530	-0.3	7/1/2009 17:09
E4	Sr-90'	0.5	15441	1560	-2.2	7/1/2009 17:10
E4	Sr-90'	0.5	15310	1590	-0.7	7/1/2009 17:10

**Plateau Raw Data**

E4	Sr-90'	0.5	15285	1620		7/1/2009 17:11
E4	Sr-90'	0.5	15594	1650		7/1/2009 17:12
F1	Sr-90'	0.11	1	750		7/1/2009 16:53
F1	Sr-90'	0.5	41	780		7/1/2009 16:54
F1	Sr-90'	0.5	140	810	5.8	7/1/2009 16:54
F1	Sr-90'	0.5	386	840	9.6	7/1/2009 16:55
F1	Sr-90'	0.5	692	870	13.4	7/1/2009 16:55
F1	Sr-90'	0.5	1203	900	17.5	7/1/2009 16:56
F1	Sr-90'	0.5	1739	930	22.0	7/1/2009 16:57
F1	Sr-90'	0.5	2486	960	24.4	7/1/2009 16:57
F1	Sr-90'	0.5	3345	990	28.5	7/1/2009 16:58
F1	Sr-90'	0.5	4063	1020	33.4	7/1/2009 16:59
F1	Sr-90'	0.5	5218	1050	39.9	7/1/2009 16:59
F1	Sr-90'	0.5	6559	1080	49.9	7/1/2009 17:00
F1	Sr-90'	0.5	8089	1110	56.9	7/1/2009 17:00
F1	Sr-90'	0.5	10105	1140	63.2	7/1/2009 17:01
F1	Sr-90'	0.5	11973	1170	63.6	7/1/2009 17:02
F1	Sr-90'	0.5	14100	1200	60.5	7/1/2009 17:02
F1	Sr-90'	0.5	15625	1230	51.4	7/1/2009 17:03
F1	Sr-90'	0.5	17349	1260	40.8	7/1/2009 17:04
F1	Sr-90'	0.5	18058	1290	29.0	7/1/2009 17:04
F1	Sr-90'	0.5	19007	1320	16.9	7/1/2009 17:05
F1	Sr-90'	0.5	19153	1350	11.1	7/1/2009 17:05
F1	Sr-90'	0.5	19337	1380	4.5	7/1/2009 17:06
F1	Sr-90'	0.5	19560	1410	4.6	7/1/2009 17:07
F1	Sr-90'	0.5	19474	1440	2.9	7/1/2009 17:07
F1	Sr-90'	0.5	19777	1470	2.2	7/1/2009 17:08
F1	Sr-90'	0.5	19660	1500	2.0	7/1/2009 17:09
F1	Sr-90'	0.5	19795	1530	1.4	7/1/2009 17:09
F1	Sr-90'	0.5	19765	1560	1.5	7/1/2009 17:10
F1	Sr-90'	0.5	19927	1590	-0.9	7/1/2009 17:10
F1	Sr-90'	0.5	19825	1620		7/1/2009 17:11
F1	Sr-90'	0.5	19634	1650		7/1/2009 17:12
F2	Sr-90'	0.11	3	750		7/1/2009 16:53
F2	Sr-90'	0.5	75	780		7/1/2009 16:54
F2	Sr-90'	0.5	255	810	8.6	7/1/2009 16:54
F2	Sr-90'	0.5	549	840	12.8	7/1/2009 16:55
F2	Sr-90'	0.5	1053	870	16.1	7/1/2009 16:56
F2	Sr-90'	0.5	1600	900	20.7	7/1/2009 16:56
F2	Sr-90'	0.5	2150	930	24.4	7/1/2009 16:57
F2	Sr-90'	0.5	3108	960	30.2	7/1/2009 16:57
F2	Sr-90'	0.5	3956	990	37.2	7/1/2009 16:58
F2	Sr-90'	0.5	5225	1020	43.1	7/1/2009 16:59
F2	Sr-90'	0.5	6673	1050	52.0	7/1/2009 16:59
F2	Sr-90'	0.5	8221	1080	57.9	7/1/2009 17:00
F2	Sr-90'	0.5	10263	1110	65.3	7/1/2009 17:00
F2	Sr-90'	0.5	12122	1140	70.5	7/1/2009 17:01
F2	Sr-90'	0.5	14514	1170	70.5	7/1/2009 17:02
F2	Sr-90'	0.5	16669	1200	64.7	7/1/2009 17:02
F2	Sr-90'	0.5	18558	1230	50.8	7/1/2009 17:03
F2	Sr-90'	0.5	19798	1260	30.8	7/1/2009 17:04
F2	Sr-90'	0.5	20571	1290	14.2	7/1/2009 17:04
F2	Sr-90'	0.48	20276	1320	4.2	7/1/2009 17:05
F2	Sr-90'	0.48	20444	1350	-2.3	7/1/2009 17:05
F2	Sr-90'	0.48	20498	1380	-0.7	7/1/2009 17:06
F2	Sr-90'	0.47	20110	1410	0.6	7/1/2009 17:07
F2	Sr-90'	0.47	20341	1440	0.6	7/1/2009 17:07
F2	Sr-90'	0.48	20608	1470	2.6	7/1/2009 17:08
F2	Sr-90'	0.47	20343	1500	1.8	7/1/2009 17:09
F2	Sr-90'	0.48	20506	1530	-0.2	7/1/2009 17:09
F2	Sr-90'	0.48	20655	1560	1.8	7/1/2009 17:10
F2	Sr-90'	0.47	20420	1590	-0.3	7/1/2009 17:10

**Plateau Raw Data**

F2	Sr-90'	0.48	20663	1620		7/1/2009 17:11
F2	Sr-90'	0.47	20459	1650		7/1/2009 17:12
F3	Sr-90'	0.11	4	750		7/1/2009 16:53
F3	Sr-90'	0.5	50	780		7/1/2009 16:54
F3	Sr-90'	0.5	177	810	6.3	7/1/2009 16:54
F3	Sr-90'	0.5	380	840	10.6	7/1/2009 16:55
F3	Sr-90'	0.5	779	870	14.1	7/1/2009 16:56
F3	Sr-90'	0.5	1332	900	17.5	7/1/2009 16:56
F3	Sr-90'	0.5	1821	930	21.0	7/1/2009 16:57
F3	Sr-90'	0.5	2490	960	24.7	7/1/2009 16:57
F3	Sr-90'	0.5	3348	990	30.7	7/1/2009 16:58
F3	Sr-90'	0.5	4268	1020	37.1	7/1/2009 16:59
F3	Sr-90'	0.5	5535	1050	43.6	7/1/2009 16:59
F3	Sr-90'	0.5	6954	1080	49.9	7/1/2009 17:00
F3	Sr-90'	0.5	8548	1110	54.8	7/1/2009 17:00
F3	Sr-90'	0.5	10239	1140	59.6	7/1/2009 17:01
F3	Sr-90'	0.5	12114	1170	60.8	7/1/2009 17:02
F3	Sr-90'	0.5	14106	1200	57.4	7/1/2009 17:02
F3	Sr-90'	0.5	15735	1230	48.0	7/1/2009 17:03
F3	Sr-90'	0.5	17035	1260	35.4	7/1/2009 17:04
F3	Sr-90'	0.5	17852	1290	25.4	7/1/2009 17:04
F3	Sr-90'	0.5	18355	1320	15.1	7/1/2009 17:05
F3	Sr-90'	0.5	18889	1350	7.9	7/1/2009 17:05
F3	Sr-90'	0.5	18778	1380	4.9	7/1/2009 17:06
F3	Sr-90'	0.5	18827	1410	2.1	7/1/2009 17:07
F3	Sr-90'	0.5	19124	1440	2.7	7/1/2009 17:07
F3	Sr-90'	0.5	19026	1470	1.2	7/1/2009 17:08
F3	Sr-90'	0.5	19090	1500	-0.3	7/1/2009 17:09
F3	Sr-90'	0.5	19021	1530	0.7	7/1/2009 17:09
F3	Sr-90'	0.5	19089	1560	1.2	7/1/2009 17:10
F3	Sr-90'	0.5	19128	1590	2.1	7/1/2009 17:10
F3	Sr-90'	0.5	19221	1620		7/1/2009 17:11
F3	Sr-90'	0.5	19274	1650		7/1/2009 17:12
F4	Sr-90'	0.12	0	750		7/1/2009 16:53
F4	Sr-90'	0.11	0	780		7/1/2009 16:54
F4	Sr-90'	0.5	125	810	5.6	7/1/2009 16:54
F4	Sr-90'	0.5	346	840	9.4	7/1/2009 16:55
F4	Sr-90'	0.5	671	870	13.3	7/1/2009 16:56
F4	Sr-90'	0.5	1133	900	16.8	7/1/2009 16:56
F4	Sr-90'	0.5	1726	930	20.4	7/1/2009 16:57
F4	Sr-90'	0.5	2343	960	24.5	7/1/2009 16:57
F4	Sr-90'	0.5	3123	990	28.7	7/1/2009 16:58
F4	Sr-90'	0.5	4105	1020	34.6	7/1/2009 16:59
F4	Sr-90'	0.5	5144	1050	40.7	7/1/2009 16:59
F4	Sr-90'	0.5	6524	1080	46.8	7/1/2009 17:00
F4	Sr-90'	0.5	8020	1110	53.6	7/1/2009 17:00
F4	Sr-90'	0.5	9687	1140	59.4	7/1/2009 17:01
F4	Sr-90'	0.5	11603	1170	59.9	7/1/2009 17:02
F4	Sr-90'	0.5	13644	1200	58.2	7/1/2009 17:02
F4	Sr-90'	0.5	15027	1230	50.3	7/1/2009 17:03
F4	Sr-90'	0.5	16711	1260	38.9	7/1/2009 17:04
F4	Sr-90'	0.5	17608	1290	27.3	7/1/2009 17:04
F4	Sr-90'	0.5	18185	1320	15.4	7/1/2009 17:05
F4	Sr-90'	0.5	18391	1350	9.8	7/1/2009 17:05
F4	Sr-90'	0.5	18626	1380	5.6	7/1/2009 17:06
F4	Sr-90'	0.5	18863	1410	3.4	7/1/2009 17:07
F4	Sr-90'	0.5	18792	1440	2.1	7/1/2009 17:07
F4	Sr-90'	0.5	18816	1470	-0.5	7/1/2009 17:08
F4	Sr-90'	0.5	18962	1500	1.5	7/1/2009 17:09
F4	Sr-90'	0.5	18700	1530	1.6	7/1/2009 17:09
F4	Sr-90'	0.5	19073	1560	0.5	7/1/2009 17:10
F4	Sr-90'	0.5	18996	1590	1.6	7/1/2009 17:10



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F4	Sr-90'	0.5	18893	1620		7/1/2009 17:11
F4	Sr-90'	0.5	19035	1650		7/1/2009 17:12
G1	Sr-90'	0.11	2	750		7/1/2009 16:53
G1	Sr-90'	0.11	8	780		7/1/2009 16:54
G1	Sr-90'	0.5	142	810	5.3	7/1/2009 16:54
G1	Sr-90'	0.5	309	840	8.5	7/1/2009 16:54
G1	Sr-90'	0.5	643	870	11.6	7/1/2009 16:55
G1	Sr-90'	0.5	1029	900	14.5	7/1/2009 16:56
G1	Sr-90'	0.5	1529	930	17.1	7/1/2009 16:56
G1	Sr-90'	0.5	2045	960	20.8	7/1/2009 16:57
G1	Sr-90'	0.5	2698	990	24.9	7/1/2009 16:58
G1	Sr-90'	0.5	3567	1020	30.5	7/1/2009 16:58
G1	Sr-90'	0.5	4501	1050	34.9	7/1/2009 16:59
G1	Sr-90'	0.5	5717	1080	42.1	7/1/2009 16:59
G1	Sr-90'	0.5	6865	1110	49.7	7/1/2009 17:00
G1	Sr-90'	0.5	8707	1140	54.5	7/1/2009 17:01
G1	Sr-90'	0.5	10467	1170	57.3	7/1/2009 17:01
G1	Sr-90'	0.5	12095	1200	52.8	7/1/2009 17:02
G1	Sr-90'	0.5	13759	1230	47.4	7/1/2009 17:03
G1	Sr-90'	0.5	14976	1260	37.0	7/1/2009 17:03
G1	Sr-90'	0.5	16137	1290	25.1	7/1/2009 17:04
G1	Sr-90'	0.5	16455	1320	16.0	7/1/2009 17:04
G1	Sr-90'	0.5	16791	1350	8.1	7/1/2009 17:05
G1	Sr-90'	0.5	17045	1380	5.8	7/1/2009 17:06
G1	Sr-90'	0.5	17060	1410	2.2	7/1/2009 17:06
G1	Sr-90'	0.5	17183	1440	0.5	7/1/2009 17:07
G1	Sr-90'	0.5	17051	1470	-0.1	7/1/2009 17:08
G1	Sr-90'	0.5	17124	1500	0.2	7/1/2009 17:08
G1	Sr-90'	0.5	17071	1530	1.3	7/1/2009 17:09
G1	Sr-90'	0.5	17202	1560	0.7	7/1/2009 17:09
G1	Sr-90'	0.5	17214	1590	1.5	7/1/2009 17:10
G1	Sr-90'	0.5	17159	1620		7/1/2009 17:11
G1	Sr-90'	0.5	17321	1650		7/1/2009 17:11
G2	Sr-90'	0.11	2	750		7/1/2009 16:53
G2	Sr-90'	0.11	8	780		7/1/2009 16:54
G2	Sr-90'	0.5	148	810	5.7	7/1/2009 16:54
G2	Sr-90'	0.5	324	840	9.1	7/1/2009 16:54
G2	Sr-90'	0.5	700	870	12.3	7/1/2009 16:55
G2	Sr-90'	0.5	1101	900	15.5	7/1/2009 16:56
G2	Sr-90'	0.5	1601	930	18.8	7/1/2009 16:56
G2	Sr-90'	0.5	2197	960	23.0	7/1/2009 16:57
G2	Sr-90'	0.5	2979	990	28.0	7/1/2009 16:58
G2	Sr-90'	0.5	3866	1020	33.2	7/1/2009 16:58
G2	Sr-90'	0.5	4971	1050	38.4	7/1/2009 16:59
G2	Sr-90'	0.5	6177	1080	44.0	7/1/2009 16:59
G2	Sr-90'	0.5	7579	1110	50.4	7/1/2009 17:00
G2	Sr-90'	0.5	9156	1140	56.2	7/1/2009 17:01
G2	Sr-90'	0.5	11042	1170	59.0	7/1/2009 17:01
G2	Sr-90'	0.5	12872	1200	58.2	7/1/2009 17:02
G2	Sr-90'	0.5	14577	1230	50.9	7/1/2009 17:03
G2	Sr-90'	0.5	16124	1260	38.8	7/1/2009 17:03
G2	Sr-90'	0.5	17054	1290	26.4	7/1/2009 17:04
G2	Sr-90'	0.5	17456	1320	16.4	7/1/2009 17:04
G2	Sr-90'	0.5	17867	1350	9.5	7/1/2009 17:05
G2	Sr-90'	0.5	18172	1380	5.6	7/1/2009 17:06
G2	Sr-90'	0.5	18119	1410	3.2	7/1/2009 17:06
G2	Sr-90'	0.5	18174	1440	2.4	7/1/2009 17:07
G2	Sr-90'	0.5	18347	1470	2.6	7/1/2009 17:08
G2	Sr-90'	0.5	18411	1500	2.6	7/1/2009 17:08
G2	Sr-90'	0.5	18383	1530	0.5	7/1/2009 17:09
G2	Sr-90'	0.5	18551	1560	0.4	7/1/2009 17:09
G2	Sr-90'	0.5	18352	1590	-1.0	7/1/2009 17:10

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G2	Sr-90'	0.5	18482	1620		7/1/2009 17:11
G2	Sr-90'	0.5	18274	1650		7/1/2009 17:11
G3	Sr-90'	0.11	1	750		7/1/2009 16:53
G3	Sr-90'	0.12	0	780		7/1/2009 16:54
G3	Sr-90'	0.5	43	810	2.8	7/1/2009 16:54
G3	Sr-90'	0.5	140	840	6.1	7/1/2009 16:54
G3	Sr-90'	0.5	346	870	10.0	7/1/2009 16:55
G3	Sr-90'	0.5	770	900	13.8	7/1/2009 16:56
G3	Sr-90'	0.5	1233	930	17.3	7/1/2009 16:56
G3	Sr-90'	0.5	1759	960	21.4	7/1/2009 16:57
G3	Sr-90'	0.5	2451	990	25.6	7/1/2009 16:58
G3	Sr-90'	0.5	3366	1020	31.4	7/1/2009 16:58
G3	Sr-90'	0.5	4276	1050	35.9	7/1/2009 16:59
G3	Sr-90'	0.5	5558	1080	42.3	7/1/2009 16:59
G3	Sr-90'	0.5	6744	1110	49.0	7/1/2009 17:00
G3	Sr-90'	0.5	8480	1140	55.9	7/1/2009 17:01
G3	Sr-90'	0.5	10165	1170	63.6	7/1/2009 17:01
G3	Sr-90'	0.5	12235	1200	67.0	7/1/2009 17:02
G3	Sr-90'	0.5	14404	1230	67.4	7/1/2009 17:03
G3	Sr-90'	0.5	16407	1260	59.3	7/1/2009 17:03
G3	Sr-90'	0.5	18185	1290	47.6	7/1/2009 17:04
G3	Sr-90'	0.5	19233	1320	33.5	7/1/2009 17:04
G3	Sr-90'	0.5	20131	1350	19.1	7/1/2009 17:05
G3	Sr-90'	0.5	20459	1380	9.5	7/1/2009 17:06
G3	Sr-90'	0.49	20432	1410	3.7	7/1/2009 17:06
G3	Sr-90'	0.49	20500	1440	1.6	7/1/2009 17:07
G3	Sr-90'	0.49	20665	1470	-0.3	7/1/2009 17:08
G3	Sr-90'	0.49	20578	1500	-1.6	7/1/2009 17:08
G3	Sr-90'	0.48	20348	1530	-1.6	7/1/2009 17:09
G3	Sr-90'	0.48	20420	1560	1.5	7/1/2009 17:09
G3	Sr-90'	0.48	20503	1590	3.3	7/1/2009 17:10
G3	Sr-90'	0.48	20725	1620		7/1/2009 17:11
G3	Sr-90'	0.48	20692	1650		7/1/2009 17:11
G4	Sr-90'	0.12	0	750		7/1/2009 16:53
G4	Sr-90'	0.12	2	780		7/1/2009 16:54
G4	Sr-90'	0.12	10	810	2.1	7/1/2009 16:54
G4	Sr-90'	0.5	96	840	4.3	7/1/2009 16:54
G4	Sr-90'	0.5	266	870	7.1	7/1/2009 16:55
G4	Sr-90'	0.5	522	900	9.6	7/1/2009 16:56
G4	Sr-90'	0.5	858	930	11.1	7/1/2009 16:56
G4	Sr-90'	0.5	1238	960	13.8	7/1/2009 16:57
G4	Sr-90'	0.5	1580	990	16.0	7/1/2009 16:58
G4	Sr-90'	0.5	2232	1020	19.4	7/1/2009 16:58
G4	Sr-90'	0.5	2756	1050	24.6	7/1/2009 16:59
G4	Sr-90'	0.5	3567	1080	28.0	7/1/2009 16:59
G4	Sr-90'	0.5	4603	1110	33.4	7/1/2009 17:00
G4	Sr-90'	0.5	5501	1140	38.6	7/1/2009 17:01
G4	Sr-90'	0.5	6802	1170	41.7	7/1/2009 17:01
G4	Sr-90'	0.5	8262	1200	44.3	7/1/2009 17:02
G4	Sr-90'	0.5	9472	1230	42.5	7/1/2009 17:03
G4	Sr-90'	0.5	10818	1260	38.5	7/1/2009 17:03
G4	Sr-90'	0.5	11904	1290	32.4	7/1/2009 17:04
G4	Sr-90'	0.5	12821	1320	23.7	7/1/2009 17:04
G4	Sr-90'	0.5	13335	1350	16.3	7/1/2009 17:05
G4	Sr-90'	0.5	13662	1380	8.9	7/1/2009 17:06
G4	Sr-90'	0.5	13925	1410	5.9	7/1/2009 17:06
G4	Sr-90'	0.5	13865	1440	2.8	7/1/2009 17:07
G4	Sr-90'	0.5	14125	1470	0.9	7/1/2009 17:08
G4	Sr-90'	0.5	13975	1500	2.0	7/1/2009 17:08
G4	Sr-90'	0.5	14009	1530	2.4	7/1/2009 17:09
G4	Sr-90'	0.5	14226	1560	3.7	7/1/2009 17:09
G4	Sr-90'	0.5	14366	1590	2.1	7/1/2009 17:10

**Plateau Raw Data**

G4	Sr-90'	0.5	14354	1620		7/1/2009 17:11
G4	Sr-90'	0.5	14254	1650		7/1/2009 17:11
H1	Sr-90'	0.11	3	750		7/1/2009 16:53
H1	Sr-90'	0.12	4	780		7/1/2009 16:54
H1	Sr-90'	0.5	120	810	5.0	7/1/2009 16:54
H1	Sr-90'	0.5	277	840	8.3	7/1/2009 16:55
H1	Sr-90'	0.5	613	870	11.3	7/1/2009 16:55
H1	Sr-90'	0.5	1000	900	15.1	7/1/2009 16:56
H1	Sr-90'	0.5	1459	930	18.3	7/1/2009 16:56
H1	Sr-90'	0.5	2112	960	22.4	7/1/2009 16:57
H1	Sr-90'	0.5	2797	990	26.1	7/1/2009 16:58
H1	Sr-90'	0.5	3684	1020	31.3	7/1/2009 16:58
H1	Sr-90'	0.5	4585	1050	36.5	7/1/2009 16:59
H1	Sr-90'	0.5	5908	1080	43.0	7/1/2009 17:00
H1	Sr-90'	0.5	7164	1110	49.9	7/1/2009 17:00
H1	Sr-90'	0.5	8847	1140	54.0	7/1/2009 17:01
H1	Sr-90'	0.5	10607	1170	56.0	7/1/2009 17:01
H1	Sr-90'	0.5	12293	1200	52.8	7/1/2009 17:02
H1	Sr-90'	0.5	13845	1230	45.0	7/1/2009 17:03
H1	Sr-90'	0.5	15147	1260	35.9	7/1/2009 17:03
H1	Sr-90'	0.5	15927	1290	24.6	7/1/2009 17:04
H1	Sr-90'	0.5	16632	1320	15.7	7/1/2009 17:05
H1	Sr-90'	0.5	16799	1350	10.3	7/1/2009 17:05
H1	Sr-90'	0.5	17067	1380	6.6	7/1/2009 17:06
H1	Sr-90'	0.5	17254	1410	5.4	7/1/2009 17:06
H1	Sr-90'	0.5	17390	1440	2.6	7/1/2009 17:07
H1	Sr-90'	0.5	17444	1470	-1.0	7/1/2009 17:08
H1	Sr-90'	0.5	17357	1500	-0.5	7/1/2009 17:08
H1	Sr-90'	0.5	17121	1530	1.8	7/1/2009 17:09
H1	Sr-90'	0.5	17478	1560	3.5	7/1/2009 17:10
H1	Sr-90'	0.5	17655	1590	2.8	7/1/2009 17:10
H1	Sr-90'	0.5	17621	1620	20.4	7/1/2009 17:11
H1	Sr-90'	0.5	17476	1650		7/1/2009 17:11
H2	Sr-90'	0.11	0	750		7/1/2009 16:53
H2	Sr-90'	0.11	2	780		7/1/2009 16:54
H2	Sr-90'	0.11	9	810	3.0	7/1/2009 16:54
H2	Sr-90'	0.5	130	840	5.7	7/1/2009 16:55
H2	Sr-90'	0.5	386	870	8.8	7/1/2009 16:55
H2	Sr-90'	0.5	671	900	11.9	7/1/2009 16:56
H2	Sr-90'	0.5	1065	930	14.0	7/1/2009 16:56
H2	Sr-90'	0.5	1570	960	18.0	7/1/2009 16:57
H2	Sr-90'	0.5	2032	990	22.2	7/1/2009 16:58
H2	Sr-90'	0.5	2889	1020	26.1	7/1/2009 16:58
H2	Sr-90'	0.5	3732	1050	31.4	7/1/2009 16:59
H2	Sr-90'	0.5	4634	1080	34.9	7/1/2009 17:00
H2	Sr-90'	0.5	5875	1110	40.7	7/1/2009 17:00
H2	Sr-90'	0.5	7057	1140	46.8	7/1/2009 17:01
H2	Sr-90'	0.5	8628	1170	52.3	7/1/2009 17:01
H2	Sr-90'	0.5	10272	1200	54.8	7/1/2009 17:02
H2	Sr-90'	0.5	12110	1230	50.3	7/1/2009 17:03
H2	Sr-90'	0.5	13536	1260	42.6	7/1/2009 17:03
H2	Sr-90'	0.5	14535	1290	31.4	7/1/2009 17:04
H2	Sr-90'	0.5	15451	1320	21.6	7/1/2009 17:05
H2	Sr-90'	0.5	15866	1350	13.4	7/1/2009 17:05
H2	Sr-90'	0.5	16110	1380	7.8	7/1/2009 17:06
H2	Sr-90'	0.5	16214	1410	5.3	7/1/2009 17:06
H2	Sr-90'	0.5	16443	1440	2.9	7/1/2009 17:07
H2	Sr-90'	0.5	16489	1470	1.2	7/1/2009 17:08
H2	Sr-90'	0.5	16408	1500	0.0	7/1/2009 17:08
H2	Sr-90'	0.5	16413	1530	1.6	7/1/2009 17:09
H2	Sr-90'	0.5	16476	1560	0.9	7/1/2009 17:10
H2	Sr-90'	0.5	16689	1590	0.2	7/1/2009 17:10

**Plateau Raw Data**

H2	Sr-90'	0.5	16407	1620		7/1/2009 17:11
H2	Sr-90'	0.5	16470	1650		7/1/2009 17:11
H3	Sr-90'	0.11	0	750		7/1/2009 16:53
H3	Sr-90'	0.11	2	780		7/1/2009 16:54
H3	Sr-90'	0.11	10	810	2.2	7/1/2009 16:54
H3	Sr-90'	0.5	107	840	5.0	7/1/2009 16:55
H3	Sr-90'	0.5	281	870	8.6	7/1/2009 16:55
H3	Sr-90'	0.5	620	900	12.4	7/1/2009 16:56
H3	Sr-90'	0.5	1041	930	16.8	7/1/2009 16:56
H3	Sr-90'	0.5	1590	960	20.0	7/1/2009 16:57
H3	Sr-90'	0.5	2316	990	24.3	7/1/2009 16:58
H3	Sr-90'	0.5	2989	1020	29.6	7/1/2009 16:58
H3	Sr-90'	0.5	3989	1050	35.8	7/1/2009 16:59
H3	Sr-90'	0.5	5187	1080	42.4	7/1/2009 17:00
H3	Sr-90'	0.5	6593	1110	48.1	7/1/2009 17:00
H3	Sr-90'	0.5	8042	1140	56.1	7/1/2009 17:01
H3	Sr-90'	0.5	9778	1170	62.8	7/1/2009 17:01
H3	Sr-90'	0.5	12005	1200	68.0	7/1/2009 17:02
H3	Sr-90'	0.5	14024	1230	67.5	7/1/2009 17:03
H3	Sr-90'	0.5	16121	1260	59.0	7/1/2009 17:03
H3	Sr-90'	0.5	17840	1290	49.1	7/1/2009 17:04
H3	Sr-90'	0.5	18952	1320	33.9	7/1/2009 17:05
H3	Sr-90'	0.5	19970	1350	20.2	7/1/2009 17:05
H3	Sr-90'	0.5	20148	1380	11.3	7/1/2009 17:06
H3	Sr-90'	0.5	20279	1410	3.1	7/1/2009 17:06
H3	Sr-90'	0.5	20488	1440	1.9	7/1/2009 17:07
H3	Sr-90'	0.49	20260	1470	1.2	7/1/2009 17:08
H3	Sr-90'	0.5	20448	1500	0.3	7/1/2009 17:08
H3	Sr-90'	0.49	20478	1530	0.5	7/1/2009 17:09
H3	Sr-90'	0.49	20420	1560	-1.7	7/1/2009 17:10
H3	Sr-90'	0.49	20351	1590	-1.3	7/1/2009 17:10
H3	Sr-90'	0.49	20252	1620		7/1/2009 17:11
H3	Sr-90'	0.49	20370	1650		7/1/2009 17:11
H4	Sr-90'	0.12	1	750		7/1/2009 16:53
H4	Sr-90'	0.11	3	780		7/1/2009 16:54
H4	Sr-90'	0.11	6	810	2.6	7/1/2009 16:54
H4	Sr-90'	0.5	150	840	5.2	7/1/2009 16:55
H4	Sr-90'	0.5	313	870	8.6	7/1/2009 16:55
H4	Sr-90'	0.5	632	900	11.7	7/1/2009 16:56
H4	Sr-90'	0.5	1050	930	16.1	7/1/2009 16:56
H4	Sr-90'	0.5	1541	960	19.0	7/1/2009 16:57
H4	Sr-90'	0.5	2266	990	21.7	7/1/2009 16:58
H4	Sr-90'	0.5	2881	1020	26.3	7/1/2009 16:58
H4	Sr-90'	0.5	3633	1050	31.4	7/1/2009 16:59
H4	Sr-90'	0.5	4798	1080	36.1	7/1/2009 17:00
H4	Sr-90'	0.5	6014	1110	42.2	7/1/2009 17:00
H4	Sr-90'	0.5	7109	1140	46.2	7/1/2009 17:01
H4	Sr-90'	0.5	8810	1170	50.5	7/1/2009 17:01
H4	Sr-90'	0.5	10328	1200	53.0	7/1/2009 17:02
H4	Sr-90'	0.5	11973	1230	48.7	7/1/2009 17:03
H4	Sr-90'	0.5	13484	1260	43.5	7/1/2009 17:03
H4	Sr-90'	0.5	14544	1290	33.5	7/1/2009 17:04
H4	Sr-90'	0.5	15574	1320	21.0	7/1/2009 17:05
H4	Sr-90'	0.5	15946	1350	13.2	7/1/2009 17:05
H4	Sr-90'	0.5	15928	1380	8.1	7/1/2009 17:06
H4	Sr-90'	0.5	16344	1410	7.2	7/1/2009 17:06
H4	Sr-90'	0.5	16589	1440	5.8	7/1/2009 17:07
H4	Sr-90'	0.5	16693	1470	1.0	7/1/2009 17:08
H4	Sr-90'	0.5	16624	1500	0.0	7/1/2009 17:08
H4	Sr-90'	0.5	16474	1530	-1.0	7/1/2009 17:09
H4	Sr-90'	0.5	16692	1560	-0.1	7/1/2009 17:10
H4	Sr-90'	0.5	16507	1590	-0.7	7/1/2009 17:10

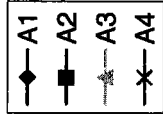
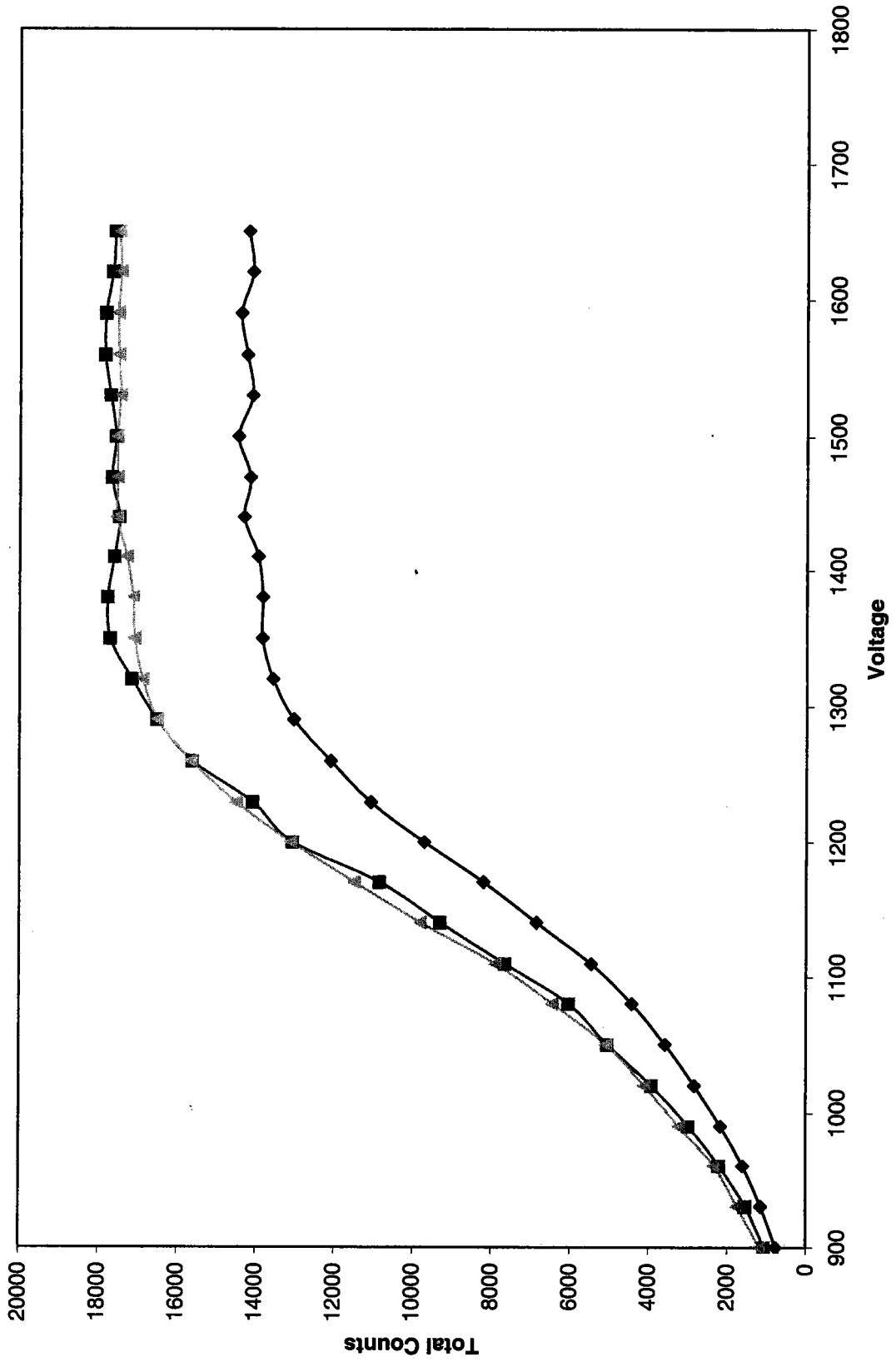
**Plateau Raw Data**

H4 Sr-90'  
H4 Sr-90'

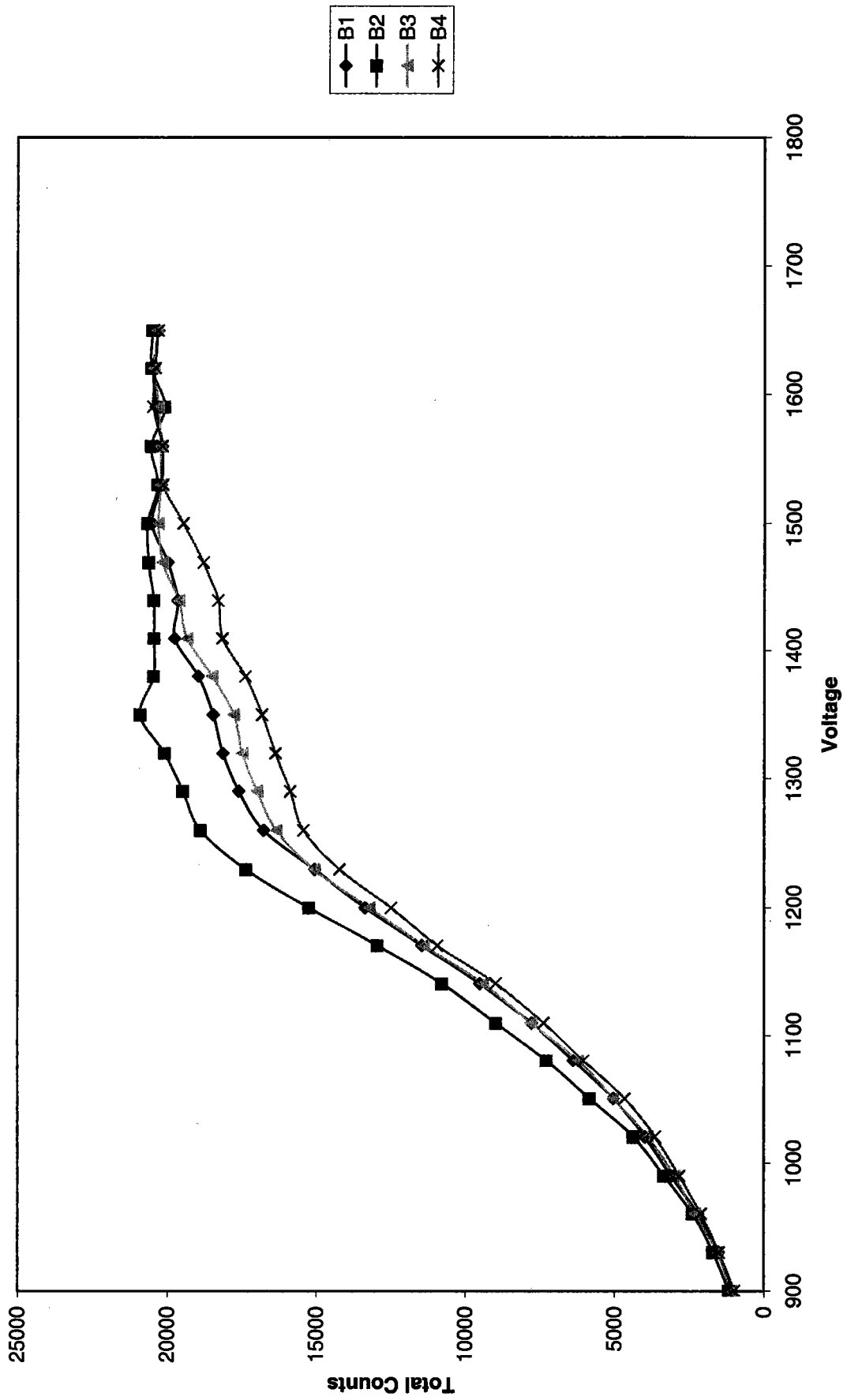
0.5 16597 1620  
0.5 16414 1650

7/1/2009 17:11  
7/1/2009 17:11

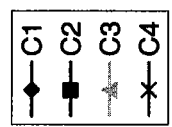
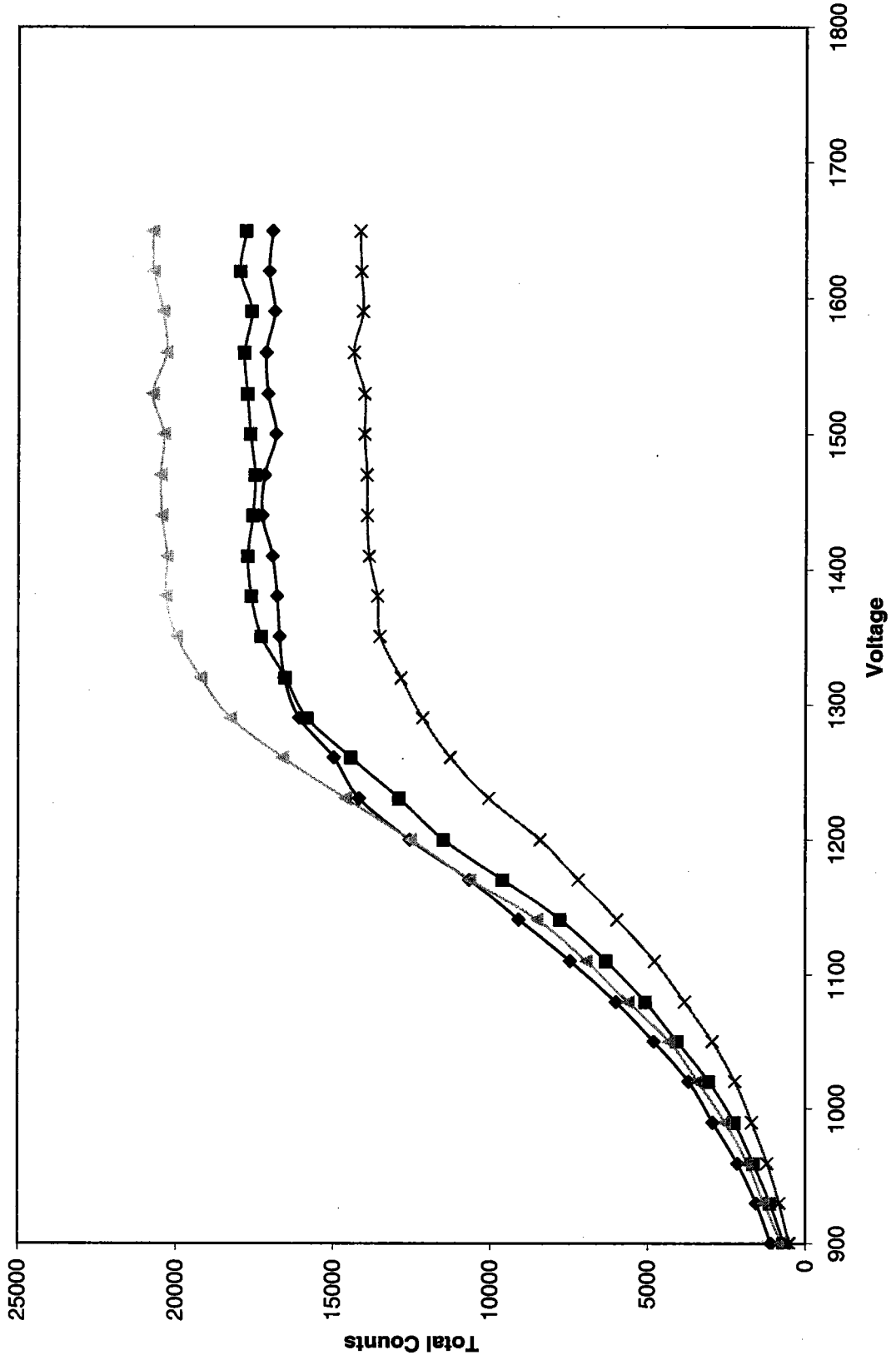
LB4100 Plateau - A Drawer



LB4100 Plateau - B Drawer

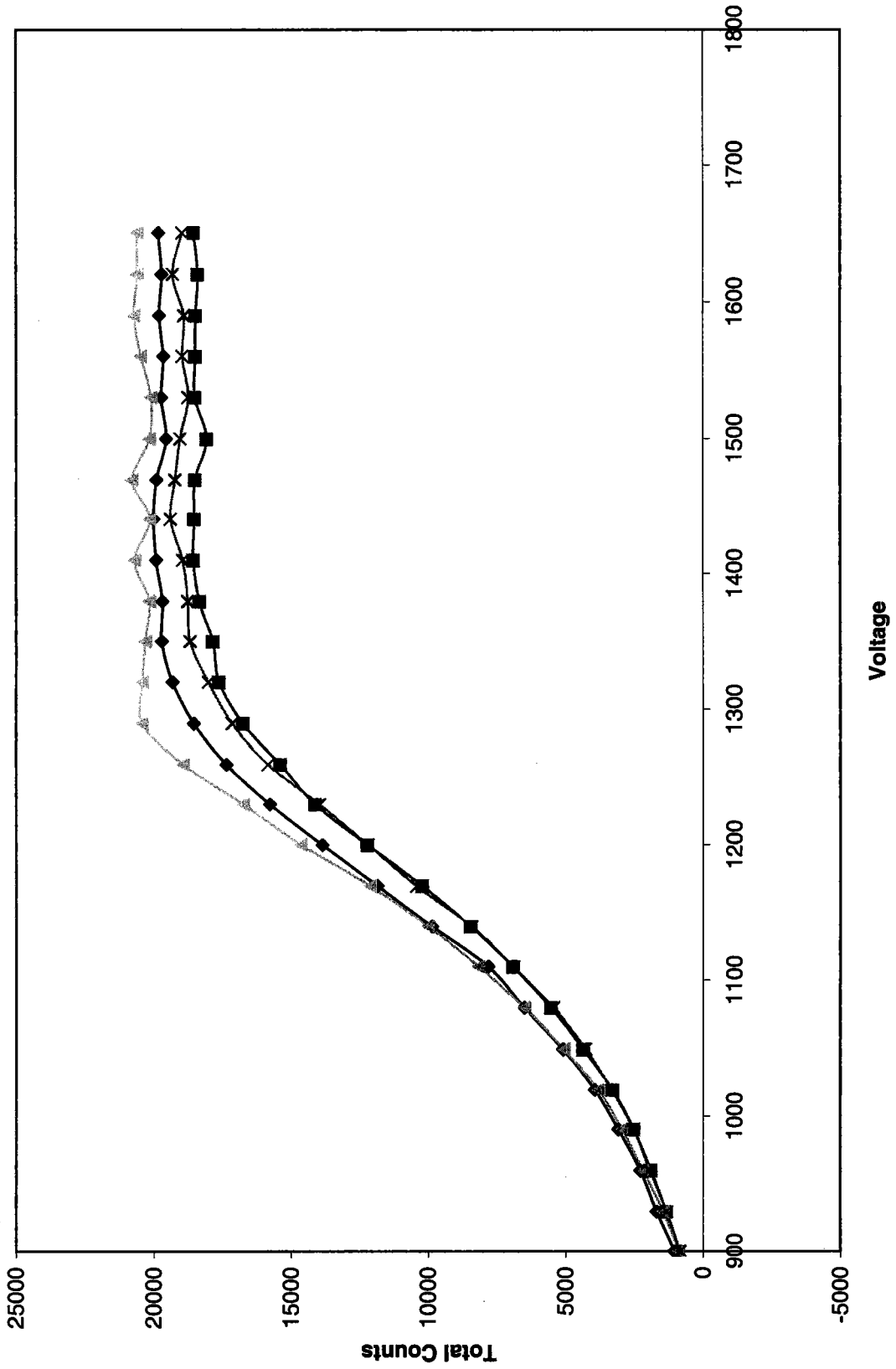


LB4100 Plateau - C Drawer

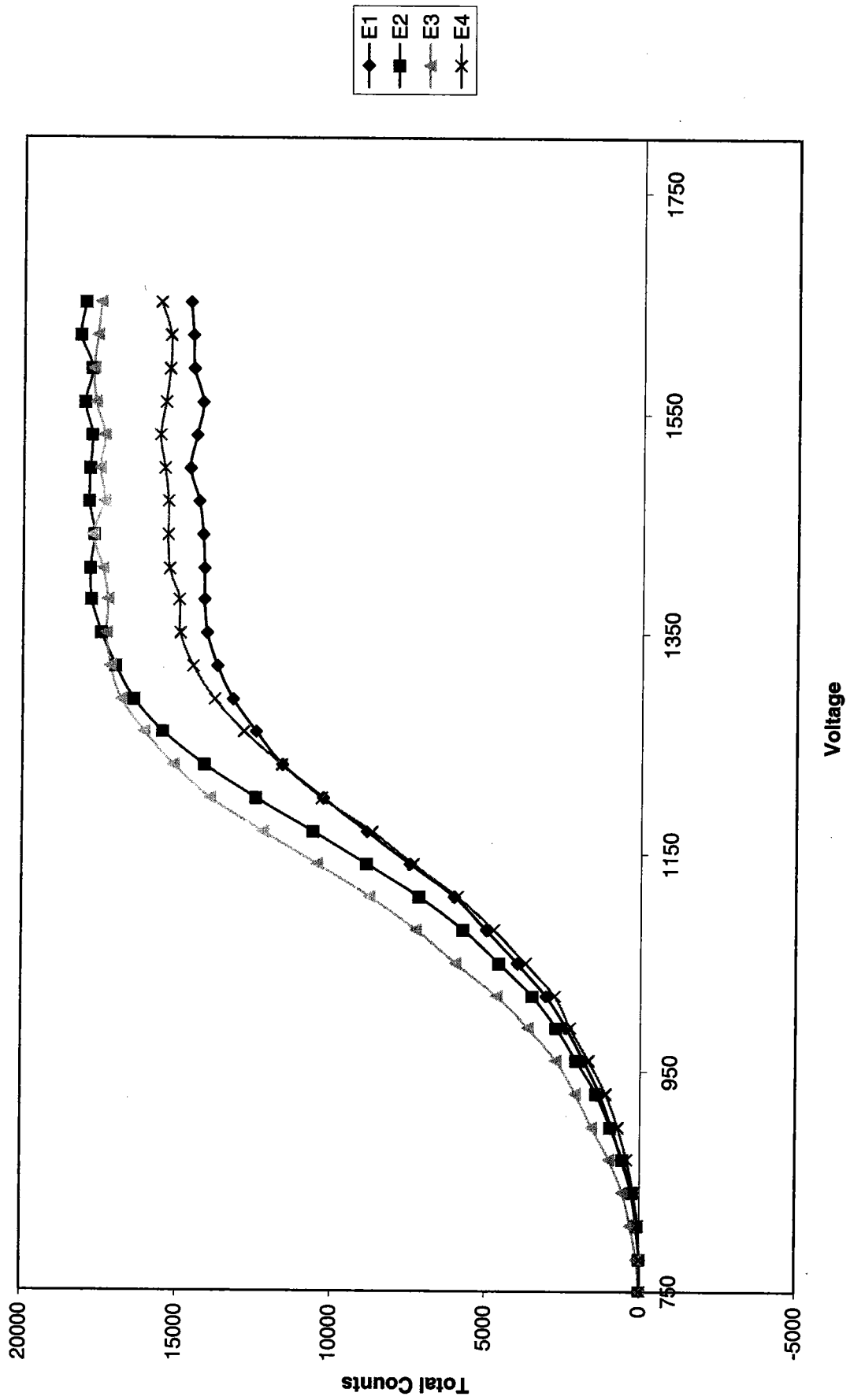




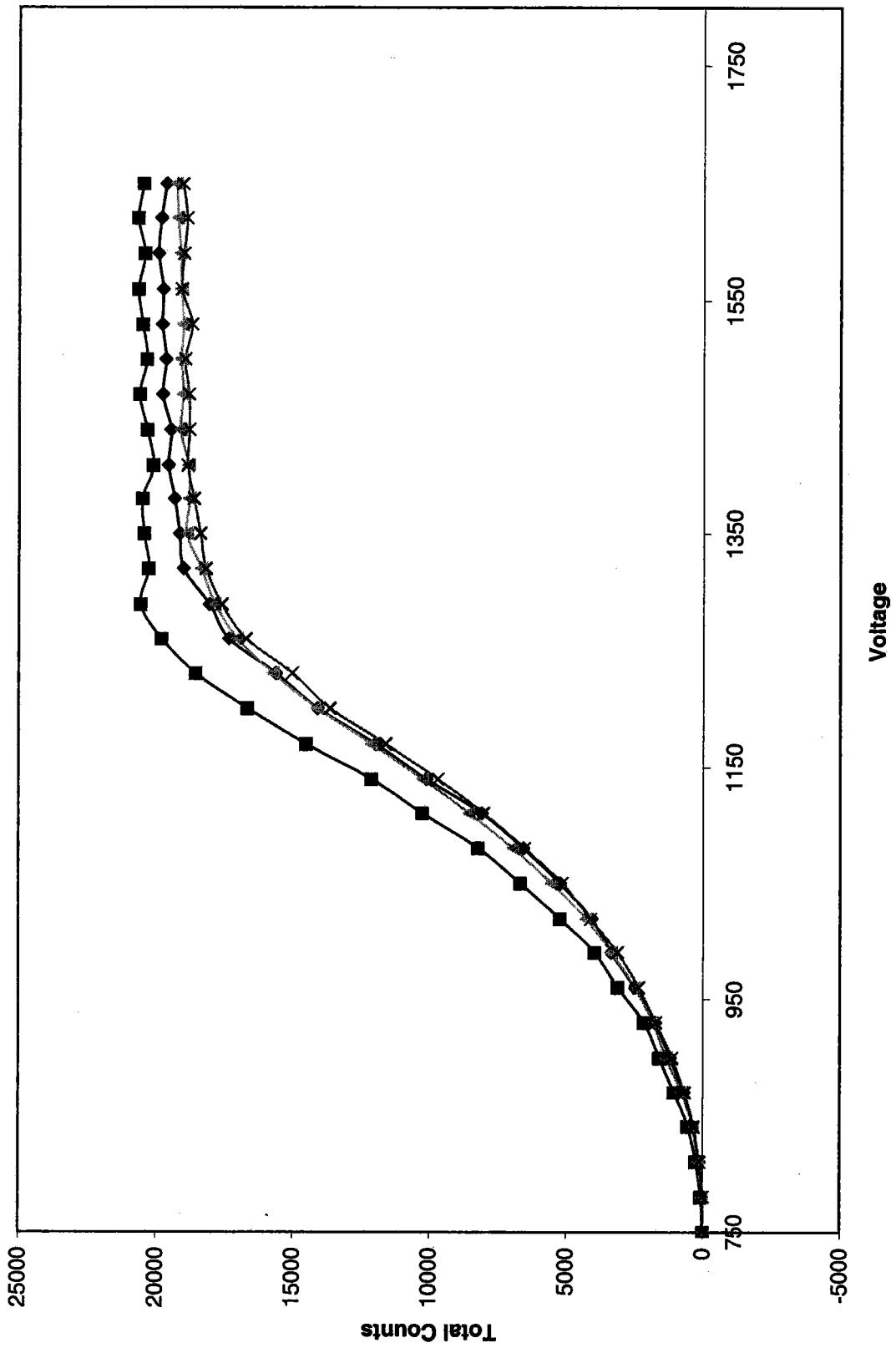
LB4100 Plateau - D Drawer



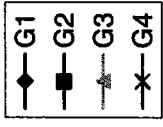
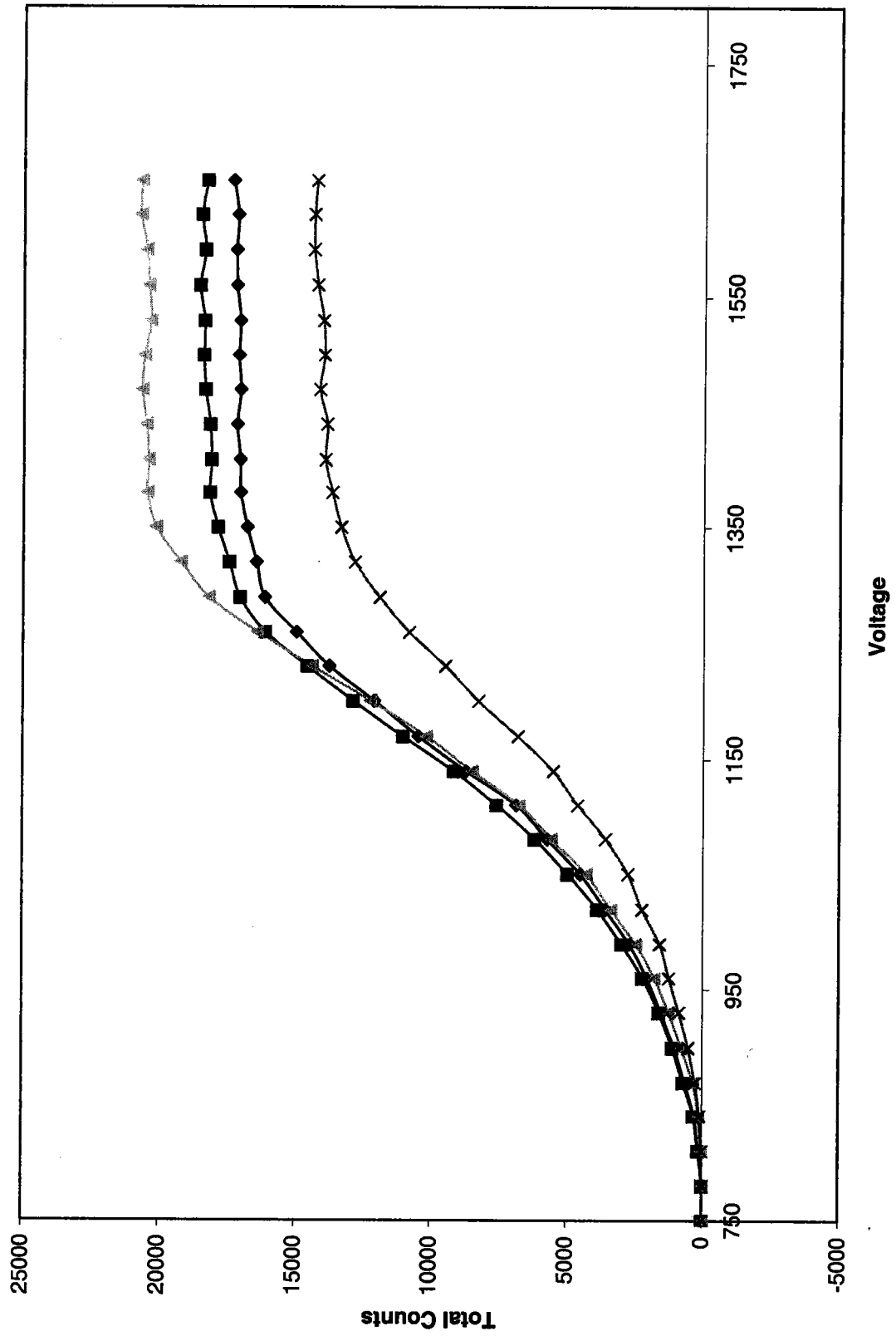
LB4100 Plateau - E Drawer



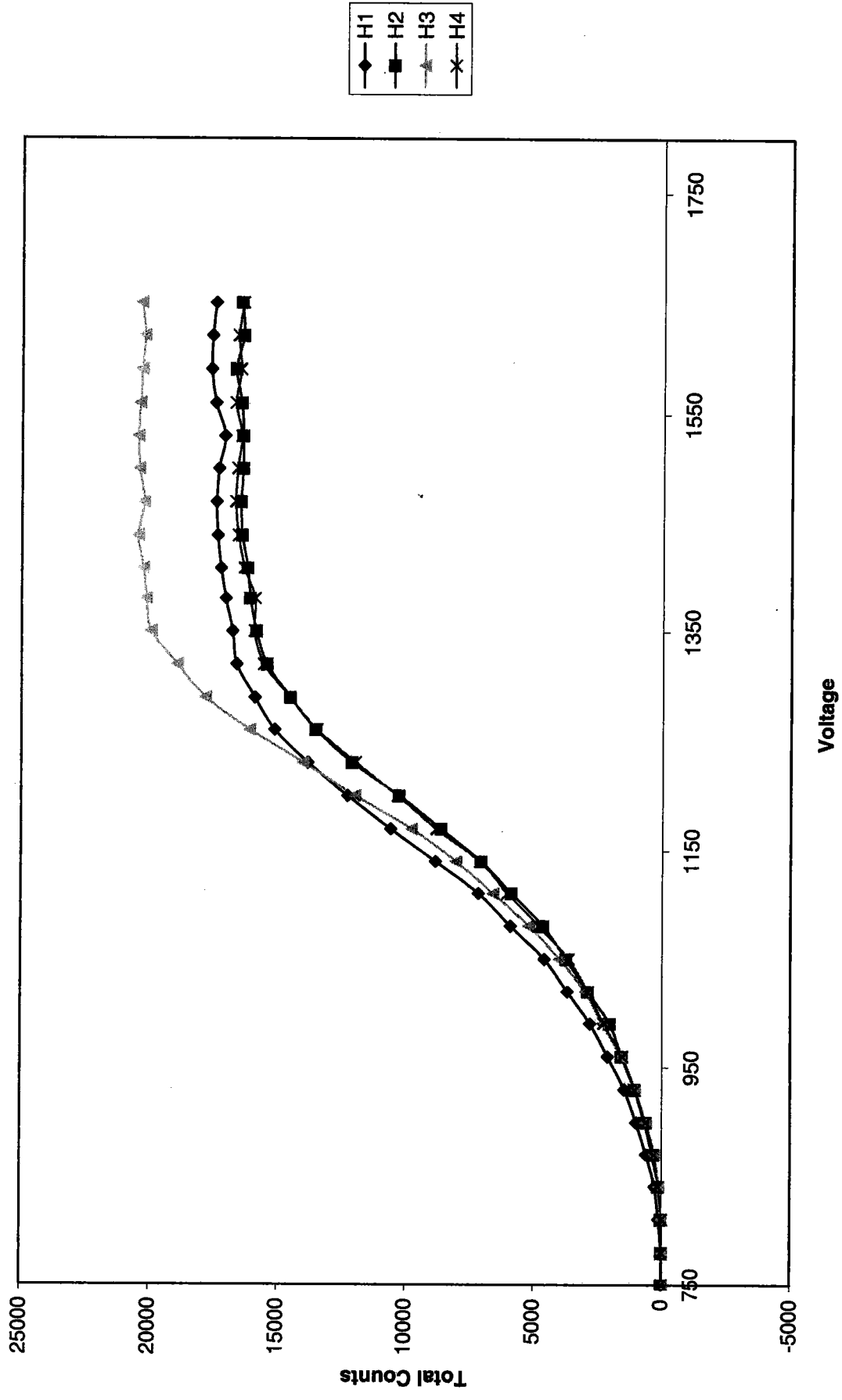
LB4100 Plateau - F Drawer



LB4100 Plateau - G Drawer



# LB4100 Plateau - H Drawer



# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

66002-278

Ra-228 5 mL Liquid in Flame Sealed Vial

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

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

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

ISOTOPE:	Ra-228
ACTIVITY (dps):	2.367 E4
HALF-LIFE:	5.75 years
CALIBRATION DATE:	April 23, 2003 12:00 EST
TOTAL UNCERTAINTY*:	2.4%

\*95% Confidence Level

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%,  
Ra-226 <0.1%

5.31628 grams 4M HCl solution with 100  $\mu\text{g/g}$  Ba carrier.

P O NUMBER 3219 RD, Item 1

SOURCE PREPARED BY:

M. Taskaeva  
M. Taskaeva, Radiochemist

Q A APPROVED:

LM. Monty 4-23-03



# Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0553-A	Isotope:	Radium-228 SPIKE
Prepared By:	Lonnie Morris	Prepared By:	Lonnie Morris
Carrier Conc:	0.5M HCl	Prep Date:	04/25/2003
Reference Date:	04/23/2003	Verification Date:	04/27/2005
Ampoule Mass (g):	5.0235 g	Expiration Date:	04/27/2006
Uncertainty:	+/-	Primary Code:	0553-B
LogBook No:	RC-S-035-068	Dilution(mL):	1000 mL
		Mass of Parent(g):	30.535 g
		Density(g/mL):	
		Balance ID:	

### Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parm Activity (dpm/mL)}) * (\text{conversion dpm to dpm}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parm Activity (dpm/mL)}) * (\text{conversion dpm to dpm}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(30.535 \text{ g}) * (13419.8626 \text{ dpm/mL}) * (1 \text{ dpm/dpm}) / (1000 \text{ mL}) = 409.7755 \text{ dpm/mL}$
$(30.535 \text{ g}) * (13419.8626 \text{ dpm/mL}) * (1 \text{ dpm/dpm}) / (\text{g/mL}) / (1000 \text{ mL}) = \text{dpm/g}$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date

GEL Laboratories LLC  
Version 1.0 9/18/2000

**CERTIFICATE OF CALIBRATION**  
Standard Radionuclide Source

64673-278

Ra-228 5 mL Liquid in Flame Sealed Vial

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

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

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

ISOTOPE:	Ra-228
ACTIVITY (dps):	1.939 E4
HALF-LIFE:	5.75 years
CALIBRATION DATE:	October 1, 2002 12:00 EST
TOTAL UNCERTAINTY*:	3.6%
SYSTEMATIC:	3.4%
RANDOM:	1.1%

\*99% Confidence Level

Impurities:  $\gamma$ -impurities <0.1%5.02617 grams 0.1M HCl solution with 110  $\mu$ g/g Ba carrier.

P O NUMBER 3208RD, Item 2

SOURCE PREPARED BY: M. Taskaeva  
M. Taskaeva, RadiochemistQ A APPROVED: M. M. 10-2-02





# Standard Traceability Log Rad

Source Material Info	
Parent Code:	0503
Prepared By:	Angela Johnson
Carrier Conc:	0.1 M HCL
Reference Date:	10/01/2002
Ampoule Mass (g):	5.02617 g
Uncertainty:	+/- 3.6 %
LogBook No:	RC S 035 018

A Solution Material Info	
Isotope:	Radium-228
Prepared By:	Angela Johnson
Prep Date:	02/20/2003
Verification Date:	04/09/2004
Expiration Date:	04/09/2005
Primary Code:	0503-A
Dilution(mL):	100 mL
Mass of Parent(g):	4.4737 g
Density(g/mL):	0.9992
Balance ID:	

### Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (dps)}) * (\text{conversion dpm to dps}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (dps)}) * (\text{conversion dpm to dps}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$
$(4.4737 \text{ g}) * (19390 \text{ dps}) * (60 \text{ dpm/dps}) / (5.02617 \text{ g} * 100 \text{ mL}) = 10355.2060 \text{ dpm/mL}$
$(4.4737 \text{ g}) * (19390 \text{ dps}) * (60 \text{ dpm/dps}) / (0.9992 \text{ g/mL}) / (5.02617 \text{ g} * 100 \text{ mL}) = 10363.0820 \text{ dpm/g}$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
04/02/2003	Lonnie Morris	39.71	1000	0503-B	411.518 dpm/mL	09/13/2008	09/13/2009

GEL Laboratories LLC  
Version 1.0 9/18/2000

# Verification for Ra-228 Standard 0503-B

D. Roy 9/13/2008	Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff Mass. Used (mL)	Standard Source DPM/mL
	0503-B	1962.0000	45.6000	1916.4000	9.263763	1.0000 206.8705773
	0503-B	1983.2000	45.6000	1937.6000	9.263763	1.0000 209.1590642
	0503-B	1927.0000	45.6000	1881.4000	9.263763	1.0000 203.092415

Mean Value (Counting) = 206.3740189  
 Stdev = 3.063655617

Certificate Value = 200.596  
 Lower Limit = 200.2467076  
 Upper Limit = 212.5013301  
 Rule 1 Pass/Fail Pass  
 Two sigma = 6.127311233  
 10 % of Mean = 20.63740189  
 Rule 2 (Pass/Fail) Pass

102.890426  
 0.01484516 Rule 3 (Pass/Fail) Pass

## Verification Rules

- Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements
- Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
- Rule 3 = The determined mean value shall be within 10% of the certificate value.

The analyst prepared three standard verification sources for Ra-228 source 0503-B by transferring portions of the standard into glass liquid scintillation vials. Ten mL of Ready Gel liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 1 mL of DI water and 10 mL of Ready Gel cocktail. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Gold for Ra-228 source standard verification. The Ra-228 efficiency calibration which was used for verification calculations was performed on 9/13/08 using source 0683-A (Ra-228). Calibration data is recorded in this logbook under Ra-228 0683-A. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

Reference RAD SOP M-001

*Daniel D. May 9/16/08*

*Angela Johnson 9/17/08*

2019/16

PAGE: 1

16 SEP 2008 16:24

ID: TOTAL ACTIVITY

USER:11 COMMENT:GOLD

PRESET TIME : 5.00

DATA CALC : CPM H# :YES SAMPLE REPEATS: 1 PRINTER : STD

COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 :EDIT

TWO PHASE : NO AGC : NO CYCLE REPEATS : 1 DISK : OFF

SCINTILLATOR: LIQUID LUMEX:YES LOW SAMPLE REJ: 0

LOW LEVEL : NO HALF LIFE CORRECTION DATE: none

CHAN: 0.0 - 990.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

CHAN: 0.0 - 1000.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

SAM NO	POS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	11-1	5.00	98.2	50.40	12.60	54.00	12.17	0.41	5.55
2	11-2	1.30	99.3	7802.31	1.99	7803.08	1.99	0.00	7.81
3	11-3	1.30	100.4	7782.31	1.99	7786.15	1.99	0.00	10.14
4	11-4	1.35	99.2	7581.48	1.98	7585.19	1.98	0.01	12.51
5	11-5	5.00	97.9	45.60	13.25	47.20	13.02	0.43	18.61
6	11-6	5.00	110.7	1962.00	2.02	1964.80	2.02	0.01	24.65
7	11-7	5.00	110.8	1983.20	2.01	1984.80	2.01	0.01	30.75
8	11-8	5.00	110.7	1927.00	2.04	1927.80	2.04	0.02	36.85

8/19/16  
278

Sample Count Start Time:  
Data Capture Date:  
User Filename:

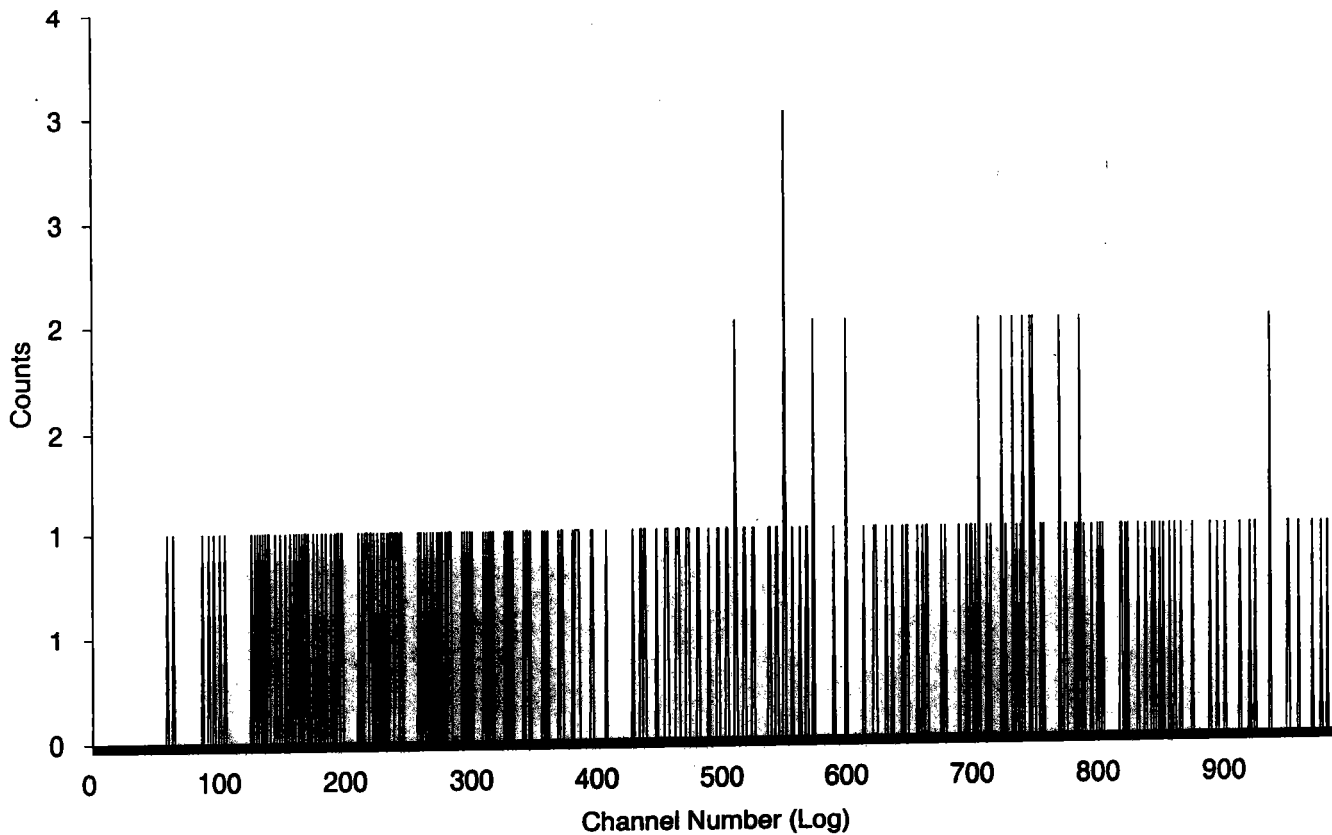
16 Sep 2008 16:46:59

9/16/2008 16:52:01  
S11091611-5A.WK1  
U11091611-1A.WK1

Spectrum Type  
User Number:  
User Id:  
User Comment:  
Isotope Name:  
Scintillator:  
Sample, Rack-Pos, Time:  
H#, Total Counts:  
Start, End, X-Axis:

Log Counts  
11  
TOTAL ACTIVITY  
GOLD  
14C  
LIQUID  
5            11-5            5.00  
97.9        69  
0            990            Channel Number

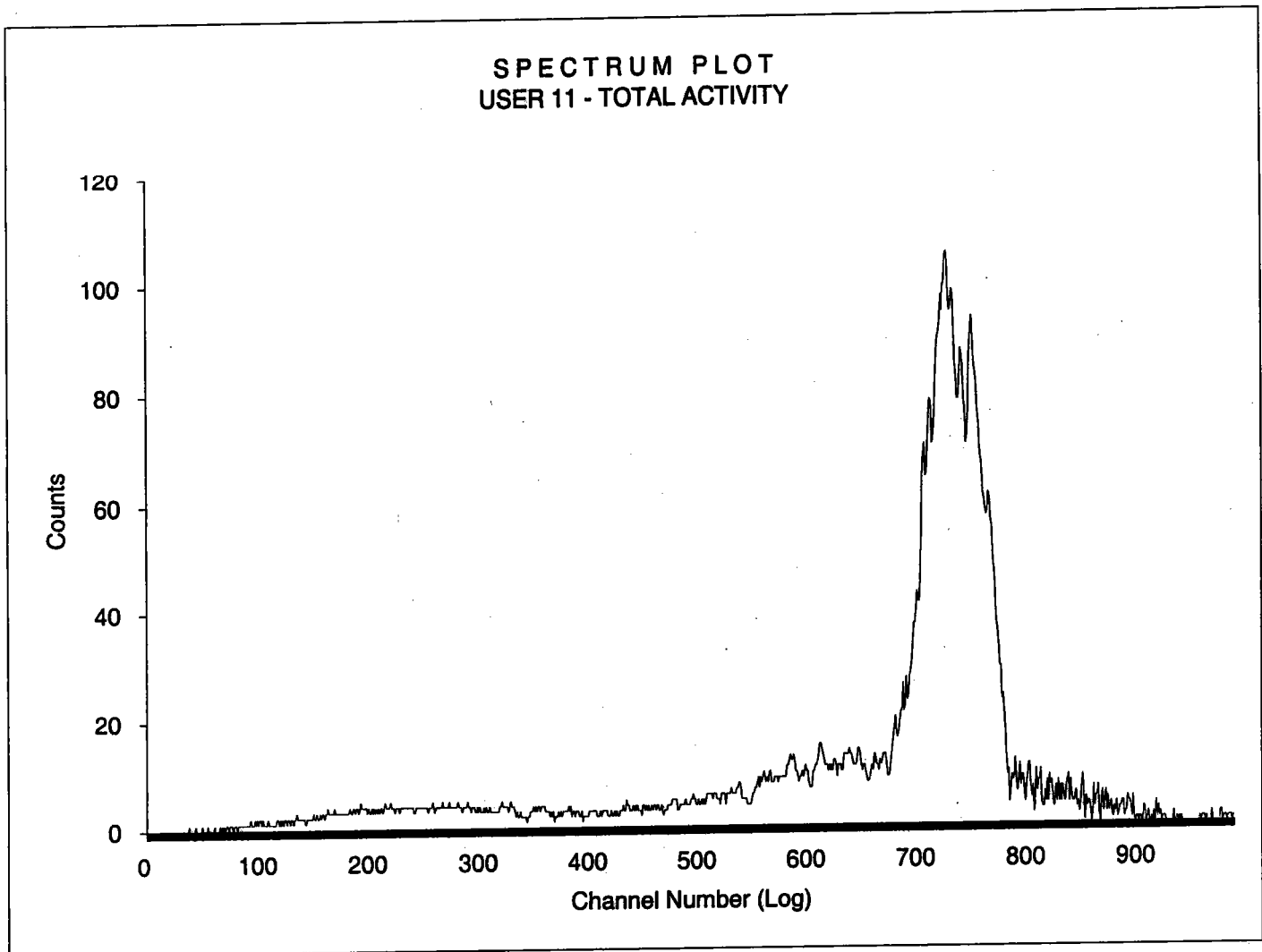
SPECTRUM PLOT  
USER 11 - TOTAL ACTIVITY



9/16/08

Sample Count Start Time: 16 Sep 2008 16:53:01  
Data Capture Date: 9/16/2008 16:58:06  
User Filename: S11091611-6A.WK1  
U11091611-1A.WK1  
Spectrum Type Log Counts  
User Number: 11  
User Id: TOTAL ACTIVITY  
User Comment: GOLD  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 6 11-6 5.00  
H#, Total Counts: 110.7 7666  
Start, End, X-Axis: 0 990 Channel Number

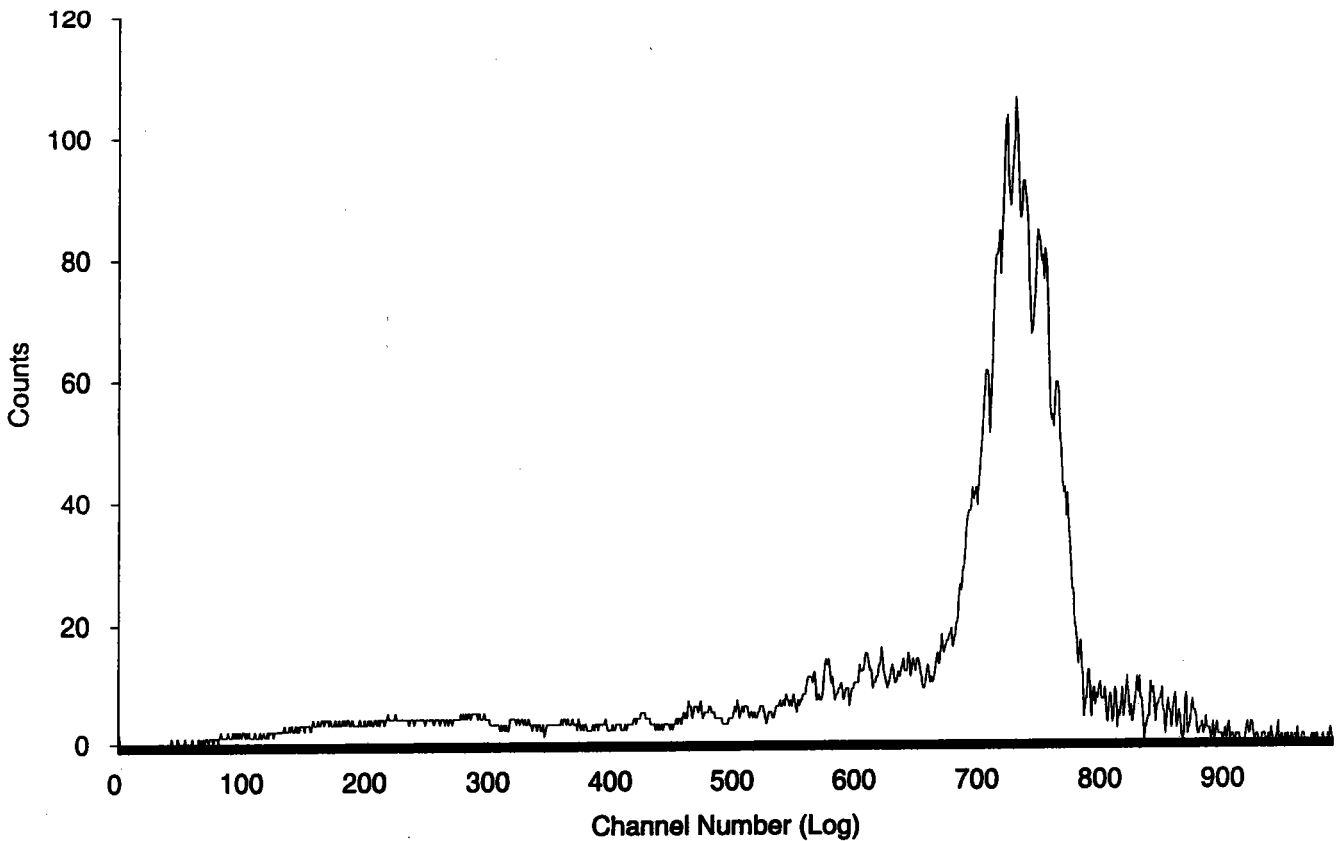
SPECTRUM PLOT  
USER 11 - TOTAL ACTIVITY



8/19/16  
LHG

Sample Count Start Time:	16 Sep 2008 16:59:07
Data Capture Date:	9/16/2008 17:04:12
User Filename:	S11091611-7A.WK1 U11091611-1A.WK1
Spectrum Type	Log Counts
User Number:	11
User Id:	TOTAL ACTIVITY
User Comment:	GOLD
Isotope Name:	14C
Scintillator:	LIQUID
Sample, Rack-Pos, Time:	7            11-7            5.00
H#, Total Counts:	110.8        7726
Start, End, X-Axis:	0            990            Channel Number

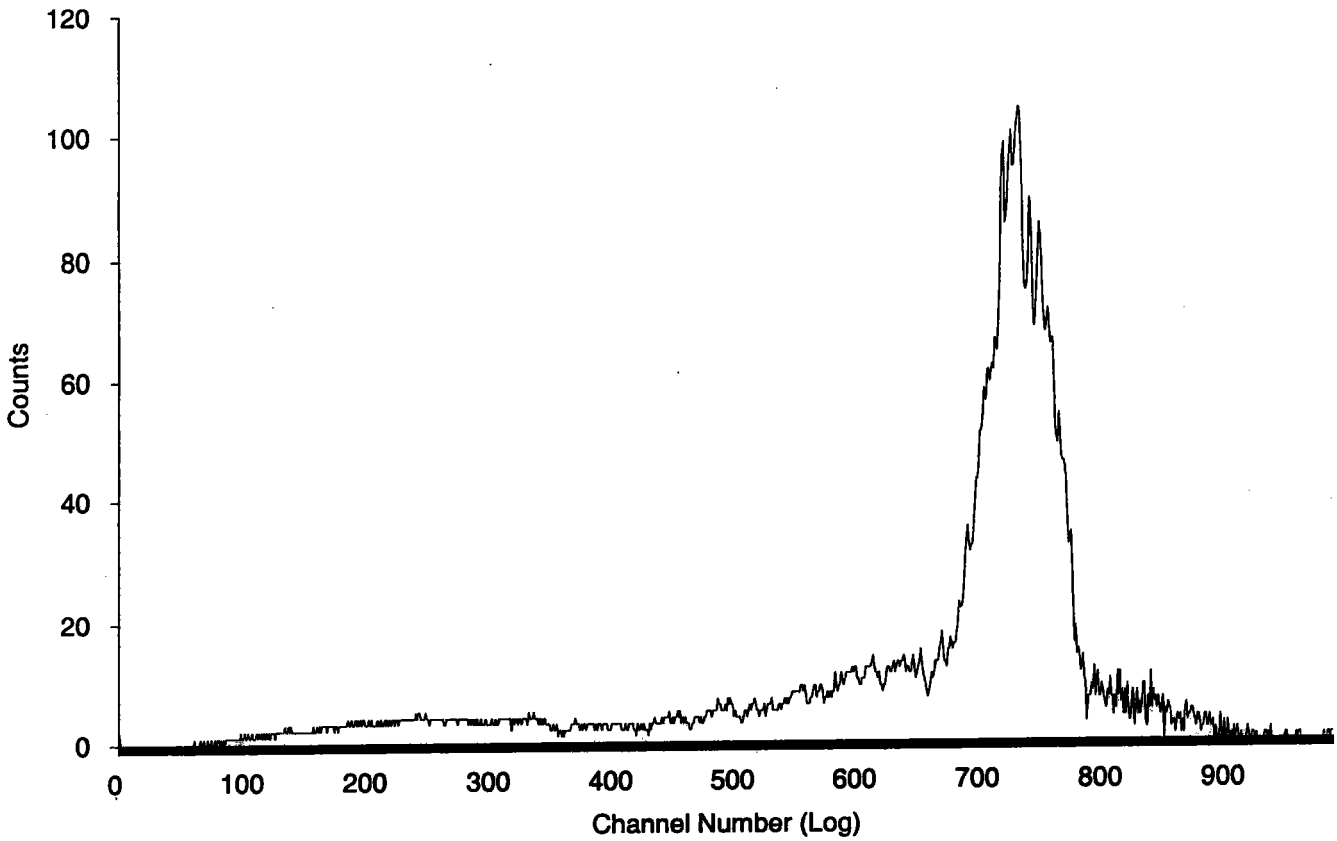
SPECTRUM PLOT  
USER 11 - TOTAL ACTIVITY



9/16/08  
S11091611

Sample Count Start Time: 16 Sep 2008 17:05:13  
Data Capture Date: 9/16/2008 17:10:18  
User Filename: S11091611-8A.WK1  
U11091611-1A.WK1  
Spectrum Type: Log Counts  
User Number: 11  
User Id: TOTAL ACTIVITY  
User Comment: GOLD  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 8 11-8 5.00  
H#, Total Counts: 110.7 7557  
Start, End, X-Axis: 0 990 Channel Number

SPECTRUM PLOT  
USER 11 - TOTAL ACTIVITY



# Radium-228 Que Sheet

SRS 6/30/09

Batch #: 881540  
 Analyst: DXM2  
 First Client Due Date: Internal Due Date: 07/03/2009  
 Spike Isotope: Radium-228  
 Spike Code: NA  
 Expiration Date: NA  
 LCS Isotope: Radium-228  
 LCS Code: DS03-B  
 Expiration Date: 9/13/09  
 Tracer Isotope: Barium-133  
 Tracer Code: 0112-3  
 Expiration Date: 2/17/10  
 Prep Date: 6/30/09  
 Initials: JRS  
 Pipet ID: 1734218  
 Balance ID: NA  
 Ac-228 Ingrow: 2025 6/30/09  
 Ac-228 Separation Date/Time: 7-2-09 0540  
 Witness: JRS 6/30/09

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collect Date & Time	Pos. #	Vol (mL)	Ba Yield (%)	Gamma Det. #
1201872112-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	1	20	100.83		↑
1201872113-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	2	20	108.20		
1201872114-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	3	20	114.22		
1201872115-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	4	20	120.58		WARD
1201872116-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	5	20	105.84		
1201872117-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	6	20	102.70		
1201872118-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	7	20	112.83		
1201872119-1	LCS for batch 881540	LCS	3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	8	20	111.91		↓

JRS 7/1/09

*[Handwritten Signature]*

Data Reviewed By: \_\_\_\_\_

Comments: \_\_\_\_\_



ASSAY 30-Jun-09 19:32:06

Protocol id 8 228\_REC  
Time limit 180  
Count limit 50000  
Isotope Ba-133  
Protocol date 9-Apr-07 10:03:07  
Run id. 54

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	97	1	180	779	229.3	4.13		19:32:13
2	97	2	180	785	231.2	4.11	100.83	19:35:24
3	97	3	180	835	248.1	3.95	108.20	19:38:35
4	97	4	180	877	261.9	3.83	114.22	19:41:47
5	97	5	180	921	276.5	3.71	120.58	19:44:58
6	72	6	180	819	242.7	4	105.84	19:48:17
7	72	7	180	798	235.5	4.07	102.70	19:51:28
8	72	8	180	867	258.7	3.85	112.82	19:54:40
9	72	9	180	861	256.6	3.87	111.91	19:57:51

END OF ASSAY

*[Handwritten signature]*  
7/2/09


**General Engineering Laboratories**

2040 Savage Road, Charleston, SC 29414  
(843)556-8171

**Gas Flow Proportional Counter Calibration Package**

Method: Re-228(Pc)

	YES	NO	Comments
1) Is all calibration standard information enclosed for: primary standard certificate? secondary standard(s) documentation? standard preparation information? standard < 1 Year old or verified?	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
2) Are the detector graphs included? beta absorption curves? beta plateau?			Average Efficiency
	<input checked="" type="checkbox"/>		
3) Is the raw count data included for: the plateau generation? the absorption curve generation? the calibration verification? the crosstalk calculations?	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
	<input checked="" type="checkbox"/>		
4) Are the calibration verification calculations included? are verification recoveries 100% +/- 25%			
	<input checked="" type="checkbox"/>		
5) Is the method Carrier Standardization included?			N/A

Prepared By: 

Date: 7/2/09

Reviewed By: 

Date: 7/2/09

Effective Date: 7/2/09







SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time
1 1A		3	126	13564	7/1/2009 13:36	7/1/2009 13:39
2 1A		3	136	12775	7/1/2009 13:52	7/1/2009 13:55
3 1A		3	135	12750	7/1/2009 13:48	7/1/2009 13:51
4 1A		3	142	12410	7/1/2009 13:41	7/1/2009 13:44
1 1B		3	115	13292	7/1/2009 13:41	7/1/2009 13:44
2 1B		3	136	13274	7/1/2009 13:36	7/1/2009 13:39
3 1B		3	131	12699	7/1/2009 13:52	7/1/2009 13:55
4 1B		3	129	12072	7/1/2009 13:48	7/1/2009 13:51
1 1C		3	207	12813	7/1/2009 13:48	7/1/2009 13:51
2 1C		3	221	12979	7/1/2009 13:41	7/1/2009 13:44
3 1C		3	189	12755	7/1/2009 13:36	7/1/2009 13:39
4 1C		3	179	11917	7/1/2009 13:52	7/1/2009 13:55
1 1D		3	558	12473	7/1/2009 13:52	7/1/2009 13:55
2 1D		3	582	12484	7/1/2009 13:48	7/1/2009 13:51
3 1D		3	632	12289	7/1/2009 13:41	7/1/2009 13:44
4 1D		3	568	12115	7/1/2009 13:36	7/1/2009 13:39
1 2A		3	424	12499	7/1/2009 13:57	7/1/2009 14:00
2 2A		3	449	12103	7/1/2009 14:15	7/1/2009 14:18
3 2A		3	419	11968	7/1/2009 14:09	7/1/2009 14:12
4 2A		3	417	11855	7/1/2009 14:02	7/1/2009 14:05
1 2B		3	42	12471	7/1/2009 14:02	7/1/2009 14:05
2 2B		3	39	12492	7/1/2009 13:57	7/1/2009 14:00
3 2B		3	54	11892	7/1/2009 14:15	7/1/2009 14:18
4 2B		3	69	11539	7/1/2009 14:09	7/1/2009 14:12
1 2C		3	504	12050	7/1/2009 14:08	7/1/2009 14:11
2 2C		3	527	11914	7/1/2009 14:02	7/1/2009 14:05
3 2C		3	496	11994	7/1/2009 13:58	7/1/2009 14:01
4 2C		3	499	10889	7/1/2009 14:15	7/1/2009 14:18
1 2D		3	543	12010	7/1/2009 14:15	7/1/2009 14:18
2 2D		3	508	12124	7/1/2009 14:08	7/1/2009 14:11
3 2D		3	542	12168	7/1/2009 14:02	7/1/2009 14:05
4 2D		3	544	11692	7/1/2009 13:58	7/1/2009 14:01
1 3A		3	1397	11194	7/1/2009 14:19	7/1/2009 14:22
2 3A		4	1809	14227	7/1/2009 14:35	7/1/2009 14:39
3 3A		4	1757	14180	7/1/2009 14:30	7/1/2009 14:34
4 3A		4	1725	13754	7/1/2009 14:25	7/1/2009 14:29
1 3B		4	914	15370	7/1/2009 14:25	7/1/2009 14:29
2 3B		3	731	11695	7/1/2009 14:20	7/1/2009 14:23
3 3B		4	960	14905	7/1/2009 14:35	7/1/2009 14:39
4 3B		4	922	14220	7/1/2009 14:30	7/1/2009 14:34
1 3C		4	671	15644	7/1/2009 14:29	7/1/2009 14:33
2 3C		4	722	15964	7/1/2009 14:25	7/1/2009 14:29
3 3C		3	558	11701	7/1/2009 14:20	7/1/2009 14:23
4 3C		4	647	14729	7/1/2009 14:35	7/1/2009 14:39
1 3D		4	651	15152	7/1/2009 14:35	7/1/2009 14:39
2 3D		4	722	15168	7/1/2009 14:30	7/1/2009 14:34
3 3D		4	684	15295	7/1/2009 14:25	7/1/2009 14:29
4 3D		3	466	10942	7/1/2009 14:20	7/1/2009 14:23
1 4A		4	412	15298	7/1/2009 14:40	7/1/2009 14:44
2 4A		4	407	14897	7/1/2009 15:00	7/1/2009 15:04
3 4A		4	389	15050	7/1/2009 14:53	7/1/2009 14:57

419  
7/2/09

4 4A	4	417	14462	7/1/2009 14:48	7/1/2009 14:52
1 4B	4	58	15335	7/1/2009 14:48	7/1/2009 14:52
2 4B	4	61	15513	7/1/2009 14:41	7/1/2009 14:45
3 4B	4	53	14521	7/1/2009 15:00	7/1/2009 15:04
4 4B	4	72	14328	7/1/2009 14:53	7/1/2009 14:57
1 4C	4	532	14733	7/1/2009 14:53	7/1/2009 14:57
2 4C	4	545	14902	7/1/2009 14:48	7/1/2009 14:52
3 4C	4	486	14856	7/1/2009 14:41	7/1/2009 14:45
4 4C	4	540	13733	7/1/2009 15:00	7/1/2009 15:04
1 4D	4	1158	14167	7/1/2009 15:00	7/1/2009 15:04
2 4D	4	1192	14204	7/1/2009 14:53	7/1/2009 14:57
3 4D	4	1136	14131	7/1/2009 14:48	7/1/2009 14:52
4 4D	4	1149	13978	7/1/2009 14:41	7/1/2009 14:45
1 5A	4	424	14870	7/1/2009 15:06	7/1/2009 15:10
2 5A	4	395	14487	7/1/2009 15:21	7/1/2009 15:25
3 5A	4	403	14259	7/1/2009 15:17	7/1/2009 15:21
4 5A	4	389	13957	7/1/2009 15:12	7/1/2009 15:16
1 5B	4	428	14869	7/1/2009 15:12	7/1/2009 15:16
2 5B	4	440	14821	7/1/2009 15:06	7/1/2009 15:10
3 5B	4	420	14289	7/1/2009 15:21	7/1/2009 15:25
4 5B	4	414	13809	7/1/2009 15:17	7/1/2009 15:21
1 5C	4	436	14676	7/1/2009 15:17	7/1/2009 15:21
2 5C	4	443	15122	7/1/2009 15:12	7/1/2009 15:16
3 5C	4	433	14958	7/1/2009 15:07	7/1/2009 15:11
4 5C	4	416	13831	7/1/2009 15:21	7/1/2009 15:25
1 5D	4	451	14321	7/1/2009 15:21	7/1/2009 15:25
2 5D	4	452	14642	7/1/2009 15:17	7/1/2009 15:21
3 5D	4	444	14443	7/1/2009 15:12	7/1/2009 15:16
4 5D	4	414	13954	7/1/2009 15:07	7/1/2009 15:11
1 6A	4	272	14018	7/1/2009 15:27	7/1/2009 15:31
2 6A	3.5	246	12283	7/1/2009 15:40	7/1/2009 15:44
3 6A	3.5	231	12111	7/1/2009 15:36	7/1/2009 15:40
4 6A	3.5	229	11598	7/1/2009 15:32	7/1/2009 15:35
1 6B	3.5	540	12151	7/1/2009 15:32	7/1/2009 15:36
2 6B	4	592	14371	7/1/2009 15:27	7/1/2009 15:31
3 6B	3.5	498	11705	7/1/2009 15:40	7/1/2009 15:44
4 6B	3.5	498	11388	7/1/2009 15:36	7/1/2009 15:40
1 6C	3.5	462	12161	7/1/2009 15:36	7/1/2009 15:40
2 6C	3.5	468	12083	7/1/2009 15:32	7/1/2009 15:36
3 6C	4	534	13638	7/1/2009 15:27	7/1/2009 15:31
4 6C	3.5	455	11218	7/1/2009 15:40	7/1/2009 15:44
1 6D	3.5	456	11987	7/1/2009 15:40	7/1/2009 15:44
2 6D	3.5	468	12183	7/1/2009 15:36	7/1/2009 15:40
3 6D	3.5	496	11882	7/1/2009 15:32	7/1/2009 15:36
4 6D	4	525	13018	7/1/2009 15:27	7/1/2009 15:31
1 7A	3.5	466	12007	7/1/2009 15:46	7/1/2009 15:50
2 7A	3.5	491	11655	7/1/2009 16:00	7/1/2009 16:04
3 7A	3.5	444	11445	7/1/2009 15:56	7/1/2009 15:59
4 7A	3.5	477	11121	7/1/2009 15:50	7/1/2009 15:54
1 7B	3.5	418	11968	7/1/2009 15:51	7/1/2009 15:54
2 7B	3.5	448	12050	7/1/2009 15:46	7/1/2009 15:50
3 7B	3.5	460	11675	7/1/2009 16:00	7/1/2009 16:04

4 7B	3.5	413	11271	7/1/2009 15:56	7/1/2009 16:00
1 7C	3.5	471	11781	7/1/2009 15:56	7/1/2009 16:00
2 7C	3.5	457	11760	7/1/2009 15:51	7/1/2009 15:54
3 7C	3.5	454	11766	7/1/2009 15:46	7/1/2009 15:50
4 7C	3.5	406	10888	7/1/2009 16:00	7/1/2009 16:04
1 7D	3.5	359	11605	7/1/2009 16:00	7/1/2009 16:04
2 7D	3.5	391	11920	7/1/2009 15:56	7/1/2009 16:00
3 7D	3.5	386	11933	7/1/2009 15:51	7/1/2009 15:55
4 7D	3.5	400	11305	7/1/2009 15:46	7/1/2009 15:50
1 8A	3.5	348	11673	7/1/2009 16:06	7/1/2009 16:09
2 8A	3.5	340	11172	7/1/2009 16:19	7/1/2009 16:22
3 8A	3.5	298	11258	7/1/2009 16:15	7/1/2009 16:18
4 8A	3.5	327	10977	7/1/2009 16:10	7/1/2009 16:13
1 8B	3.5	124	11583	7/1/2009 16:10	7/1/2009 16:13
2 8B	3.5	112	11758	7/1/2009 16:06	7/1/2009 16:09
3 8B	3.5	110	11499	7/1/2009 16:19	7/1/2009 16:23
4 8B	3.5	102	10844	7/1/2009 16:15	7/1/2009 16:18
1 8C	3.5	202	11539	7/1/2009 16:15	7/1/2009 16:18
2 8C	3.5	196	11774	7/1/2009 16:10	7/1/2009 16:14
3 8C	3.5	203	11611	7/1/2009 16:06	7/1/2009 16:09
4 8C	3.5	207	10809	7/1/2009 16:19	7/1/2009 16:23
1 8D	3.5	240	11301	7/1/2009 16:19	7/1/2009 16:23
2 8D	3.5	248	11412	7/1/2009 16:15	7/1/2009 16:18
3 8D	3.5	233	11660	7/1/2009 16:10	7/1/2009 16:14
4 8D	3.5	235	10918	7/1/2009 16:06	7/1/2009 16:10
1 9A	3.5	39	11605	7/1/2009 16:24	7/1/2009 16:28
2 9A	3.5	49	11281	7/1/2009 16:42	7/1/2009 16:46
3 9A	3.5	47	11301	7/1/2009 16:33	7/1/2009 16:36
4 9A	3.5	64	10987	7/1/2009 16:29	7/1/2009 16:32
1 9B	3.5	53	11151	7/1/2009 16:29	7/1/2009 16:32
2 9B	3.5	39	11462	7/1/2009 16:24	7/1/2009 16:28
3 9B	3.5	45	11004	7/1/2009 16:42	7/1/2009 16:46
4 9B	3.5	51	10581	7/1/2009 16:33	7/1/2009 16:36
1 9C	3.5	49	11026	7/1/2009 16:33	7/1/2009 16:36
2 9C	3.5	49	11281	7/1/2009 16:29	7/1/2009 16:32
3 9C	3.5	40	11016	7/1/2009 16:24	7/1/2009 16:28
4 9C	3.5	60	10297	7/1/2009 16:42	7/1/2009 16:46
1 9D	3.5	65	11135	7/1/2009 16:38	7/1/2009 16:41
2 9D	3.5	53	11412	7/1/2009 16:33	7/1/2009 16:37
3 9D	3.5	54	11340	7/1/2009 16:29	7/1/2009 16:32
4 9D	3.5	77	10912	7/1/2009 16:24	7/1/2009 16:28
1 10A	3.5	71	10991	7/1/2009 16:47	7/1/2009 16:51
2 10A	4	106	11959	7/1/2009 17:12	7/1/2009 17:16
3 10A	3.5	70	10553	7/1/2009 16:58	7/1/2009 17:01
4 10A	3.5	95	10338	7/1/2009 16:53	7/1/2009 16:56
1 10B	4	139	11110	7/1/2009 17:03	7/1/2009 17:07
2 10B	3.5	102	10812	7/1/2009 16:47	7/1/2009 16:51
3 10B	4	103	11422	7/1/2009 17:12	7/1/2009 17:16
4 10B	3.5	110	9967	7/1/2009 16:58	7/1/2009 17:01
1 10C	3.5	74	10482	7/1/2009 16:58	7/1/2009 17:01
2 10C	3.5	79	10535	7/1/2009 16:53	7/1/2009 16:57
3 10C	3.5	87	10723	7/1/2009 16:47	7/1/2009 16:51



4 10C	4	95	11066	7/1/2009 17:13	7/1/2009 17:17
1 10D	4	102	12021	7/1/2009 17:13	7/1/2009 17:17
2 10D	3.5	75	10614	7/1/2009 16:58	7/1/2009 17:01
3 10D	3.5	78	10643	7/1/2009 16:53	7/1/2009 16:57
4 10D	3.5	81	10064	7/1/2009 16:48	7/1/2009 16:51
1 11A	3	31	14773	7/1/2009 11:56	7/1/2009 11:59
2 11A	3	23	14429	7/1/2009 12:08	7/1/2009 12:11
3 11A	3	33	14454	7/1/2009 12:04	7/1/2009 12:07
4 11A	3	49	14013	7/1/2009 12:00	7/1/2009 12:03
1 11B	3	43	16203	7/1/2009 12:00	7/1/2009 12:03
2 11B	3	53	16106	7/1/2009 11:56	7/1/2009 11:59
3 11B	3	46	15643	7/1/2009 12:08	7/1/2009 12:11
4 11B	3	42	15133	7/1/2009 12:04	7/1/2009 12:07
1 11C	3	27	15637	7/1/2009 12:04	7/1/2009 12:07
2 11C	3	38	15919	7/1/2009 12:00	7/1/2009 12:03
3 11C	3	33	16452	7/1/2009 11:56	7/1/2009 11:59
4 11C	3	46	14887	7/1/2009 12:08	7/1/2009 12:11
1 11D	3	43	15607	7/1/2009 12:08	7/1/2009 12:11
2 11D	3	42	15944	7/1/2009 12:04	7/1/2009 12:07
3 11D	3	32	16098	7/1/2009 12:00	7/1/2009 12:03
4 11D	3	39	15191	7/1/2009 11:56	7/1/2009 11:59
1 12A	3	29	15450	7/1/2009 12:15	7/1/2009 12:18
2 12A	3	28	15016	7/1/2009 12:28	7/1/2009 12:31
3 12A	3	31	14984	7/1/2009 12:24	7/1/2009 12:27
4 12A	3	46	14530	7/1/2009 12:20	7/1/2009 12:23
1 12B	3	26	15404	7/1/2009 12:20	7/1/2009 12:23
2 12B	3	31	15607	7/1/2009 12:15	7/1/2009 12:18
3 12B	3	34	15060	7/1/2009 12:28	7/1/2009 12:31
4 12B	3	49	14553	7/1/2009 12:24	7/1/2009 12:27
1 12C	3	24	15183	7/1/2009 12:24	7/1/2009 12:27
2 12C	3	44	15651	7/1/2009 12:20	7/1/2009 12:23
3 12C	3	46	15216	7/1/2009 12:15	7/1/2009 12:18
4 12C	3	60	14117	7/1/2009 12:28	7/1/2009 12:31
1 12D	3	48	15174	7/1/2009 12:28	7/1/2009 12:31
2 12D	3	37	15137	7/1/2009 12:24	7/1/2009 12:27
3 12D	3	25	15418	7/1/2009 12:20	7/1/2009 12:23
4 12D	3	59	14566	7/1/2009 12:15	7/1/2009 12:18
1 13A	3	50	15230	7/1/2009 12:33	7/1/2009 12:36
2 13A	3	36	14784	7/1/2009 12:50	7/1/2009 12:53
3 13A	3	41	14851	7/1/2009 12:41	7/1/2009 12:44
4 13A	3	49	14183	7/1/2009 12:37	7/1/2009 12:40
1 13B	3	39	15625	7/1/2009 12:37	7/1/2009 12:40
2 13B	3	41	15450	7/1/2009 12:33	7/1/2009 12:36
3 13B	3	37	14689	7/1/2009 12:50	7/1/2009 12:53
4 13B	3	47	14377	7/1/2009 12:41	7/1/2009 12:44
1 13C	3	54	15426	7/1/2009 12:41	7/1/2009 12:44
2 13C	3	41	15315	7/1/2009 12:37	7/1/2009 12:40
3 13C	3	36	15288	7/1/2009 12:33	7/1/2009 12:36
4 13C	3	34	14222	7/1/2009 12:50	7/1/2009 12:53
1 13D	3	47	14492	7/1/2009 12:50	7/1/2009 12:53
2 13D	3	50	14858	7/1/2009 12:46	7/1/2009 12:49
3 13D	3	43	14873	7/1/2009 12:37	7/1/2009 12:40

4 13D	3	47	14389	7/1/2009 12:33	7/1/2009 12:36
1 14A	3	44	14463	7/1/2009 12:54	7/1/2009 12:57
2 14A	3	41	14137	7/1/2009 13:17	7/1/2009 13:20
3 14A	3	45	14022	7/1/2009 13:13	7/1/2009 13:16
4 14A	3	51	13451	7/1/2009 13:02	7/1/2009 13:05
1 14B	3	42	14039	7/1/2009 13:01	7/1/2009 13:04
2 14B	3	36	14398	7/1/2009 12:54	7/1/2009 12:57
3 14B	3	47	13475	7/1/2009 13:17	7/1/2009 13:20
4 14B	3	47	13077	7/1/2009 13:13	7/1/2009 13:16
1 14C	3	26	14116	7/1/2009 13:12	7/1/2009 13:15
2 14C	3	35	14187	7/1/2009 13:02	7/1/2009 13:05
3 14C	3	37	14409	7/1/2009 12:55	7/1/2009 12:58
4 14C	3	38	13229	7/1/2009 13:17	7/1/2009 13:20
1 14D	3	16	13927	7/1/2009 13:17	7/1/2009 13:20
2 14D	3	32	14089	7/1/2009 13:12	7/1/2009 13:15
3 14D	3	16	13912	7/1/2009 13:02	7/1/2009 13:05
4 14D	3	47	13545	7/1/2009 12:55	7/1/2009 12:58



Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/fm) is the batch Prep Date
- 3 - Spike Normalis are Decay corrected to Sample Date/Time

indicates results calculated at 100% recovery

Decision Level	Critical Level	Required MDA	MDA	Sample Act. Conc.		Net Count Rate		Net Count Rate		Counting Uncertainty		Sample Type	Nominal pCi/L	Recovery
				Conc. pCi/L	Error pCi/L	Rate CPM	Rate CPM	Rate CPM	Rate CPM	pCi/L	pCi/L			
0.3471	0.2451	1	0.6937	134.0279	0.0254	131.6880	2.9666	5.9178	21.6466	164.3409	81.6%			
0.3647	0.2575	1	0.7192	133.0399	0.0251	130.2590	2.9508	5.9071	21.4655	164.3409	81.0%			
0.5389	0.3790	1	0.9659	145.2921	0.0243	139.8173	3.0611	6.2347	23.3752	164.3409	88.4%			
0.4695	0.3314	1	0.8755	159.8328	0.0239	150.4760	3.1730	6.6057	25.6756	164.3409	97.3%			
0.4261	0.3008	1	0.8057	127.0000	0.0237	122.0633	2.8583	5.8279	20.5368	164.3409	77.3%			
0.7599	0.5395	1	1.2813	141.0616	0.0247	135.4387	3.0211	6.1673	22.7300	164.3409	85.8%			
0.3798	0.2681	1	0.7515	141.8559	0.0253	131.7993	2.9681	6.2613	22.9053	164.3409	86.3%			
0.4150	0.2930	1	0.8072	145.8182	0.0251	131.8887	2.9686	6.4352	23.5274	164.3409	88.7%			
0.6347	0.4481	1	1.1343	129.6854	0.0284	108.9047	2.7042	6.3116	21.1935	164.3409	82.4%			
0.9035	0.6379	1	1.5022	135.4510	0.0266	119.6900	2.8455	6.3115	21.9803	164.3409	86.0%			
0.6078	0.4291	1	1.0779	141.2594	0.0255	128.6447	2.9382	6.3235	22.8259	164.3409	94.7%			
0.5473	0.3864	1	0.9887	155.5960	0.0247	137.7700	3.0378	6.7244	25.0636	164.3409	82.5%			
0.6283	0.4438	1	1.1054	135.5336	0.0264	124.2433	2.8886	6.1761	21.9739	164.3409	83.3%			
0.9036	0.6378	1	1.4942	138.9155	0.0254	125.4287	2.9134	6.2333	22.1127	164.3409	88.8%			
0.7676	0.5419	1	1.3079	145.9826	0.0252	130.3400	2.9624	6.5032	23.5821	164.3409	90.0%			
0.7520	0.5309	1	1.3000	147.9661	0.0268	124.2633	2.8910	6.7471	24.0105	164.3409	82.1%			
0.4809	0.3395	1	0.9027	134.9811	0.0269	120.7040	2.8427	6.2312	21.9265	164.3409	80.0%			
0.8974	0.4924	1	1.2076	131.4742	0.0271	117.9500	2.8170	6.1544	21.3797	164.3409	89.0%			
0.8530	0.4610	1	1.1419	148.2299	0.0259	132.9873	2.9894	6.4406	23.6659	164.3409	95.2%			
0.7661	0.5409	1	1.3064	156.3706	0.0255	139.2187	3.0605	6.7377	25.2668	164.3409	81.7%			
0.8899	0.4871	1	1.1997	134.1883	0.0270	118.9960	2.8288	6.2523	21.8127	164.3409	83.4%			
0.6079	0.4292	1	1.0862	137.0396	0.0269	120.3027	2.8412	6.3436	22.2643	164.3409	88.8%			
0.9509	0.6713	1	1.5725	146.0056	0.0264	127.0507	2.9317	6.6044	23.6775	164.3409	88.0%			
0.4376	0.3090	1	0.8562	144.5849	0.0275	113.7227	2.7577	6.3803	21.8573	164.3409	83.8%			
0.4227	0.2984	1	0.8330	134.2390	0.0275	113.7227	2.7577	6.3803	21.8573	164.3409	83.8%			
0.4360	0.3079	1	0.8480	137.6373	0.0270	118.4887	2.8152	6.4094	22.3723	164.3409	92.4%			
0.3962	0.2797	1	0.7956	151.8935	0.0262	128.6313	2.9319	6.7858	24.6088	164.3409	92.6%			
0.4480	0.3163	1	0.8657	152.1131	0.0261	130.4707	2.9539	6.7499	24.6318	164.3409	77.8%			
0.6332	0.4470	1	1.1278	127.8251	0.0279	109.4120	2.7108	6.2072	20.8618	164.3409	82.2%			
0.9817	0.6831	1	1.6167	135.1471	0.0273	117.2540	2.8197	6.3699	21.9896	164.3409	89.2%			
0.5779	0.4080	1	1.0463	146.8864	0.0263	127.3240	2.8214	6.5922	23.7610	164.3409	86.1%			
0.8422	0.5946	1	1.4301	141.4935	0.0272	117.4680	2.8147	6.6441	23.0149	164.3409	79.4%			
0.4379	0.3091	1	0.8509	130.5505	0.0276	112.2200	2.7400	6.2478	21.2682	164.3409	81.4%			
0.7972	0.5629	1	1.3635	133.7974	0.0277	112.5273	2.7540	6.4182	21.8026	164.3409	87.8%			
0.4475	0.3159	1	0.8728	144.2924	0.0269	119.7633	2.8301	6.6832	23.4437	164.3409	91.9%			
0.8154	0.5159	1	1.3863	150.8313	0.0263	128.3747	2.9406	6.7718	24.4459	164.3409	81.8%			
0.4063	0.2868	1	0.8104	134.4151	0.0275	113.5507	2.7553	6.3927	21.8871	164.3409	82.2%			
1.9322	1.3641	1	2.9747	135.0540	0.0285	109.6040	2.8489	6.7565	23.8548	164.3409	89.4%			
0.4205	0.2969	1	0.8358	146.9063	0.0268	121.4093	2.8489	6.7689	23.5500	164.3409	88.1%			
0.4437	0.3132	1	0.8728	144.8386	0.0271	117.5853	2.8041	6.7699	23.5500	164.3409	82.4%			
0.3432	0.2423	1	0.6763	135.4549	0.0253	141.3227	3.0733	5.7736	21.8705	164.3409	80.1%			
0.3289	0.2322	1	0.6397	131.8931	0.0247	150.2887	3.1684	5.4434	21.2189	164.3409	80.1%			
0.2949	0.2082	1	0.5922	148.8038	0.0237	169.2980	3.2628	5.7929	23.8866	164.3409	90.5%			
0.3379	0.2385	1	0.6530	151.8473	0.0235	172.6707	3.3968	5.9549	24.3915	164.3409	92.4%			
0.4816	0.3400	1	0.8577	131.6889	0.0249	148.2120	3.1520	5.4891	21.2301	164.3409	80.1%			
0.7488	0.5287	1	1.2332	134.8866	0.0246	153.3873	3.2186	5.5463	21.7215	164.3409	82.1%			
0.4447	0.3140	1	0.8052	148.8317	0.0238	167.9907	3.3090	5.8232	23.8982	164.3409	90.6%			
0.6180	0.4363	1	1.0494	143.9479	0.0241	162.8880	3.3090	5.7315	23.1394	164.3409	87.8%			
0.3427	0.2420	1	0.6680	135.0873	0.0248	148.3533	3.1490	5.8202	21.7752	164.3409	82.2%			
0.5997	0.4234	1	1.0256	129.5009	0.0251	144.7940	3.1202	5.4687	20.8960	164.3409	78.8%			
0.3316	0.2341	1	0.6469	146.0021	0.0240	163.4967	3.3053	5.7852	23.4616	164.3409	88.8%			
0.6355	0.4487	1	1.0805	159.6717	0.0235	174.3747	3.4225	6.1425	25.6134	164.3409	97.2%			
0.3136	0.2214	1	0.6265	132.0625	0.0251	144.5507	3.1078	5.5650	21.3060	164.3409	80.4%			
1.4618	1.0321	1	2.2506	135.6135	0.0254	145.4707	3.1861	5.8215	21.9070	164.3409	82.5%			
0.3185	0.2249	1	0.6330	141.6298	0.0245	158.5427	3.2193	5.7718	22.7990	164.3409	86.2%			
0.3327	0.2349	1	0.6546	146.7439	0.0242	156.8520	3.2579	5.8988	23.6017	164.3409	89.3%			

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine
1	1A	15	36	1980	7/2/2009 8:39	7/2/2009 8:54	Protean
2	1B	15	27	1959	7/2/2009 8:40	7/2/2009 8:55	Protean
3	1C	15	44	2108	7/2/2009 8:40	7/2/2009 8:55	Protean
4	1D	15	108	2265	7/2/2009 8:40	7/2/2009 8:55	Protean
5	2A	15	69	1838	7/2/2009 8:40	7/2/2009 8:55	Protean
6	2B	15	8	2053	7/2/2009 8:40	7/2/2009 8:55	Protean
7	2C	15	96	1982	7/2/2009 8:40	7/2/2009 8:55	Protean
8	2D	15	93	1984	7/2/2009 9:08	7/2/2009 9:23	Protean
1	3A	15	233	1645	7/2/2009 9:08	7/2/2009 9:23	Protean
2	3B	15	99	1821	7/2/2009 9:08	7/2/2009 9:23	Protean
3	3C	15	96	1942	7/2/2009 9:08	7/2/2009 9:23	Protean
4	3D	15	90	2076	7/2/2009 9:08	7/2/2009 9:23	Protean
5	4A	15	79	1877	7/2/2009 9:08	7/2/2009 9:23	Protean
6	4B	15	13	1909	7/2/2009 9:08	7/2/2009 9:23	Protean
7	4C	15	97	1974	7/2/2009 9:09	7/2/2009 9:24	Protean
8	4D	15	181	1880	7/2/2009 9:25	7/2/2009 9:40	Protean
1	5A	15	53	1818	7/2/2009 9:26	7/2/2009 9:41	Protean
2	5B	15	59	1785	7/2/2009 9:26	7/2/2009 9:41	Protean
3	5C	15	43	2009	7/2/2009 9:26	7/2/2009 9:41	Protean
4	5D	15	59	2107	7/2/2009 9:26	7/2/2009 9:41	Protean
5	6A	15	35	1800	7/2/2009 9:27	7/2/2009 9:42	Protean
6	6B	15	71	1816	7/2/2009 9:27	7/2/2009 9:42	Protean
7	6C	15	81	1933	7/2/2009 9:27	7/2/2009 9:42	Protean
8	6D	15	81	1826	7/2/2009 9:47	7/2/2009 10:02	Protean
1	7A	15	75	1711	7/2/2009 9:48	7/2/2009 10:03	Protean
2	7B	15	59	1783	7/2/2009 9:48	7/2/2009 10:03	Protean
3	7C	15	74	1934	7/2/2009 9:48	7/2/2009 10:03	Protean
4	7D	15	83	1963	7/2/2009 9:48	7/2/2009 10:03	Protean
5	8A	15	49	1653	7/2/2009 9:48	7/2/2009 10:03	Protean
6	8B	15	20	1788	7/2/2009 9:48	7/2/2009 10:03	Protean
7	8C	15	34	1920	7/2/2009 9:48	7/2/2009 10:03	Protean
8	8D	15	45	1782	7/2/2009 10:07	7/2/2009 10:22	Protean
1	9A	15	17	1689	7/2/2009 10:06	7/2/2009 10:21	Protean
2	9B	15	13	1706	7/2/2009 10:06	7/2/2009 10:21	Protean
3	9C	15	13	1802	7/2/2009 10:06	7/2/2009 10:21	Protean
4	9D	15	15	1945	7/2/2009 10:06	7/2/2009 10:21	Protean
5	10A	15	10	1708	7/2/2009 10:07	7/2/2009 10:22	Protean
6	10B	15	19	1743	7/2/2009 10:07	7/2/2009 10:22	Protean
7	10C	15	15	1826	7/2/2009 10:07	7/2/2009 10:22	Protean
8	10D	15	14	1769	7/2/2009 10:22	7/2/2009 10:37	Protean
1	11A	15	19	2125	7/2/2009 7:26	7/2/2009 7:41	Protean
2	11B	15	22	2260	7/2/2009 7:26	7/2/2009 7:41	Protean
3	11C	15	13	2544	7/2/2009 7:26	7/2/2009 7:41	Protean
4	11D	15	14	2596	7/2/2009 7:26	7/2/2009 7:41	Protean
5	12A	15	17	2235	7/2/2009 7:26	7/2/2009 7:41	Protean
6	12B	15	10	2330	7/2/2009 7:26	7/2/2009 7:41	Protean
7	12C	15	16	2530	7/2/2009 7:26	7/2/2009 7:41	Protean
8	12D	15	10	2463	7/2/2009 7:26	7/2/2009 7:41	Protean
1	13A	15	11	2231	7/2/2009 7:49	7/2/2009 8:04	Protean
2	13B	15	13	2190	7/2/2009 7:49	7/2/2009 8:04	Protean
3	13C	15	11	2458	7/2/2009 7:49	7/2/2009 8:04	Protean

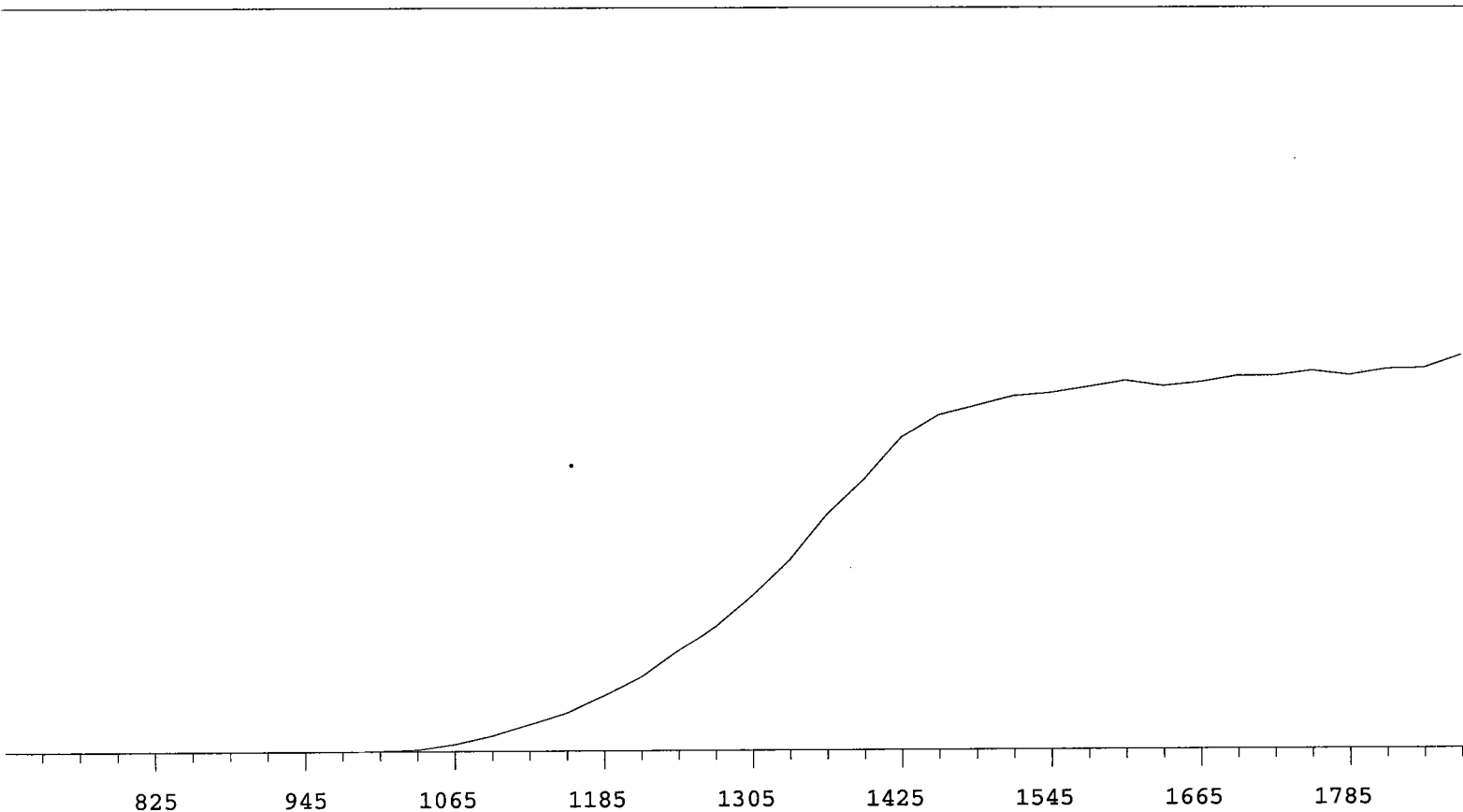
219  
7/2/09

4	13D	15	12	2635	7/2/2009 7:50	7/2/2009 8:05	Protean
5	14A	15	11	2173	7/2/2009 7:50	7/2/2009 8:05	Protean
6	14B	15	11	2281	7/2/2009 7:50	7/2/2009 8:05	Protean
7	14C	15	14	2323	7/2/2009 7:50	7/2/2009 8:05	Protean
8	14D	15	14	2388	7/2/2009 7:50	7/2/2009 8:05	Protean

Ra-228 Protean	Cal Date A0	7/2/2009 A1	Exp Date A2	7/31/2009 A3	A4
1A	6.30258E-01				
1B	6.28221E-01				
1C	6.17615E-01				
1D	6.04341E-01				
2A	6.17224E-01				
2B	6.16681E-01				
2C	5.96919E-01				
2D	6.11886E-01				
3A	5.68218E-01				
3B	5.98041E-01				
3C	6.16431E-01				
3D	5.99405E-01				
4A	6.20765E-01				
4B	6.20459E-01				
4C	6.05183E-01				
4D	5.87325E-01				
5A	6.25790E-01				
5B	6.28027E-01				
5C	6.36802E-01				
5D	6.23741E-01				
6A	6.22050E-01				
6B	6.16280E-01				
6C	6.11053E-01				
6D	6.12043E-01				
7A	6.17961E-01				
7B	6.27962E-01				
7C	6.17791E-01				
7D	6.25720E-01				
8A	6.24723E-01				
8B	6.33167E-01				
8C	6.33890E-01				
8D	6.28089E-01				
9A	6.496412E-01				
9B	6.356321E-01				
9C	6.273008E-01				
9D	6.432553E-01				
10A	6.389066E-01				
10B	6.137441E-01				
10C	6.249999E-01				
10D	6.319781E-01				
11A	5.82502E-01				
11B	6.37172E-01				
11C	6.35171E-01				
11D	6.34840E-01				
12A	6.28566E-01				
12B	6.35234E-01				
12C	6.30366E-01				
12D	6.31956E-01				
13A	6.40953E-01				

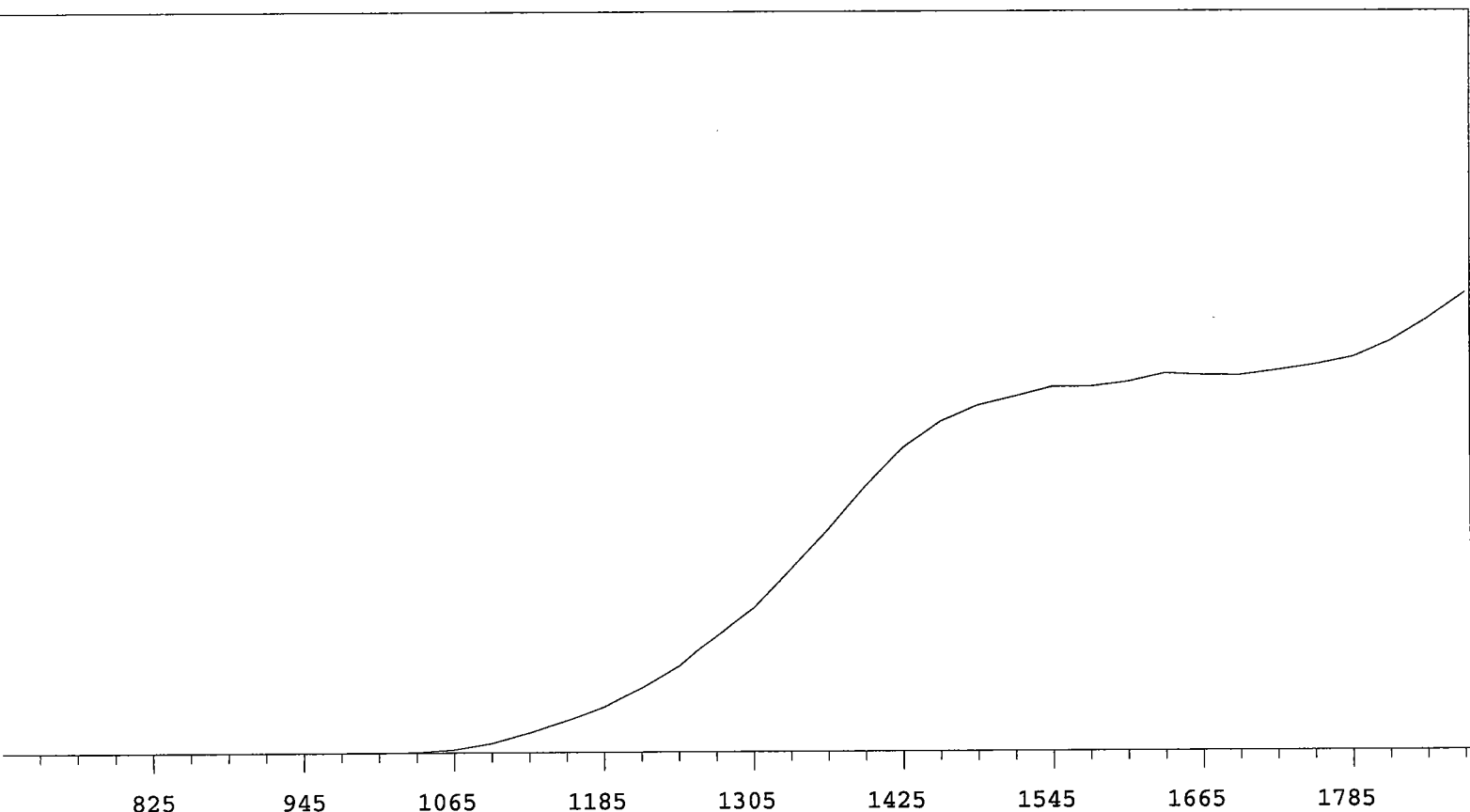
<b>13B</b>	6.52643E-01
<b>13C</b>	6.53798E-01
<b>13D</b>	6.37701E-01
<b>14A</b>	6.39290E-01
<b>14B</b>	6.26611E-01
<b>14C</b>	6.37531E-01
<b>14D</b>	6.32609E-01



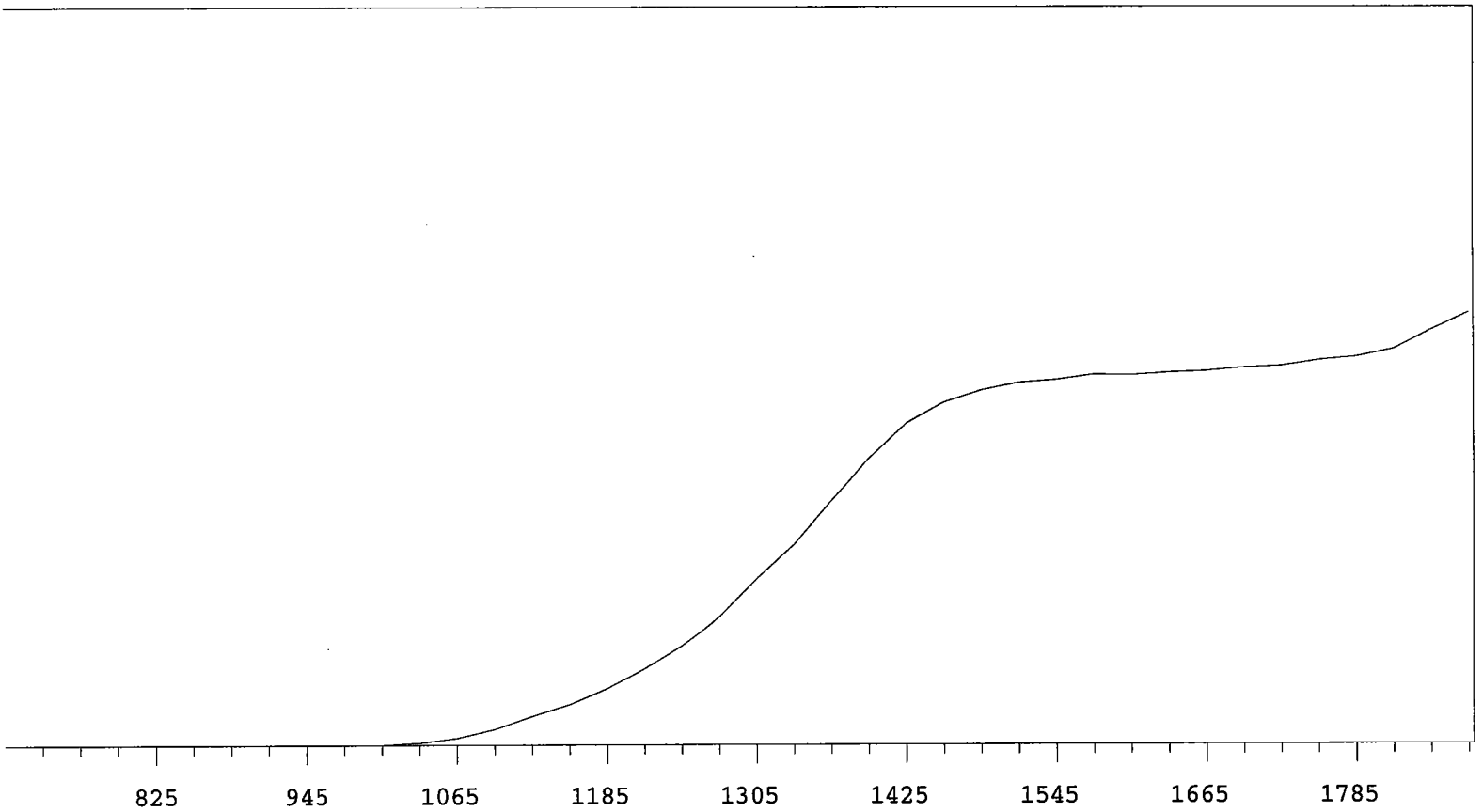


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	11640	+69.78
735	1		1335	14241	+62.88
765	0		1365	17534	+55.91
795	0	+0.00	1395	20127	+45.04
825	0	>100	1425	23254	+31.29
855	1	>100	1455	24902	+20.41
885	0	+55.56	1485	25605	+10.49
915	2	+66.67	1515	26310	+6.44
945	0	>100	1545	26535	+5.31
975	2	>100	1575	26953	+2.79
1005	42	>100	1605	27399	+1.83
1035	145	>100	1635	27000	+1.71
1065	544	>100	1665	27255	+1.62
1095	1136	>100	1695	27723	+3.14
1125	1967	>100	1725	27705	+1.56
1155	2845	>100	1755	28072	+1.15
1185	4078	>100	1785	27729	+1.43
1215	5483	+93.18	1815	28194	+3.24
1245	7400	+83.35	1845	28243	
1275	9328	+75.40	1875	29191	

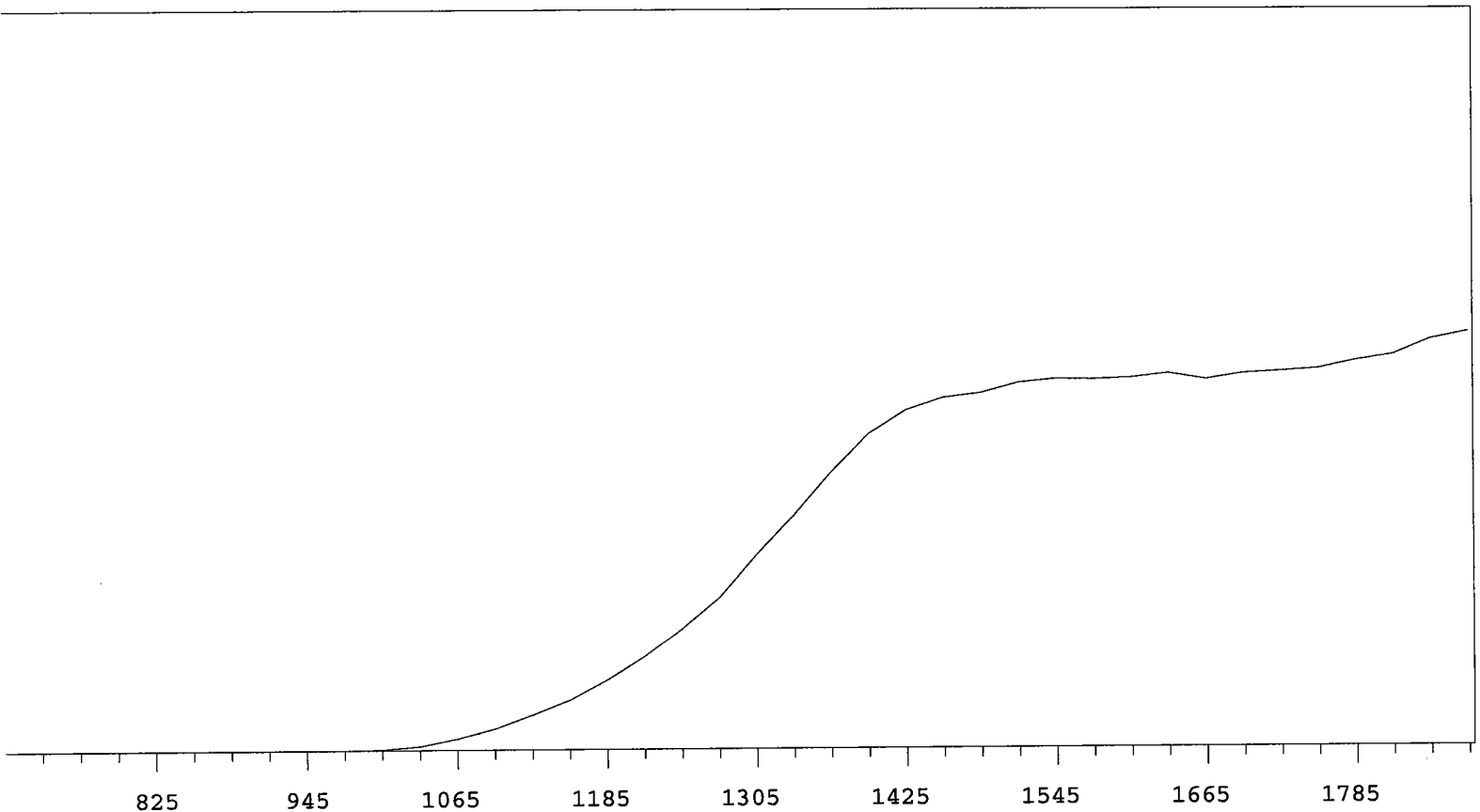
Alpha Volts: 1575 Beta Volts: 1575



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	13188	+75.92
735	0		1335	16818	+67.60
765	0	+55.56	1365	20420	+59.86
795	1	+83.33	1395	24341	+47.85
825	1	+55.56	1425	27854	+35.51
855	0	>100	1455	30288	+23.26
885	1	+0.00	1485	31798	+14.54
915	0	+0.00	1515	32622	+8.32
945	1	>100	1545	33496	+5.11
975	0	>100	1575	33475	+4.43
1005	4	>100	1605	33903	+3.09
1035	56	>100	1635	34654	+2.46
1065	292	>100	1665	34485	+1.74
1095	890	>100	1695	34445	+1.84
1125	1841	>100	1725	34908	+3.91
1155	2936	>100	1755	35401	+6.80
1185	4179	>100	1785	36062	+10.27
1215	5837	>100	1815	37505	+14.30
1245	7821	+91.28	1845	39508	
1275	10638	+83.88	1875	41843	



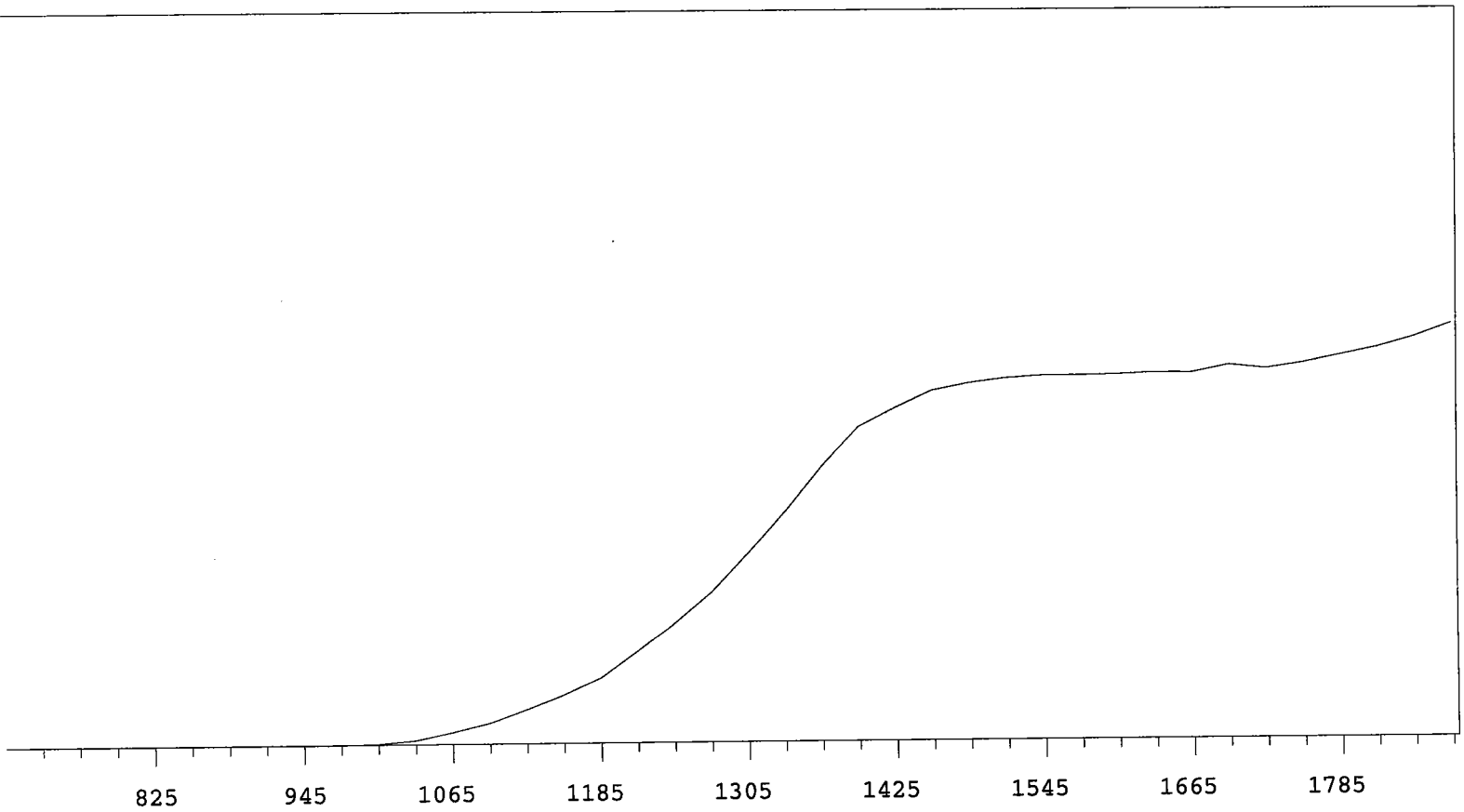
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	14817	+71.06
735	0		1335	17823	+63.34
765	1	+0.00	1365	21704	+53.63
795	0	>100	1395	25422	+42.55
825	1	-55.56	1425	28424	+29.21
855	1	+55.56	1455	30244	+18.11
885	0	>100	1485	31305	+10.10
915	1	>100	1515	31989	+6.07
945	0	>100	1545	32223	+3.43
975	4	>100	1575	32671	+2.15
1005	32	>100	1605	32621	+1.68
1035	206	>100	1635	32837	+1.52
1065	639	>100	1665	32961	+2.01
1095	1416	>100	1695	33249	+2.64
1125	2551	>100	1725	33409	+3.21
1155	3619	>100	1755	33931	+4.07
1185	5037	+98.68	1785	34234	+7.20
1215	6875	+91.19	1815	34909	+10.28
1245	8915	+85.53	1845	36660	
1275	11519	+77.28	1875	38205	



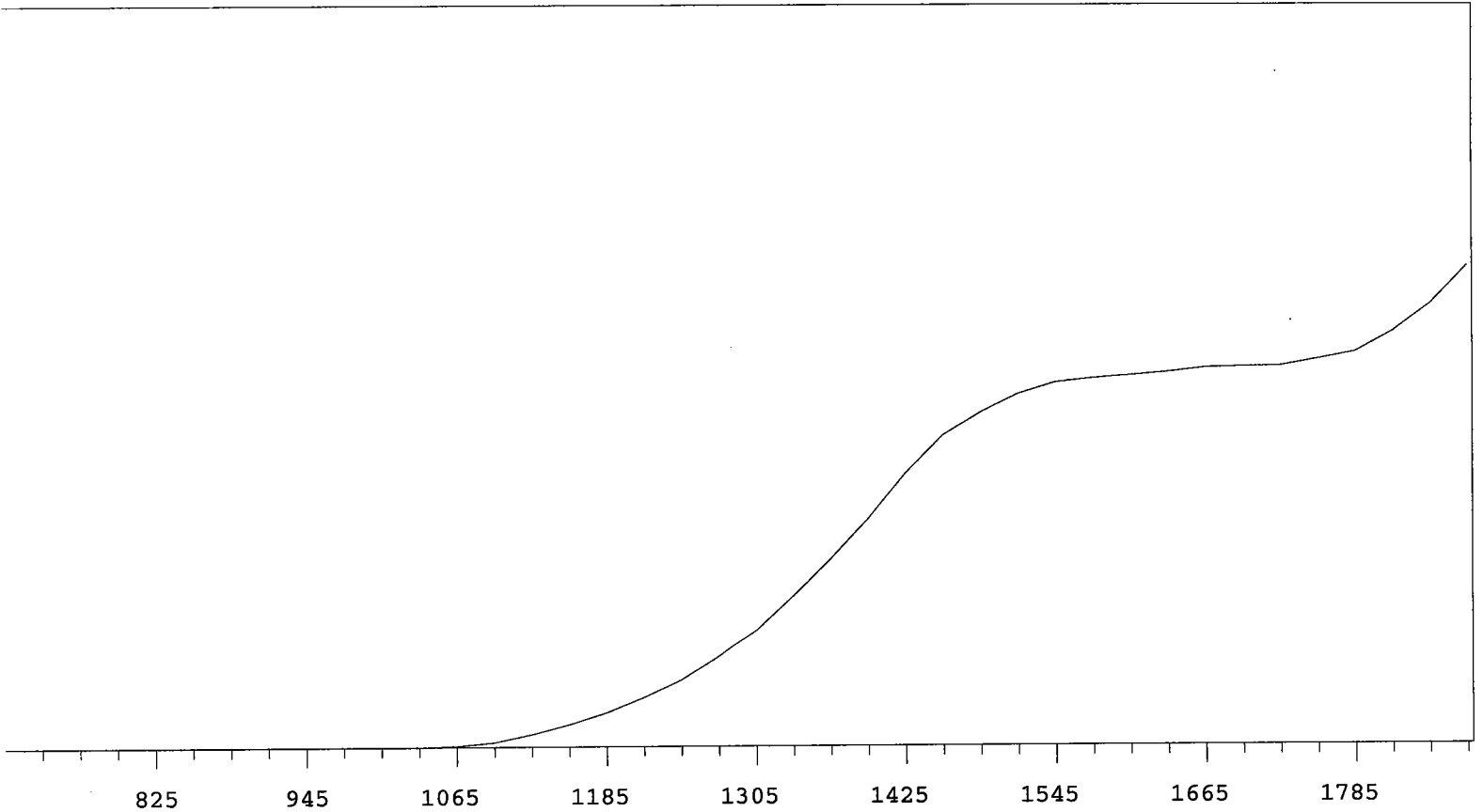
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	15202	+66.36
735	1		1335	18216	+57.86
765	0	+0.00	1365	21597	+45.58
795	1	+0.00	1395	24648	+32.96
825	0	+0.00	1425	26505	+19.92
855	1	>100	1455	27475	+11.42
885	0	>100	1485	27836	+7.08
915	0	>100	1515	28609	+4.51
945	0	>100	1545	28896	+2.93
975	8	>100	1575	28862	+1.66
1005	75	>100	1605	28969	+0.36
1035	303	>100	1635	29292	+0.80
1065	872	>100	1665	28836	+1.06
1095	1656	>100	1695	29279	+1.48
1125	2729	>100	1725	29439	+3.59
1155	3862	>100	1755	29642	+4.07
1185	5425	+98.19	1785	30243	+6.51
1215	7256	+88.82	1815	30699	+7.79
1245	9510	+81.89	1845	31876	
1275	11944	+74.07	1875	32444	

MPC 9600 Plateau  
 Alpha Volts: 705

Instrument 2 MPC 9604 Detector A 7/1/2009  
 Beta Volts: 1575



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	19017	+67.45
735	1		1335	23157	+59.23
765	0	+83.33	1365	27625	+45.78
795	0	-83.33	1395	31465	+32.72
825	1	>100	1425	33352	+20.41
855	0	>100	1455	35084	+11.74
885	1	+100.00	1485	35819	+7.11
915	1	>100	1515	36292	+3.35
945	2	>100	1545	36527	+1.63
975	12	>100	1575	36540	+0.87
1005	91	>100	1605	36585	+0.48
1035	421	>100	1635	36742	+1.76
1065	1239	>100	1665	36691	+1.53
1095	2155	>100	1695	37461	+1.89
1125	3527	>100	1725	37073	+3.07
1155	4974	>100	1755	37603	+4.02
1185	6647	+97.44	1785	38346	+6.58
1215	9250	+89.00	1815	39111	+7.95
1245	12041	+82.15	1845	40115	
1275	15094	+73.81	1875	41409	

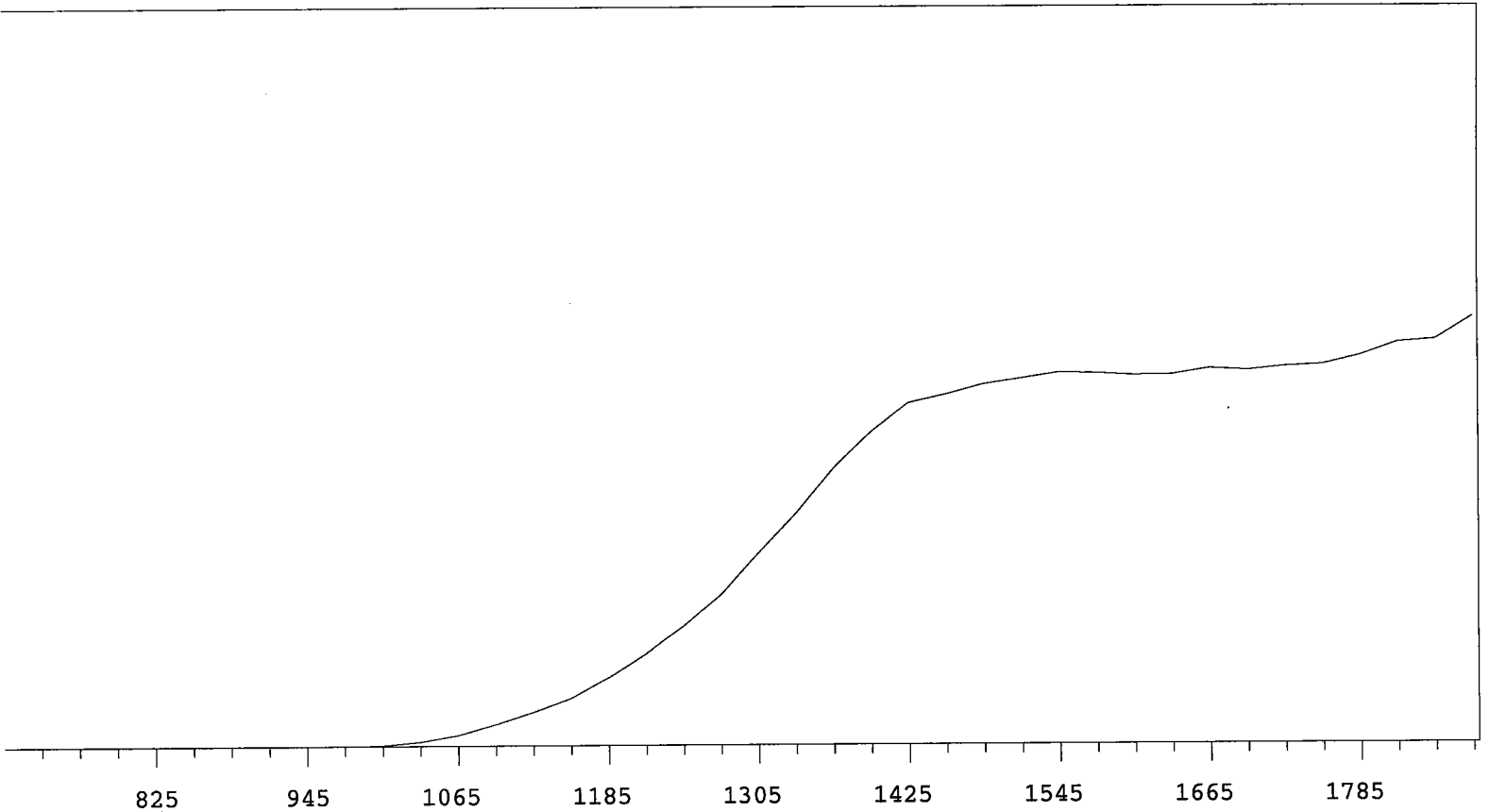


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	12541	+83.18
735	1		1335	16192	+74.48
765	0		1365	20083	+67.17
795	0	>100	1395	24273	+58.43
825	0	>100	1425	29090	+46.86
855	0	>100	1455	33223	+34.56
885	0	>100	1485	35608	+22.67
915	0	>100	1515	37581	+13.63
945	1	>100	1545	38762	+8.18
975	2	>100	1575	39185	+4.42
1005	3	>100	1605	39484	+3.06
1035	14	>100	1635	39806	+2.61
1065	127	>100	1665	40264	+2.03
1095	500	>100	1695	40353	+2.32
1125	1332	>100	1725	40431	+3.28
1155	2373	>100	1755	41127	+7.09
1185	3614	>100	1785	41882	+12.40
1215	5227	>100	1815	44049	+18.52
1245	7060	+97.33	1845	46950	
1275	9574	+90.30	1875	51097	

MPC 9600 Plateau  
Alpha Volts: 705

Instrument 2 MPC 9604 Detector C  
Beta Volts: 1575

7/1/2009

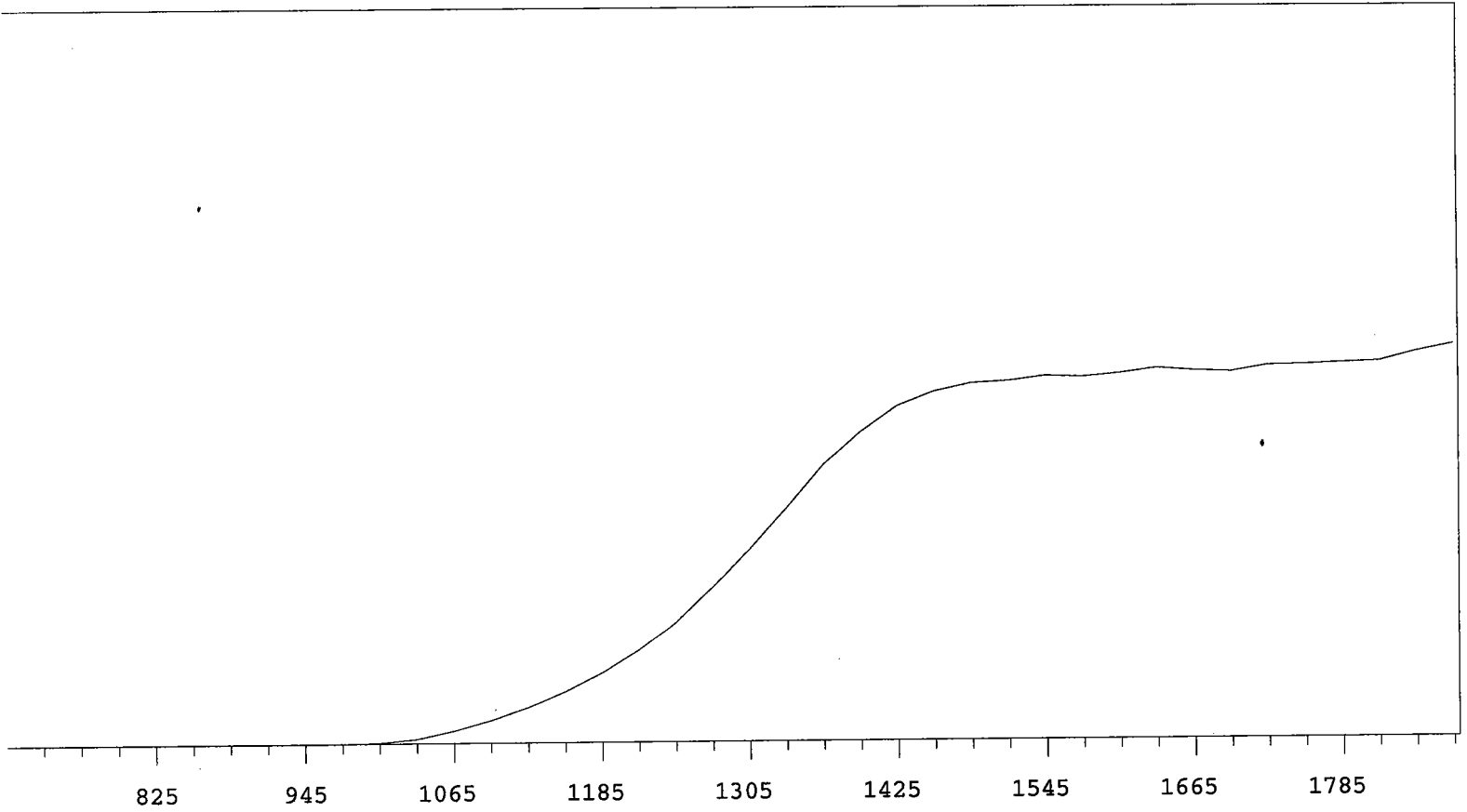


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	18216	+67.74
735	0		1335	21995	+58.11
765	0		1365	26173	+46.11
795	0	>100	1395	29479	+32.75
825	0	>100	1425	32186	+20.62
855	0	>100	1455	33022	+12.13
885	0	>100	1485	33981	+7.22
915	1	>100	1515	34520	+4.95
945	0	>100	1545	35095	+2.07
975	17	>100	1575	35014	+0.38
1005	87	>100	1605	34812	+0.55
1035	438	>100	1635	34859	+1.11
1065	1055	>100	1665	35460	+1.94
1095	2114	>100	1695	35273	+1.95
1125	3282	>100	1725	35629	+2.73
1155	4625	>100	1755	35811	+5.77
1185	6554	+97.66	1785	36656	+6.44
1215	8743	+88.09	1815	37896	+9.21
1245	11345	+81.31	1845	38145	
1275	14261	+74.60	1875	40283	

MPC 9600 Plateau  
Alpha Volts: 705

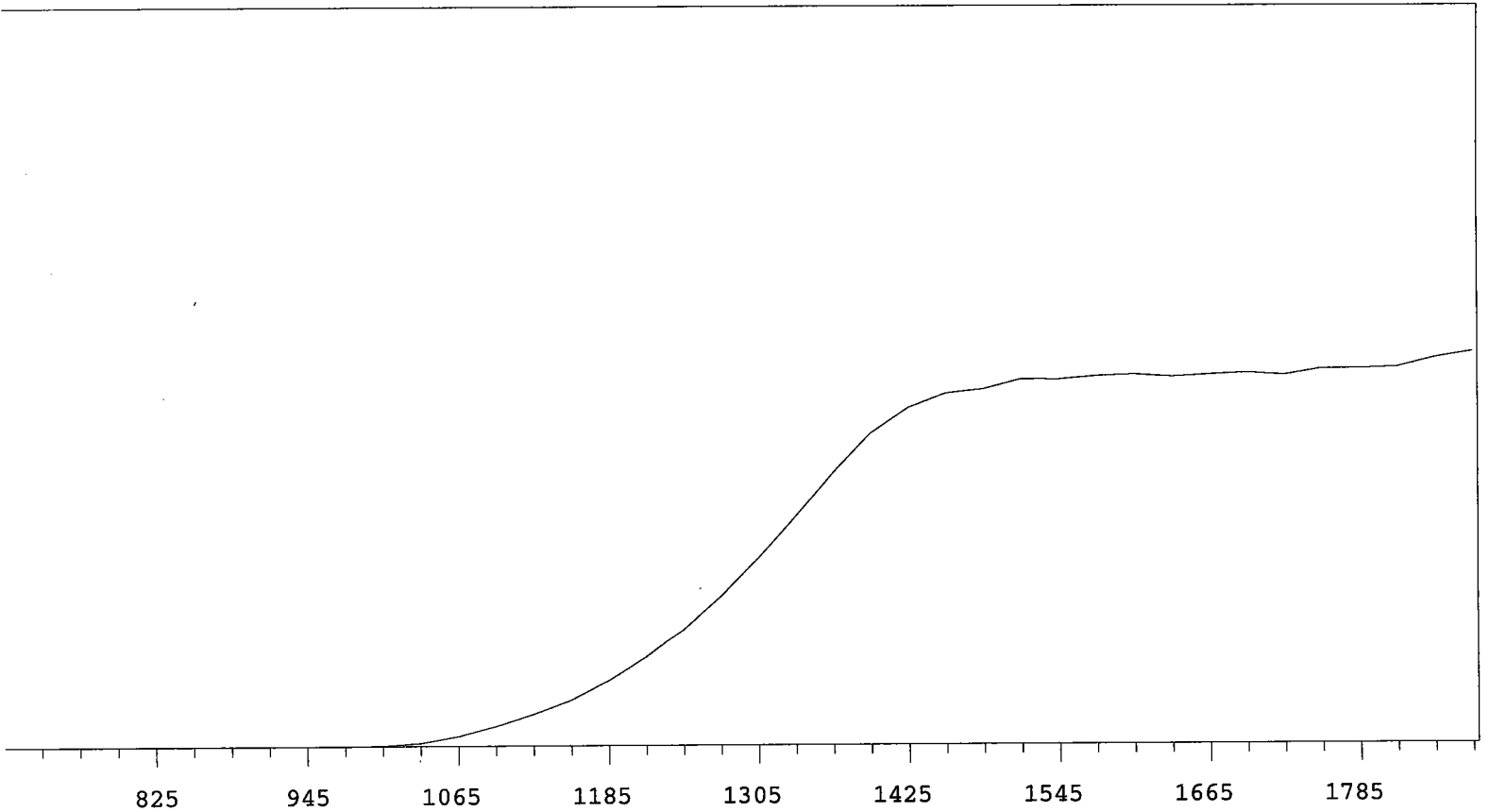
Instrument 2 MPC 9604 Detector D  
Beta Volts: 1575

7/1/2009

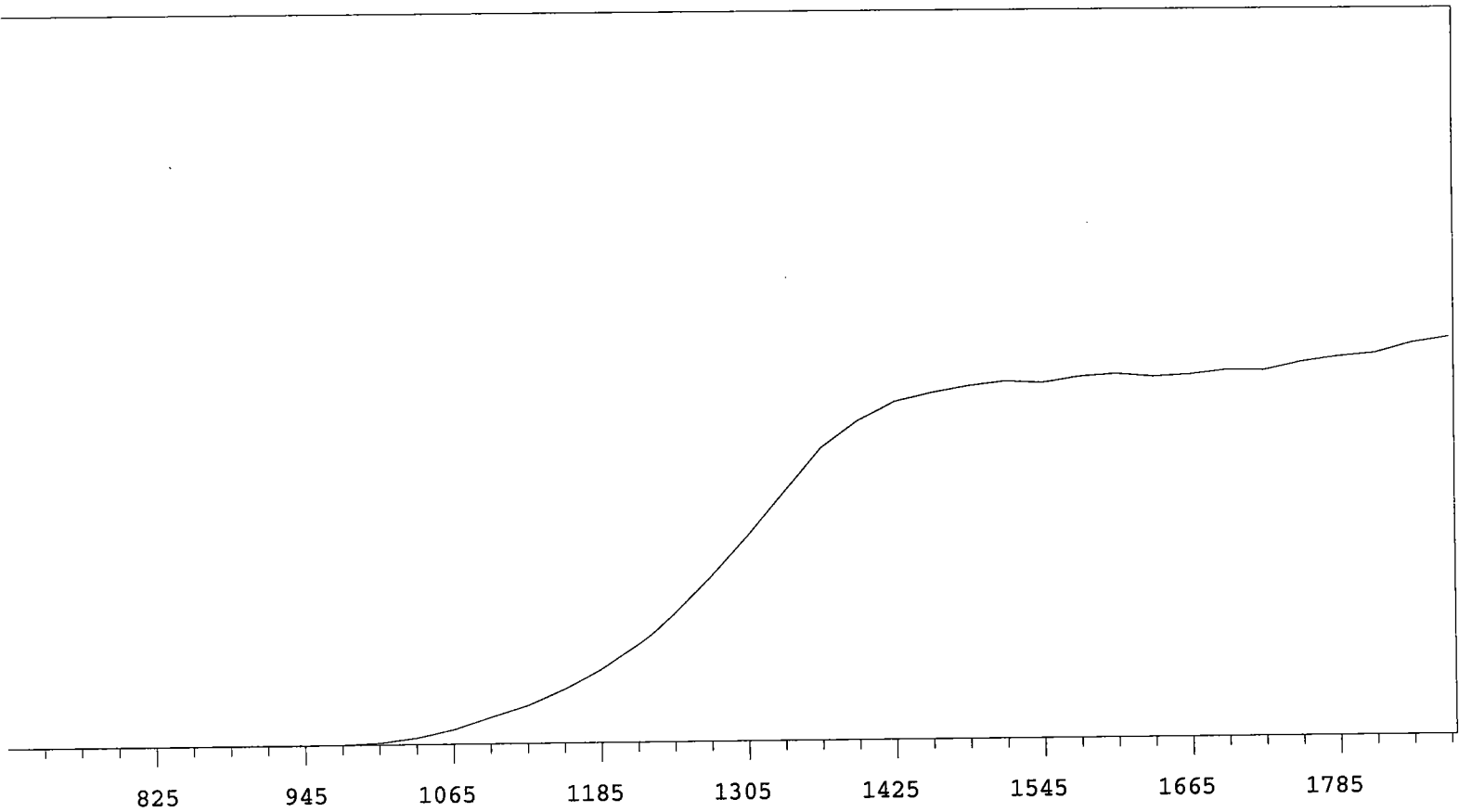


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	18675	+65.94
735	0		1335	22620	+55.69
765	0	+83.33	1365	26869	+44.63
795	2	+55.56	1395	29957	+32.08
825	1	>100	1425	32494	+20.49
855	0	>100	1455	33836	+11.98
885	0	>100	1485	34627	+6.45
915	0	>100	1515	34849	+3.22
945	2	>100	1545	35298	+1.98
975	9	>100	1575	35180	+2.37
1005	89	>100	1605	35503	+1.57
1035	439	>100	1635	36006	+0.99
1065	1198	>100	1665	35722	+0.89
1095	2164	>100	1695	35597	+0.93
1125	3436	>100	1725	36188	+1.86
1155	4917	>100	1755	36272	+1.90
1185	6762	+96.59	1785	36389	+2.55
1215	9006	+89.14	1815	36529	+4.39
1245	11800	+81.34	1845	37459	
1275	15132	+73.59	1875	38170	

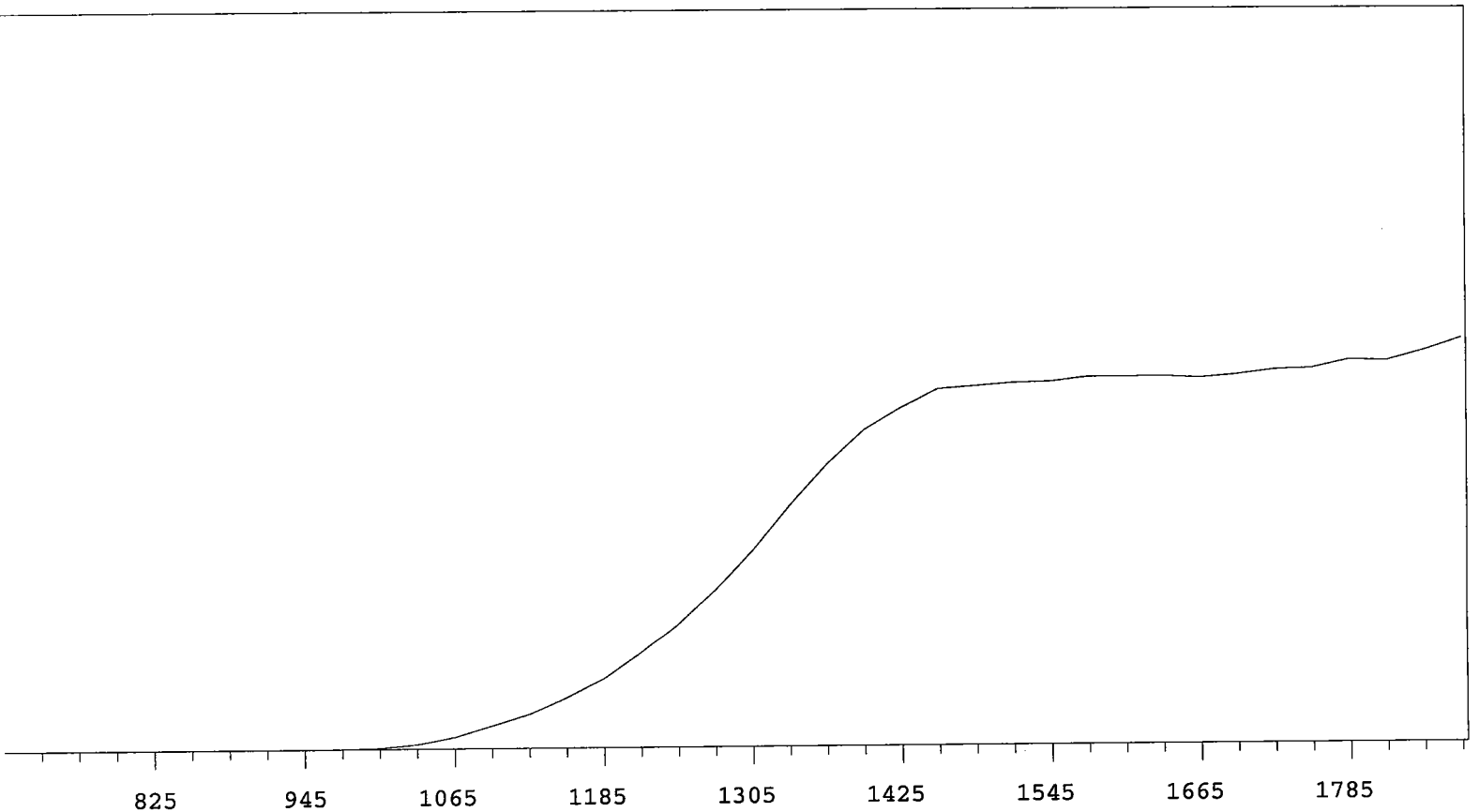




VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	16654	+68.57
735	0		1335	20416	+59.26
765	0	+55.56	1365	24191	+47.28
795	1	>100	1395	27643	+34.04
825	1	+0.00	1425	29891	+21.08
855	1	>100	1455	31183	+12.30
885	0	>100	1485	31558	+6.67
915	0	>100	1515	32444	+4.05
945	0	>100	1545	32413	+2.90
975	9	>100	1575	32704	+0.81
1005	53	>100	1605	32837	+0.71
1035	302	>100	1635	32629	+0.49
1065	878	>100	1665	32797	+0.16
1095	1805	>100	1695	32964	+1.32
1125	2887	>100	1725	32746	+1.40
1155	4163	>100	1755	33308	+1.56
1185	5842	+99.81	1785	33318	+3.21
1215	7959	+90.90	1815	33456	+3.92
1245	10323	+83.03	1845	34283	
1275	13250	+75.91	1875	34815	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	19810	+64.73
735	1		1335	23962	+52.62
765	0	-55.56	1365	28091	+39.27
795	0	>100	1395	30594	+25.61
825	1	>100	1425	32381	+14.86
855	3	+33.33	1455	33206	+8.91
885	0	+0.00	1485	33832	+4.41
915	1	>100	1515	34260	+3.01
945	2	>100	1545	34071	+2.33
975	29	>100	1575	34623	+1.34
1005	165	>100	1605	34848	+1.22
1035	613	>100	1635	34564	+0.89
1065	1394	>100	1665	34733	+1.01
1095	2558	>100	1695	35144	+2.76
1125	3702	>100	1725	35084	+3.66
1155	5222	>100	1755	35839	+3.97
1185	7161	+96.06	1785	36332	+5.39
1215	9507	+89.18	1815	36654	+5.35
1245	12552	+81.52	1845	37609	
1275	16030	+73.64	1875	38164	

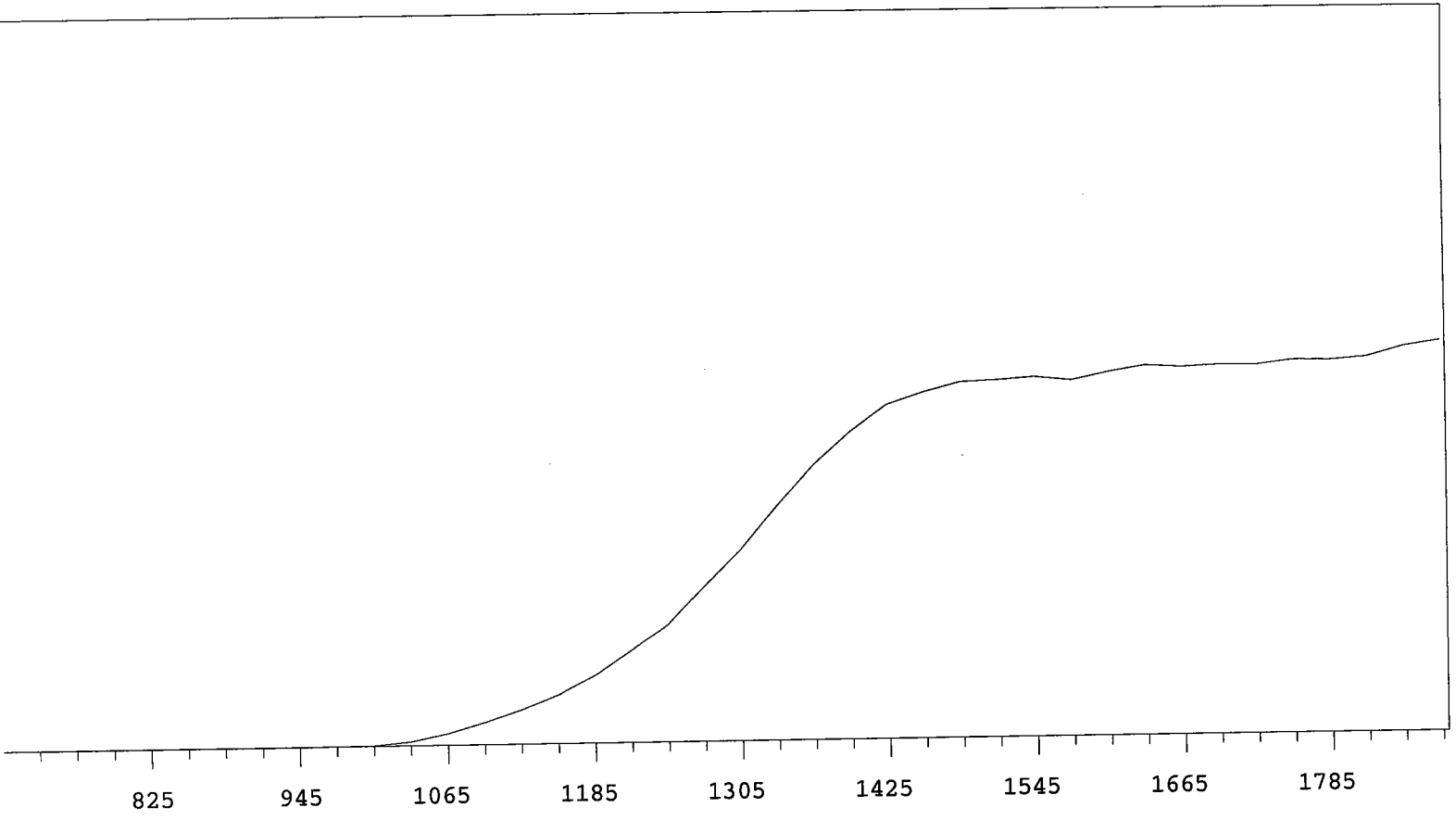


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	21412	+66.80
735	1		1335	26262	+56.32
765	1		1365	30679	+43.71
795	0	>100	1395	34466	+31.61
825	0	+0.00	1425	36949	+20.14
855	0	>100	1455	38998	+11.16
885	1	>100	1485	39313	+5.34
915	1	>100	1515	39625	+2.44
945	1	>100	1545	39751	+2.04
975	17	>100	1575	40227	+1.45
1005	122	>100	1605	40228	+0.56
1035	533	>100	1635	40255	+0.13
1065	1287	>100	1665	40075	+1.22
1095	2493	>100	1695	40384	+1.95
1125	3753	>100	1725	40900	+3.50
1155	5482	>100	1755	41028	+3.05
1185	7538	+99.39	1785	41899	+3.71
1215	10305	+90.31	1815	41767	+5.64
1245	13415	+82.57	1845	42852	
1275	17141	+75.13	1875	44132	

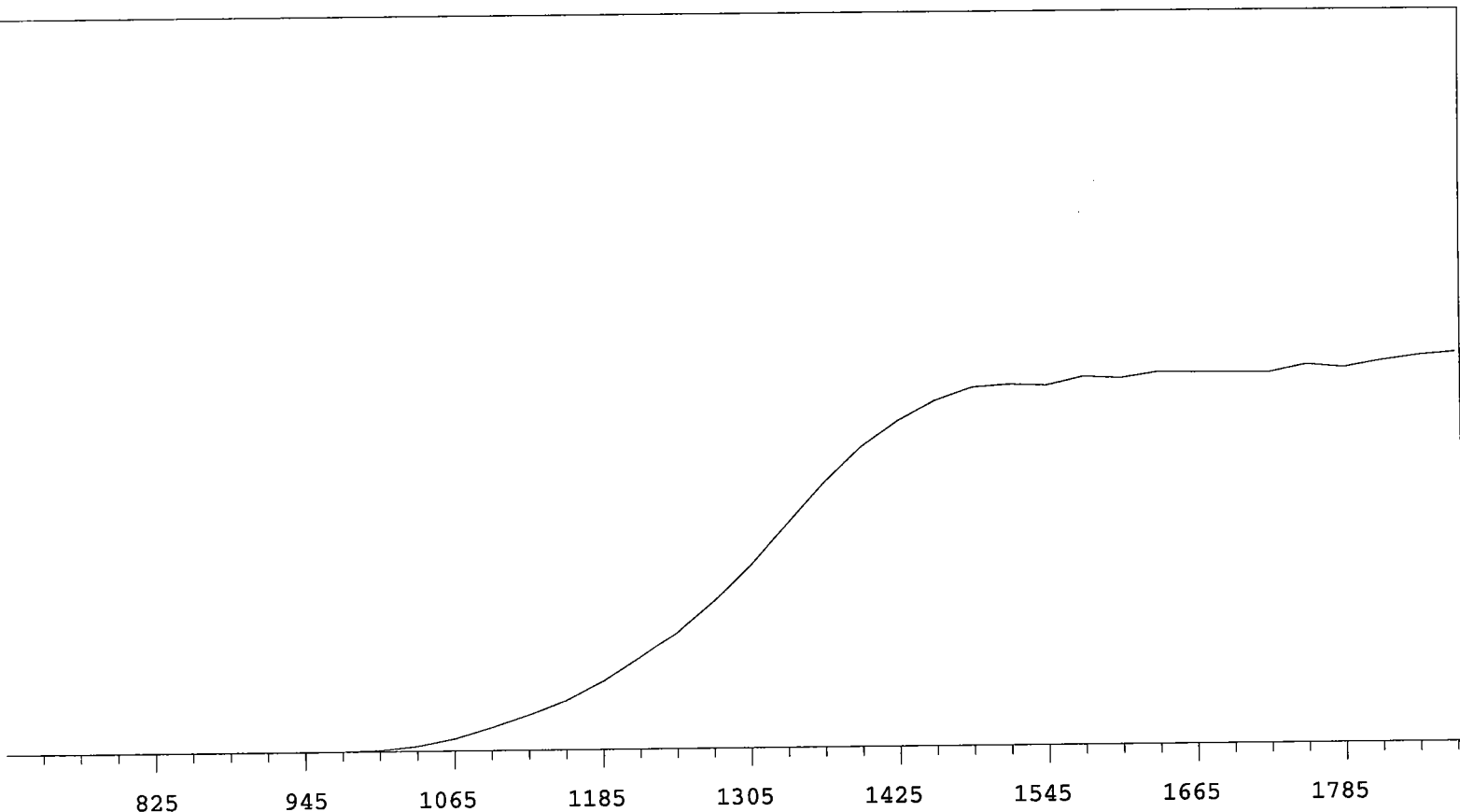
MPC 9600 Plateau  
 Alpha Volts: 705

Instrument 3 MPC 9604 Detector D  
 Beta Volts: 1575

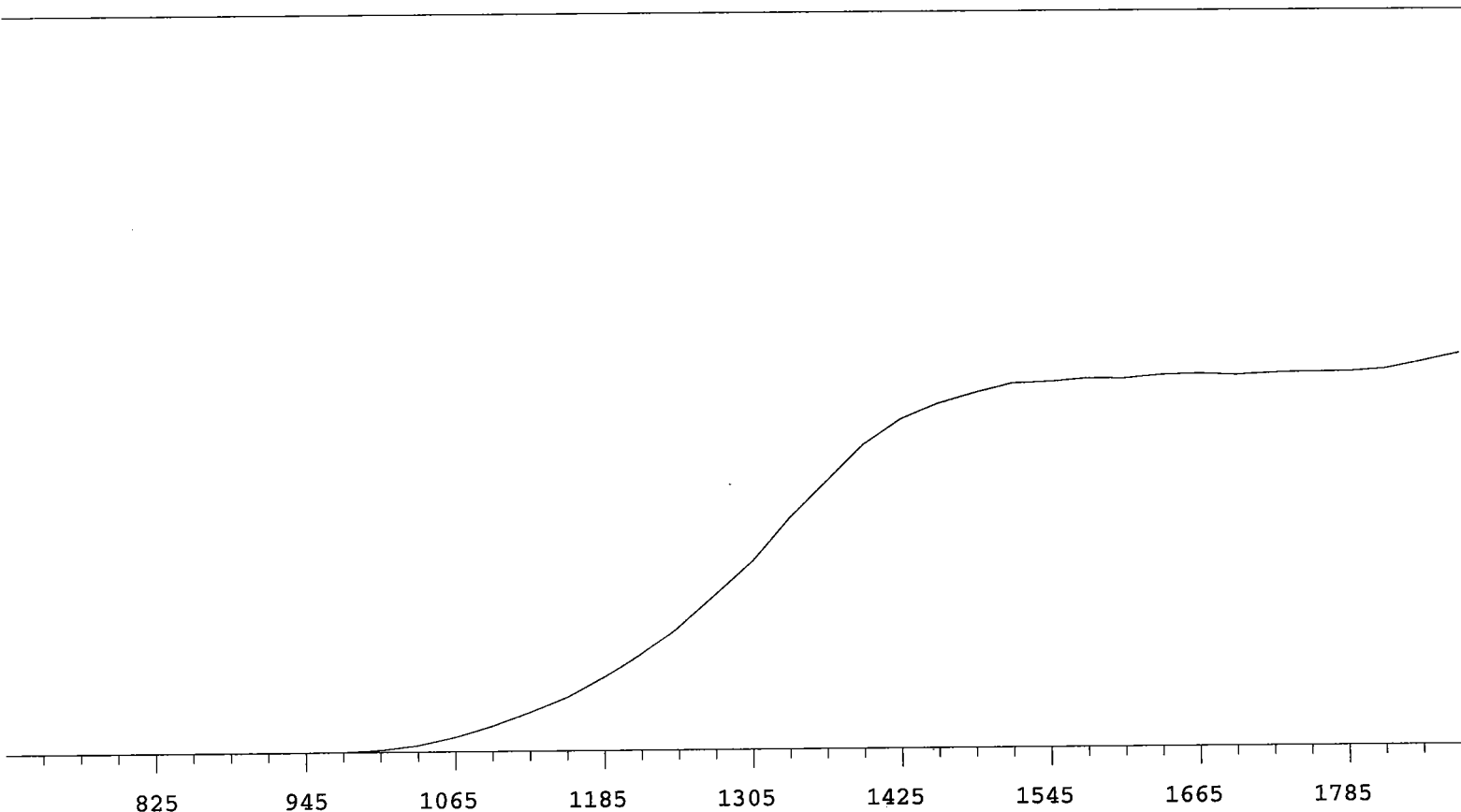
7/1/2009



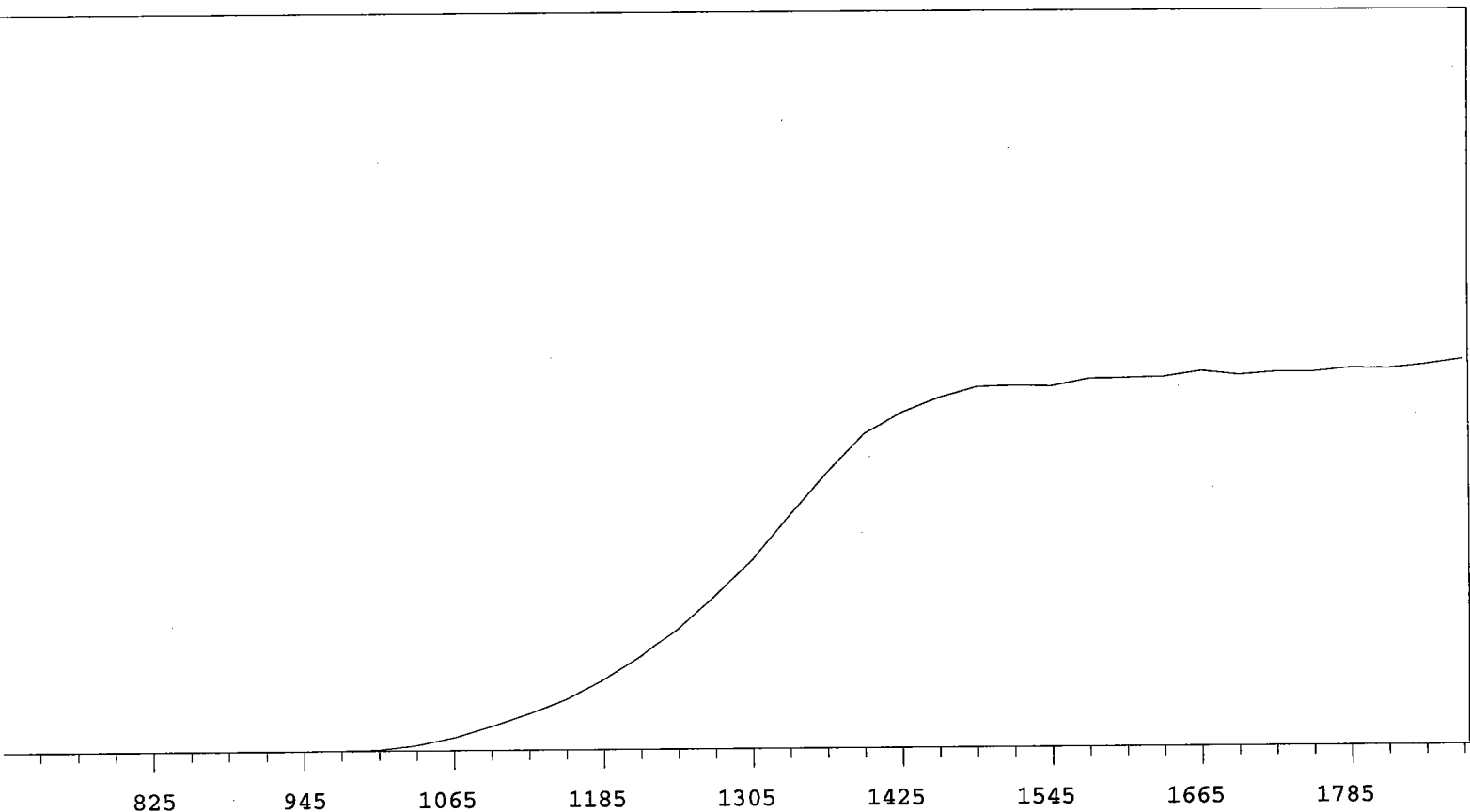
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	14171	+66.45
735	1		1335	17362	+54.90
765	0	+0.00	1365	20310	+43.83
795	1	>100	1395	22647	+30.82
825	0	+83.33	1425	24551	+20.19
855	0	-83.33	1455	25440	+11.69
885	1	>100	1485	26124	+5.90
915	0	>100	1515	26245	+2.21
945	1	>100	1545	26428	+1.39
975	12	>100	1575	26151	+2.69
1005	51	>100	1605	26721	+2.72
1035	298	>100	1635	27168	+2.80
1065	848	>100	1665	27007	+0.87
1095	1649	>100	1695	27135	+0.70
1125	2535	>100	1725	27089	+1.24
1155	3602	>100	1755	27414	+1.43
1185	5036	+98.31	1785	27373	+3.21
1215	6880	+91.37	1815	27581	+4.34
1245	8822	+82.29	1845	28332	
1275	11546	+74.61	1875	28750	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16442	+66.24
735	0		1335	20146	+57.40
765	0		1365	23769	+46.40
795	0	>100	1395	26926	+34.68
825	2	+55.56	1425	29276	+24.40
855	1	>100	1455	31037	+15.28
885	0	-55.56	1485	32197	+7.91
915	3	>100	1515	32425	+4.33
945	0	>100	1545	32314	+2.14
975	16	>100	1575	33071	+2.66
1005	114	>100	1605	32918	+2.52
1035	451	>100	1635	33435	+1.02
1065	1100	>100	1665	33382	+0.73
1095	2068	>100	1695	33349	+1.07
1125	3189	>100	1725	33324	+1.28
1155	4386	>100	1755	34001	+2.26
1185	6094	+94.81	1785	33701	+3.08
1215	8184	+87.09	1815	34304	+2.97
1245	10489	+78.88	1845	34744	
1275	13273	+72.66	1875	35012	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	15747	+62.38
735	1		1335	19230	+54.19
765	0	+0.00	1365	22255	+44.46
795	1	>100	1395	25299	+32.45
825	0	>100	1425	27370	+22.24
855	0	>100	1455	28625	+14.10
885	0	>100	1485	29467	+8.56
915	0	>100	1515	30213	+5.29
945	2	>100	1545	30326	+2.77
975	31	>100	1575	30564	+1.57
1005	176	>100	1605	30548	+1.52
1035	550	>100	1635	30820	+0.85
1065	1218	>100	1665	30898	+0.79
1095	2114	>100	1695	30779	+0.44
1125	3212	>100	1725	30934	+0.45
1155	4416	>100	1755	31008	+0.96
1185	6066	+92.28	1785	30991	+2.01
1215	7936	+85.60	1815	31196	+3.80
1245	10288	+76.79	1845	31781	
1275	13020	+70.59	1875	32406	



VOLTS    COUNTS    %/100 Volts

VOLTS    COUNTS    %/100 Volts

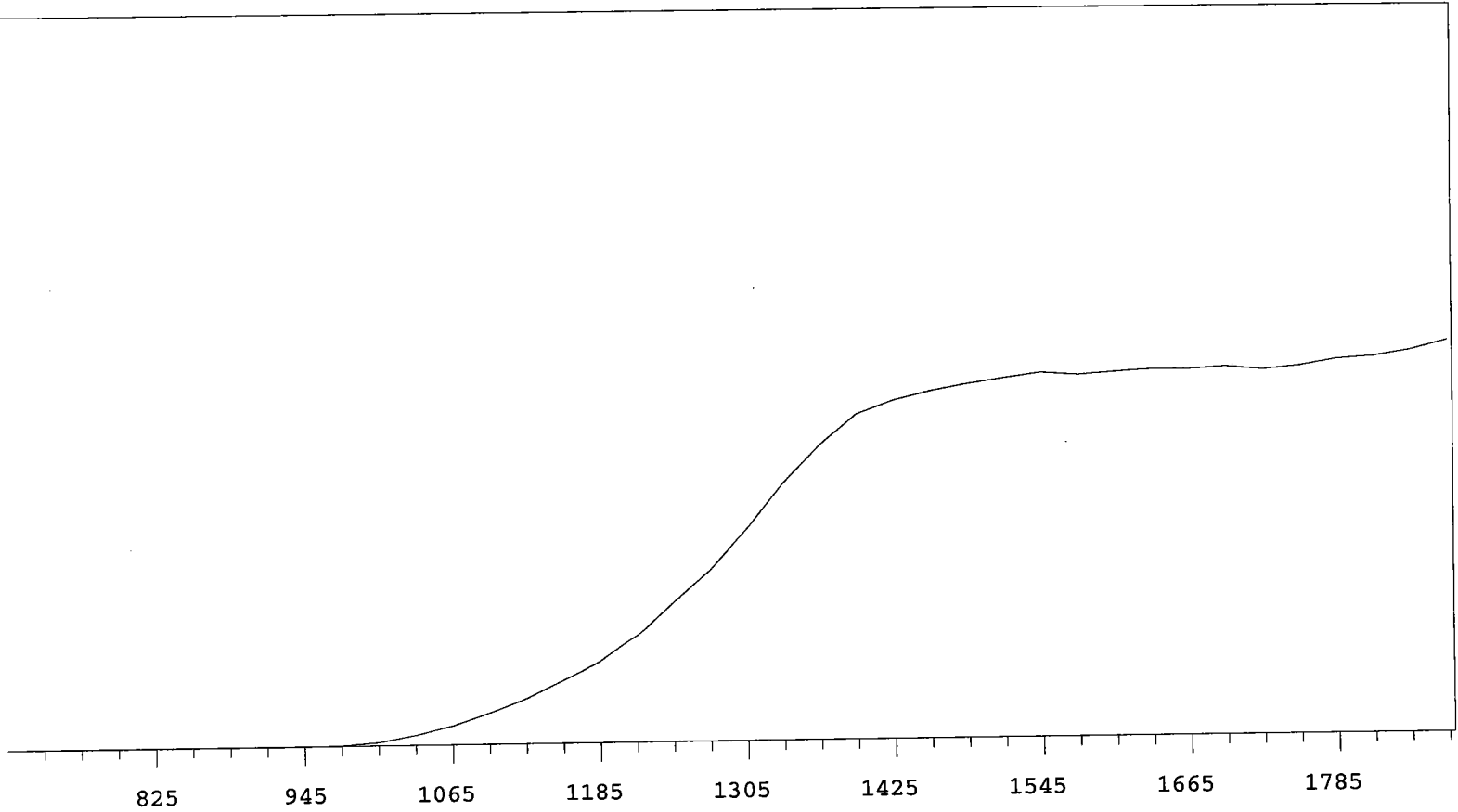
705	0	
735	1	
765	0	+55.56
795	2	+0.00
825	0	-55.56
855	1	>100
885	0	>100
915	0	>100
945	2	>100
975	24	>100
1005	134	>100
1035	558	>100
1065	1361	>100
1095	2511	>100
1125	3762	>100
1155	5246	>100
1185	7268	+96.29
1215	9733	+88.98
1245	12701	+79.94
1275	16176	+73.13

1305	19796	+65.77
1335	24338	+57.55
1365	28686	+45.86
1395	32750	+32.27
1425	34919	+20.83
1455	36434	+11.45
1485	37487	+5.80
1515	37623	+3.32
1545	37528	+2.07
1575	38277	+2.12
1605	38338	+2.70
1635	38426	+1.12
1665	39007	+1.06
1695	38592	+0.64
1725	38870	+0.63
1755	38868	+1.30
1785	39238	+1.45
1815	39169	+2.34
1845	39570	
1875	40086	

MPC 9600 Plateau  
Alpha Volts: 705

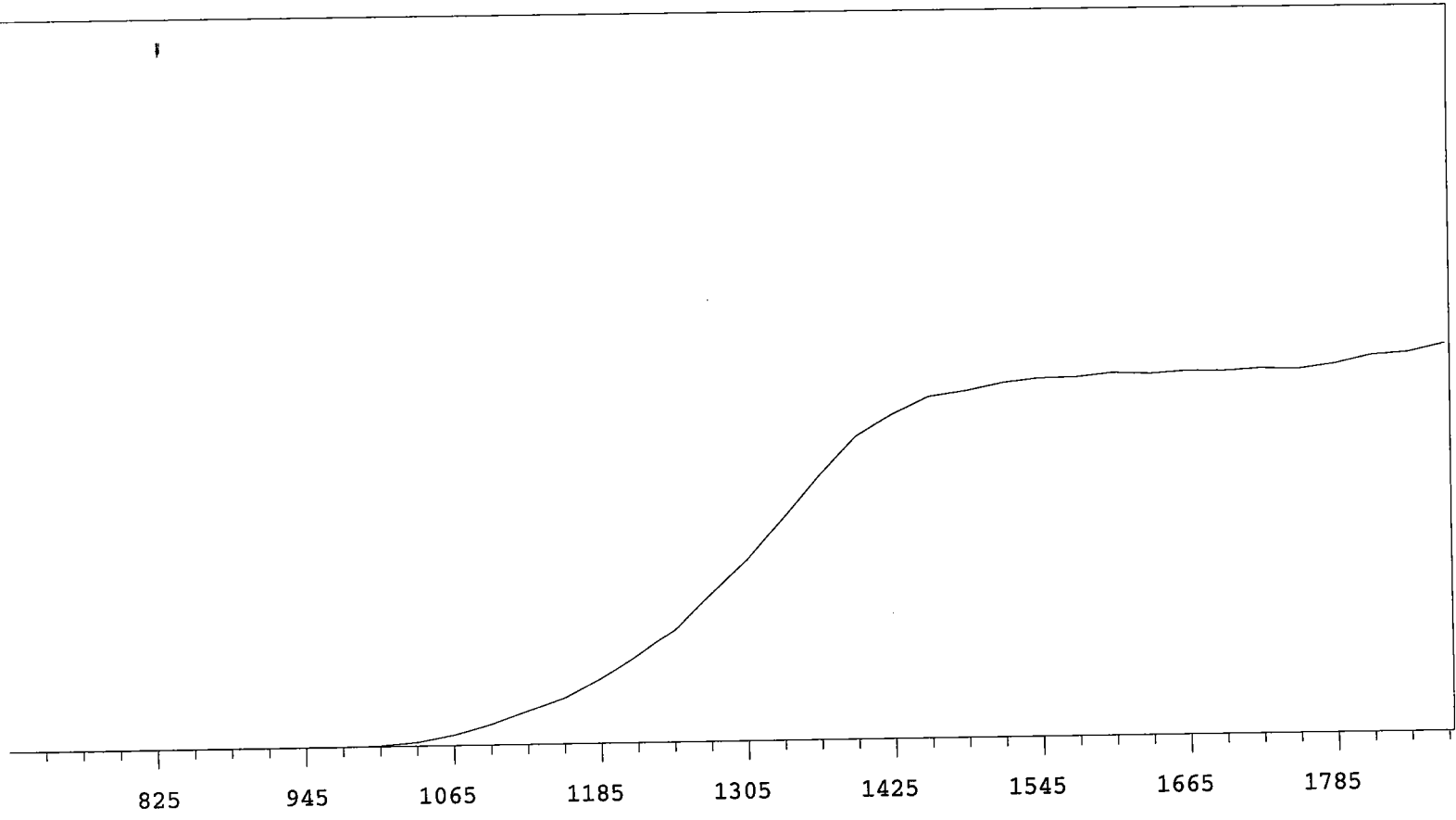
Instrument 4 MPC 9604 Detector D  
Beta Volts: 1575

7/1/2009



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	18491	+61.09
735	0		1335	22444	+51.56
765	0	+0.00	1365	25756	+37.44
795	0	>100	1395	28379	+23.82
825	1	+83.33	1425	29517	+14.00
855	1	+55.56	1455	30309	+8.08
885	0	+0.00	1485	30874	+6.03
915	1	>100	1515	31345	+3.66
945	1	>100	1545	31782	+2.17
975	60	>100	1575	31567	+1.31
1005	297	>100	1605	31789	+0.78
1035	855	>100	1635	31963	+1.34
1065	1647	>100	1665	31956	+0.29
1095	2700	>100	1695	32123	+0.20
1125	3921	>100	1725	31850	+1.46
1155	5471	+96.54	1755	32114	+2.39
1185	7042	+90.21	1785	32665	+3.95
1215	9405	+82.23	1815	32876	+4.96
1245	12266	+76.33	1845	33399	
1275	14989	+69.38	1875	34206	



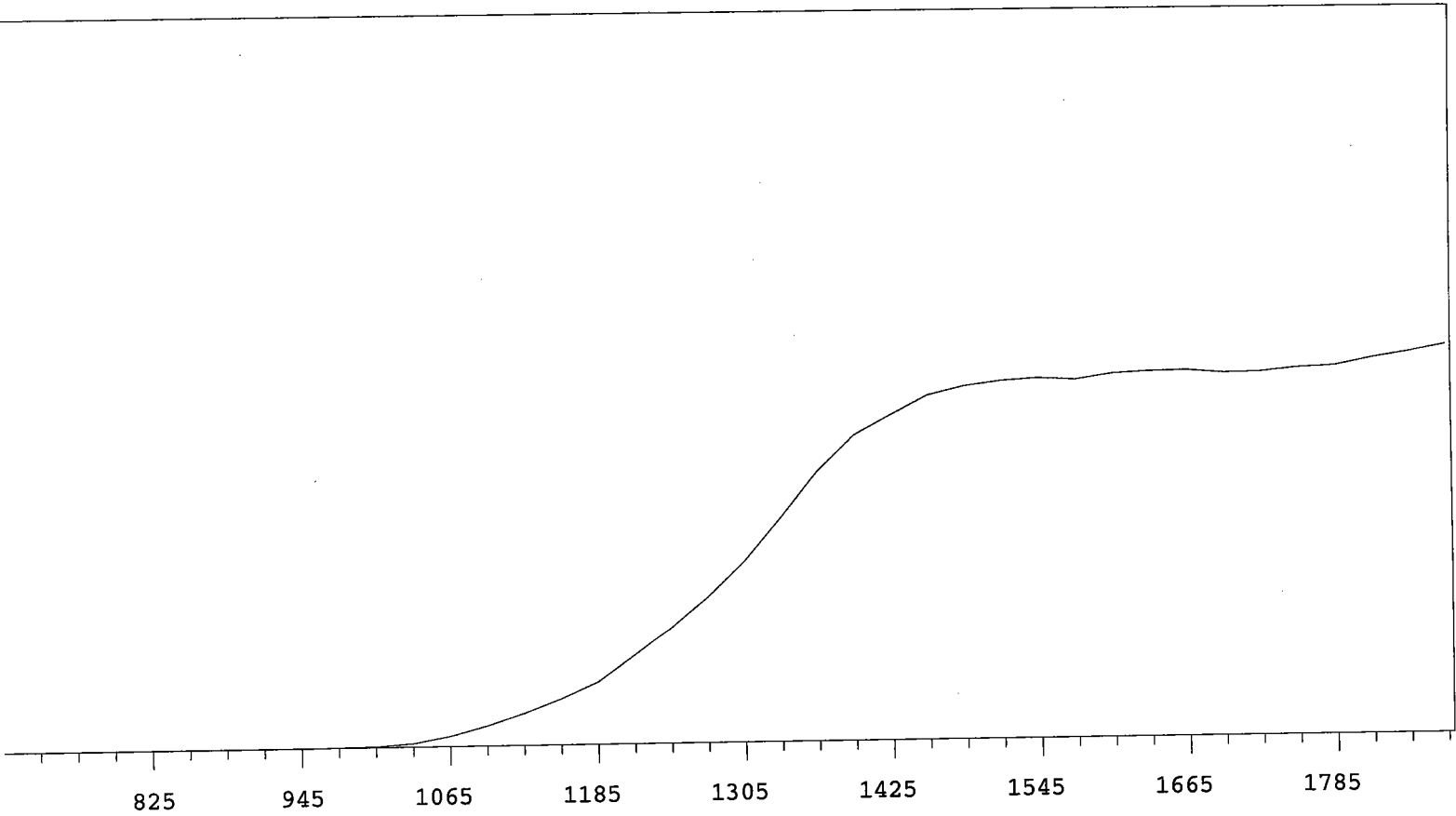


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	13974	+68.00
735	0		1335	17170	+58.62
765	1		1365	20456	+47.04
795	1	+83.33	1395	23332	+33.83
825	1	-83.33	1425	24996	+21.10
855	1	>100	1455	26290	+12.40
885	0	-55.56	1485	26683	+7.74
915	0	>100	1515	27270	+4.43
945	1	>100	1545	27590	+3.48
975	9	>100	1575	27635	+1.71
1005	76	>100	1605	27932	+1.20
1035	308	>100	1635	27807	+0.88
1065	814	>100	1665	28006	+0.62
1095	1600	>100	1695	27964	+0.63
1125	2598	>100	1725	28112	+0.98
1155	3596	>100	1755	28020	+2.84
1185	5065	+96.05	1785	28392	+3.76
1215	6773	+90.23	1815	29028	+5.17
1245	8717	+81.43	1845	29220	
1275	11391	+74.83	1875	29849	

MPC 9600 Plateau  
 Alpha Volts: 705

Instrument 5 MPC 9604 Detector B  
 Beta Volts: 1575

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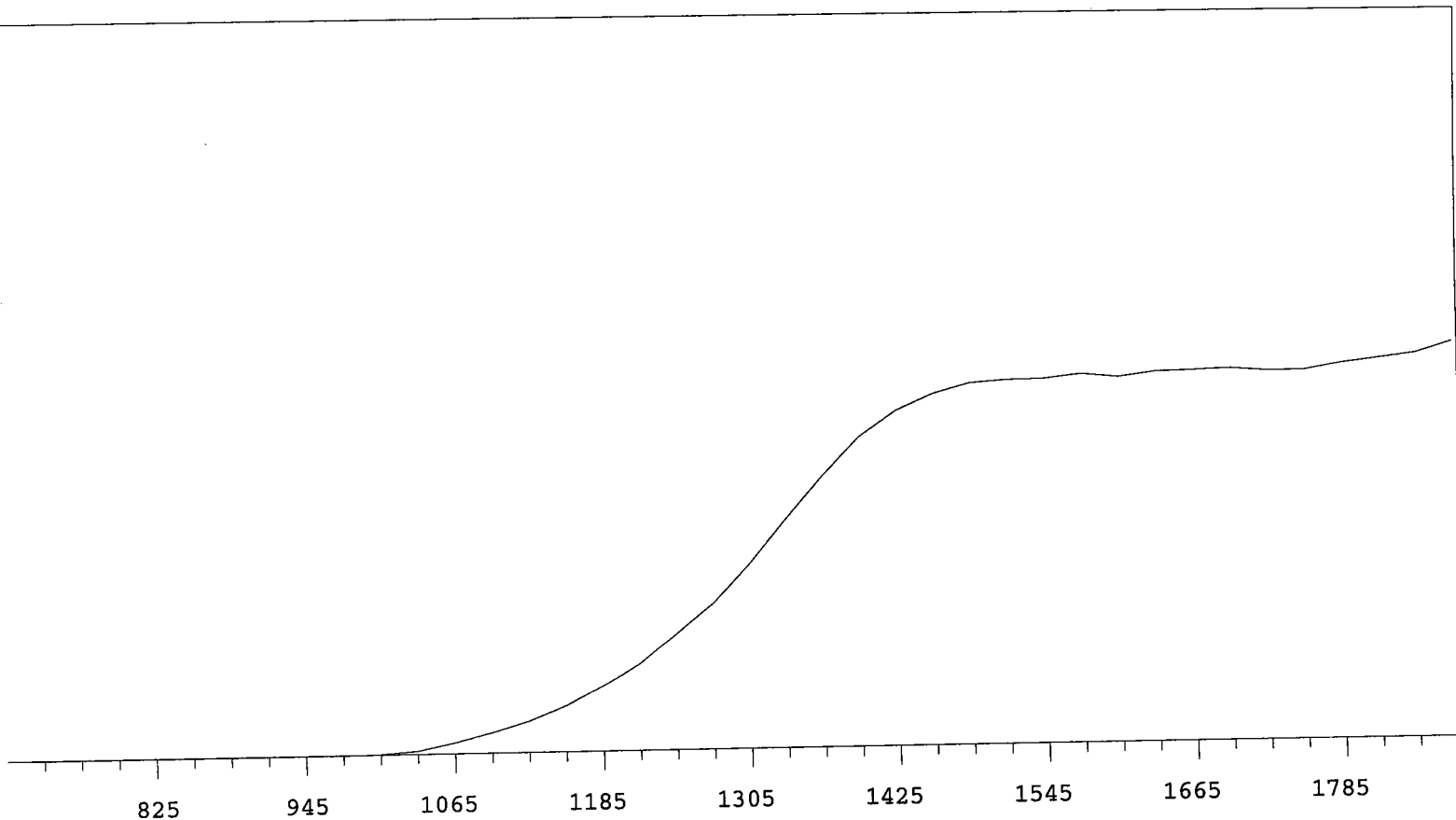


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	17414	+68.46
735	0		1335	21540	+59.98
765	0		1365	25854	+46.75
795	0	>100	1395	29222	+33.38
825	1	>100	1425	31128	+21.52
855	1	+41.67	1455	32995	+13.26
885	2	-33.33	1485	33846	+8.09
915	0	>100	1515	34289	+3.25
945	1	>100	1545	34528	+2.00
975	17	>100	1575	34311	+1.78
1005	87	>100	1605	34866	+1.78
1035	336	>100	1635	35046	+1.14
1065	1010	>100	1665	35087	-0.26
1095	1955	>100	1695	34795	+0.11
1125	3124	>100	1725	34857	+0.93
1155	4486	>100	1755	35220	+2.81
1185	6017	>100	1785	35363	+3.98
1215	8507	+91.20	1815	36028	+4.79
1245	11148	+82.59	1845	36577	
1275	14003	+74.21	1875	37207	

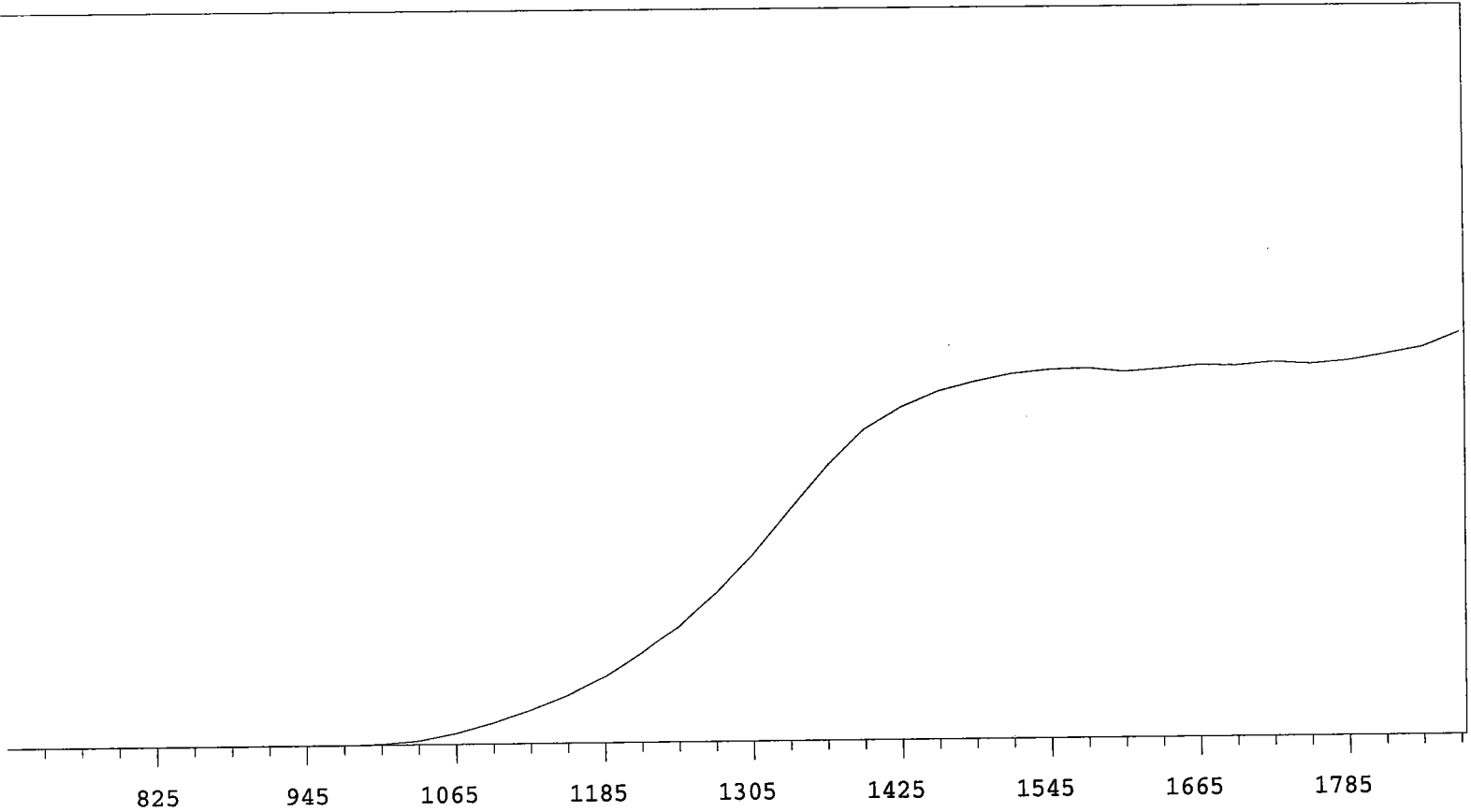
MPC 9600 Plateau  
 Alpha Volts: 705

Instrument 5 MPC 9604 Detector C  
 Beta Volts: 1575

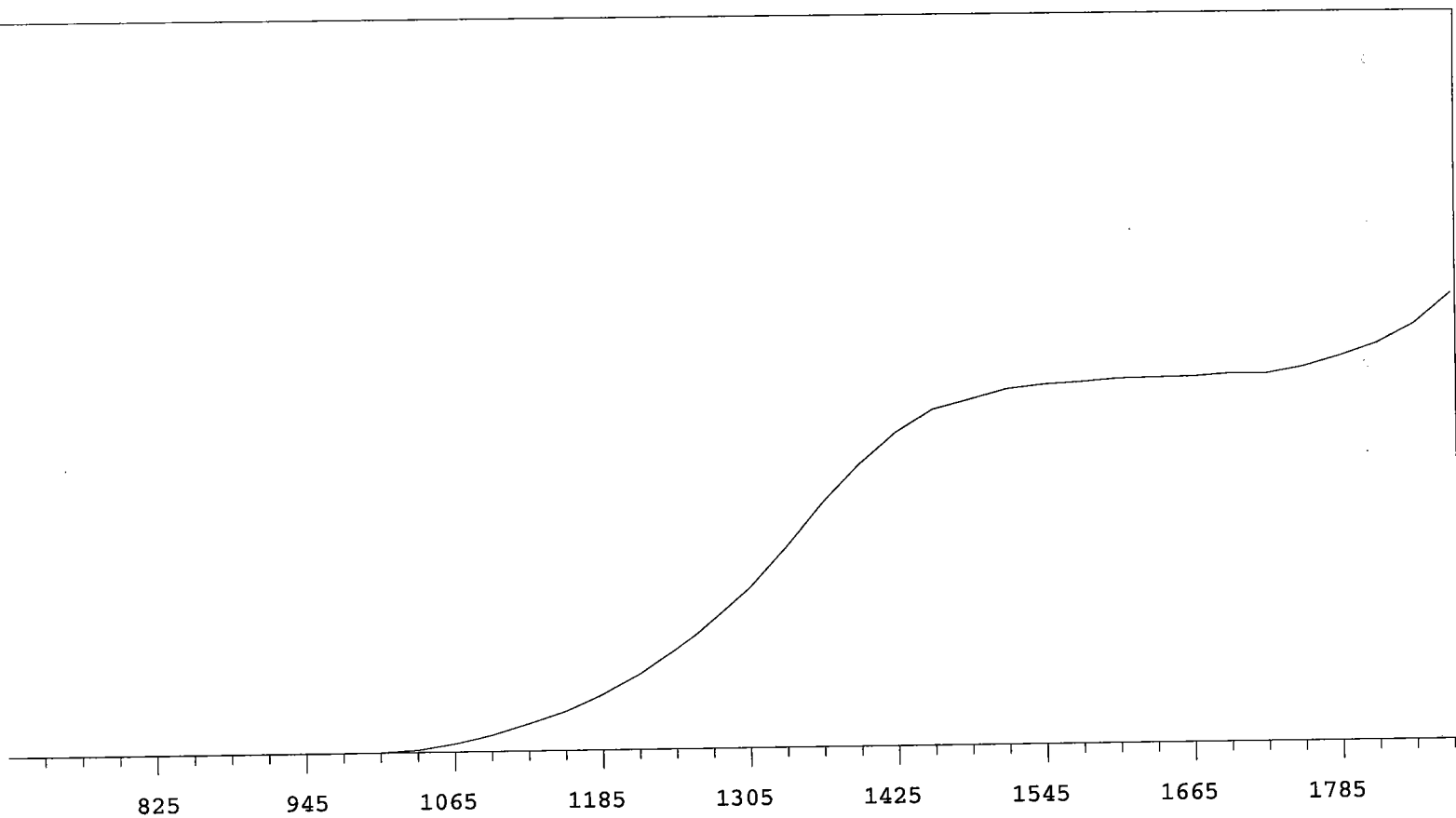
7/1/2009



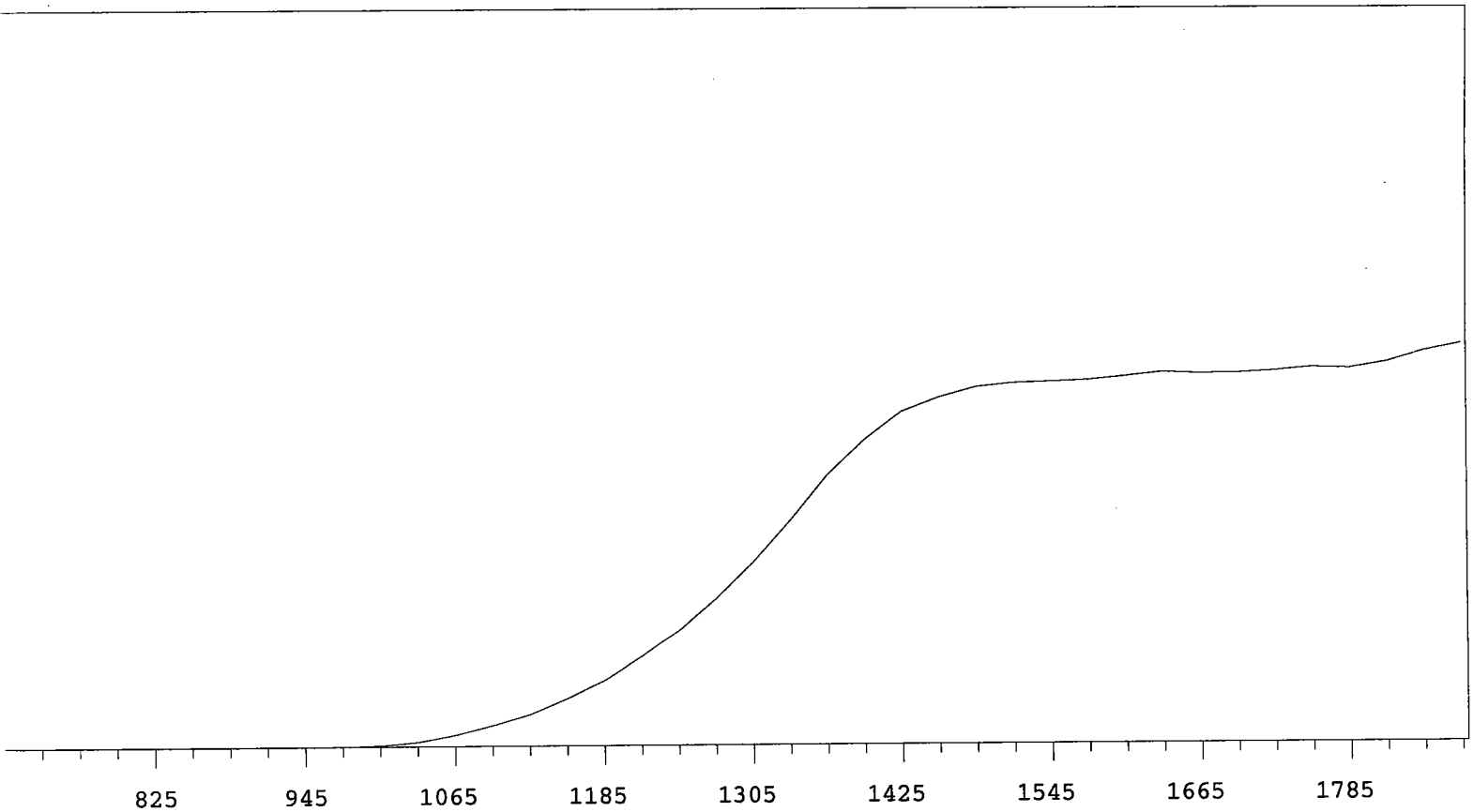
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	17085	+68.24
735	0		1335	21135	+59.99
765	0		1365	25066	+47.39
795	0	>100	1395	28530	+33.93
825	0	>100	1425	30823	+22.30
855	1	>100	1455	32287	+12.93
885	0	>100	1485	33217	+6.71
915	1	>100	1515	33474	+3.57
945	2	>100	1545	33517	+1.17
975	7	>100	1575	33921	+1.13
1005	56	>100	1605	33584	+1.27
1035	305	>100	1635	34014	+1.12
1065	982	>100	1665	34116	+0.98
1095	1874	>100	1695	34225	-0.22
1125	2890	>100	1725	33980	+0.58
1155	4260	>100	1755	33971	+1.96
1185	6001	>100	1785	34541	+3.64
1215	8050	+91.54	1815	34954	+5.38
1245	10895	+82.98	1845	35375	
1275	13556	+76.26	1875	36384	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	15025	+68.87
735	0		1335	18640	+58.97
765	0		1365	22048	+45.84
795	0	>100	1395	24877	+32.08
825	0	>100	1425	26653	+20.83
855	0	>100	1455	27899	+13.08
885	0	>100	1485	28670	+8.43
915	0	>100	1515	29257	+5.13
945	0	>100	1545	29568	+2.06
975	6	>100	1575	29683	+0.52
1005	81	>100	1605	29362	+0.57
1035	318	>100	1635	29589	+0.80
1065	897	>100	1665	29870	+1.82
1095	1710	>100	1695	29783	+0.90
1125	2714	>100	1725	30077	+0.75
1155	3925	>100	1755	29889	+2.02
1185	5395	+97.31	1785	30152	+3.33
1215	7282	+88.49	1815	30656	+6.54
1245	9426	+81.36	1845	31211	
1275	12007	+75.65	1875	32389	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16217	+71.57
735	0		1335	20184	+63.76
765	0		1365	24605	+53.98
795	0	>100	1395	28528	+41.40
825	0	>100	1425	31675	+28.02
855	0	>100	1455	33899	+17.93
885	0	>100	1485	34826	+10.65
915	0	>100	1515	35815	+6.13
945	0	>100	1545	36225	+4.15
975	7	>100	1575	36456	+2.28
1005	31	>100	1605	36747	+1.47
1035	238	>100	1635	36801	+1.26
1065	810	>100	1665	36859	+0.85
1095	1637	>100	1695	37095	+1.85
1125	2743	>100	1725	37072	+4.01
1155	3932	>100	1755	37724	+6.65
1185	5579	>100	1785	38802	+10.33
1215	7602	+94.41	1815	40036	+14.71
1245	10078	+84.86	1845	41975	
1275	13091	+77.67	1875	45123	

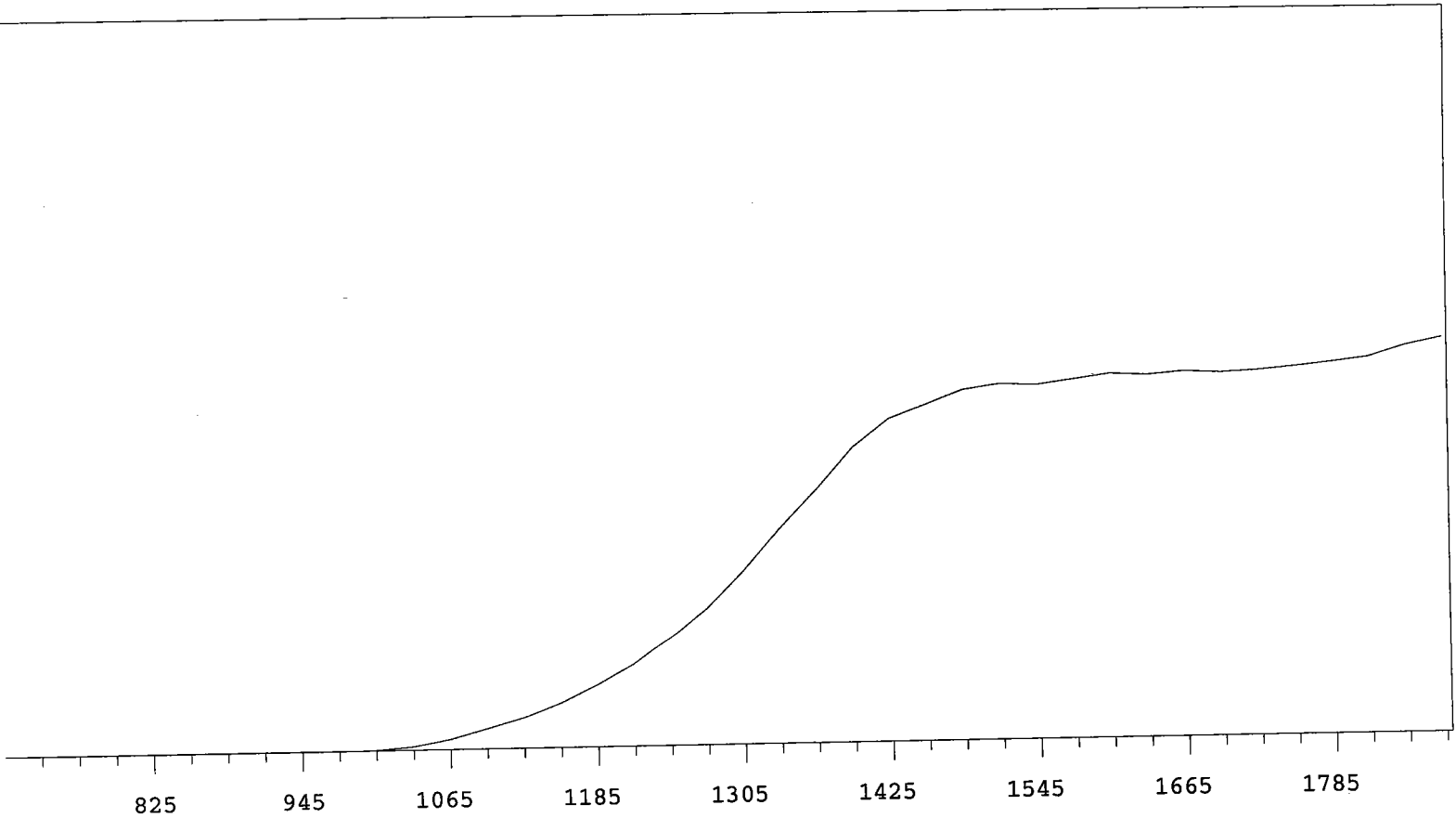


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	20094	+68.67
735	0		1335	24665	+59.40
765	0		1365	29591	+47.86
795	0	>100	1395	33376	+34.51
825	1	+83.33	1425	36440	+22.50
855	1	-83.33	1455	38024	+13.58
885	0	>100	1485	39187	+7.04
915	0	>100	1515	39608	+3.63
945	5	>100	1545	39722	+2.10
975	18	>100	1575	39894	+2.32
1005	125	>100	1605	40298	+2.09
1035	482	>100	1635	40711	+1.41
1065	1255	>100	1665	40574	+0.80
1095	2318	>100	1695	40608	+1.02
1125	3540	>100	1725	40839	+1.28
1155	5288	>100	1755	41201	+1.97
1185	7168	+98.51	1785	41065	+3.74
1215	9760	+88.48	1815	41711	+5.42
1245	12656	+81.52	1845	42917	
1275	16065	+74.58	1875	43699	

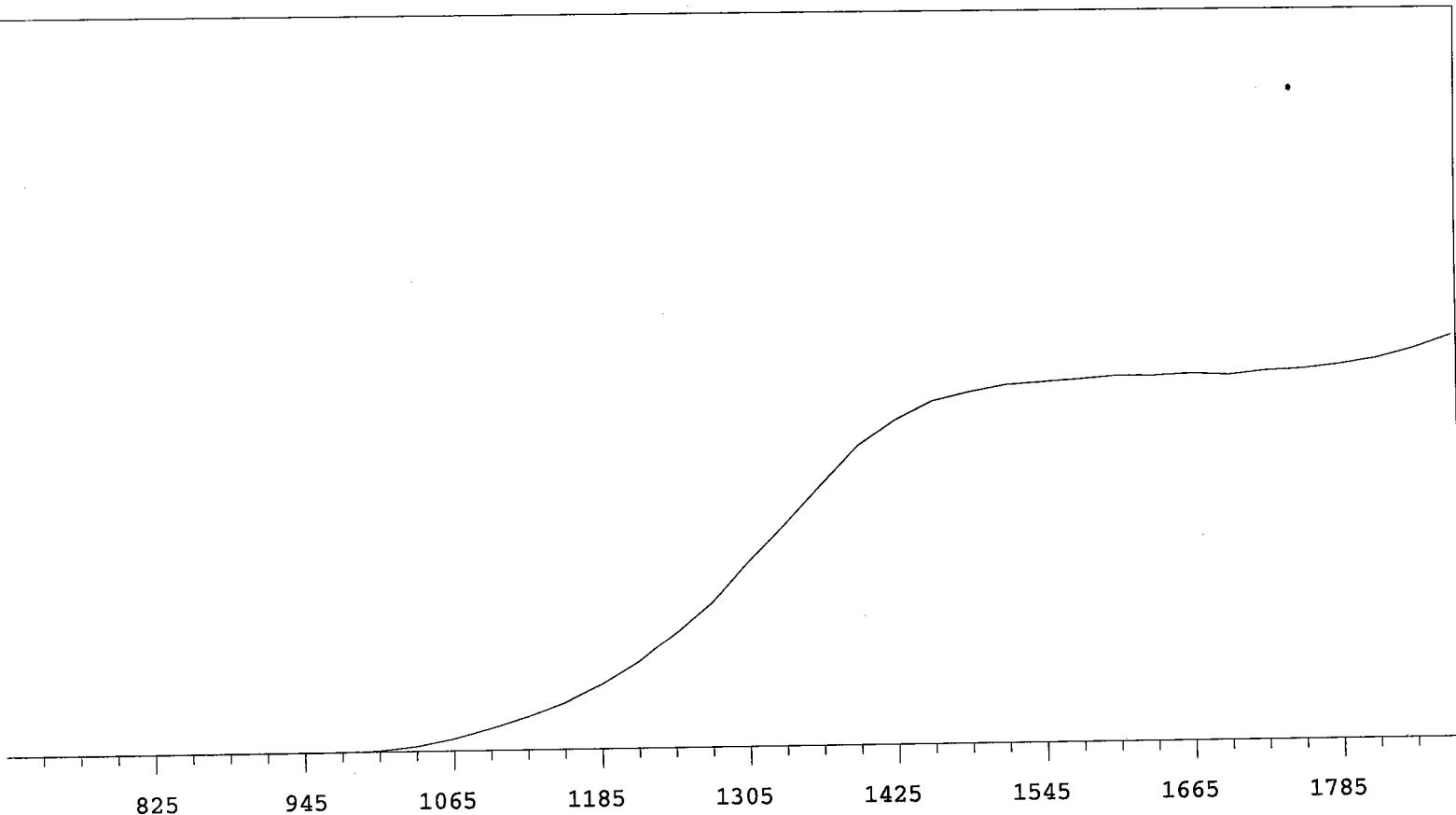
MPC 9600 Plateau  
Alpha Volts: 705

Instrument 6 MPC 9604 Detector C  
Beta Volts: 1575

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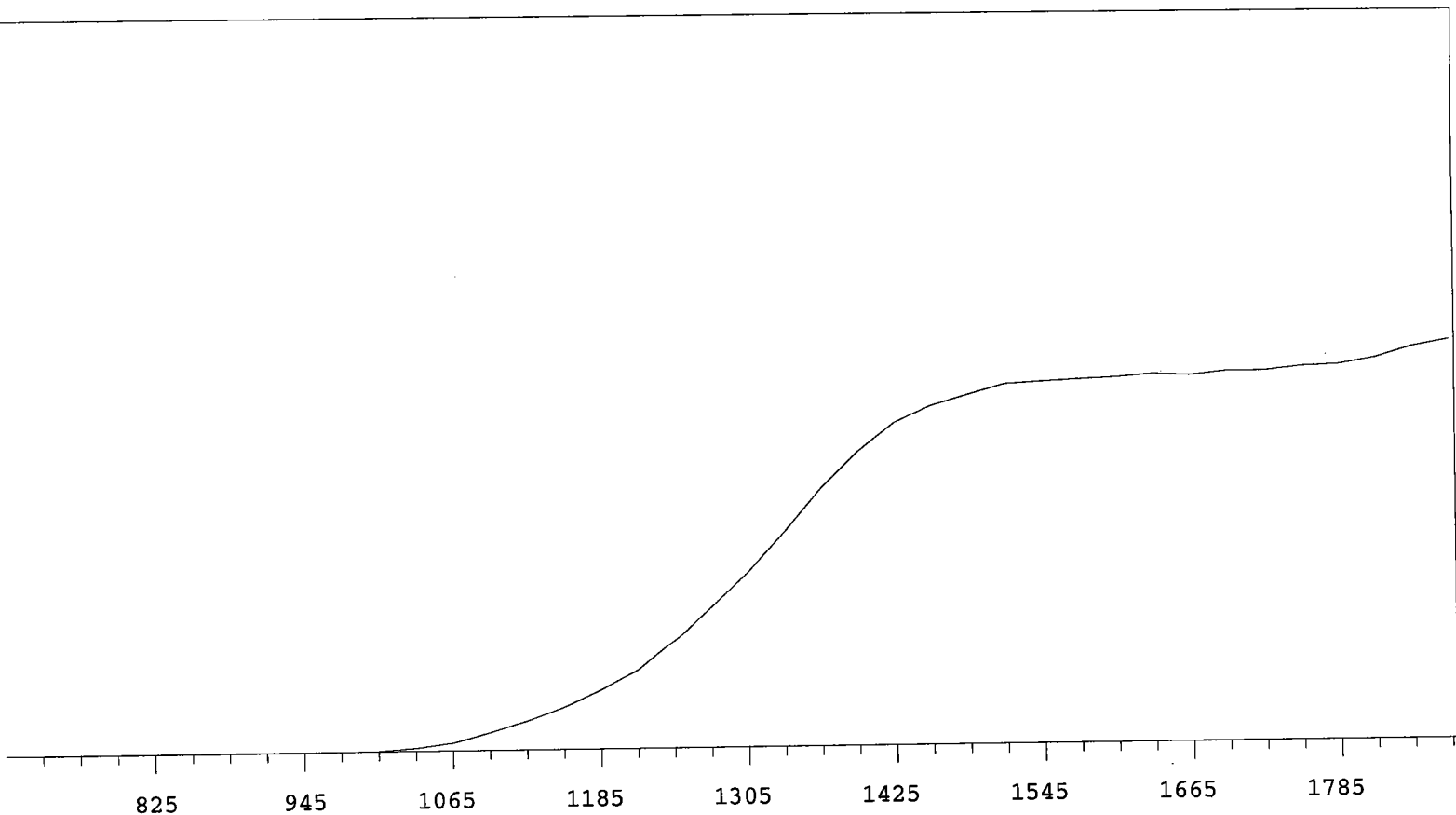


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	17350	+67.80
735	0		1335	21371	+60.27
765	1	+0.00	1365	25084	+49.32
795	0	>100	1395	29177	+36.15
825	0	+0.00	1425	31927	+24.86
855	0	>100	1455	33217	+14.70
885	1	>100	1485	34545	+7.74
915	1	>100	1515	35097	+4.64
945	2	>100	1545	34927	+2.96
975	8	>100	1575	35439	+2.21
1005	70	>100	1605	35939	+2.41
1035	353	>100	1635	35763	+0.94
1065	990	>100	1665	36053	+0.35
1095	1956	>100	1695	35886	+1.15
1125	3024	>100	1725	36066	+1.77
1155	4400	>100	1755	36379	+3.03
1185	6173	+99.75	1785	36768	+4.80
1215	8230	+89.85	1815	37193	+6.14
1245	10904	+82.36	1845	38320	
1275	13747	+76.18	1875	39061	

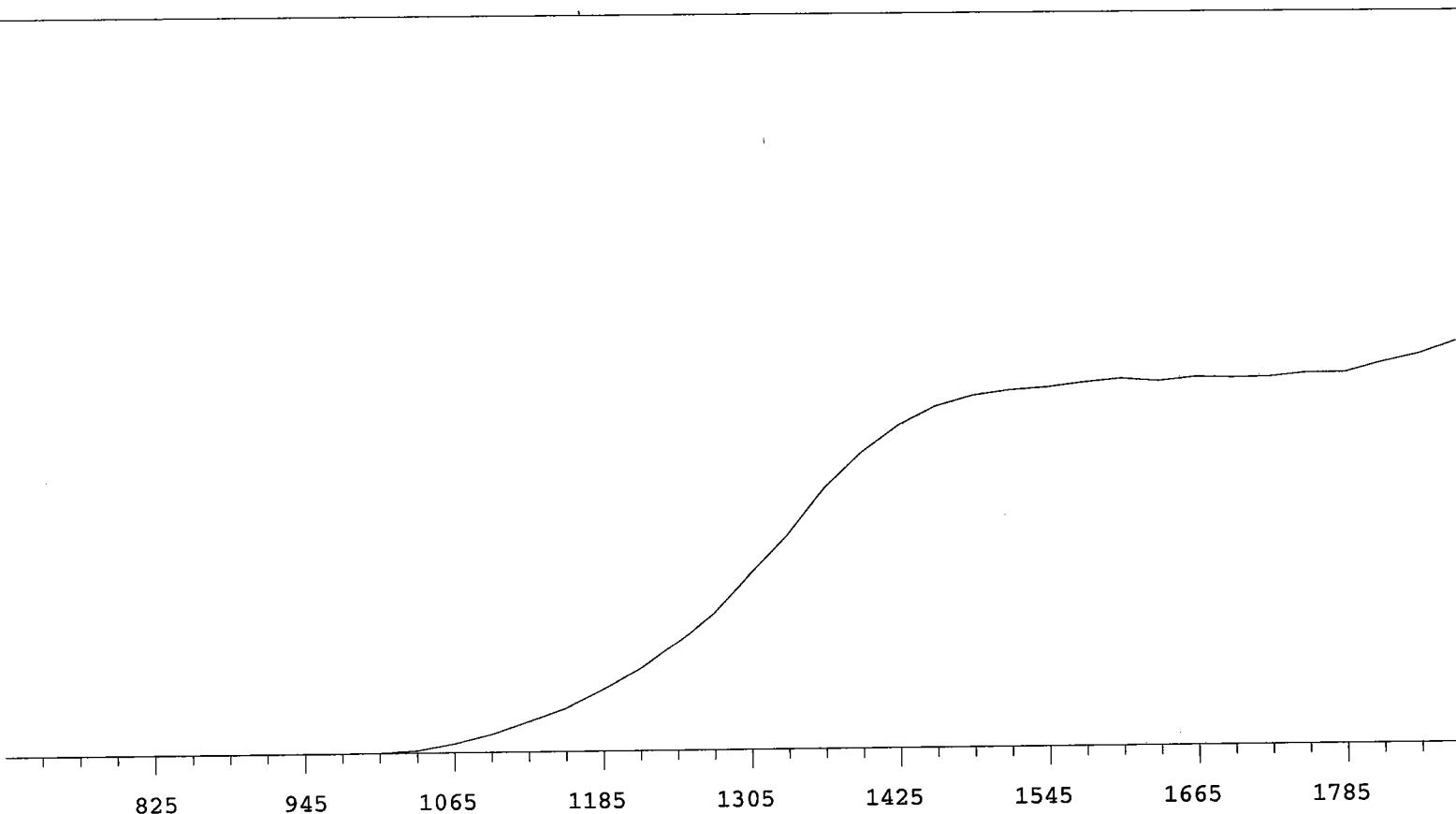


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	17954	+65.82
735	0		1335	21482	+57.64
765	0		1365	25373	+45.78
795	1	+0.00	1395	29042	+34.80
825	0	>100	1425	31373	+23.29
855	0	+0.00	1455	33143	+14.25
885	0	>100	1485	34006	+8.49
915	1	>100	1515	34662	+4.71
945	0	>100	1545	34892	+3.14
975	14	>100	1575	35129	+1.86
1005	109	>100	1605	35411	+1.49
1035	481	>100	1635	35380	+0.62
1065	1177	>100	1665	35554	+0.65
1095	2133	>100	1695	35385	+1.18
1125	3243	>100	1725	35755	+1.89
1155	4554	>100	1755	35907	+3.26
1185	6285	+98.38	1785	36305	+4.62
1215	8468	+89.75	1815	36870	+6.98
1245	11266	+83.13	1845	37807	
1275	14088	+74.43	1875	39047	

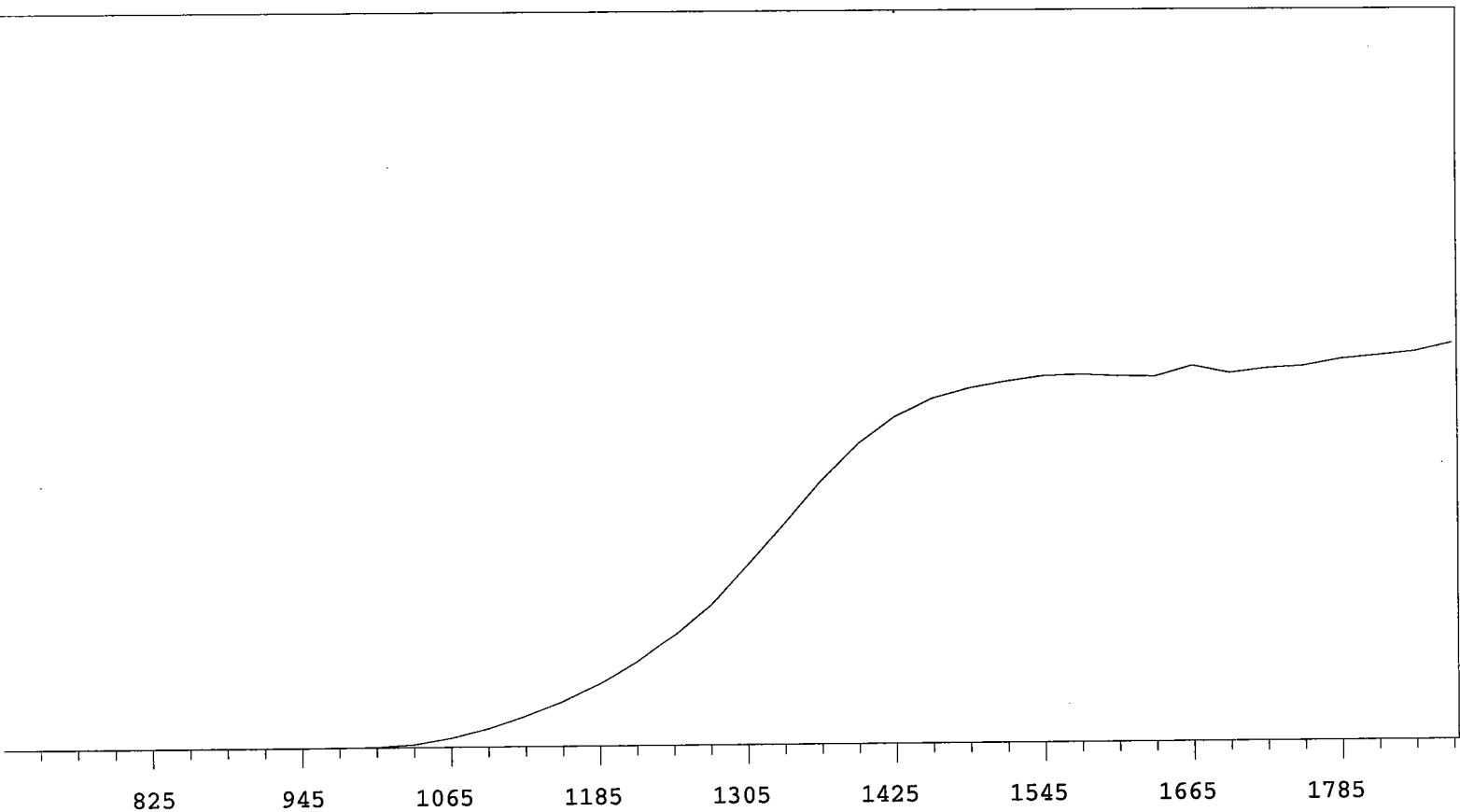




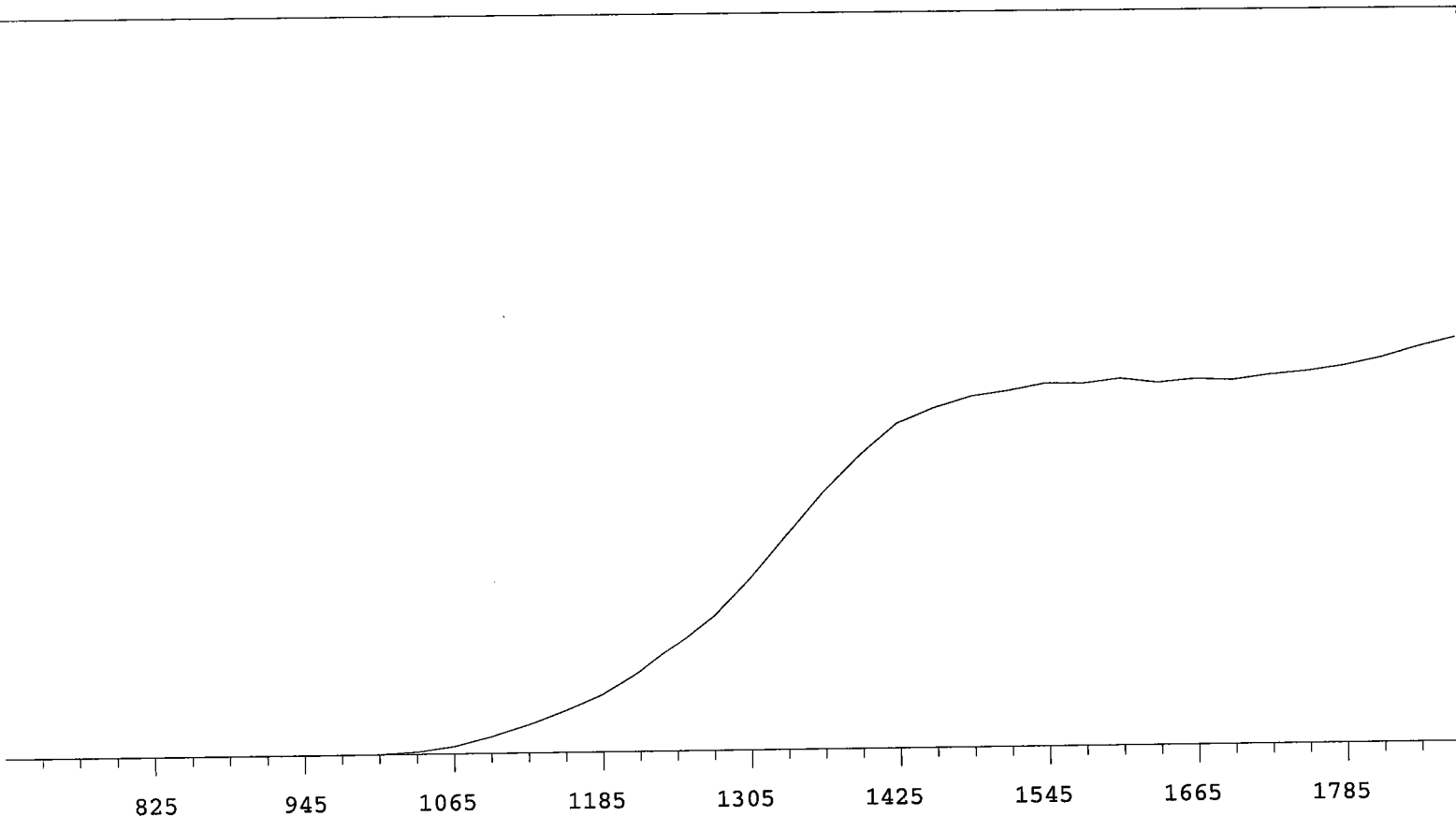
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	13228	+70.36
735	0		1335	16271	+60.12
765	0		1365	19506	+49.19
795	0	>100	1395	22188	+36.46
825	1	+83.33	1425	24373	+24.43
855	1	-83.33	1455	25649	+15.99
885	0	-55.56	1485	26433	+9.58
915	0	>100	1515	27195	+5.74
945	1	>100	1545	27367	+3.24
975	3	>100	1575	27490	+1.86
1005	42	>100	1605	27608	+1.22
1035	242	>100	1635	27841	+1.33
1065	613	>100	1665	27695	+1.11
1095	1353	>100	1695	27999	+1.42
1125	2213	>100	1725	27992	+2.04
1155	3256	>100	1755	28289	+2.52
1185	4474	>100	1785	28408	+4.56
1215	5932	+94.10	1815	28863	+5.70
1245	8072	+87.32	1845	29664	
1275	10579	+79.61	1875	30148	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16978	+70.97
735	0		1335	20569	+61.39
765	0		1365	24989	+48.97
795	0	>100	1395	28389	+36.69
825	0	>100	1425	30977	+24.05
855	0	>100	1455	32727	+14.93
885	0	>100	1485	33697	+8.42
915	1	>100	1515	34195	+4.89
945	1	>100	1545	34437	+3.49
975	3	>100	1575	34850	+2.11
1005	34	>100	1605	35174	+1.62
1035	221	>100	1635	34923	+0.68
1065	825	>100	1665	35250	+0.35
1095	1709	>100	1695	35171	+1.24
1125	2873	>100	1725	35237	+1.02
1155	4078	>100	1755	35584	+2.79
1185	5858	>100	1785	35587	+4.59
1215	7809	+91.82	1815	36485	+6.74
1245	10336	+85.02	1845	37270	
1275	13215	+77.79	1875	38453	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16543	+70.03
735	0		1335	20257	+60.71
765	0		1365	24245	+48.17
795	0	>100	1395	27602	+35.50
825	0	>100	1425	30019	+23.48
855	0	>100	1455	31614	+14.53
885	0	>100	1485	32522	+8.91
915	0	>100	1515	33103	+5.28
945	0	>100	1545	33572	+2.60
975	4	>100	1575	33695	+0.70
1005	57	>100	1605	33525	+1.48
1035	277	>100	1635	33477	+0.99
1065	817	>100	1665	34432	+1.49
1095	1666	>100	1695	33745	+1.43
1125	2766	>100	1725	34149	+1.60
1155	4077	>100	1755	34350	+3.69
1185	5667	>100	1785	34955	+3.62
1215	7694	+91.50	1815	35251	+4.44
1245	10209	+84.83	1845	35592	
1275	12950	+77.50	1875	36382	

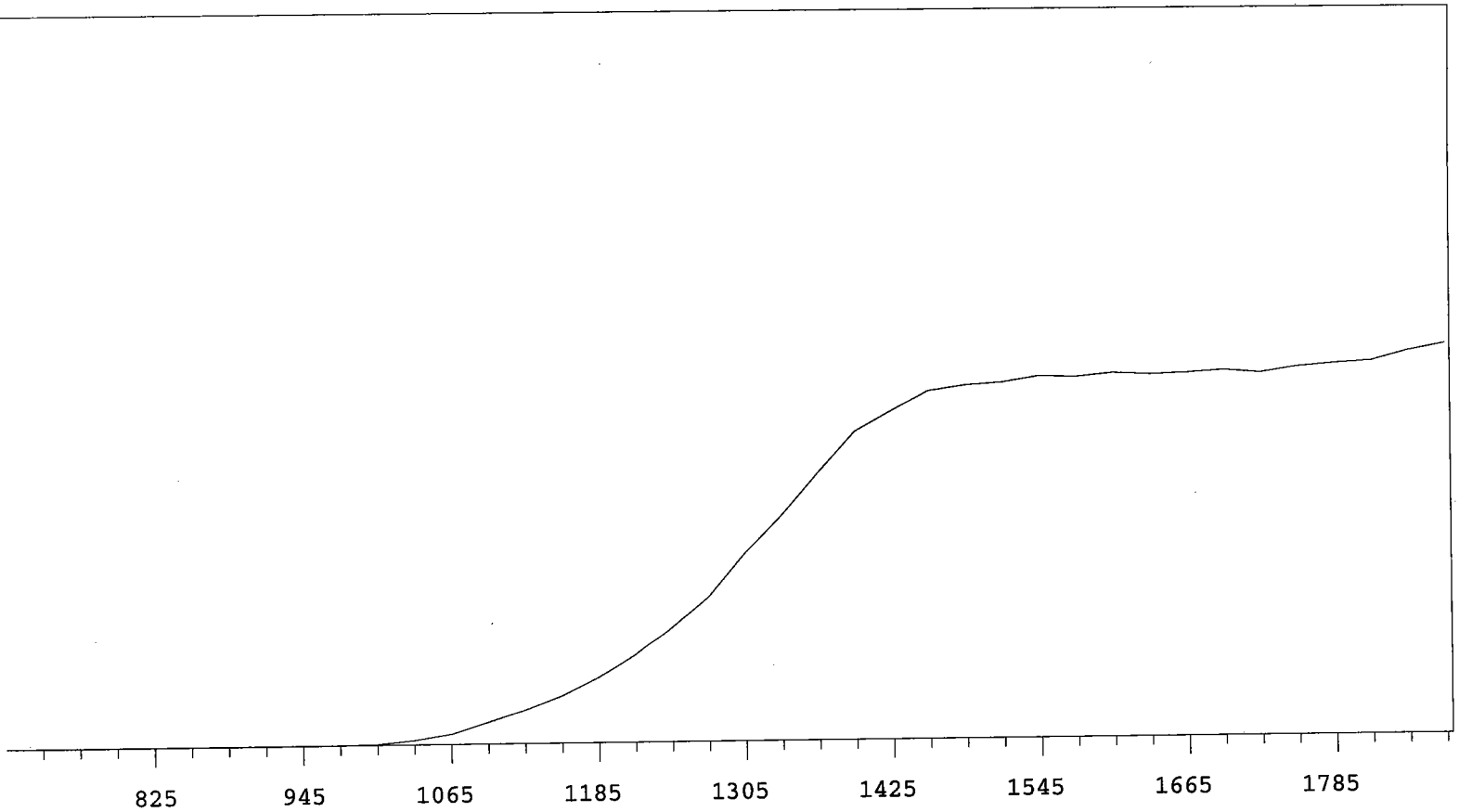


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	14016	+71.42
735	0		1335	17436	+62.21
765	0		1365	20814	+50.32
795	0	>100	1395	23760	+36.91
825	0	>100	1425	26302	+24.91
855	0	>100	1455	27519	+15.17
885	0	>100	1485	28410	+8.91
915	0	>100	1515	28843	+5.41
945	0	>100	1545	29396	+3.58
975	5	>100	1575	29357	+1.54
1005	29	>100	1605	29719	+0.51
1035	204	>100	1635	29358	+0.23
1065	609	>100	1665	29623	+0.57
1095	1354	>100	1695	29509	+2.12
1125	2316	>100	1725	29896	+2.84
1155	3418	>100	1755	30165	+4.42
1185	4654	>100	1785	30570	+5.65
1215	6455	+92.99	1815	31180	+6.95
1245	8669	+86.45	1845	31995	
1275	10931	+79.15	1875	32717	

MPC 9600 Plateau  
Alpha Volts: 705

Instrument 8 MPC 9604 Detector A  
Beta Volts: 1575

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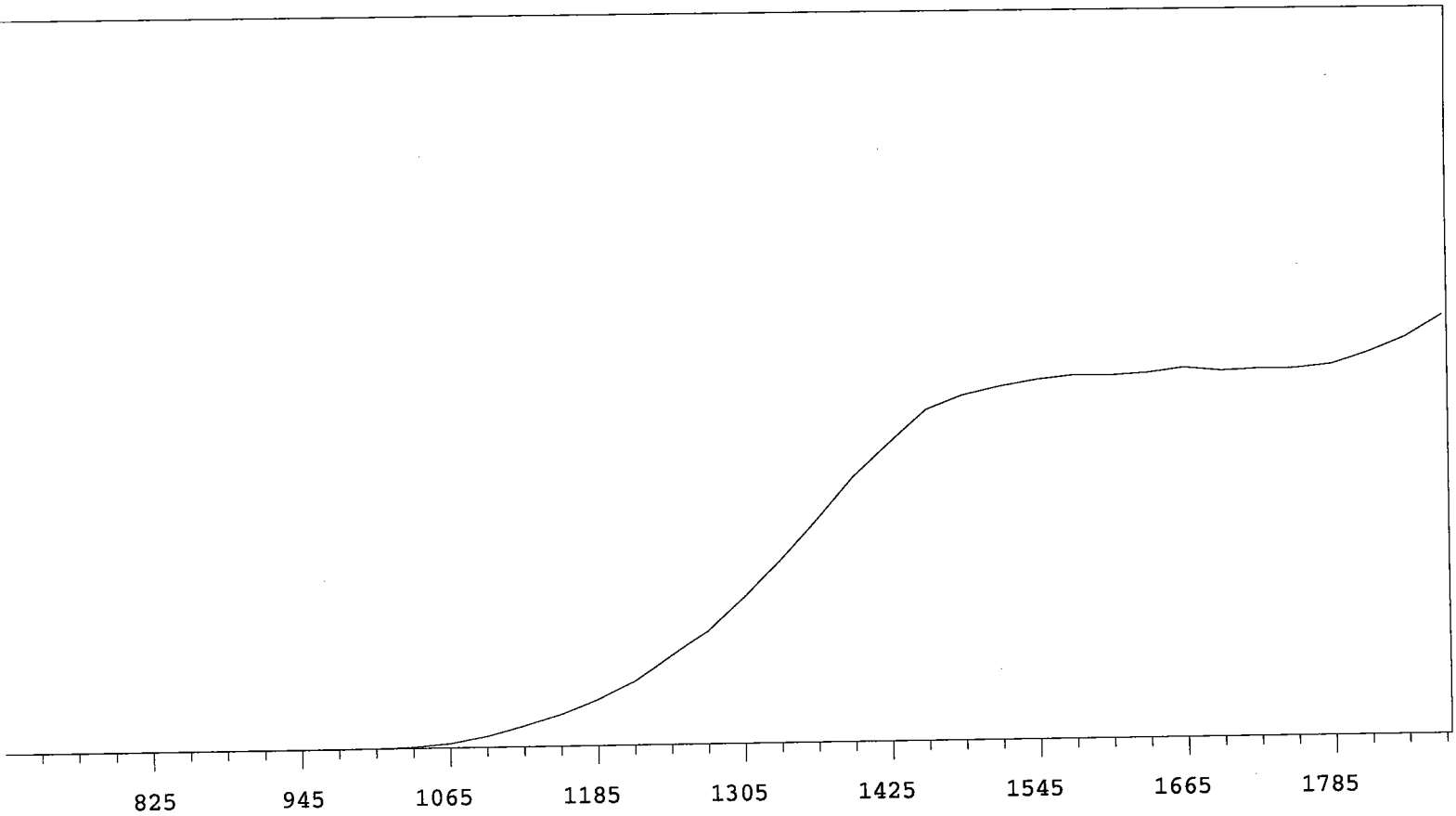


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	19482	+67.45
735	0		1335	23344	+59.35
765	0		1365	27793	+45.86
795	0	>100	1395	31916	+34.29
825	0	>100	1425	33979	+21.61
855	0	>100	1455	35993	+11.71
885	0	>100	1485	36530	+7.04
915	0	>100	1515	36796	+3.11
945	1	>100	1545	37393	+2.44
975	9	>100	1575	37279	+1.41
1005	96	>100	1605	37650	+0.49
1035	468	>100	1635	37458	+0.91
1065	1084	>100	1665	37579	+0.12
1095	2286	>100	1695	37828	+1.10
1125	3479	>100	1725	37535	+1.72
1155	4912	>100	1755	38104	+2.18
1185	6819	+98.23	1785	38416	+4.12
1215	9153	+89.05	1815	38633	+4.92
1245	12105	+83.21	1845	39649	
1275	15122	+75.24	1875	40366	

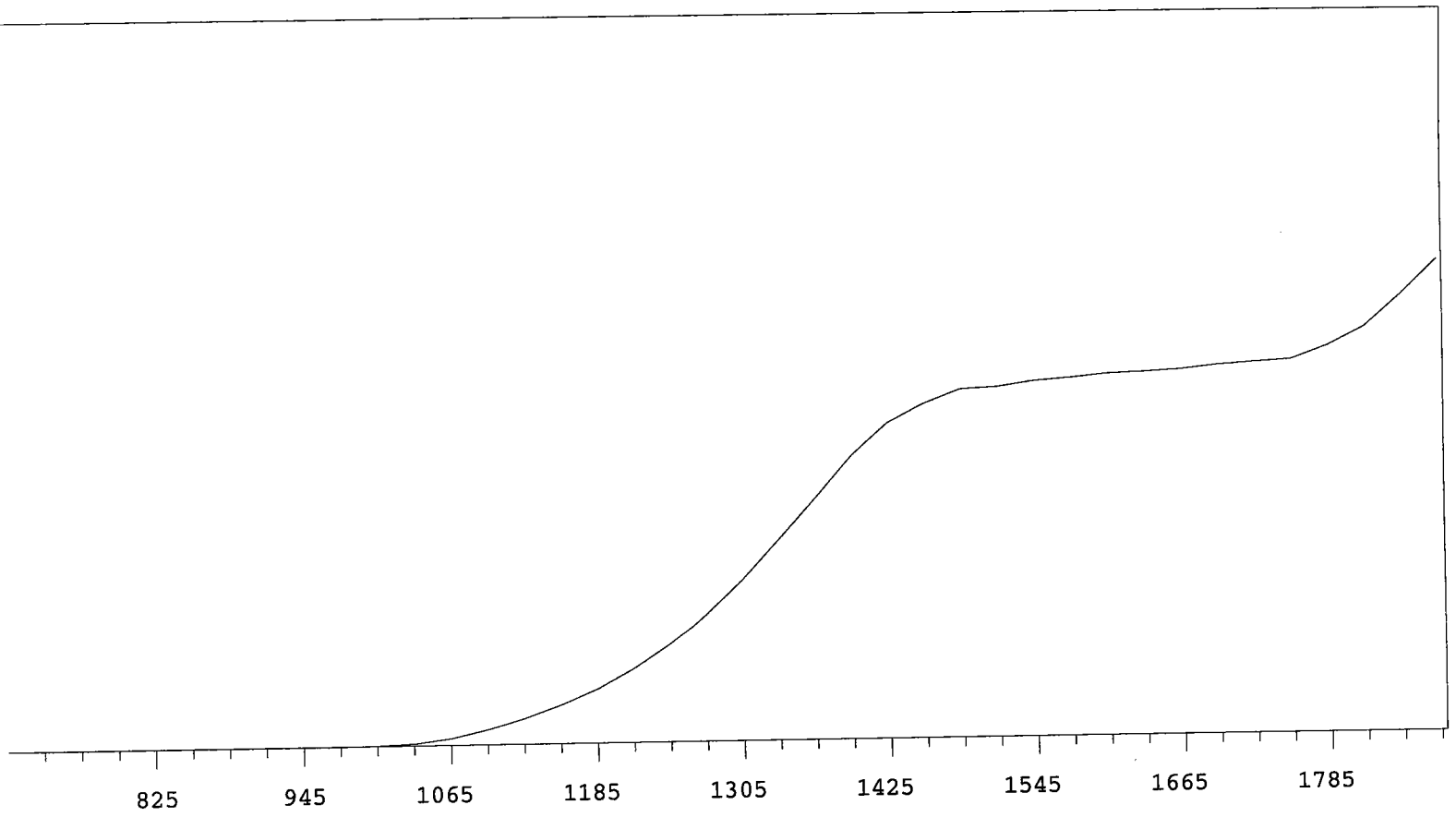
MPC 9600 Plateau  
 Alpha Volts: 705

Instrument 8 MPC 9604 Detector B  
 Beta Volts: 1575

7/1/2009



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16337	+74.91
735	0		1335	20471	+68.07
765	0		1365	25012	+57.86
795	0	>100	1395	29694	+47.48
825	0	>100	1425	33409	+35.17
855	0	>100	1455	37013	+23.27
885	0	>100	1485	38629	+14.35
915	0	>100	1515	39529	+7.69
945	0	>100	1545	40284	+4.34
975	0	>100	1575	40711	+2.52
1005	20	>100	1605	40642	+1.97
1035	122	>100	1635	40879	+1.11
1065	511	>100	1665	41405	+0.98
1095	1263	>100	1695	41011	+0.30
1125	2390	>100	1725	41182	+0.41
1155	3641	>100	1755	41178	+3.28
1185	5246	>100	1785	41573	+6.47
1215	7212	+98.32	1815	42858	+10.82
1245	9897	+89.80	1845	44440	
1275	12742	+82.40	1875	46780	

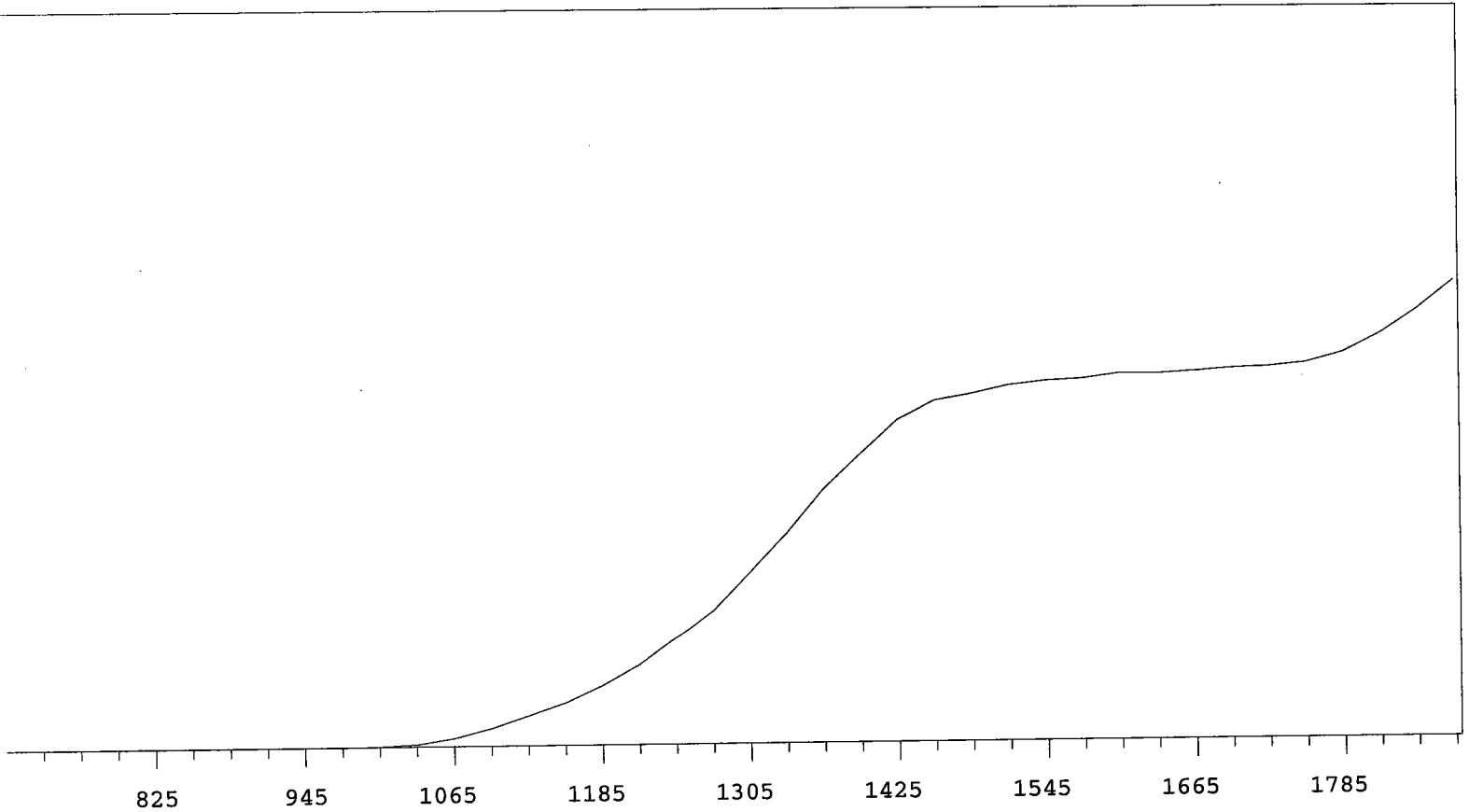


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16303	+72.82
735	0		1335	20309	+64.32
765	0		1365	24364	+53.82
795	0	>100	1395	28527	+40.95
825	0	>100	1425	31774	+28.74
855	0	>100	1455	33631	+16.87
885	0	>100	1485	35030	+9.25
915	0	>100	1515	35208	+5.21
945	0	>100	1545	35741	+3.27
975	4	>100	1575	36019	+2.95
1005	46	>100	1605	36373	+2.21
1035	202	>100	1635	36484	+2.27
1065	697	>100	1665	36713	+2.28
1095	1532	>100	1695	37093	+2.46
1125	2614	>100	1725	37325	+4.17
1155	3953	>100	1755	37543	+7.52
1185	5474	>100	1785	38833	+13.43
1215	7466	+93.09	1815	40656	+19.49
1245	9842	+86.73	1845	43753	
1275	12814	+80.29	1875	47246	

MPC 9600 Plateau  
Alpha Volts: 705

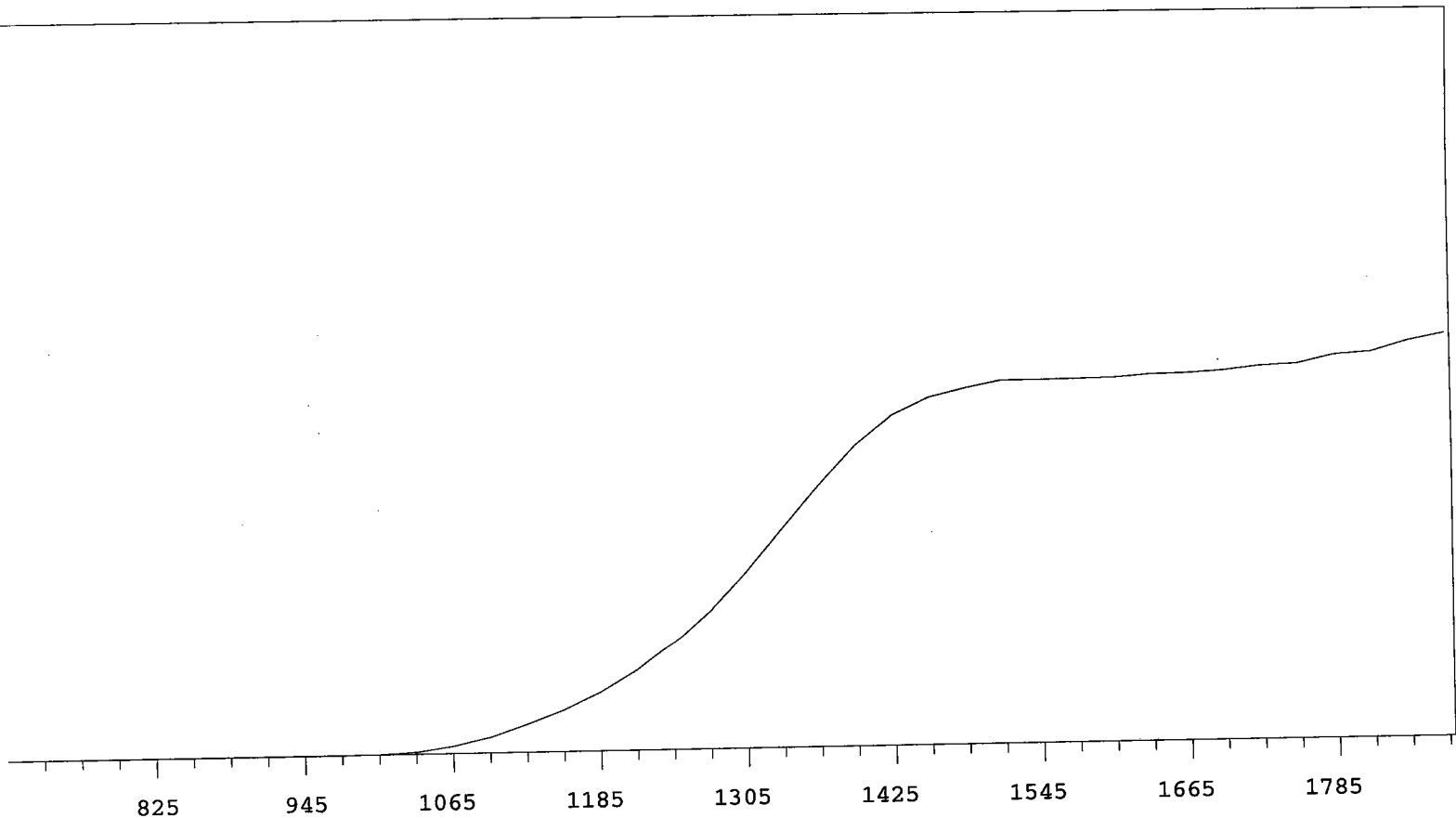
Instrument 8 MPC 9604 Detector D  
Beta Volts: 1575

7/1/2009

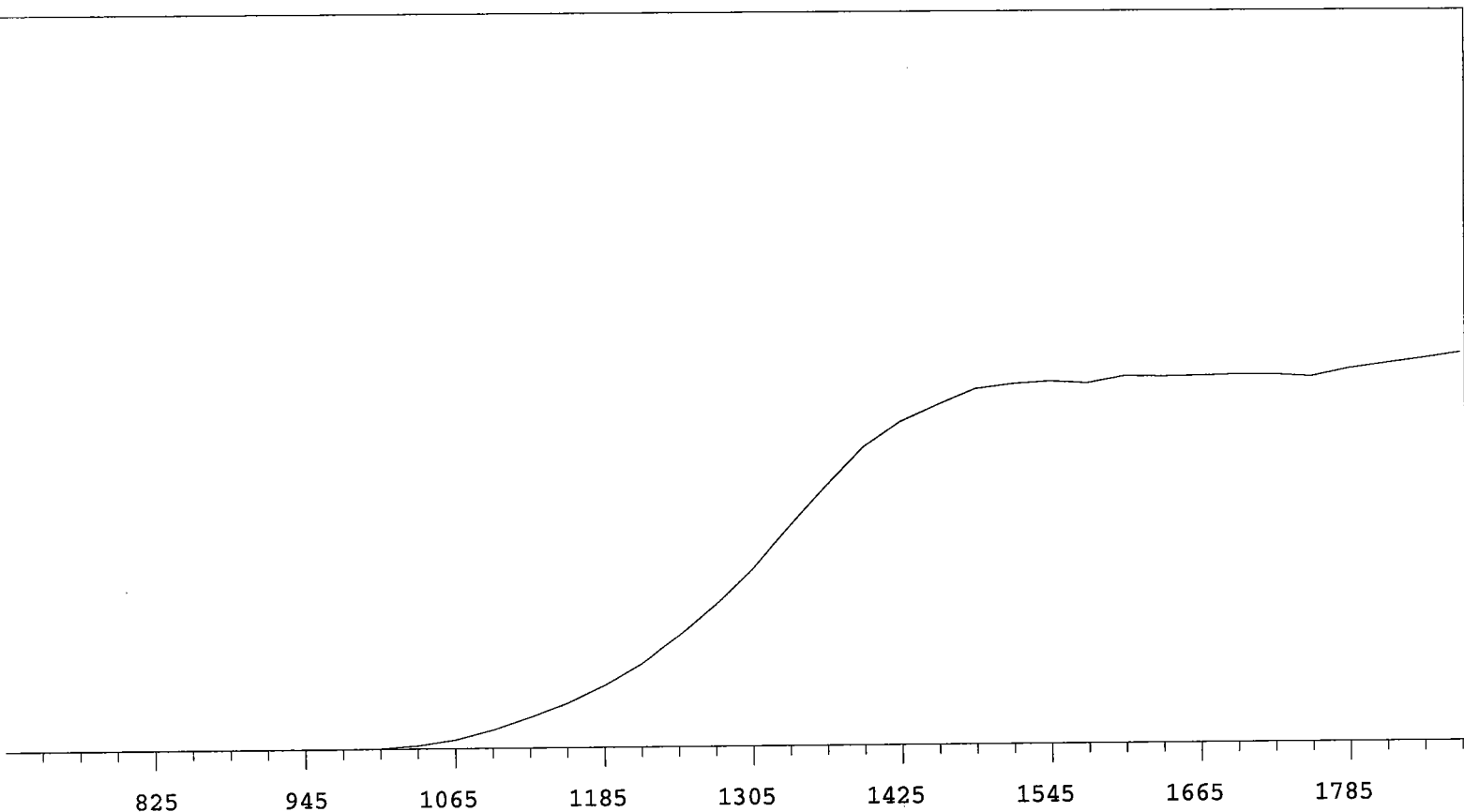


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16889	+70.18
735	0		1335	20600	+61.29
765	1	+0.00	1365	24824	+50.40
795	0	>100	1395	28208	+38.85
825	0	>100	1425	31539	+25.79
855	0	>100	1455	33391	+16.06
885	0	>100	1485	33991	+8.60
915	0	>100	1515	34782	+5.01
945	0	>100	1545	35201	+4.10
975	5	>100	1575	35380	+2.50
1005	47	>100	1605	35849	+1.87
1035	243	>100	1635	35784	+1.79
1065	792	>100	1665	36000	+1.43
1095	1744	>100	1695	36269	+2.10
1125	2933	>100	1725	36381	+3.46
1155	4123	>100	1755	36733	+6.86
1185	5780	>100	1785	37669	+11.78
1215	7791	+91.58	1815	39465	+16.64
1245	10478	+84.93	1845	41803	
1275	13118	+77.50	1875	44665	





VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16226	+71.71
735	0		1335	20083	+61.95
765	1	+0.00	1365	23913	+49.99
795	0	>100	1395	27526	+36.97
825	0	>100	1425	30193	+24.54
855	0	>100	1455	31747	+14.71
885	0	>100	1485	32544	+7.71
915	0	>100	1515	33198	+3.66
945	0	>100	1545	33188	+1.51
975	2	>100	1575	33227	+0.73
1005	33	>100	1605	33278	+1.04
1035	203	>100	1635	33518	+1.38
1065	668	>100	1665	33565	+1.95
1095	1403	>100	1695	33774	+1.99
1125	2545	>100	1725	34135	+3.30
1155	3800	>100	1755	34244	+3.67
1185	5363	>100	1785	35022	+4.84
1215	7355	+95.00	1815	35229	+5.93
1245	9807	+87.69	1845	36179	
1275	12700	+80.28	1875	36821	

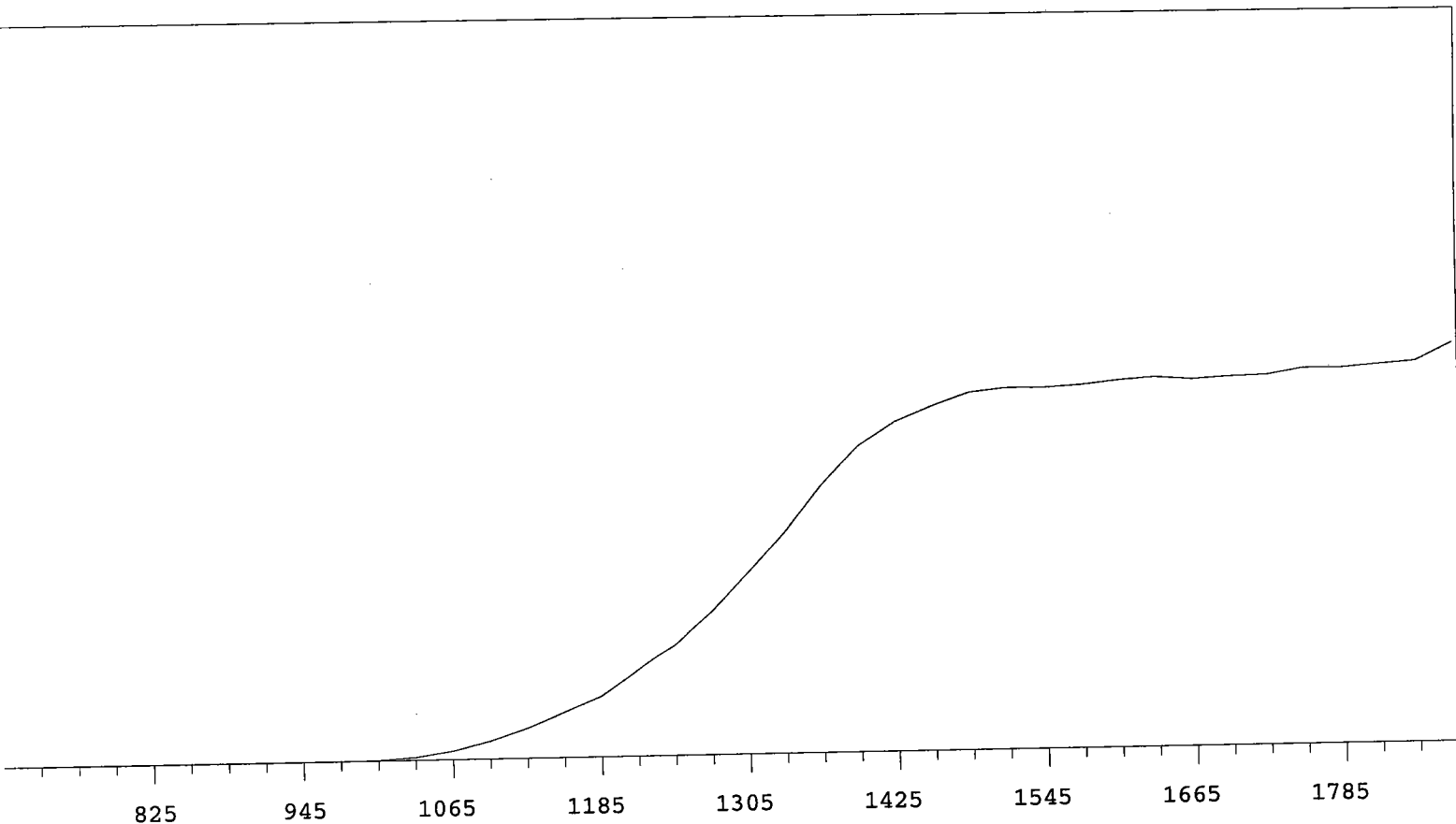


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16723	+68.78
735	0		1335	20749	+60.55
765	0		1365	24686	+48.78
795	0	>100	1395	28343	+35.24
825	0	>100	1425	30657	+24.31
855	0	>100	1455	32208	+15.22
885	0	>100	1485	33662	+9.32
915	0	>100	1515	34098	+4.47
945	0	>100	1545	34326	+2.17
975	4	>100	1575	34133	+1.60
1005	45	>100	1605	34758	+1.41
1035	300	>100	1635	34706	+1.35
1065	836	>100	1665	34769	+0.30
1095	1742	>100	1695	34830	-0.10
1125	2896	>100	1725	34850	+0.90
1155	4198	>100	1755	34613	+2.41
1185	5849	>100	1785	35351	+3.87
1215	7887	+92.20	1815	35849	+4.97
1245	10561	+83.55	1845	36285	
1275	13442	+76.62	1875	36814	

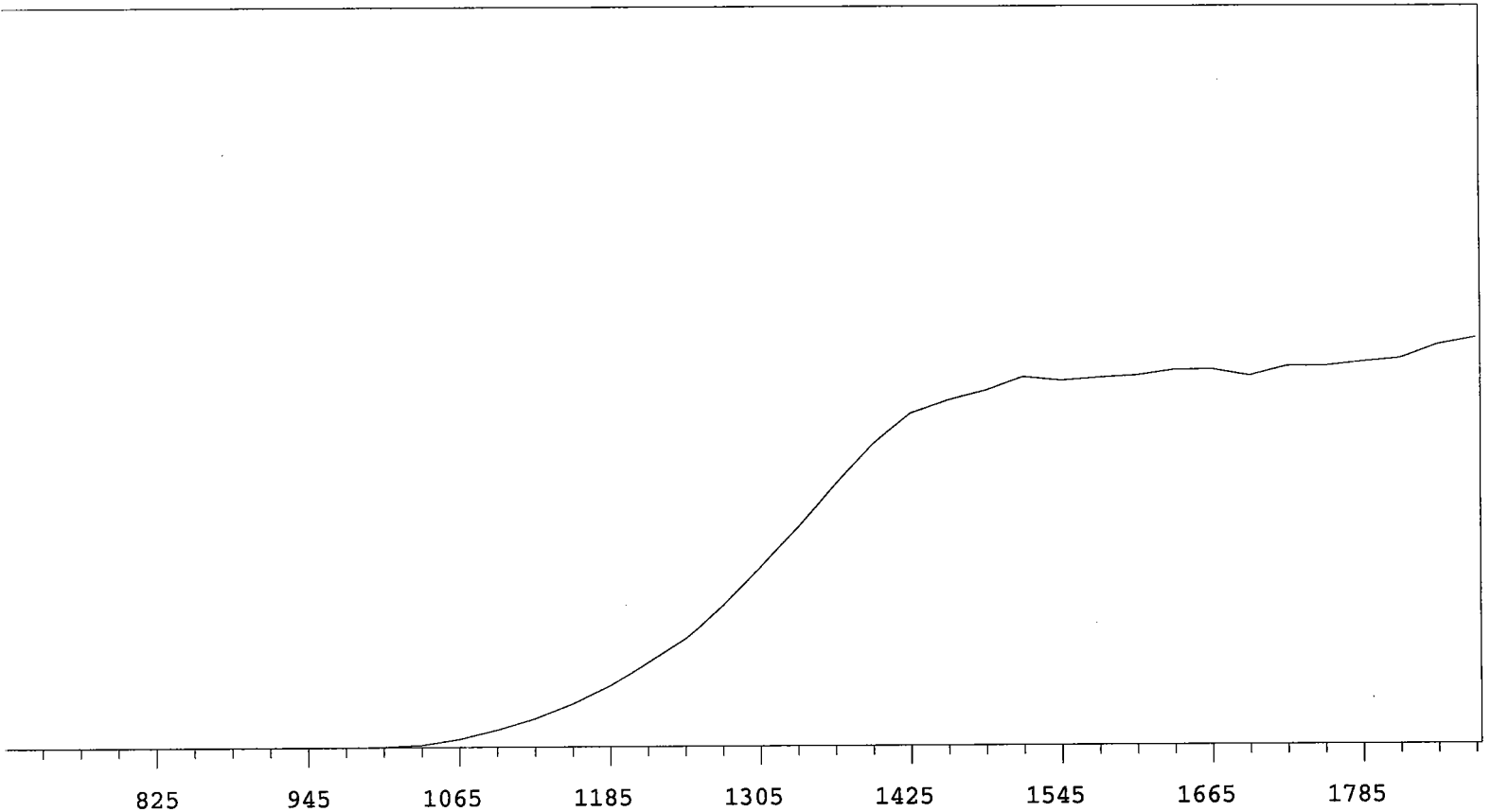
MPC 9600 Plateau  
Alpha Volts: 870

Instrument 9 MPC 9604 Detector C  
Beta Volts: 1530

7/1/2009



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	20192	+70.39
735	0		1335	24524	+60.97
765	0		1365	29650	+48.44
795	0	>100	1395	33904	+35.09
825	0	>100	1425	36549	+22.73
855	0	>100	1455	38217	+13.58
885	1	>100	1485	39628	+7.51
915	1	>100	1515	40035	+3.73
945	2	>100	1545	40020	+1.92
975	3	>100	1575	40236	+2.06
1005	64	>100	1605	40680	+1.62
1035	349	>100	1635	40953	+1.03
1065	970	>100	1665	40643	+0.43
1095	1982	>100	1695	40882	+1.41
1125	3328	>100	1725	40979	+2.18
1155	5012	>100	1755	41654	+2.20
1185	6669	>100	1785	41602	+2.27
1215	9448	+92.67	1815	41935	+4.50
1245	12293	+86.58	1845	42259	
1275	15917	+76.99	1875	44183	

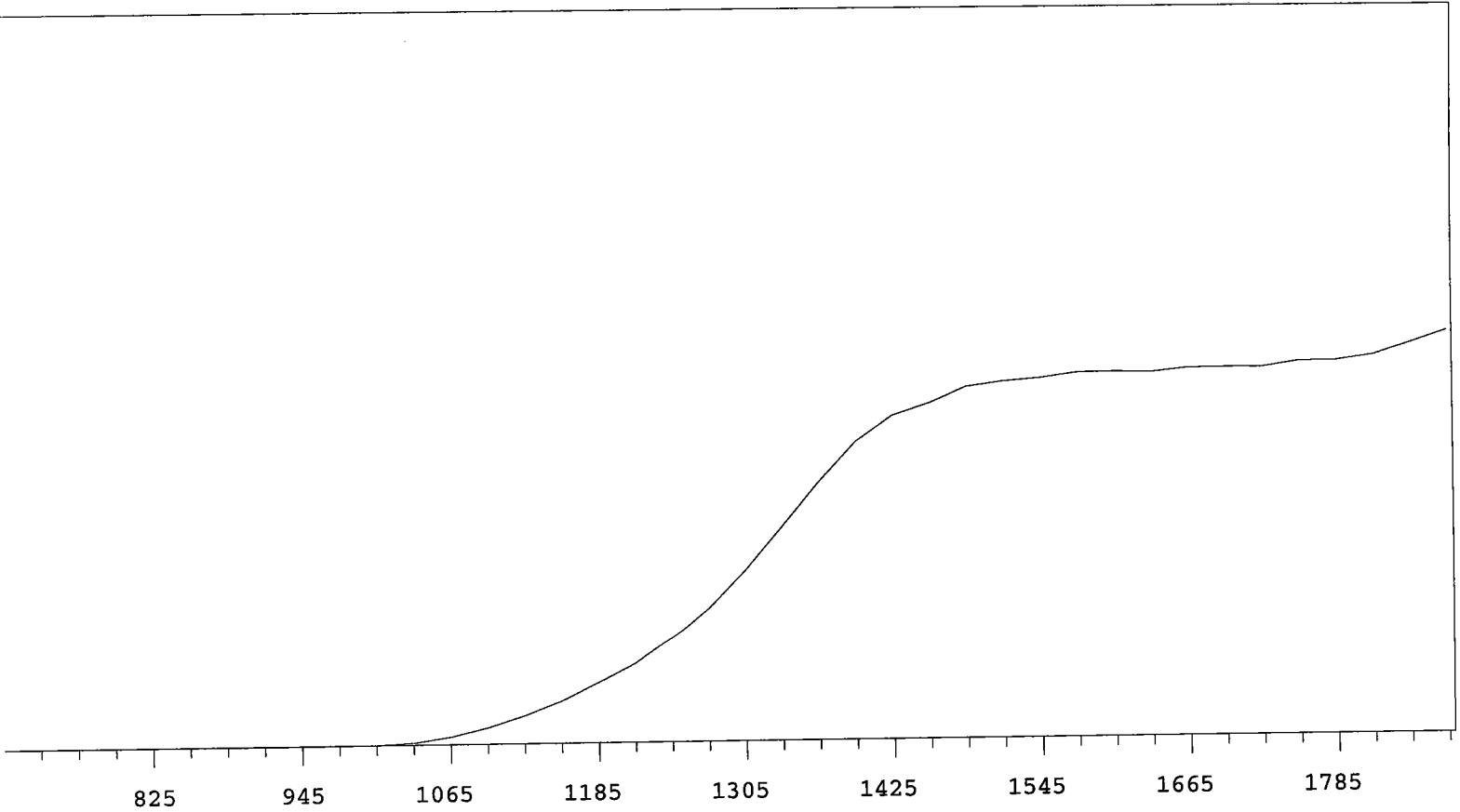


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	13319	+70.94
735	0		1335	16319	+61.35
765	0		1365	19577	+50.27
795	0	>100	1395	22498	+36.85
825	0	>100	1425	24782	+23.90
855	0	>100	1455	25761	+15.37
885	0	>100	1485	26486	+8.38
915	1	>100	1515	27503	+5.11
945	0	>100	1545	27223	+2.67
975	5	>100	1575	27453	+1.71
1005	35	>100	1605	27604	+2.70
1035	186	>100	1635	28021	+0.78
1065	618	>100	1665	28059	+1.05
1095	1280	>100	1695	27548	+0.90
1125	2141	>100	1725	28280	+2.16
1155	3268	>100	1755	28290	+3.51
1185	4659	>100	1785	28600	+4.46
1215	6343	+90.68	1815	28879	+6.35
1245	8064	+83.46	1845	29913	
1275	10497	+77.03	1875	30417	

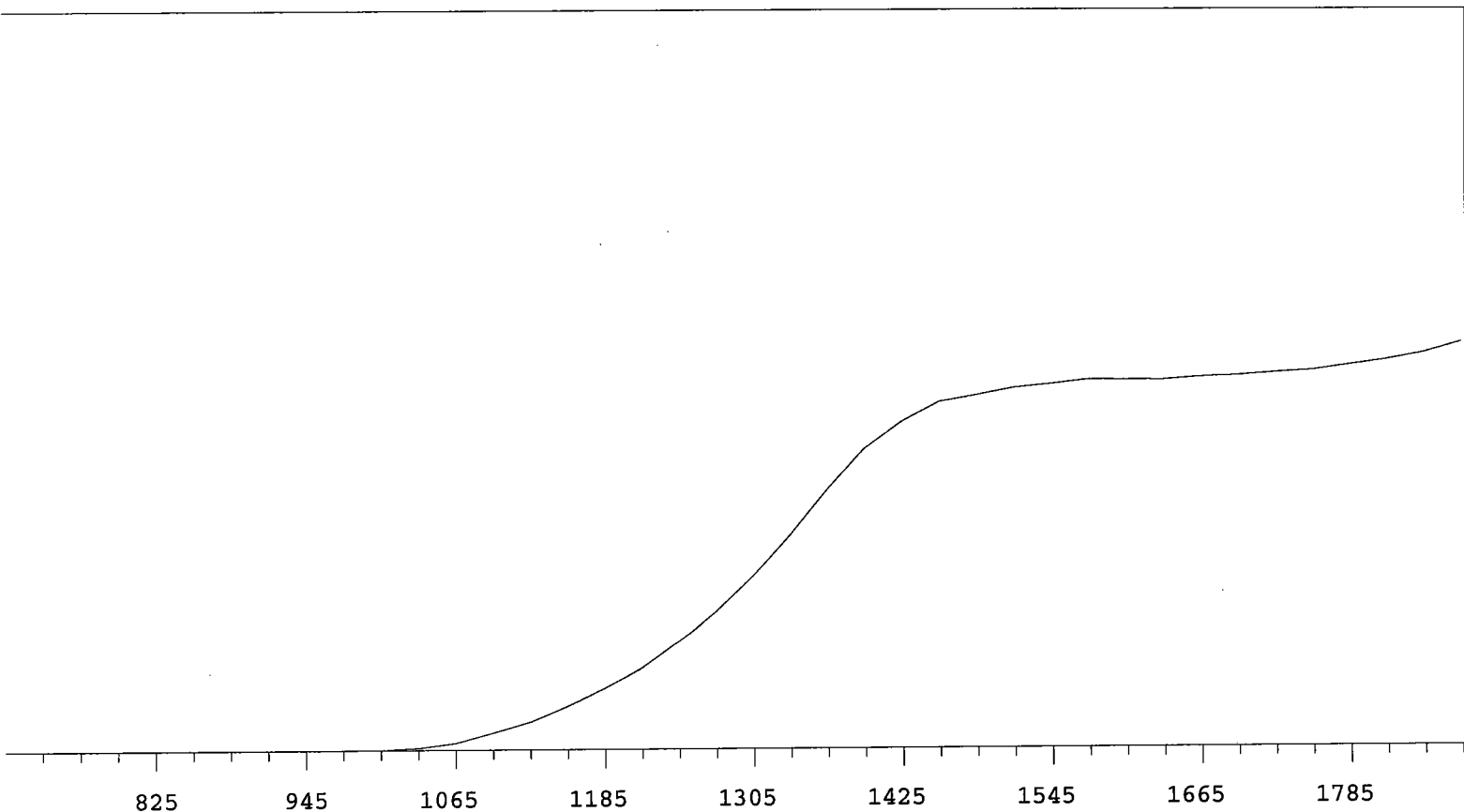
MPC 9600 Plateau  
 Alpha Volts: 870

Instrument 10 MPC 9604 Detector A  
 Beta Volts: 1552

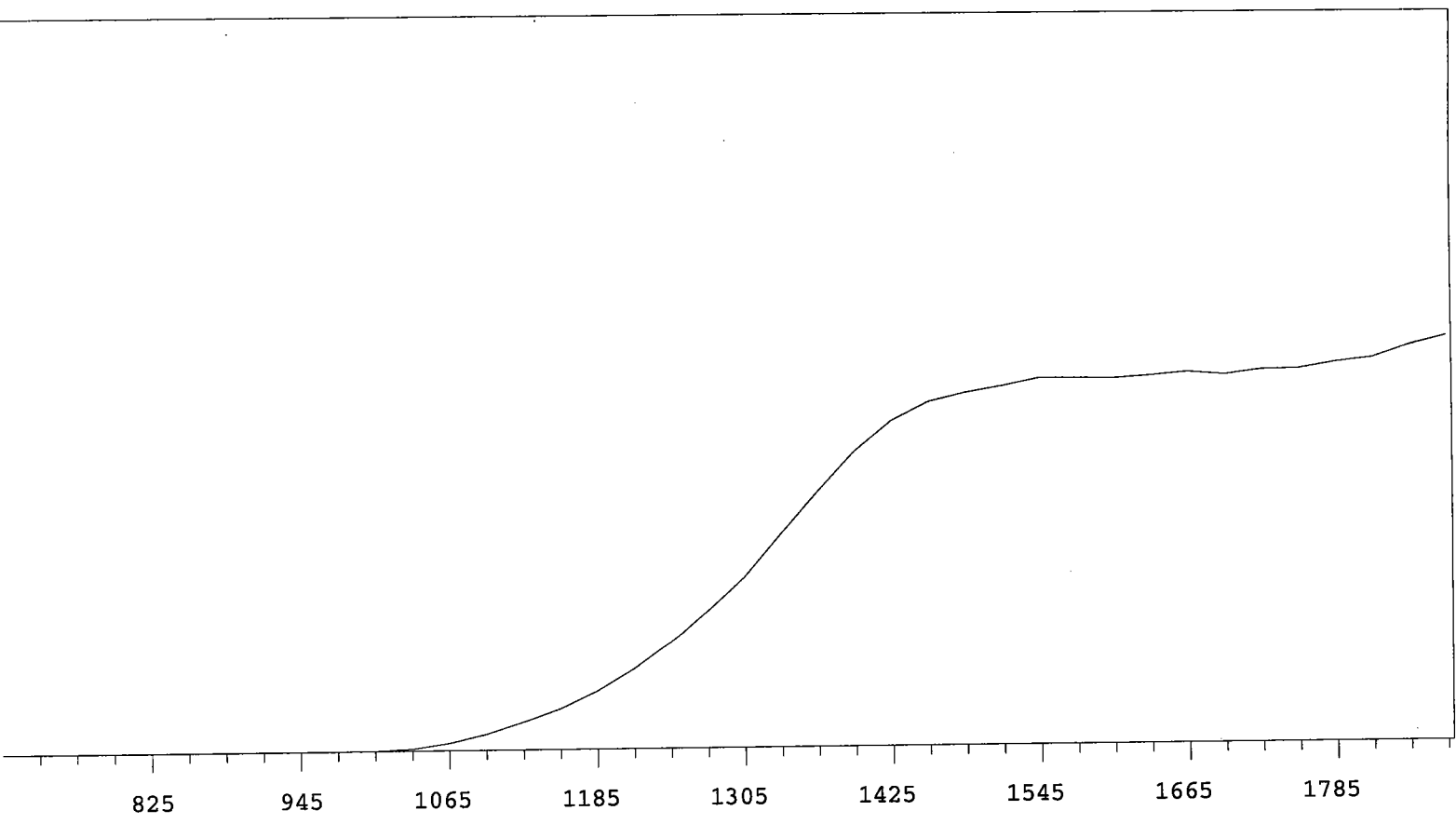
7/1/2009



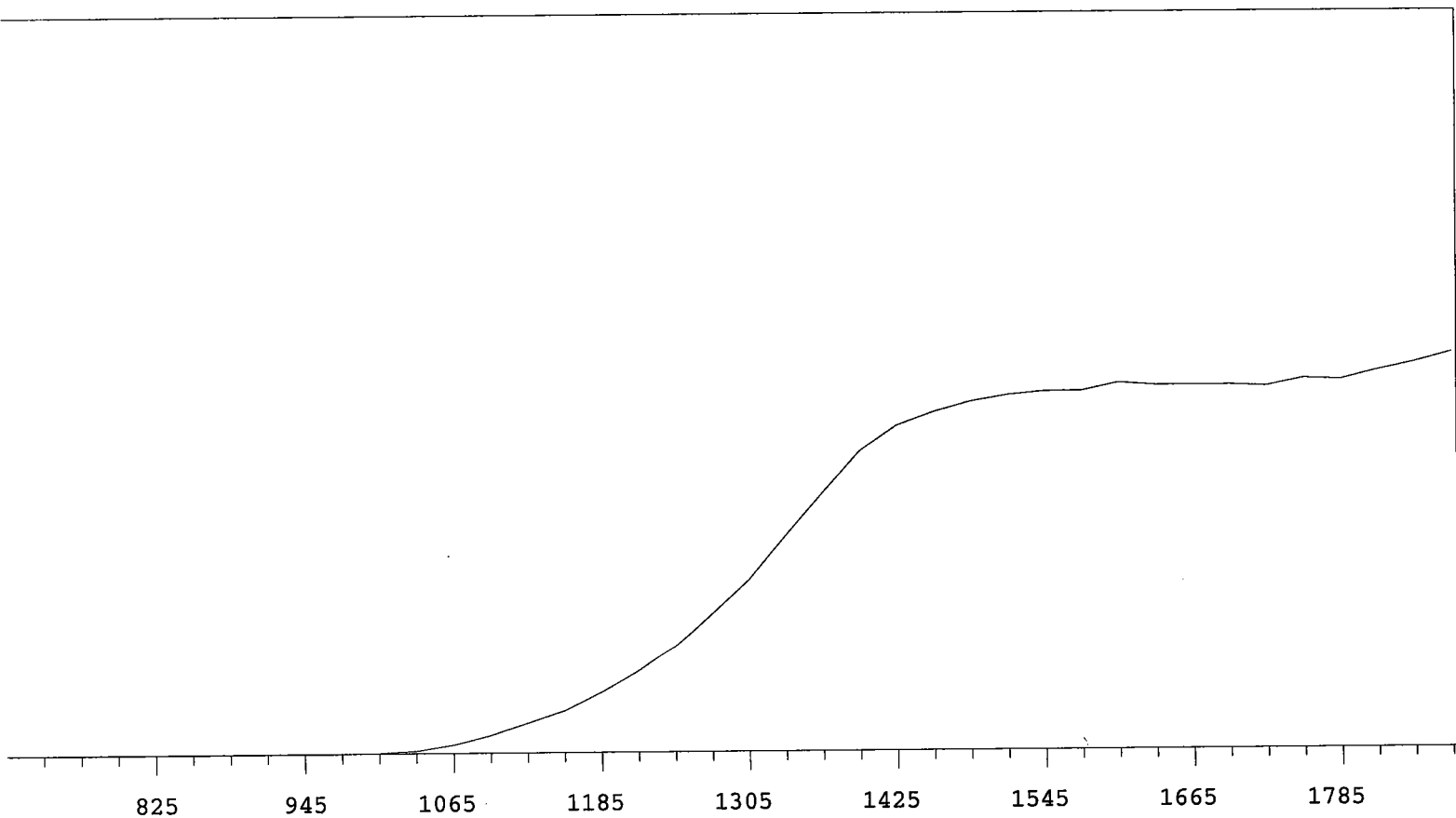
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	16076	+72.76
735	1		1335	19985	+63.85
765	0		1365	24102	+50.95
795	0	>100	1395	27819	+36.01
825	0	>100	1425	30228	+23.86
855	0	>100	1455	31343	+14.40
885	0	>100	1485	32811	+8.77
915	0	>100	1515	33243	+6.10
945	0	>100	1545	33518	+3.25
975	1	>100	1575	34010	+1.98
1005	37	>100	1605	34061	+1.59
1035	198	>100	1635	33973	+0.97
1065	687	>100	1665	34346	+0.93
1095	1491	>100	1695	34366	+1.72
1125	2580	>100	1725	34341	+1.54
1155	3920	>100	1755	34860	+2.47
1185	5588	>100	1785	34897	+4.50
1215	7384	+91.32	1815	35377	+6.60
1245	9794	+84.81	1845	36458	
1275	12572	+79.73	1875	37630	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	14469	+71.08
735	0		1335	17904	+63.07
765	0		1365	21677	+51.20
795	0	>100	1395	25027	+38.06
825	0	>100	1425	27237	+24.55
855	0	>100	1455	28914	+14.61
885	0	>100	1485	29480	+8.48
915	0	>100	1515	30075	+5.06
945	1	>100	1545	30374	+3.42
975	7	>100	1575	30738	+1.68
1005	28	>100	1605	30703	+1.08
1035	190	>100	1635	30679	+0.77
1065	597	>100	1665	30902	+1.46
1095	1474	>100	1695	30992	+1.89
1125	2383	>100	1725	31224	+2.40
1155	3680	>100	1755	31397	+3.27
1185	5131	>100	1785	31826	+4.13
1215	6808	+89.95	1815	32236	+5.59
1245	8990	+83.03	1845	32782	
1275	11493	+77.30	1875	33632	



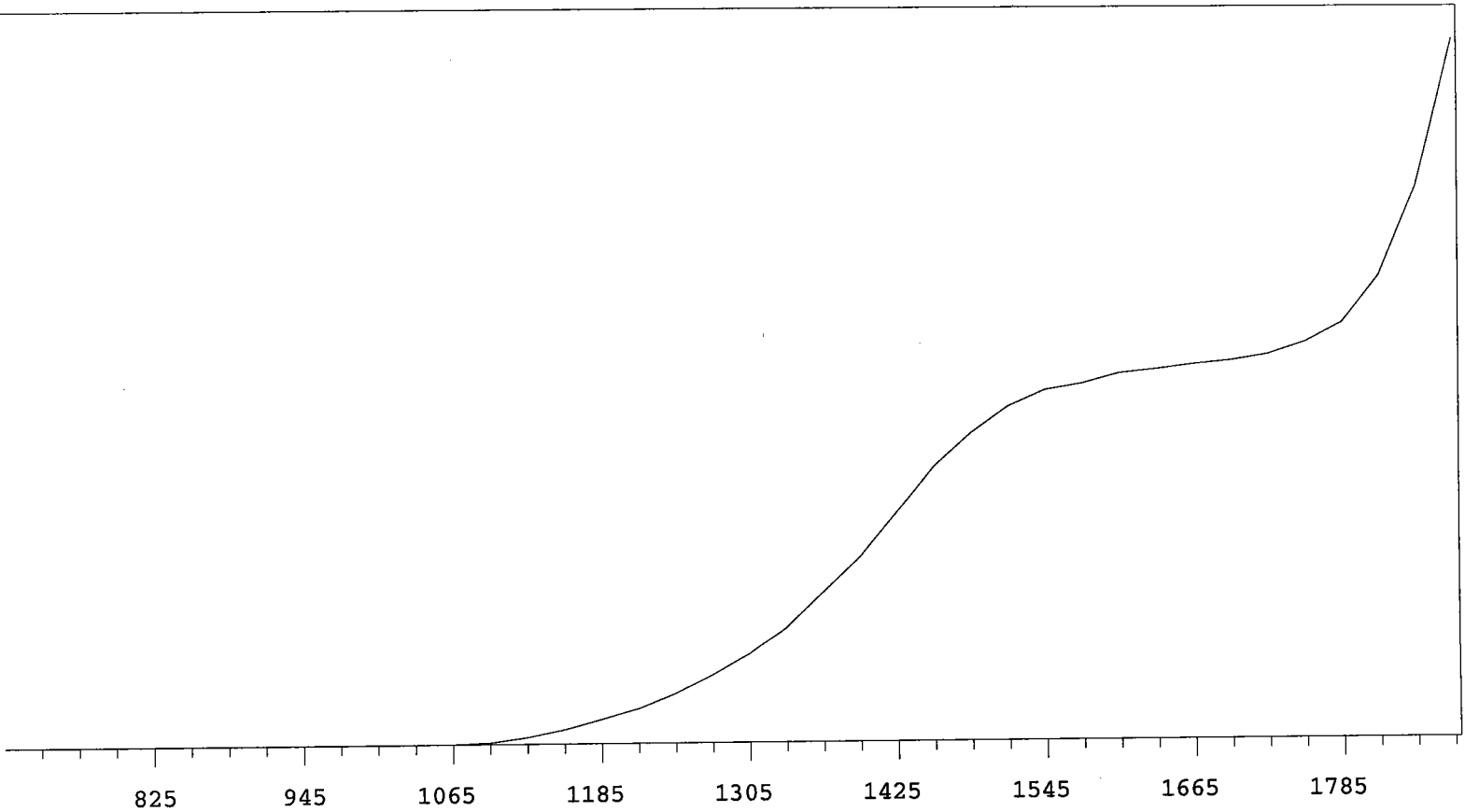
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	18051	+71.16
735	0		1335	22586	+62.34
765	0		1365	26973	+51.47
795	0	>100	1395	31137	+38.24
825	0	>100	1425	34321	+25.70
855	0	>100	1455	36267	+15.37
885	1	>100	1485	37197	+9.21
915	0	>100	1515	37851	+5.38
945	2	>100	1545	38622	+3.00
975	2	>100	1575	38600	+1.55
1005	36	>100	1605	38538	+1.03
1035	220	>100	1635	38786	+0.91
1065	780	>100	1665	39129	+1.38
1095	1712	>100	1695	38832	+1.20
1125	2926	>100	1725	39323	+2.00
1155	4297	>100	1755	39390	+3.35
1185	6097	>100	1785	40031	+4.86
1215	8397	+95.11	1815	40466	+6.64
1245	11155	+85.84	1845	41713	
1275	14430	+78.79	1875	42620	



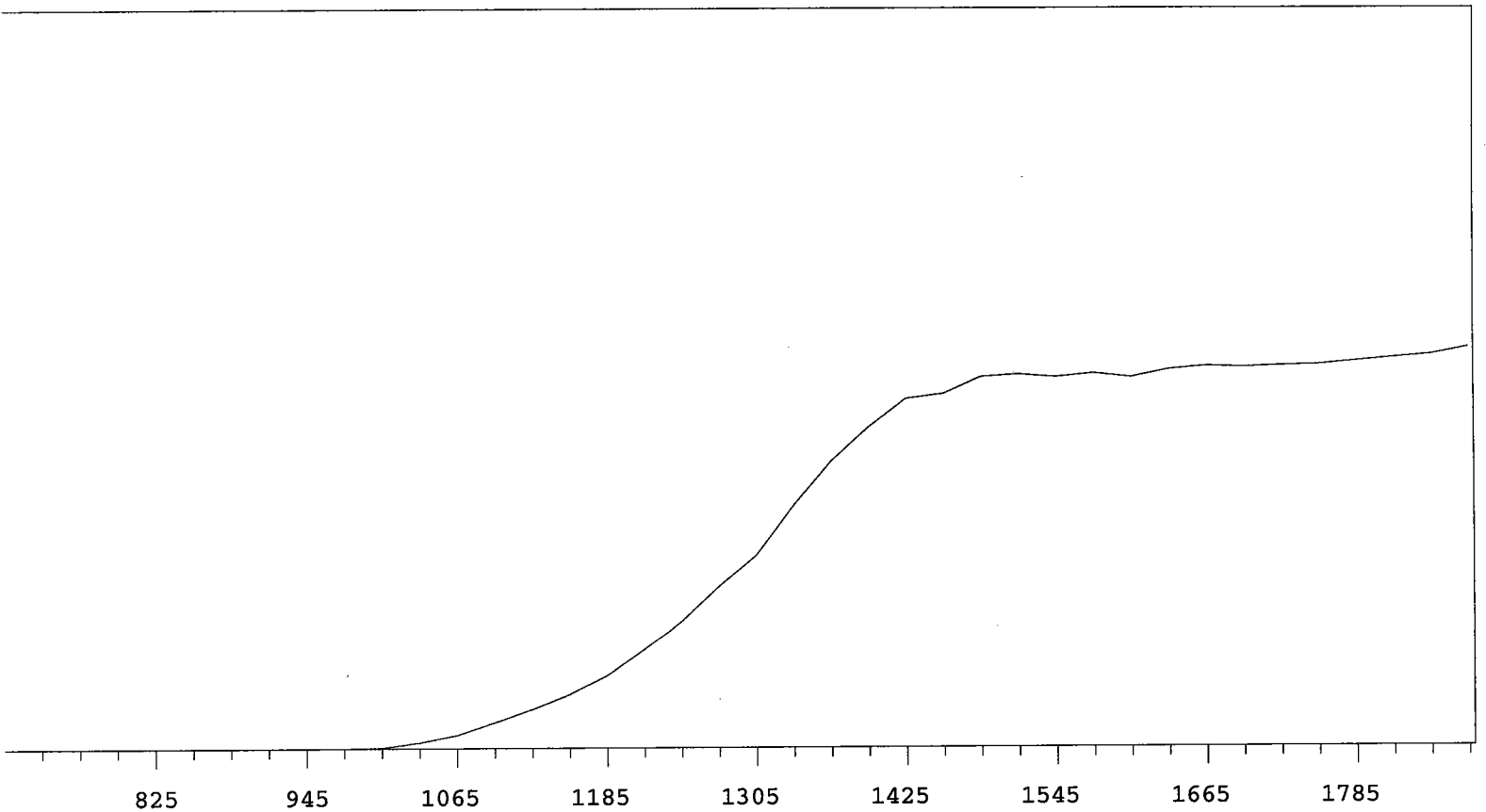
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	15430	+69.87
735	0		1335	19258	+61.49
765	0		1365	23018	+50.06
795	0	>100	1395	26562	+35.34
825	0	>100	1425	28750	+22.67
855	0	>100	1455	29911	+13.20
885	0	>100	1485	30798	+8.01
915	0	>100	1515	31375	+4.83
945	0	>100	1545	31684	+3.74
975	3	>100	1575	31721	+2.38
1005	49	>100	1605	32398	+1.44
1035	244	>100	1635	32154	+0.64
1065	764	>100	1665	32157	-0.77
1095	1584	>100	1695	32152	+0.99
1125	2677	>100	1725	32029	+1.41
1155	3763	>100	1755	32699	+3.00
1185	5395	>100	1785	32566	+4.71
1215	7350	+93.71	1815	33351	+5.92
1245	9655	+83.52	1845	34031	
1275	12504	+76.82	1875	34941	



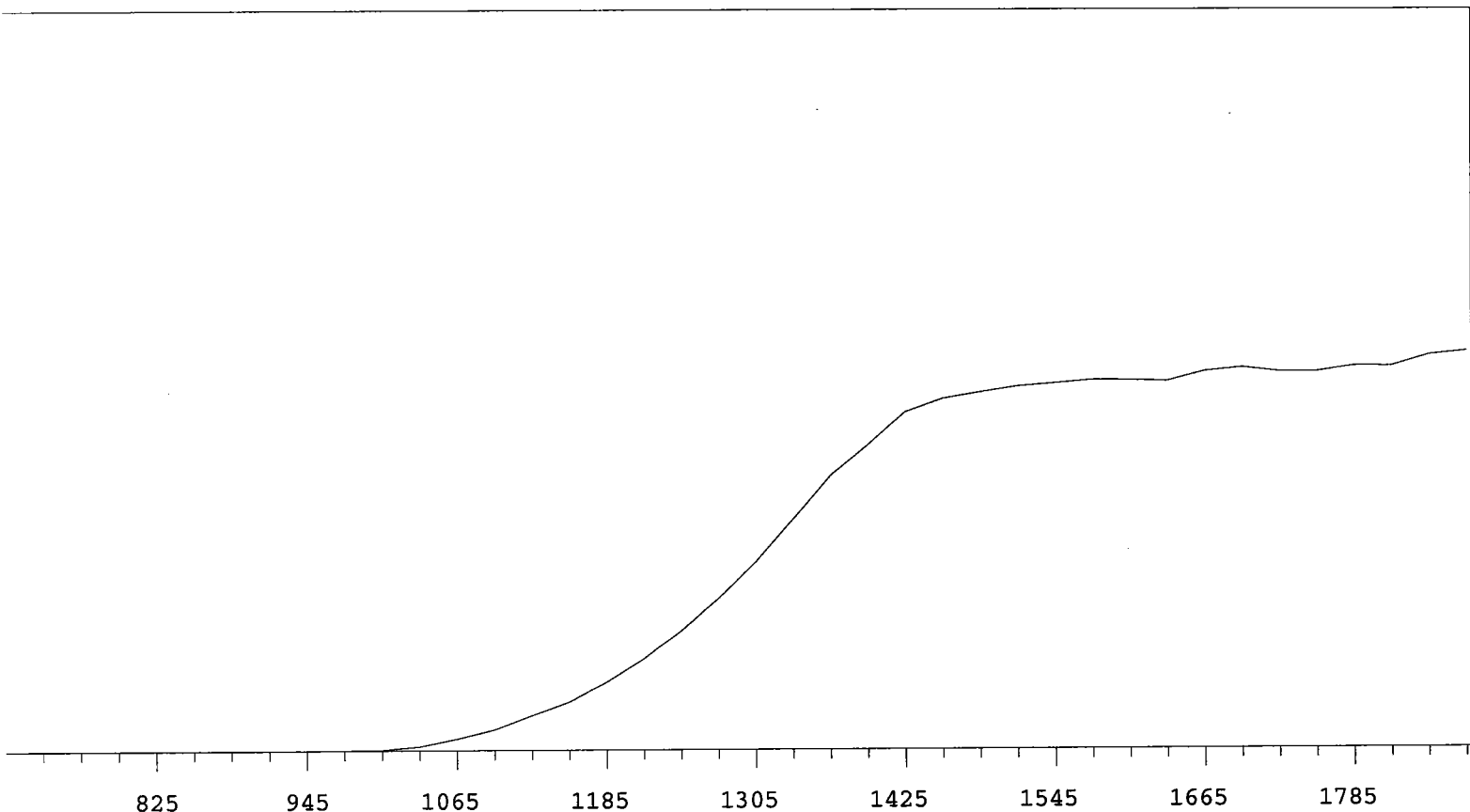
Alpha Volts: 1515 Beta Volts: 1515



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	3225	+87.64
735	1		1335	4189	+80.15
765	0		1365	5428	+75.12
795	0	>100	1395	6662	+68.60
825	0	>100	1425	8241	+58.14
855	0	>100	1455	9857	+46.65
885	0	>100	1485	11018	+33.24
915	0	>100	1515	11953	+21.01
945	1	+0.00	1545	12538	+13.57
975	0	>100	1575	12760	+8.35
1005	0	>100	1605	13114	+5.84
1035	2	>100	1635	13258	+4.78
1065	9	>100	1665	13430	+3.99
1095	61	>100	1695	13551	+5.46
1125	248	>100	1725	13771	+8.65
1155	528	>100	1755	14204	+16.44
1185	882	>100	1785	14916	+30.03
1215	1270	>100	1815	16579	+48.74
1245	1786	>100	1845	19717	
1275	2478	+93.67	1875	25029	



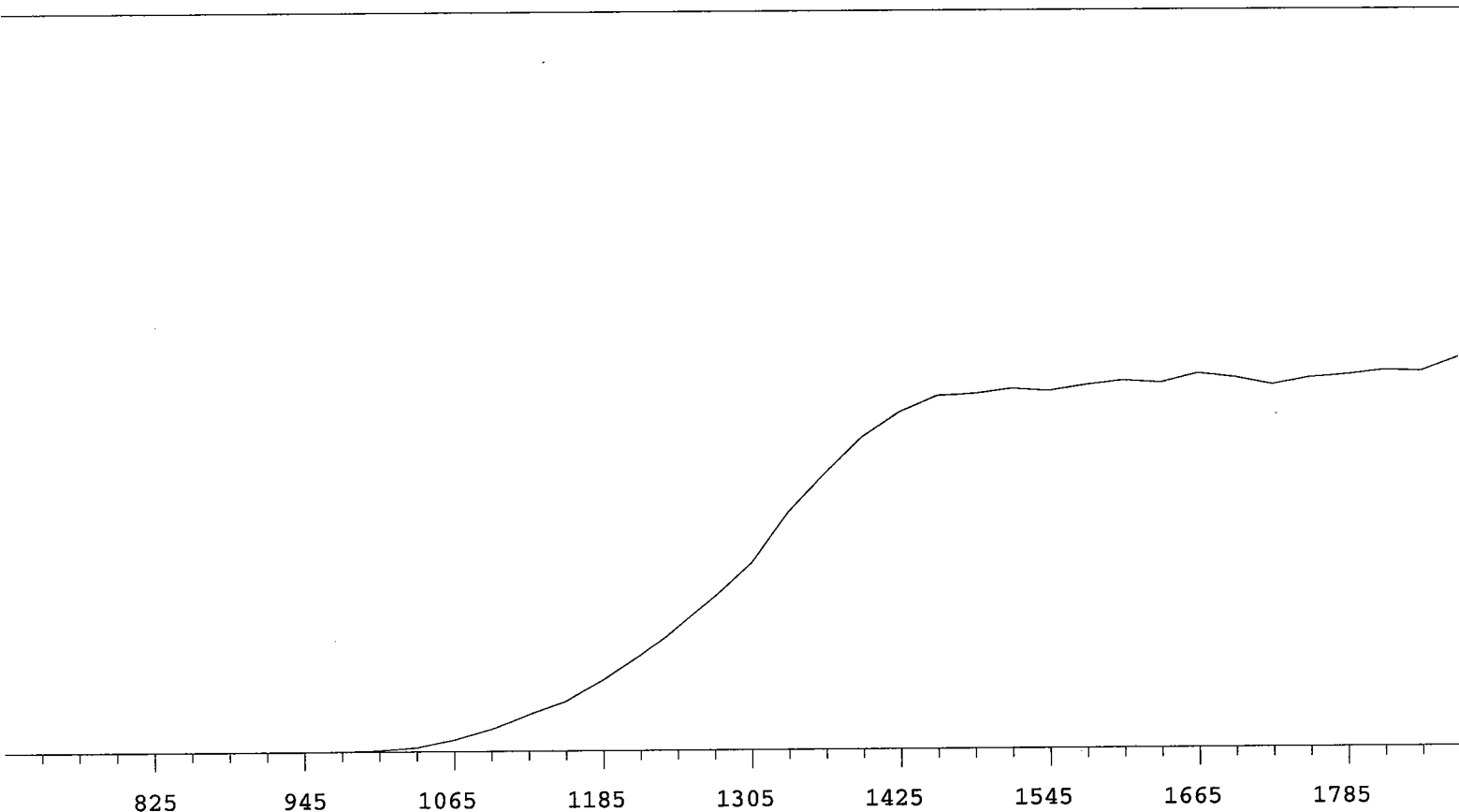
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	8947	+65.63
735	0		1335	11238	+56.58
765	0		1365	13246	+46.66
795	0	>100	1395	14838	+30.69
825	0	>100	1425	16166	+20.11
855	0	>100	1455	16396	+11.95
885	0	>100	1485	17161	+5.61
915	1	>100	1515	17274	+3.59
945	0	>100	1545	17144	-0.00
975	11	>100	1575	17323	+0.80
1005	47	>100	1605	17136	+2.21
1035	280	>100	1635	17484	+1.94
1065	610	>100	1665	17638	+2.16
1095	1192	>100	1695	17580	+0.85
1125	1789	>100	1725	17655	+1.05
1155	2466	>100	1755	17700	+1.98
1185	3337	+94.91	1785	17857	+2.38
1215	4526	+88.85	1815	18006	+3.36
1245	5885	+78.40	1845	18140	
1275	7518	+72.09	1875	18468	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	8636	+66.44
735	0		1335	10593	+56.56
765	0	+0.00	1365	12582	+46.23
795	0	>100	1395	13957	+33.45
825	1	+0.00	1425	15443	+21.49
855	0	>100	1455	16048	+13.14
885	0	+0.00	1485	16331	+6.45
915	0	>100	1515	16603	+4.19
945	1	>100	1545	16736	+2.73
975	7	>100	1575	16884	+1.11
1005	46	>100	1605	16875	+1.91
1035	191	>100	1635	16813	+2.86
1065	540	>100	1665	17257	+2.60
1095	957	>100	1695	17425	+1.58
1125	1597	>100	1725	17238	+0.49
1155	2217	>100	1755	17230	+0.63
1185	3154	+98.74	1785	17482	+3.27
1215	4239	+89.75	1815	17468	+4.46
1245	5550	+79.98	1845	17977	
1275	6980	+73.12	1875	18163	

Alpha Volts: 1515

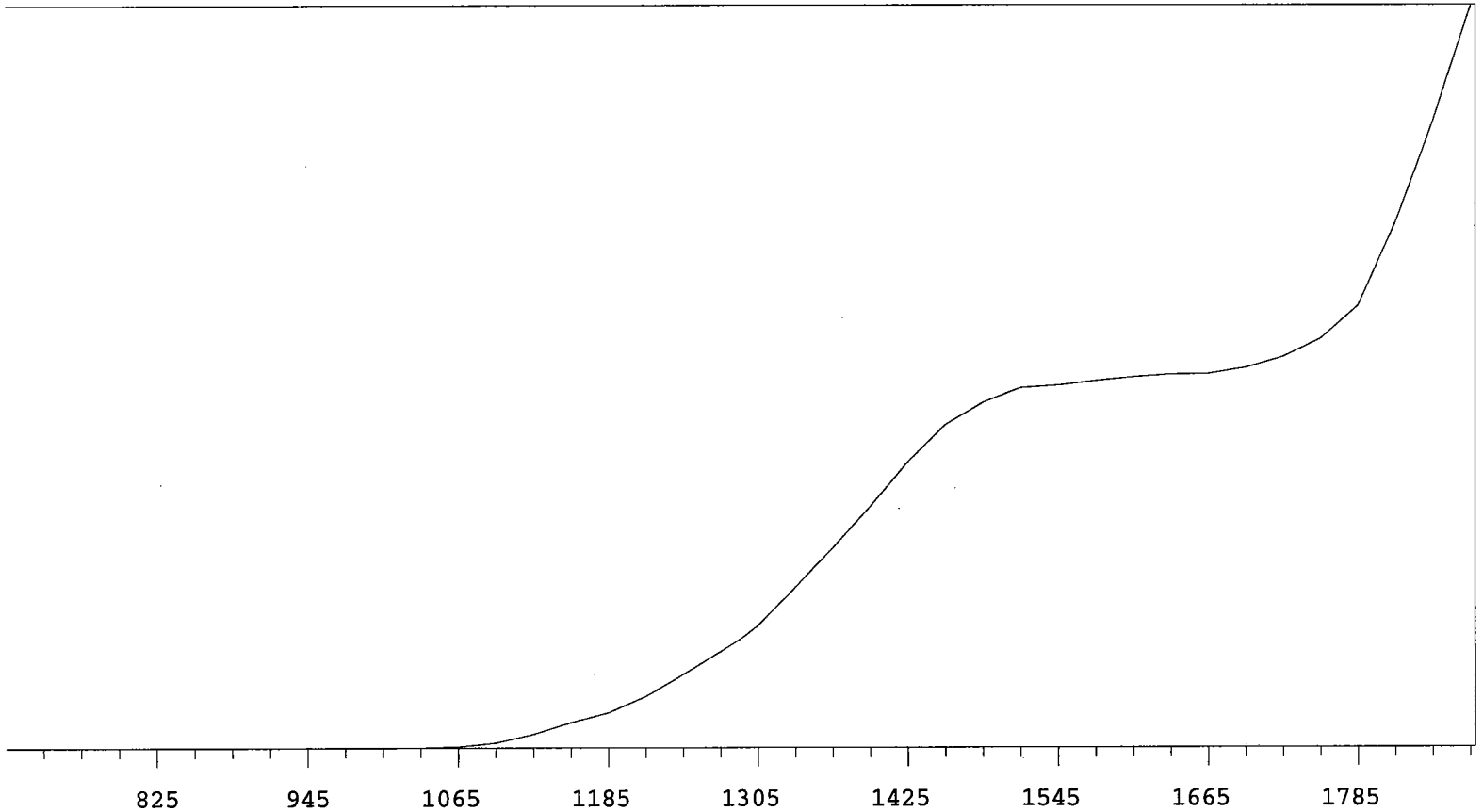
Beta Volts: 1515



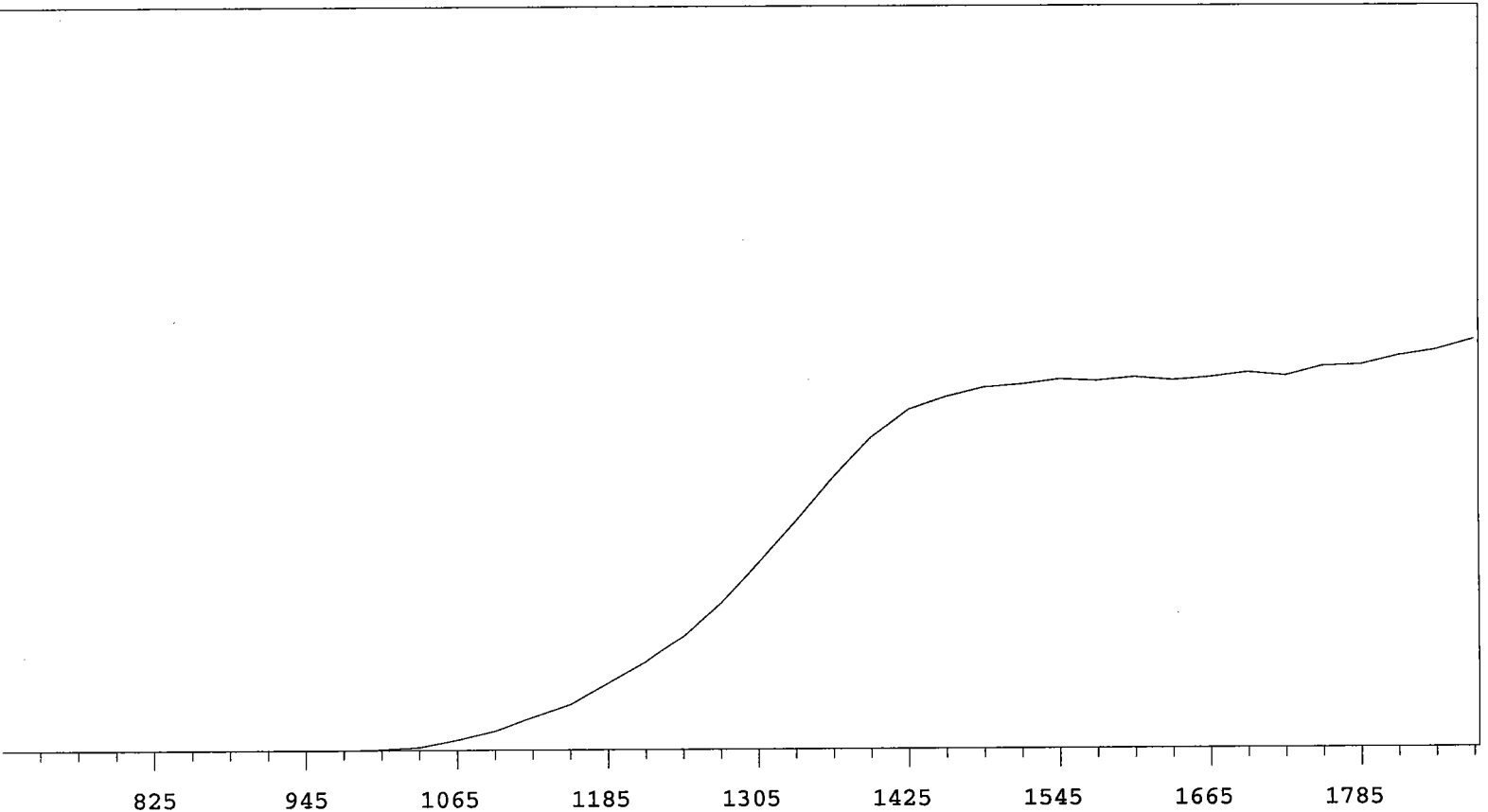
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	7679	+65.97
735	0		1335	9737	+57.57
765	0		1365	11301	+45.87
795	0	>100	1395	12767	+31.71
825	0	>100	1425	13767	+19.90
855	1	+83.33	1455	14399	+10.72
885	1	+55.56	1485	14467	+4.38
915	0	>100	1515	14671	+2.12
945	1	>100	1545	14576	+2.61
975	9	>100	1575	14808	+1.80
1005	60	>100	1605	14974	+3.15
1035	173	>100	1635	14872	+1.76
1065	480	>100	1665	15248	-0.41
1095	911	>100	1695	15067	-0.27
1125	1508	>100	1725	14784	-0.43
1155	2024	>100	1755	15044	+2.01
1185	2872	+97.38	1785	15163	+2.82
1215	3858	+89.30	1815	15333	+3.61
1245	5070	+78.02	1845	15278	
1275	6322	+73.30	1875	15817	

Alpha Volts: 705

Beta Volts: 1515



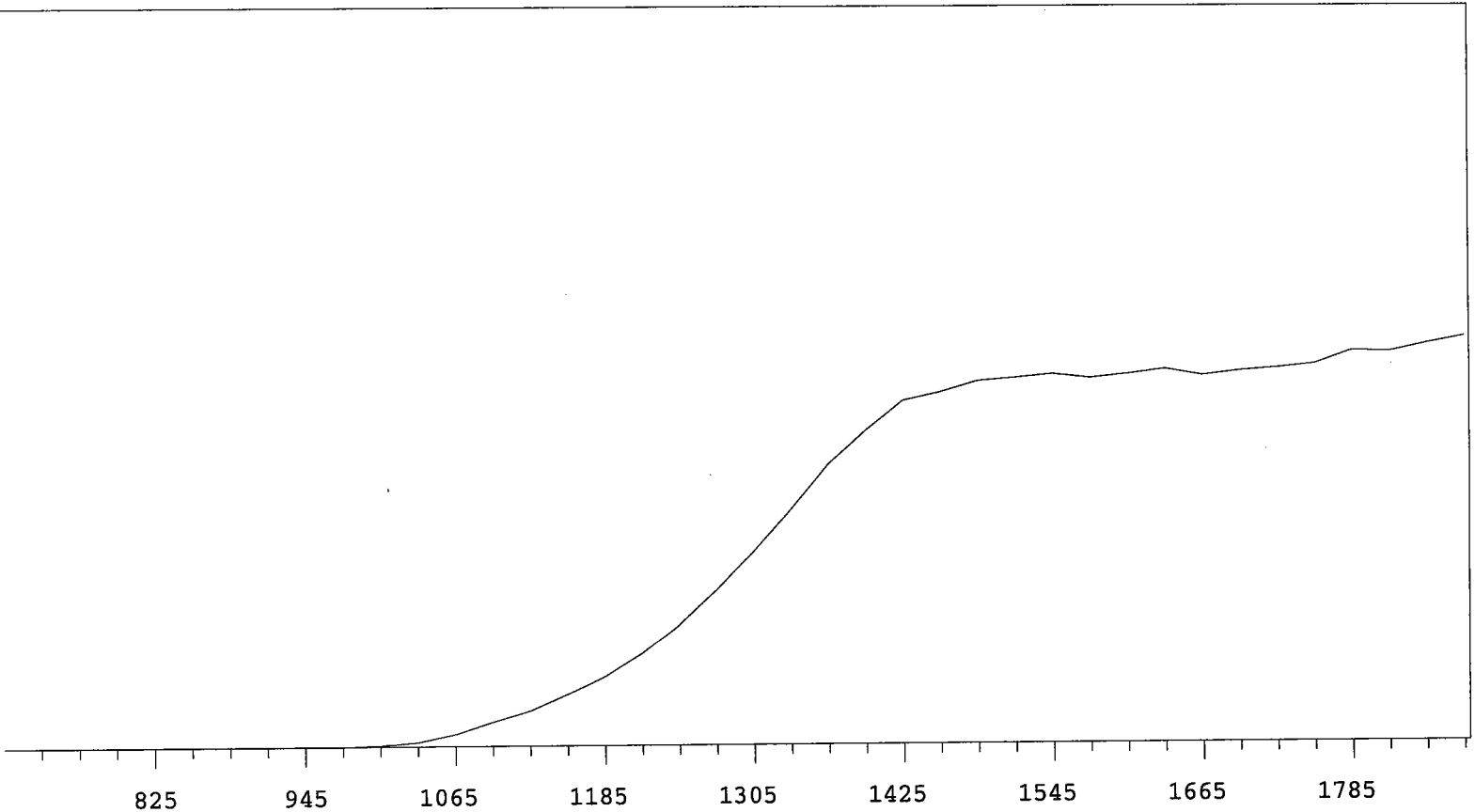
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	6302	+80.03
735	1		1335	8191	+73.78
765	0		1365	10140	+66.18
795	0	>100	1395	12247	+55.83
825	0	>100	1425	14468	+43.92
855	0	>100	1455	16303	+31.28
885	0	>100	1485	17411	+18.64
915	0	>100	1515	18150	+9.87
945	0	>100	1545	18275	+5.30
975	1	>100	1575	18496	+3.16
1005	3	>100	1605	18685	+2.66
1035	17	>100	1635	18820	+2.63
1065	84	>100	1665	18855	+4.16
1095	267	>100	1695	19152	+7.70
1125	709	>100	1725	19706	+13.90
1155	1299	>100	1755	20640	+26.51
1185	1813	>100	1785	22308	+40.92
1215	2638	>100	1815	26460	+51.46
1245	3777	+96.47	1845	31616	
1275	4915	+87.98	1875	37348	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	10207	+70.42
735	0		1335	12473	+60.75
765	0		1365	14900	+48.87
795	0	>100	1395	17101	+35.36
825	0	>100	1425	18643	+22.53
855	1	+83.33	1455	19350	+12.34
885	1	-83.33	1485	19848	+6.68
915	0	-55.56	1515	20014	+3.51
945	0	>100	1545	20278	+2.03
975	1	>100	1575	20186	+0.80
1005	43	>100	1605	20375	+0.32
1035	165	>100	1635	20209	+1.36
1065	557	>100	1665	20364	+0.83
1095	1055	>100	1695	20607	+2.43
1125	1775	>100	1725	20429	+2.51
1155	2470	>100	1755	20924	+3.64
1185	3617	+98.46	1785	20984	+5.11
1215	4757	+90.95	1815	21470	+5.63
1245	6186	+83.59	1845	21773	
1275	8021	+77.85	1875	22346	

Alpha Volts: 705

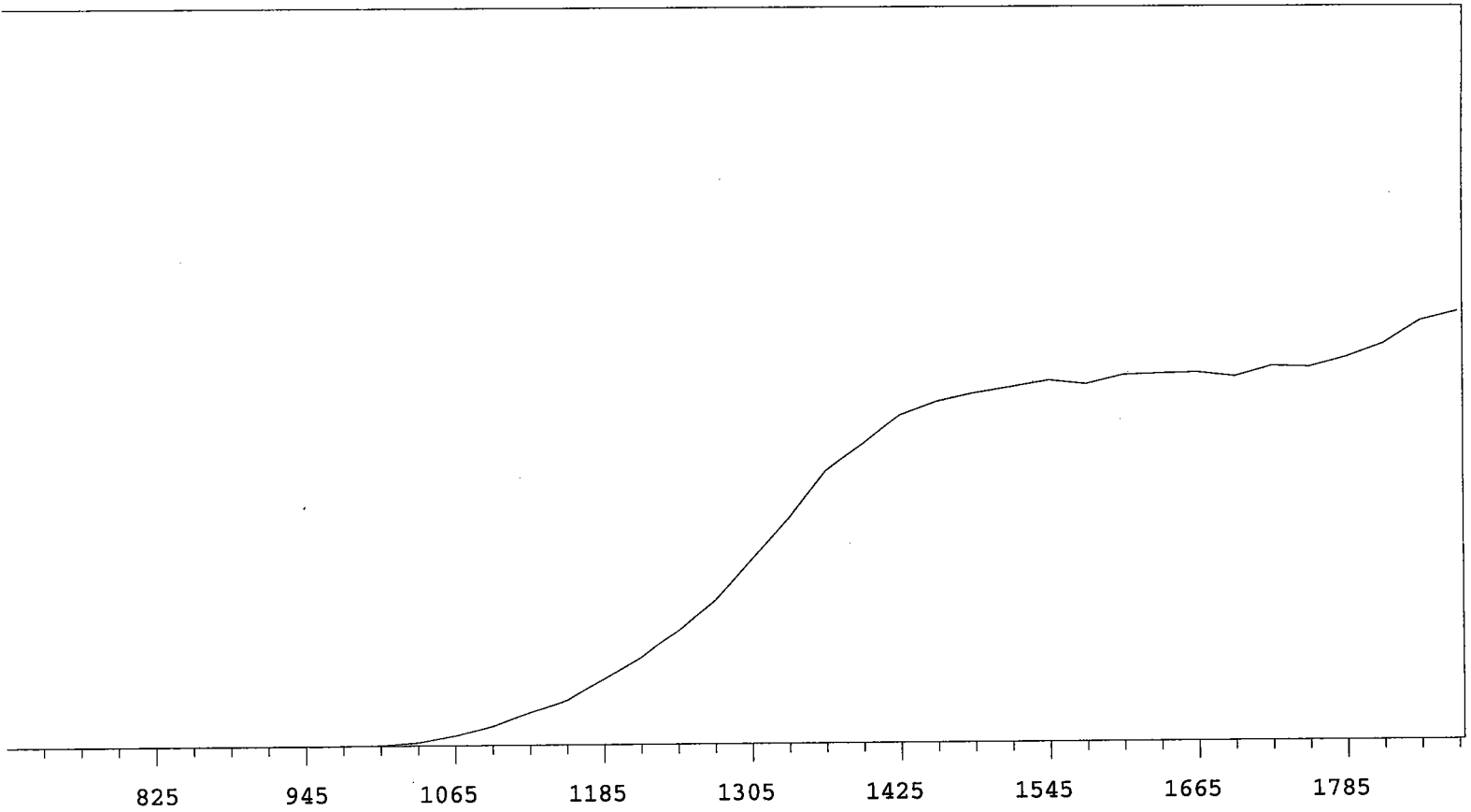
Beta Volts: 1515



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	9543	+67.01
735	0		1335	11617	+56.47
765	0		1365	13791	+45.47
795	0	>100	1395	15387	+31.66
825	0	>100	1425	16819	+20.02
855	0	>100	1455	17210	+11.63
885	1	+0.00	1485	17742	+6.05
915	0	>100	1515	17892	+3.04
945	0	>100	1545	18070	+1.09
975	7	>100	1575	17856	+1.43
1005	52	>100	1605	18054	+0.42
1035	214	>100	1635	18287	+1.06
1065	590	>100	1665	17969	+0.78
1095	1201	>100	1695	18187	+1.48
1125	1759	>100	1725	18317	+4.89
1155	2569	>100	1755	18518	+4.76
1185	3440	+95.13	1785	19156	+5.18
1215	4583	+87.74	1815	19100	+5.18
1245	5985	+81.67	1845	19496	
1275	7682	+74.54	1875	19842	

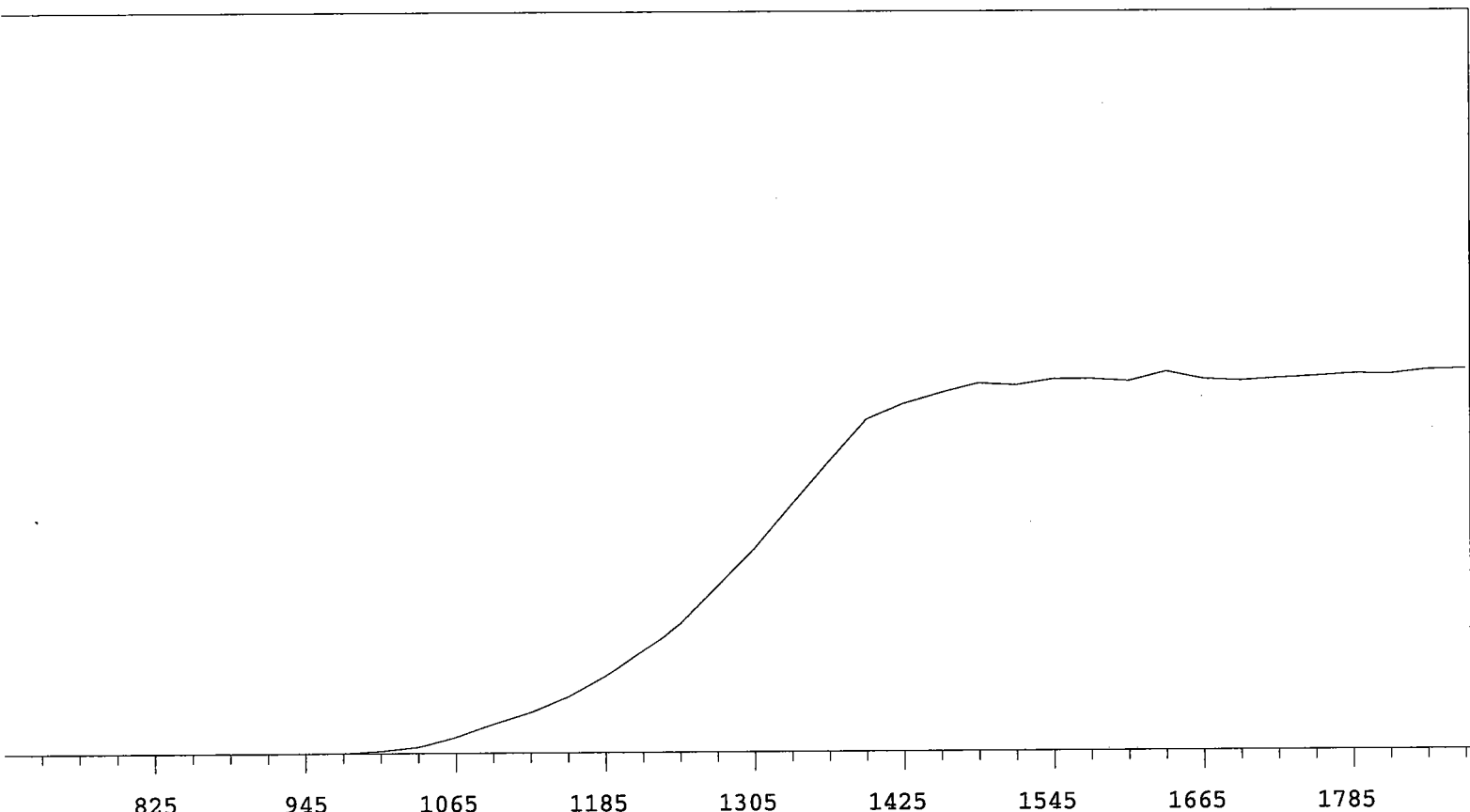
Alpha Volts: 705

Beta Volts: 1515

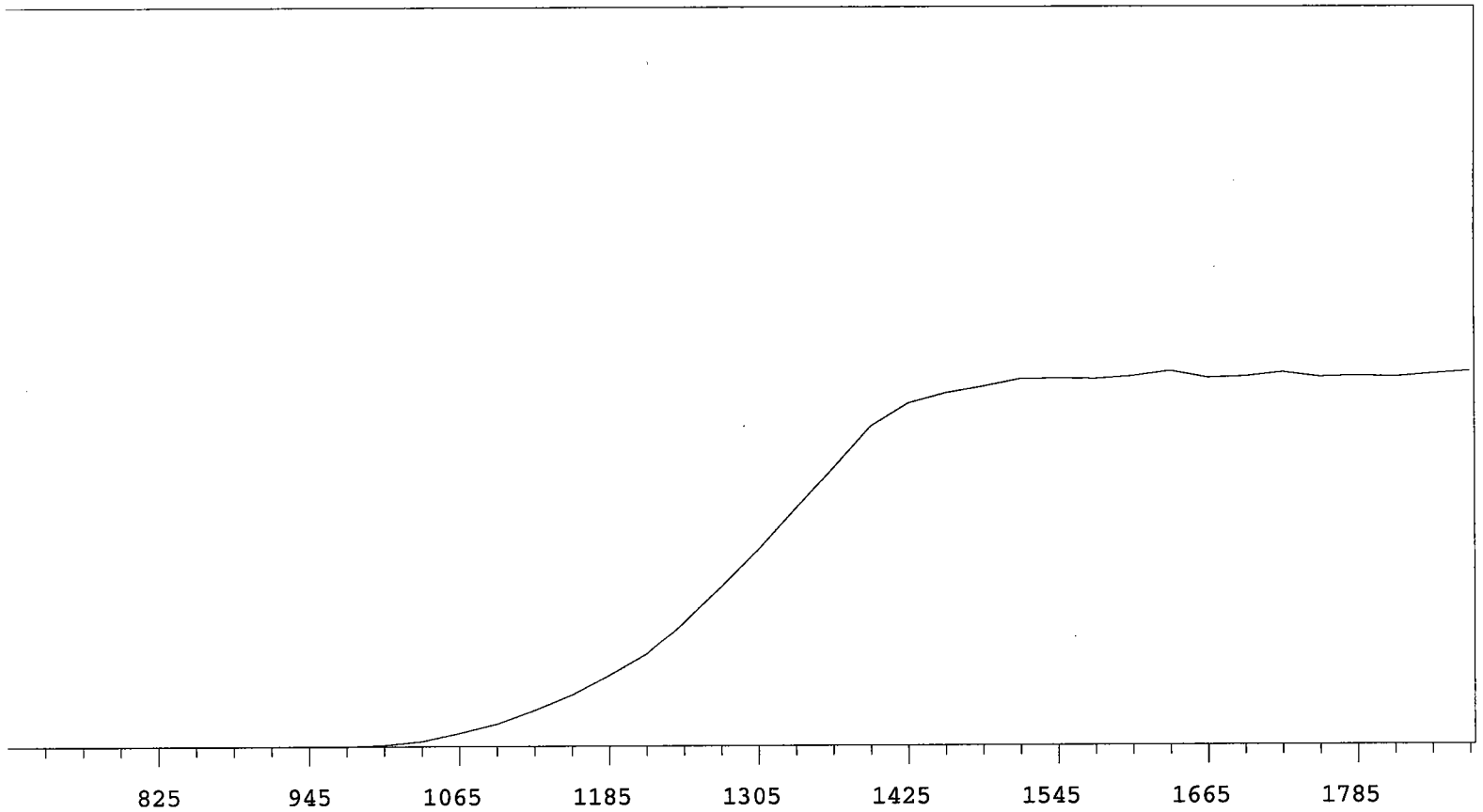


VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	9144	+69.92
735	0		1335	11120	+58.43
765	0		1365	13399	+45.40
795	0	>100	1395	14711	+32.57
825	0	>100	1425	16134	+20.69
855	0	>100	1455	16805	+13.46
885	0	>100	1485	17209	+7.90
915	0	>100	1515	17500	+4.31
945	0	>100	1545	17812	+3.48
975	4	>100	1575	17629	+2.80
1005	26	>100	1605	18066	+2.23
1035	169	>100	1635	18122	+1.44
1065	483	>100	1665	18166	+1.20
1095	955	>100	1695	17967	+1.60
1125	1639	>100	1725	18469	+3.41
1155	2233	>100	1755	18409	+6.35
1185	3262	+98.61	1785	18884	+9.47
1215	4306	+89.77	1815	19535	+11.98
1245	5662	+82.36	1845	20630	
1275	7113	+76.36	1875	21076	

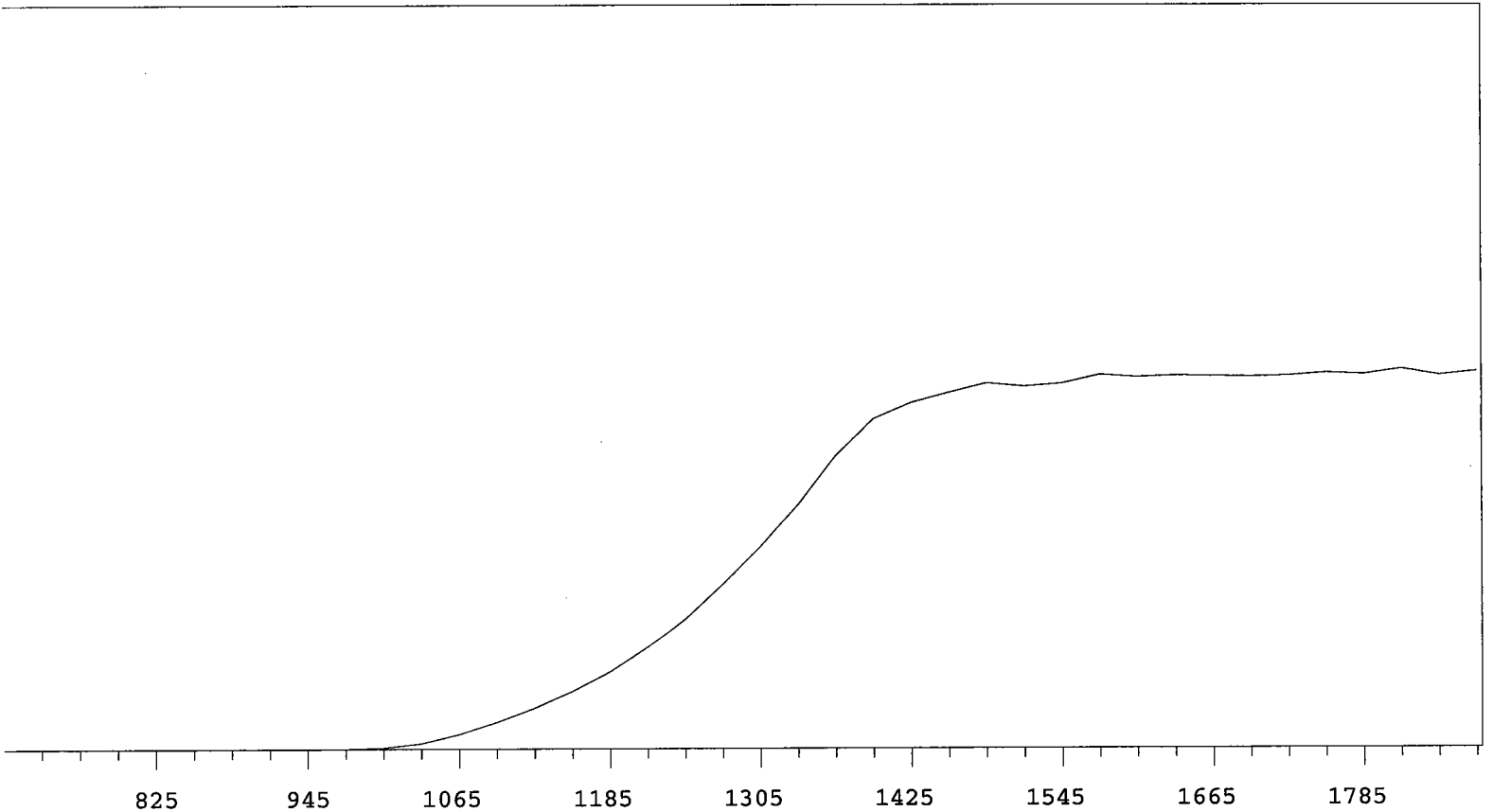




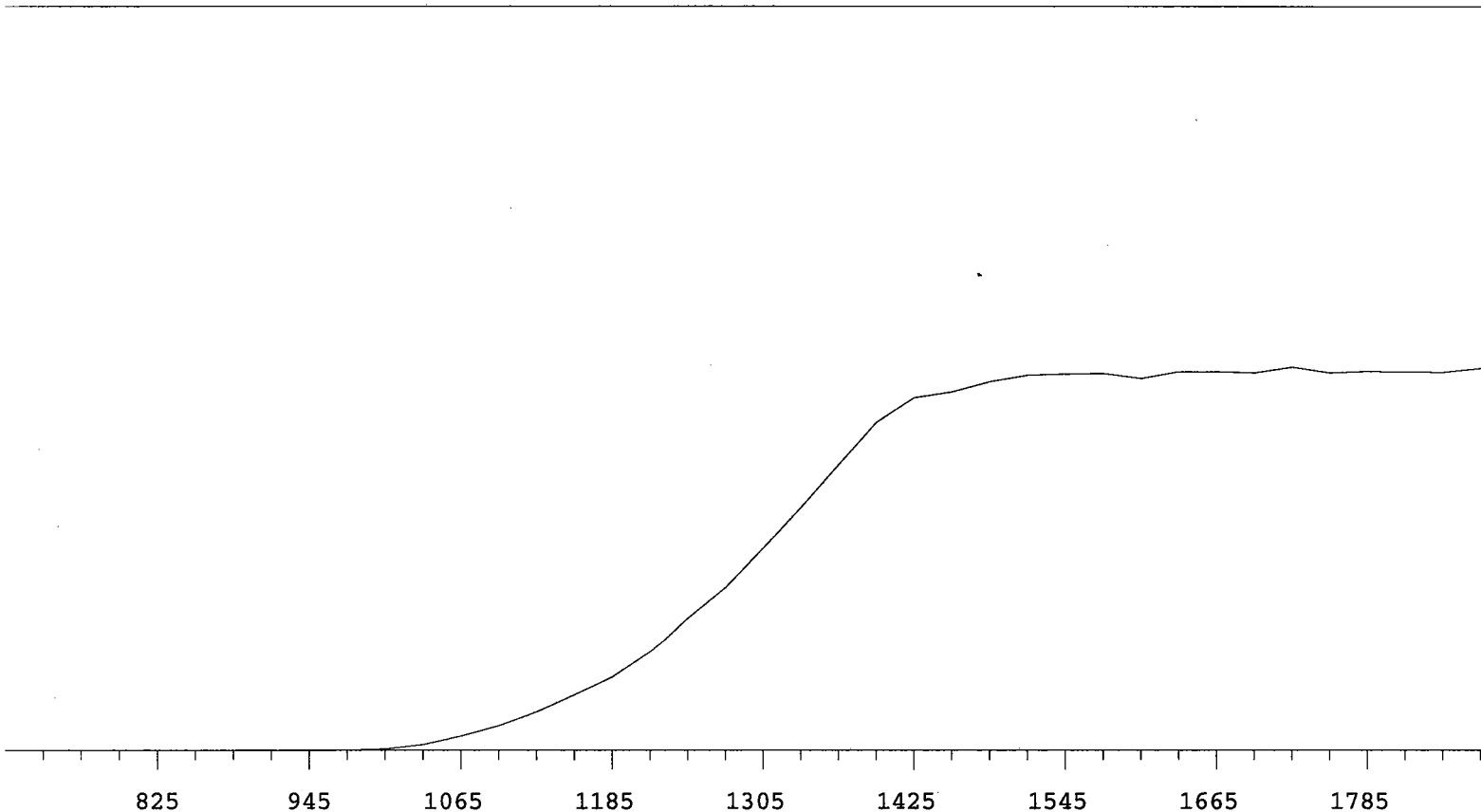
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	9209	+64.55
735	1		1335	11200	+55.94
765	0	+55.56	1365	13123	+43.27
795	2	>100	1395	14957	+29.04
825	0	+0.00	1425	15658	+17.41
855	0	>100	1455	16123	+8.01
885	1	>100	1485	16530	+4.92
915	0	>100	1515	16437	+2.71
945	1	>100	1545	16704	+0.83
975	14	>100	1575	16707	+2.14
1005	104	>100	1605	16602	+0.55
1035	281	>100	1635	17024	-0.28
1065	720	>100	1665	16684	-0.42
1095	1302	>100	1695	16597	-0.85
1125	1834	>100	1725	16711	+1.27
1155	2544	>100	1755	16796	+1.51
1185	3485	+92.28	1785	16903	+1.57
1215	4624	+85.50	1815	16880	+1.46
1245	5878	+77.82	1845	17066	
1275	7515	+71.49	1875	17085	



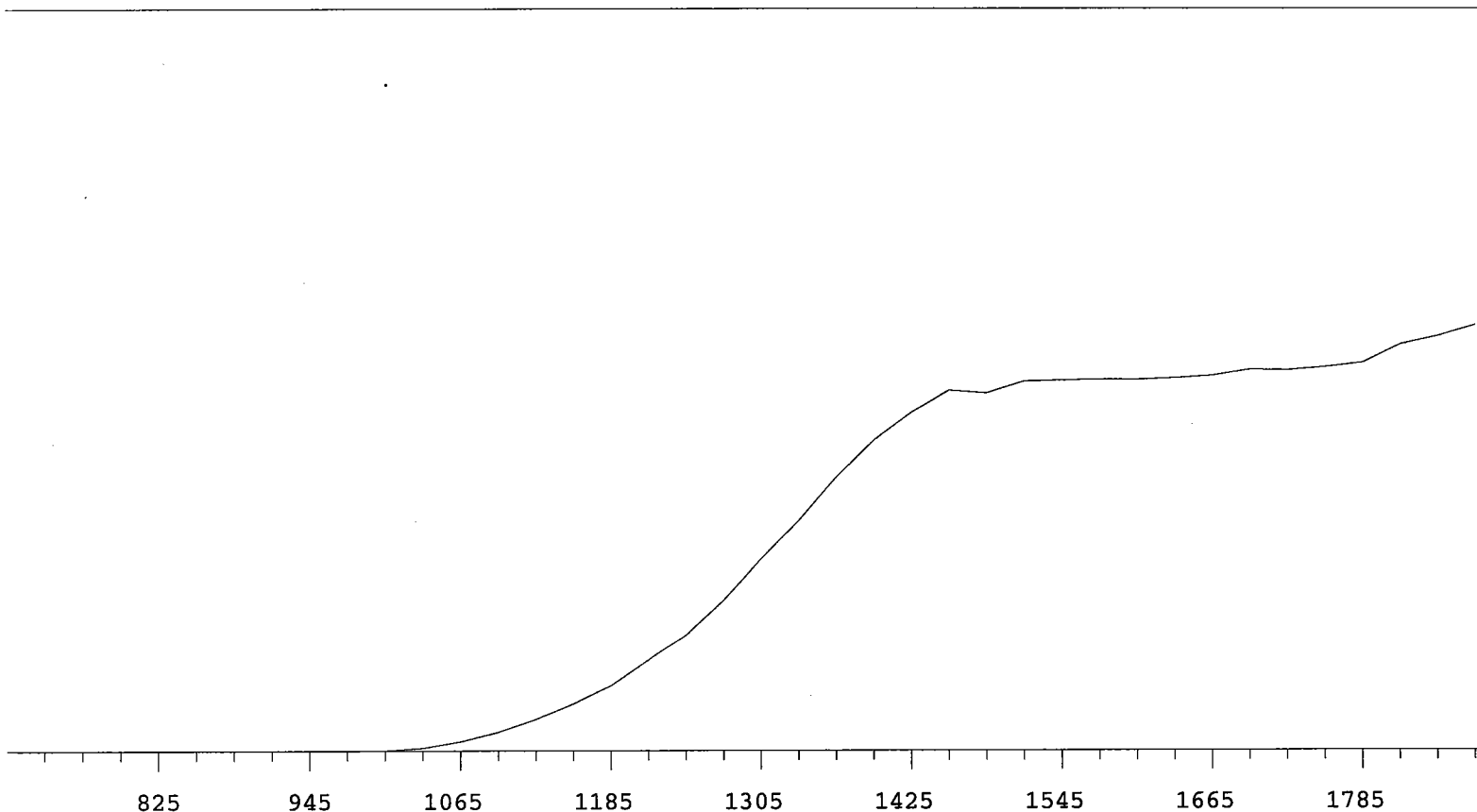
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	9666	+64.39
735	0		1335	11722	+55.91
765	0		1365	13680	+44.91
795	0	>100	1395	15677	+31.56
825	0	>100	1425	16786	+19.46
855	0	>100	1455	17283	+10.57
885	0	>100	1485	17608	+5.95
915	1	>100	1515	17972	+3.32
945	0	>100	1545	18006	+1.84
975	4	>100	1575	17970	+1.58
1005	70	>100	1605	18104	+0.74
1035	257	>100	1635	18351	+0.24
1065	648	>100	1665	18016	+0.16
1095	1116	>100	1695	18080	-0.63
1125	1784	>100	1725	18283	+0.29
1155	2560	>100	1755	18047	-0.47
1185	3531	+96.11	1785	18110	-0.32
1215	4568	+89.22	1815	18040	+1.17
1245	6137	+81.65	1845	18200	
1275	7855	+74.42	1875	18320	



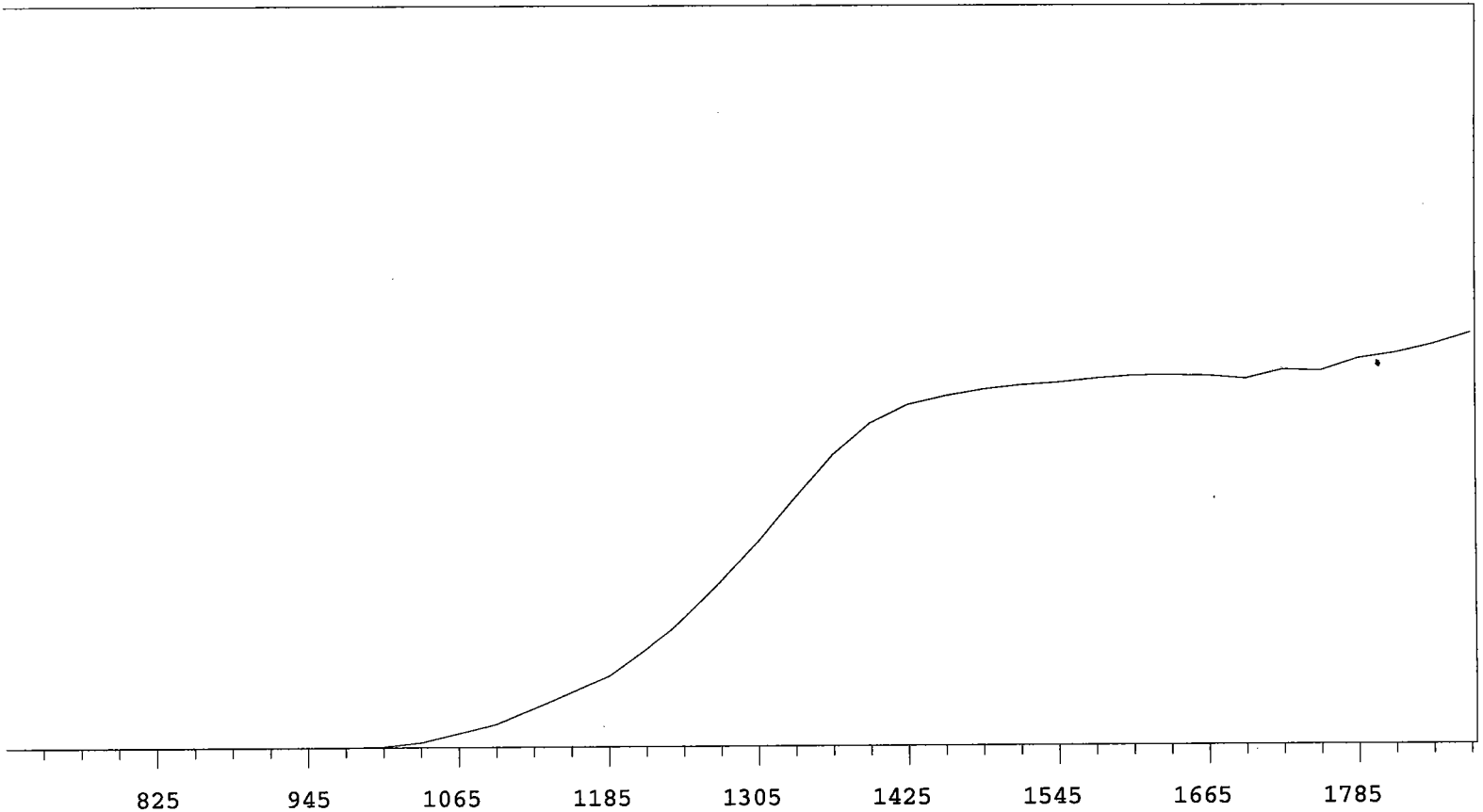
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	11573	+64.95
735	0		1335	13929	+56.47
765	0		1365	16726	+43.82
795	0	>100	1395	18834	+29.38
825	0	>100	1425	19743	+16.84
855	0	>100	1455	20314	+7.95
885	0	>100	1485	20860	+4.16
915	0	>100	1515	20670	+3.23
945	0	>100	1545	20844	+2.09
975	9	>100	1575	21330	+2.48
1005	93	>100	1605	21188	+1.16
1035	325	>100	1635	21280	-0.32
1065	834	>100	1665	21237	+0.08
1095	1525	>100	1695	21202	+0.42
1125	2318	>100	1725	21254	+0.60
1155	3233	>100	1755	21406	+1.41
1185	4357	+92.07	1785	21326	+0.42
1215	5755	+85.64	1815	21619	+0.16
1245	7438	+78.35	1845	21282	
1275	9463	+70.89	1875	21478	



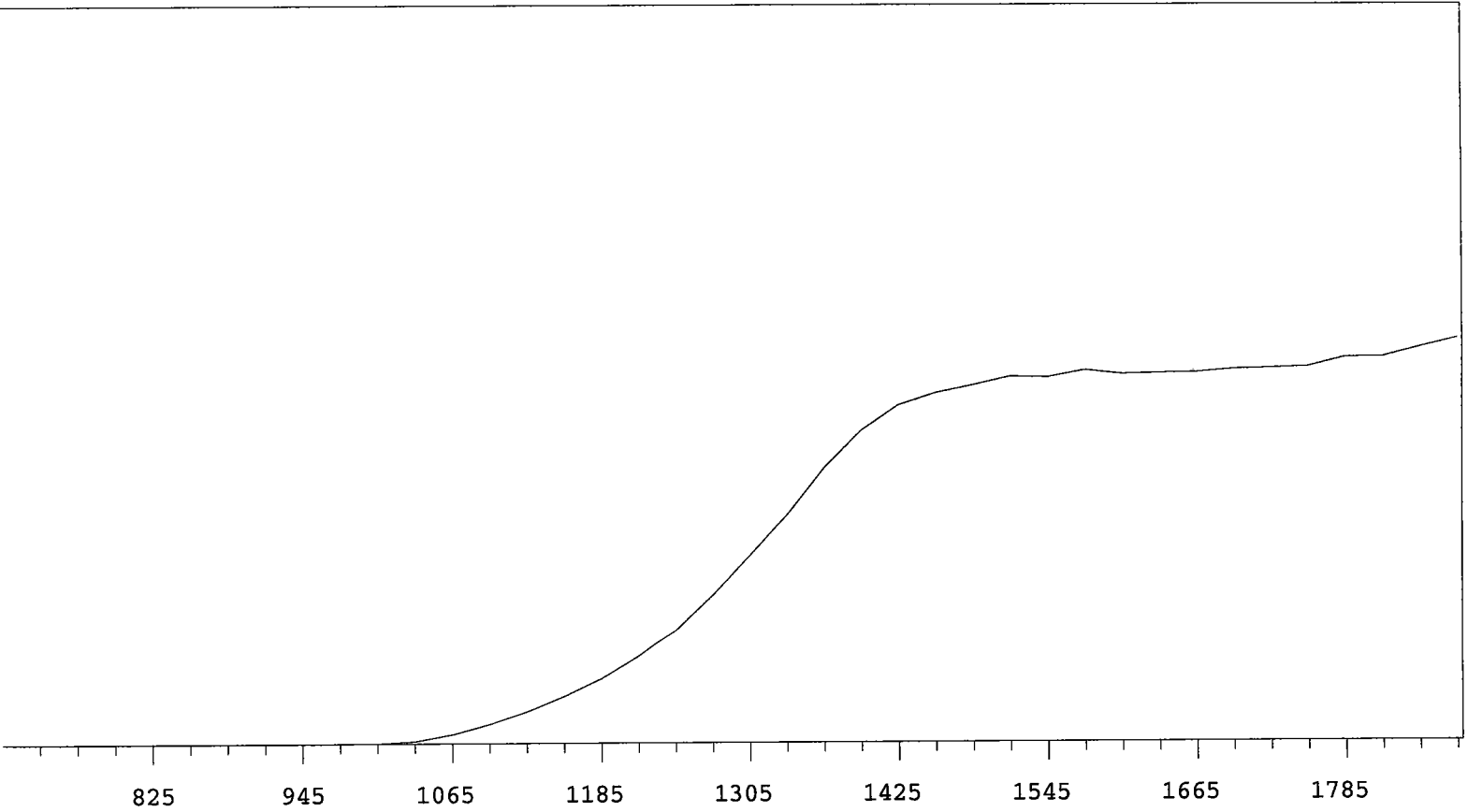
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	1		1305	7524	+61.93
735	0		1335	9002	+55.36
765	0		1365	10542	+44.70
795	0	>100	1395	12064	+31.21
825	0	>100	1425	12981	+19.20
855	0	>100	1455	13192	+10.41
885	0	>100	1485	13570	+5.93
915	0	>100	1515	13820	+4.08
945	0	>100	1545	13866	+0.75
975	9	>100	1575	13880	+0.21
1005	58	>100	1605	13695	+0.59
1035	228	>100	1635	13950	+0.77
1065	544	>100	1665	13954	+1.92
1095	936	>100	1695	13911	+0.19
1125	1468	>100	1725	14116	+0.02
1155	2110	>100	1755	13908	-0.24
1185	2770	+94.71	1785	13960	-0.81
1215	3670	+85.91	1815	13939	+0.71
1245	4937	+79.46	1845	13931	
1275	6066	+70.79	1875	14071	



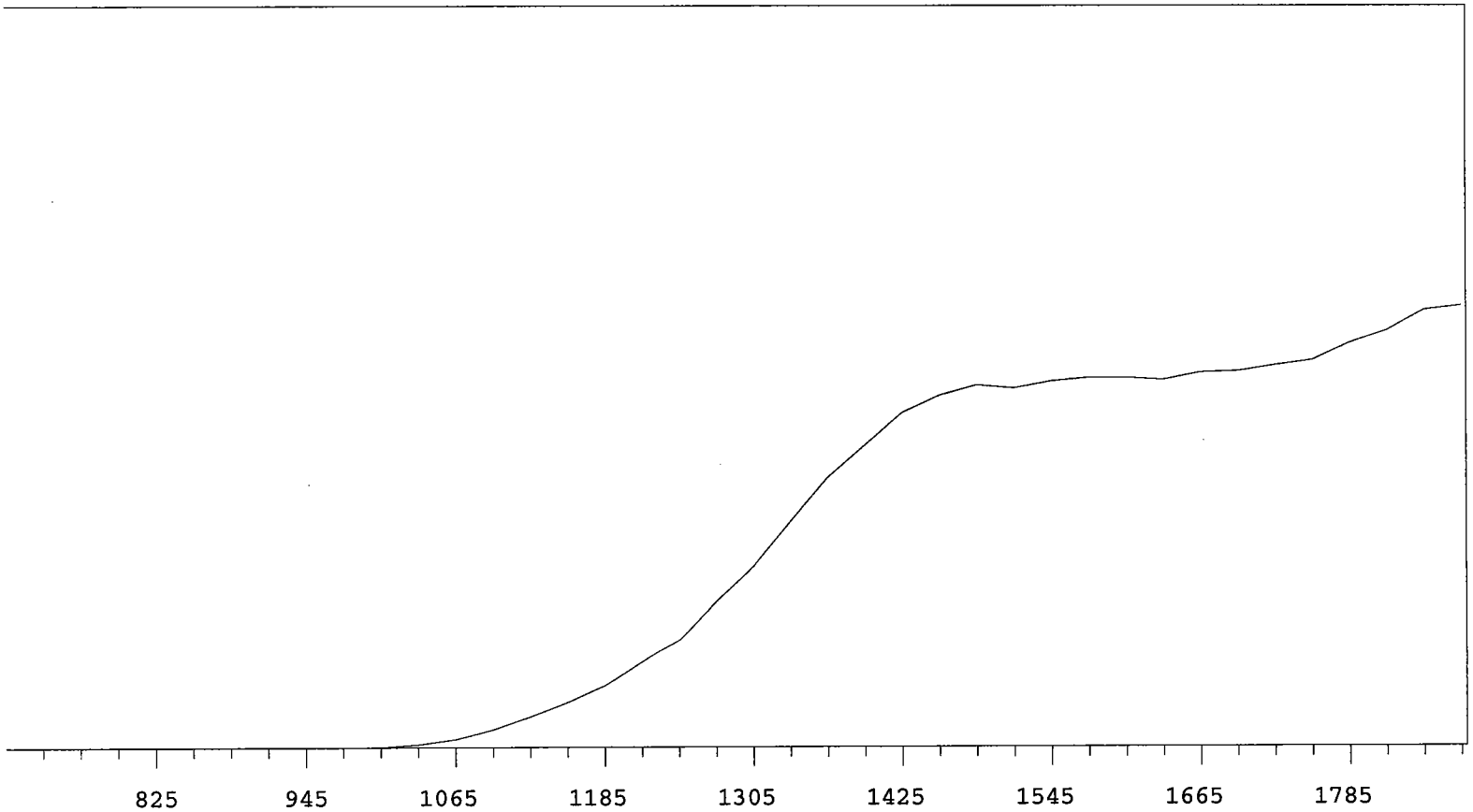
VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	8778	+67.49
735	0		1335	10502	+57.68
765	0		1365	12516	+46.36
795	0	>100	1395	14215	+35.88
825	0	>100	1425	15472	+22.01
855	0	>100	1455	16469	+12.99
885	1	+0.00	1485	16342	+6.70
915	0	>100	1515	16874	+3.07
945	0	>100	1545	16918	+2.53
975	0	>100	1575	16950	+0.58
1005	18	>100	1605	16943	+0.95
1035	137	>100	1635	17008	+2.13
1065	430	>100	1665	17130	+2.45
1095	865	>100	1695	17403	+2.43
1125	1444	>100	1725	17377	+2.43
1155	2151	>100	1755	17515	+4.88
1185	2981	>100	1785	17710	+7.54
1215	4168	+92.14	1815	18533	+9.04
1245	5377	+84.73	1845	18905	
1275	6924	+74.92	1875	19415	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	8797	+65.44
735	0		1335	10726	+54.47
765	0		1365	12570	+41.11
795	0	>100	1395	13917	+26.79
825	0	>100	1425	14687	+15.44
855	1	+0.00	1455	15048	+8.47
885	0	>100	1485	15318	+5.00
915	0	>100	1515	15494	+3.76
945	0	>100	1545	15606	+3.04
975	3	>100	1575	15776	+2.35
1005	40	>100	1605	15889	+1.44
1035	210	>100	1635	15907	-0.16
1065	590	>100	1665	15881	+0.64
1095	983	>100	1695	15741	+1.21
1125	1645	>100	1725	16124	+3.63
1155	2342	>100	1755	16076	+5.41
1185	3045	+96.43	1785	16588	+5.79
1215	4201	+90.42	1815	16830	+7.53
1245	5579	+83.64	1845	17185	
1275	7121	+74.44	1875	17682	



VOLTS	COUNTS	%/100 Volts	VOLTS	COUNTS	%/100 Volts
705	0		1305	10118	+69.76
735	0		1335	12269	+59.65
765	0		1365	14810	+47.35
795	0	>100	1395	16773	+33.46
825	0	>100	1425	18104	+20.13
855	0	>100	1455	18720	+11.98
885	1	+0.00	1485	19122	+6.50
915	0	>100	1515	19580	+4.77
945	0	>100	1545	19527	+2.48
975	2	>100	1575	19902	+0.81
1005	21	>100	1605	19690	+0.53
1035	132	>100	1635	19739	+0.23
1065	491	>100	1665	19765	+1.29
1095	1036	>100	1695	19932	+1.40
1125	1698	>100	1725	19976	+2.72
1155	2517	>100	1755	20051	+2.92
1185	3468	>100	1785	20523	+4.26
1215	4721	+91.83	1815	20542	+5.57
1245	6175	+85.13	1845	21035	
1275	8025	+76.82	1875	21528	



VOLTS	COUNTS	%/100 Volts
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VOLTS	COUNTS	%/100 Volts
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705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	1	>100
1005	14	>100
1035	130	>100
1065	363	>100
1095	785	>100
1125	1357	>100
1155	1996	>100
1185	2735	+99.45
1215	3785	+94.20
1245	4857	+86.43
1275	6571	+78.80

1305	8095	+71.16
1335	10052	+58.38
1365	11990	+47.92
1395	13400	+35.01
1425	14808	+23.58
1455	15554	+13.45
1485	15987	+6.39
1515	15861	+3.45
1545	16156	+2.18
1575	16297	+1.72
1605	16297	+1.33
1635	16208	+1.62
1665	16526	+2.92
1695	16581	+3.94
1725	16832	+5.91
1755	17039	+8.68
1785	17800	+11.53
1815	18351	+11.46
1845	19265	
1875	19468	



# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

66002-278

Ra-228 5 mL Liquid in Flame Sealed Vial

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

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

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

ISOTOPE:	Ra-228
ACTIVITY (dps):	2.367 E4
HALF-LIFE:	5.75 years
CALIBRATION DATE:	April 23, 2003 12:00 EST
TOTAL UNCERTAINTY*:	2.4%

\*95% Confidence Level

Impurities:  $\gamma$ -impurities (other than decay products) <0.1%,  
Ra-226 <0.1%

5.31628 grams 4M HCl solution with 100  $\mu$ g/g Ba carrier.

P O NUMBER 3219 RD, Item 1

SOURCE PREPARED BY:

M. Taskaeva  
M. Taskaeva, Radiochemist

Q A APPROVED:

LM. Muty 4-23-03



# Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0553-A	Isotope:	Radium-228 SPIKE
Prepared By:	Lonnie Morris	Prepared By:	Lonnie Morris
Carrier Conc:	0.5M HCl	Prep Date:	04/25/2003
Reference Date:	04/23/2003	Verification Date:	04/27/2005
Ampoule Mass (g):	5.0235 g	Expiration Date:	04/27/2006
Uncertainty:	+/-	Primary Code:	0553-B
LogBook No:	RC-S-035-068	Dilution(mL):	1000 mL
		Mass of Parent(g):	30.535 g
		Density(g/mL):	
		Balance ID:	

### Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parent Activity (dpm/mL)}) * (\text{conversion dpm to dpm}) / (\text{Dilution Vol}) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parent Activity (dpm/mL)}) * (\text{conversion dpm to dpm}) / \text{Density (g/mL)} / (\text{Dilution Vol}) = \text{Parent Activity (dpm/g)}$
$(30.535 \text{ g}) * (13419.8626 \text{ dpm/mL}) * (1 \text{ dpm/dpm}) / (1000 \text{ mL}) = 409.7755 \text{ dpm/mL}$
$(30.535 \text{ g}) * (13419.8626 \text{ dpm/mL}) * (1 \text{ dpm/dpm}) / (\text{g/mL}) / (1000 \text{ mL}) = \text{dpm/g}$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
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GEL Laboratories LLC  
Version 1.0 9/18/2000

# CERTIFICATE OF CALIBRATION

## Standard Radionuclide Source

64673-278

Ra-228 5 mL Liquid in Flame Sealed Vial

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

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

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

ISOTOPE:	Ra-228
ACTIVITY (dps):	1.939 E4
HALF-LIFE:	5.75 years
CALIBRATION DATE:	October 1, 2002 12:00 EST
TOTAL UNCERTAINTY*:	3.6%
SYSTEMATIC:	3.4%
RANDOM:	1.1%

\*99% Confidence Level

Impurities:  $\gamma$ -impurities <0.1%

5.02617 grams 0.1M HCl solution with 110  $\mu\text{g/g}$  Ba carrier.

P O NUMBER 3208RD, Item 2

SOURCE PREPARED BY:

M. Taskaeva  
M. Taskaeva, Radiochemist

Q A APPROVED:

M. M. T. 10202



# Standard Traceability Log Rad

Source Material Info		A Solution Material Info	
Parent Code:	0503	Isotope:	Radium-228
Prepared By:	Angela Johnson	Prepared By:	Angela Johnson
Carrier Conc:	0.1 M HCL	Prep Date:	02/20/2003
Reference Date:	10/01/2002	Verification Date:	04/09/2004
Ampoule Mass (g):	5.02617 g	Expiration Date:	04/09/2005
Uncertainty:	+/- 3.6 %	Primary Code:	0503-A
LogBook No:	RC S 035 018	Dilution(mL):	100 mL
		Mass of Parent(g):	4.4737 g
		Density(g/mL):	0.9992
		Balance ID:	

### Calculations Converting parent activity to dpm/mL|dpm/g

$(\text{Mass of parent(g)}) * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / (\text{Ampoule Mass(g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/mL)}$
$(\text{Mass of parent(g)}) * (\text{Parm Activity (dps)}) * (\text{conversion dpm to dps}) / \text{Density} / (\text{Ampoule Mass (g)} * (\text{Dilution Vol})) = \text{Parent Activity (dpm/g)}$
$(4.4737 \text{ g}) * (19390 \text{ dps}) * (60 \text{ dpm/dps}) / (5.02617 \text{ g} * 100 \text{ mL}) = 10355.2060 \text{ dpm/mL}$
$(4.4737 \text{ g}) * (19390 \text{ dps}) * (60 \text{ dpm/dps}) / (0.9992 \text{ g/mL}) / (5.02617 \text{ g} * 100 \text{ mL}) = 10363.0820 \text{ dpm/g}$

### Secondary Standards

Prep Date	Preparer	Mass Primary	Dilution (mL)	Code	Conc dpm/mL	Verification Date	Expiration Date
04/02/2003	Lonnie Morris	39.71	1000	0503-B	411.518 dpm/mL	09/13/2008	09/13/2009

GEL Laboratories LLC  
Version 1.0 9/18/2000

# Verification for Ra-228 Standard 0503-B

D. Roy 9/13/2008	Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff Mass. Used (mL)	Standard Source DPM/mL
	0503-B	1962.0000	45.6000	1916.4000	9.263763	206.8705773
	0503-B	1983.2000	45.6000	1937.6000	9.263763	209.1590642
	0503-B	1927.0000	45.6000	1881.4000	9.263763	203.092415

Mean Value (Counting) = 206.3740189 dpm/mL      **Pass**  
 Stdev = 3.063655617 dpm/mL      0.01484516 Rule 3 (Pass/Fail)

Certificate Value = 200.596 dpm/mL  
 Lower Limit = 200.2467076 dpm/mL  
 Upper Limit = 212.5013301 dpm/mL  
 Rule 1 Pass/Fail **Pass**  
 Two sigma = 6.127311233  
 10 % of Mean = 20.63740189  
 Rule 2 (Pass/Fail) **Pass**

### Verification Rules

- Rule 1 = The certificate value (NOT including any uncertainty) shall lie within the 95% confidence interval determined from the mean and two sigma standard deviation of the three measurements
- Rule 2 = The two sigma value used for the 95% confidence interval shall not exceed 10% of the mean value of the three verification measurements.
- Rule 3 = The determined mean value shall be within 10% of the certificate value.

The analyst prepared three standard verification sources for Ra-228 source 0503-B by transferring portions of the standard into glass liquid scintillation vials. Ten mL of Ready Gel liquid scintillation cocktail was added to each vial and the vials were shaken to mix. A Blank vial was prepared in a similar fashion using 1 mL of DI water and 10 mL of Ready Gel cocktail. The standard verification vials and Background source were dark adapted for two hours and counted on LSC Gold for Ra-228 source standard verification. The Ra-228 efficiency calibration which was used for verification calculations was performed on 9/13/08 using source 0683-A (Ra-228). Calibration data is recorded in this logbook under Ra-228 0683-A. Each verification source calculation was performed as follows:

$$\text{Source dpm/g} = (A - B)/(C)(D)$$

where:

- A = Ver. source cpm,
- B = BKG cpm,
- C = System efficiency, (cpm/dpm), and
- D = mass used for standard verification.

Reference RAD SOP M-001

*David S. J. 9/16/08*

*Angela Johnson 9/17/08*

5/16/16

16 SEP 2008 16:24

ID: TOTAL ACTIVITY

USER:11 COMMENT:GOLD

PRESET TIME : 5.00

DATA CALC : CPM H# :YES SAMPLE REPEATS: 1 PRINTER : STD

COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 :EDIT

TWO PHASE : NO AQC : NO CYCLE REPEATS : 1 DISK : OFF

SCINTILLATOR: LIQUID LUMEX:YES LOW SAMPLE REJ: 0

LOW LEVEL : NO HALF LIFE CORRECTION DATE: none

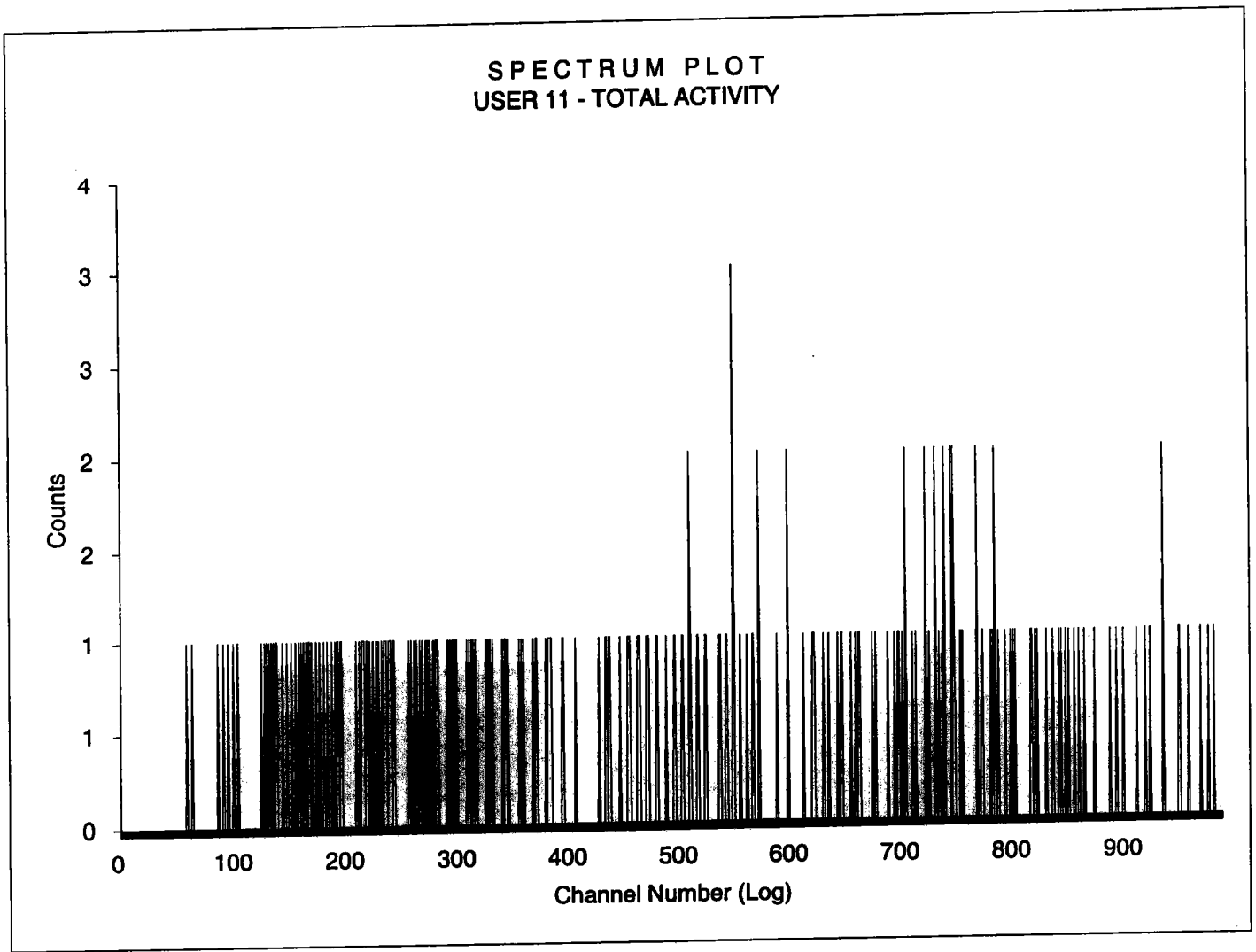
CHAN: 0.0 - 990.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

CHAN: 0.0 - 1000.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

SAM NO	POS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	11-1	5.00	98.2	50.40	12.60	54.00	12.17	0.41	5.55
2	11-2	1.30	99.3	7802.31	1.99	7803.08	1.99	0.00	7.81
3	11-3	1.30	100.4	7782.31	1.99	7786.15	1.99	0.00	10.14
4	11-4	1.35	99.2	7581.48	1.98	7585.19	1.98	0.01	12.51
5	11-5	5.00	97.9	45.60	13.25	47.20	13.02	0.43	18.61
6	11-6	5.00	110.7	1962.00	2.02	1964.80	2.02	0.01	24.65
7	11-7	5.00	110.8	1983.20	2.01	1984.80	2.01	0.01	30.75
8	11-8	5.00	110.7	1927.00	2.04	1927.80	2.04	0.02	36.85

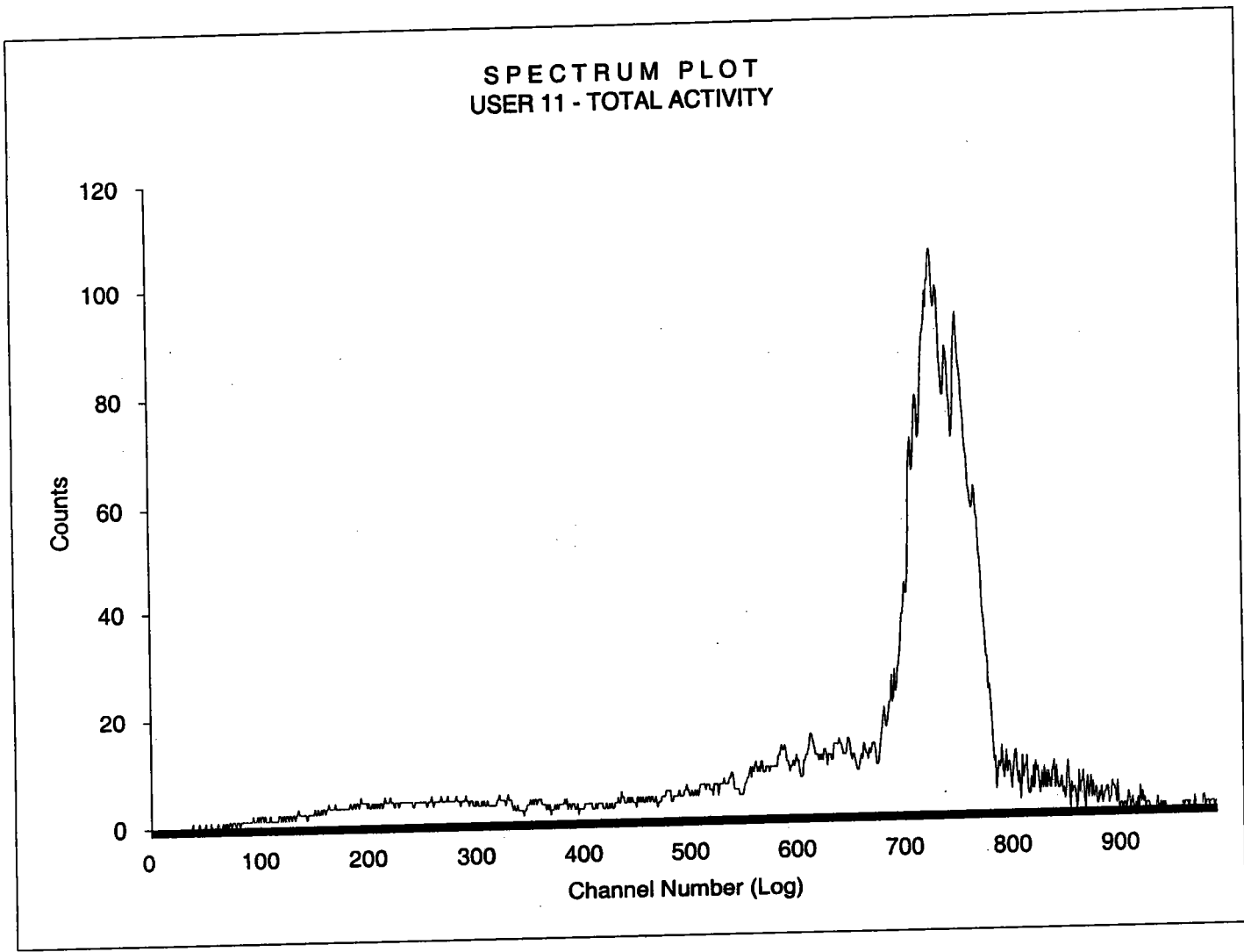
801916  
28

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Data Capture Date: 9/16/2008 16:52:01  
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U11091611-1A.WK1  
Spectrum Type: Log Counts  
User Number: 11  
User Id: TOTAL ACTIVITY  
User Comment: GOLD  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 5 11-5 5.00  
H#, Total Counts: 97.9 69  
Start, End, X-Axis: 0 990 Channel Number



50/9/16  
22

Sample Count Start Time: 16 Sep 2008 16:53:01  
Data Capture Date: 9/16/2008 16:58:06  
User Filename: S11091611-6A.WK1  
U11091611-1A.WK1  
Spectrum Type: Log Counts  
User Number: 11  
User Id: TOTAL ACTIVITY  
User Comment: GOLD  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 6 11-6 5.00  
H#, Total Counts: 110.7 7666  
Start, End, X-Axis: 0 990 Channel Number

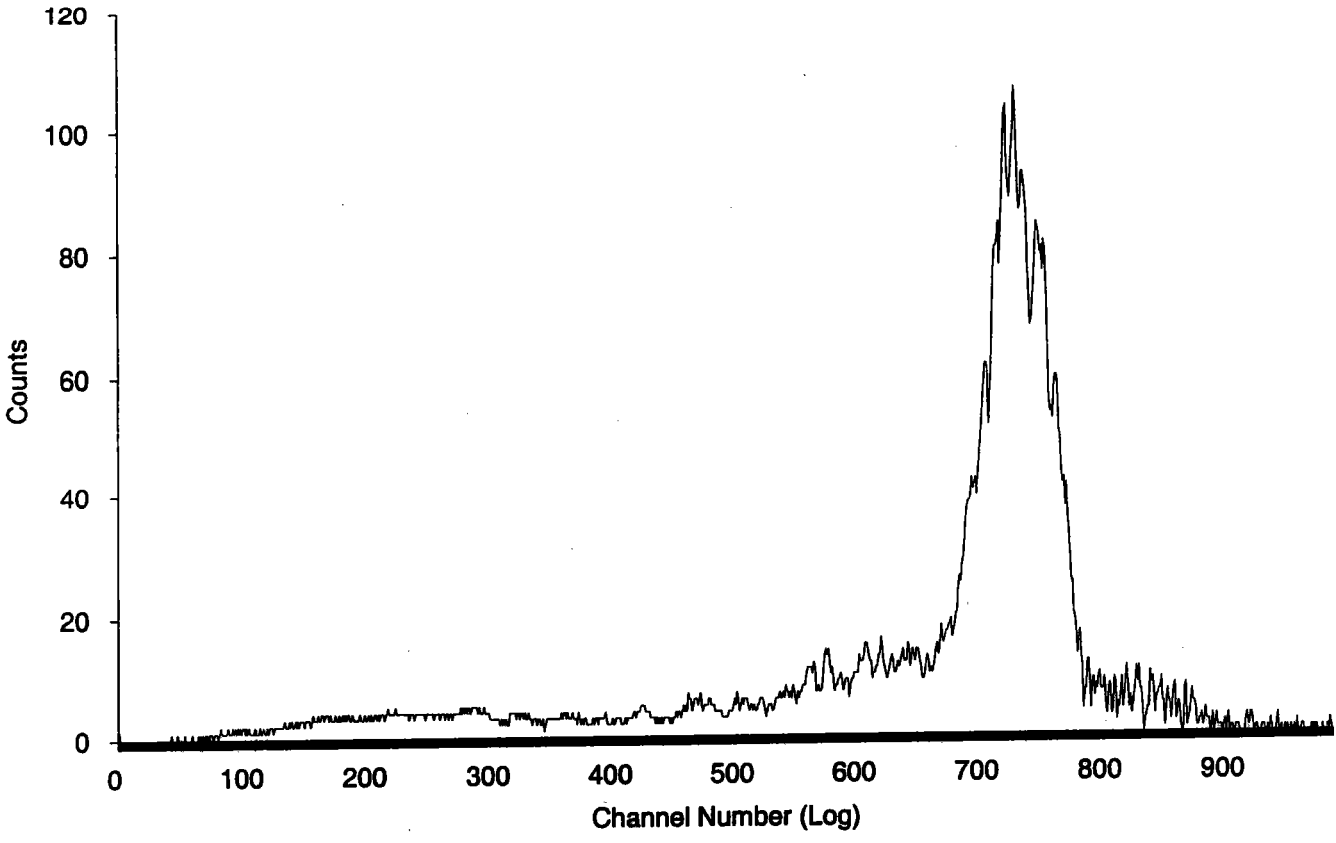




8/16/08  
LJS

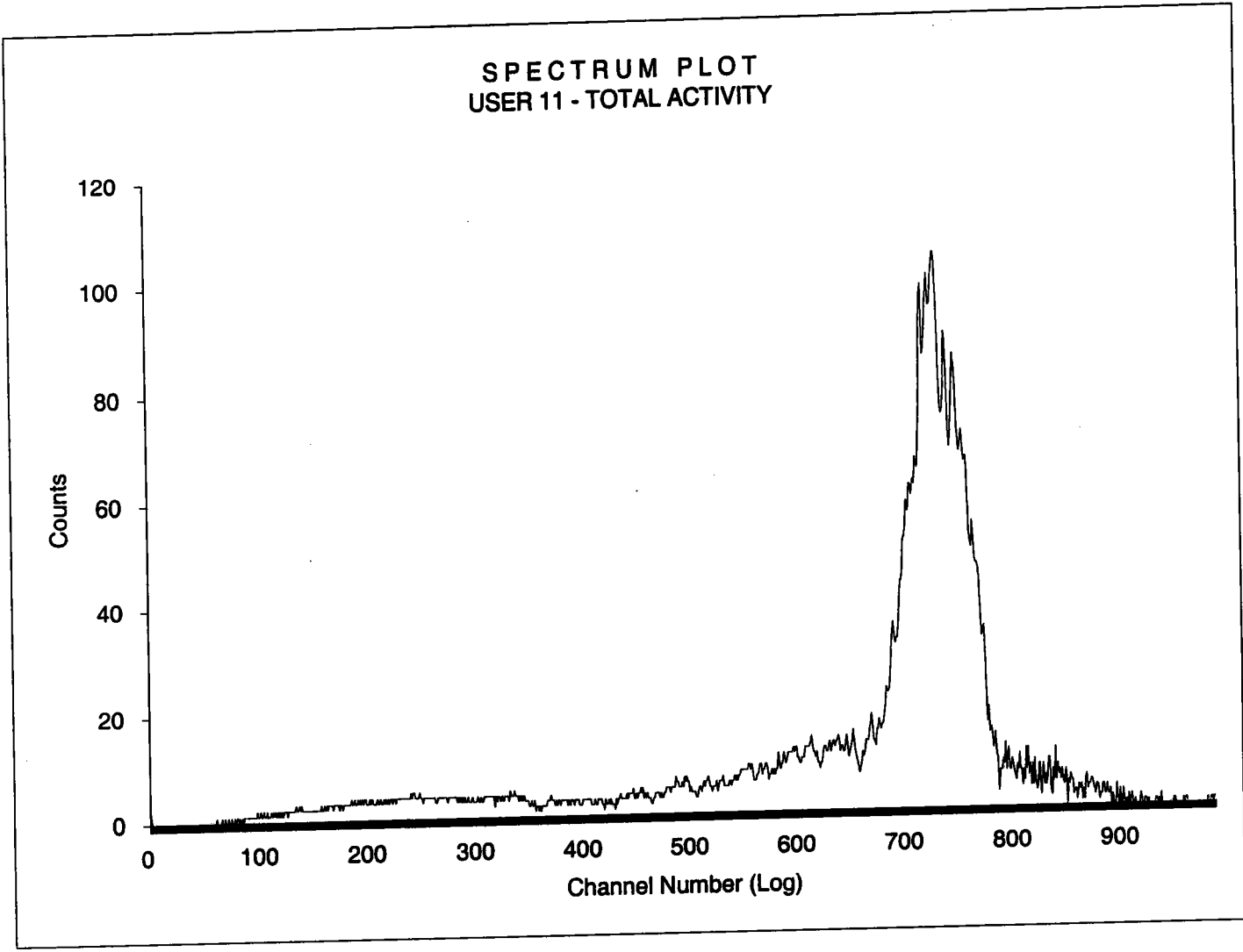
Sample Count Start Time: 16 Sep 2008 16:59:07  
Data Capture Date: 9/16/2008 17:04:12  
User Filename: S11091611-7A.WK1  
U11091611-1A.WK1  
Spectrum Type: Log Counts  
User Number: 11  
User Id: TOTAL ACTIVITY  
User Comment: GOLD  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 7 11-7 5.00  
H#, Total Counts: 110.8 7726  
Start, End, X-Axis: 0 990 Channel Number

SPECTRUM PLOT  
USER 11 - TOTAL ACTIVITY



9/16/08  
S

Sample Count Start Time: 16 Sep 2008 17:05:13  
Data Capture Date: 9/16/2008 17:10:18  
User Filename: S11091611-8A.WK1  
U11091611-1A.WK1  
Spectrum Type: Log Counts  
User Number: 11  
User Id: TOTAL ACTIVITY  
User Comment: GOLD  
Isotope Name: 14C  
Scintillator: LIQUID  
Sample, Rack-Pos, Time: 8 11-8 5.00  
H#, Total Counts: 110.7 7557  
Start, End, X-Axis: 0 990 Channel Number



# Radium-228 Que Sheet

SR 6/30/09

Batch #: 881540  
 Spike Isotope: Radium-228  
 LCS Isotope: Radium-228  
 Tracer Isotope: Barium-133  
 Prep Date: 6/30/09  
 Analyst: DXM2  
 Spike Code: NA  
 LCS Code: 0503-B  
 Tracer Code: 0112-2  
 Initials: JRS  
 First Client Due Date: NA  
 Expiration Date: 9/13/09  
 Expiration Date: 2/17/10  
 Pipet ID: 1734212  
 Internal Due Date: 7/03/2009  
 Ac-228 Ingrow: 2025 6/30/09  
 Ac-228 Separation Date/Time: 7-2-09 0540  
 Witness: JRS 6/30/09  
 Balance ID: NA

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collect Date & Time	Pos. #	Vol (mL)	Ba Yield (%)	Gamma Det. #
1201872112-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	1	20	100.83	↑
1201872113-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	2	20	108.20	
1201872114-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	3	20	114.22	
1201872115-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	4	20	120.58	WZAL
1201872116-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	5	20	105.84	
1201872117-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	6	20	107.70	
1201872118-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	7	20	112.82	
1201872119-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	8	20	111.91	↓

JRS 7/2/09

JRS 7/2/09

Data Reviewed By:

Comments:

ASSAY 30-Jun-09 19:32:06

Protocol id 8 228\_REC  
Time limit 180  
Count limit 50000  
Isotope Ba-133  
Protocol date 9-Apr-07 10:03:07  
Run id. 54

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT	TIME
1	97	1	180	779	229.3	4.13			19:32:13
2	97	2	180	785	231.2	4.11	100.83		19:35:24
3	97	3	180	835	248.1	3.95	108.20		19:38:35
4	97	4	180	877	261.9	3.83	114.22		19:41:47
5	97	5	180	921	276.5	3.71	120.58		19:44:58
6	72	6	180	819	242.7	4	105.84		19:48:17
7	72	7	180	798	235.5	4.07	102.70		19:51:28
8	72	8	180	867	258.7	3.85	112.82		19:54:40
9	72	9	180	861	256.6	3.87	111.91		19:57:51

END OF ASSAY

*[Handwritten signature]*  
7/2/09

# ALPHA SPECTROSCOPY

## Alpha Spectroscopy Calibration Sources

The following is a summary of the procedure performed for preparing mixed alpha calibration standards:

A calibration stock solution was prepared by combining the following in a volumetric flask and diluting to 50 ml (51.4561 grams). These individual standards were first verified by direct precipitation of small aliquots of each standard (as described in Attachment I).

Isotope	Serial #	amount used (g)	dpm (note 1)
Gd-148	64445-278	0.2471	212.159287
Np-237	4341	1.8075	204.438594
Cm-244	4320A	7.2704	240.144737

Note 1: Dpm values are decay corrected to 2/7/2003.

Forty one weighted aliquots were then directly precipitated using Neodymium Flouride /HF system. The sources were then mounted on 0.1Poly-propylene filters and taped securely to 1 inch stainless steel planchettes for counting in an Alpha Spectroscopy system. The liquid fraction that passes through the filter is collected, traced with Am-241 and prepared for counting using the identical procedure. These samples are counted to ensure there is no more than 1% loss in the filtering processes. All sources pass this requirement. The DPM information for each source is listed in attachment II.

Certificate files were then created on the Alpha system used for acquisition and processing of data. Each source is assigned a name (AESS-001 through AESS-041). The information for the source activities is entered into the certificate files appropriate for the detector being used.

For example: If source AESS-001 is used for calibrating detector 25, the source data is entered into the certificate file name [env\_alpha.cer]U025.cer.

The computer software uses these certificate files to calculate an energy calibration and determine the efficiency of the detector after counting the source.

*Ante Hill*  
4/1/03

2002 Alpha Eff Source Stock Verification

Curium-244

Isotope	Value pCi/g
SSTOCK2002A2_AM	106.000
SSTOCK2002B2_AM	106.000
SSTOCK2002C2_AM	106.000

Mean Value (Counting) = 106.000 98.04%  
 Stdev = 0

Target = 108.1230 pCi/g  
 Lower Limit = 106  
 Upper Limit = 106  
 Rule 1 Pass/Fail Pass  
 Two sigma = 0  
 10 % of Mean = 10.6  
 Rule 2 (Pass/Fail) Pass

PASS  
 Fair 3/2/0

Neptunium-237

Isotope	Value pCi/g
SSTOCK2002A2_AM	90.100
SSTOCK2002B2_AM	87.200
SSTOCK2002C2_AM	93.500

Mean Value (Counting) = 90.267 98.02%  
 Stdev = 3.153305144

Target = 92.0900 pCi/g  
 Lower Limit = 83.96005638  
 Upper Limit = 96.57327696  
 Rule 1 Pass/Fail Pass  
 Two sigma = 6.306610289  
 10 % of Mean = 9.026666667  
 Rule 2 (Pass/Fail) Pass

Gadolinium-148

Isotope	Value pCi/g
SSTOCK2002A2_AM	95.080
SSTOCK2002B2_AM	93.750
SSTOCK2002C2_AM	96.560

Mean Value (Counting) = 95.463 99.81%  
 Stdev = 1.503074627

Target = 95.6460 pCi/g  
 Lower Limit = 92.45718408  
 Upper Limit = 98.46948259  
 Rule 1 Pass/Fail Pass  
 Two sigma = 3.006148253  
 10 % of Mean = 9.546333333  
 Rule 2 (Pass/Fail) Pass

The analyst prepared three standard verification sources for the mixed alpha stock standard using 0.1030 g for source #1, 0.1035 g for source #2 and 0.1028 g for source #3. Each standard was combined with 1.0 mL of Am-243 standard 0454-A and 0.1 mL of Nd carrier in a disposable centrifuge tube. Four mL of 2 M HCl was added to each standard and then diluted with 4 mL of DI water. 5 mL of ascorbic acid was added to each sample then one mL of 48% HF was added to precipitate Nd (and Curium) fluoride. After 30 minutes, each sample was filtered following routine procedures for alpha spectroscopy source preparation. Each source was counted using routine alpha spec procedures. pCi/L values for the Mixed Alpha Stock were calculated and compared to Am-243 certified values.

① The rule failed because the 3 results from 3 sources were the same. Therefore, the stdev was zero. The intent of this rule is to ensure an appropriate amount of counts are achieved for proper determinations. ~~Since~~ For each standard the # of counts achieved was

Just under 10000 which has a counting error of nearly 1%. Because the standard's bias is < 2% from the known value the standard is acceptable.

Robertson 02/20/03

Attachment II

Mixed alpha Reference date = 2/7/2003		Stock Dpm/g	Reference date	Half-life (years)	amount used for mixed	Dpm/g mixed	Decay corr dpm/g
isotope	Source						
Gd-148	64445-278 (0502)	44354.59289	9/5/2002	74.60	0.2471	212.9974853	212.159287
Np-237	Srm 4341 (0493)	5820	3/1/1992	2.14E+06	1.8075	204.4393182	204.438594
Cm-244	SRM 4320a (0490)	2223.6	2/1/1996	18.1	7.2704	314.1796879	240.144737
Source	Amount of standard used	dpm Gd-148	dpm Np-237	dpm Cm-244	dps Gd-148	dps Np-237	dps Cm-244
AESS-001	1.0362	219.839	211.839	248.838	3.664	3.531	4.147
AESS-002	1.0344	219.458	211.471	248.406	3.658	3.525	4.140
AESS-003	1.034	219.373	211.390	248.310	3.656	3.523	4.138
AESS-004	1.0331	219.182	211.206	248.094	3.653	3.520	4.135
AESS-005	1.0353	219.649	211.655	248.622	3.661	3.528	4.144
AESS-006	1.0331	219.182	211.206	248.094	3.653	3.520	4.135
AESS-007	1.0348	219.542	211.553	248.502	3.659	3.526	4.142
AESS-008	1.0363	219.861	211.860	248.862	3.664	3.531	4.148
AESS-009	1.0352	219.627	211.635	248.598	3.660	3.527	4.143
AESS-010	1.0346	219.500	211.512	248.454	3.658	3.525	4.141
AESS-011	1.0353	219.649	211.655	248.622	3.661	3.528	4.144
AESS-012	1.0367	219.946	211.941	248.958	3.666	3.532	4.149
AESS-013	1.0396	220.561	212.534	249.654	3.676	3.542	4.161
AESS-014	1.0368	219.967	211.962	248.982	3.666	3.533	4.150
AESS-015	1.0363	219.861	211.860	248.862	3.664	3.531	4.148
AESS-016	1.0353	219.649	211.655	248.622	3.661	3.528	4.144
AESS-017	1.0356	219.712	211.717	248.694	3.662	3.529	4.145
AESS-018	1.0359	219.776	211.778	248.766	3.663	3.530	4.146
AESS-019	1.0349	219.564	211.574	248.526	3.659	3.526	4.142
AESS-020	1.0361	219.818	211.819	248.814	3.664	3.530	4.147
AESS-021	1.0348	219.542	211.553	248.502	3.659	3.526	4.142
AESS-022	1.0353	219.649	211.655	248.622	3.661	3.528	4.144
AESS-023	1.0353	219.649	211.655	248.622	3.661	3.528	4.144
AESS-024	1.0343	219.436	211.451	248.382	3.657	3.524	4.140
AESS-025	1.0364	219.882	211.880	248.886	3.665	3.531	4.148
AESS-026	1.0336	219.288	211.308	248.214	3.655	3.522	4.137
AESS-027	1.0353	219.649	211.655	248.622	3.661	3.528	4.144
AESS-028	1.0366	219.924	211.921	248.934	3.665	3.532	4.149



Attachment II

AESS-029	1.0355	219.691	211.696	248.670	3.662	3.528	4.144
AESS-030	1.0349	219.564	211.574	248.526	3.659	3.526	4.142
AESS-031	1.0343	219.436	211.451	248.382	3.657	3.524	4.140
AESS-032	1.0326	219.076	211.103	247.973	3.651	3.518	4.133
AESS-033	1.0308	218.694	210.735	247.541	3.645	3.512	4.126
AESS-034	1.0314	218.821	210.858	247.685	3.647	3.514	4.128
AESS-035	1.0303	218.588	210.633	247.421	3.643	3.511	4.124
AESS-036	1.0343	219.436	211.451	248.382	3.657	3.524	4.140
AESS-037	1.0353	219.649	211.655	248.622	3.661	3.528	4.144
AESS-038	1.0373	220.073	212.064	249.102	3.668	3.534	4.152
AESS-039	1.0334	219.245	211.267	248.166	3.654	3.521	4.136
AESS-040	1.0346	219.500	211.512	248.454	3.658	3.525	4.141
AESS-041	1.0352	219.627	211.635	248.598	3.660	3.527	4.143



0490  
0491

# National Institute of Standards & Technology

## Certificate

### Standard Reference Material 4320A Curium-244 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive curium-244 nitrate and nitric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of alpha-particle counting instruments and for the monitoring of radiochemical procedures.

#### Radiological Hazard

The SRM ampoule contains curium-244 with a total activity of approximately 200 Bq. Curium-244 decays by alpha-particle emission to plutonium-240, which also decays by alpha-particle emission. None of the alpha particles escape from the SRM ampoule. During the decay process X-rays and gamma rays with energies from 40 keV to 1100 keV are also emitted. Most of these photons escape from the SRM ampoule but their intensities are so small that they do not represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]\*. The SRM should be used only by persons qualified to handle radioactive material.

#### Chemical Hazard

The SRM ampoule contains nitric acid ( $\text{HNO}_3$ ) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

#### Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least February 2006.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

#### Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899  
February 1996 (Text only revised November 1997)

Thomas E. Gills, Chief  
Standard Reference Materials Program

### Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle.  
**NEVER PIPETTE BY MOUTH**
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]\*.

PROPERTIES OF SRM 4320A  
(Certified values are shown in bold type)

Source identification number	NIST SRM 4320A		
Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall Thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution density	(1.030 ± 0.002) g·mL <sup>-1</sup> at 22.8 °C [b]*		
Solution mass	Approximately 5.15 g		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L <sup>-1</sup> )	Mass Fraction (g·g <sup>-1</sup> )
	H <sub>2</sub> O	54	0.94
	HNO <sub>3</sub>	1.0	0.06
	HCl	<0.001	<4 × 10 <sup>-5</sup>
	<sup>244</sup> Cm +3	5 × 10 <sup>-11</sup>	1 × 10 <sup>-11</sup>
Radiological Properties:			
Radionuclide	Curium-244		
Reference time	1230 EST, 1 February 1996 [c]		
Massic activity of the solution [d]	37.06 Bq·g <sup>-1</sup> 24.12 Bq·g <sup>-1</sup>		
Relative expanded uncertainty (k=2)	0.68% [e] [f]		
Alpha-particle-emitting daughters	Plutonium-240: (0.22 ± 0.11) Bq·g <sup>-1</sup> [b] [c]		
Alpha-particle-emitting impurities	Curium-243: (0.005 ± 0.004) Bq·g <sup>-1</sup> [b] [g]		
Photon-emitting impurities	None detected [h]		
Half lives used in the decay corrections	Curium-244: (18.10 ± 0.02) a [i] Plutonium-240: (6563 ± 7) a [i]		
Calibration method	Two 4π liquid-scintillation counting systems		

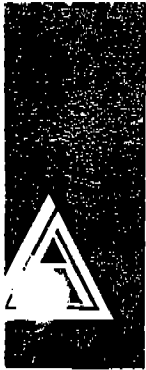
37.06 x 2      2004

6

- [i] The stated uncertainty is the standard uncertainty. See reference [5].
- [j] Relative standard uncertainty of the input quantity  $x_i$ .
- [k] The relative change in the output quantity  $y$  divided by the relative change in the input quantity  $x_i$ . If  $|\partial y/\partial x_i| \cdot (x_i/y) = 1.0$ , then a 1% change in  $x_i$  results in a 1% change in  $y$ . If  $|\partial y/\partial x_i| \cdot (x_i/y) = 0.05$ , then a 1% change in  $x_i$  results in a 0.05% change in  $y$ .
- [m] Relative component of combined standard uncertainty of output quantity  $y$ , rounded to two significant figures or less. The relative component of combined standard uncertainty of  $y$  is given by  $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$ . The numerical values of  $u(x_i)/x_i$ ,  $|\partial y/\partial x_i| \cdot (x_i/y)$ , and  $u_i(y)/y$ , all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.
- [n] The relative standard uncertainty of  $\lambda \cdot t$  is determined by the relative standard uncertainty of  $\lambda$  (i.e., of the half life). The relative standard uncertainty of  $t$  is negligible.
- [p]  $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$
- [q] The live time is determined by counting the pulses from a gated oscillator.
- [r] The standard uncertainty given is for the detected Cm-243 impurity.  $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of Cm-244})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of Cm-244})\}$ .
- [s] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e.  $u(x_i)/x_i = 100\%$ .  $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of Cm-244})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of Cm-244})\}$ . Thus  $u_i(y)/y$  is the relative change in  $y$  if the impurity were present with a massic activity equal to the estimated limit of detection.

#### REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993".)
- [3] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] Evaluated Nuclear Structure Data File (ENSDF), February 1996.



# CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

64445-278

Gd-148 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

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

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

ISOTOPE:	Gd-148
ACTIVITY (dps):	<u>3.759-E3</u>
HALF-LIFE:	<u>74.6 years</u>
CALIBRATION DATE:	September 5, 2002 12:00 EST
TOTAL UNCERTAINTY*:	2.7%
SYSTEMATIC:	1.9%
RANDOM:	0.8%

99% confidence level.

5.08493 grams 0.1M HCl solution.

P O NUMBER 3207RD, Item 1

SOURCE PREPARED BY:

M.D. Currie  
M.D. Currie, Radiochemist

Q A APPROVED:

W.M. [Signature] 9-6-02

25  
31  
30  
31  
31  
7

0493



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material 4341 Radioactivity Standard

Radionuclide	Neptunium-237
Source identification	SRM 4341
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule <sup>(1)</sup> *
Solution mass	Approximately 5 grams
Solution composition	Neptunium-237 in 2 mol·L <sup>-1</sup> nitric acid
Reference time	March 1992
Radioactivity concentration	97.0 Bq·g <sup>-1</sup>
Overall uncertainty	1.28 percent <sup>(2)</sup>
Photon-emitting impurities	None detected <sup>(3)</sup>
Alpha-particle-emitting impurities	None detected <sup>(4)</sup>
Half life	(2.14 ± 0.11) × 10 <sup>6</sup> years <sup>(5)</sup>
Measuring instrument	NIST "0.8π"α defined-solid-angle counter with scintillation detector

This standard reference material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M. Robin Hutchinson, Acting Group Leader.

Gaithersburg, MD  
January 1993

William P. Reed, Chief  
Standard Reference Materials Program

\*Notes on back

## NOTES

- (1) Approximately five milliliters of solution. Ampoule specifications:
- |                      |                        |
|----------------------|------------------------|
| body diameter        | $16.5 \pm 0.5$ mm      |
| wall thickness       | $0.60 \pm 0.04$ mm     |
| barium content       | less than 2.5 percent  |
| lead oxide content   | less than 0.02 percent |
| other heavy elements | trace quantities       |
- (2) The overall uncertainty was formed by taking three times the quadratic combination of the standard deviations of the mean, or approximations thereof, for the following:
- |  |              |
|--|--------------|
| a) alpha-particle-emission-rate measurements         | 0.34 percent |
| b) background  | 0.01 percent |
| c) livetime  | 0.10 percent |
| d) detection efficiency                              | 0.16 percent |
| e) count-rate-vs-energy extrapolation to zero energy | 0.10 percent |
| f) half life   | 0.00 percent |
| g) gravimetric measurements                          | 0.10 percent |
| h) alpha-emitting impurities                         | 0.10 percent |
- (3) The protactinium-233 daughter of neptunium-237 is approximately in equilibrium. The limit of detection for photon-emitting impurities is
- $0.19 \text{ } \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$  for energies between 30 and 307 keV and  
 $0.01 \text{ } \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$  for energies between 317 and 1750 keV,  
provided that the impurity photons are separated in energy by 5 keV or more from photons emitted in the decay of neptunium-237 and progeny.
- (4) The limit of detection for alpha-particle-emitting impurities is
- $0.10 \text{ } \alpha \cdot \text{s}^{-1} \cdot \text{g}^{-1}$  for energies between 1.0 and 4.3 MeV and  
 $0.05 \text{ } \alpha \cdot \text{s}^{-1} \cdot \text{g}^{-1}$  for energies between 4.9 and 10 MeV.
- (5) Evaluated Nuclear Structure Data File (ENSDF), February 1990.

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## Subsection 1: Energy Calibration

The Energy Calibration energy=Cal\_Zero+(e1\*C)+(e2\*C^2)

where : Cal\_Zero = Energy Calibration Zero  
 e1 = Energy Calibration Slope  
 e2 = Energy Calibration Quadratic  
 C = Channel

	Instrument :	CHAMBER 001		
	Detector :	78788		
	Calibration Date/Time :	4-SEP-2009 12:35:32		
	Calibration Source Id :	AESS-001		
Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.226
NP-237	4341	2/28/10	4768.800	4768.853
CM-244	4320A	2/28/10	5795.020	5795.021
	Energy/Channel Equation :	see above		
	Energy Calibration Zero :	2535.497		
	Energy Calibration Slope :	5.123575		
	Energy Calibration Quadratic :	3.5177087E-04		
	Energy Calibration Range :	8151.000		

	Instrument :	CHAMBER 002		
	Detector :	78266		
	Calibration Date/Time :	4-SEP-2009 12:35:41		
	Calibration Source Id :	AESS-002		
Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3181.913
NP-237	4341	2/28/10	4768.800	4768.018
CM-244	4320A	2/28/10	5795.020	5794.179
	Energy/Channel Equation :	see above		
	Energy Calibration Zero :	2471.037		
	Energy Calibration Slope :	5.125078		
	Energy Calibration Quadratic :	3.3477767E-04		
	Energy Calibration Range :	8070.000		

	Instrument :	CHAMBER 003		
	Detector :	67617		
	Calibration Date/Time :	4-SEP-2009 12:35:49		
	Calibration Source Id :	AESS-003		
Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.431
NP-237	4341	2/28/10	4768.800	4767.487
CM-244	4320A	2/28/10	5795.020	5793.671
	Energy/Channel Equation :	see above		
	Energy Calibration Zero :	2603.599		
	Energy Calibration Slope :	5.520661		
	Energy Calibration Quadratic :	3.8628373E-04		
	Energy Calibration Range :	8662.000		

Instrument : CHAMBER 004  
 Detector : 64279  
 Calibration Date/Time : 4-SEP-2009 12:35:56  
 Calibration Source Id : AESS-004  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.248  
 NP-237 4341 2/28/10 4768.800 4768.163  
 CM-244 4320A 2/28/10 5795.020 5794.666  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2539.883  
 Energy Calibration Slope : 5.106114  
 Energy Calibration Quadratic : 3.6220285E-04  
 Energy Calibration Range : 8148.000

Instrument : CHAMBER 005  
 Detector : 67612  
 Calibration Date/Time : 4-SEP-2009 12:36:04  
 Calibration Source Id : AESS-005  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.596  
 NP-237 4341 2/28/10 4768.800 4768.626  
 CM-244 4320A 2/28/10 5795.020 5794.885  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2389.695  
 Energy Calibration Slope : 5.003819  
 Energy Calibration Quadratic : 3.1809139E-04  
 Energy Calibration Range : 7847.000

Instrument : CHAMBER 006  
 Detector : 67613  
 Calibration Date/Time : 4-SEP-2009 12:36:12  
 Calibration Source Id : AESS-006  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.970  
 CM-244 4320A 2/28/10 5795.020 5795.230  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2372.089  
 Energy Calibration Slope : 4.968963  
 Energy Calibration Quadratic : 2.9746475E-04  
 Energy Calibration Range : 7772.000

Instrument : CHAMBER 007  
 Detector : 67607  
 Calibration Date/Time : 4-SEP-2009 12:36:20  
 Calibration Source Id : AESS-007

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3194.223
NP-237	4341	2/28/10	4768.800	4774.131
CM-244	4320A	2/28/10	5795.020	5795.286

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2411.533  
 Energy Calibration Slope : 5.136289  
 Energy Calibration Quadratic : 3.6015504E-04  
 Energy Calibration Range : 8049.000

Instrument : CHAMBER 008  
 Detector : 78788  
 Calibration Date/Time : 4-SEP-2009 12:36:40  
 Calibration Source Id : AESS-008

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.947
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2374.892  
 Energy Calibration Slope : 4.958869  
 Energy Calibration Quadratic : 3.2790817E-04  
 Energy Calibration Range : 7797.000

Instrument : CHAMBER 009  
 Detector : 72528  
 Calibration Date/Time : 4-SEP-2009 12:36:51  
 Calibration Source Id : AESS-009

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.331
NP-237	4341	2/28/10	4768.800	4768.908
CM-244	4320A	2/28/10	5795.020	5795.229

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2369.859  
 Energy Calibration Slope : 4.969983  
 Energy Calibration Quadratic : 3.0930861E-04  
 Energy Calibration Range : 7783.000

Instrument : CHAMBER 010  
 Detector : 72529  
 Calibration Date/Time : 4-SEP-2009 12:37:00  
 Calibration Source Id : AESS-010

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.738
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2375.295  
 Energy Calibration Slope : 4.946028  
 Energy Calibration Quadratic : 2.9286626E-04  
 Energy Calibration Range : 7747.000

Instrument : CHAMBER 011  
 Detector : 72531  
 Calibration Date/Time : 4-SEP-2009 12:37:27  
 Calibration Source Id : AESS-011

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.151

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2351.281  
 Energy Calibration Slope : 4.995483  
 Energy Calibration Quadratic : 3.1063837E-04  
 Energy Calibration Range : 7792.000

Instrument : CHAMBER 012  
 Detector : 67594  
 Calibration Date/Time : 4-SEP-2009 12:37:37  
 Calibration Source Id : AESS-012

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.665
CM-244	4320A	2/28/10	5795.020	5794.701

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2380.536  
 Energy Calibration Slope : 4.954679  
 Energy Calibration Quadratic : 2.8732172E-04  
 Energy Calibration Range : 7755.000

Instrument : CHAMBER 013  
 Detector : 78790  
 Calibration Date/Time : 4-SEP-2009 12:37:47  
 Calibration Source Id : AESS-013

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.702
NP-237	4341	2/28/10	4768.800	4769.527
CM-244	4320A	2/28/10	5795.020	5795.398

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2358.963  
 Energy Calibration Slope : 4.909760  
 Energy Calibration Quadratic : 2.9884593E-04  
 Energy Calibration Range : 7700.000

Instrument : CHAMBER 014  
 Detector : 67616  
 Calibration Date/Time : 4-SEP-2009 12:37:57  
 Calibration Source Id : AESS-014

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.690
NP-237	4341	2/28/10	4768.800	4768.619
CM-244	4320A	2/28/10	5795.020	5794.719

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2351.225  
 Energy Calibration Slope : 4.953602  
 Energy Calibration Quadratic : 3.2283107E-04  
 Energy Calibration Range : 7762.000

Instrument : CHAMBER 015  
 Detector : 61581  
 Calibration Date/Time : 4-SEP-2009 12:38:32  
 Calibration Source Id : AESS-015

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.566
NP-237	4341	2/28/10	4768.800	4769.887
CM-244	4320A	2/28/10	5795.020	5795.771

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2340.391  
 Energy Calibration Slope : 4.902360  
 Energy Calibration Quadratic : 2.9459049E-04  
 Energy Calibration Range : 7669.000

Instrument : CHAMBER 016  
 Detector : 78774  
 Calibration Date/Time : 4-SEP-2009 12:39:14  
 Calibration Source Id : AESS-016  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.862  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2352.881  
 Energy Calibration Slope : 4.887459  
 Energy Calibration Quadratic : 3.1538753E-04  
 Energy Calibration Range : 7688.000

Instrument : CHAMBER 017  
 Detector : 78791  
 Calibration Date/Time : 4-SEP-2009 12:39:56  
 Calibration Source Id : AESS-017  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.864  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2360.881  
 Energy Calibration Slope : 4.992493  
 Energy Calibration Quadratic : 2.7980251E-04  
 Energy Calibration Range : 7767.000

Instrument : CHAMBER 018  
 Detector : 78782  
 Calibration Date/Time : 4-SEP-2009 12:40:11  
 Calibration Source Id : AESS-018  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5794.892  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2354.269  
 Energy Calibration Slope : 4.957198  
 Energy Calibration Quadratic : 3.2317592E-04  
 Energy Calibration Range : 7769.000

Instrument : CHAMBER 019  
 Detector : 78786  
 Calibration Date/Time : 4-SEP-2009 12:40:24  
 Calibration Source Id : AESS-019

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.321
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2346.765  
 Energy Calibration Slope : 5.052913  
 Energy Calibration Quadratic : 2.4091676E-04  
 Energy Calibration Range : 7774.000

Instrument : CHAMBER 020  
 Detector : 78787  
 Calibration Date/Time : 4-SEP-2009 12:40:33  
 Calibration Source Id : AESS-020

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.527
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2338.013  
 Energy Calibration Slope : 4.982131  
 Energy Calibration Quadratic : 2.9908412E-04  
 Energy Calibration Range : 7753.000

Instrument : CHAMBER 021  
 Detector : 67047  
 Calibration Date/Time : 4-SEP-2009 12:40:41  
 Calibration Source Id : AESS-021

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2273.506  
 Energy Calibration Slope : 4.978734  
 Energy Calibration Quadratic : 2.7200553E-04  
 Energy Calibration Range : 7657.000

Instrument : CHAMBER 022  
 Detector : 72530  
 Calibration Date/Time : 4-SEP-2009 12:40:50  
 Calibration Source Id : AESS-022  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.361  
 NP-237 4341 2/28/10 4768.800 4769.133  
 CM-244 4320A 2/28/10 5795.020 5795.021  
  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2375.240  
 Energy Calibration Slope : 4.980961  
 Energy Calibration Quadratic : 2.7447013E-04  
 Energy Calibration Range : 7764.000

Instrument : CHAMBER 023  
 Detector : 78264  
 Calibration Date/Time : 4-SEP-2009 12:40:59  
 Calibration Source Id : AESS-023  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.015  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5794.708  
  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2381.774  
 Energy Calibration Slope : 5.002218  
 Energy Calibration Quadratic : 2.9209474E-04  
 Energy Calibration Range : 7810.000

Instrument : CHAMBER 024  
 Detector : 76542  
 Calibration Date/Time : 4-SEP-2009 12:41:10  
 Calibration Source Id : AESS-024  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2348.764  
 Energy Calibration Slope : 4.960187  
 Energy Calibration Quadratic : 2.8149344E-04  
 Energy Calibration Range : 7723.000



Instrument : CHAMBER 025  
 Detector : 45-149AA5  
 Calibration Date/Time : 5-SEP-2009 13:36:12  
 Calibration Source Id : AESS-025

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.301
NP-237	4341	2/28/10	4768.800	4769.169
CM-244	4320A	2/28/10	5795.020	5795.134

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2313.345  
 Energy Calibration Slope : 4.853284  
 Energy Calibration Quadratic : 3.0770546E-04  
 Energy Calibration Range : 7606.000

Instrument : CHAMBER 026  
 Detector : 78204  
 Calibration Date/Time : 5-SEP-2009 13:36:22  
 Calibration Source Id : AESS-026

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.929
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2358.057  
 Energy Calibration Slope : 4.920322  
 Energy Calibration Quadratic : 3.5937896E-04  
 Energy Calibration Range : 7773.000

Instrument : CHAMBER 027  
 Detector : 42484  
 Calibration Date/Time : 5-SEP-2009 13:36:31  
 Calibration Source Id : AESS-027

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.819
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2363.651  
 Energy Calibration Slope : 4.963936  
 Energy Calibration Quadratic : 3.2873321E-04  
 Energy Calibration Range : 7791.000

Instrument : CHAMBER 028  
 Detector : 78792  
 Calibration Date/Time : 5-SEP-2009 13:36:41  
 Calibration Source Id : AESS-028

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.019

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2311.599  
 Energy Calibration Slope : 4.936965  
 Energy Calibration Quadratic : 3.4681335E-04  
 Energy Calibration Range : 7731.000

Instrument : CHAMBER 029  
 Detector : 33454  
 Calibration Date/Time : 5-SEP-2009 13:36:49  
 Calibration Source Id : AESS-029

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.046
NP-237	4341	2/28/10	4768.800	4768.273
CM-244	4320A	2/28/10	5795.020	5794.838

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2346.906  
 Energy Calibration Slope : 4.889407  
 Energy Calibration Quadratic : 2.9813289E-04  
 Energy Calibration Range : 7666.000

Instrument : CHAMBER 030  
 Detector : 33447  
 Calibration Date/Time : 5-SEP-2009 13:36:58  
 Calibration Source Id : AESS-030

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2376.621  
 Energy Calibration Slope : 4.959564  
 Energy Calibration Quadratic : 3.0966211E-04  
 Energy Calibration Range : 7780.000

Instrument : CHAMBER 031  
 Detector : 67042  
 Calibration Date/Time : 5-SEP-2009 13:37:09  
 Calibration Source Id : AESS-031

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.344
NP-237	4341	2/28/10	4768.800	4769.750
CM-244	4320A	2/28/10	5795.020	5795.848

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2358.347  
 Energy Calibration Slope : 4.922678  
 Energy Calibration Quadratic : 3.3807335E-04  
 Energy Calibration Range : 7754.000

Instrument : CHAMBER 032  
 Detector : 67041  
 Calibration Date/Time : 5-SEP-2009 13:37:21  
 Calibration Source Id : AESS-032

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3082.708
NP-237	4341	2/28/10	4768.800	4596.952
CM-244	4320A	2/28/10	5795.020	5590.557

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2480.957  
 Energy Calibration Slope : 5.431309  
 Energy Calibration Quadratic :  
 Energy Calibration Range : 8043.000

Instrument : CHAMBER 033  
 Detector : 78785  
 Calibration Date/Time : 5-SEP-2009 13:37:30  
 Calibration Source Id : AESS-033

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.293
NP-237	4341	2/28/10	4768.800	4768.798
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2371.628  
 Energy Calibration Slope : 4.957000  
 Energy Calibration Quadratic : 3.2105893E-04  
 Energy Calibration Range : 7784.000

Instrument : CHAMBER 034  
 Detector : 61586  
 Calibration Date/Time : 5-SEP-2009 13:37:40  
 Calibration Source Id : AESS-034  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3048.128  
 NP-237 4341 2/28/10 4768.800 4505.317  
 CM-244 4320A 2/28/10 5795.020 5654.358  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2505.085  
 Energy Calibration Slope : 5.306273  
 Energy Calibration Quadratic :  
 Energy Calibration Range : 7939.000

Instrument : CHAMBER 035  
 Detector : 78202  
 Calibration Date/Time : 5-SEP-2009 13:37:51  
 Calibration Source Id : AESS-035  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.195  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2331.502  
 Energy Calibration Slope : 4.956956  
 Energy Calibration Quadratic : 3.3284936E-04  
 Energy Calibration Range : 7756.000

Instrument : CHAMBER 036  
 Detector : 78203  
 Calibration Date/Time : 5-SEP-2009 13:38:00  
 Calibration Source Id : AESS-036  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.261  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.112  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2349.949  
 Energy Calibration Slope : 4.931112  
 Energy Calibration Quadratic : 3.3396695E-04  
 Energy Calibration Range : 7750.000

Instrument : CHAMBER 037  
 Detector : 45-149BB5  
 Calibration Date/Time : 5-SEP-2009 13:38:11  
 Calibration Source Id : AESS-037

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4769.328
CM-244	4320A	2/28/10	5795.020	5795.274

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2377.698  
 Energy Calibration Slope : 4.936130  
 Energy Calibration Quadratic : 2.6397177E-04  
 Energy Calibration Range : 7709.000

Instrument : CHAMBER 038  
 Detector : 72532  
 Calibration Date/Time : 5-SEP-2009 13:38:20  
 Calibration Source Id : AESS-038

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.173

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2373.418  
 Energy Calibration Slope : 4.945736  
 Energy Calibration Quadratic : 3.1779311E-04  
 Energy Calibration Range : 7771.000

Instrument : CHAMBER 039  
 Detector : 45-149BB2  
 Calibration Date/Time : 5-SEP-2009 13:38:28  
 Calibration Source Id : AESS-039

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.413
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2383.597  
 Energy Calibration Slope : 4.901721  
 Energy Calibration Quadratic : 3.2673960E-04  
 Energy Calibration Range : 7746.000

Instrument : CHAMBER 040  
 Detector : 78773  
 Calibration Date/Time : 5-SEP-2009 13:38:36  
 Calibration Source Id : AESS-040  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.203  
 NP-237 4341 2/28/10 4768.800 4768.877  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2349.601  
 Energy Calibration Slope : 4.890684  
 Energy Calibration Quadratic : 3.3607692E-04  
 Energy Calibration Range : 7710.000

Instrument : CHAMBER 041  
 Detector : 78205  
 Calibration Date/Time : 5-SEP-2009 13:38:44  
 Calibration Source Id : AESS-041  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.316  
 NP-237 4341 2/28/10 4768.800 4768.914  
 CM-244 4320A 2/28/10 5795.020 5795.124  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2359.603  
 Energy Calibration Slope : 4.927306  
 Energy Calibration Quadratic : 3.6796945E-04  
 Energy Calibration Range : 7791.000

Instrument : CHAMBER 042  
 Detector : 78793  
 Calibration Date/Time : 5-SEP-2009 13:38:52  
 Calibration Source Id : AESS-042  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.945  
 CM-244 4320A 2/28/10 5795.020 5795.068  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2375.562  
 Energy Calibration Slope : 4.905127  
 Energy Calibration Quadratic : 3.3096116E-04  
 Energy Calibration Range : 7745.000

Instrument : CHAMBER 043  
 Detector : 76543  
 Calibration Date/Time : 5-SEP-2009 13:38:59  
 Calibration Source Id : AESS-043

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.008
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.285

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2370.828  
 Energy Calibration Slope : 4.912446  
 Energy Calibration Quadratic : 3.4794814E-04  
 Energy Calibration Range : 7766.000

Instrument : CHAMBER 044  
 Detector : 79459  
 Calibration Date/Time : 5-SEP-2009 13:39:07  
 Calibration Source Id : AESS-044

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.899
CM-244	4320A	2/28/10	5795.020	5795.019

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2357.678  
 Energy Calibration Slope : 4.935909  
 Energy Calibration Quadratic : 3.3428424E-04  
 Energy Calibration Range : 7763.000

Instrument : CHAMBER 045  
 Detector : 78783  
 Calibration Date/Time : 5-SEP-2009 13:39:15  
 Calibration Source Id : AESS-045

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2362.021  
 Energy Calibration Slope : 4.936533  
 Energy Calibration Quadratic : 3.2874785E-04  
 Energy Calibration Range : 7762.000

Instrument : CHAMBER 046  
 Detector : 76544  
 Calibration Date/Time : 5-SEP-2009 13:39:23  
 Calibration Source Id : AESS-046

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.265
NP-237	4341	2/28/10	4768.800	4768.973
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2361.969  
 Energy Calibration Slope : 4.880176  
 Energy Calibration Quadratic : 3.5064379E-04  
 Energy Calibration Range : 7727.000

Instrument : CHAMBER 047  
 Detector : 46-089B1  
 Calibration Date/Time : 5-SEP-2009 13:39:31  
 Calibration Source Id : AESS-047

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.348
NP-237	4341	2/28/10	4768.800	4768.802
CM-244	4320A	2/28/10	5795.020	5795.019

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2352.118  
 Energy Calibration Slope : 4.961685  
 Energy Calibration Quadratic : 3.1629670E-04  
 Energy Calibration Range : 7765.000

Instrument : CHAMBER 048  
 Detector : 42483  
 Calibration Date/Time : 5-SEP-2009 13:39:40  
 Calibration Source Id : AESS-048

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.138
NP-237	4341	2/28/10	4768.800	4768.944
CM-244	4320A	2/28/10	5795.020	5795.069

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2374.542  
 Energy Calibration Slope : 4.945658  
 Energy Calibration Quadratic : 2.9861915E-04  
 Energy Calibration Range : 7752.000



## Subsection 2: Background Calibration

Instrument : CHAMBER 001  
 Detector : 78788  
 Background Analysis Date/Time : 30-AUG-2009 16:15:10  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.095	3301.491	2.000000	0.4800001	70.71068	95.00000
NP-237	4436.328	4901.460	12.00000	2.880001	28.86751	95.00000
CM-244	5531.570	5886.270	6.000000	1.440000	40.82483	95.00000

Instrument : CHAMBER 002  
 Detector : 78266  
 Background Analysis Date/Time : 30-AUG-2009 16:15:10  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.085	3299.620	1.000000	0.2400001	100.0000	95.00000
NP-237	4434.644	4904.846	7.000000	1.680000	37.79645	95.00000
CM-244	5534.154	5882.659	0.000000E+00	0.000000E+00	0.000000E+00	95.00000

Instrument : CHAMBER 003  
 Detector : 67617  
 Background Analysis Date/Time : 30-AUG-2009 16:15:10  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.938	3299.717	3.000000	0.7200001	57.73503	95.00000
NP-237	4432.844	4902.827	10.00000	2.400001	31.62278	95.00000
CM-244	5531.440	5887.803	4.000000	0.9600002	50.00000	95.00000

Instrument : CHAMBER 004  
 Detector : 64279  
 Background Analysis Date/Time : 30-AUG-2009 16:15:10  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.026	3298.308	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4435.760	4905.548	7.000000	1.680000	37.79645	95.00000
CM-244	5534.947	5883.809	2.000000	0.4800001	70.71068	95.00000

Instrument : CHAMBER 005  
 Detector : 67612  
 Background Analysis Date/Time : 30-AUG-2009 16:15:10  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.654	3300.689	4.000000	0.9600002	50.00000	95.00000
NP-237	4436.859	4901.997	5.000000	1.200000	44.72136	95.00000
CM-244	5533.435	5885.045	2.000000	0.4800001	70.71068	95.00000

Instrument : CHAMBER 006  
 Detector : 67613  
 Background Analysis Date/Time : 30-AUG-2009 16:15:10  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2987.771	3301.528	3.000000	0.7200001	57.73503	95.00000
NP-237	4433.310	4904.612	10.00000	2.400001	31.62278	95.00000
CM-244	5535.175	5883.158	9.000000	2.160001	33.33334	95.00000

Instrument : CHAMBER 007  
 Detector : 67607  
 Background Analysis Date/Time : 30-AUG-2009 16:15:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.315	3300.370	2.000000	0.4799997	70.71068	95.00000
NP-237	4436.975	4905.147	7.000000	1.679999	37.79645	95.00000
CM-244	5533.959	5885.477	23.00000	5.519996	20.85144	95.00000

Instrument : CHAMBER 008  
 Detector : 78788  
 Background Analysis Date/Time : 30-AUG-2009 16:15:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.794	3298.426	2.000000	0.4799997	70.71068	95.00000
NP-237	4437.020	4904.595	6.000000	1.439999	40.82483	95.00000
CM-244	5532.536	5882.336	4.000000	0.9599993	50.00000	95.00000

Instrument : CHAMBER 009  
 Detector : 72528  
 Background Analysis Date/Time : 30-AUG-2009 16:15:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.892	3299.892	4.000000	0.9599993	50.00000	95.00000
NP-237	4433.436	4905.789	10.00000	2.399998	31.62278	95.00000
CM-244	5532.687	5887.081	9.000000	2.159998	33.33334	95.00000

Instrument : CHAMBER 010  
 Detector : 72529  
 Background Analysis Date/Time : 30-AUG-2009 16:15:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.087	3300.334	3.000000	0.7199995	57.73503	95.00000
NP-237	4436.842	4905.812	6.000000	1.439999	40.82483	95.00000
CM-244	5533.178	5884.706	6.000000	1.439999	40.82483	95.00000

Instrument : CHAMBER 011  
 Detector : 72531  
 Background Analysis Date/Time : 30-AUG-2009 16:15:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.718	3301.411	3.000000	0.7199995	57.73503	95.00000
NP-237	4435.900	4905.463	15.00000	3.599998	25.81989	95.00000
CM-244	5535.617	5886.431	10.00000	2.399998	31.62278	95.00000

Instrument : CHAMBER 012  
 Detector : 67594  
 Background Analysis Date/Time : 30-AUG-2009 16:15:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.283	3301.924	2.000000	0.4799997	70.71068	95.00000
NP-237	4434.309	4903.502	10.00000	2.399998	31.62278	95.00000
CM-244	5531.028	5882.575	10.00000	2.399998	31.62278	95.00000

Instrument : CHAMBER 013  
 Detector : 78790  
 Background Analysis Date/Time : 30-AUG-2009 16:15:12  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.309	3297.583	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4432.512	4904.184	11.00000	2.640001	30.15113	95.00000
CM-244	5533.734	5883.657	4.000000	0.9600002	50.00000	95.00000

Instrument : CHAMBER 014  
 Detector : 67616  
 Background Analysis Date/Time : 30-AUG-2009 16:15:12  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.575	3298.988	3.000000	0.7200001	57.73503	95.00000
NP-237	4436.470	4903.458	8.000000	1.920000	35.35534	95.00000
CM-244	5530.496	5885.133	26.00000	6.240001	19.61161	95.00000

Instrument : CHAMBER 015  
 Detector : 61581  
 Background Analysis Date/Time : 30-AUG-2009 16:15:12  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2987.656	3297.520	3.000000	0.7200001	57.73503	95.00000
NP-237	4435.901	4901.612	9.000000	2.160001	33.33334	95.00000
CM-244	5535.255	5884.514	26.00000	6.240001	19.61161	95.00000

Instrument : CHAMBER 016  
 Detector : 78774  
 Background Analysis Date/Time : 30-AUG-2009 16:15:12  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.611	3297.891	1.000000	0.2400001	100.0000	95.00000
NP-237	4435.494	4901.479	2.000000	0.4800001	70.71068	95.00000
CM-244	5530.741	5886.030	3.000000	0.7200001	57.73503	95.00000

Instrument : CHAMBER 017  
 Detector : 78791  
 Background Analysis Date/Time : 30-AUG-2009 16:15:12  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.315	3299.165	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4433.955	4905.994	7.000000	1.680000	37.79645	95.00000
CM-244	5531.756	5885.157	1.000000	0.2400001	100.0000	95.00000

Instrument : CHAMBER 018  
 Detector : 78782  
 Background Analysis Date/Time : 30-AUG-2009 16:15:12  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.045	3297.645	5.000000	1.200000	44.72136	95.00000
NP-237	4435.824	4903.103	6.000000	1.440000	40.82483	95.00000
CM-244	5530.534	5885.395	5.000000	1.200000	44.72136	95.00000

Instrument : CHAMBER 019  
 Detector : 78786  
 Background Analysis Date/Time : 30-AUG-2009 16:15:13  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.371	3300.084	2.000000	0.4800001	70.71068	95.00000
NP-237	4432.711	4901.697	6.000000	1.440000	40.82483	95.00000
CM-244	5534.730	5883.386	3.000000	0.7200001	57.73503	95.00000

Instrument : CHAMBER 020  
 Detector : 78787  
 Background Analysis Date/Time : 30-AUG-2009 16:15:13  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.745	3300.511	3.000000	0.7200001	57.73503	95.00000
NP-237	4436.191	4903.850	11.00000	2.640001	30.15113	95.00000
CM-244	5531.198	5885.719	4.000000	0.9600002	50.00000	95.00000

Instrument : CHAMBER 021  
 Detector : 67047  
 Background Analysis Date/Time : 30-AUG-2009 16:15:13  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.027	3300.488	2.000000	0.4800001	70.71068	95.00000
NP-237	4433.390	4904.438	6.000000	1.440000	40.82483	95.00000
CM-244	5534.035	5886.544	16.00000	3.840001	25.00000	95.00000

Instrument : CHAMBER 022  
 Detector : 72530  
 Background Analysis Date/Time : 30-AUG-2009 16:15:13  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.050	3301.029	39.00000	9.360003	16.01282	95.00000
NP-237	4437.549	4902.815	18.00000	4.320001	23.57022	95.00000
CM-244	5531.706	5883.854	12.00000	2.880001	28.86751	95.00000

Instrument : CHAMBER 023  
 Detector : 78264  
 Background Analysis Date/Time : 30-AUG-2009 16:15:13  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.319	3301.853	1.000000	0.2400001	100.0000	95.00000
NP-237	4434.632	4902.993	6.000000	1.440000	40.82483	95.00000
CM-244	5531.100	5885.960	8.000000	1.920000	35.35534	95.00000

Instrument : CHAMBER 024  
 Detector : 76542  
 Background Analysis Date/Time : 30-AUG-2009 16:15:13  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.280	3301.361	1.000000	0.2400001	100.0000	95.00000
NP-237	4434.951	4904.473	14.00000	3.360001	26.72612	95.00000
CM-244	5532.286	5883.922	5.000000	1.200000	44.72136	95.00000

Instrument : CHAMBER 025  
 Detector : 45-149AA5  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.958	3301.287	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4436.686	4904.740	7.000000	1.680000	37.79645	95.00000
CM-244	5534.991	5882.562	76.00000	18.24000	11.47079	95.00000

Instrument : CHAMBER 026  
 Detector : 78204  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.735	3300.836	2.000000	0.4800001	70.71068	95.00000
NP-237	4435.801	4902.784	4.000000	0.9600002	50.00000	95.00000
CM-244	5530.708	5886.284	60.00000	14.40000	12.90994	95.00000

Instrument : CHAMBER 027  
 Detector : 42484  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.280	3298.316	9.000000	2.160000	33.33334	95.00000
NP-237	4433.196	4906.637	9.000000	2.160000	33.33334	95.00000
CM-244	5535.439	5885.723	61.00000	14.64000	12.80369	95.00000

Instrument : CHAMBER 028  
 Detector : 78792  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.441	3297.640	2.000000	0.4800001	70.71068	95.00000
NP-237	4435.847	4903.788	13.00000	3.120001	27.73501	95.00000
CM-244	5532.676	5883.223	65.00000	15.60000	12.40347	95.00000

Instrument : CHAMBER 029  
 Detector : 33454  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2987.567	3301.667	2.000000	0.4800001	70.71068	95.00000
NP-237	4432.493	4902.470	13.000000	3.120001	27.73501	95.00000
CM-244	5535.032	5883.746	87.000000	20.88000	10.72113	95.00000

Instrument : CHAMBER 030  
 Detector : 33447  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.332	3299.665	1.000000	0.2400000	100.0000	95.00000
NP-237	4436.037	4902.215	13.000000	3.120001	27.73501	95.00000
CM-244	5533.195	5886.933	97.000000	23.28000	10.15346	95.00000

Instrument : CHAMBER 031  
 Detector : 67042  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.980	3300.809	8.000000	1.919999	35.35534	95.00000
NP-237	4433.475	4904.204	10.000000	2.399998	31.62278	95.00000
CM-244	5535.021	5883.627	87.000000	20.87999	10.72113	95.00000

Instrument : CHAMBER 032  
 Detector : 67041  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.500	3301.085	2.000000	0.4799997	70.71068	95.00000
NP-237	4436.228	4903.321	14.000000	3.359998	26.72612	95.00000
CM-244	5533.353	5886.388	25.000000	5.999996	20.00000	95.00000



Instrument : CHAMBER 033  
 Detector : 78785  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.232	3299.661	3.000000	0.7199996	57.73503	95.00000
NP-237	4437.092	4904.010	7.000000	1.679999	37.79645	95.00000
CM-244	5530.913	5885.453	49.00000	11.75999	14.28572	95.00000

Instrument : CHAMBER 034  
 Detector : 61586  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2987.956	3301.026	2.000000	0.4799997	70.71068	95.00000
NP-237	4436.568	4903.521	30.00000	7.199996	18.25742	95.00000
CM-244	5534.967	5885.181	31.00000	7.439995	17.96053	95.00000

Instrument : CHAMBER 035  
 Detector : 78202  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.620	3300.593	2.000000	0.4799997	70.71068	95.00000
NP-237	4435.499	4903.774	16.00000	3.839998	25.00000	95.00000
CM-244	5532.763	5883.199	70.00000	16.79999	11.95229	95.00000

Instrument : CHAMBER 036  
 Detector : 78203  
 Background Analysis Date/Time : 30-AUG-2009 16:15:14  
 Background Count Time : 59999.99

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.620	3298.917	2.000000	0.4799997	70.71068	95.00000
NP-237	4433.050	4904.263	7.000000	1.679999	37.79645	95.00000
CM-244	5535.616	5884.466	51.00000	12.23999	14.00280	95.00000

Instrument : CHAMBER 037  
 Detector : 45-149BB5  
 Background Analysis Date/Time : 30-AUG-2009 16:15:15  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.836	3299.917	5.000000	1.199999	44.72136	95.00000
NP-237	4435.582	4906.557	19.000000	4.559997	22.94157	95.00000
CM-244	5534.307	5882.810	72.000000	17.27999	11.78511	95.00000

Instrument : CHAMBER 038  
 Detector : 72532  
 Background Analysis Date/Time : 30-AUG-2009 16:15:15  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.576	3299.256	2.000000	0.4799997	70.71068	95.00000
NP-237	4433.771	4904.686	10.000000	2.399998	31.62278	95.00000
CM-244	5535.244	5883.467	79.000000	18.95999	11.25088	95.00000

Instrument : CHAMBER 039  
 Detector : 45-149BB2  
 Background Analysis Date/Time : 30-AUG-2009 16:15:15  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.453	3301.599	1.000000	0.2399998	100.0000	95.00000
NP-237	4432.722	4905.688	12.000000	2.879998	28.86751	95.00000
CM-244	5532.346	5883.894	84.000000	20.15999	10.91089	95.00000

Instrument : CHAMBER 040  
 Detector : 78773  
 Background Analysis Date/Time : 30-AUG-2009 16:15:15  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.070	3301.002	6.000000	1.439999	40.82483	95.00000
NP-237	4437.116	4905.104	4.000000	0.9599993	50.00000	95.00000
CM-244	5532.249	5884.180	66.000000	15.83999	12.30915	95.00000

Instrument : CHAMBER 041  
 Detector : 78205  
 Background Analysis Date/Time : 30-AUG-2009 16:15:15  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.305	3298.942	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4436.425	4904.659	10.00000	2.399998	31.62278	95.00000
CM-244	5534.452	5885.748	82.00000	19.67999	11.04315	95.00000

Instrument : CHAMBER 042  
 Detector : 78793  
 Background Analysis Date/Time : 30-AUG-2009 16:15:15  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.887	3299.366	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4437.123	4905.630	11.00000	2.639998	30.15113	95.00000
CM-244	5533.333	5885.512	81.00000	19.43999	11.11111	95.00000

Instrument : CHAMBER 043  
 Detector : 76543  
 Background Analysis Date/Time : 30-AUG-2009 16:15:16  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.321	3301.623	1.000000	0.2400000	100.0000	95.00000
NP-237	4433.027	4903.519	5.000000	1.200000	44.72136	95.00000
CM-244	5534.268	5882.956	61.00000	14.64000	12.80369	95.00000

Instrument : CHAMBER 044  
 Detector : 79459  
 Background Analysis Date/Time : 30-AUG-2009 16:15:16  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.930	3302.506	5.000000	1.200000	44.72136	95.00000
NP-237	4437.594	4903.934	14.00000	3.360001	26.72612	95.00000
CM-244	5530.392	5884.844	80.00000	19.20000	11.18034	95.00000

Instrument : CHAMBER 045  
 Detector : 78783  
 Background Analysis Date/Time : 30-AUG-2009 16:15:16  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.243	3301.709	2.000000	0.4800001	70.71068	95.00000
NP-237	4436.057	4901.945	5.000000	1.200000	44.72136	95.00000
CM-244	5533.013	5887.031	74.00000	17.76000	11.62476	95.00000

Instrument : CHAMBER 046  
 Detector : 76544  
 Background Analysis Date/Time : 30-AUG-2009 16:15:16  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.377	3301.861	2.000000	0.4800001	70.71068	95.00000
NP-237	4437.291	4905.414	7.000000	1.680000	37.79645	95.00000
CM-244	5533.098	5885.505	74.00000	17.76000	11.62476	95.00000

Instrument : CHAMBER 047  
 Detector : 46-089B1  
 Background Analysis Date/Time : 30-AUG-2009 16:15:16  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.396	3301.175	5.000000	1.200000	44.72136	95.00000
NP-237	4434.358	4901.480	17.00000	4.080001	24.25356	95.00000
CM-244	5533.889	5883.104	83.00000	19.92000	10.97643	95.00000

Instrument : CHAMBER 048  
 Detector : 42483  
 Background Analysis Date/Time : 30-AUG-2009 16:15:16  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.395	3299.708	1.000000	0.2400000	100.0000	95.00000
NP-237	4436.890	4906.295	16.00000	3.840001	25.00000	95.00000
CM-244	5534.380	5886.375	85.00000	20.40000	10.84652	95.00000

### Subsection 3: Efficiency Calibration

Instrument : CHAMBER 001  
 Detector : 78788  
 Standard ID : AESS-001  
 Standard Reference Date : 20-FEB-2008 09:54:53  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:39  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:35:32  
 Average Efficiency : 0.3122659  
 Average Efficiency Error : 8.6114258E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	208.6698	28-FEB-2010	2989.095	3301.491	15006.00	0.3039177	1.3064248E-02	58.79536
NP-237	171.0024	28-FEB-2010	4436.328	4901.460	12916.00	0.3146430	1.5974019E-02	71.14886
CM-244	158.1060	28-FEB-2010	5531.570	5886.270	11555.00	0.3229480	1.6424600E-02	57.32594

Instrument : CHAMBER 002  
 Detector : 78266  
 Standard ID : AESS-002  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:39  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:35:41  
 Average Efficiency : 0.3090980  
 Average Efficiency Error : 8.5114390E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.1144	28-FEB-2010	2992.085	3299.620	14650.00	0.3094049	1.3305944E-02	45.54427
NP-237	200.4990	28-FEB-2010	4434.644	4904.846	15015.00	0.3119993	1.5806440E-02	68.48380
CM-244	196.5558	28-FEB-2010	5534.154	5882.659	13603.00	0.3058844	1.5517467E-02	51.44160

Instrument : CHAMBER 003  
 Detector : 67617  
 Standard ID : AESS-003  
 Standard Reference Date : 15-FEB-2008 13:12:27  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:39  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:35:49  
 Average Efficiency : 0.3361934  
 Average Efficiency Error : 9.2456024E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.9740	28-FEB-2010	2991.938	3299.717	15919.00	0.3314925	1.4234867E-02	68.71011
NP-237	203.2080	28-FEB-2010	4432.844	4902.827	16799.00	0.3444051	1.7424129E-02	74.30300
CM-244	197.2236	28-FEB-2010	5531.440	5887.803	14947.00	0.3350840	1.6976947E-02	62.51212

Instrument : CHAMBER 004  
 Detector : 64279  
 Standard ID : AESS-004  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:39  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:35:56  
 Average Efficiency : 0.3331009  
 Average Efficiency Error : 9.1593768E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.1222	28-FEB-2010	2992.026	3298.308	16101.00	0.3301861	1.4176016E-02	53.22534
NP-237	204.2586	28-FEB-2010	4435.760	4905.548	16353.00	0.3335505	1.6880305E-02	62.94835
CM-244	198.8100	28-FEB-2010	5534.947	5883.809	15145.00	0.3368652	1.7064264E-02	54.23564

Instrument : CHAMBER 005  
 Detector : 67612  
 Standard ID : AESS-005  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:39  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:36:04  
 Average Efficiency : 0.2950116  
 Average Efficiency Error : 8.1236903E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	210.7452	28-FEB-2010	2989.654	3300.689	14685.00	0.2945226	1.2665418E-02	52.17361
NP-237	209.5938	28-FEB-2010	4436.859	4901.997	14804.00	0.2942757	1.4911278E-02	59.02256
CM-244	202.7478	28-FEB-2010	5533.435	5885.045	13592.00	0.2964495	1.5039029E-02	52.51872

Instrument : CHAMBER 006  
 Detector : 67613  
 Standard ID : AESS-006  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:39  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:36:12  
 Average Efficiency : 0.3072436  
 Average Efficiency Error : 8.4615378E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.6952	28-FEB-2010	2987.771	3301.528	14462.00	0.3000935	1.2908642E-02	53.74769
NP-237	204.7038	28-FEB-2010	4433.310	4904.612	15292.00	0.3112141	1.5762975E-02	64.28081
CM-244	195.0060	28-FEB-2010	5535.175	5883.158	13852.00	0.3140766	1.5929047E-02	53.04362

Instrument : CHAMBER 007  
 Detector : 67607  
 Standard ID : AESS-007  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:40  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:36:20  
 Average Efficiency : 0.2367712  
 Average Efficiency Error : 6.6109751E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.7342	28-FEB-2010	2991.315	3300.370	13798.00	0.2821096	1.2145956E-02	48.72938
NP-237	205.0260	28-FEB-2010	4436.975	4905.147	11957.00	0.2429639	1.2349783E-02	65.83331
CM-244	199.6806	28-FEB-2010	5533.959	5885.477	9051.000	0.2003213	1.0235304E-02	52.23785

Instrument : CHAMBER 008  
 Detector : 78788  
 Standard ID : AESS-008  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:40  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:36:40  
 Average Efficiency : 0.3205987  
 Average Efficiency Error : 8.8198772E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.0418	28-FEB-2010	2989.794	3298.426	15461.00	0.3171742	1.3626882E-02	47.98743
NP-237	209.2716	28-FEB-2010	4437.020	4904.595	16084.00	0.3202048	1.6208146E-02	61.69046
CM-244	199.6488	28-FEB-2010	5532.536	5882.336	14721.00	0.3260421	1.6522150E-02	43.41613

Instrument : CHAMBER 009  
 Detector : 72528  
 Standard ID : AESS-009  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:40  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:36:51  
 Average Efficiency : 0.3402912  
 Average Efficiency Error : 9.3554687E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.3736	28-FEB-2010	2990.892	3299.892	16250.00	0.3376825	1.4495632E-02	49.34795
NP-237	204.0192	28-FEB-2010	4433.436	4905.789	16617.00	0.3393191	1.7169004E-02	62.72510
CM-244	197.2128	28-FEB-2010	5532.687	5887.081	15400.00	0.3450909	1.7477276E-02	53.13368

Instrument : CHAMBER 010  
 Detector : 72529  
 Standard ID : AESS-010  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:40  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:37:00  
 Average Efficiency : 0.3139585  
 Average Efficiency Error : 8.6422609E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.0008	28-FEB-2010	2988.087	3300.334	14912.00	0.3120262	1.3414358E-02	49.22013
NP-237	202.9926	28-FEB-2010	4436.842	4905.812	15310.00	0.3142270	1.5915314E-02	60.15851
CM-244	196.2330	28-FEB-2010	5533.178	5884.706	14044.00	0.3164504	1.6046330E-02	53.33372

Instrument : CHAMBER 011  
 Detector : 72531  
 Standard ID : AESS-011  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:40  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:37:27  
 Average Efficiency : 0.2979373  
 Average Efficiency Error : 8.2009137E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	212.8284	28-FEB-2010	2990.718	3301.411	14912.00	0.2961519	1.2731905E-02	50.71152
NP-237	214.4868	28-FEB-2010	4435.900	4905.463	15442.00	0.2999101	1.5188582E-02	60.36610
CM-244	208.4184	28-FEB-2010	5535.617	5886.431	14071.00	0.2985013	1.5135813E-02	50.96436

Instrument : CHAMBER 012  
 Detector : 67594  
 Standard ID : AESS-012  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:40  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:37:37  
 Average Efficiency : 0.2994823  
 Average Efficiency Error : 8.2469489E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.2200	28-FEB-2010	2989.283	3301.924	14660.00	0.3004818	1.2922071E-02	52.00318
NP-237	205.8930	28-FEB-2010	4434.309	4903.502	14933.00	0.3021517	1.5308659E-02	64.10130
CM-244	203.1954	28-FEB-2010	5531.028	5882.575	13584.00	0.2955756	1.4994888E-02	57.14846



Instrument : CHAMBER 013  
 Detector : 78790  
 Standard ID : AESS-013  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:41  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:37:47  
 Average Efficiency : 0.3441789  
 Average Efficiency Error : 9.4585977E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.6544	28-FEB-2010	2992.309	3297.583	16707.00	0.3467621	1.4878578E-02	47.93691
NP-237	210.2526	28-FEB-2010	4432.512	4904.184	17205.00	0.3409068	1.7242415E-02	63.48001
CM-244	201.9108	28-FEB-2010	5533.734	5883.657	15707.00	0.3439779	1.7416557E-02	53.05471

Instrument : CHAMBER 014  
 Detector : 67616  
 Standard ID : AESS-014  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:41  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:37:57  
 Average Efficiency : 0.3126531  
 Average Efficiency Error : 8.6011579E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	214.7088	28-FEB-2010	2990.575	3298.988	15569.00	0.3064544	1.3164708E-02	48.59332
NP-237	211.7160	28-FEB-2010	4436.470	4903.458	16179.00	0.3183725	1.6114254E-02	68.41453
CM-244	207.3882	28-FEB-2010	5530.496	5885.133	14842.00	0.3161798	1.6020818E-02	54.78078

Instrument : CHAMBER 015  
 Detector : 61581  
 Standard ID : AESS-015  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:41  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:38:32  
 Average Efficiency : 0.3250474  
 Average Efficiency Error : 8.9431657E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.0270	28-FEB-2010	2987.656	3297.520	15498.00	0.3210663	1.3793531E-02	58.50532
NP-237	200.6460	28-FEB-2010	4435.901	4901.612	15878.00	0.3296820	1.6690506E-02	70.32646
CM-244	195.9270	28-FEB-2010	5535.255	5884.514	14460.00	0.3262195	1.6535265E-02	60.28641

Instrument : CHAMBER 016  
 Detector : 78774  
 Standard ID : AESS-016  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:41  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:39:14  
 Average Efficiency : 0.3337179  
 Average Efficiency Error : 9.1785332E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.0534	28-FEB-2010	2988.611	3297.891	15952.00	0.3304393	1.4189126E-02	48.70612
NP-237	199.3962	28-FEB-2010	4435.494	4901.479	16393.00	0.3425452	1.7334972E-02	61.52191
CM-244	198.6402	28-FEB-2010	5530.741	5886.030	14827.00	0.3300566	1.6723992E-02	56.19504

Instrument : CHAMBER 017  
 Detector : 78791  
 Standard ID : AESS-017  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:41  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:39:56  
 Average Efficiency : 0.2932511  
 Average Efficiency Error : 8.0763726E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	210.0798	28-FEB-2010	2989.315	3299.165	14535.00	0.2924541	1.2578820E-02	44.96824
NP-237	208.5846	28-FEB-2010	4433.955	4905.994	14930.00	0.2982117	1.5109048E-02	56.65096
CM-244	205.5828	28-FEB-2010	5531.756	5885.157	13466.00	0.2896459	1.4695838E-02	49.42458

Instrument : CHAMBER 018  
 Detector : 78782  
 Standard ID : AESS-018  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:41  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:40:11  
 Average Efficiency : 0.3229291  
 Average Efficiency Error : 8.8838805E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.1856	28-FEB-2010	2989.045	3297.645	15448.00	0.3229351	1.3874616E-02	44.39913
NP-237	208.8990	28-FEB-2010	4435.824	4903.103	16130.00	0.3216979	1.6283154E-02	64.50001
CM-244	198.1458	28-FEB-2010	5530.534	5885.395	14527.00	0.3241743	1.6430404E-02	51.39432

Instrument : CHAMBER 019  
 Detector : 78786  
 Standard ID : AESS-019  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:42  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:40:24  
 Average Efficiency : 0.2905655  
 Average Efficiency Error : 8.0145085E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.6468	28-FEB-2010	2992.371	3300.084	13452.00	0.2778059	1.1966659E-02	44.41962
NP-237	202.9140	28-FEB-2010	4432.711	4901.697	14988.00	0.3077365	1.5590836E-02	62.76942
CM-244	199.3140	28-FEB-2010	5534.730	5883.386	13290.00	0.2946945	1.4954864E-02	50.33946

Instrument : CHAMBER 020  
 Detector : 78787  
 Standard ID : AESS-020  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:42  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:40:33  
 Average Efficiency : 0.3434685  
 Average Efficiency Error : 9.4453506E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	205.5870	28-FEB-2010	2990.745	3300.511	16134.00	0.3317050	1.4240759E-02	49.47922
NP-237	203.4984	28-FEB-2010	4436.191	4903.850	17194.00	0.3519965	1.7803436E-02	60.99994
CM-244	197.1096	28-FEB-2010	5531.198	5885.719	15755.00	0.3534269	1.7894309E-02	50.27258

Instrument : CHAMBER 021  
 Detector : 67047  
 Standard ID : AESS-021  
 Standard Reference Date : 19-FEB-2008 15:31:52  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:42  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:40:41  
 Average Efficiency : 0.3053718  
 Average Efficiency Error : 8.4061036E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	208.3608	28-FEB-2010	2991.027	3300.488	14910.00	0.3024271	1.3001683E-02	54.25101
NP-237	210.1548	28-FEB-2010	4433.390	4904.438	15336.00	0.3040332	1.5398674E-02	66.84158
CM-244	200.7390	28-FEB-2010	5534.035	5886.544	14134.00	0.3111110	1.5774274E-02	53.45971

Instrument : CHAMBER 022  
 Detector : 72530  
 Standard ID : AESS-022  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:42  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:40:50  
 Average Efficiency : 0.3167550  
 Average Efficiency Error : 8.7174345E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	209.6724	28-FEB-2010	2992.050	3301.029	15236.00	0.3069546	1.3191545E-02	48.80446
NP-237	206.8830	28-FEB-2010	4437.549	4902.815	16171.00	0.3256005	1.6480263E-02	64.55595
CM-244	203.0208	28-FEB-2010	5531.706	5883.854	14838.00	0.3231215	1.6372502E-02	53.46963

Instrument : CHAMBER 023  
 Detector : 78264  
 Standard ID : AESS-023  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:42  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:40:59  
 Average Efficiency : 0.3319828  
 Average Efficiency Error : 9.1288136E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	207.4764	28-FEB-2010	2991.319	3301.853	16017.00	0.3263104	1.4010864E-02	47.06707
NP-237	207.4998	28-FEB-2010	4434.632	4902.993	16663.00	0.3345701	1.6928136E-02	62.52299
CM-244	199.8804	28-FEB-2010	5531.100	5885.960	15271.00	0.3377988	1.7109787E-02	47.13729

Instrument : CHAMBER 024  
 Detector : 76542  
 Standard ID : AESS-024  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 4-SEP-2009 07:36:42  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 4-SEP-2009 12:41:10  
 Average Efficiency : 0.3282878  
 Average Efficiency Error : 9.0300748E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.5218	28-FEB-2010	2988.280	3301.361	15578.00	0.3235334	1.3898253E-02	49.01440
NP-237	205.6662	28-FEB-2010	4434.951	4904.473	16364.00	0.3314564	1.6774241E-02	73.72572
CM-244	198.3060	28-FEB-2010	5532.286	5883.922	14893.00	0.3320678	1.6824935E-02	56.15541

Instrument : CHAMBER 025  
 Detector : 45-149AA5  
 Standard ID : AESS-025  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:08  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:36:12  
 Average Efficiency : 0.3276502  
 Average Efficiency Error : 9.0310313E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	195.5670	28-FEB-2010	2988.958	3301.287	15226.00	0.3290954	1.4142862E-02	57.79382
NP-237	167.9916	28-FEB-2010	4436.686	4904.740	13253.00	0.3286704	1.6679743E-02	71.75627
CM-244	157.2432	28-FEB-2010	5534.991	5882.562	11563.00	0.3246800	1.6513394E-02	67.10056

Instrument : CHAMBER 026  
 Detector : 78204  
 Standard ID : AESS-026  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:08  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:36:22  
 Average Efficiency : 0.3213052  
 Average Efficiency Error : 9.4170934E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	199.5072	28-FEB-2010	2988.735	3300.836	15089.00	0.3196830	1.6195688E-02	50.04417
NP-237	168.0294	28-FEB-2010	4435.801	4902.784	13239.00	0.3282672	1.6659509E-02	56.07543
CM-244	160.5822	28-FEB-2010	5530.708	5886.284	11504.00	0.3164098	1.6093958E-02	50.89248

Instrument : CHAMBER 027  
 Detector : 42484  
 Standard ID : AESS-027  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:08  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:36:31  
 Average Efficiency : 0.3385510  
 Average Efficiency Error : 9.9218553E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	193.4238	28-FEB-2010	2989.280	3298.316	15261.00	0.3334595	1.6891224E-02	44.29322
NP-237	161.6154	28-FEB-2010	4433.196	4906.637	13292.00	0.3426305	1.7387481E-02	57.33553
CM-244	148.1754	28-FEB-2010	5535.439	5885.723	11402.00	0.3398517	1.7288936E-02	52.16496

Instrument : CHAMBER 028  
 Detector : 78792  
 Standard ID : AESS-028  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:08  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:36:41  
 Average Efficiency : 0.3044925  
 Average Efficiency Error : 8.9324238E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	199.6542	28-FEB-2010	2989.441	3297.640	14137.00	0.2992923	1.5175839E-02	43.30858
NP-237	168.1992	28-FEB-2010	4435.847	4903.788	12490.00	0.3093279	1.5712239E-02	58.21876
CM-244	156.7614	28-FEB-2010	5532.676	5883.223	10835.00	0.3052154	1.5540821E-02	45.24567

Instrument : CHAMBER 029  
 Detector : 33454  
 Standard ID : AESS-029  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:08  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:36:49  
 Average Efficiency : 0.3151154  
 Average Efficiency Error : 9.2400359E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	201.5742	28-FEB-2010	2987.567	3301.667	14598.00	0.3061087	1.5514722E-02	59.98596
NP-237	169.7700	28-FEB-2010	4432.493	4902.470	13008.00	0.3191791	1.6202597E-02	64.76778
CM-244	154.8234	28-FEB-2010	5535.032	5883.746	11258.00	0.3209674	1.6332163E-02	52.83419

Instrument : CHAMBER 030  
 Detector : 33447  
 Standard ID : AESS-030  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:08  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:36:58  
 Average Efficiency : 0.3203139  
 Average Efficiency Error : 9.3901874E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	198.9792	28-FEB-2010	2991.332	3299.665	14751.00	0.3133562	1.5879847E-02	54.85928
NP-237	166.3758	28-FEB-2010	4436.037	4902.215	13026.00	0.3261414	1.6555686E-02	71.82014
CM-244	157.1856	28-FEB-2010	5533.195	5886.933	11469.00	0.3220125	1.6380262E-02	58.73045

Instrument : CHAMBER 031  
 Detector : 67042  
 Standard ID : AESS-031  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:09  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:37:09  
 Average Efficiency : 0.3353133  
 Average Efficiency Error : 9.2432722E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	193.6650	28-FEB-2010	2988.980	3300.809	15051.00	0.3284457	1.4117910E-02	62.13078
NP-237	162.9186	28-FEB-2010	4433.475	4904.204	13378.00	0.3420834	1.7358093E-02	78.83074
CM-244	153.1968	28-FEB-2010	5535.021	5883.627	11764.00	0.3388719	1.7230390E-02	60.52183

Instrument : CHAMBER 032  
 Detector : 67041  
 Standard ID : AESS-032  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:09  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:37:21  
 Average Efficiency : 0.2159665  
 Average Efficiency Error : 6.2416224E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	195.2364	28-FEB-2010	2991.500	3301.085	12930.00	0.2799107	1.2067080E-02	108.5704
NP-237	165.9822	28-FEB-2010	4436.228	4903.321	11857.00	0.2975635	1.5127208E-02	150.4912
CM-244	153.7938	28-FEB-2010	5533.353	5886.388	5601.000	0.1608285	8.3242906E-03	0.0000000E+00

Instrument : CHAMBER 033  
 Detector : 78785  
 Standard ID : AESS-033  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:09  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:37:30  
 Average Efficiency : 0.3134830  
 Average Efficiency Error : 8.6526405E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	192.4158	28-FEB-2010	2991.232	3299.661	14169.00	0.3112248	1.3392622E-02	46.76679
NP-237	161.7816	28-FEB-2010	4437.092	4904.010	12161.00	0.3131624	1.5913626E-02	60.14054
CM-244	147.2670	28-FEB-2010	5530.913	5885.453	10575.00	0.3170980	1.6152723E-02	52.75375

Instrument : CHAMBER 034  
 Detector : 61586  
 Standard ID : AESS-034  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:09  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:37:40  
 Average Efficiency : 5.4748973E-05  
 Average Efficiency Error : 8.9538866E-05  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.5488	28-FEB-2010	2987.956	3301.026	9319.000	0.1963924	8.5345702E-03	80.18852
NP-237	167.2962	28-FEB-2010	4436.568	4903.521	7134.000	0.1774998	9.1209533E-03	0.0000000E+00
CM-244	154.4388	28-FEB-2010	5534.967	5885.181	8.000000	1.6030130E-05	6.59548113E-05	5.306273

Instrument : CHAMBER 035  
 Detector : 78202  
 Standard ID : AESS-035  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:09  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:37:51  
 Average Efficiency : 0.3050995  
 Average Efficiency Error : 8.4187118E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	198.6666	28-FEB-2010	2991.620	3300.593	14168.00	0.3014163	1.2970550E-02	45.14441
NP-237	168.2934	28-FEB-2010	4435.499	4903.774	12515.00	0.3097561	1.5733534E-02	52.82528
CM-244	158.8128	28-FEB-2010	5532.763	5883.199	11004.00	0.3058464	1.5568729E-02	51.98632

Instrument : CHAMBER 036  
 Detector : 78203  
 Standard ID : AESS-036  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:09  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:00  
 Average Efficiency : 0.3236991  
 Average Efficiency Error : 8.9239618E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	201.3204	28-FEB-2010	2991.620	3298.917	15082.00	0.3166323	1.3609574E-02	51.84582
NP-237	167.4312	28-FEB-2010	4433.050	4904.263	13282.00	0.3304925	1.6771674E-02	66.46858
CM-244	156.4188	28-FEB-2010	5535.616	5884.466	11603.00	0.3275855	1.6659884E-02	53.86180



Instrument : CHAMBER 037  
 Detector : 45-149BB5  
 Standard ID : AESS-037  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:11  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:11  
 Average Efficiency : 0.3527313  
 Average Efficiency Error : 9.7141266E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.7372	28-FEB-2010	2988.836	3299.917	16029.00	0.3425954	1.4709930E-02	69.97938
NP-237	167.1294	28-FEB-2010	4435.582	4906.557	14502.00	0.3614331	1.8319361E-02	87.55756
CM-244	154.7664	28-FEB-2010	5534.307	5882.810	12611.00	0.3597120	1.8269511E-02	71.60854

Instrument : CHAMBER 038  
 Detector : 72532  
 Standard ID : AESS-038  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:11  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:20  
 Average Efficiency : 0.3374661  
 Average Efficiency Error : 9.2953844E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.1408	28-FEB-2010	2991.576	3299.256	15782.00	0.3332799	1.4313720E-02	52.53116
NP-237	170.0886	28-FEB-2010	4433.771	4904.686	13898.00	0.3404015	1.7263360E-02	67.00319
CM-244	157.7460	28-FEB-2010	5535.244	5883.467	12174.00	0.3406372	1.7310385E-02	53.71938

Instrument : CHAMBER 039  
 Detector : 45-149BB2  
 Standard ID : AESS-039  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:11  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:28  
 Average Efficiency : 0.3630306  
 Average Efficiency Error : 9.9983541E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	192.2418	28-FEB-2010	2991.453	3301.599	16042.00	0.3526957	1.5143363E-02	60.09052
NP-237	159.1506	28-FEB-2010	4432.722	4905.688	14315.00	0.3747012	1.8995127E-02	78.06614
CM-244	151.7142	28-FEB-2010	5532.346	5883.894	12631.00	0.3674615	1.8662771E-02	63.39179

Instrument : CHAMBER 040  
 Detector : 78773  
 Standard ID : AESS-040  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:11  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:36  
 Average Efficiency : 0.3207370  
 Average Efficiency Error : 8.8450955E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.4828	28-FEB-2010	2991.070	3301.002	14629.00	0.3178972	1.3671570E-02	46.05933
NP-237	166.8174	28-FEB-2010	4437.116	4905.104	12857.00	0.3211111	1.6303439E-02	59.80341
CM-244	155.0100	28-FEB-2010	5532.249	5884.180	11394.00	0.3244938	1.6507916E-02	47.50864

Instrument : CHAMBER 041  
 Detector : 78205  
 Standard ID : AESS-041  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:11  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:44  
 Average Efficiency : 0.3298833  
 Average Efficiency Error : 9.0887686E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.9034	28-FEB-2010	2991.305	3298.942	15596.00	0.3232844	1.3887258E-02	46.32725
NP-237	171.2268	28-FEB-2010	4436.425	4904.659	13704.00	0.3334179	1.6912539E-02	62.94285
CM-244	159.5796	28-FEB-2010	5534.452	5885.748	12158.00	0.3362667	1.7088668E-02	51.06727

Instrument : CHAMBER 042  
 Detector : 78793  
 Standard ID : AESS-042  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:11  
 Calibration Count Time : 239.9998  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:52  
 Average Efficiency : 0.3262490  
 Average Efficiency Error : 8.9996839E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	188.7090	28-FEB-2010	2988.887	3299.366	14425.00	0.3230868	1.3898331E-02	45.61874
NP-237	159.6558	28-FEB-2010	4437.123	4905.630	12564.00	0.3278245	1.6650224E-02	58.62441
CM-244	150.5208	28-FEB-2010	5533.333	5885.512	11230.00	0.3292493	1.6754221E-02	49.02582

Instrument : CHAMBER 043  
 Detector : 76543  
 Standard ID : AESS-043  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:12  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:38:59  
 Average Efficiency : 0.3388386  
 Average Efficiency Error : 9.3338015E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.7708	28-FEB-2010	2990.321	3301.623	15716.00	0.3358650	1.4425773E-02	53.08127
NP-237	168.7422	28-FEB-2010	4433.027	4903.519	13744.00	0.3393443	1.7212395E-02	71.29913
CM-244	156.3252	28-FEB-2010	5534.268	5882.956	12132.00	0.3426539	1.7413609E-02	49.48456

Instrument : CHAMBER 044  
 Detector : 79459  
 Standard ID : AESS-044  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:12  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:39:07  
 Average Efficiency : 0.3461110  
 Average Efficiency Error : 9.5328372E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.4510	28-FEB-2010	2989.930	3302.506	16084.00	0.3495771	1.5008831E-02	49.84488
NP-237	166.6248	28-FEB-2010	4437.594	4903.934	13869.00	0.3467283	1.7584775E-02	67.30765
CM-244	155.8290	28-FEB-2010	5530.392	5884.844	12036.00	0.3408923	1.7326539E-02	50.42044

Instrument : CHAMBER 045  
 Detector : 78783  
 Standard ID : AESS-045  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:12  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:39:15  
 Average Efficiency : 0.3386171  
 Average Efficiency Error : 9.3369978E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	186.9936	28-FEB-2010	2989.243	3301.709	15126.00	0.3418811	1.4694056E-02	41.09813
NP-237	160.8066	28-FEB-2010	4436.057	4901.945	12808.00	0.3318377	1.6849035E-02	59.62828
CM-244	145.8384	28-FEB-2010	5533.013	5887.031	11276.00	0.3412594	1.7364025E-02	48.59882

Instrument : CHAMBER 046  
 Detector : 76544  
 Standard ID : AESS-046  
 Standard Reference Date : 19-FEB-2008 19:35:48  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:12  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:39:23  
 Average Efficiency : 0.3428833  
 Average Efficiency Error : 9.4477413E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.7474	28-FEB-2010	2992.377	3301.861	15517.00	0.3367483	1.4466916E-02	50.54656
NP-237	164.6658	28-FEB-2010	4437.291	4905.414	13709.00	0.3468411	1.7593319E-02	60.02387
CM-244	151.3824	28-FEB-2010	5533.098	5885.505	11938.00	0.3480568	1.7692965E-02	49.85977

Instrument : CHAMBER 047  
 Detector : 46-089B1  
 Standard ID : AESS-047  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:12  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:39:31  
 Average Efficiency : 0.3414553  
 Average Efficiency Error : 9.4057210E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.4804	28-FEB-2010	2992.396	3301.175	15755.00	0.3371730	1.4481370E-02	53.45372
NP-237	168.3948	28-FEB-2010	4434.358	4901.480	13876.00	0.3432392	1.7407728E-02	75.59270
CM-244	154.6032	28-FEB-2010	5533.889	5883.104	12119.00	0.3459478	1.7581582E-02	61.01867

Instrument : CHAMBER 048  
 Detector : 42483  
 Standard ID : AESS-048  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 5-SEP-2009 09:03:12  
 Calibration Count Time : 240.0000  
 Efficiency Calibration Date/Time : 5-SEP-2009 13:39:40  
 Average Efficiency : 0.3165880  
 Average Efficiency Error : 8.7361159E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	191.8350	28-FEB-2010	2992.395	3299.708	14224.00	0.3133849	1.3484558E-02	54.26610
NP-237	161.5530	28-FEB-2010	4436.890	4906.295	12281.00	0.3166445	1.6088169E-02	68.16459
CM-244	151.1856	28-FEB-2010	5534.380	5886.375	11007.00	0.3212399	1.6352450E-02	58.44775

## Subsection 1: Energy Calibration

The Energy Calibration energy=Cal\_Zero+(e1\*C)+(e2\*C^2)

where : Cal\_Zero = Energy Calibration Zero  
 e1 = Energy Calibration Slope  
 e2 = Energy Calibration Quadratic  
 C = Channel

Instrument : CHAMBER 113  
 Detector : 45-111B4  
 Calibration Date/Time : 17-SEP-2009 15:08:33  
 Calibration Source Id : AESS-001

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.774
CM-244	4320A	2/28/10	5795.020	5794.950

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2386.732  
 Energy Calibration Slope : 5.009326  
 Energy Calibration Quadratic : 2.6770448E-04  
 Energy Calibration Range : 7797.000

Instrument : CHAMBER 114  
 Detector : 78258  
 Calibration Date/Time : 17-SEP-2009 15:08:44  
 Calibration Source Id : AESS-007

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.722
NP-237	4341	2/28/10	4768.800	4768.568
CM-244	4320A	2/28/10	5795.020	5794.894

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2339.893  
 Energy Calibration Slope : 4.993507  
 Energy Calibration Quadratic : 2.3911390E-04  
 Energy Calibration Range : 7704.000

Instrument : CHAMBER 115  
 Detector : 45-132FF4  
 Calibration Date/Time : 17-SEP-2009 15:08:54  
 Calibration Source Id : AESS-002

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5794.872

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2361.262  
 Energy Calibration Slope : 5.000648  
 Energy Calibration Quadratic : 2.6309560E-04  
 Energy Calibration Range : 7758.000

Instrument : CHAMBER 116  
 Detector : 45-132FF2  
 Calibration Date/Time : 17-SEP-2009 15:09:06  
 Calibration Source Id : AESS-008  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2359.730  
 Energy Calibration Slope : 4.985509  
 Energy Calibration Quadratic : 2.6726534E-04  
 Energy Calibration Range : 7745.000

Instrument : CHAMBER 117  
 Detector : 33450  
 Calibration Date/Time : 17-SEP-2009 15:09:16  
 Calibration Source Id : AESS-003  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.491  
 NP-237 4341 2/28/10 4768.800 4768.339  
 CM-244 4320A 2/28/10 5795.020 5794.819  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2385.651  
 Energy Calibration Slope : 4.970261  
 Energy Calibration Quadratic : 2.8056922E-04  
 Energy Calibration Range : 7769.000

Instrument : CHAMBER 118  
 Detector : 75544  
 Calibration Date/Time : 17-SEP-2009 15:09:28  
 Calibration Source Id : AESS-009  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2346.819  
 Energy Calibration Slope : 4.967181  
 Energy Calibration Quadratic : 2.8012006E-04  
 Energy Calibration Range : 7727.000

Instrument : CHAMBER 119  
 Detector : 74429  
 Calibration Date/Time : 2-FEB-2009 15:15:38  
 Calibration Source Id : AESS-004  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3112.902  
 NP-237 4341 2/28/10 4768.800 4669.281  
 CM-244 4320A 2/28/10 5795.020 5706.875  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2437.949  
 Energy Calibration Slope : 5.036866  
 Energy Calibration Quadratic :  
 Energy Calibration Range : 7596.000

Instrument : CHAMBER 120  
 Detector : 74430  
 Calibration Date/Time : 17-SEP-2009 15:09:40  
 Calibration Source Id : AESS-010  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.710  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2314.428  
 Energy Calibration Slope : 4.966161  
 Energy Calibration Quadratic : 2.5640638E-04  
 Energy Calibration Range : 7669.000

Instrument : CHAMBER 121  
 Detector : 75545  
 Calibration Date/Time : 17-SEP-2009 15:09:49  
 Calibration Source Id : AESS-005  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2338.861  
 Energy Calibration Slope : 4.942947  
 Energy Calibration Quadratic : 2.9029930E-04  
 Energy Calibration Range : 7705.000

Instrument : CHAMBER 122  
 Detector : 75546  
 Calibration Date/Time : 17-SEP-2009 15:09:59  
 Calibration Source Id : AESS-011

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5794.807

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2335.373  
 Energy Calibration Slope : 4.957498  
 Energy Calibration Quadratic : 2.7508504E-04  
 Energy Calibration Range : 7700.000

Instrument : CHAMBER 123  
 Detector : 45-142V3  
 Calibration Date/Time : 17-SEP-2009 15:10:08  
 Calibration Source Id : AESS-006

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.112

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2378.713  
 Energy Calibration Slope : 4.974333  
 Energy Calibration Quadratic : 2.5756090E-04  
 Energy Calibration Range : 7743.000

Instrument : CHAMBER 124  
 Detector : 45-142V2  
 Calibration Date/Time : 17-SEP-2009 15:10:17  
 Calibration Source Id : AESS-012

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.748
NP-237	4341	2/28/10	4768.800	4768.555
CM-244	4320A	2/28/10	5795.020	5794.792

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2392.695  
 Energy Calibration Slope : 5.013852  
 Energy Calibration Quadratic : 2.6642549E-04  
 Energy Calibration Range : 7806.000



Instrument : CHAMBER 125  
 Detector : 75547  
 Calibration Date/Time : 17-SEP-2009 15:10:26  
 Calibration Source Id : AESS-013

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.724
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2346.597  
 Energy Calibration Slope : 4.937986  
 Energy Calibration Quadratic : 2.8199228E-04  
 Energy Calibration Range : 7699.000

Instrument : CHAMBER 126  
 Detector : 75548  
 Calibration Date/Time : 17-SEP-2009 15:10:43  
 Calibration Source Id : AESS-019

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.630
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2351.075  
 Energy Calibration Slope : 5.037023  
 Energy Calibration Quadratic : 1.9564512E-04  
 Energy Calibration Range : 7714.000

Instrument : CHAMBER 127  
 Detector : 78770  
 Calibration Date/Time : 17-SEP-2009 15:10:52  
 Calibration Source Id : AESS-014

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.015
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2339.960  
 Energy Calibration Slope : 4.959275  
 Energy Calibration Quadratic : 2.7139953E-04  
 Energy Calibration Range : 7703.000

Instrument : CHAMBER 128  
 Detector : 75549  
 Calibration Date/Time : 17-SEP-2009 15:11:01  
 Calibration Source Id : AESS-020

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.687
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2332.893  
 Energy Calibration Slope : 5.000373  
 Energy Calibration Quadratic : 2.3169331E-04  
 Energy Calibration Range : 7696.000

Instrument : CHAMBER 129  
 Detector : 76227  
 Calibration Date/Time : 17-SEP-2009 15:11:11  
 Calibration Source Id : AESS-015

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.775
NP-237	4341	2/28/10	4768.800	4768.764
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2349.422  
 Energy Calibration Slope : 4.954164  
 Energy Calibration Quadratic : 2.6775626E-04  
 Energy Calibration Range : 7703.000

Instrument : CHAMBER 130  
 Detector : 76228  
 Calibration Date/Time : 17-SEP-2009 15:11:20  
 Calibration Source Id : AESS-021

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.546
NP-237	4341	2/28/10	4768.800	4768.433
CM-244	4320A	2/28/10	5795.020	5794.777

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2341.580  
 Energy Calibration Slope : 4.993090  
 Energy Calibration Quadratic : 2.1626826E-04  
 Energy Calibration Range : 7681.000

Instrument : CHAMBER 131  
 Detector : 33448  
 Calibration Date/Time : 17-SEP-2009 15:11:29  
 Calibration Source Id : AESS-016  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.958  
 NP-237 4341 2/28/10 4768.800 4768.209  
 CM-244 4320A 2/28/10 5795.020 5794.532  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2411.500  
 Energy Calibration Slope : 4.968785  
 Energy Calibration Quadratic : 2.8956254E-04  
 Energy Calibration Range : 7803.000

Instrument : CHAMBER 132  
 Detector : 67579  
 Calibration Date/Time : 17-SEP-2009 15:11:39  
 Calibration Source Id : AESS-022  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.807  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2330.434  
 Energy Calibration Slope : 5.033886  
 Energy Calibration Quadratic : 2.1528341E-04  
 Energy Calibration Range : 7711.000

Instrument : CHAMBER 133  
 Detector : 76229  
 Calibration Date/Time : 17-SEP-2009 15:11:48  
 Calibration Source Id : AESS-017  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.772  
 NP-237 4341 2/28/10 4768.800 4768.493  
 CM-244 4320A 2/28/10 5795.020 5795.019  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2312.054  
 Energy Calibration Slope : 4.909425  
 Energy Calibration Quadratic : 2.5591909E-04  
 Energy Calibration Range : 7608.000

Instrument : CHAMBER 134  
 Detector : 76230  
 Calibration Date/Time : 17-SEP-2009 15:11:57  
 Calibration Source Id : AESS-023

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.690
CM-244	4320A	2/28/10	5795.020	5794.888

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2332.446  
 Energy Calibration Slope : 4.965801  
 Energy Calibration Quadratic : 2.4601555E-04  
 Energy Calibration Range : 7675.000

Instrument : CHAMBER 135  
 Detector : 64270  
 Calibration Date/Time : 17-SEP-2009 15:12:06  
 Calibration Source Id : AESS-018

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.697
NP-237	4341	2/28/10	4768.800	4768.428
CM-244	4320A	2/28/10	5795.020	5794.686

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2343.759  
 Energy Calibration Slope : 4.952811  
 Energy Calibration Quadratic : 2.7405450E-04  
 Energy Calibration Range : 7703.000

Instrument : CHAMBER 136  
 Detector : 68549  
 Calibration Date/Time : 17-SEP-2009 15:12:16  
 Calibration Source Id : AESS-024

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.402
NP-237	4341	2/28/10	4768.800	4769.943
CM-244	4320A	2/28/10	5795.020	5797.448

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2342.322  
 Energy Calibration Slope : 5.020517  
 Energy Calibration Quadratic : 2.2833873E-04  
 Energy Calibration Range : 7723.000

Instrument : CHAMBER 137  
 Detector : 64288  
 Calibration Date/Time : 16-SEP-2009 12:25:39  
 Calibration Source Id : AESS-025

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.831
NP-237	4341	2/28/10	4768.800	4768.466
CM-244	4320A	2/28/10	5795.020	5794.813

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2384.608  
 Energy Calibration Slope : 5.017363  
 Energy Calibration Quadratic : 3.1012692E-04  
 Energy Calibration Range : 7848.000

Instrument : CHAMBER 138  
 Detector : 65877  
 Calibration Date/Time : 16-SEP-2009 12:25:51  
 Calibration Source Id : AESS-031

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.721
NP-237	4341	2/28/10	4768.800	4768.624
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2381.507  
 Energy Calibration Slope : 4.981775  
 Energy Calibration Quadratic : 3.0701407E-04  
 Energy Calibration Range : 7805.000

Instrument : CHAMBER 139  
 Detector : 76231  
 Calibration Date/Time : 16-SEP-2009 12:26:02  
 Calibration Source Id : AESS-026

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.667
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2352.536  
 Energy Calibration Slope : 4.942561  
 Energy Calibration Quadratic : 2.9986945E-04  
 Energy Calibration Range : 7728.000

Instrument : CHAMBER 140  
 Detector : 78771  
 Calibration Date/Time : 16-SEP-2009 12:26:12  
 Calibration Source Id : AESS-032  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.880  
 NP-237 4341 2/28/10 4768.800 4768.746  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2344.410  
 Energy Calibration Slope : 4.964199  
 Energy Calibration Quadratic : 2.9030148E-04  
 Energy Calibration Range : 7732.000

Instrument : CHAMBER 141  
 Detector : 76232  
 Calibration Date/Time : 16-SEP-2009 12:26:23  
 Calibration Source Id : AESS-027  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3182.756  
 NP-237 4341 2/28/10 4768.800 4768.664  
 CM-244 4320A 2/28/10 5795.020 5794.921  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2359.530  
 Energy Calibration Slope : 4.949186  
 Energy Calibration Quadratic : 2.9451301E-04  
 Energy Calibration Range : 7736.000

Instrument : CHAMBER 142  
 Detector : 64261  
 Calibration Date/Time : 16-SEP-2009 12:26:33  
 Calibration Source Id : AESS-033  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.702  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2380.580  
 Energy Calibration Slope : 4.968856  
 Energy Calibration Quadratic : 3.0223309E-04  
 Energy Calibration Range : 7786.000

Instrument : CHAMBER 143  
 Detector : 65882  
 Calibration Date/Time : 16-SEP-2009 12:26:43  
 Calibration Source Id : AESS-028  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2353.411  
 Energy Calibration Slope : 4.964171  
 Energy Calibration Quadratic : 2.8231755E-04  
 Energy Calibration Range : 7733.000

Instrument : CHAMBER 144  
 Detector : 75551  
 Calibration Date/Time : 16-SEP-2009 12:26:53  
 Calibration Source Id : AESS-034  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.799  
 CM-244 4320A 2/28/10 5795.020 5795.045  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2347.296  
 Energy Calibration Slope : 4.959377  
 Energy Calibration Quadratic : 2.8099009E-04  
 Energy Calibration Range : 7720.000

Instrument : CHAMBER 145  
 Detector : 72526  
 Calibration Date/Time : 16-SEP-2009 12:27:03  
 Calibration Source Id : AESS-029  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.799  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2354.857  
 Energy Calibration Slope : 4.970427  
 Energy Calibration Quadratic : 2.8643355E-04  
 Energy Calibration Range : 7745.000

Instrument : CHAMBER 146  
 Detector : 72527  
 Calibration Date/Time : 16-SEP-2009 12:27:13  
 Calibration Source Id : AESS-035  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.019  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2349.628  
 Energy Calibration Slope : 4.953955  
 Energy Calibration Quadratic : 2.6576858E-04  
 Energy Calibration Range : 7701.000

Instrument : CHAMBER 147  
 Detector : 75550  
 Calibration Date/Time : 16-SEP-2009 12:27:23  
 Calibration Source Id : AESS-030  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2346.748  
 Energy Calibration Slope : 4.969914  
 Energy Calibration Quadratic : 2.5925279E-04  
 Energy Calibration Range : 7708.000

Instrument : CHAMBER 148  
 Detector : 74429  
 Calibration Date/Time : 16-SEP-2009 12:27:33  
 Calibration Source Id : AESS-036  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2346.190  
 Energy Calibration Slope : 4.957554  
 Energy Calibration Quadratic : 2.8058770E-04  
 Energy Calibration Range : 7717.000



Instrument : CHAMBER 149  
 Detector : 33449  
 Calibration Date/Time : 15-SEP-2009 13:29:50  
 Calibration Source Id : AESS-037

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.962
CM-244	4320A	2/28/10	5795.020	5795.120

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2390.249  
 Energy Calibration Slope : 4.945051  
 Energy Calibration Quadratic : 3.1025134E-04  
 Energy Calibration Range : 7779.000

Instrument : CHAMBER 150  
 Detector : 75552  
 Calibration Date/Time : 15-SEP-2009 13:30:04  
 Calibration Source Id : AESS-043

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2355.846  
 Energy Calibration Slope : 4.963627  
 Energy Calibration Quadratic : 2.8320536E-04  
 Energy Calibration Range : 7736.000

Instrument : CHAMBER 151  
 Detector : 75556  
 Calibration Date/Time : 15-SEP-2009 13:30:37  
 Calibration Source Id : AESS-038

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.876
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2346.769  
 Energy Calibration Slope : 4.917734  
 Energy Calibration Quadratic : 2.9527576E-04  
 Energy Calibration Range : 7692.000

Instrument : CHAMBER 152  
 Detector : 76222  
 Calibration Date/Time : 15-SEP-2009 13:30:48  
 Calibration Source Id : AESS-044

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.772
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2342.471  
 Energy Calibration Slope : 4.955277  
 Energy Calibration Quadratic : 2.6035175E-04  
 Energy Calibration Range : 7690.000

Instrument : CHAMBER 153  
 Detector : 76223  
 Calibration Date/Time : 15-SEP-2009 13:31:00  
 Calibration Source Id : AESS-039

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.192
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2333.990  
 Energy Calibration Slope : 4.951685  
 Energy Calibration Quadratic : 2.7959119E-04  
 Energy Calibration Range : 7698.000

Instrument : CHAMBER 154  
 Detector : 76224  
 Calibration Date/Time : 15-SEP-2009 13:31:26  
 Calibration Source Id : AESS-045

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2342.016  
 Energy Calibration Slope : 4.948280  
 Energy Calibration Quadratic : 2.8570730E-04  
 Energy Calibration Range : 7709.000

Instrument : CHAMBER 155  
 Detector : 75553  
 Calibration Date/Time : 15-SEP-2009 13:31:39  
 Calibration Source Id : AESS-040

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.184
NP-237	4341	2/28/10	4768.800	4768.936
CM-244	4320A	2/28/10	5795.020	5795.140

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2366.281  
 Energy Calibration Slope : 4.966718  
 Energy Calibration Quadratic : 2.9833001E-04  
 Energy Calibration Range : 7765.000

Instrument : CHAMBER 156  
 Detector : 75554  
 Calibration Date/Time : 15-SEP-2009 13:31:49  
 Calibration Source Id : AESS-046

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3189.446
NP-237	4341	2/28/10	4768.800	5162.066
CM-244	4320A	2/28/10	5795.020	5800.248

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2363.858  
 Energy Calibration Slope : 4.985206  
 Energy Calibration Quadratic : 2.8685082E-04  
 Energy Calibration Range : 7769.000

Instrument : CHAMBER 157  
 Detector : 75555  
 Calibration Date/Time : 15-SEP-2009 13:32:00  
 Calibration Source Id : AESS-041

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2360.555  
 Energy Calibration Slope : 4.963046  
 Energy Calibration Quadratic : 2.9731516E-04  
 Energy Calibration Range : 7754.000

Instrument : CHAMBER 158  
 Detector : 33451  
 Calibration Date/Time : 15-SEP-2009 13:32:11  
 Calibration Source Id : AESS-047

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2391.673  
 Energy Calibration Slope : 4.990663  
 Energy Calibration Quadratic : 3.2096857E-04  
 Energy Calibration Range : 7839.000

Instrument : CHAMBER 159  
 Detector : 76225  
 Calibration Date/Time : 15-SEP-2009 13:32:21  
 Calibration Source Id : AESS-042

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3182.819
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2354.535  
 Energy Calibration Slope : 4.988183  
 Energy Calibration Quadratic : 2.8453415E-04  
 Energy Calibration Range : 7761.000

Instrument : CHAMBER 160  
 Detector : 76226  
 Calibration Date/Time : 15-SEP-2009 13:32:31  
 Calibration Source Id : AESS-048

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.745
CM-244	4320A	2/28/10	5795.020	5794.943

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2354.507  
 Energy Calibration Slope : 5.015394  
 Energy Calibration Quadratic : 2.5826940E-04  
 Energy Calibration Range : 7761.000

## Subsection 2: Background Calibration

Instrument : CHAMBER 113  
 Detector : 45-111B4  
 Background Analysis Date/Time : 13-SEP-2009 12:07:37  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.706	3302.190	1.000000	0.3000000	100.0000	95.00000
NP-237	4433.295	4905.578	9.000000	2.700000	33.33334	95.00000
CM-244	5531.363	5884.629	11.00000	3.300000	30.15113	95.00000

Instrument : CHAMBER 114  
 Detector : 78258  
 Background Analysis Date/Time : 13-SEP-2009 12:07:42  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.034	3302.376	1.000000	0.3000000	100.0000	95.00000
NP-237	4432.616	4901.658	1.000000	0.3000000	100.0000	95.00000
CM-244	5533.073	5883.287	3.000000	0.9000000	57.73503	95.00000

Instrument : CHAMBER 115  
 Detector : 45-132FF4  
 Background Analysis Date/Time : 13-SEP-2009 12:07:47  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.454	3300.485	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.893	4906.309	7.000000	2.100000	37.79645	95.00000
CM-244	5530.846	5883.358	10.00000	3.000000	31.62278	95.00000

Instrument : CHAMBER 116  
 Detector : 45-132FF2  
 Background Analysis Date/Time : 13-SEP-2009 12:07:52  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.147	3301.366	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4433.104	4903.545	7.000000	2.100000	37.79645	95.00000
CM-244	5532.219	5884.159	18.00000	5.400000	23.57022	95.00000

Instrument : CHAMBER 117  
 Detector : 33450  
 Background Analysis Date/Time : 13-SEP-2009 12:07:56  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.160	3299.532	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.233	4904.181	9.000000	2.700000	33.33334	95.00000
CM-244	5532.536	5884.461	14.00000	4.200000	26.72612	95.00000

Instrument : CHAMBER 118  
 Detector : 75544  
 Background Analysis Date/Time : 13-SEP-2009 12:08:02  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.246	3300.695	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.648	4905.687	4.000000	1.200000	50.00000	95.00000
CM-244	5534.149	5886.128	10.00000	3.000000	31.62278	95.00000

Instrument : CHAMBER 119  
 Detector : 74429  
 Background Analysis Date/Time : 13-SEP-2009 12:08:06  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.004	3299.253	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4432.548	4906.013	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
CM-244	5530.584	5883.165	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000

Instrument : CHAMBER 120  
 Detector : 74430  
 Background Analysis Date/Time : 13-SEP-2009 12:08:12  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.533	3297.646	2.000000	0.6000000	70.71068	95.00000
NP-237	4435.084	4903.407	2.000000	0.6000000	70.71068	95.00000
CM-244	5534.300	5884.438	2.000000	0.6000000	70.71068	95.00000

Instrument : CHAMBER 121  
 Detector : 75545  
 Background Analysis Date/Time : 13-SEP-2009 12:08:17  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.369	3298.608	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.997	4903.847	3.000000	0.9000000	57.73503	95.00000
CM-244	5530.990	5882.362	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 122  
 Detector : 75546  
 Background Analysis Date/Time : 13-SEP-2009 12:08:22  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.526	3302.417	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4434.926	4903.828	13.00000	3.900000	27.73501	95.00000
CM-244	5530.663	5887.014	17.00000	5.100000	24.25356	95.00000

Instrument : CHAMBER 123  
 Detector : 45-142V3  
 Background Analysis Date/Time : 13-SEP-2009 12:08:27  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.415	3297.641	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4435.564	4904.117	4.000000	1.200000	50.00000	95.00000
CM-244	5535.344	5885.681	8.000000	2.400000	35.35534	95.00000

Instrument : CHAMBER 124  
 Detector : 45-142V2  
 Background Analysis Date/Time : 13-SEP-2009 12:08:33  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.039	3298.711	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4435.637	4902.902	5.000000	1.500000	44.72136	95.00000
CM-244	5534.267	5882.317	5.000000	1.500000	44.72136	95.00000

Instrument : CHAMBER 125  
 Detector : 75547  
 Background Analysis Date/Time : 13-SEP-2009 12:08:38  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.290	3300.040	2.000000	0.6000000	70.71068	95.00000
NP-237	4434.085	4901.751	2.000000	0.6000000	70.71068	95.00000
CM-244	5532.412	5882.738	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 126  
 Detector : 75548  
 Background Analysis Date/Time : 13-SEP-2009 12:08:44  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.846	3299.840	2.000000	0.6000000	70.71068	95.00000
NP-237	4433.552	4902.802	10.00000	3.000000	31.62278	95.00000
CM-244	5533.398	5882.628	5.000000	1.500000	44.72136	95.00000

Instrument : CHAMBER 127  
 Detector : 78770  
 Background Analysis Date/Time : 13-SEP-2009 12:08:49  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.252	3302.146	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.433	4903.142	2.000000	0.6000000	70.71068	95.00000
CM-244	5534.926	5885.739	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000

Instrument : CHAMBER 128  
 Detector : 75549  
 Background Analysis Date/Time : 13-SEP-2009 12:08:54  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.918	3301.506	2.000000	0.6000000	70.71068	95.00000
NP-237	4437.567	4901.469	5.000000	1.500000	44.72136	95.00000
CM-244	5532.764	5882.821	1.000000	0.3000000	100.0000	95.00000



Instrument : CHAMBER 129  
 Detector : 76227  
 Background Analysis Date/Time : 13-SEP-2009 12:08:58  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2987.942	3300.379	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.988	4903.888	7.000000	2.100000	37.79645	95.00000
CM-244	5534.503	5884.627	4.000000	1.200000	50.00000	95.00000

Instrument : CHAMBER 130  
 Detector : 76228  
 Background Analysis Date/Time : 13-SEP-2009 12:09:04  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.288	3298.075	3.000000	0.9000000	57.73503	95.00000
NP-237	4435.444	4902.612	12.00000	3.600000	28.86751	95.00000
CM-244	5530.953	5884.486	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000

Instrument : CHAMBER 131  
 Detector : 33448  
 Background Analysis Date/Time : 13-SEP-2009 12:09:09  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.775	3300.047	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.944	4905.225	5.000000	1.500000	44.72136	95.00000
CM-244	5534.242	5886.644	5.000000	1.500000	44.72136	95.00000

Instrument : CHAMBER 132  
 Detector : 67579  
 Background Analysis Date/Time : 13-SEP-2009 12:09:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.478	3299.760	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.728	4906.447	7.000000	2.100000	37.79645	95.00000
CM-244	5534.199	5884.992	3.000000	0.9000000	57.73503	95.00000

Instrument : CHAMBER 133  
 Detector : 76229  
 Background Analysis Date/Time : 13-SEP-2009 12:09:19  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.448	3299.164	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.532	4903.111	3.000000	0.9000000	57.73503	95.00000
CM-244	5532.731	5884.588	5.000000	1.500000	44.72136	95.00000

Instrument : CHAMBER 134  
 Detector : 76230  
 Background Analysis Date/Time : 13-SEP-2009 12:09:24  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.219	3300.010	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.624	4902.916	35.00000	10.50000	16.90309	95.00000
CM-244	5532.171	5886.589	7.000000	2.100000	37.79645	95.00000

Instrument : CHAMBER 135  
 Detector : 64270  
 Background Analysis Date/Time : 13-SEP-2009 12:09:28  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.256	3299.743	1.000000	0.3000000	100.0000	95.00000
NP-237	4436.015	4904.361	7.000000	2.100000	37.79645	95.00000
CM-244	5530.434	5886.345	10.00000	3.000000	31.62278	95.00000

Instrument : CHAMBER 136  
 Detector : 68549  
 Background Analysis Date/Time : 13-SEP-2009 12:09:33  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.690	3299.356	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4433.911	4904.417	19.00000	5.700000	22.94157	95.00000
CM-244	5532.210	5883.186	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 137  
 Detector : 64288  
 Background Analysis Date/Time : 13-SEP-2009 12:09:37  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.157	3297.781	3.000000	0.9000000	57.73503	95.00000
NP-237	4435.908	4901.616	4.000000	1.200000	50.00000	95.00000
CM-244	5533.626	5885.457	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 138  
 Detector : 65877  
 Background Analysis Date/Time : 13-SEP-2009 12:09:42  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.797	3298.359	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4433.795	4901.574	16.00000	4.800000	25.00000	95.00000
CM-244	5534.629	5884.088	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 139  
 Detector : 76231  
 Background Analysis Date/Time : 13-SEP-2009 12:09:46  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.097	3302.448	7.000000	2.100000	37.79645	95.00000
NP-237	4434.583	4904.027	9.000000	2.700000	33.33334	95.00000
CM-244	5532.194	5884.250	7.000000	2.100000	37.79645	95.00000

Instrument : CHAMBER 140  
 Detector : 78771  
 Background Analysis Date/Time : 13-SEP-2009 12:09:51  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.623	3298.088	3.000000	0.9000000	57.73503	95.00000
NP-237	4433.734	4904.340	8.000000	2.400000	35.35534	95.00000
CM-244	5533.806	5886.466	1.000000	0.3000000	100.0000	95.00000

Instrument : CHAMBER 141  
 Detector : 76232  
 Background Analysis Date/Time : 13-SEP-2009 12:09:56  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2987.803	3300.386	27.00000	8.100000	19.24501	95.00000
NP-237	4433.014	4902.508	26.00000	7.800000	19.61161	95.00000
CM-244	5530.609	5882.563	14.00000	4.200000	26.72612	95.00000

Instrument : CHAMBER 142  
 Detector : 64261  
 Background Analysis Date/Time : 13-SEP-2009 12:10:00  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.279	3300.003	3.000000	0.9000000	57.73503	95.00000
NP-237	4437.328	4903.684	13.00000	3.900000	27.73501	95.00000
CM-244	5534.720	5883.018	16.00000	4.800000	25.00000	95.00000

Instrument : CHAMBER 143  
 Detector : 65882  
 Background Analysis Date/Time : 13-SEP-2009 12:10:05  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.414	3301.724	9.000000	2.700000	33.33334	95.00000
NP-237	4436.178	4906.076	12.00000	3.600000	28.86751	95.00000
CM-244	5534.405	5886.338	8.000000	2.400000	35.35534	95.00000

Instrument : CHAMBER 144  
 Detector : 75551  
 Background Analysis Date/Time : 13-SEP-2009 12:10:09  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.731	3299.721	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4433.065	4902.473	11.00000	3.300000	30.15113	95.00000
CM-244	5535.430	5887.007	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 145  
 Detector : 72526  
 Background Analysis Date/Time : 13-SEP-2009 12:10:13  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.721	3299.421	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.677	4906.422	5.000000	1.500000	44.72136	95.00000
CM-244	5530.652	5883.277	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 146  
 Detector : 72527  
 Background Analysis Date/Time : 13-SEP-2009 12:10:17  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.088	3300.474	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.771	4903.488	6.000000	1.800000	40.82483	95.00000
CM-244	5533.810	5883.749	15.00000	4.500000	25.81989	95.00000

Instrument : CHAMBER 147  
 Detector : 75550  
 Background Analysis Date/Time : 13-SEP-2009 12:10:22  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.181	3300.391	5.000000	1.500000	44.72136	95.00000
NP-237	4433.176	4901.748	17.00000	5.100000	24.25356	95.00000
CM-244	5533.043	5883.438	7.000000	2.100000	37.79645	95.00000

Instrument : CHAMBER 148  
 Detector : 74429  
 Background Analysis Date/Time : 13-SEP-2009 12:10:27  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.384	3298.254	7.000000	2.100000	37.79645	95.00000
NP-237	4436.330	4905.591	5.000000	1.500000	44.72136	95.00000
CM-244	5533.038	5884.458	5.000000	1.500000	44.72136	95.00000

Instrument : CHAMBER 149  
 Detector : 33449  
 Background Analysis Date/Time : 13-SEP-2009 12:10:31  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.123	3300.525	5.000000	1.500000	44.72136	95.00000
NP-237	4433.492	4903.565	7.000000	2.100000	37.79645	95.00000
CM-244	5532.823	5885.611	8.000000	2.400000	35.35534	95.00000

Instrument : CHAMBER 150  
 Detector : 75552  
 Background Analysis Date/Time : 13-SEP-2009 12:10:36  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.795	3299.018	4.000000	1.200000	50.00000	95.00000
NP-237	4433.345	4903.215	6.000000	1.800000	40.82483	95.00000
CM-244	5531.531	5883.467	8.000000	2.400000	35.35534	95.00000

Instrument : CHAMBER 151  
 Detector : 75556  
 Background Analysis Date/Time : 13-SEP-2009 12:10:41  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.065	3301.859	4.000000	1.200000	50.00000	95.00000
NP-237	4433.320	4905.527	3.000000	0.9000000	57.73503	95.00000
CM-244	5530.408	5885.912	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 152  
 Detector : 76222  
 Background Analysis Date/Time : 13-SEP-2009 12:10:46  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.057	3298.427	2.000000	0.6000000	70.71068	95.00000
NP-237	4433.408	4906.063	4.000000	1.200000	50.00000	95.00000
CM-244	5530.659	5885.565	7.000000	2.100000	37.79645	95.00000

Instrument : CHAMBER 153  
 Detector : 76223  
 Background Analysis Date/Time : 13-SEP-2009 12:10:51  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.484	3300.080	6.000000	1.800000	40.82483	95.00000
NP-237	4437.092	4905.894	12.000000	3.600000	28.86751	95.00000
CM-244	5532.708	5883.766	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 154  
 Detector : 76224  
 Background Analysis Date/Time : 13-SEP-2009 12:10:55  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.121	3297.561	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4434.389	4903.288	1.000000	0.3000000	100.0000	95.00000
CM-244	5530.382	5887.013	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 155  
 Detector : 75553  
 Background Analysis Date/Time : 13-SEP-2009 12:11:00  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.782	3300.412	1.000000	0.3000000	100.0000	95.00000
NP-237	4437.153	4903.167	6.000000	1.800000	40.82483	95.00000
CM-244	5533.649	5886.970	10.00000	3.000000	31.62278	95.00000

Instrument : CHAMBER 156  
 Detector : 75554  
 Background Analysis Date/Time : 13-SEP-2009 12:11:05  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.491	3301.031	8.000000	2.400000	35.35534	95.00000
NP-237	4435.135	4901.821	15.00000	4.500000	25.81989	95.00000
CM-244	5532.917	5886.438	4.000000	1.200000	50.00000	95.00000

Instrument : CHAMBER 157  
 Detector : 75555  
 Background Analysis Date/Time : 13-SEP-2009 12:11:09  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.619	3299.042	2.000000	0.6000000	70.71068	95.00000
NP-237	4434.971	4905.888	4.000000	1.200000	50.00000	95.00000
CM-244	5530.610	5883.642	4.000000	1.200000	50.00000	95.00000

Instrument : CHAMBER 158  
 Detector : 33451  
 Background Analysis Date/Time : 13-SEP-2009 12:11:14  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.107	3300.392	6.000000	1.800000	40.82483	95.00000
NP-237	4434.046	4903.553	8.000000	2.400000	35.35534	95.00000
CM-244	5533.886	5884.921	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 159  
 Detector : 76225  
 Background Analysis Date/Time : 13-SEP-2009 12:11:19  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2987.563	3302.370	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4437.078	4903.944	7.000000	2.100000	37.79645	95.00000
CM-244	5535.224	5883.443	3.000000	0.9000000	57.73503	95.00000

Instrument : CHAMBER 160  
 Detector : 76226  
 Background Analysis Date/Time : 13-SEP-2009 12:11:23  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.547	3301.417	2.000000	0.6000000	70.71068	95.00000
NP-237	4433.329	4905.681	15.00000	4.500000	25.81989	95.00000
CM-244	5531.326	5884.399	7.000000	2.100000	37.79645	95.00000



### Subsection 3: Efficiency Calibration

Instrument : CHAMBER 113  
 Detector : 45-111B4  
 Standard ID : AESS-001  
 Standard Reference Date : 20-FEB-2008 09:54:53  
 Calibration Analysis Date/Time : 17-SEP-2009 07:22:34  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:08:33  
 Average Efficiency : 0.2493664  
 Average Efficiency Error : 6.8753385E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	208.6698	28-FEB-2010	2991.706	3302.190	15200.00	0.2463616	1.0587734E-02	67.05293
NP-237	171.0024	28-FEB-2010	4433.295	4905.578	12844.00	0.2503200	1.2709484E-02	68.82748
CM-244	158.1060	28-FEB-2010	5531.363	5884.629	11294.00	0.2528249	1.2863314E-02	69.69121

Instrument : CHAMBER 114  
 Detector : 78258  
 Standard ID : AESS-007  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 17-SEP-2009 07:22:42  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:08:44  
 Average Efficiency : 0.2549134  
 Average Efficiency Error : 7.0137801E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.7342	28-FEB-2010	2988.034	3302.376	15415.00	0.2522229	1.0836960E-02	47.39108
NP-237	205.0260	28-FEB-2010	4432.616	4901.658	15874.00	0.2580762	1.3065383E-02	60.20995
CM-244	199.6806	28-FEB-2010	5533.073	5883.287	14411.00	0.2556491	1.2958678E-02	47.07045

Instrument : CHAMBER 115  
 Detector : 45-132FF4  
 Standard ID : AESS-002  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 17-SEP-2009 07:22:48  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:08:54  
 Average Efficiency : 0.2607451  
 Average Efficiency Error : 7.1741594E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.1144	28-FEB-2010	2990.454	3300.485	15582.00	0.2633568	1.1313187E-02	59.06649
NP-237	200.4990	28-FEB-2010	4434.893	4906.309	15600.00	0.2593181	1.3131134E-02	67.99342
CM-244	196.5558	28-FEB-2010	5530.846	5883.358	14362.00	0.2586598	1.3111949E-02	66.45667

Instrument : CHAMBER 116  
 Detector : 45-132FF2  
 Standard ID : AESS-008  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 17-SEP-2009 07:22:54  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:09:06  
 Average Efficiency : 0.2642209  
 Average Efficiency Error : 7.2657783E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.0418	28-FEB-2010	2992.147	3301.366	15928.00	0.2614976	1.1229084E-02	58.63169
NP-237	209.2716	28-FEB-2010	4433.104	4903.545	16584.00	0.2641209	1.3364404E-02	67.71608
CM-244	199.6488	28-FEB-2010	5532.219	5884.159	15127.00	0.2683146	1.3592103E-02	63.73655

Instrument : CHAMBER 117  
 Detector : 33450  
 Standard ID : AESS-003  
 Standard Reference Date : 15-FEB-2008 13:12:27  
 Calibration Analysis Date/Time : 17-SEP-2009 07:22:59  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:09:16  
 Average Efficiency : 0.2539330  
 Average Efficiency Error : 6.9886767E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.9740	28-FEB-2010	2991.160	3299.532	15096.00	0.2515729	1.0813041E-02	72.94815
NP-237	203.2080	28-FEB-2010	4434.233	4904.181	15475.00	0.2538008	1.2853066E-02	68.32410
CM-244	197.2236	28-FEB-2010	5532.536	5884.461	14342.00	0.2575089	1.3053890E-02	66.10744

Instrument : CHAMBER 118  
 Detector : 75544  
 Standard ID : AESS-009  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:06  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:09:28  
 Average Efficiency : 0.2562016  
 Average Efficiency Error : 7.0496872E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.3736	28-FEB-2010	2992.246	3300.695	15488.00	0.2575730	1.1065898E-02	48.08698
NP-237	204.0192	28-FEB-2010	4435.648	4905.687	15474.00	0.2527997	1.2802343E-02	51.47660
CM-244	197.2128	28-FEB-2010	5534.149	5886.128	14364.00	0.2578340	1.3070064E-02	51.26923

Instrument : CHAMBER 119  
 Detector : 74429  
 Standard ID : AESS-004  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:12  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 2-FEB-2009 15:15:38  
 Average Efficiency : 0.2936279  
 Average Efficiency Error : 1.2630888E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.1222	28-FEB-2010	2992.004	3299.253	14305.00	0.2936279	1.2630888E-02	65.91196
NP-237	204.2586	28-FEB-2010	4432.548	4906.013	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CM-244	198.8100	28-FEB-2010	5530.584	5883.165	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00

Instrument : CHAMBER 120  
 Detector : 74430  
 Standard ID : AESS-010  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:19  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:09:40  
 Average Efficiency : 0.2607642  
 Average Efficiency Error : 7.1738800E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.0008	28-FEB-2010	2989.533	3297.646	15530.00	0.2600539	1.1171980E-02	51.65312
NP-237	202.9926	28-FEB-2010	4435.084	4903.407	15890.00	0.2609192	1.3209156E-02	58.42772
CM-244	196.2330	28-FEB-2010	5534.300	5884.438	14492.00	0.2616084	1.3259737E-02	53.52900

Instrument : CHAMBER 121  
 Detector : 75545  
 Standard ID : AESS-005  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:26  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:09:49  
 Average Efficiency : 0.2451099  
 Average Efficiency Error : 6.7468924E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	210.7452	28-FEB-2010	2991.369	3298.608	14990.00	0.2406018	1.0342800E-02	48.96049
NP-237	209.5938	28-FEB-2010	4434.997	4903.847	15464.00	0.2459217	1.2454119E-02	62.72179
CM-244	202.7478	28-FEB-2010	5530.990	5882.362	14372.00	0.2510890	1.2728020E-02	56.59771

Instrument : CHAMBER 122  
 Detector : 75546  
 Standard ID : AESS-011  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:33  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:09:59  
 Average Efficiency : 0.2511206  
 Average Efficiency Error : 6.9071823E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	212.8284	28-FEB-2010	2989.526	3302.417	15637.00	0.2485339	1.0675786E-02	50.53908
NP-237	214.4868	28-FEB-2010	4434.926	4903.828	16238.00	0.2522937	1.2769196E-02	58.55772
CM-244	208.4184	28-FEB-2010	5530.663	5887.014	14930.00	0.2536814	1.2853005E-02	49.92265

Instrument : CHAMBER 123  
 Detector : 45-142V3  
 Standard ID : AESS-006  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:40  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:10:08  
 Average Efficiency : 0.2596290  
 Average Efficiency Error : 7.1429913E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.6952	28-FEB-2010	2989.415	3297.641	15549.00	0.2582173	1.1092825E-02	65.43886
NP-237	204.7038	28-FEB-2010	4435.564	4904.117	15822.00	0.2576210	1.3042886E-02	67.03554
CM-244	195.0060	28-FEB-2010	5535.344	5885.681	14523.00	0.2637896	1.3369960E-02	69.14881

Instrument : CHAMBER 124  
 Detector : 45-142V2  
 Standard ID : AESS-012  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:47  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:10:17  
 Average Efficiency : 0.2573053  
 Average Efficiency Error : 7.0782932E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.2200	28-FEB-2010	2988.039	3298.711	15522.00	0.2546119	1.0938271E-02	67.72288
NP-237	205.8930	28-FEB-2010	4435.637	4902.902	16168.00	0.2617298	1.3247415E-02	71.34655
CM-244	203.1954	28-FEB-2010	5534.267	5882.317	14734.00	0.2568478	1.3015599E-02	72.65984

Instrument : CHAMBER 125  
 Detector : 75547  
 Standard ID : AESS-013  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 17-SEP-2009 07:23:54  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:10:26  
 Average Efficiency : 0.2582467  
 Average Efficiency Error : 7.1037016E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.6544	28-FEB-2010	2988.290	3300.040	15695.00	0.2606819	1.1196902E-02	49.19345
NP-237	210.2526	28-FEB-2010	4434.085	4901.751	16039.00	0.2542721	1.2871174E-02	57.62983
CM-244	201.9108	28-FEB-2010	5532.412	5882.738	14766.00	0.2590335	1.3125989E-02	51.15325

Instrument : CHAMBER 126  
 Detector : 75548  
 Standard ID : AESS-019  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:03  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:10:43  
 Average Efficiency : 0.2528757  
 Average Efficiency Error : 6.9609745E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.6468	28-FEB-2010	2988.846	3299.840	14908.00	0.2463797	1.0592219E-02	51.21568
NP-237	202.9140	28-FEB-2010	4433.552	4902.802	15759.00	0.2588291	1.3104737E-02	56.16846
CM-244	199.3140	28-FEB-2010	5533.398	5882.628	14458.00	0.2568124	1.3017087E-02	52.26496

Instrument : CHAMBER 127  
 Detector : 78770  
 Standard ID : AESS-014  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:09  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:10:52  
 Average Efficiency : 0.2474696  
 Average Efficiency Error : 6.8085734E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	214.7088	28-FEB-2010	2989.252	3302.146	15471.00	0.2437071	1.0470388E-02	48.16148
NP-237	211.7160	28-FEB-2010	4434.433	4903.142	15929.00	0.2507826	1.2695607E-02	58.40179
CM-244	207.3882	28-FEB-2010	5534.926	5885.739	14624.00	0.2496737	1.2653272E-02	52.79491

Instrument : CHAMBER 128  
 Detector : 75549  
 Standard ID : AESS-020  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:16  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:11:01  
 Average Efficiency : 0.2534627  
 Average Efficiency Error : 6.9763800E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	205.5870	28-FEB-2010	2991.918	3301.506	15064.00	0.2478480	1.0653354E-02	48.72564
NP-237	203.4984	28-FEB-2010	4437.567	4901.469	15680.00	0.2568161	1.3003596E-02	61.32889
CM-244	197.1096	28-FEB-2010	5532.764	5882.821	14387.00	0.2585539	1.3106194E-02	50.94863

Instrument : CHAMBER 129  
 Detector : 76227  
 Standard ID : AESS-015  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:21  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:11:11  
 Average Efficiency : 0.2630869  
 Average Efficiency Error : 7.2373999E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.0270	28-FEB-2010	2987.942	3300.379	15637.00	0.2592492	1.1136069E-02	51.14825
NP-237	200.6460	28-FEB-2010	4435.988	4903.888	16067.00	0.2668864	1.3509459E-02	61.16219
CM-244	195.9270	28-FEB-2010	5534.503	5884.627	14653.00	0.2649124	1.3425237E-02	55.22726

Instrument : CHAMBER 130  
 Detector : 76228  
 Standard ID : AESS-021  
 Standard Reference Date : 19-FEB-2008 15:31:52  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:25  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:11:20  
 Average Efficiency : 0.2483380  
 Average Efficiency Error : 6.8345908E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	208.3608	28-FEB-2010	2989.288	3298.075	15085.00	0.2448552	1.0524444E-02	49.62173
NP-237	210.1548	28-FEB-2010	4435.444	4902.612	15873.00	0.2517098	1.2743165E-02	56.97301
CM-244	200.7390	28-FEB-2010	5530.953	5884.486	14177.00	0.2500546	1.2677893E-02	51.59090

Instrument : CHAMBER 131  
 Detector : 33448  
 Standard ID : AESS-016  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:30  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:11:29  
 Average Efficiency : 0.2501664  
 Average Efficiency Error : 6.8896543E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.0534	28-FEB-2010	2991.775	3300.047	14580.00	0.2416933	1.0394993E-02	94.70427
NP-237	199.3962	28-FEB-2010	4434.944	4905.225	15408.00	0.2575527	1.3043756E-02	97.00230
CM-244	198.6402	28-FEB-2010	5534.242	5886.644	14360.00	0.2560634	1.2980316E-02	84.26888

Instrument : CHAMBER 132  
 Detector : 67579  
 Standard ID : AESS-022  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:36  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:11:39  
 Average Efficiency : 0.2502582  
 Average Efficiency Error : 6.8874490E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	209.6724	28-FEB-2010	2988.478	3299.760	15157.00	0.2445240	1.0509308E-02	47.44493
NP-237	206.8830	28-FEB-2010	4435.728	4906.447	15902.00	0.2561820	1.2969248E-02	59.39411
CM-244	203.0208	28-FEB-2010	5534.199	5884.992	14501.00	0.2530044	1.2823543E-02	54.36437

Instrument : CHAMBER 133  
 Detector : 76229  
 Standard ID : AESS-017  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:41  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:11:48  
 Average Efficiency : 0.2438080  
 Average Efficiency Error : 6.7106839E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	210.0798	28-FEB-2010	2989.448	3299.164	15021.00	0.2418610	1.0396539E-02	54.98614
NP-237	208.5846	28-FEB-2010	4434.532	4903.111	15484.00	0.2474312	1.2530360E-02	61.05153
CM-244	205.5828	28-FEB-2010	5532.731	5884.588	14106.00	0.2430393	1.2323108E-02	54.34287

Instrument : CHAMBER 134  
 Detector : 76230  
 Standard ID : AESS-023  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:46  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:11:57  
 Average Efficiency : 0.2444534  
 Average Efficiency Error : 6.7299884E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	207.4764	28-FEB-2010	2992.219	3300.010	14779.00	0.2409492	1.0360401E-02	46.56962
NP-237	207.4998	28-FEB-2010	4435.624	4902.916	15337.00	0.2462044	1.2469973E-02	55.22544
CM-244	199.8804	28-FEB-2010	5532.171	5886.589	13986.00	0.2478311	1.2567575E-02	48.04740

Instrument : CHAMBER 135  
 Detector : 64270  
 Standard ID : AESS-018  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:53  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:12:06  
 Average Efficiency : 0.2526507  
 Average Efficiency Error : 6.9530043E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.1856	28-FEB-2010	2992.256	3299.743	15152.00	0.2534960	1.0894979E-02	56.63107
NP-237	208.8990	28-FEB-2010	4436.015	4904.361	15645.00	0.2496088	1.2639027E-02	67.14091
CM-244	198.1458	28-FEB-2010	5530.434	5886.345	14246.00	0.2546374	1.2909472E-02	60.82066

Instrument : CHAMBER 136  
 Detector : 68549  
 Standard ID : AESS-024  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 17-SEP-2009 07:24:58  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 17-SEP-2009 15:12:16  
 Average Efficiency : 0.2485794  
 Average Efficiency Error : 6.8427753E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.5218	28-FEB-2010	2988.690	3299.356	14903.00	0.2476970	1.0648914E-02	56.69555
NP-237	205.6662	28-FEB-2010	4433.911	4904.417	15511.00	0.2513022	1.2726229E-02	83.91869
CM-244	198.3060	28-FEB-2010	5532.210	5883.186	13838.00	0.2471603	1.2535414E-02	66.08641



Instrument : CHAMBER 137  
 Detector : 64288  
 Standard ID : AESS-025  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 16-SEP-2009 07:03:27  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:25:39  
 Average Efficiency : 0.2528386  
 Average Efficiency Error : 6.9739525E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	195.5670	28-FEB-2010	2991.157	3297.781	14785.00	0.2557061	1.0994853E-02	66.23147
NP-237	167.9916	28-FEB-2010	4435.908	4901.616	12861.00	0.2551677	1.2955310E-02	79.15361
CM-244	157.2432	28-FEB-2010	5533.626	5885.457	10964.00	0.2468996	1.2568292E-02	71.74486

Instrument : CHAMBER 138  
 Detector : 65877  
 Standard ID : AESS-031  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 16-SEP-2009 07:03:32  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:25:51  
 Average Efficiency : 0.2560047  
 Average Efficiency Error : 7.0619099E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	193.6650	28-FEB-2010	2988.797	3298.359	14674.00	0.2562743	1.1020770E-02	57.98399
NP-237	162.9186	28-FEB-2010	4433.795	4901.574	12708.00	0.2599091	1.3198568E-02	62.78986
CM-244	153.1968	28-FEB-2010	5534.629	5884.088	10904.00	0.2519520	1.2826724E-02	60.43048

Instrument : CHAMBER 139  
 Detector : 76231  
 Standard ID : AESS-026  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 16-SEP-2009 07:03:37  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:26:02  
 Average Efficiency : 0.2492872  
 Average Efficiency Error : 7.3094456E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	199.5072	28-FEB-2010	2990.097	3302.448	14822.00	0.2512630	1.2732445E-02	51.16375
NP-237	168.0294	28-FEB-2010	4434.583	4904.027	12686.00	0.2516089	1.2777339E-02	56.09538
CM-244	160.5822	28-FEB-2010	5532.194	5884.250	11118.00	0.2451757	1.2477465E-02	51.18374

Instrument : CHAMBER 140  
 Detector : 78771  
 Standard ID : AESS-032  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 16-SEP-2009 07:03:42  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:26:12  
 Average Efficiency : 0.2526492  
 Average Efficiency Error : 6.9693825E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	195.2364	28-FEB-2010	2989.623	3298.088	14531.00	0.2517187	1.0826853E-02	46.10829
NP-237	165.9822	28-FEB-2010	4433.734	4904.340	12513.00	0.2512438	1.2761484E-02	54.69451
CM-244	153.7938	28-FEB-2010	5533.806	5886.466	11096.00	0.2554495	1.3000681E-02	47.20534

Instrument : CHAMBER 141  
 Detector : 76232  
 Standard ID : AESS-027  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 16-SEP-2009 07:03:47  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:26:23  
 Average Efficiency : 0.2547455  
 Average Efficiency Error : 7.4726613E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	193.4238	28-FEB-2010	2987.803	3300.386	14389.00	0.2514884	1.2749074E-02	55.20152
NP-237	161.6154	28-FEB-2010	4433.014	4902.508	12459.00	0.2568074	1.3045154E-02	58.63324
CM-244	148.1754	28-FEB-2010	5530.609	5882.563	10718.00	0.2560930	1.3041621E-02	54.14653

Instrument : CHAMBER 142  
 Detector : 64261  
 Standard ID : AESS-033  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 16-SEP-2009 07:03:52  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:26:33  
 Average Efficiency : 0.2603842  
 Average Efficiency Error : 7.1830968E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	192.4158	28-FEB-2010	2991.279	3300.003	14554.00	0.2558129	1.1002630E-02	53.68588
NP-237	161.7816	28-FEB-2010	4437.328	4903.684	12703.00	0.2616512	1.3287083E-02	68.08553
CM-244	147.2670	28-FEB-2010	5534.720	5883.018	11068.00	0.2659896	1.3537915E-02	58.50507

Instrument : CHAMBER 143  
 Detector : 65882  
 Standard ID : AESS-028  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 16-SEP-2009 07:03:57  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:26:43  
 Average Efficiency : 0.2438162  
 Average Efficiency Error : 7.1521485E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	199.6542	28-FEB-2010	2988.414	3301.724	14343.00	0.2429526	1.2316748E-02	45.85791
NP-237	168.1992	28-FEB-2010	4436.178	4906.076	12465.00	0.2469572	1.2544546E-02	55.41743
CM-244	156.7614	28-FEB-2010	5534.405	5886.338	10698.00	0.2416553	1.2306704E-02	49.25873

Instrument : CHAMBER 144  
 Detector : 75551  
 Standard ID : AESS-034  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 16-SEP-2009 07:04:02  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:26:53  
 Average Efficiency : 0.2432079  
 Average Efficiency Error : 6.7124735E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.5488	28-FEB-2010	2991.731	3299.721	14149.00	0.2386236	1.0268736E-02	49.42162
NP-237	167.2962	28-FEB-2010	4433.065	4902.473	12333.00	0.2456661	1.2481030E-02	52.43185
CM-244	154.4388	28-FEB-2010	5535.430	5887.007	10803.00	0.2476103	1.2607776E-02	51.75169

Instrument : CHAMBER 145  
 Detector : 72526  
 Standard ID : AESS-029  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 16-SEP-2009 07:04:08  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:27:03  
 Average Efficiency : 0.2494907  
 Average Efficiency Error : 7.3155323E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	201.5742	28-FEB-2010	2990.721	3299.421	14837.00	0.2489683	1.2615955E-02	50.61446
NP-237	169.7700	28-FEB-2010	4435.677	4906.422	12664.00	0.2486207	1.2625882E-02	55.75652
CM-244	154.8234	28-FEB-2010	5530.652	5883.277	10970.00	0.2509164	1.2772597E-02	53.06380

Instrument : CHAMBER 146  
 Detector : 72527  
 Standard ID : AESS-035  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 16-SEP-2009 07:04:13  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:27:13  
 Average Efficiency : 0.2521794  
 Average Efficiency Error : 6.9540716E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	198.6666	28-FEB-2010	2988.088	3300.474	14792.00	0.2518262	1.0827903E-02	50.57500
NP-237	168.2934	28-FEB-2010	4435.771	4903.488	12795.00	0.2533910	1.2866129E-02	58.62805
CM-244	158.8128	28-FEB-2010	5533.810	5883.749	11284.00	0.2514743	1.2794847E-02	52.59344

Instrument : CHAMBER 147  
 Detector : 75550  
 Standard ID : AESS-030  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 16-SEP-2009 07:04:19  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:27:23  
 Average Efficiency : 0.2462009  
 Average Efficiency Error : 7.2221002E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	198.9792	28-FEB-2010	2992.181	3300.391	14151.00	0.2405333	1.2196311E-02	44.26603
NP-237	166.3758	28-FEB-2010	4433.176	4901.748	12552.00	0.2513769	1.2767726E-02	56.17089
CM-244	157.1856	28-FEB-2010	5533.043	5883.438	10973.00	0.2472064	1.2583700E-02	52.54537

Instrument : CHAMBER 148  
 Detector : 74429  
 Standard ID : AESS-036  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 16-SEP-2009 07:04:24  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 16-SEP-2009 12:27:33  
 Average Efficiency : 0.2474463  
 Average Efficiency Error : 6.8263425E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	201.3204	28-FEB-2010	2990.384	3298.254	14523.00	0.2439571	1.0493157E-02	54.37553
NP-237	167.4312	28-FEB-2010	4436.330	4905.591	12624.00	0.2512974	1.2762434E-02	58.03280
CM-244	156.4188	28-FEB-2010	5533.038	5884.458	10990.00	0.2487361	1.2661190E-02	52.85587

Instrument : CHAMBER 149  
 Detector : 33449  
 Standard ID : AESS-037  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:20  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:29:50  
 Average Efficiency : 0.2442746  
 Average Efficiency Error : 6.7418939E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.7372	28-FEB-2010	2988.123	3300.525	14041.00	0.2401365	1.0335403E-02	63.60672
NP-237	167.1294	28-FEB-2010	4433.492	4903.565	12391.00	0.2470920	1.2552506E-02	63.37567
CM-244	154.7664	28-FEB-2010	5532.823	5885.611	10826.00	0.2475891	1.2606204E-02	58.70196

Instrument : CHAMBER 150  
 Detector : 75552  
 Standard ID : AESS-043  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:25  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:30:04  
 Average Efficiency : 0.2497773  
 Average Efficiency Error : 6.8896711E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.7708	28-FEB-2010	2990.795	3299.018	14579.00	0.2492991	1.0722128E-02	50.95595
NP-237	168.7422	28-FEB-2010	4433.345	4903.215	12583.00	0.2485292	1.2622490E-02	60.02569
CM-244	156.3252	28-FEB-2010	5531.531	5883.467	11119.00	0.2517459	1.2811826E-02	53.55379

Instrument : CHAMBER 151  
 Detector : 75556  
 Standard ID : AESS-038  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:30  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:30:37  
 Average Efficiency : 0.2445973  
 Average Efficiency Error : 6.7483815E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.1408	28-FEB-2010	2991.065	3301.859	14594.00	0.2466028	1.0605961E-02	51.54713
NP-237	170.0886	28-FEB-2010	4433.320	4905.527	12551.00	0.2459524	1.2492075E-02	61.04260
CM-244	157.7460	28-FEB-2010	5530.408	5885.912	10724.00	0.2406166	1.2253285E-02	55.41215

Instrument : CHAMBER 152  
 Detector : 76222  
 Standard ID : AESS-044  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:36  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:30:48  
 Average Efficiency : 0.2467650  
 Average Efficiency Error : 6.8100104E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.4510	28-FEB-2010	2991.057	3298.427	14281.00	0.2483825	1.0686823E-02	51.43459
NP-237	166.6248	28-FEB-2010	4433.408	4906.063	12493.00	0.2498989	1.2693445E-02	55.87722
CM-244	155.8290	28-FEB-2010	5530.659	5885.565	10640.00	0.2416724	1.2308771E-02	51.92970

Instrument : CHAMBER 153  
 Detector : 76223  
 Standard ID : AESS-039  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:41  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:31:00  
 Average Efficiency : 0.2530614  
 Average Efficiency Error : 6.9837277E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	192.2418	28-FEB-2010	2992.484	3300.080	14284.00	0.2512709	1.0811096E-02	45.25198
NP-237	159.1506	28-FEB-2010	4437.092	4905.894	12330.00	0.2581708	1.3116390E-02	53.88176
CM-244	151.7142	28-FEB-2010	5532.708	5883.766	10746.00	0.2507173	1.2767147E-02	50.96059

Instrument : CHAMBER 154  
 Detector : 76224  
 Standard ID : AESS-045  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:46  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:31:26  
 Average Efficiency : 0.2566059  
 Average Efficiency Error : 7.0827994E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	186.9936	28-FEB-2010	2990.121	3297.561	14209.00	0.2569968	1.1058494E-02	47.64388
NP-237	160.8066	28-FEB-2010	4434.389	4903.288	12086.00	0.2505226	1.2731740E-02	51.56582
CM-244	145.8384	28-FEB-2010	5530.382	5887.013	10826.00	0.2627504	1.3378122E-02	46.75677

Instrument : CHAMBER 155  
 Detector : 75553  
 Standard ID : AESS-040  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:52  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:31:39  
 Average Efficiency : 0.2586447  
 Average Efficiency Error : 7.1315672E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.4828	28-FEB-2010	2991.782	3300.412	14971.00	0.2603490	1.1191908E-02	52.31090
NP-237	166.8174	28-FEB-2010	4437.153	4903.167	12889.00	0.2575112	1.3073887E-02	61.10300
CM-244	155.0100	28-FEB-2010	5533.649	5886.970	11275.00	0.2574479	1.3098875E-02	53.76326

Instrument : CHAMBER 156  
 Detector : 75554  
 Standard ID : AESS-046  
 Standard Reference Date : 19-FEB-2008 19:35:48  
 Calibration Analysis Date/Time : 15-SEP-2009 07:17:57  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:31:49  
 Average Efficiency : 0.2458351  
 Average Efficiency Error : 6.7870235E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.7474	28-FEB-2010	2991.491	3301.031	12844.31	0.2400144	1.0333307E-02	49.77089
NP-237	164.6658	28-FEB-2010	4435.135	4901.821	97.08801	0.2506796	1.2734897E-02	61.19961
CM-244	151.3824	28-FEB-2010	5532.917	5886.438	10151.71	0.0000000E+00	0.0000000E+00	52.61485

Instrument : CHAMBER 157  
 Detector : 75555  
 Standard ID : AESS-041  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 15-SEP-2009 07:18:03  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:32:00  
 Average Efficiency : 0.2474201  
 Average Efficiency Error : 6.8232059E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.9034	28-FEB-2010	2990.619	3299.042	14777.00	0.2450977	1.0538791E-02	51.15771
NP-237	171.2268	28-FEB-2010	4434.971	4905.888	12804.00	0.2492367	1.2655036E-02	55.90152
CM-244	159.5796	28-FEB-2010	5530.610	5883.642	11223.00	0.2489554	1.2667720E-02	51.75545

Instrument : CHAMBER 158  
 Detector : 33451  
 Standard ID : AESS-047  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 15-SEP-2009 07:18:08  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:32:11  
 Average Efficiency : 0.2493795  
 Average Efficiency Error : 6.8797250E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.4804	28-FEB-2010	2990.107	3300.392	14422.00	0.2469665	1.0623971E-02	68.44221
NP-237	168.3948	28-FEB-2010	4434.046	4903.553	12588.00	0.2491289	1.2652891E-02	70.67268
CM-244	154.6032	28-FEB-2010	5533.886	5884.921	11059.00	0.2531897	1.2886493E-02	68.82631

Instrument : CHAMBER 159  
 Detector : 76225  
 Standard ID : AESS-042  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 15-SEP-2009 07:18:13  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:32:21  
 Average Efficiency : 0.2508302  
 Average Efficiency Error : 6.9238753E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	188.7090	28-FEB-2010	2987.563	3302.370	14009.00	0.2510785	1.0806765E-02	45.91304
NP-237	159.6558	28-FEB-2010	4437.078	4903.944	12079.00	0.2521446	1.2814357E-02	56.71059
CM-244	150.5208	28-FEB-2010	5535.224	5883.443	10596.00	0.2491983	1.2692972E-02	51.46926

Instrument : CHAMBER 160  
 Detector : 76226  
 Standard ID : AESS-048  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 15-SEP-2009 07:18:19  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 15-SEP-2009 13:32:31  
 Average Efficiency : 0.2441046  
 Average Efficiency Error : 6.7402101E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	191.8350	28-FEB-2010	2990.547	3301.417	13828.00	0.2437831	1.0495425E-02	76.67180
NP-237	161.5530	28-FEB-2010	4433.329	4905.681	11940.00	0.2462660	1.2518029E-02	87.79373
CM-244	151.1856	28-FEB-2010	5531.326	5884.399	10356.00	0.2424449	1.2354254E-02	77.67188



## Subsection 1: Energy Calibration

The Energy Calibration energy=Cal\_Zero+(e1\*C)+(e2\*C^2)

where : Cal\_Zero = Energy Calibration Zero  
 e1 = Energy Calibration Slope  
 e2 = Energy Calibration Quadratic  
 C = Channel

Instrument : CHAMBER 161  
 Detector : 70321  
 Calibration Date/Time : 21-SEP-2009 14:45:33  
 Calibration Source Id : AESS-001

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.798
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2376.675  
 Energy Calibration Slope : 4.903314  
 Energy Calibration Quadratic : 3.3071014E-04  
 Energy Calibration Range : 7744.000

Instrument : CHAMBER 162  
 Detector : 70323  
 Calibration Date/Time : 21-SEP-2009 14:45:43  
 Calibration Source Id : AESS-007

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2372.249  
 Energy Calibration Slope : 4.921350  
 Energy Calibration Quadratic : 3.0858925E-04  
 Energy Calibration Range : 7735.000

Instrument : CHAMBER 163  
 Detector : 70324  
 Calibration Date/Time : 21-SEP-2009 14:46:06  
 Calibration Source Id : AESS-002

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2383.315  
 Energy Calibration Slope : 4.921310  
 Energy Calibration Quadratic : 3.3110939E-04  
 Energy Calibration Range : 7770.000

Instrument : CHAMBER 164  
 Detector : 70325  
 Calibration Date/Time : 21-SEP-2009 14:46:16  
 Calibration Source Id : AESS-008

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2381.492  
 Energy Calibration Slope : 4.935361  
 Energy Calibration Quadratic : 3.1875577E-04  
 Energy Calibration Range : 7770.000

Instrument : CHAMBER 165  
 Detector : 72544  
 Calibration Date/Time : 21-SEP-2009 14:46:29  
 Calibration Source Id : AESS-003

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2386.890  
 Energy Calibration Slope : 4.958474  
 Energy Calibration Quadratic : 2.9448030E-04  
 Energy Calibration Range : 7773.000

Instrument : CHAMBER 166  
 Detector : 74545  
 Calibration Date/Time : 21-SEP-2009 14:47:27  
 Calibration Source Id : AESS-009

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2376.522  
 Energy Calibration Slope : 4.921530  
 Energy Calibration Quadratic : 3.3686910E-04  
 Energy Calibration Range : 7769.000

Instrument : CHAMBER 167  
 Detector : 72546  
 Calibration Date/Time : 21-SEP-2009 14:48:04  
 Calibration Source Id : AESS-004

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2378.613  
 Energy Calibration Slope : 4.924971  
 Energy Calibration Quadratic : 3.2533024E-04  
 Energy Calibration Range : 7763.000

Instrument : CHAMBER 168  
 Detector : 72547  
 Calibration Date/Time : 21-SEP-2009 14:48:25  
 Calibration Source Id : AESS-010

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2381.283  
 Energy Calibration Slope : 4.946027  
 Energy Calibration Quadratic : 3.0436489E-04  
 Energy Calibration Range : 7765.000

Instrument : CHAMBER 169  
 Detector : 72548  
 Calibration Date/Time : 21-SEP-2009 14:48:47  
 Calibration Source Id : AESS-005

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.001
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2384.302  
 Energy Calibration Slope : 4.926007  
 Energy Calibration Quadratic : 3.2111545E-04  
 Energy Calibration Range : 7765.000

Instrument : CHAMBER 170  
 Detector : 72549  
 Calibration Date/Time : 21-SEP-2009 14:49:16  
 Calibration Source Id : AESS-011

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2384.736  
 Energy Calibration Slope : 4.931669  
 Energy Calibration Quadratic : 3.3333997E-04  
 Energy Calibration Range : 7784.000

Instrument : CHAMBER 171  
 Detector : 78260  
 Calibration Date/Time : 21-SEP-2009 14:49:40  
 Calibration Source Id : AESS-006

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.120
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2375.901  
 Energy Calibration Slope : 4.923372  
 Energy Calibration Quadratic : 3.1892414E-04  
 Energy Calibration Range : 7752.000

Instrument : CHAMBER 172  
 Detector : 78772  
 Calibration Date/Time : 21-SEP-2009 14:49:54  
 Calibration Source Id : AESS-012

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2374.003  
 Energy Calibration Slope : 4.928030  
 Energy Calibration Quadratic : 3.2592146E-04  
 Energy Calibration Range : 7762.000

Instrument : CHAMBER 173  
 Detector : 74431  
 Calibration Date/Time : 21-SEP-2009 14:50:04  
 Calibration Source Id : AESS-013  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2368.870  
 Energy Calibration Slope : 4.977422  
 Energy Calibration Quadratic : 2.7764533E-04  
 Energy Calibration Range : 7757.000

Instrument : CHAMBER 174  
 Detector : 74432  
 Calibration Date/Time : 21-SEP-2009 14:50:13  
 Calibration Source Id : AESS-019  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2361.911  
 Energy Calibration Slope : 5.039232  
 Energy Calibration Quadratic : 2.0001861E-04  
 Energy Calibration Range : 7732.000

Instrument : CHAMBER 175  
 Detector : 74433  
 Calibration Date/Time : 21-SEP-2009 14:50:24  
 Calibration Source Id : AESS-014  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.019  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2364.263  
 Energy Calibration Slope : 4.969145  
 Energy Calibration Quadratic : 2.8674255E-04  
 Energy Calibration Range : 7753.000

Instrument : CHAMBER 176  
 Detector : 74434  
 Calibration Date/Time : 21-SEP-2009 14:50:36  
 Calibration Source Id : AESS-020

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2359.390  
 Energy Calibration Slope : 5.025916  
 Energy Calibration Quadratic : 2.3010977E-04  
 Energy Calibration Range : 7747.000

Instrument : CHAMBER 177  
 Detector : 74435  
 Calibration Date/Time : 21-SEP-2009 14:50:46  
 Calibration Source Id : AESS-015

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2363.896  
 Energy Calibration Slope : 4.971116  
 Energy Calibration Quadratic : 2.8296176E-04  
 Energy Calibration Range : 7751.000

Instrument : CHAMBER 178  
 Detector : 74436  
 Calibration Date/Time : 21-SEP-2009 14:50:57  
 Calibration Source Id : AESS-021

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2357.960  
 Energy Calibration Slope : 4.995038  
 Energy Calibration Quadratic : 2.5281982E-04  
 Energy Calibration Range : 7738.000

Instrument : CHAMBER 179  
 Detector : 74437  
 Calibration Date/Time : 21-SEP-2009 14:51:07  
 Calibration Source Id : AESS-016  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2362.475  
 Energy Calibration Slope : 4.962544  
 Energy Calibration Quadratic : 2.9229760E-04  
 Energy Calibration Range : 7751.000

Instrument : CHAMBER 180  
 Detector : 74438  
 Calibration Date/Time : 21-SEP-2009 14:51:16  
 Calibration Source Id : AESS-022  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2357.168  
 Energy Calibration Slope : 5.024229  
 Energy Calibration Quadratic : 2.2182068E-04  
 Energy Calibration Range : 7735.000

Instrument : CHAMBER 181  
 Detector : 74439  
 Calibration Date/Time : 21-SEP-2009 14:51:26  
 Calibration Source Id : AESS-017  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2361.833  
 Energy Calibration Slope : 4.977290  
 Energy Calibration Quadratic : 2.7170058E-04  
 Energy Calibration Range : 7743.000

Instrument : CHAMBER 182  
 Detector : 74440  
 Calibration Date/Time : 21-SEP-2009 14:51:42  
 Calibration Source Id : AESS-023

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.675
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2351.365  
 Energy Calibration Slope : 5.006705  
 Energy Calibration Quadratic : 2.3110739E-04  
 Energy Calibration Range : 7721.000

Instrument : CHAMBER 183  
 Detector : 74441  
 Calibration Date/Time : 21-SEP-2009 14:51:54  
 Calibration Source Id : AESS-018

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2365.306  
 Energy Calibration Slope : 4.968304  
 Energy Calibration Quadratic : 2.8504903E-04  
 Energy Calibration Range : 7752.000

Instrument : CHAMBER 184  
 Detector : 74442  
 Calibration Date/Time : 21-SEP-2009 14:52:17  
 Calibration Source Id : AESS-024

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2357.045  
 Energy Calibration Slope : 5.026213  
 Energy Calibration Quadratic : 2.2053947E-04  
 Energy Calibration Range : 7735.000



Instrument : CHAMBER 185  
 Detector : 68615  
 Calibration Date/Time : 21-SEP-2009 14:52:26  
 Calibration Source Id : AESS-025

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2363.439  
 Energy Calibration Slope : 4.921171  
 Energy Calibration Quadratic : 2.9912216E-04  
 Energy Calibration Range : 7716.000

Instrument : CHAMBER 186  
 Detector : 68616  
 Calibration Date/Time : 21-SEP-2009 14:52:35  
 Calibration Source Id : AESS-031

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2362.841  
 Energy Calibration Slope : 4.954493  
 Energy Calibration Quadratic : 2.7342763E-04  
 Energy Calibration Range : 7723.000

Instrument : CHAMBER 187  
 Detector : 68620  
 Calibration Date/Time : 21-SEP-2009 14:52:45  
 Calibration Source Id : AESS-026

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2375.999  
 Energy Calibration Slope : 4.962572  
 Energy Calibration Quadratic : 3.0889659E-04  
 Energy Calibration Range : 7782.000

Instrument : CHAMBER 188  
 Detector : 68621  
 Calibration Date/Time : 21-SEP-2009 14:57:16  
 Calibration Source Id : AESS-032

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2372.483  
 Energy Calibration Slope : 4.952415  
 Energy Calibration Quadratic : 3.0726261E-04  
 Energy Calibration Range : 7766.000

Instrument : CHAMBER 189  
 Detector : 68622  
 Calibration Date/Time : 21-SEP-2009 14:53:03  
 Calibration Source Id : AESS-027

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2360.450  
 Energy Calibration Slope : 4.959707  
 Energy Calibration Quadratic : 2.6419348E-04  
 Energy Calibration Range : 7716.000

Instrument : CHAMBER 190  
 Detector : 68623  
 Calibration Date/Time : 21-SEP-2009 14:53:12  
 Calibration Source Id : AESS-033

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.800
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2356.994  
 Energy Calibration Slope : 4.952447  
 Energy Calibration Quadratic : 2.7996209E-04  
 Energy Calibration Range : 7722.000

Instrument : CHAMBER 191  
 Detector : 68624  
 Calibration Date/Time : 21-SEP-2009 14:53:21  
 Calibration Source Id : AESS-028

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2375.194  
 Energy Calibration Slope : 4.970817  
 Energy Calibration Quadratic : 3.1015038E-04  
 Energy Calibration Range : 7791.000

Instrument : CHAMBER 192  
 Detector : 74430  
 Calibration Date/Time : 21-SEP-2009 14:53:32  
 Calibration Source Id : AESS-034

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.020

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2368.673  
 Energy Calibration Slope : 4.975485  
 Energy Calibration Quadratic : 3.0052042E-04  
 Energy Calibration Range : 7779.000

Instrument : CHAMBER 193  
 Detector : 68627  
 Calibration Date/Time : 21-SEP-2009 14:53:41  
 Calibration Source Id : AESS-029

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2366.307  
 Energy Calibration Slope : 4.926867  
 Energy Calibration Quadratic : 3.0849138E-04  
 Energy Calibration Range : 7735.000

Instrument : CHAMBER 194  
 Detector : 68635  
 Calibration Date/Time : 21-SEP-2009 14:53:50  
 Calibration Source Id : AESS-035

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.001
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2363.136  
 Energy Calibration Slope : 4.944215  
 Energy Calibration Quadratic : 2.9438949E-04  
 Energy Calibration Range : 7735.000

Instrument : CHAMBER 195  
 Detector : 68636  
 Calibration Date/Time : 21-SEP-2009 14:53:59  
 Calibration Source Id : AESS-030

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2364.925  
 Energy Calibration Slope : 4.962630  
 Energy Calibration Quadratic : 2.7555652E-04  
 Energy Calibration Range : 7736.000

Instrument : CHAMBER 196  
 Detector : 68637  
 Calibration Date/Time : 21-SEP-2009 14:54:08  
 Calibration Source Id : AESS-036

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.798
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2367.455  
 Energy Calibration Slope : 4.936808  
 Energy Calibration Quadratic : 2.9704699E-04  
 Energy Calibration Range : 7734.000

Instrument : CHAMBER 197  
 Detector : 78894  
 Calibration Date/Time : 21-SEP-2009 14:42:21  
 Calibration Source Id : AESS-037  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.799  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2367.634  
 Energy Calibration Slope : 4.977818  
 Energy Calibration Quadratic : 2.8380580E-04  
 Energy Calibration Range : 7763.000

Instrument : CHAMBER 198  
 Detector : 78895  
 Calibration Date/Time : 21-SEP-2009 14:54:28  
 Calibration Source Id : AESS-043  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2368.665  
 Energy Calibration Slope : 4.961154  
 Energy Calibration Quadratic : 2.8666743E-04  
 Energy Calibration Range : 7749.000

Instrument : CHAMBER 199  
 Detector : 78896  
 Calibration Date/Time : 21-SEP-2009 14:54:37  
 Calibration Source Id : AESS-038  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.801  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2369.988  
 Energy Calibration Slope : 4.975040  
 Energy Calibration Quadratic : 2.8448759E-04  
 Energy Calibration Range : 7763.000

Instrument : CHAMBER 200  
 Detector : 78900  
 Calibration Date/Time : 21-SEP-2009 14:54:46  
 Calibration Source Id : AESS-044  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.799  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2368.958  
 Energy Calibration Slope : 4.954888  
 Energy Calibration Quadratic : 3.0549458E-04  
 Energy Calibration Range : 7763.000

Instrument : CHAMBER 201  
 Detector : 78902  
 Calibration Date/Time : 21-SEP-2009 14:54:55  
 Calibration Source Id : AESS-039  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.799  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2361.867  
 Energy Calibration Slope : 4.974102  
 Energy Calibration Quadratic : 2.9147897E-04  
 Energy Calibration Range : 7761.000

Instrument : CHAMBER 202  
 Detector : 78903  
 Calibration Date/Time : 21-SEP-2009 14:55:05  
 Calibration Source Id : AESS-045  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2354.252  
 Energy Calibration Slope : 4.963346  
 Energy Calibration Quadratic : 2.8640320E-04  
 Energy Calibration Range : 7737.000

Instrument : CHAMBER 203  
 Detector : 78905  
 Calibration Date/Time : 21-SEP-2009 14:55:14  
 Calibration Source Id : AESS-040

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2365.971  
 Energy Calibration Slope : 4.956215  
 Energy Calibration Quadratic : 3.0086067E-04  
 Energy Calibration Range : 7757.000

Instrument : CHAMBER 204  
 Detector : 78907  
 Calibration Date/Time : 21-SEP-2009 14:55:23  
 Calibration Source Id : AESS-046

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.801
CM-244	4320A	2/28/10	5795.020	5795.019

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2364.131  
 Energy Calibration Slope : 4.970463  
 Energy Calibration Quadratic : 2.7864033E-04  
 Energy Calibration Range : 7746.000

Instrument : CHAMBER 205  
 Detector : 78908  
 Calibration Date/Time : 21-SEP-2009 14:55:32  
 Calibration Source Id : AESS-041

Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy
GD-148	6445-278	2/28/10	3183.000	3183.000
NP-237	4341	2/28/10	4768.800	4768.799
CM-244	4320A	2/28/10	5795.020	5795.021

Energy/Channel Equation : see above  
 Energy Calibration Zero : 2369.855  
 Energy Calibration Slope : 4.963379  
 Energy Calibration Quadratic : 2.9518205E-04  
 Energy Calibration Range : 7762.000

Instrument : CHAMBER 206  
 Detector : 78909  
 Calibration Date/Time : 21-SEP-2009 14:55:41  
 Calibration Source Id : AESS-047  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2367.801  
 Energy Calibration Slope : 4.940775  
 Energy Calibration Quadratic : 3.1145863E-04  
 Energy Calibration Range : 7754.000

Instrument : CHAMBER 207  
 Detector : 78910  
 Calibration Date/Time : 21-SEP-2009 14:55:50  
 Calibration Source Id : AESS-042  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.020  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2367.063  
 Energy Calibration Slope : 4.985894  
 Energy Calibration Quadratic : 2.7485727E-04  
 Energy Calibration Range : 7761.000

Instrument : CHAMBER 208  
 Detector : 78911  
 Calibration Date/Time : 21-SEP-2009 14:56:00  
 Calibration Source Id : AESS-048  
 Cal. Isotopes Source Id Expiration Date Standard Energy Actual Energy  
 GD-148 6445-278 2/28/10 3183.000 3183.000  
 NP-237 4341 2/28/10 4768.800 4768.800  
 CM-244 4320A 2/28/10 5795.020 5795.021  
 Energy/Channel Equation : see above  
 Energy Calibration Zero : 2366.635  
 Energy Calibration Slope : 4.964264  
 Energy Calibration Quadratic : 3.0284186E-04  
 Energy Calibration Range : 7768.000



## Subsection 2: Background Calibration

Instrument : CHAMBER 161  
 Detector : 70321  
 Background Analysis Date/Time : 20-SEP-2009 15:51:51  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.771	3300.133	1.000000	0.3000000	100.0000	95.00000
NP-237	4437.452	4905.776	11.00000	3.300000	30.15113	95.00000
CM-244	5533.229	5885.267	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 162  
 Detector : 70323  
 Background Analysis Date/Time : 20-SEP-2009 15:51:55  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.239	3298.296	1.000000	0.3000000	100.0000	95.00000
NP-237	4436.702	4904.841	3.000000	0.9000000	57.73503	95.00000
CM-244	5531.500	5882.828	10.00000	3.000000	31.62278	95.00000

Instrument : CHAMBER 163  
 Detector : 70324  
 Background Analysis Date/Time : 20-SEP-2009 15:52:00  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.643	3300.046	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4435.946	4905.743	20.00000	6.000000	22.36068	95.00000
CM-244	5535.155	5882.911	12.00000	3.600000	28.86751	95.00000

Instrument : CHAMBER 164  
 Detector : 70325  
 Background Analysis Date/Time : 20-SEP-2009 15:52:04  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.351	3300.390	2.000000	0.6000000	70.71068	95.00000
NP-237	4432.597	4902.599	13.00000	3.900000	27.73501	95.00000
CM-244	5531.973	5884.930	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 165  
 Detector : 72544  
 Background Analysis Date/Time : 20-SEP-2009 15:52:09  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.177	3299.087	2.000000	0.6000000	70.71068	95.00000
NP-237	4432.981	4902.991	5.000000	1.500000	44.72136	95.00000
CM-244	5531.772	5884.104	7.000000	2.100000	37.79645	95.00000

Instrument : CHAMBER 166  
 Detector : 74545  
 Background Analysis Date/Time : 20-SEP-2009 15:52:13  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.972	3298.535	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.387	4905.732	7.000000	2.100000	37.79645	95.00000
CM-244	5530.676	5884.311	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 167  
 Detector : 72546  
 Background Analysis Date/Time : 20-SEP-2009 15:52:18  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.306	3300.867	1.000000	0.3000000	100.0000	95.00000
NP-237	4436.966	4901.435	16.00000	4.800000	25.00000	95.00000
CM-244	5530.518	5883.394	9.000000	2.700000	33.33334	95.00000

Instrument : CHAMBER 168  
 Detector : 72547  
 Background Analysis Date/Time : 20-SEP-2009 15:52:22  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.229	3301.657	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4434.347	4904.144	14.00000	4.200000	26.72612	95.00000
CM-244	5532.888	5885.320	10.00000	3.000000	31.62278	95.00000

Instrument : CHAMBER 169  
 Detector : 72548  
 Background Analysis Date/Time : 20-SEP-2009 15:52:26  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.054	3301.559	7.000000	2.100000	37.79645	95.00000
NP-237	4437.192	4906.601	22.00000	6.600000	21.32007	95.00000
CM-244	5535.250	5882.471	13.00000	3.900000	27.73501	95.00000

Instrument : CHAMBER 170  
 Detector : 72549  
 Background Analysis Date/Time : 20-SEP-2009 15:52:31  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.361	3298.395	1.000000	0.3000000	100.0000	95.00000
NP-237	4436.739	4902.328	14.00000	4.200000	26.72612	95.00000
CM-244	5533.108	5887.023	12.00000	3.600000	28.86751	95.00000

Instrument : CHAMBER 171  
 Detector : 78260  
 Background Analysis Date/Time : 20-SEP-2009 15:52:36  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.303	3297.640	3.000000	0.9000000	57.73503	95.00000
NP-237	4432.543	4901.594	10.00000	3.000000	31.62278	95.00000
CM-244	5535.033	5887.339	8.000000	2.400000	35.35534	95.00000

Instrument : CHAMBER 172  
 Detector : 78772  
 Background Analysis Date/Time : 20-SEP-2009 15:52:40  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.091	3301.893	2.000000	0.6000000	70.71068	95.00000
NP-237	4433.700	4903.740	15.00000	4.500000	25.81989	95.00000
CM-244	5533.343	5886.514	6.000000	1.800000	40.82483	95.00000

Instrument : CHAMBER 173  
 Detector : 74431  
 Background Analysis Date/Time : 20-SEP-2009 15:52:45  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.339	3299.195	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.469	4905.977	7.000000	2.100000	37.79645	95.00000
CM-244	5534.997	5887.255	28.00000	8.400001	18.89822	95.00000

Instrument : CHAMBER 174  
 Detector : 74432  
 Background Analysis Date/Time : 20-SEP-2009 15:52:49  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.852	3301.015	5.000000	1.500000	44.72136	95.00000
NP-237	4435.608	4905.341	7.000000	2.100000	37.79645	95.00000
CM-244	5531.406	5886.389	21.00000	6.300000	21.82179	95.00000

Instrument : CHAMBER 175  
 Detector : 74433  
 Background Analysis Date/Time : 20-SEP-2009 15:52:53  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.886	3298.444	3.000000	0.9000000	57.73503	95.00000
NP-237	4434.203	4904.756	10.00000	3.000000	31.62278	95.00000
CM-244	5534.062	5886.590	23.00000	6.900000	20.85144	95.00000

Instrument : CHAMBER 176  
 Detector : 74434  
 Background Analysis Date/Time : 20-SEP-2009 15:52:58  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.225	3302.172	2.000000	0.6000000	70.71068	95.00000
NP-237	4432.630	4903.602	3.000000	0.9000000	57.73503	95.00000
CM-244	5532.053	5883.416	19.00000	5.700000	22.94157	95.00000

Instrument : CHAMBER 177  
 Detector : 74435  
 Background Analysis Date/Time : 20-SEP-2009 15:53:02  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.707	3298.313	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4434.012	4904.435	5.000000	1.500000	44.72136	95.00000
CM-244	5533.475	5885.809	18.00000	5.400000	23.57022	95.00000

Instrument : CHAMBER 178  
 Detector : 74436  
 Background Analysis Date/Time : 20-SEP-2009 15:53:06  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.348	3300.873	3.000000	0.9000000	57.73503	95.00000
NP-237	4432.820	4902.942	9.000000	2.700000	33.33334	95.00000
CM-244	5530.837	5887.508	19.00000	5.700000	22.94157	95.00000

Instrument : CHAMBER 179  
 Detector : 74437  
 Background Analysis Date/Time : 20-SEP-2009 15:53:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2992.396	3300.692	2.000000	0.6000000	70.71068	95.00000
NP-237	4435.850	4906.313	3.000000	0.9000000	57.73503	95.00000
CM-244	5535.639	5882.885	32.00000	9.600000	17.67767	95.00000

Instrument : CHAMBER 180  
 Detector : 74438  
 Background Analysis Date/Time : 20-SEP-2009 15:53:16  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.663	3299.349	1.000000	0.3000000	100.0000	95.00000
NP-237	4433.569	4903.757	13.00000	3.900000	27.73501	95.00000
CM-244	5530.967	5886.867	29.00000	8.700001	18.56953	95.00000

Instrument : CHAMBER 181  
 Detector : 74439  
 Background Analysis Date/Time : 20-SEP-2009 15:53:20  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.239	3302.087	2.000000	0.6000000	70.71068	95.00000
NP-237	4432.597	4902.658	3.000000	0.9000000	57.73503	95.00000
CM-244	5530.942	5882.719	27.00000	8.100000	19.24501	95.00000

Instrument : CHAMBER 182  
 Detector : 74440  
 Background Analysis Date/Time : 20-SEP-2009 15:53:24  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.945	3300.794	1.000000	0.3000000	100.0000	95.00000
NP-237	4432.572	4902.020	5.000000	1.500000	44.72136	95.00000
CM-244	5533.775	5884.077	33.00000	9.900001	17.40777	95.00000

Instrument : CHAMBER 183  
 Detector : 74441  
 Background Analysis Date/Time : 20-SEP-2009 15:53:29  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.798	3299.272	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4434.624	4904.963	5.000000	1.500000	44.72136	95.00000
CM-244	5533.945	5886.272	42.00000	12.60000	15.43033	95.00000

Instrument : CHAMBER 184  
 Detector : 74442  
 Background Analysis Date/Time : 20-SEP-2009 15:53:33  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.768	3299.551	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.041	4904.303	1.000000	0.3000000	100.0000	95.00000
CM-244	5531.580	5887.500	28.00000	8.400001	18.89822	95.00000

Instrument : CHAMBER 185  
 Detector : 68615  
 Background Analysis Date/Time : 20-SEP-2009 15:53:38  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.255	3299.191	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4436.568	4904.026	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
CM-244	5534.840	5885.460	35.00000	10.50000	16.90309	95.00000

Instrument : CHAMBER 186  
 Detector : 68616  
 Background Analysis Date/Time : 20-SEP-2009 15:53:42  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.448	3298.893	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.968	4903.217	3.000000	0.9000000	57.73503	95.00000
CM-244	5534.439	5884.968	30.00000	9.000000	18.25742	95.00000

Instrument : CHAMBER 187  
 Detector : 68620  
 Background Analysis Date/Time : 20-SEP-2009 15:53:46  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.069	3299.571	4.000000	1.200000	50.00000	95.00000
NP-237	4436.508	4902.892	10.00000	3.000000	31.62278	95.00000
CM-244	5534.129	5882.618	35.00000	10.50000	16.90309	95.00000

Instrument : CHAMBER 188  
 Detector : 68621  
 Background Analysis Date/Time : 20-SEP-2009 15:53:50  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.307	3299.196	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4433.812	4904.473	3.000000	0.9000000	57.73503	95.00000
CM-244	5534.433	5887.575	21.00000	6.300000	21.82179	95.00000

Instrument : CHAMBER 189  
 Detector : 68622  
 Background Analysis Date/Time : 20-SEP-2009 15:53:55  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.567	3302.212	2.000000	0.6000000	70.71068	95.00000
NP-237	4433.165	4906.352	5.000000	1.500000	44.72136	95.00000
CM-244	5531.737	5887.138	29.00000	8.700001	18.56953	95.00000

Instrument : CHAMBER 190  
 Detector : 68623  
 Background Analysis Date/Time : 20-SEP-2009 15:53:59  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.470	3297.949	3.000000	0.9000000	57.73503	95.00000
NP-237	4434.559	4903.208	45.00000	13.50000	14.90712	95.00000
CM-244	5535.128	5886.122	75.00000	22.50000	11.54701	95.00000

Instrument : CHAMBER 191  
 Detector : 68624  
 Background Analysis Date/Time : 20-SEP-2009 15:54:03  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.297	3300.325	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4434.026	4906.466	4.000000	1.200000	50.00000	95.00000
CM-244	5533.499	5882.588	39.00000	11.70000	16.01282	95.00000

Instrument : CHAMBER 192  
 Detector : 74430  
 Background Analysis Date/Time : 20-SEP-2009 15:54:07  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.254	3299.423	1.000000	0.3000000	100.0000	95.00000
NP-237	4433.037	4905.173	6.000000	1.800000	40.82483	95.00000
CM-244	5531.571	5885.579	27.00000	8.100000	19.24501	95.00000



Instrument : CHAMBER 193  
 Detector : 68627  
 Background Analysis Date/Time : 20-SEP-2009 15:54:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.990	3298.419	3.000000	0.9000000	57.73503	95.00000
NP-237	4433.001	4901.628	20.00000	6.000000	22.36068	95.00000
CM-244	5534.240	5885.963	35.00000	10.50000	16.90309	95.00000

Instrument : CHAMBER 194  
 Detector : 68635  
 Background Analysis Date/Time : 20-SEP-2009 15:54:15  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.781	3297.998	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4434.565	4903.602	2.000000	0.6000000	70.71068	95.00000
CM-244	5531.095	5882.711	16.00000	4.800000	25.00000	95.00000

Instrument : CHAMBER 195  
 Detector : 68636  
 Background Analysis Date/Time : 20-SEP-2009 15:54:19  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.560	3297.508	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.548	4904.654	6.000000	1.800000	40.82483	95.00000
CM-244	5531.770	5882.945	25.00000	7.500000	20.00000	95.00000

Instrument : CHAMBER 196  
 Detector : 68637  
 Background Analysis Date/Time : 20-SEP-2009 15:54:23  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.197	3301.025	2.000000	0.6000000	70.71068	95.00000
NP-237	4436.299	4904.887	12.00000	3.600000	28.86751	95.00000
CM-244	5531.851	5883.206	21.00000	6.300000	21.82179	95.00000

Instrument : CHAMBER 197  
 Detector : 78894  
 Background Analysis Date/Time : 20-SEP-2009 15:54:27  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.248	3298.244	0.000000E+00	0.000000E+00	0.000000E+00	95.00000
NP-237	4435.410	4906.453	2.000000	0.6000000	70.71068	95.00000
CM-244	5531.008	5883.783	22.00000	6.600000	21.32007	95.00000

Instrument : CHAMBER 198  
 Detector : 78895  
 Background Analysis Date/Time : 20-SEP-2009 15:54:30  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.256	3301.357	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.341	4905.168	3.000000	0.9000000	57.73503	95.00000
CM-244	5533.514	5885.508	20.00000	6.000000	22.36068	95.00000

Instrument : CHAMBER 199  
 Detector : 78896  
 Background Analysis Date/Time : 20-SEP-2009 15:54:35  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.267	3300.107	3.000000	0.9000000	57.73503	95.00000
NP-237	4436.748	4902.339	6.000000	1.800000	40.82483	95.00000
CM-244	5531.913	5884.562	27.00000	8.100000	19.24501	95.00000

Instrument : CHAMBER 200  
 Detector : 78900  
 Background Analysis Date/Time : 20-SEP-2009 15:54:38  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.062	3301.136	2.000000	0.6000000	70.71068	95.00000
NP-237	4436.203	4901.740	14.00000	4.200000	26.72612	95.00000
CM-244	5531.761	5884.914	26.00000	7.800000	19.61161	95.00000

Instrument : CHAMBER 201  
 Detector : 78902  
 Background Analysis Date/Time : 20-SEP-2009 15:54:42  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.184	3302.217	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.609	4905.994	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
CM-244	5531.184	5884.407	20.00000	6.000000	22.36068	95.00000

Instrument : CHAMBER 202  
 Detector : 78903  
 Background Analysis Date/Time : 20-SEP-2009 15:54:47  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.216	3297.484	1.000000	0.3000000	100.0000	95.00000
NP-237	4437.369	4902.276	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
CM-244	5530.984	5883.177	24.00000	7.200000	20.41241	95.00000

Instrument : CHAMBER 203  
 Detector : 78905  
 Background Analysis Date/Time : 20-SEP-2009 15:54:51  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.199	3298.236	9.000000	2.700000	33.33334	95.00000
NP-237	4432.988	4903.526	7.000000	2.100000	37.79645	95.00000
CM-244	5533.164	5886.048	26.00000	7.800000	19.61161	95.00000

Instrument : CHAMBER 204  
 Detector : 78907  
 Background Analysis Date/Time : 20-SEP-2009 15:54:55  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.792	3298.277	15.00000	4.500000	25.81989	95.00000
NP-237	4433.265	4903.277	16.00000	4.800000	25.00000	95.00000
CM-244	5531.668	5883.589	51.00000	15.30000	14.00280	95.00000

Instrument : CHAMBER 205  
 Detector : 78908  
 Background Analysis Date/Time : 20-SEP-2009 15:54:58  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.853	3298.183	1.000000	0.3000000	100.0000	95.00000
NP-237	4433.644	4904.311	4.000000	1.200000	50.00000	95.00000
CM-244	5533.979	5886.811	26.00000	7.800000	19.61161	95.00000

Instrument : CHAMBER 206  
 Detector : 78909  
 Background Analysis Date/Time : 20-SEP-2009 15:55:02  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2990.264	3297.560	2.000000	0.6000000	70.71068	95.00000
NP-237	4435.483	4905.550	2.000000	0.6000000	70.71068	95.00000
CM-244	5534.828	5887.642	15.00000	4.500000	25.81989	95.00000

Instrument : CHAMBER 207  
 Detector : 78910  
 Background Analysis Date/Time : 20-SEP-2009 15:55:07  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2989.540	3298.860	2.000000	0.6000000	70.71068	95.00000
NP-237	4436.642	4902.427	8.000000	2.400000	35.35534	95.00000
CM-244	5532.022	5884.565	36.00000	10.80000	16.66667	95.00000

Instrument : CHAMBER 208  
 Detector : 78911  
 Background Analysis Date/Time : 20-SEP-2009 15:55:11  
 Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2991.900	3300.465	2.000000	0.6000000	70.71068	95.00000
NP-237	4437.256	4903.414	3.000000	0.9000000	57.73503	95.00000
CM-244	5534.200	5882.369	22.00000	6.600000	21.32007	95.00000

### Subsection 3: Efficiency Calibration

Instrument : CHAMBER 161  
 Detector : 70321  
 Standard ID : AESS-001  
 Standard Reference Date : 20-FEB-2008 09:54:53  
 Calibration Analysis Date/Time : 21-SEP-2009 09:28:18  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:45:33  
 Average Efficiency : 0.3689128  
 Average Efficiency Error : 1.0123267E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	208.6698	28-FEB-2010	2989.771	3300.133	21764.00	0.3527895	1.5079973E-02	62.09401
NP-237	171.0024	28-FEB-2010	4437.452	4905.776	19466.00	0.3793849	1.9163225E-02	75.59914
CM-244	158.1060	28-FEB-2010	5533.229	5885.267	17188.00	0.3849835	1.9471968E-02	61.24743

Instrument : CHAMBER 162  
 Detector : 70323  
 Standard ID : AESS-007  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 21-SEP-2009 09:28:25  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:45:43  
 Average Efficiency : 0.3711489  
 Average Efficiency Error : 1.0169771E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.7342	28-FEB-2010	2992.239	3298.296	21845.00	0.3574707	1.5279390E-02	61.21131
NP-237	205.0260	28-FEB-2010	4436.702	4904.841	23392.00	0.3802952	1.9176660E-02	80.07285
CM-244	199.6806	28-FEB-2010	5531.500	5882.828	21627.00	0.3837951	1.9366477E-02	60.40187

Instrument : CHAMBER 163  
 Detector : 70324  
 Standard ID : AESS-002  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 21-SEP-2009 09:28:32  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:46:06  
 Average Efficiency : 0.3784813  
 Average Efficiency Error : 1.0368052E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.1144	28-FEB-2010	2988.643	3300.046	21830.00	0.3690017	1.5772363E-02	62.20918
NP-237	200.4990	28-FEB-2010	4435.946	4905.743	23254.00	0.3865025	1.9490723E-02	75.42545
CM-244	196.5558	28-FEB-2010	5535.155	5882.911	21361.00	0.3848922	1.9424047E-02	59.52460

Instrument : CHAMBER 164  
 Detector : 70325  
 Standard ID : AESS-008  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 21-SEP-2009 09:28:39  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:46:16  
 Average Efficiency : 0.3791597  
 Average Efficiency Error : 1.0381414E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.0418	28-FEB-2010	2988.351	3300.390	22809.00	0.3744951	1.5998594E-02	58.40551
NP-237	209.2716	28-FEB-2010	4432.597	4902.599	23895.00	0.3805439	1.9185850E-02	71.09055
CM-244	199.6488	28-FEB-2010	5531.973	5884.930	21669.00	0.3846071	1.9407105E-02	56.87473

Instrument : CHAMBER 165  
 Detector : 72544  
 Standard ID : AESS-003  
 Standard Reference Date : 15-FEB-2008 13:12:27  
 Calibration Analysis Date/Time : 21-SEP-2009 09:28:46  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:46:29  
 Average Efficiency : 0.3786044  
 Average Efficiency Error : 1.0371909E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.9740	28-FEB-2010	2991.177	3299.087	21994.00	0.3665624	1.5666667E-02	68.94492
NP-237	203.2080	28-FEB-2010	4432.981	4902.991	23569.00	0.3865909	1.9492906E-02	76.46336
CM-244	197.2236	28-FEB-2010	5531.772	5884.104	21676.00	0.3894331	1.9650551E-02	69.10842

Instrument : CHAMBER 166  
 Detector : 74545  
 Standard ID : AESS-009  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 21-SEP-2009 09:28:52  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:47:27  
 Average Efficiency : 0.3925645  
 Average Efficiency Error : 1.0746635E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.3736	28-FEB-2010	2991.972	3298.535	23250.00	0.3867014	1.6516251E-02	56.08769
NP-237	204.0192	28-FEB-2010	4435.387	4905.732	24303.00	0.3970365	2.0014562E-02	79.13438
CM-244	197.2128	28-FEB-2010	5530.676	5884.311	22089.00	0.3967021	2.0013960E-02	55.09056

Instrument : CHAMBER 167  
 Detector : 72546  
 Standard ID : AESS-004  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 21-SEP-2009 09:28:59  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:48:04  
 Average Efficiency : 0.3871779  
 Average Efficiency Error : 1.0602054E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.1222	28-FEB-2010	2989.306	3300.867	22941.00	0.3765221	1.6084069E-02	55.09563
NP-237	204.2586	28-FEB-2010	4436.966	4901.435	24233.00	0.3953844	1.9931784E-02	76.26476
CM-244	198.8100	28-FEB-2010	5530.518	5883.394	22180.00	0.3953461	1.9944822E-02	56.09549

Instrument : CHAMBER 168  
 Detector : 72547  
 Standard ID : AESS-010  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:07  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:48:25  
 Average Efficiency : 0.3895916  
 Average Efficiency Error : 1.0669101E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.0008	28-FEB-2010	2989.229	3301.657	22631.00	0.3790159	1.6193239E-02	61.00068
NP-237	202.9926	28-FEB-2010	4434.347	4904.144	24065.00	0.3951014	1.9918641E-02	83.09320
CM-244	196.2330	28-FEB-2010	5532.888	5885.320	22172.00	0.4003809	2.0198891E-02	61.18747

Instrument : CHAMBER 169  
 Detector : 72548  
 Standard ID : AESS-005  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:13  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:48:47  
 Average Efficiency : 0.3742271  
 Average Efficiency Error : 1.0248713E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	210.7452	28-FEB-2010	2990.054	3301.559	22666.00	0.3638192	1.5543718E-02	59.25828
NP-237	209.5938	28-FEB-2010	4437.192	4906.601	23965.00	0.3810294	1.9209908E-02	71.80399
CM-244	202.7478	28-FEB-2010	5535.250	5882.471	21940.00	0.3834514	1.9346640E-02	60.12471

Instrument : CHAMBER 170  
 Detector : 72549  
 Standard ID : AESS-011  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:20  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:49:16  
 Average Efficiency : 0.3642089  
 Average Efficiency Error : 9.9735176E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	212.8284	28-FEB-2010	2991.361	3298.395	22497.00	0.3575987	1.5279310E-02	63.36363
NP-237	214.4868	28-FEB-2010	4436.739	4902.328	23611.00	0.3668730	1.8498441E-02	80.98635
CM-244	208.4184	28-FEB-2010	5533.108	5887.023	21846.00	0.3714186	1.8740255E-02	58.50939

Instrument : CHAMBER 171  
 Detector : 78260  
 Standard ID : AESS-006  
 Standard Reference Date : 14-FEB-2008 09:35:18  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:26  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:49:40  
 Average Efficiency : 0.3810605  
 Average Efficiency Error : 1.0438851E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.6952	28-FEB-2010	2991.303	3297.640	22193.00	0.3685752	1.5750948E-02	59.60153
NP-237	204.7038	28-FEB-2010	4432.543	4901.594	23828.00	0.3879591	1.9560140E-02	73.97815
CM-244	195.0060	28-FEB-2010	5535.033	5887.339	21671.00	0.3938129	1.9871602E-02	62.27898

Instrument : CHAMBER 172  
 Detector : 78772  
 Standard ID : AESS-012  
 Standard Reference Date : 14-FEB-2008 13:39:25  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:32  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:49:54  
 Average Efficiency : 0.3822589  
 Average Efficiency Error : 1.0466043E-02  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	206.2200	28-FEB-2010	2990.091	3301.893	22979.00	0.3769604	1.6102478E-02	57.80247
NP-237	205.8930	28-FEB-2010	4433.700	4903.740	24203.00	0.3917651	1.9749530E-02	76.25694
CM-244	203.1954	28-FEB-2010	5533.343	5886.514	21835.00	0.3808052	1.9213919E-02	58.76520



Instrument : CHAMBER 173  
 Detector : 74431  
 Standard ID : AESS-013  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:38  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:50:04  
 Average Efficiency : 0.2602993  
 Average Efficiency Error : 7.1600322E-03  
 Confidence : 95.00000

Cal. Istds	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.6544	28-FEB-2010	2990.339	3299.195	15911.00	0.2643020	1.1349737E-02	50.51283
NP-237	210.2526	28-FEB-2010	4435.469	4905.977	15987.00	0.2534239	1.2828780E-02	57.29033
CM-244	201.9108	28-FEB-2010	5534.997	5887.255	14946.00	0.2621880	1.3283902E-02	53.12511

Instrument : CHAMBER 174  
 Detector : 74432  
 Standard ID : AESS-019  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:43  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:50:13  
 Average Efficiency : 0.2533270  
 Average Efficiency Error : 6.9733807E-03  
 Confidence : 95.00000

Cal. Istds	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.6468	28-FEB-2010	2989.852	3301.015	14930.00	0.2467540	1.0608066E-02	48.02879
NP-237	202.9140	28-FEB-2010	4435.608	4905.341	15850.00	0.2603388	1.3180215E-02	57.62176
CM-244	199.3140	28-FEB-2010	5531.406	5886.389	14432.00	0.2563750	1.2995369E-02	54.02073

Instrument : CHAMBER 175  
 Detector : 74433  
 Standard ID : AESS-014  
 Standard Reference Date : 19-FEB-2008 11:05:22  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:50  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:50:24  
 Average Efficiency : 0.2543943  
 Average Efficiency Error : 6.9960668E-03  
 Confidence : 95.00000

Cal. Istds	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	214.7088	28-FEB-2010	2989.886	3298.444	16030.00	0.2525296	1.0842831E-02	50.61414
NP-237	211.7160	28-FEB-2010	4434.203	4904.756	16439.00	0.2587745	1.3095257E-02	57.23130
CM-244	207.3882	28-FEB-2010	5534.062	5886.590	14808.00	0.2528055	1.2810053E-02	51.72563

Instrument : CHAMBER 176  
 Detector : 74434  
 Standard ID : AESS-020  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 21-SEP-2009 09:29:58  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:50:36  
 Average Efficiency : 0.2547762  
 Average Efficiency Error : 7.0115663E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	205.5870	28-FEB-2010	2991.225	3302.172	15206.00	0.2502103	1.0753103E-02	46.19209
NP-237	203.4984	28-FEB-2010	4432.630	4903.602	15838.00	0.2594141	1.3133497E-02	58.51922
CM-244	197.1096	28-FEB-2010	5532.053	5883.416	14295.00	0.2569134	1.3024328E-02	51.87393

Instrument : CHAMBER 177  
 Detector : 74435  
 Standard ID : AESS-015  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:03  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:50:46  
 Average Efficiency : 0.2659749  
 Average Efficiency Error : 7.3150843E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.0270	28-FEB-2010	2989.707	3298.313	15952.00	0.2645041	1.1357911E-02	48.05111
NP-237	200.6460	28-FEB-2010	4434.012	4904.435	16053.00	0.2666638	1.3498317E-02	54.07773
CM-244	195.9270	28-FEB-2010	5533.475	5885.809	14787.00	0.2673737	1.3548458E-02	55.83525

Instrument : CHAMBER 178  
 Detector : 74436  
 Standard ID : AESS-021  
 Standard Reference Date : 19-FEB-2008 15:31:52  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:10  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:50:57  
 Average Efficiency : 0.2584701  
 Average Efficiency Error : 7.1088150E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	208.3608	28-FEB-2010	2991.348	3300.873	15813.00	0.2566991	1.1024418E-02	46.60859
NP-237	210.1548	28-FEB-2010	4432.820	4902.942	16293.00	0.2583858	1.3076977E-02	58.74612
CM-244	200.7390	28-FEB-2010	5530.837	5887.508	14803.00	0.2611073	1.3230741E-02	51.69608

Instrument : CHAMBER 179  
 Detector : 74437  
 Standard ID : AESS-016  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:16  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:51:07  
 Average Efficiency : 0.2656665  
 Average Efficiency Error : 7.3066968E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	204.0534	28-FEB-2010	2992.396	3300.692	16018.00	0.2655541	1.1402219E-02	48.47999
NP-237	199.3962	28-FEB-2010	4435.850	4906.313	16096.00	0.2690641	1.3619361E-02	58.18980
CM-244	198.6402	28-FEB-2010	5535.639	5882.885	14727.00	0.2625763	1.3306193E-02	54.75912

Instrument : CHAMBER 180  
 Detector : 74438  
 Standard ID : AESS-022  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:22  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:51:16  
 Average Efficiency : 0.2482043  
 Average Efficiency Error : 6.8309689E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	209.6724	28-FEB-2010	2988.663	3299.349	15136.00	0.2442104	1.0496107E-02	47.14516
NP-237	206.8830	28-FEB-2010	4433.569	4903.757	15632.00	0.2518027	1.2750288E-02	52.81374
CM-244	203.0208	28-FEB-2010	5530.967	5886.867	14358.00	0.2504804	1.2697529E-02	50.18464

Instrument : CHAMBER 181  
 Detector : 74439  
 Standard ID : AESS-017  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:28  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:51:26  
 Average Efficiency : 0.2568994  
 Average Efficiency Error : 7.0653898E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	210.0798	28-FEB-2010	2988.239	3302.087	16106.00	0.2593535	1.1134949E-02	50.88416
NP-237	208.5846	28-FEB-2010	4432.597	4902.658	16106.00	0.2573713	1.3027404E-02	57.22441
CM-244	205.5828	28-FEB-2010	5530.942	5882.719	14695.00	0.2531832	1.2830525E-02	53.69027

Instrument : CHAMBER 182  
 Detector : 74440  
 Standard ID : AESS-023  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:34  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:51:42  
 Average Efficiency : 0.2555217  
 Average Efficiency Error : 7.0314407E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	207.4764	28-FEB-2010	2990.945	3300.794	15263.00	0.2488660	1.0694612E-02	45.64035
NP-237	207.4998	28-FEB-2010	4432.572	4902.020	16228.00	0.2606671	1.3193036E-02	52.09262
CM-244	199.8804	28-FEB-2010	5533.775	5884.077	14703.00	0.2605115	1.3201850E-02	48.97062

Instrument : CHAMBER 183  
 Detector : 74441  
 Standard ID : AESS-018  
 Standard Reference Date : 14-FEB-2008 17:45:04  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:39  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:51:54  
 Average Efficiency : 0.2611987  
 Average Efficiency Error : 7.1849022E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	202.1856	28-FEB-2010	2990.798	3299.272	15703.00	0.2627467	1.1285488E-02	47.53299
NP-237	208.8990	28-FEB-2010	4434.624	4904.963	16100.00	0.2568786	1.3002539E-02	53.88460
CM-244	198.1458	28-FEB-2010	5533.945	5886.272	14750.00	0.2635892	1.3357328E-02	53.93570

Instrument : CHAMBER 184  
 Detector : 74442  
 Standard ID : AESS-024  
 Standard Reference Date : 14-FEB-2008 21:55:55  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:45  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:52:17  
 Average Efficiency : 0.2584583  
 Average Efficiency Error : 7.1114316E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.5218	28-FEB-2010	2988.768	3299.551	15277.00	0.2539344	1.0912240E-02	50.31911
NP-237	205.6662	28-FEB-2010	4434.041	4904.303	16050.00	0.2601255	1.3167357E-02	58.63404
CM-244	198.3060	28-FEB-2010	5531.580	5887.500	14754.00	0.2635180	1.3353555E-02	51.04471

Instrument : CHAMBER 185  
 Detector : 68615  
 Standard ID : AESS-025  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:51  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:52:26  
 Average Efficiency : 0.2578048  
 Average Efficiency Error : 7.1078530E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	195.5670	28-FEB-2010	2988.255	3299.191	14889.00	0.2575537	1.1072870E-02	57.86859
NP-237	167.9916	28-FEB-2010	4436.568	4904.026	13054.00	0.2590211	1.3147981E-02	60.38557
CM-244	157.2432	28-FEB-2010	5534.840	5885.460	11412.00	0.2569523	1.3071318E-02	57.79462

Instrument : CHAMBER 186  
 Detector : 68616  
 Standard ID : AESS-031  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 21-SEP-2009 09:30:57  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:52:35  
 Average Efficiency : 0.2488432  
 Average Efficiency Error : 6.8683540E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	193.6650	28-FEB-2010	2991.448	3298.893	14023.00	0.2449313	1.0542010E-02	55.63848
NP-237	162.9186	28-FEB-2010	4434.968	4903.217	12465.00	0.2550169	1.2953850E-02	61.88278
CM-244	153.1968	28-FEB-2010	5534.439	5884.968	10759.00	0.2485880	1.2658793E-02	53.78214

Instrument : CHAMBER 187  
 Detector : 68620  
 Standard ID : AESS-026  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:03  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:52:45  
 Average Efficiency : 0.2500139  
 Average Efficiency Error : 7.3307389E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	199.5072	28-FEB-2010	2991.069	3299.571	14686.00	0.2490046	1.2619531E-02	51.85893
NP-237	168.0294	28-FEB-2010	4436.508	4902.892	12870.00	0.2552532	1.2959577E-02	54.96236
CM-244	160.5822	28-FEB-2010	5534.129	5882.618	11163.00	0.2461146	1.2524742E-02	53.45123

Instrument : CHAMBER 188  
 Detector : 68621  
 Standard ID : AESS-032  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:08  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:57:16  
 Average Efficiency : 0.2573678  
 Average Efficiency Error : 7.0972578E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	195.2364	28-FEB-2010	2991.307	3299.196	14948.00	0.2589918	1.1133890E-02	51.99499
NP-237	165.9822	28-FEB-2010	4433.812	4904.473	12790.00	0.2568368	1.3041135E-02	63.01558
CM-244	153.7938	28-FEB-2010	5534.433	5887.575	11106.00	0.2556783	1.3012402E-02	52.96853

Instrument : CHAMBER 189  
 Detector : 68622  
 Standard ID : AESS-027  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:15  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:53:03  
 Average Efficiency : 0.2613129  
 Average Efficiency Error : 7.6623494E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	193.4238	28-FEB-2010	2989.567	3302.212	14738.00	0.2577560	1.3062426E-02	55.08699
NP-237	161.6154	28-FEB-2010	4433.165	4906.352	12695.00	0.2618049	1.3294927E-02	59.92243
CM-244	148.1754	28-FEB-2010	5531.737	5887.138	11072.00	0.2645886	1.3466716E-02	57.86366

Instrument : CHAMBER 190  
 Detector : 68623  
 Standard ID : AESS-033  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:22  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:53:12  
 Average Efficiency : 0.2619864  
 Average Efficiency Error : 7.2268778E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	192.4158	28-FEB-2010	2990.470	3297.949	14602.00	0.2566898	1.1039688E-02	51.16143
NP-237	161.7816	28-FEB-2010	4434.559	4903.208	12864.00	0.2647705	1.3443264E-02	59.23622
CM-244	147.2670	28-FEB-2010	5535.128	5886.122	11129.00	0.2671734	1.3597734E-02	49.90292

Instrument : CHAMBER 191  
 Detector : 68624  
 Standard ID : AESS-028  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:28  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:53:21  
 Average Efficiency : 0.2625601  
 Average Efficiency Error : 7.6934313E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	199.6542	28-FEB-2010	2991.297	3300.325	15252.00	0.2584319	1.3090833E-02	50.79485
NP-237	168.1992	28-FEB-2010	4434.026	4906.466	13308.00	0.2637113	1.3382300E-02	58.03377
CM-244	156.7614	28-FEB-2010	5533.499	5882.588	11769.00	0.2657853	1.3513734E-02	53.41747

Instrument : CHAMBER 192  
 Detector : 74430  
 Standard ID : AESS-034  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:34  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:53:32  
 Average Efficiency : 0.2544576  
 Average Efficiency Error : 7.0170104E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.5488	28-FEB-2010	2990.254	3299.423	14893.00	0.2511986	1.0799594E-02	50.05982
NP-237	167.2962	28-FEB-2010	4433.037	4905.173	12941.00	0.2578104	1.3088287E-02	62.20525
CM-244	154.4388	28-FEB-2010	5531.571	5885.579	11163.00	0.2558767	1.3021424E-02	54.21256

Instrument : CHAMBER 193  
 Detector : 68627  
 Standard ID : AESS-029  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:40  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:53:41  
 Average Efficiency : 0.2615199  
 Average Efficiency Error : 7.6632542E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	201.5742	28-FEB-2010	2991.990	3298.419	15396.00	0.2583720	1.3086254E-02	50.38469
NP-237	169.7700	28-FEB-2010	4433.001	4901.628	13286.00	0.2607451	1.3232258E-02	58.19065
CM-244	154.8234	28-FEB-2010	5534.240	5885.963	11618.00	0.2656835	1.3511403E-02	53.47323

Instrument : CHAMBER 194  
 Detector : 68635  
 Standard ID : AESS-035  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:45  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:53:50  
 Average Efficiency : 0.2542233  
 Average Efficiency Error : 7.0097935E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	198.6666	28-FEB-2010	2990.781	3297.998	14819.00	0.2523236	1.0848935E-02	51.65903
NP-237	168.2934	28-FEB-2010	4434.565	4903.602	13013.00	0.2577325	1.3083202E-02	59.92809
CM-244	158.8128	28-FEB-2010	5531.095	5882.711	11369.00	0.2534982	1.2896180E-02	53.05344

Instrument : CHAMBER 195  
 Detector : 68636  
 Standard ID : AESS-030  
 Standard Reference Date : 15-FEB-2008 09:06:52  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:51  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:53:59  
 Average Efficiency : 0.2554399  
 Average Efficiency Error : 7.4881674E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	198.9792	28-FEB-2010	2989.560	3297.508	14812.00	0.2518228	1.2760897E-02	51.28571
NP-237	166.3758	28-FEB-2010	4435.548	4904.654	12878.00	0.2579744	1.3097576E-02	59.53444
CM-244	157.1856	28-FEB-2010	5531.770	5882.945	11394.00	0.2567084	1.3059122E-02	52.18182

Instrument : CHAMBER 196  
 Detector : 68637  
 Standard ID : AESS-036  
 Standard Reference Date : 18-FEB-2008 11:28:15  
 Calibration Analysis Date/Time : 21-SEP-2009 09:31:58  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:54:08  
 Average Efficiency : 0.2560611  
 Average Efficiency Error : 7.0601865E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	201.3204	28-FEB-2010	2989.197	3301.025	14971.00	0.2515414	1.0813317E-02	54.46194
NP-237	167.4312	28-FEB-2010	4436.299	4904.887	13068.00	0.2600951	1.3202412E-02	58.47227
CM-244	156.4188	28-FEB-2010	5531.851	5883.206	11431.00	0.2587482	1.3162114E-02	55.12206



Instrument : CHAMBER 197  
 Detector : 78894  
 Standard ID : AESS-037  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:04  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:42:21  
 Average Efficiency : 0.2524827  
 Average Efficiency Error : 6.9639706E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.7372	28-FEB-2010	2989.248	3298.244	14631.00	0.2502923	1.0764122E-02	53.79660
NP-237	167.1294	28-FEB-2010	4435.410	4906.453	12637.00	0.2520285	1.2799331E-02	65.84109
CM-244	154.7664	28-FEB-2010	5531.008	5883.783	11198.00	0.2561660	1.3035372E-02	58.58810

Instrument : CHAMBER 198  
 Detector : 78895  
 Standard ID : AESS-043  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:10  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:54:28  
 Average Efficiency : 0.2546443  
 Average Efficiency Error : 7.0217522E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.7708	28-FEB-2010	2988.256	3301.357	14781.00	0.2528079	1.0870277E-02	53.58070
NP-237	168.7422	28-FEB-2010	4435.341	4905.168	12907.00	0.2549473	1.2943417E-02	60.79170
CM-244	156.3252	28-FEB-2010	5533.514	5885.508	11347.00	0.2569917	1.3074390E-02	55.00752

Instrument : CHAMBER 199  
 Detector : 78896  
 Standard ID : AESS-038  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:15  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:54:37  
 Average Efficiency : 0.2501853  
 Average Efficiency Error : 6.8995738E-03  
 Confidence : 95.00000

Cal. Isteps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	200.1408	28-FEB-2010	2991.267	3300.107	14889.00	0.2516318	1.0818291E-02	52.50020
NP-237	170.0886	28-FEB-2010	4436.748	4902.339	12711.00	0.2490705	1.2648016E-02	63.29102
CM-244	157.7460	28-FEB-2010	5531.913	5884.562	11110.00	0.2493175	1.2688680E-02	53.66205

Instrument : CHAMBER 200  
 Detector : 78900  
 Standard ID : AESS-044  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:21  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:54:46  
 Average Efficiency : 0.2682398  
 Average Efficiency Error : 7.3923203E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.4510	28-FEB-2010	2988.062	3301.136	15568.00	0.2708094	1.1633540E-02	50.91508
NP-237	166.6248	28-FEB-2010	4436.203	4901.740	13553.00	0.2710442	1.3750886E-02	57.22134
CM-244	155.8290	28-FEB-2010	5531.761	5884.914	11543.00	0.2622247	1.3336830E-02	45.01981

Instrument : CHAMBER 201  
 Detector : 78902  
 Standard ID : AESS-039  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:27  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:54:55  
 Average Efficiency : 0.2589892  
 Average Efficiency Error : 7.1445713E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	192.2418	28-FEB-2010	2988.184	3302.217	14648.00	0.2577410	1.1084234E-02	45.65341
NP-237	159.1506	28-FEB-2010	4434.609	4905.994	12631.00	0.2645504	1.3435334E-02	55.65960
CM-244	151.7142	28-FEB-2010	5531.184	5884.407	10948.00	0.2554961	1.3006385E-02	45.41114

Instrument : CHAMBER 202  
 Detector : 78903  
 Standard ID : AESS-045  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:32  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:55:05  
 Average Efficiency : 0.2665268  
 Average Efficiency Error : 7.3516225E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	186.9936	28-FEB-2010	2989.216	3297.484	14828.00	0.2682285	1.1532663E-02	43.97738
NP-237	160.8066	28-FEB-2010	4437.369	4902.276	12547.00	0.2600848	1.3209904E-02	52.01093
CM-244	145.8384	28-FEB-2010	5530.984	5883.177	11169.00	0.2711185	1.3796896E-02	50.67951

Instrument : CHAMBER 203  
 Detector : 78905  
 Standard ID : AESS-040  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:39  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:55:14  
 Average Efficiency : 0.2582881  
 Average Efficiency Error : 7.1221651E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.4828	28-FEB-2010	2990.199	3298.236	14936.00	0.2597386	1.1166240E-02	50.45560
NP-237	166.8174	28-FEB-2010	4432.988	4903.526	12999.00	0.2597034	1.3183516E-02	56.72982
CM-244	155.0100	28-FEB-2010	5533.164	5886.048	11164.00	0.2549590	1.2974691E-02	53.05425

Instrument : CHAMBER 204  
 Detector : 78907  
 Standard ID : AESS-046  
 Standard Reference Date : 19-FEB-2008 19:35:48  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:45  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:55:23  
 Average Efficiency : 0.2496188  
 Average Efficiency Error : 6.8885502E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	194.7474	28-FEB-2010	2989.792	3298.277	14212.00	0.2467715	1.0618629E-02	52.28694
NP-237	164.6658	28-FEB-2010	4433.265	4903.277	12386.00	0.2506330	1.2732573E-02	55.30292
CM-244	151.3824	28-FEB-2010	5531.668	5883.589	10818.00	0.2527654	1.2870559E-02	51.63226

Instrument : CHAMBER 205  
 Detector : 78908  
 Standard ID : AESS-041  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:51  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:55:32  
 Average Efficiency : 0.2549397  
 Average Efficiency Error : 7.0272260E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	203.9034	28-FEB-2010	2989.853	3298.183	15200.00	0.2521578	1.0836856E-02	49.40310
NP-237	171.2268	28-FEB-2010	4433.644	4904.311	13124.00	0.2554664	1.2966554E-02	56.83091
CM-244	159.5796	28-FEB-2010	5533.979	5886.811	11652.00	0.2584914	1.3144889E-02	54.55809

Instrument : CHAMBER 206  
 Detector : 78909  
 Standard ID : AESS-047  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 21-SEP-2009 09:32:57  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:55:41  
 Average Efficiency : 0.2541434  
 Average Efficiency Error : 7.0085586E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	197.4804	28-FEB-2010	2990.264	3297.560	14794.00	0.2533972	1.0895449E-02	48.44042
NP-237	168.3948	28-FEB-2010	4435.483	4905.550	12839.00	0.2541331	1.2903095E-02	60.11407
CM-244	154.6032	28-FEB-2010	5534.828	5887.642	11143.00	0.2552143	1.2987950E-02	53.79968

Instrument : CHAMBER 207  
 Detector : 78910  
 Standard ID : AESS-042  
 Standard Reference Date : 18-FEB-2008 15:31:47  
 Calibration Analysis Date/Time : 21-SEP-2009 09:33:03  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:55:50  
 Average Efficiency : 0.2573462  
 Average Efficiency Error : 7.1005006E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	188.7090	28-FEB-2010	2989.540	3298.860	14353.00	0.2572728	1.1068305E-02	52.62569
NP-237	159.6558	28-FEB-2010	4436.642	4902.427	12327.00	0.2573162	1.3072978E-02	61.37923
CM-244	150.5208	28-FEB-2010	5532.022	5884.565	10951.00	0.2574795	1.3107520E-02	49.75304

Instrument : CHAMBER 208  
 Detector : 78911  
 Standard ID : AESS-048  
 Standard Reference Date : 19-FEB-2008 00:32:27  
 Calibration Analysis Date/Time : 21-SEP-2009 09:33:08  
 Calibration Count Time : 300.0000  
 Efficiency Calibration Date/Time : 21-SEP-2009 14:56:00  
 Average Efficiency : 0.2510063  
 Average Efficiency Error : 6.9273296E-03  
 Confidence : 95.00000

Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	191.8350	28-FEB-2010	2991.900	3300.465	14140.00	0.2493222	1.0729297E-02	51.69543
NP-237	161.5530	28-FEB-2010	4437.256	4903.414	12240.00	0.2525304	1.2831211E-02	60.66938
CM-244	151.1856	28-FEB-2010	5534.200	5882.369	10757.00	0.2518900	1.2826865E-02	52.12144

## Subsection 1: Energy Calibration

The Energy Calibration energy=Cal\_Zero+(e1\*C)+(e2\*C^2)

where : Cal\_Zero = Energy Calibration Zero  
e1 = Energy Calibration Slope  
e2 = Energy Calibration Quadratic  
C = Channel

	Instrument	:	CHAMBER 160		
	Detector	:	76226		
	Calibration Date/Time	:	29-SEP-2009 07:10:00		
	Calibration Source Id	:	AESS-048		
Cal. Isotopes	Source Id	Expiration Date	Standard Energy	Actual Energy	
GD-148	6445-278	2/28/10	3183.000	3183.000	
NP-237	4341	2/28/10	4768.800	4768.800	
CM-244	4320A	2/28/10	5795.020	5795.020	

Energy/Channel Equation	:	see above
Energy Calibration Zero	:	2360.017
Energy Calibration Slope	:	4.989815
Energy Calibration Quadratic	:	2.8332110E-04
Energy Calibration Range	:	7767.000

## Subsection 2: Background Calibration

Instrument : CHAMBER 160  
Detector : 76226  
Background Analysis Date/Time : 27-SEP-2009 18:44:20  
Background Count Time : 60000.00

Cal. Isotopes	Start Energy	End Energy	Counts in 1000 min	Counts during Cal	% Error	Confidence
GD-148	2988.170	3297.924	4.000000	1.200000	50.00000	95.00000
NP-237	4432.583	4904.667	11.00000	3.300000	30.15113	95.00000
CM-244	5530.574	5884.099	6.000000	1.800000	40.82483	95.00000

### Subsection 3: Efficiency Calibration

Instrument : CHAMBER 160  
Detector : 76226  
Standard ID : AESS-048  
Standard Reference Date : 19-FEB-2008 00:32:27  
Calibration Analysis Date/Time : 28-SEP-2009 12:47:27  
Calibration Count Time : 300.0000  
Efficiency Calibration Date/Time : 29-SEP-2009 07:10:00  
Average Efficiency : 0.2444646  
Average Efficiency Error : 6.7500472E-03  
Confidence : 95.00000

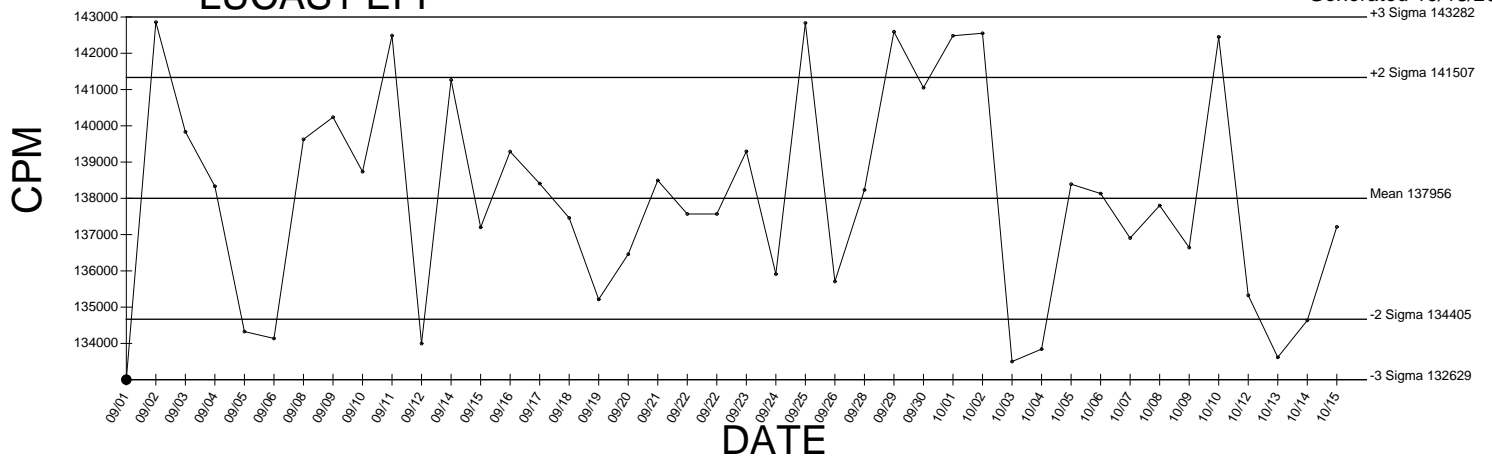
Cal. Istps	DPM	Exp. Date	Start Engy	End Engy	Counts	EFF.	EFF Err	Resolution
GD-148	191.8350	28-FEB-2010	2988.170	3297.924	13796.00	0.2432897	1.0474726E-02	45.84011
NP-237	161.5530	28-FEB-2010	4432.583	4904.667	11802.00	0.2434434	1.2376855E-02	60.53790
CM-244	151.1856	28-FEB-2010	5530.574	5884.099	10545.00	0.2472199	1.2593360E-02	51.03231

# **BACKGROUND AND EFFICIENCY DATA**



# LUCAS1 EFF

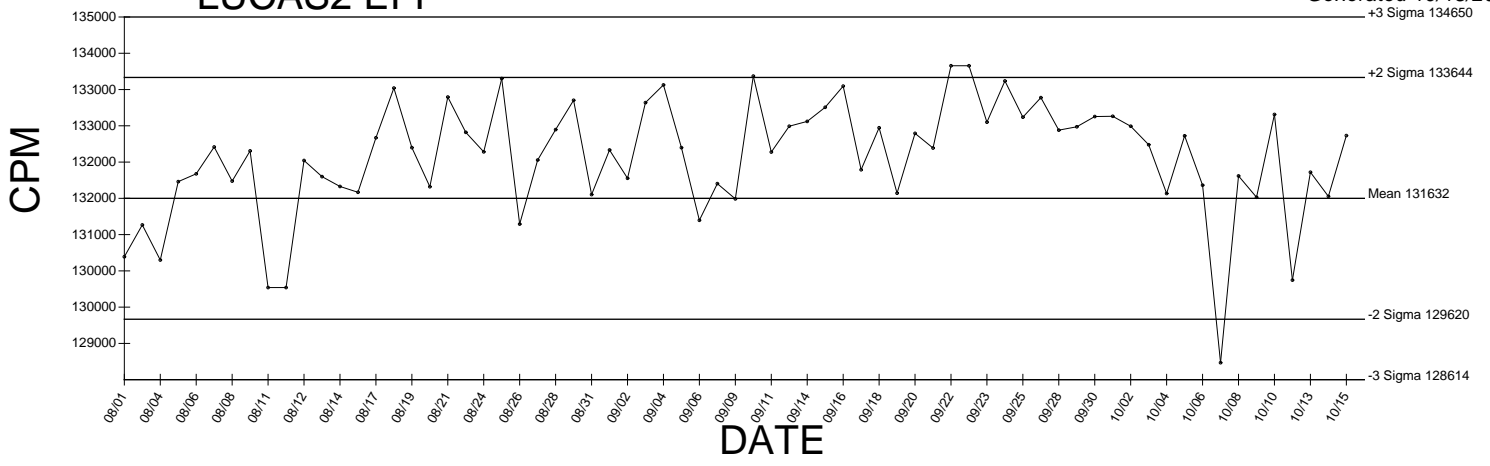
Generated 10/15/2009



● Denotes Outlier

# LUCAS2 EFF

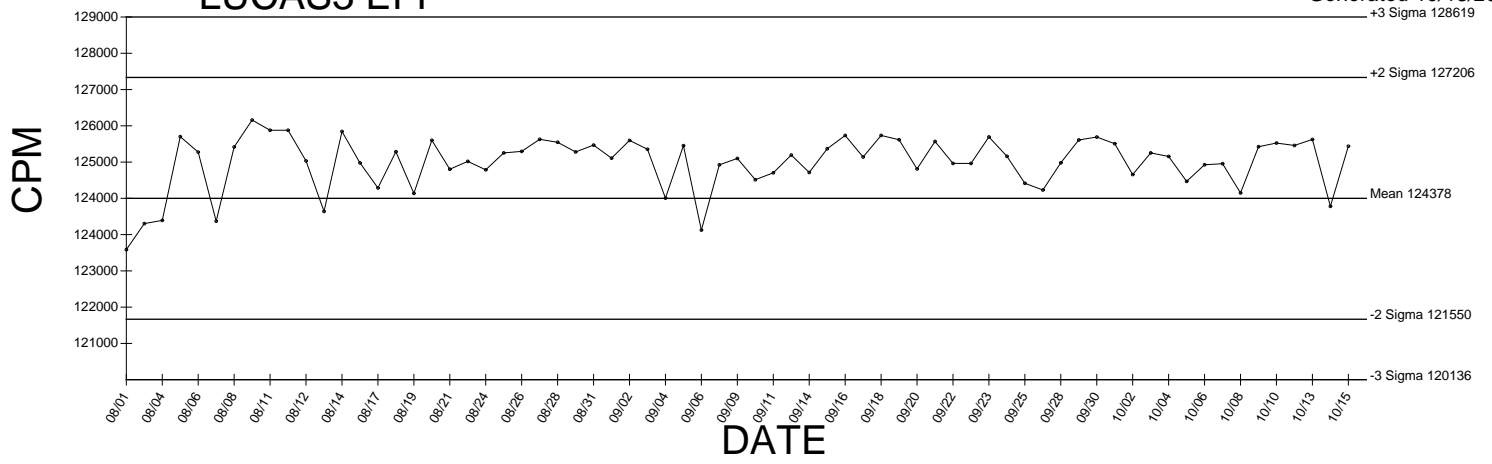
Generated 10/15/2009



● Denotes Outlier

# LUCAS3 EFF

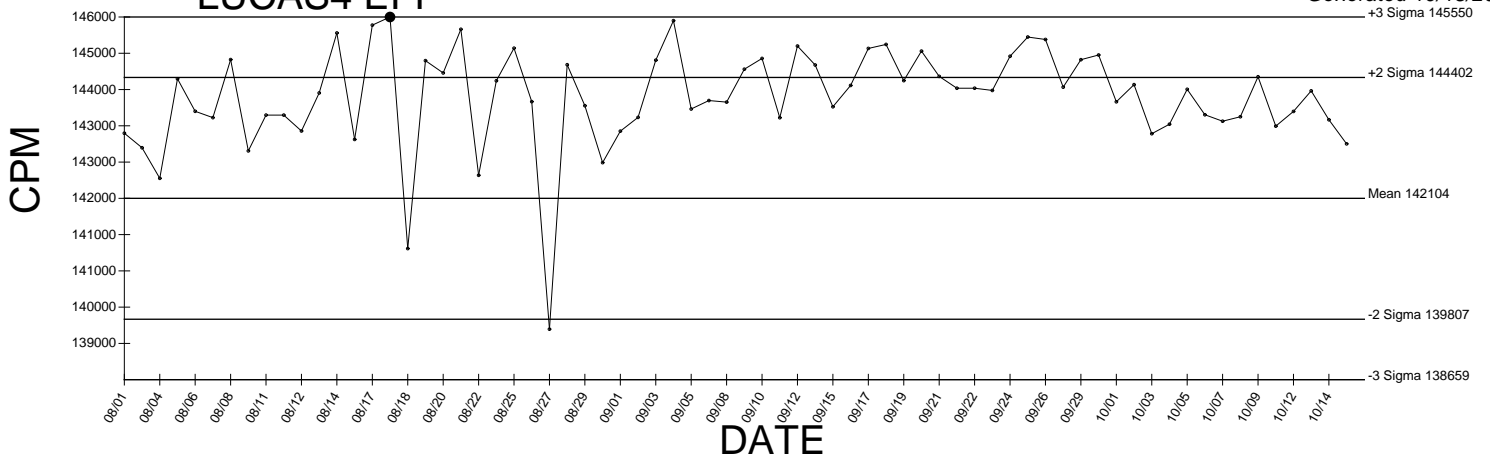
Generated 10/15/2009



● Denotes Outlier

# LUCAS4 EFF

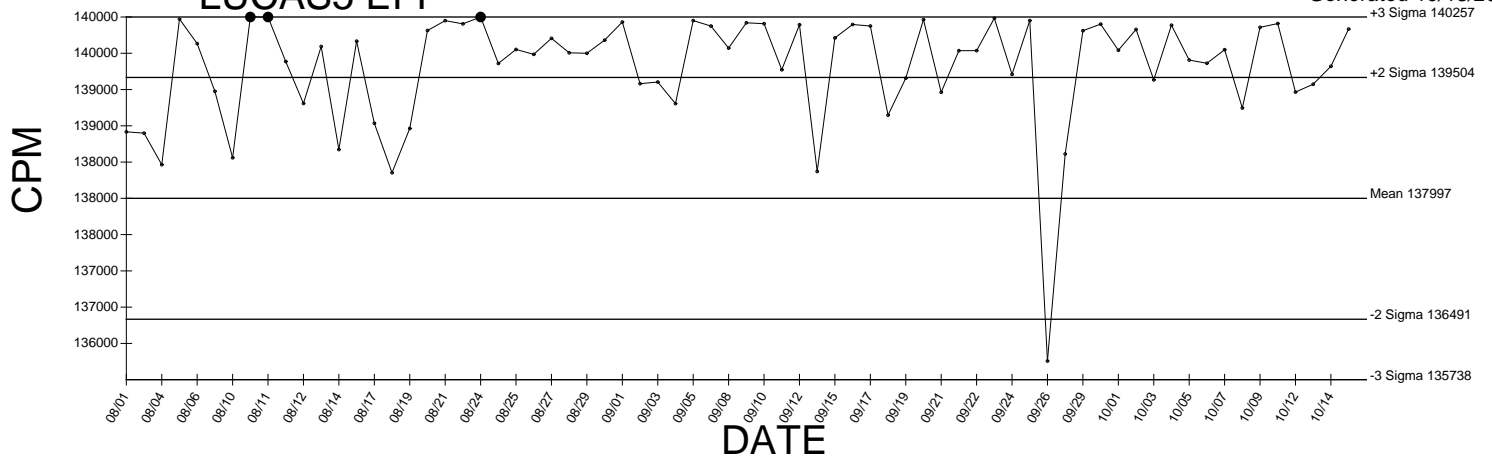
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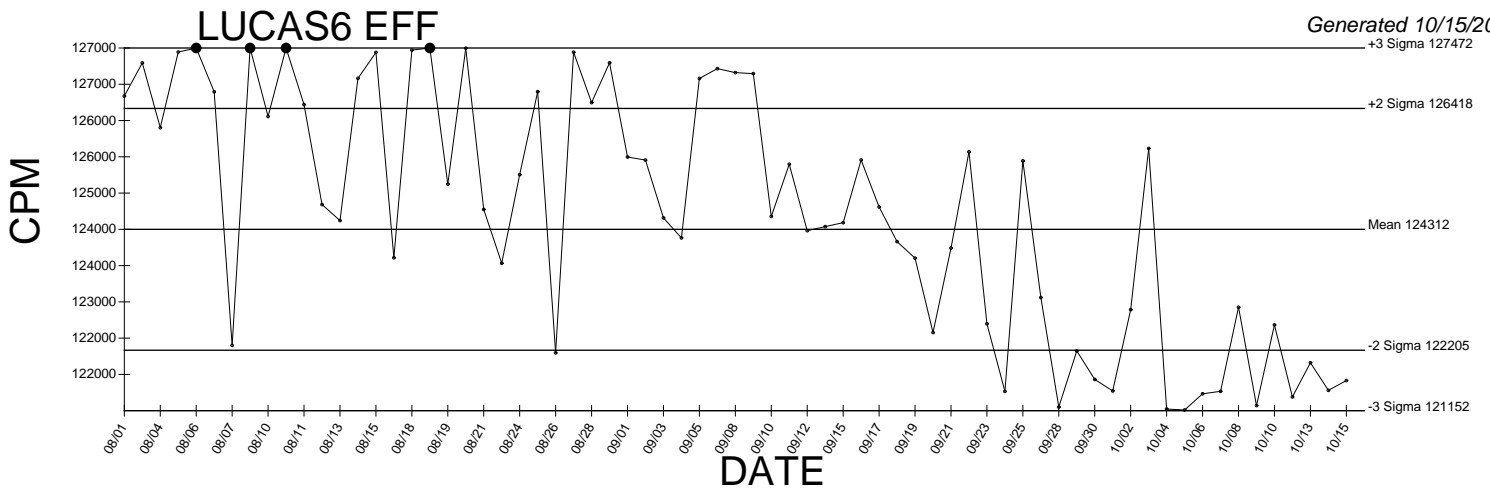
● Denotes Outlier

# LUCAS5 EFF

Generated 10/15/2009



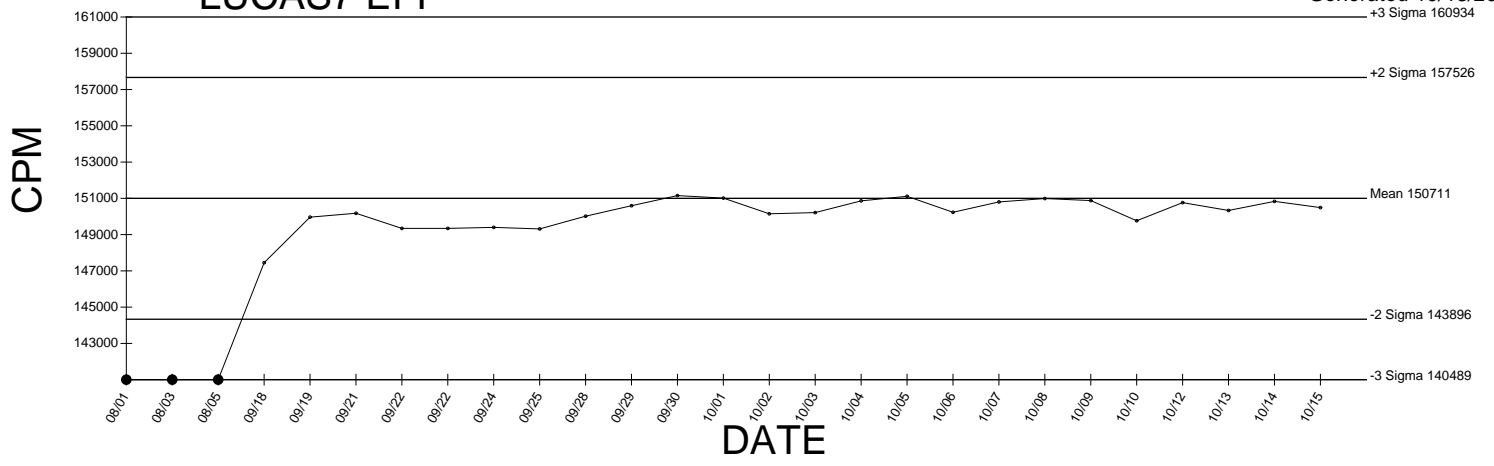
● Denotes Outlier



● Denotes Outlier

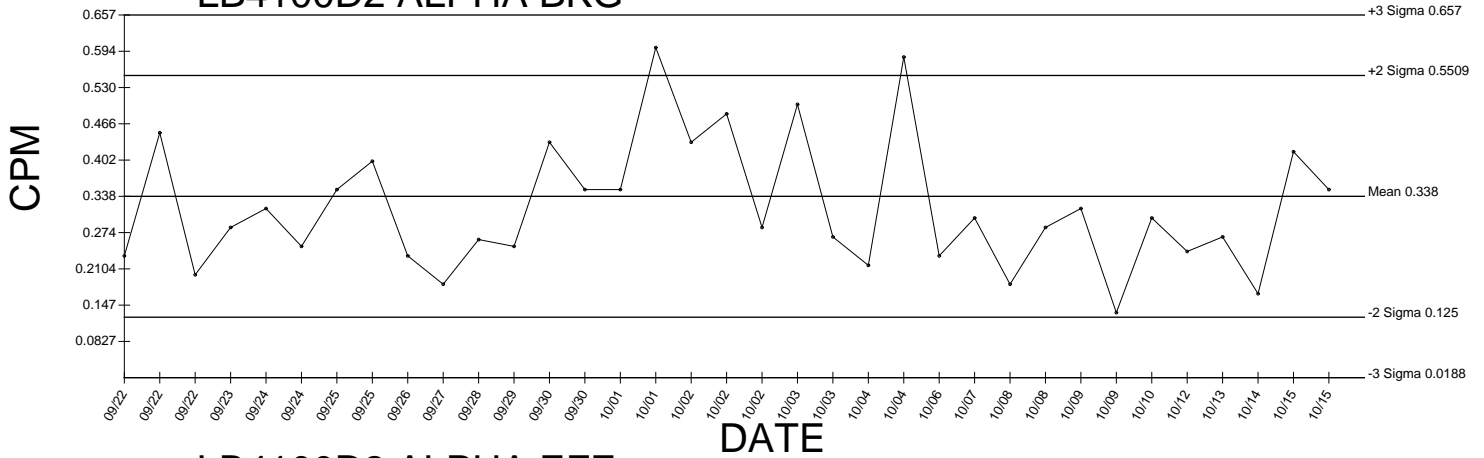
# LUCAS7 EFF

Generated 10/15/2009

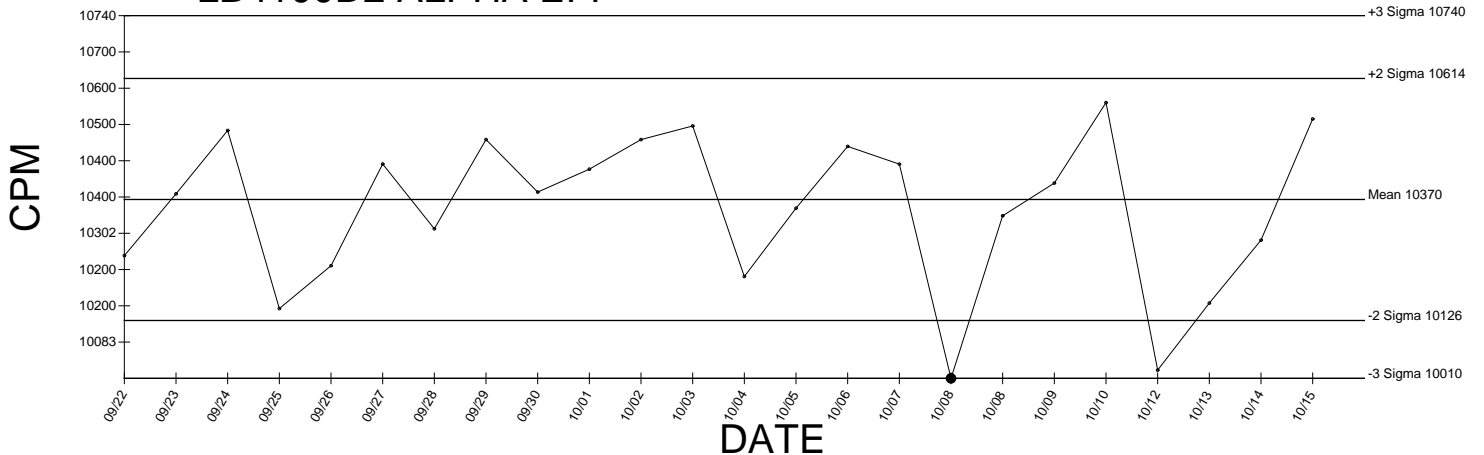


● Denotes Outlier

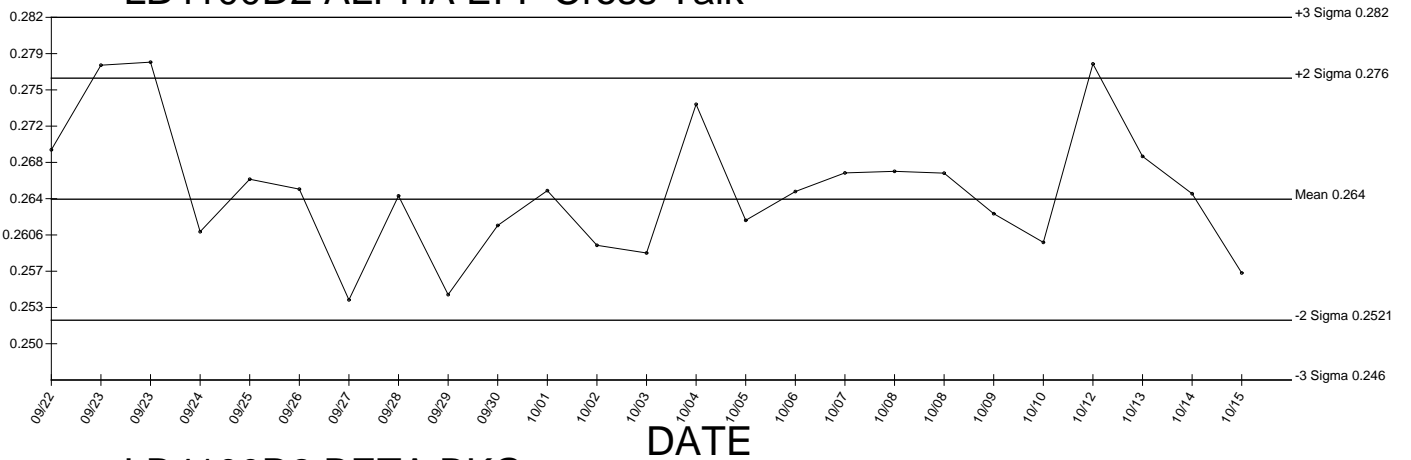
### LB4100D2 ALPHA BKG



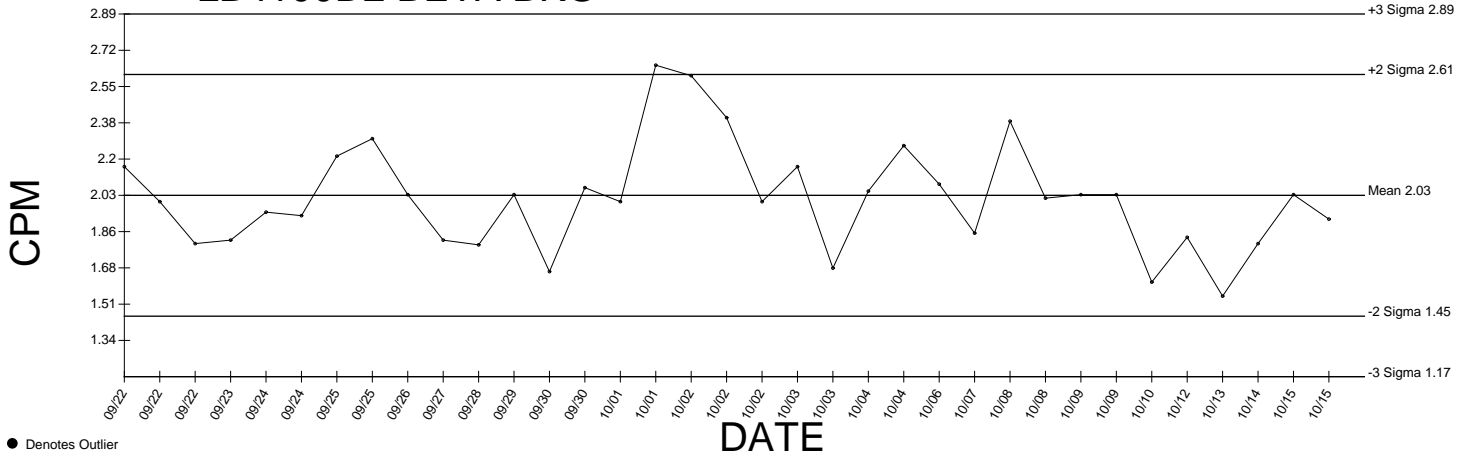
### LB4100D2 ALPHA EFF



### LB4100D2 ALPHA EFF Cross Talk



### LB4100D2 BETA BKG

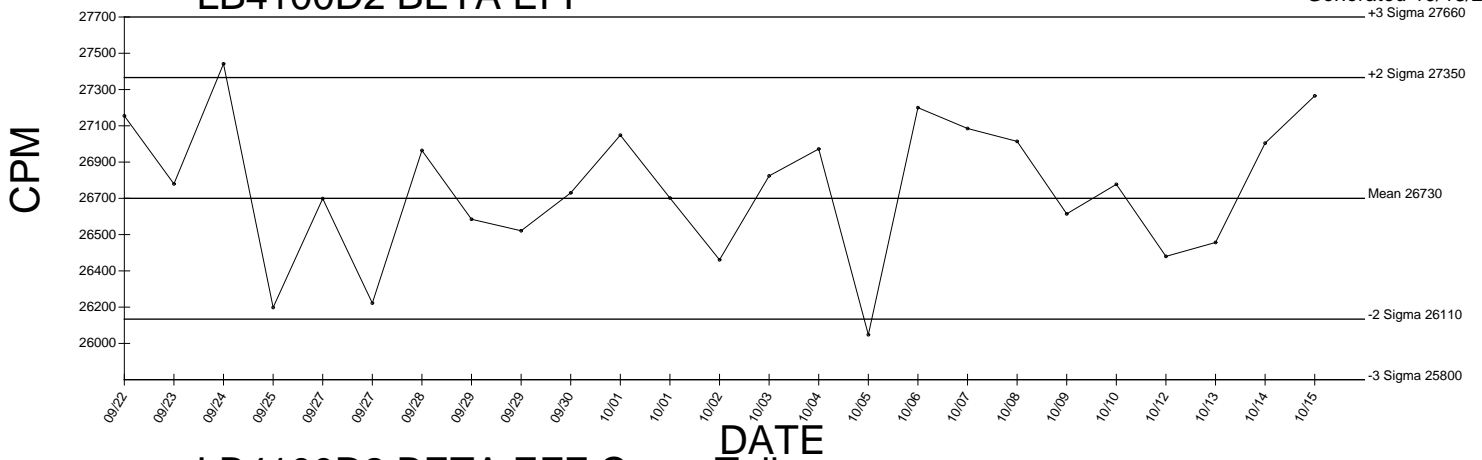


● Denotes Outlier

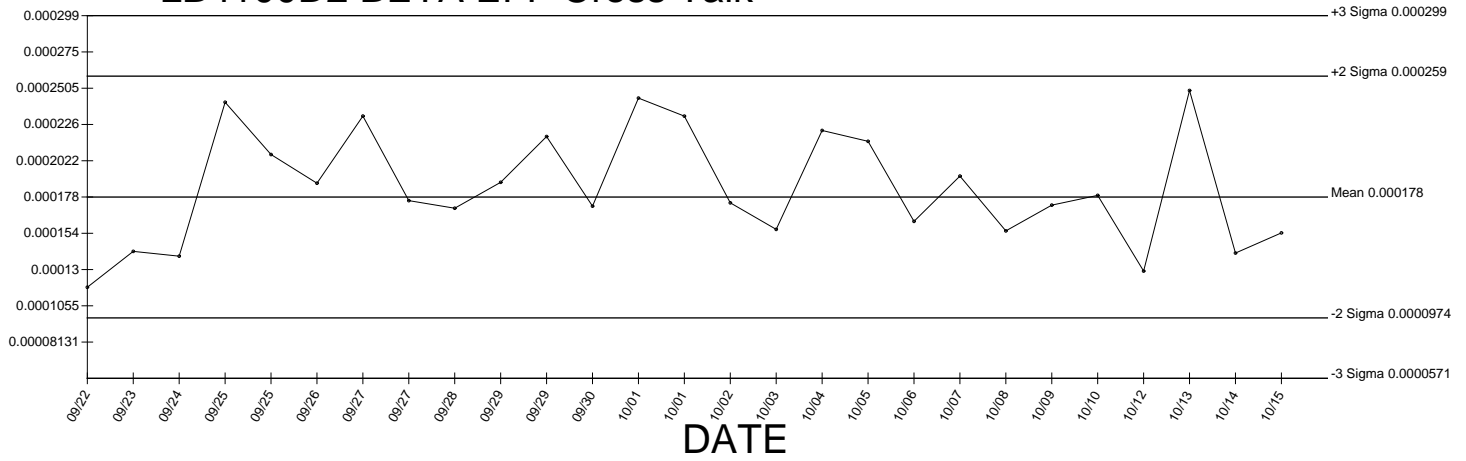


# LB4100D2 BETA EFF

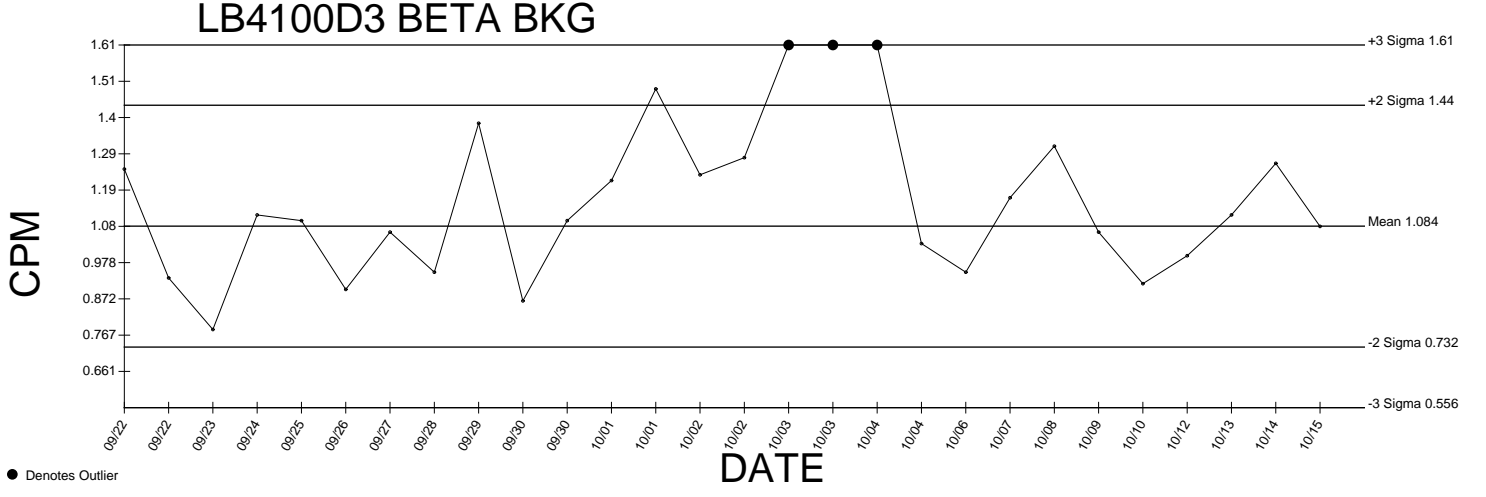
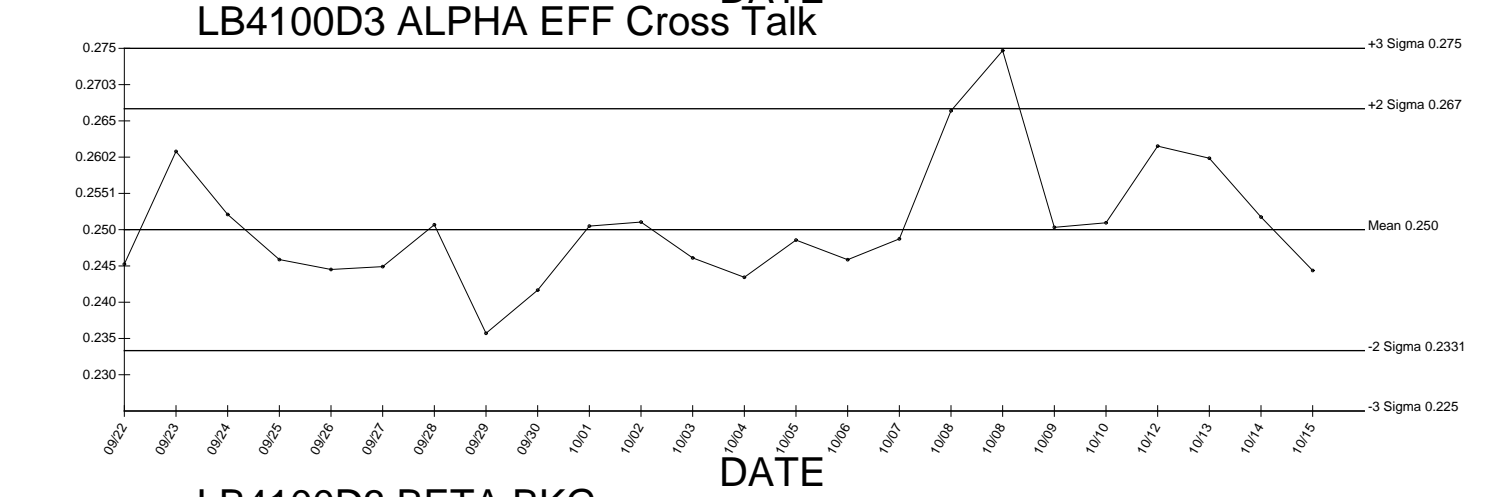
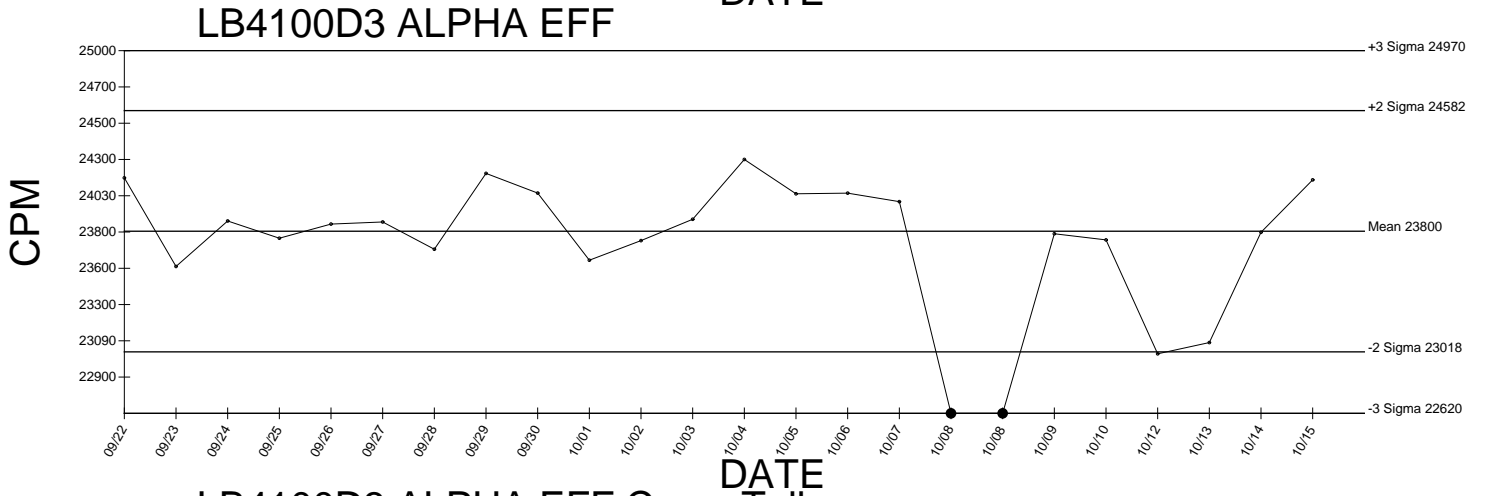
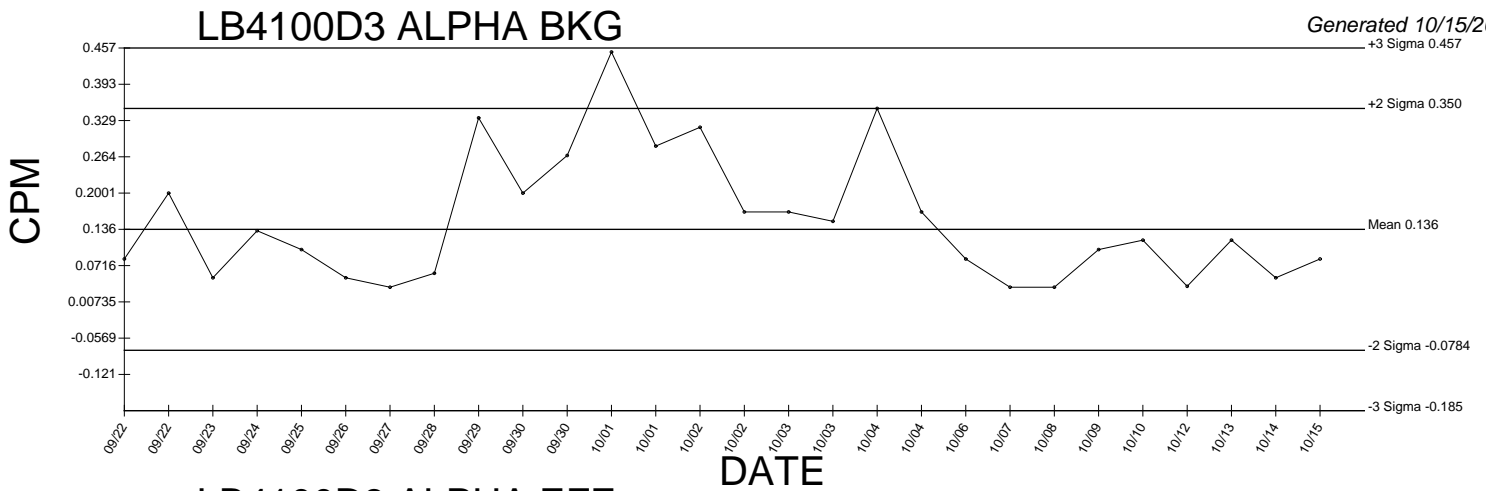
Generated 10/15/2009



# LB4100D2 BETA EFF Cross Talk



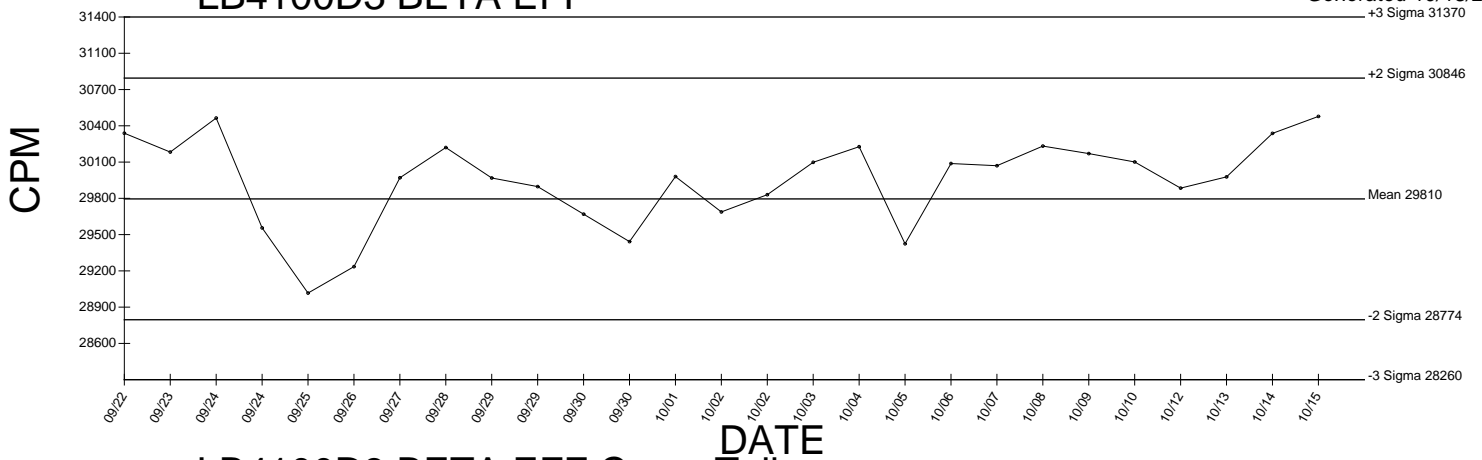
● Denotes Outlier



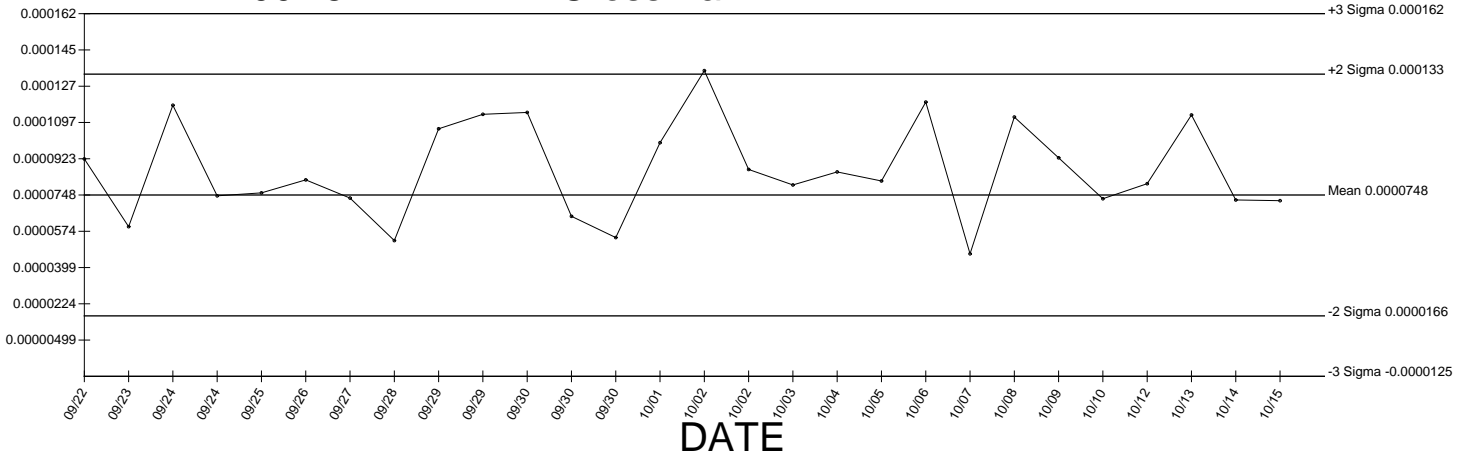
● Denotes Outlier

# LB4100D3 BETA EFF

Generated 10/15/2009



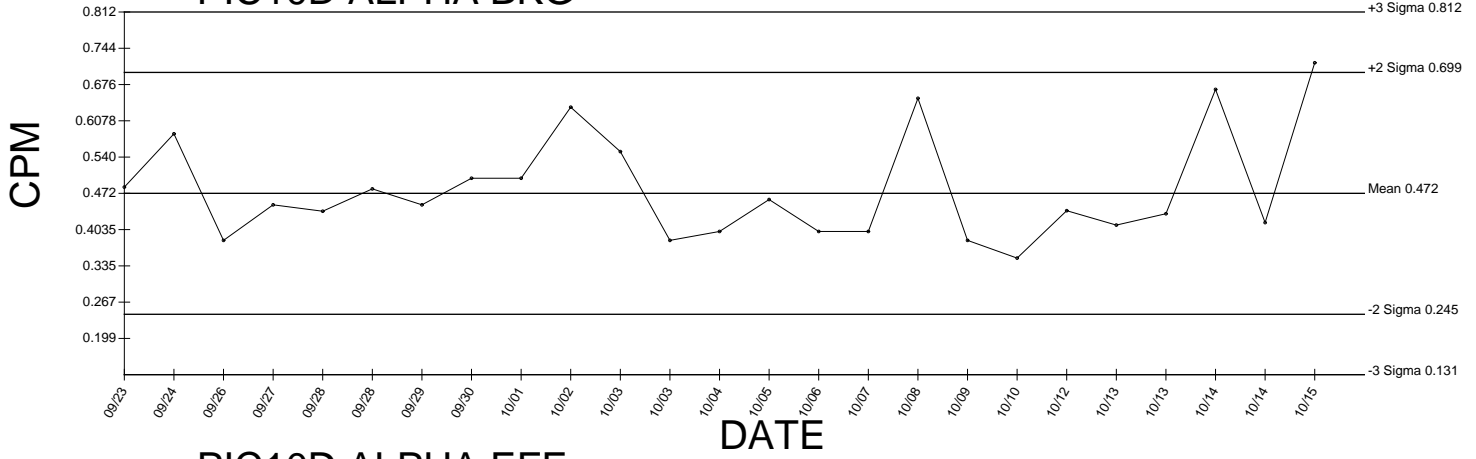
# LB4100D3 BETA EFF Cross Talk



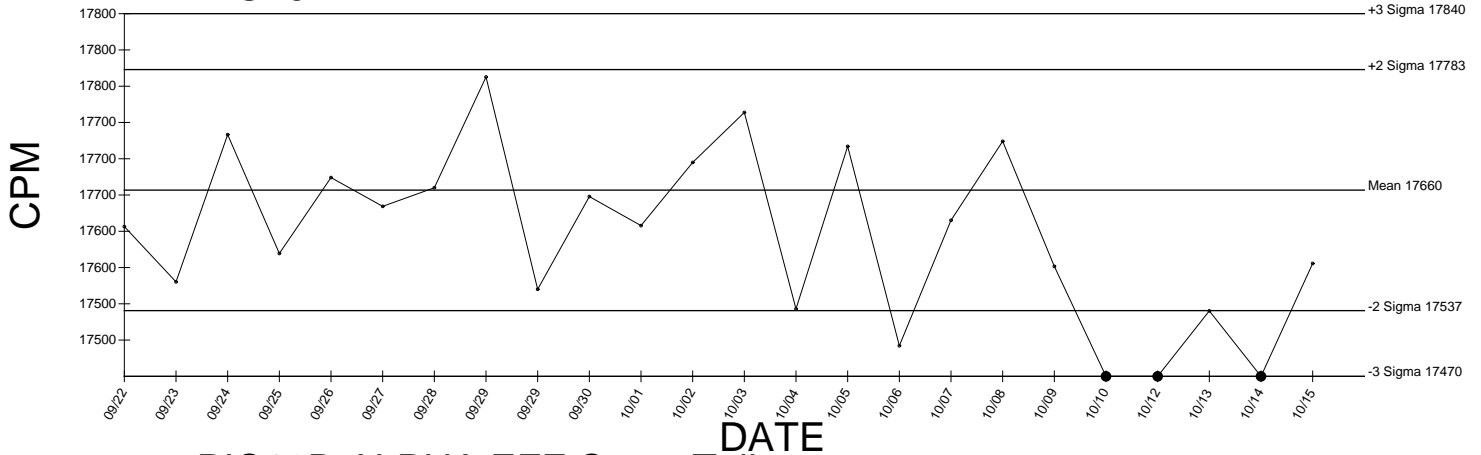
● Denotes Outlier

# PIC10D ALPHA BKG

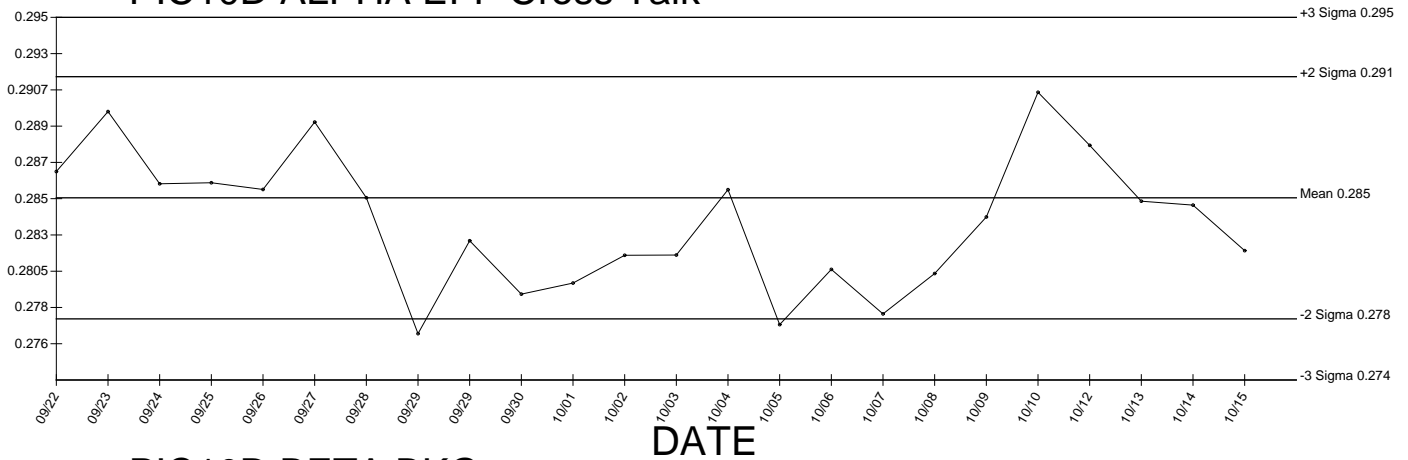
Generated 10/15/2009



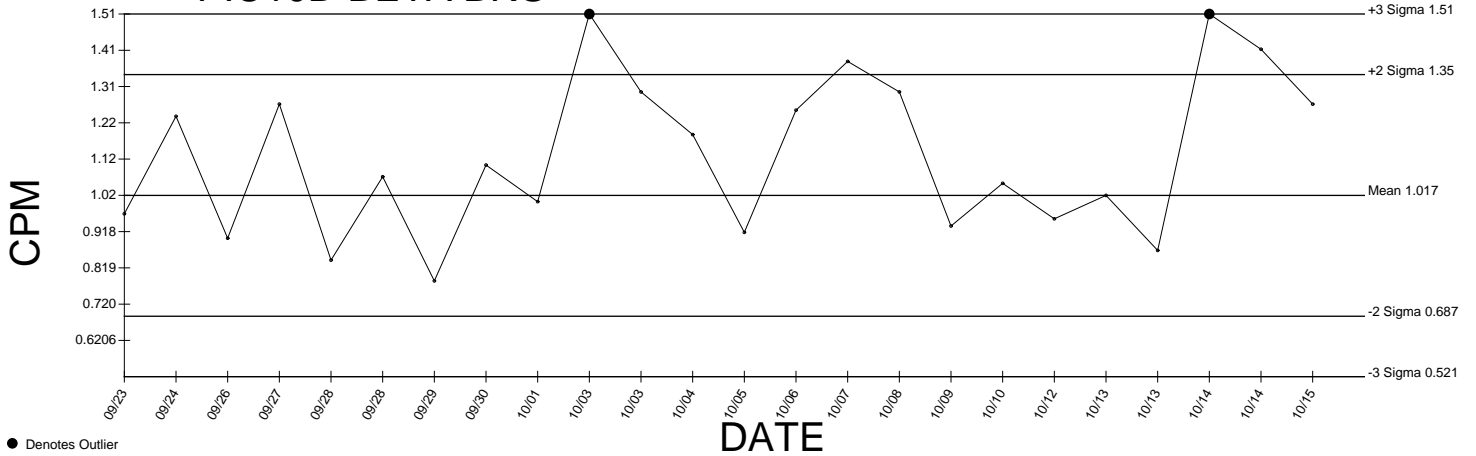
# PIC10D ALPHA EFF



# PIC10D ALPHA EFF Cross Talk



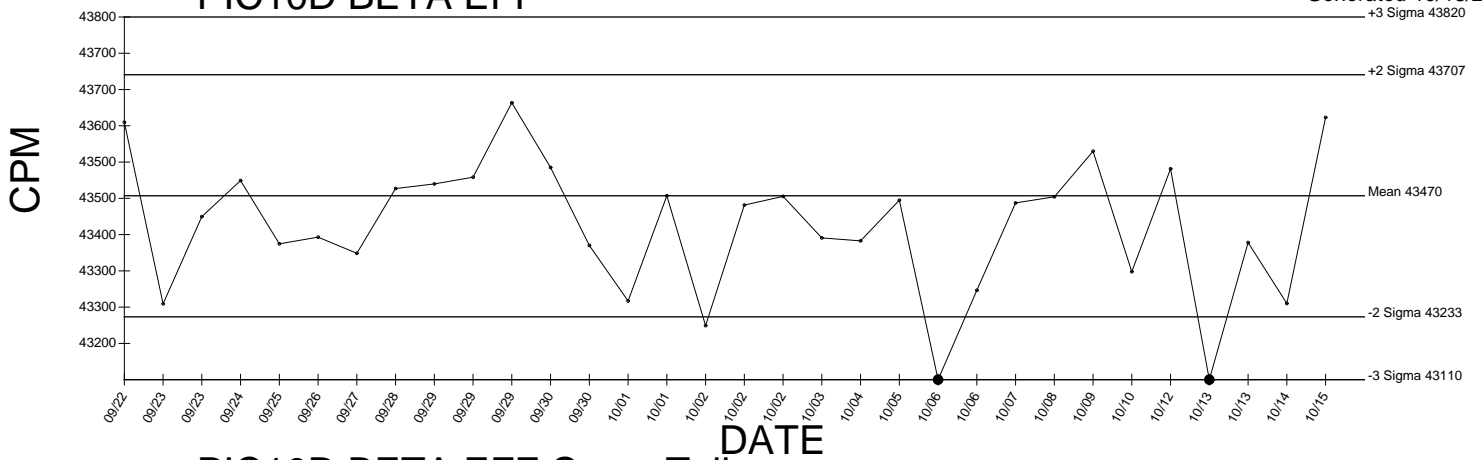
# PIC10D BETA BKG



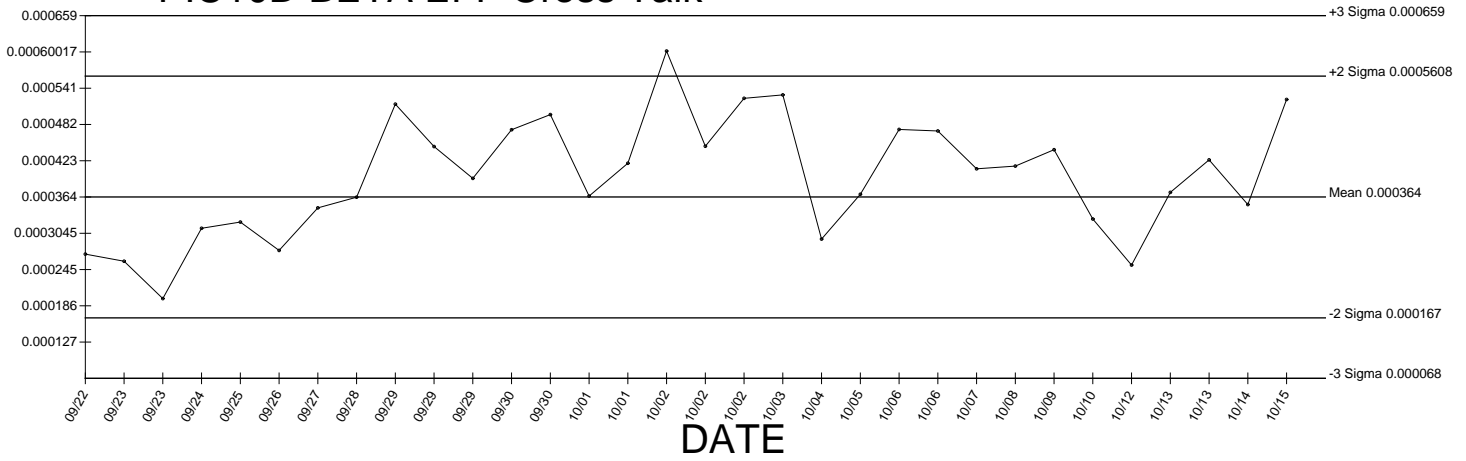
● Denotes Outlier

# PIC10D BETA EFF

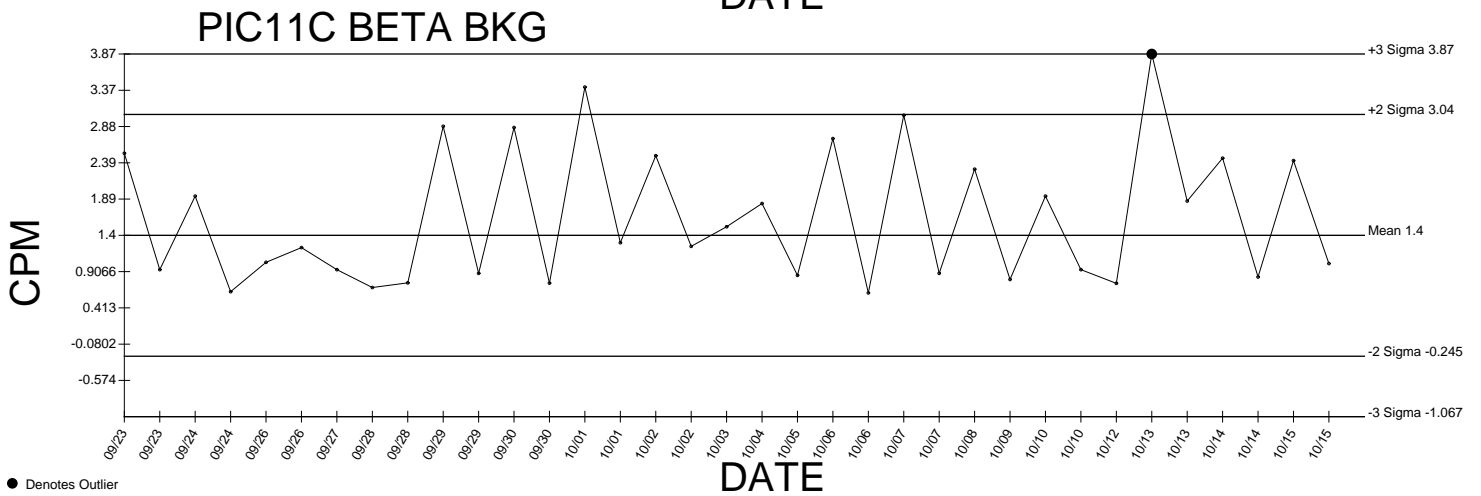
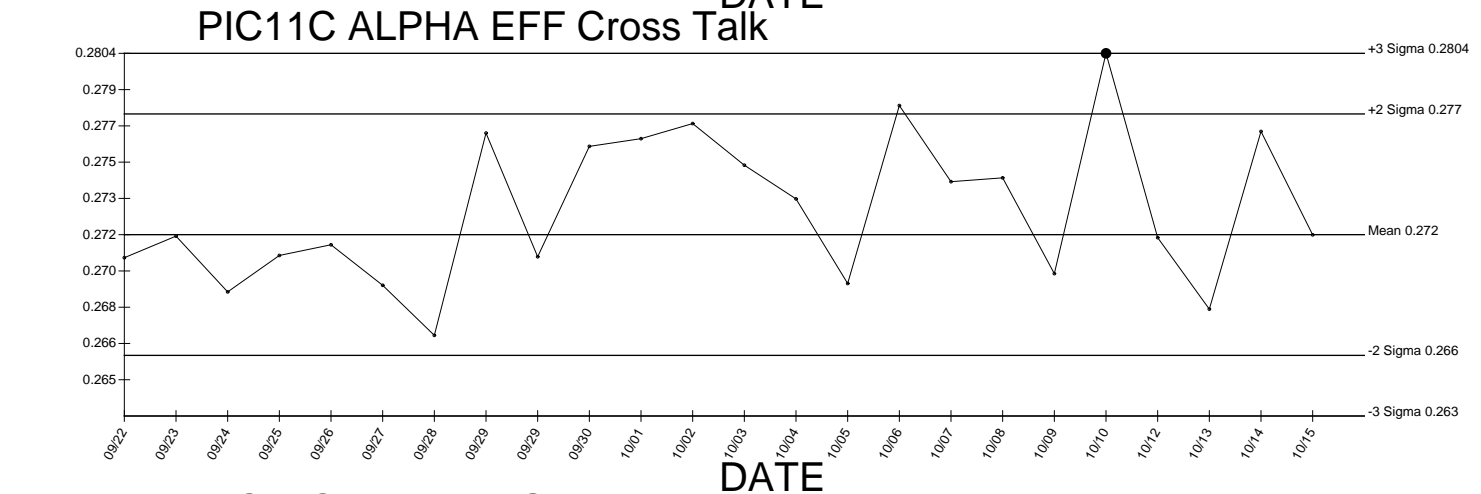
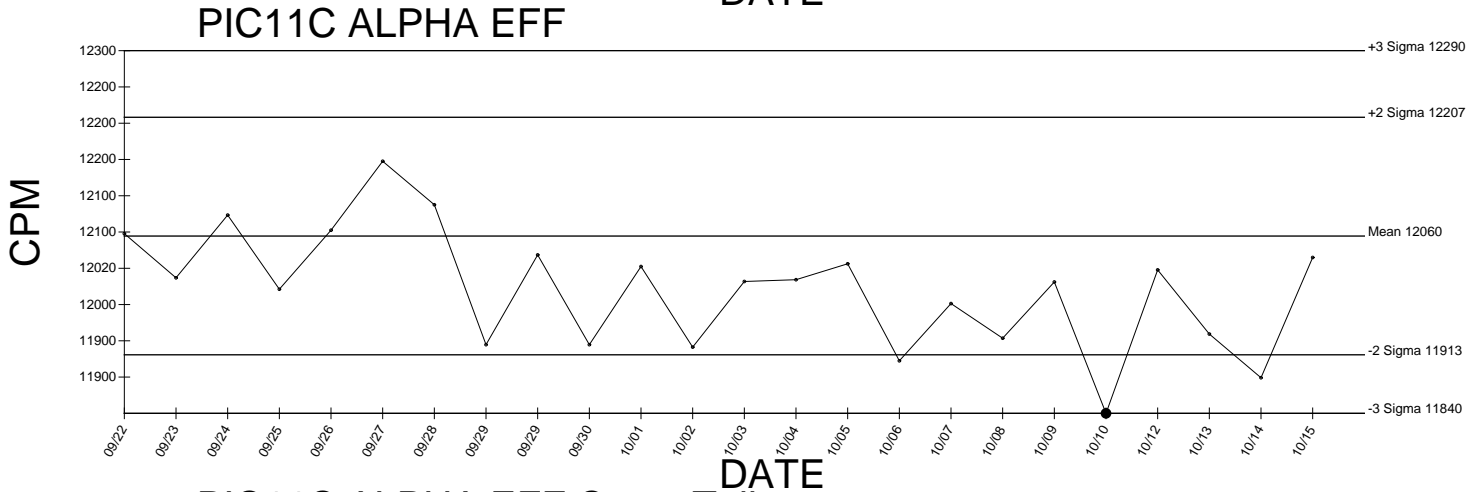
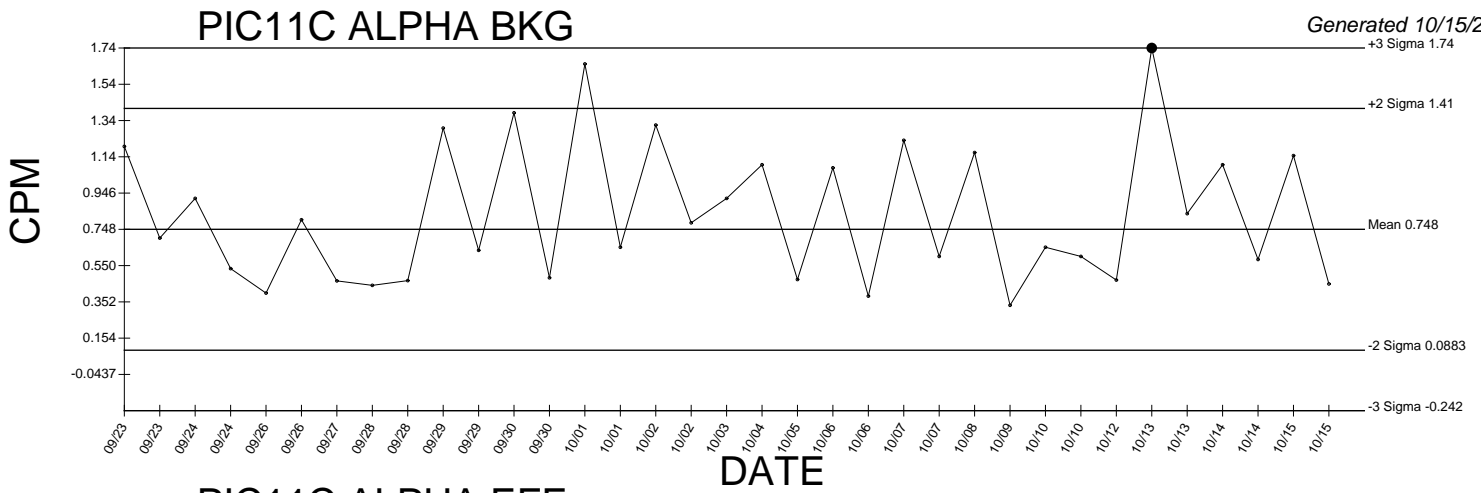
Generated 10/15/2009



# PIC10D BETA EFF Cross Talk



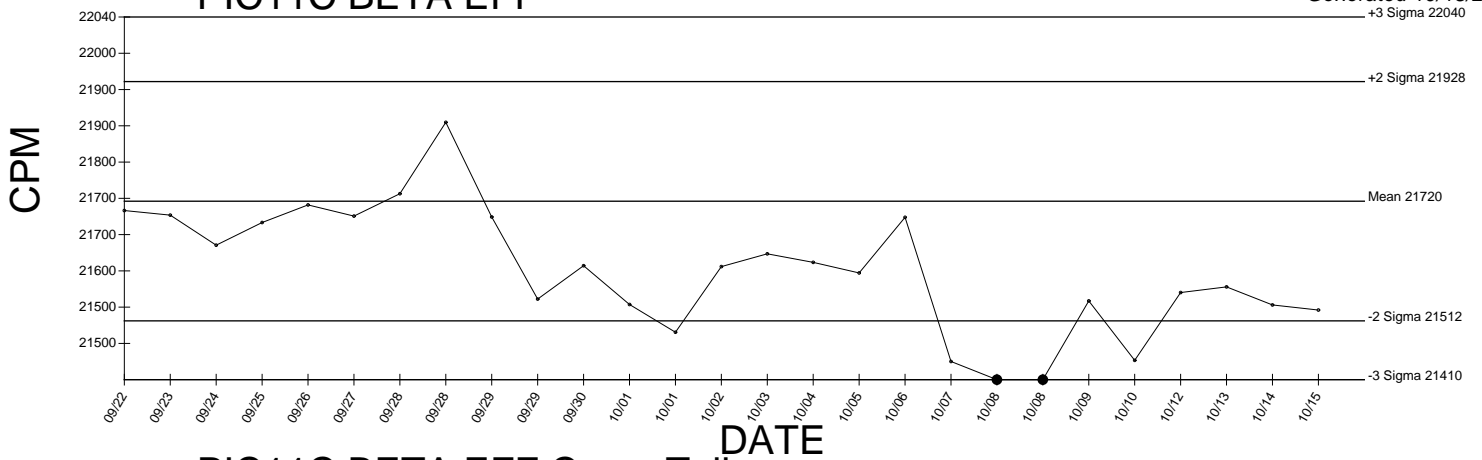
● Denotes Outlier



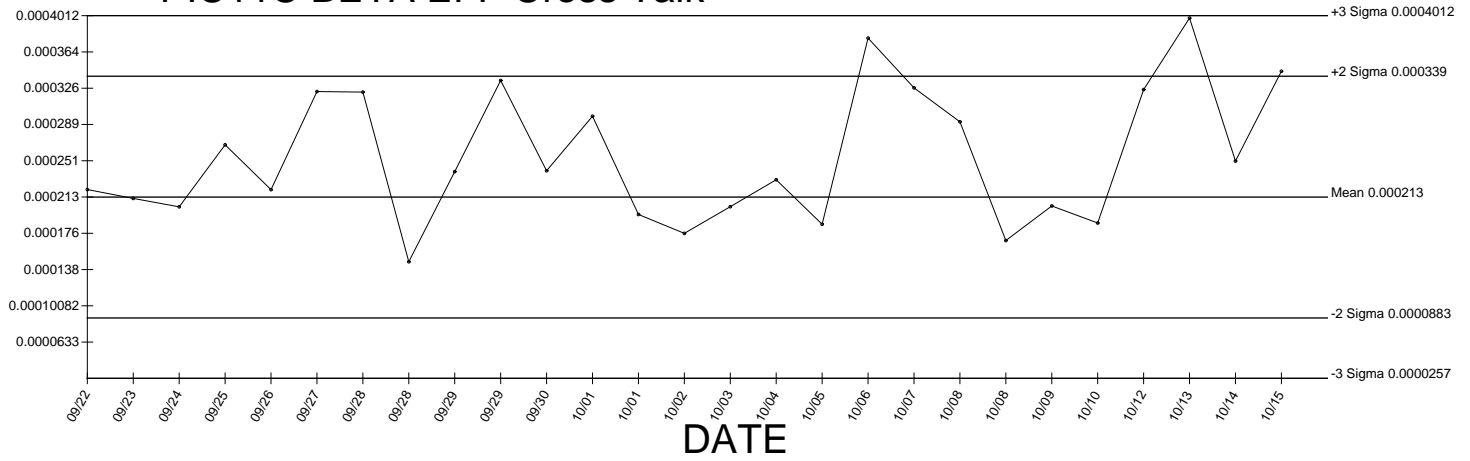
● Denotes Outlier

# PIC11C BETA EFF

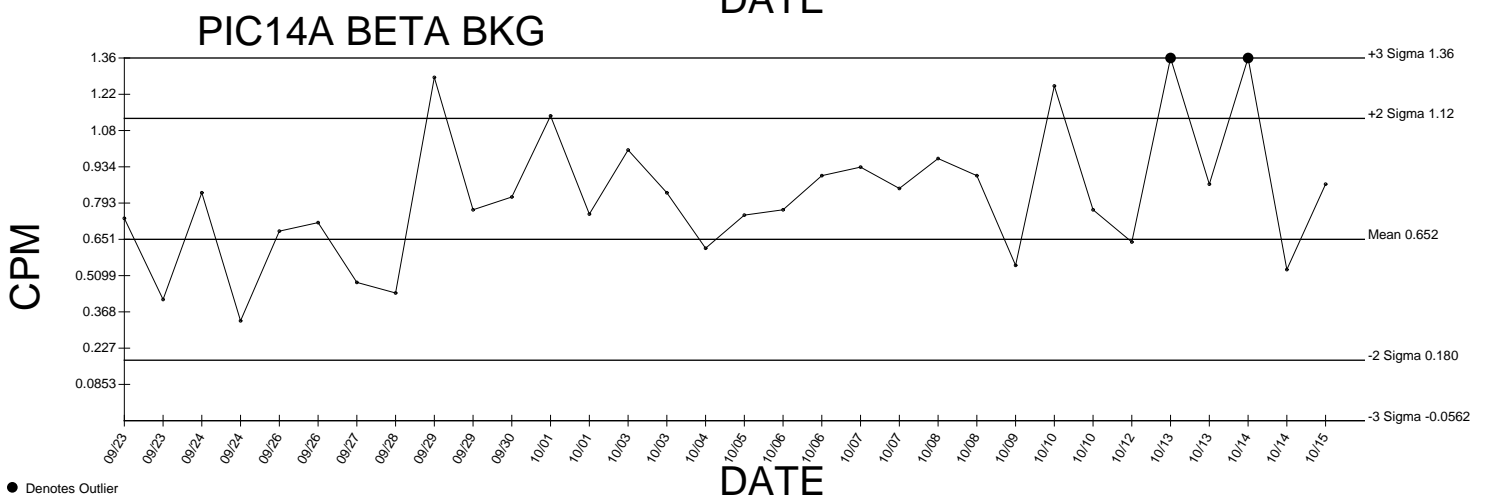
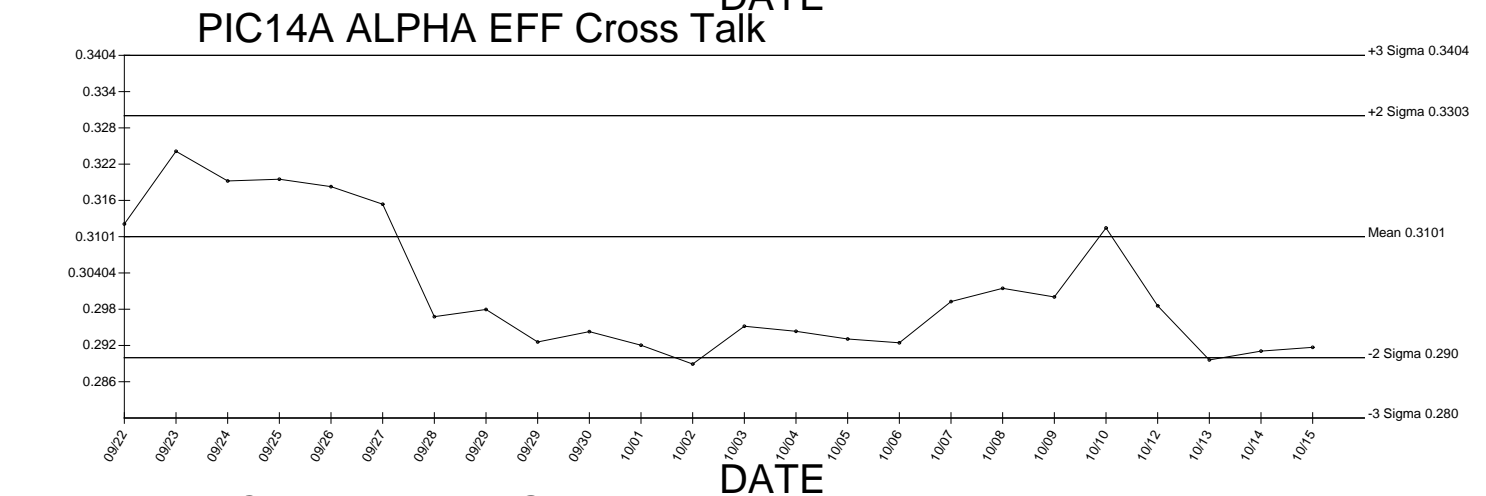
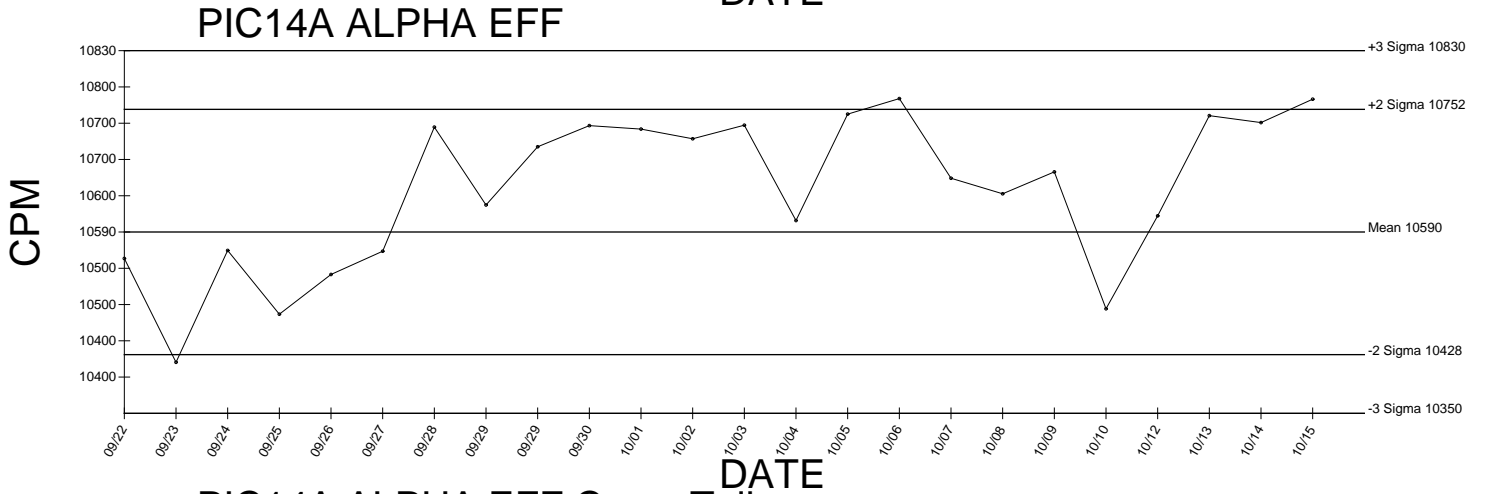
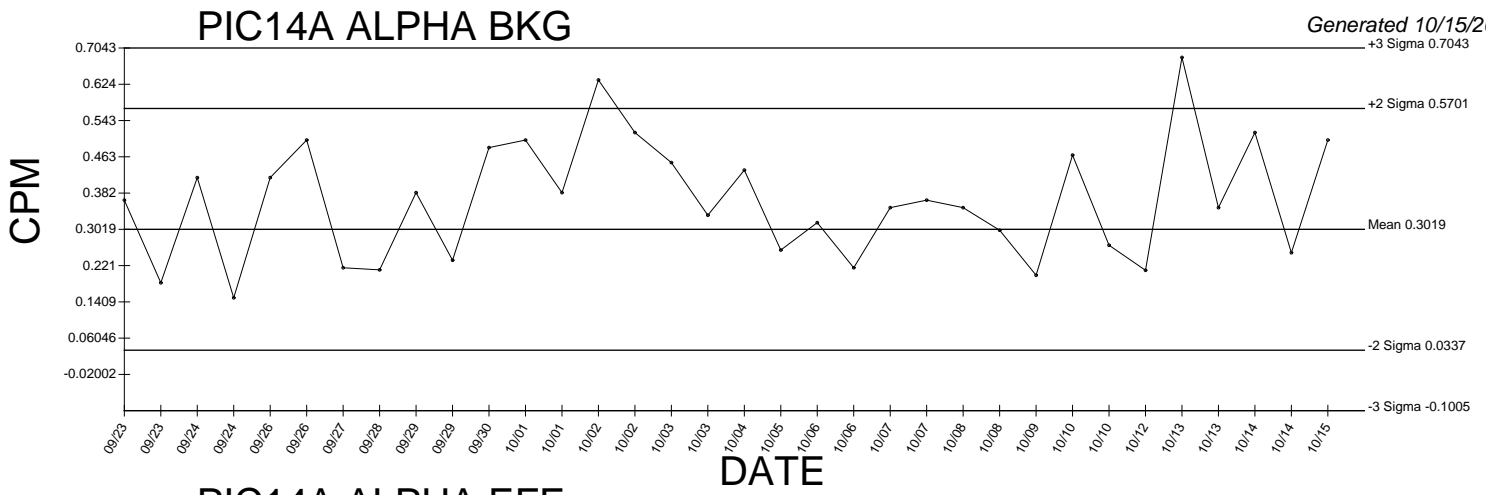
Generated 10/15/2009



# PIC11C BETA EFF Cross Talk



● Denotes Outlier

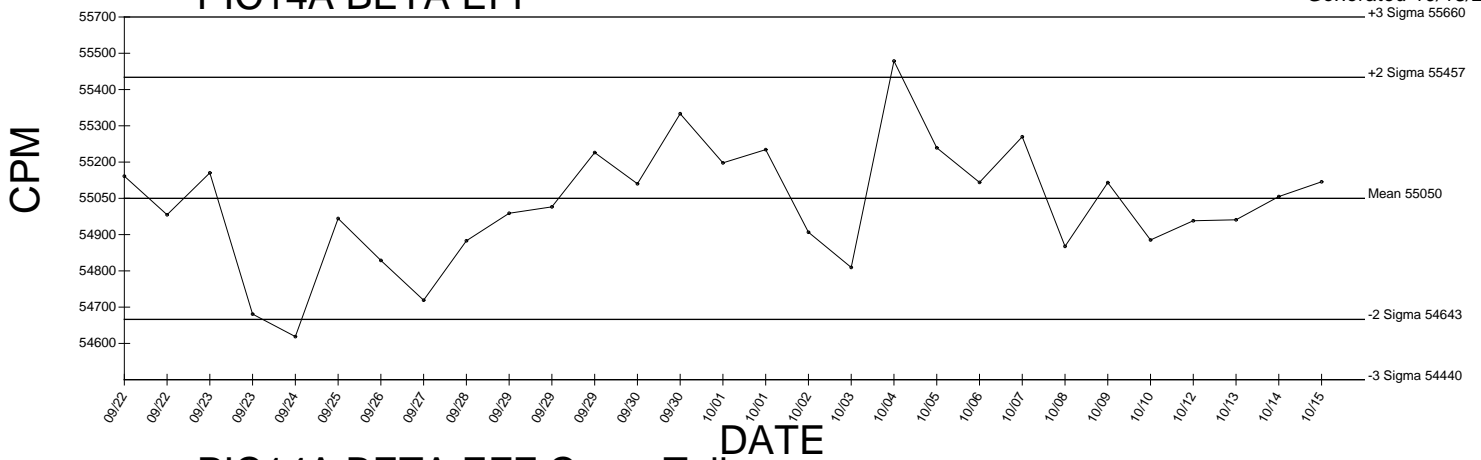


● Denotes Outlier

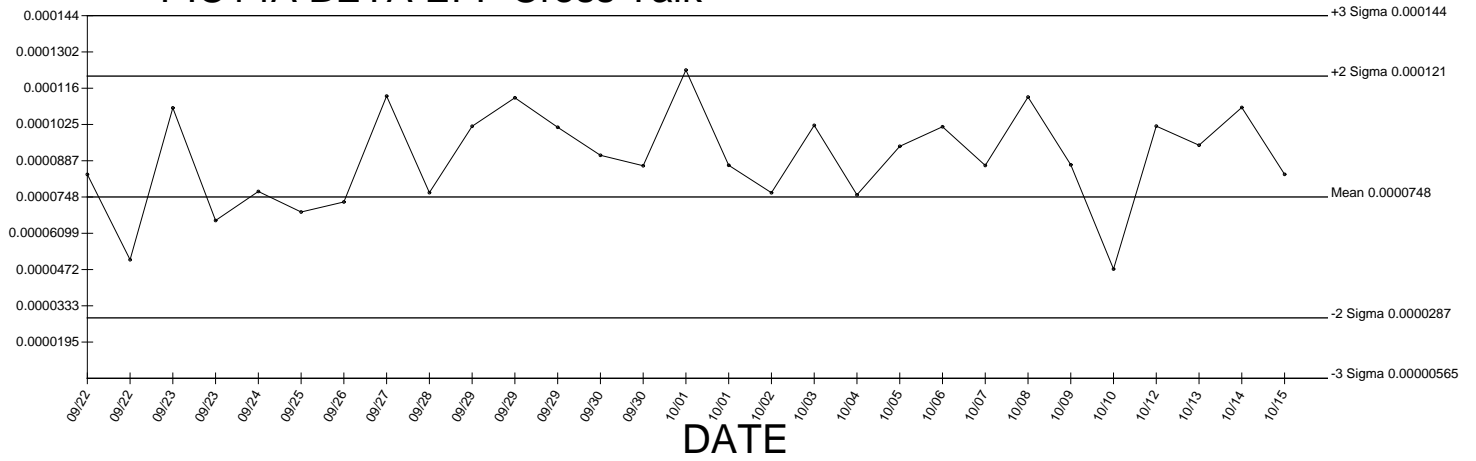


# PIC14A BETA EFF

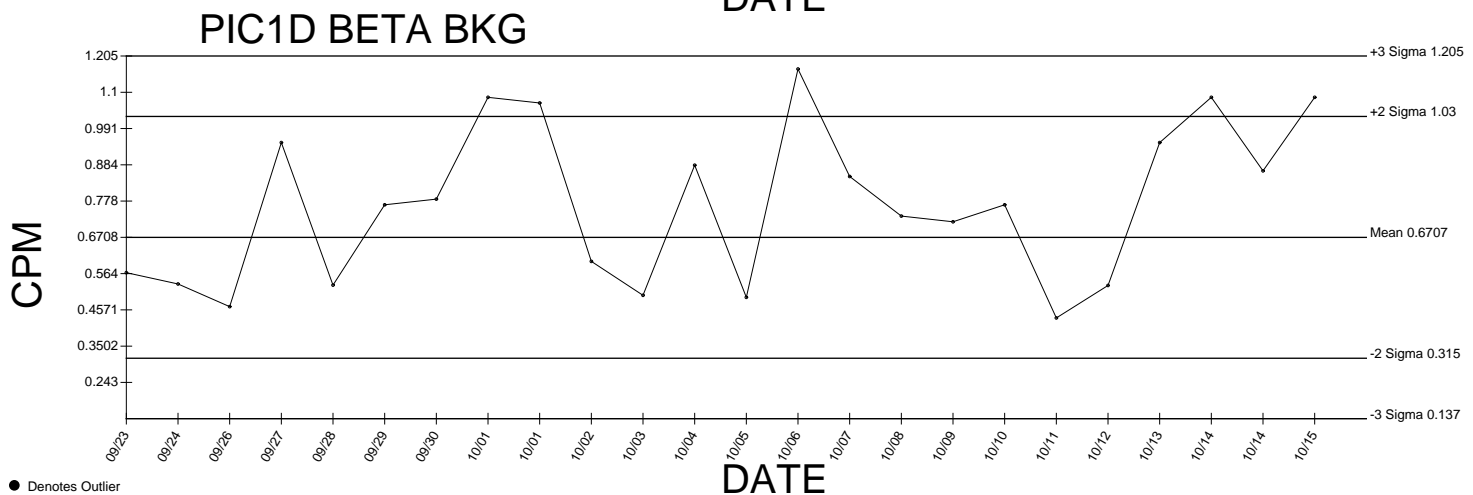
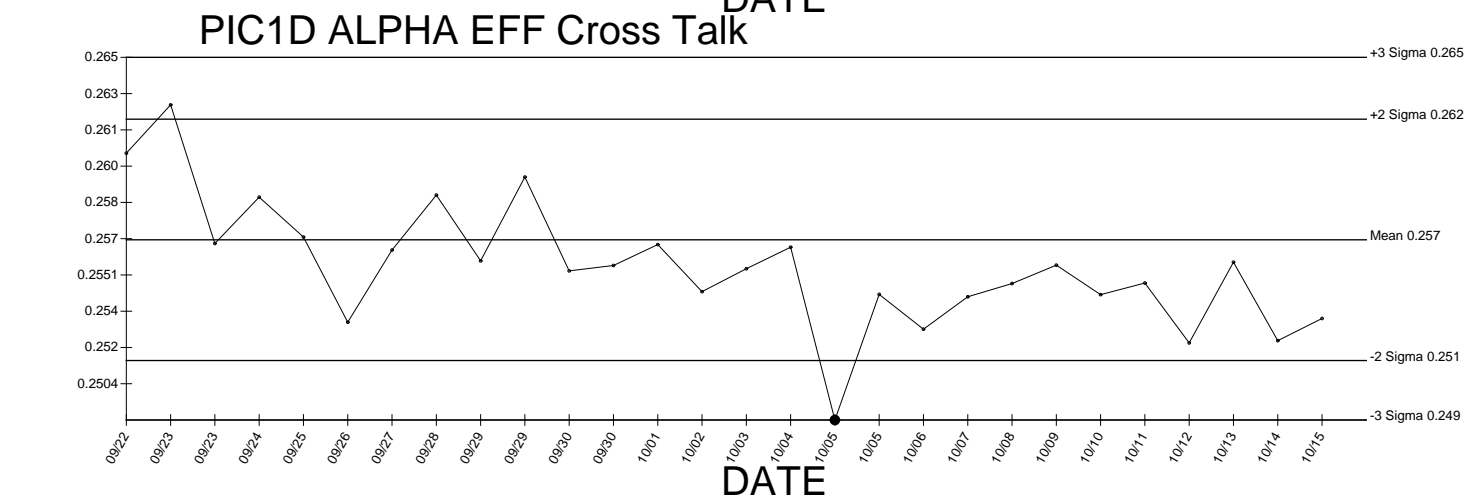
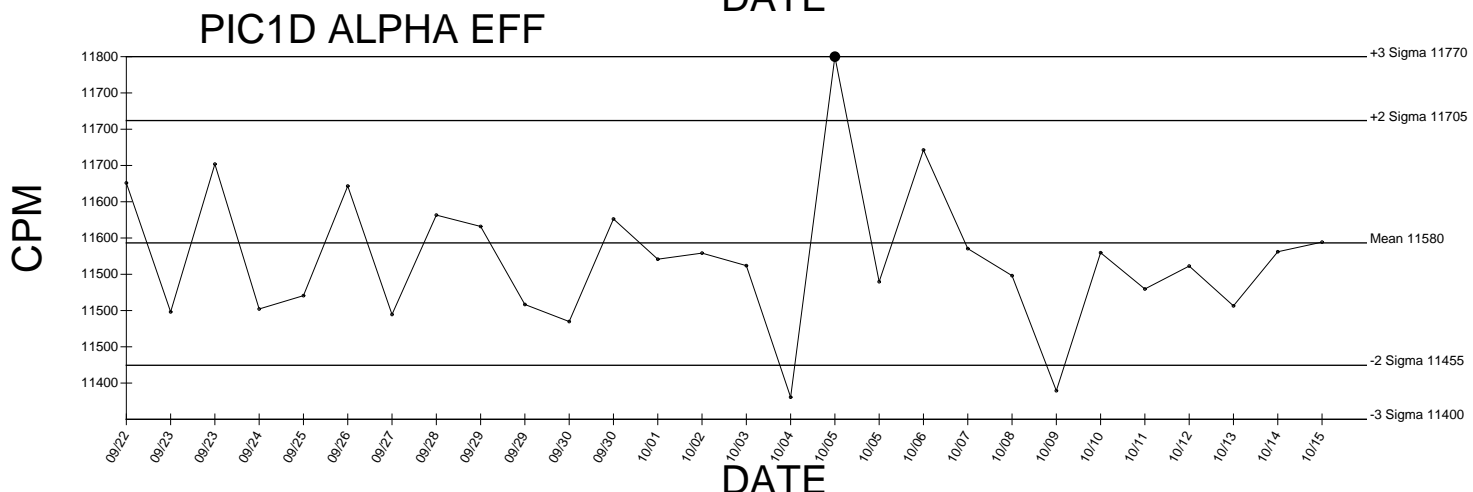
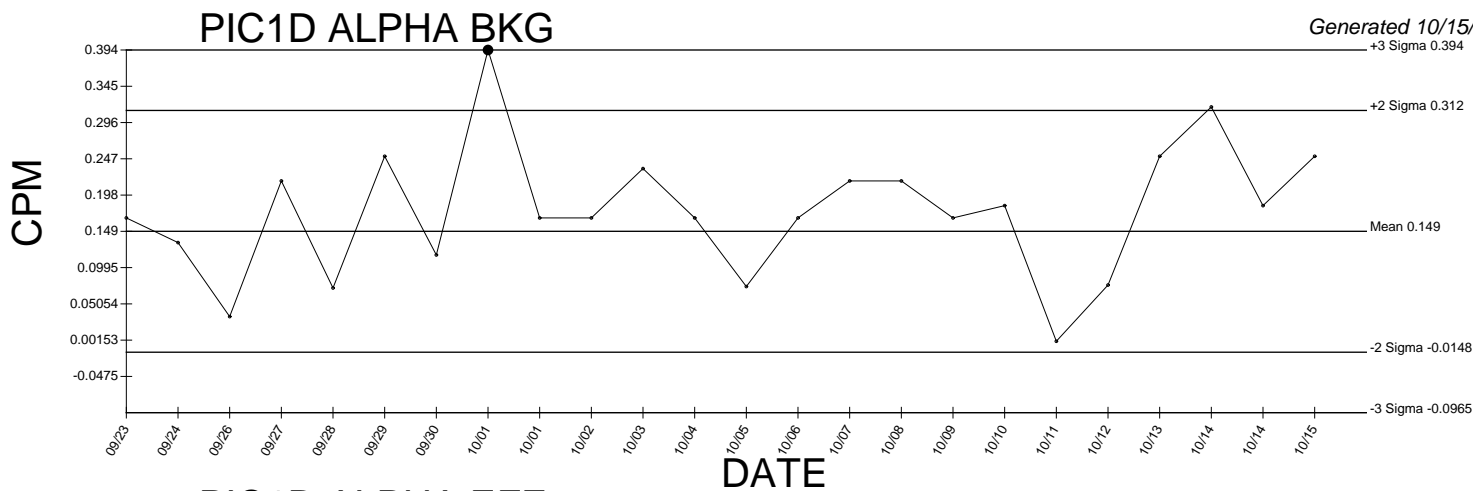
Generated 10/15/2009



# PIC14A BETA EFF Cross Talk



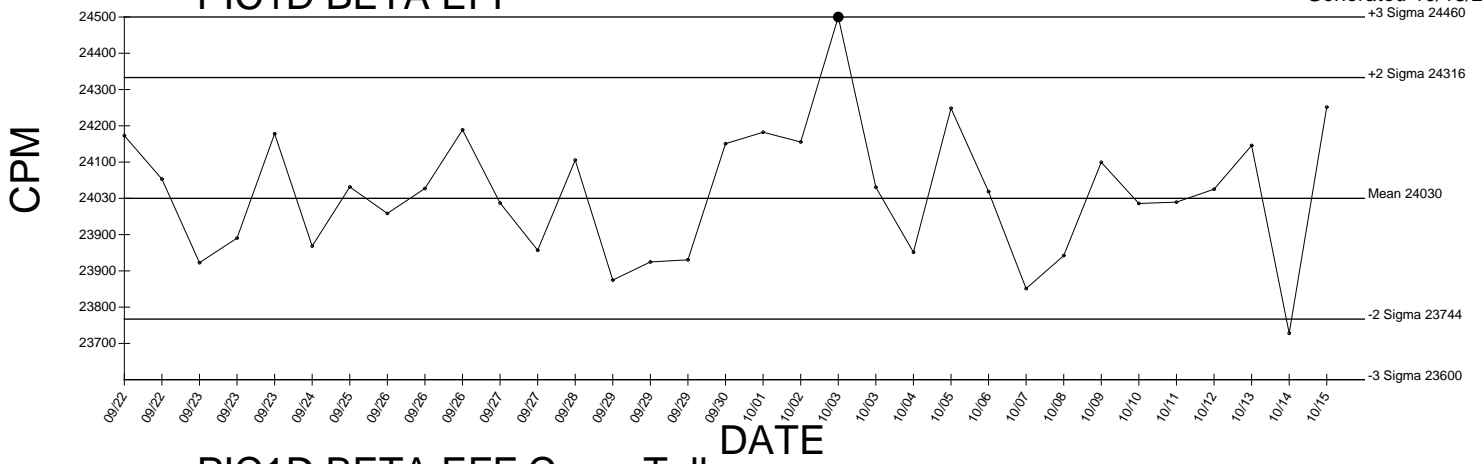
● Denotes Outlier



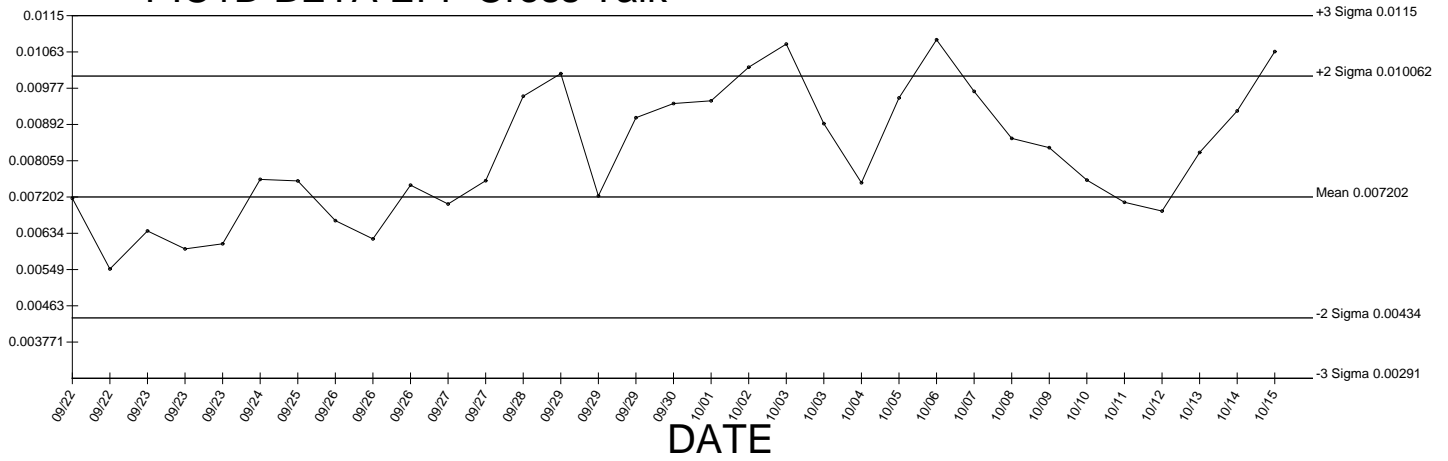
● Denotes Outlier

# PIC1D BETA EFF

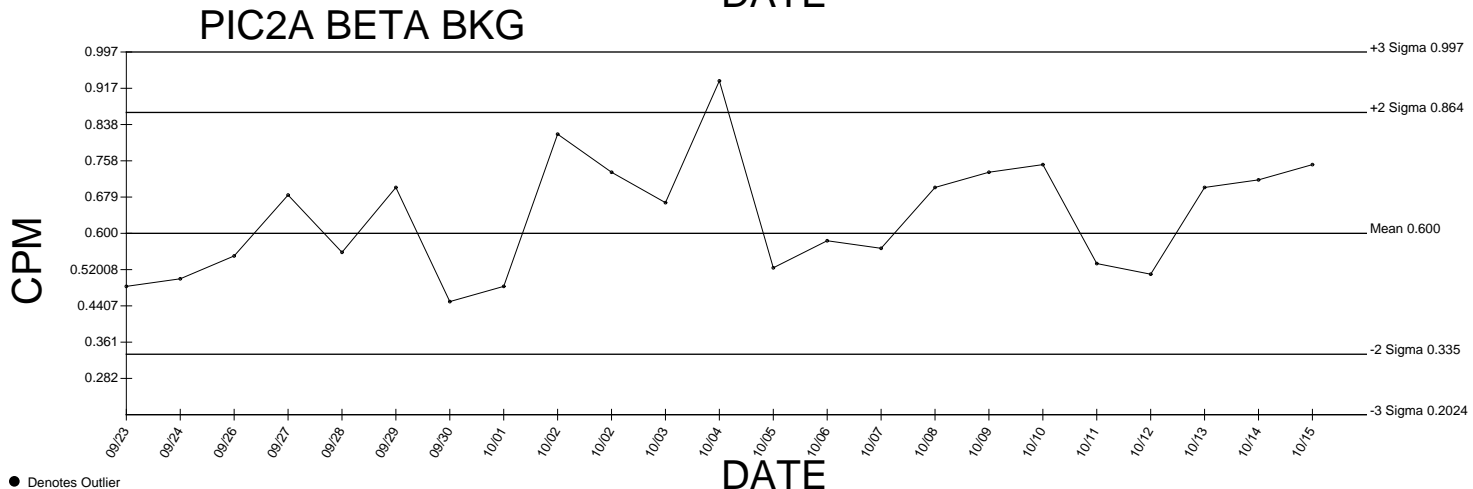
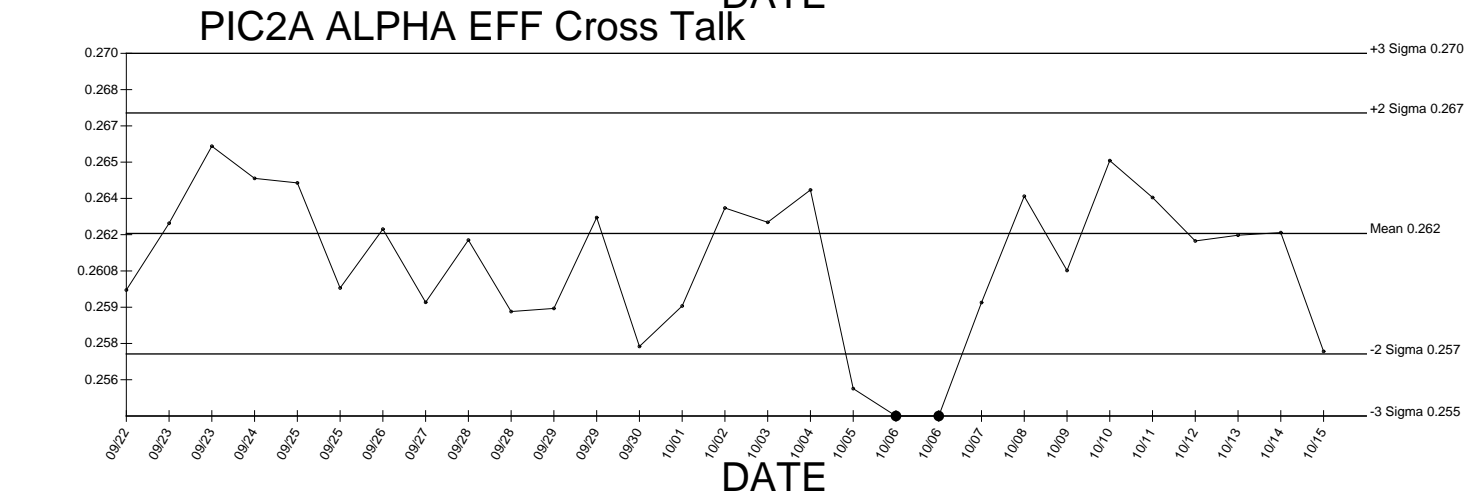
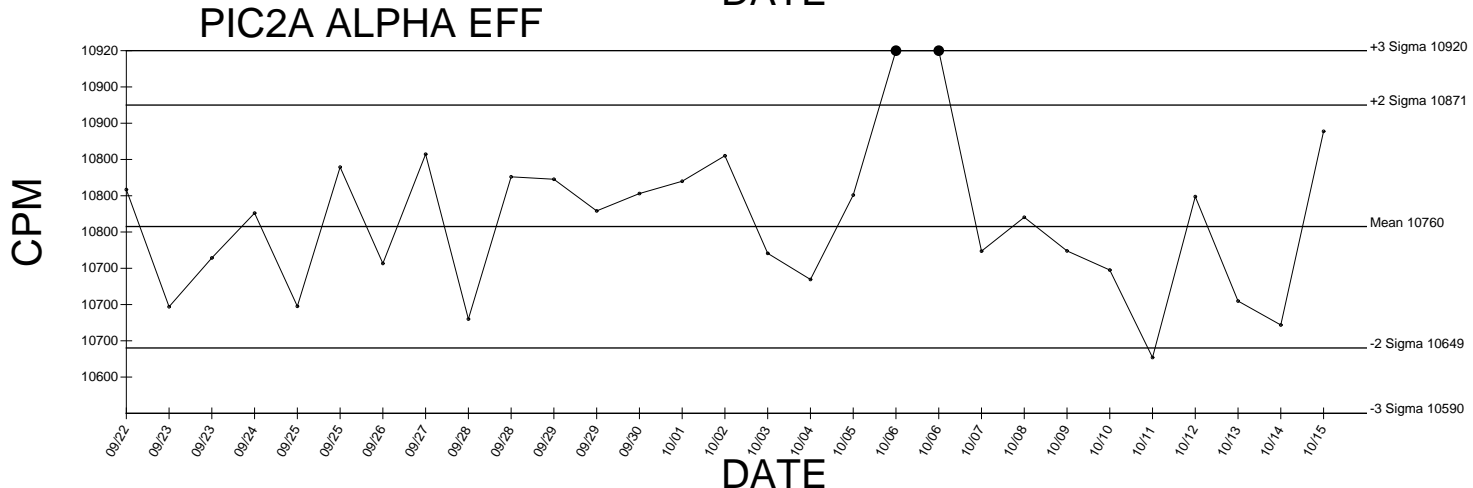
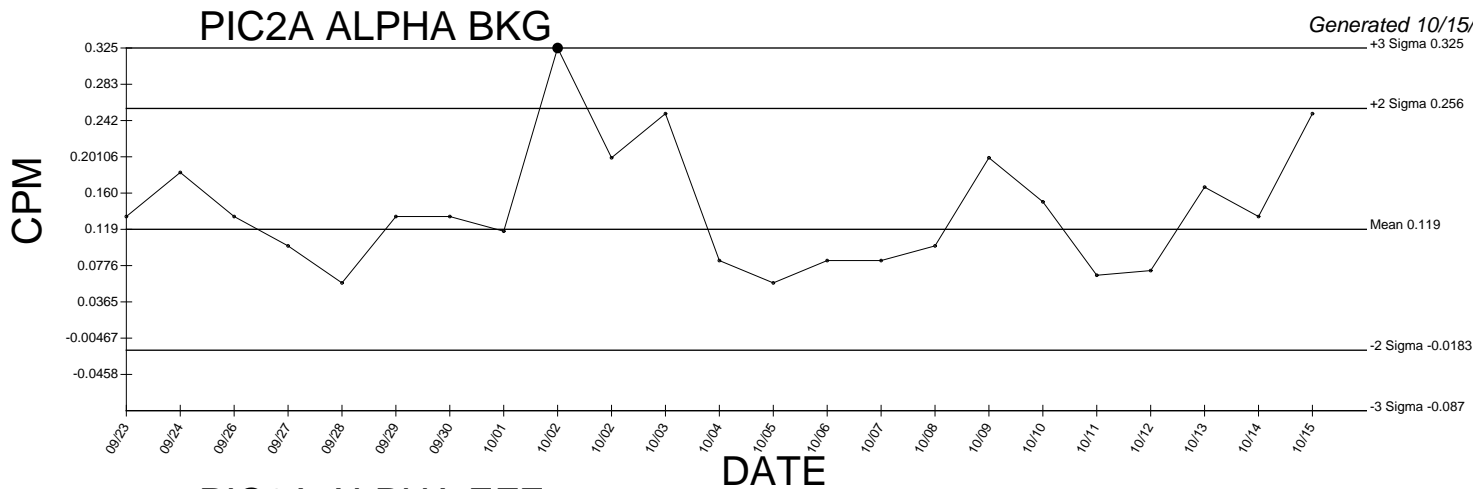
Generated 10/15/2009



# PIC1D BETA EFF Cross Talk



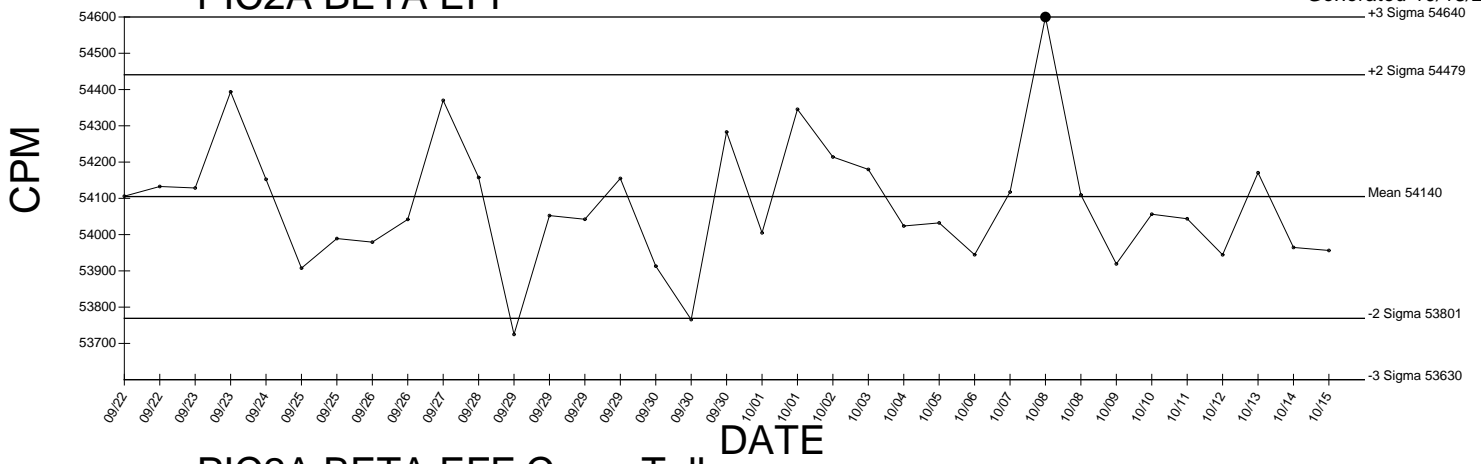
● Denotes Outlier



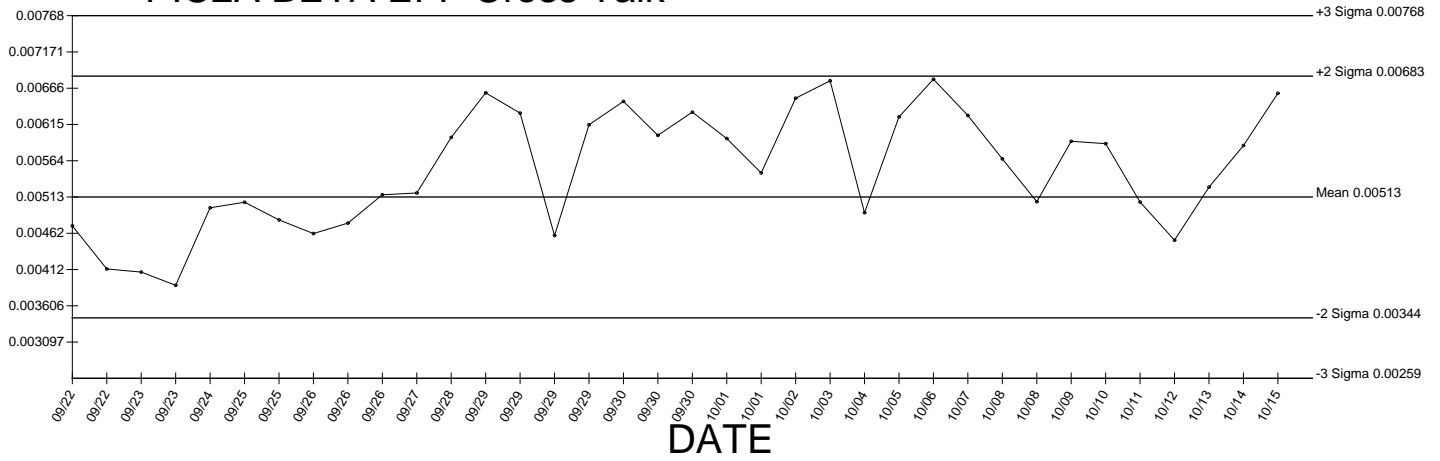
● Denotes Outlier

# PIC2A BETA EFF

Generated 10/15/2009



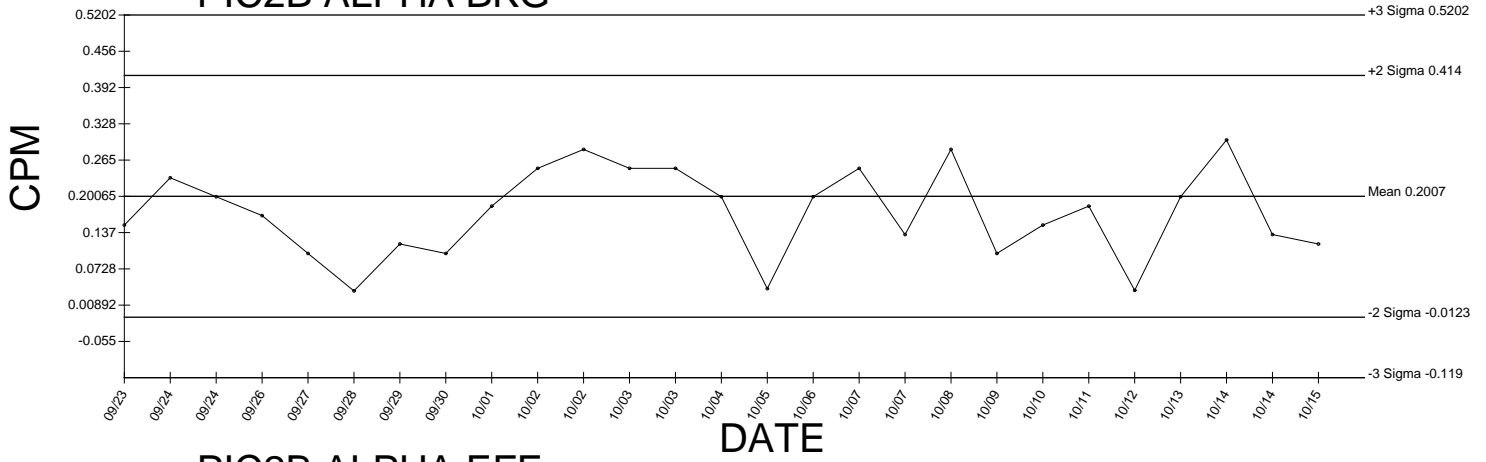
# PIC2A BETA EFF Cross Talk



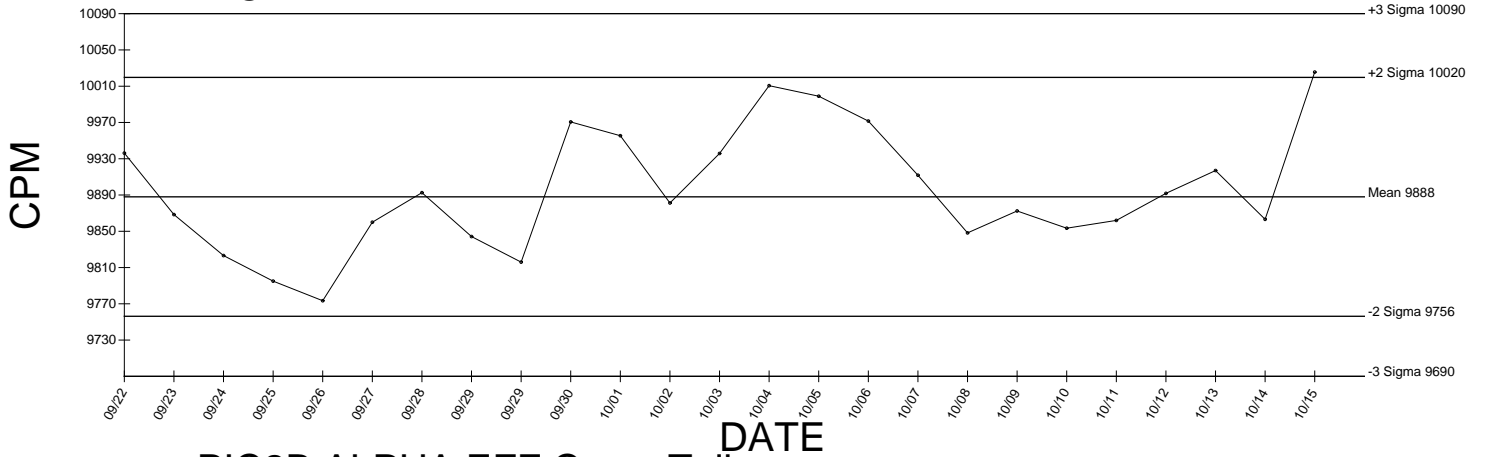
● Denotes Outlier

### PIC2B ALPHA BKG

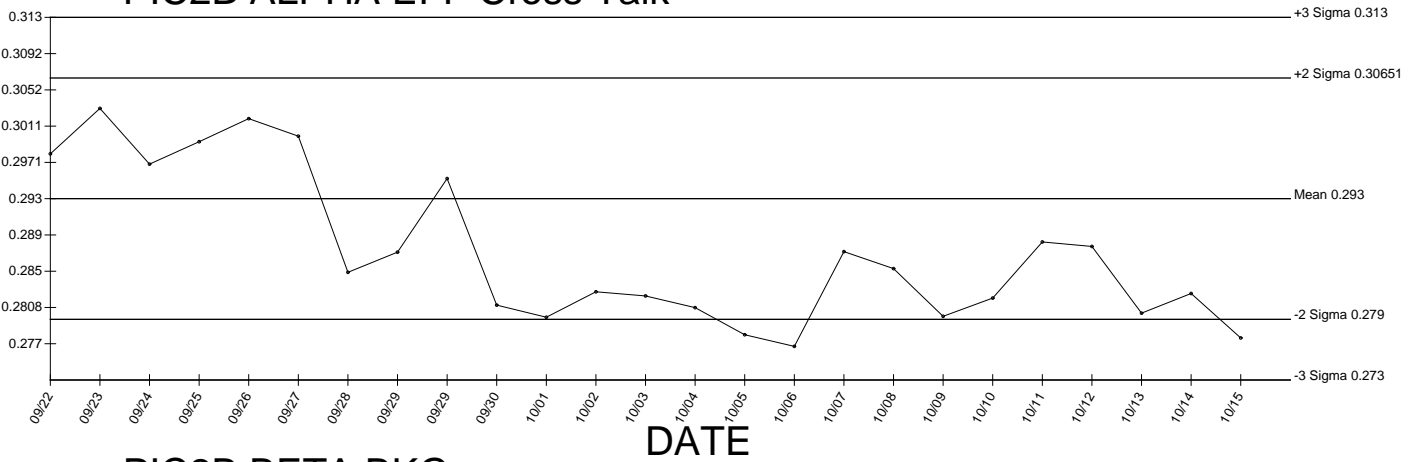
Generated 10/15/2009



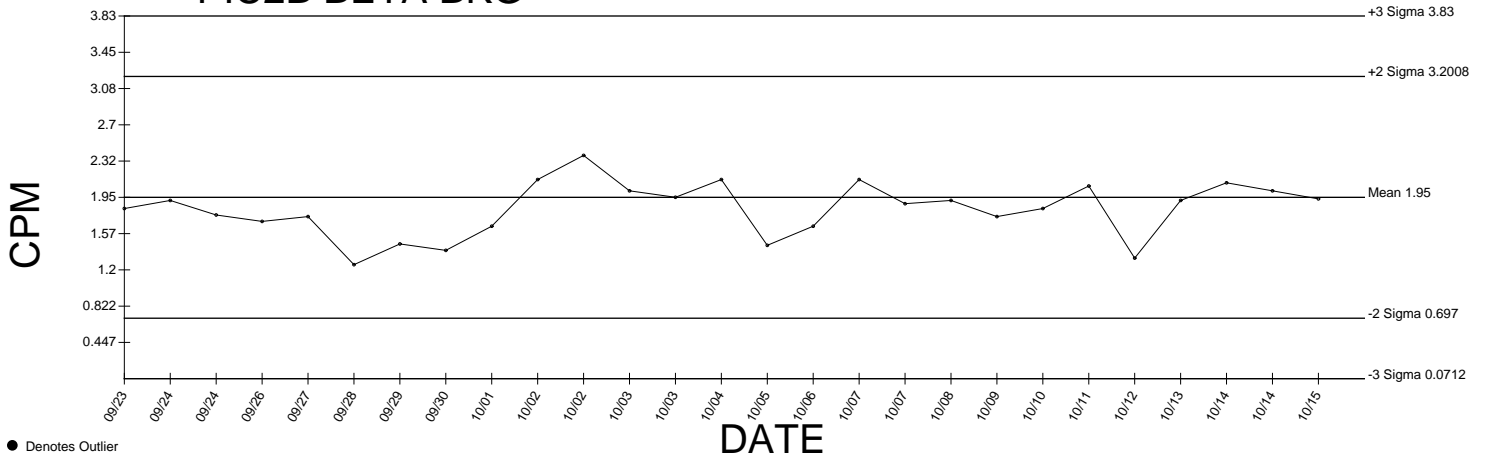
### PIC2B ALPHA EFF



### PIC2B ALPHA EFF Cross Talk



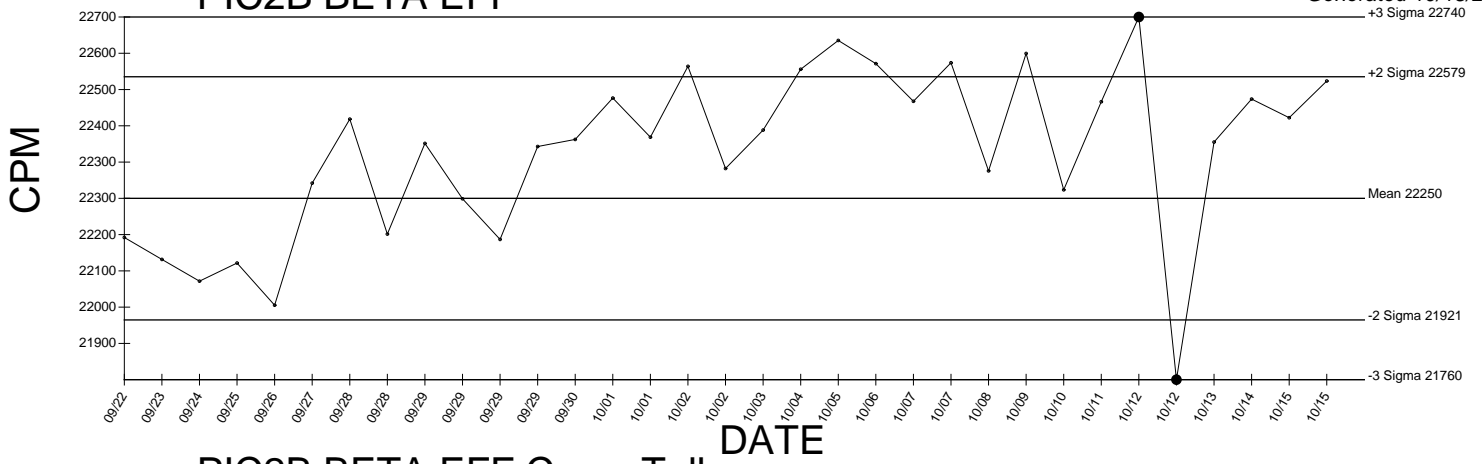
### PIC2B BETA BKG



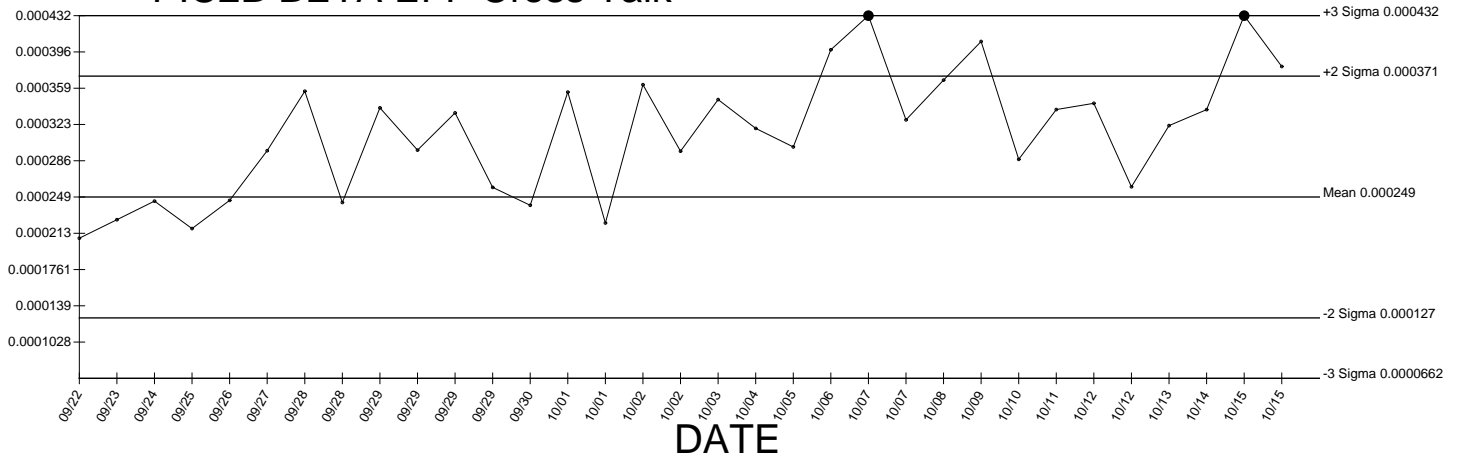
● Denotes Outlier

# PIC2B BETA EFF

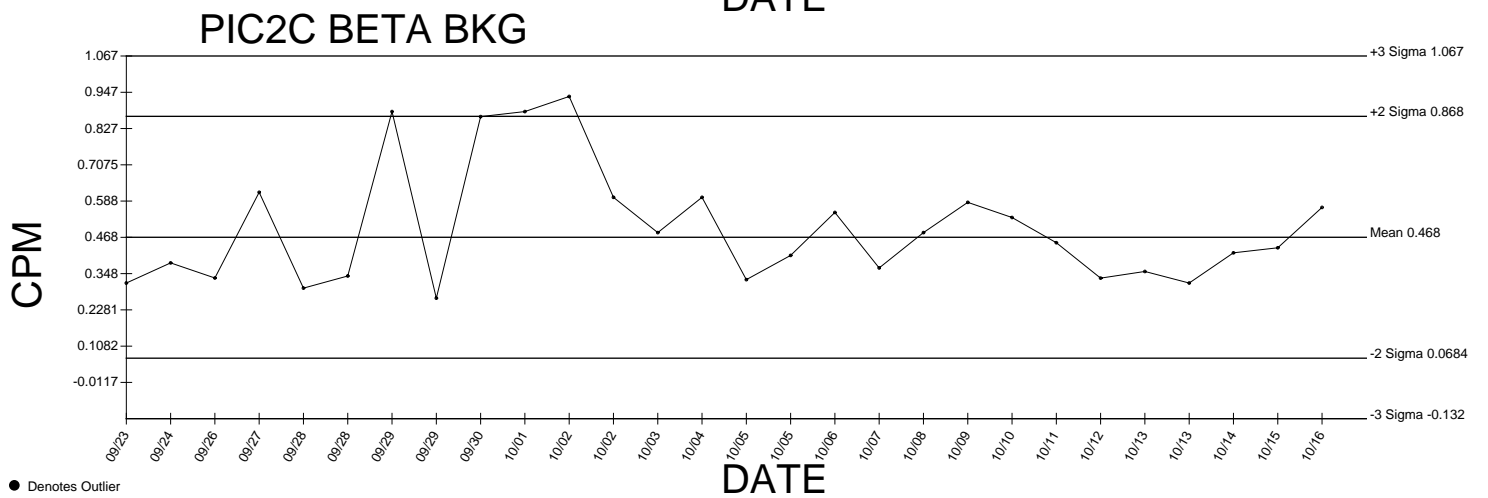
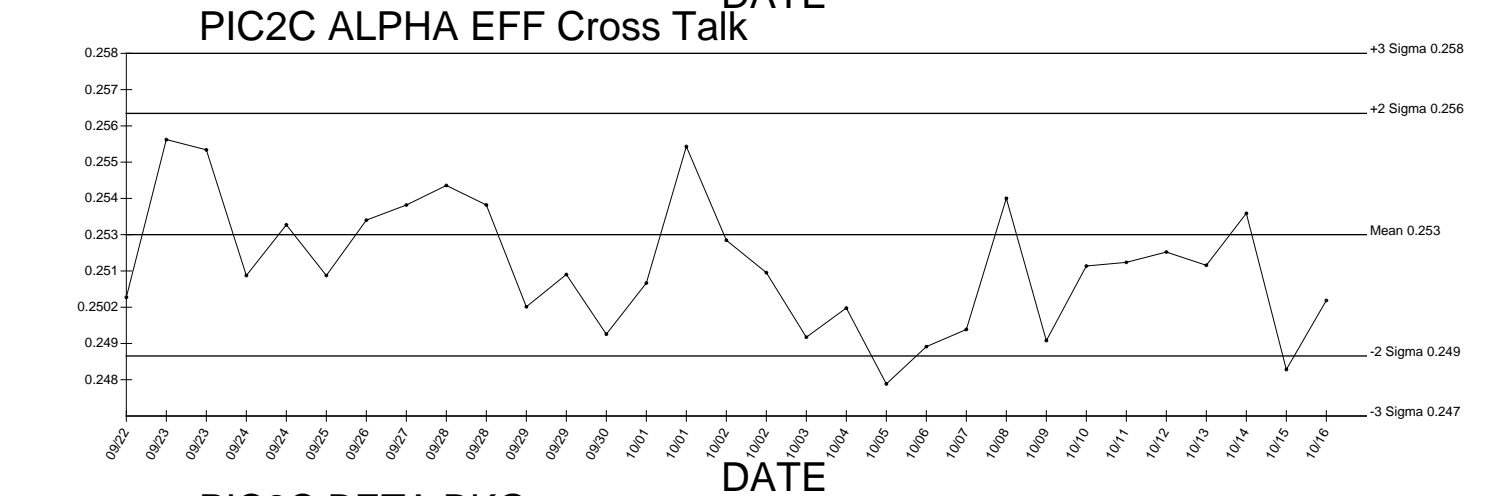
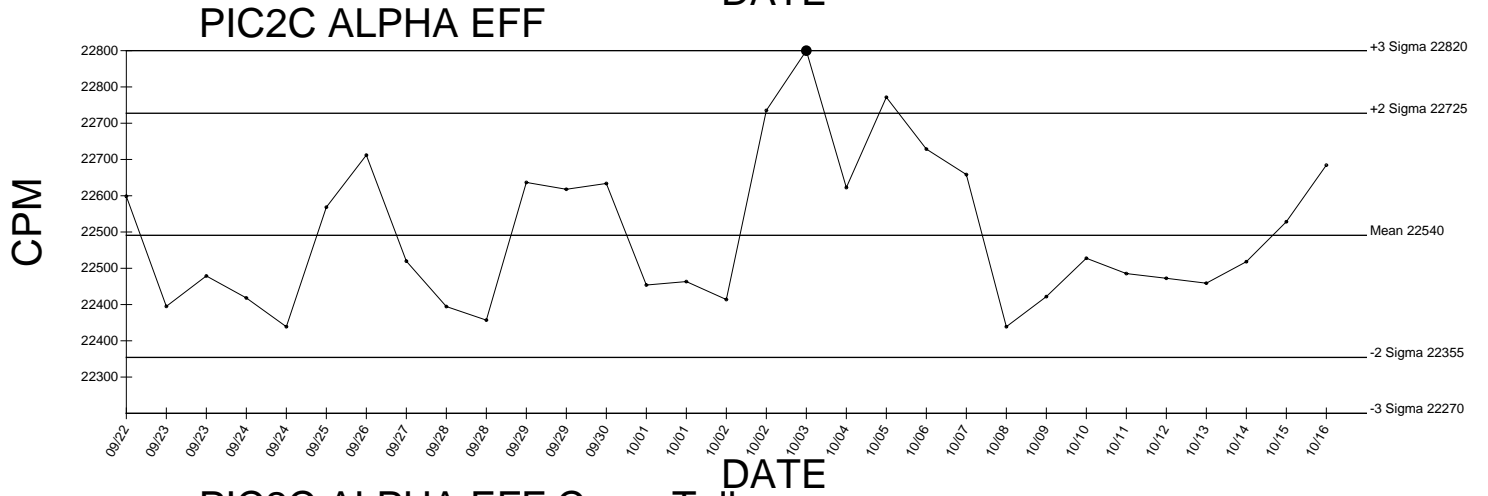
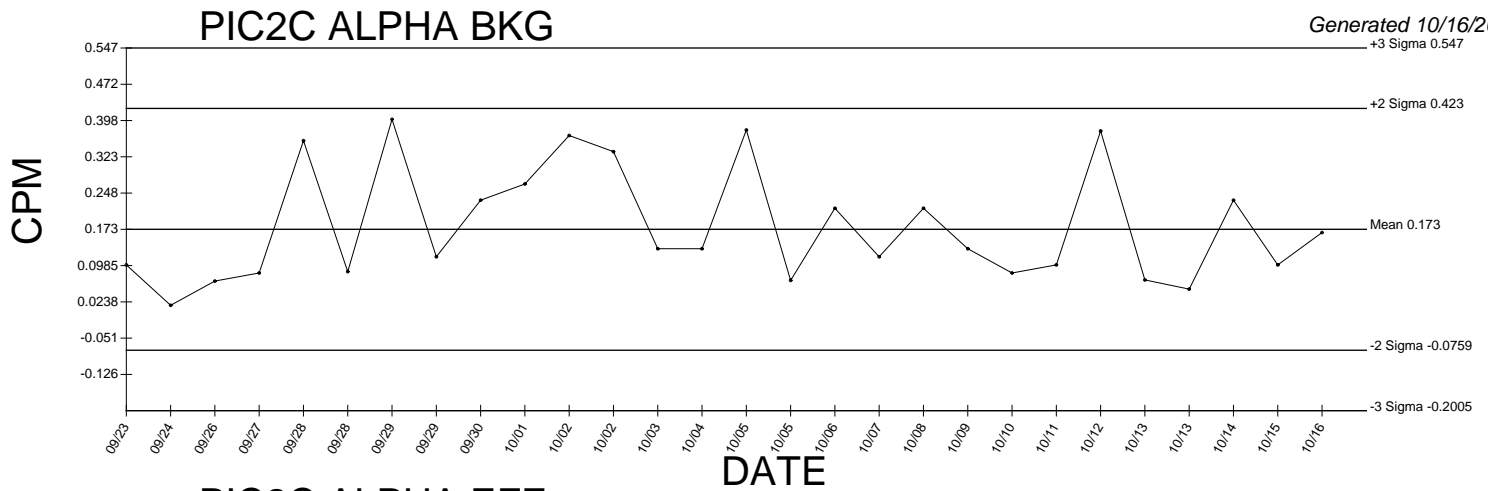
Generated 10/15/2009



# PIC2B BETA EFF Cross Talk



● Denotes Outlier

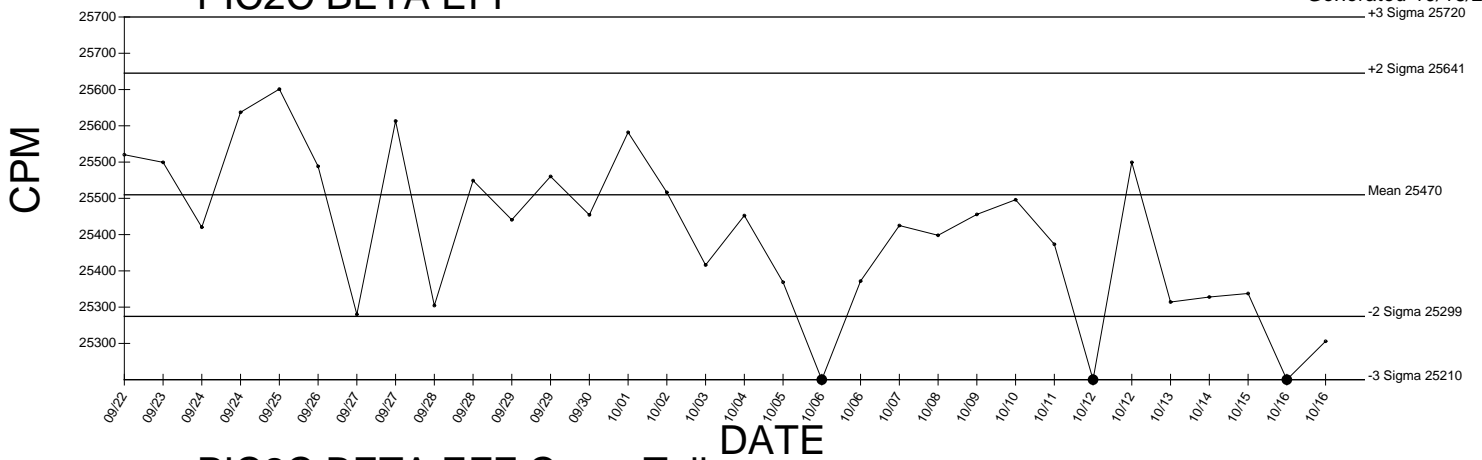


● Denotes Outlier

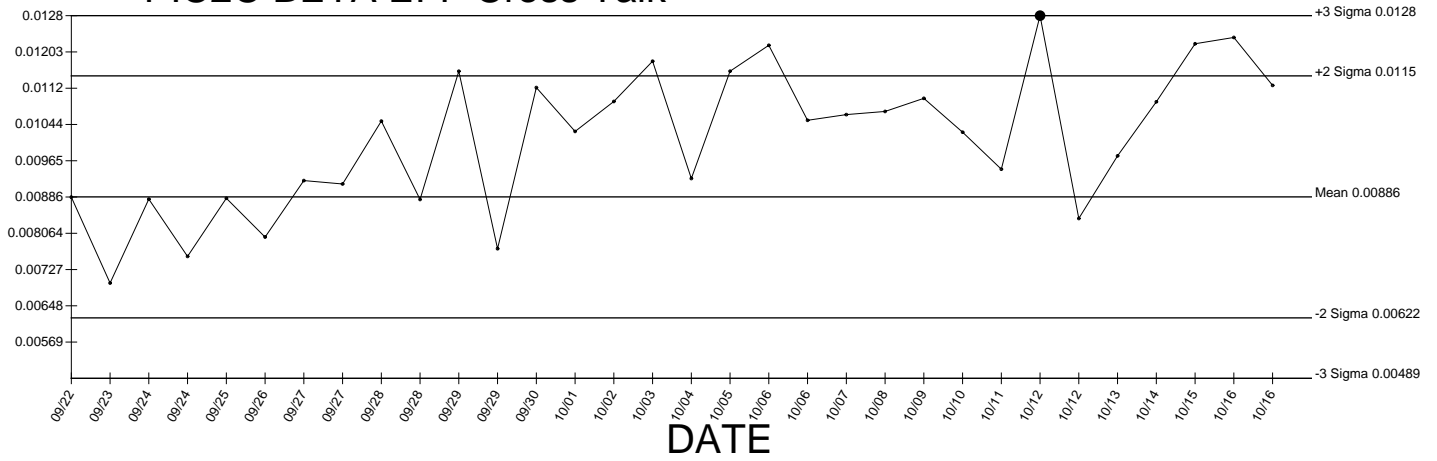


# PIC2C BETA EFF

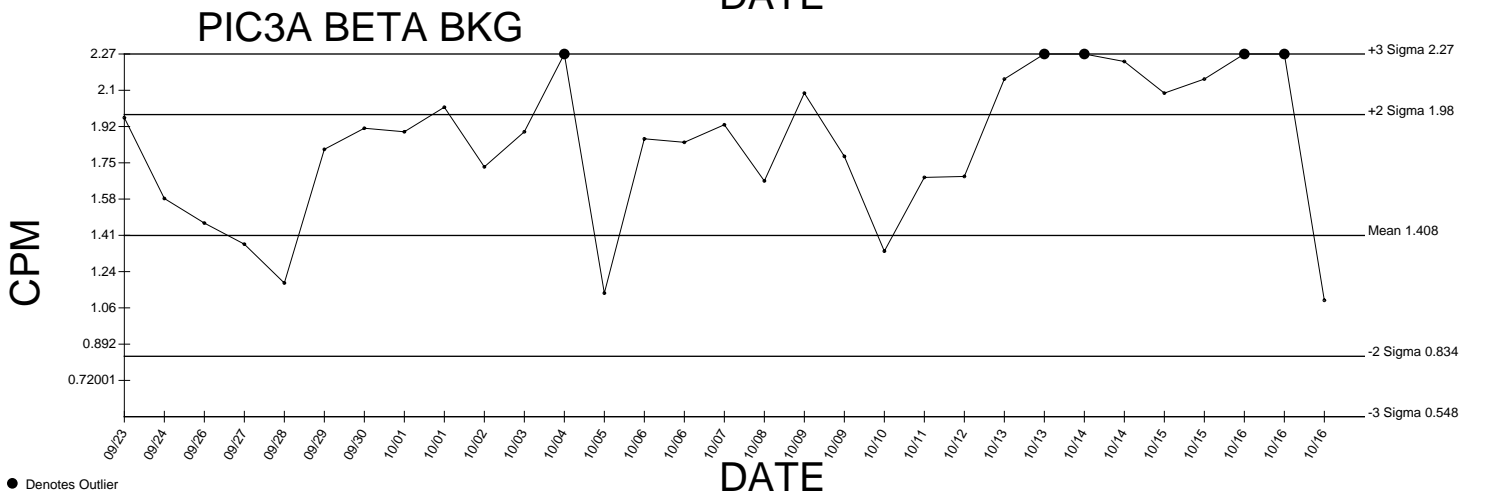
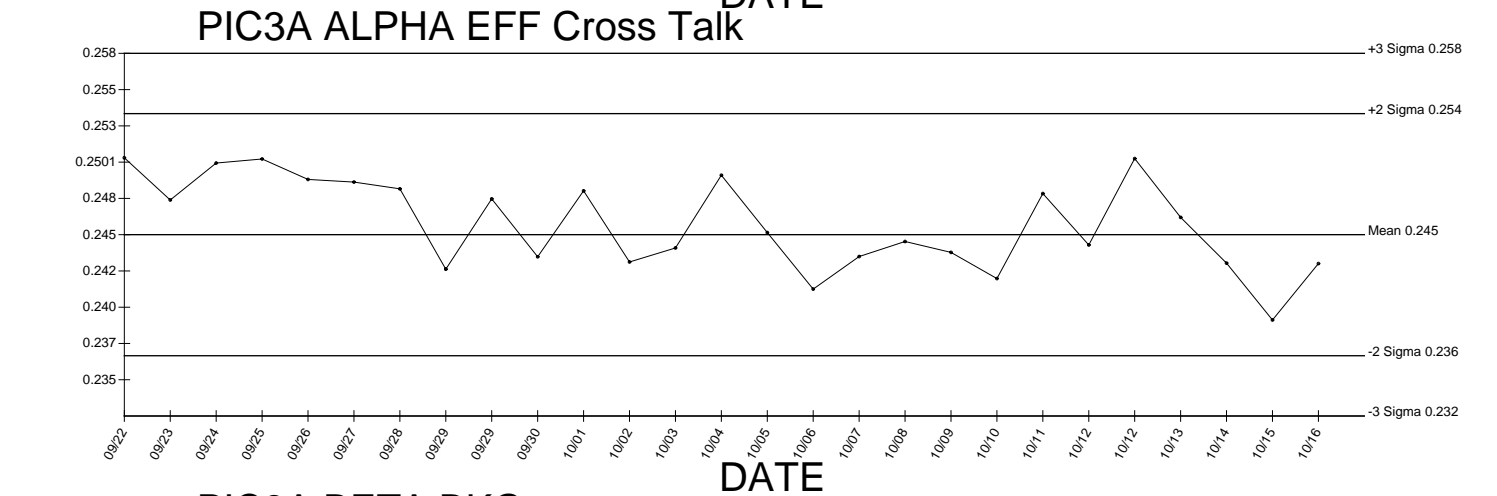
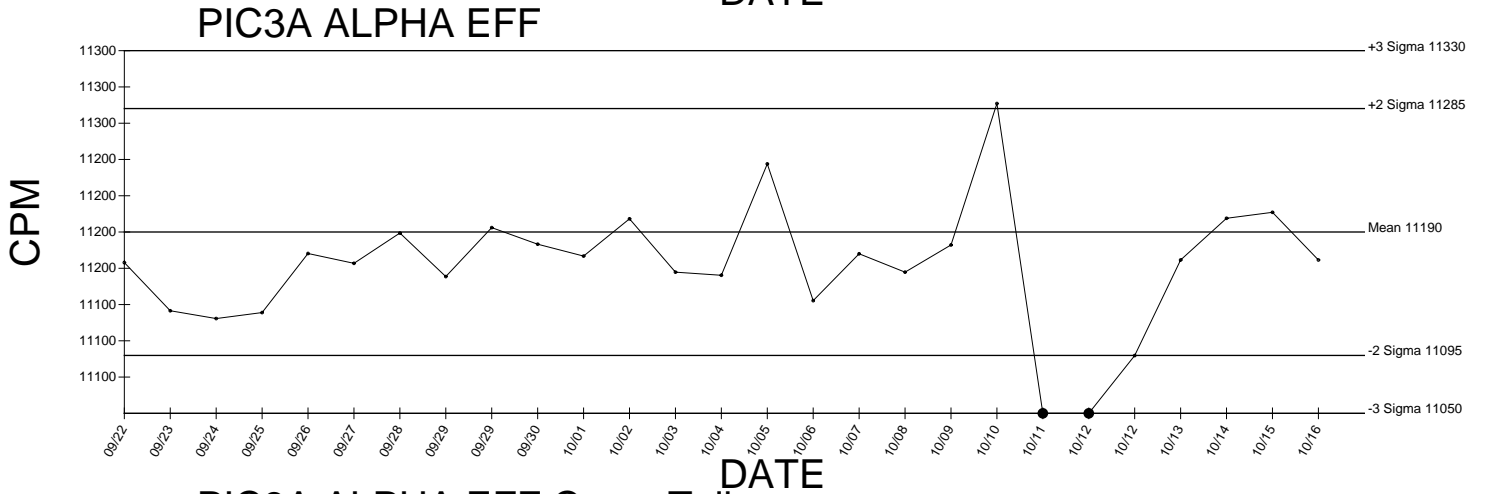
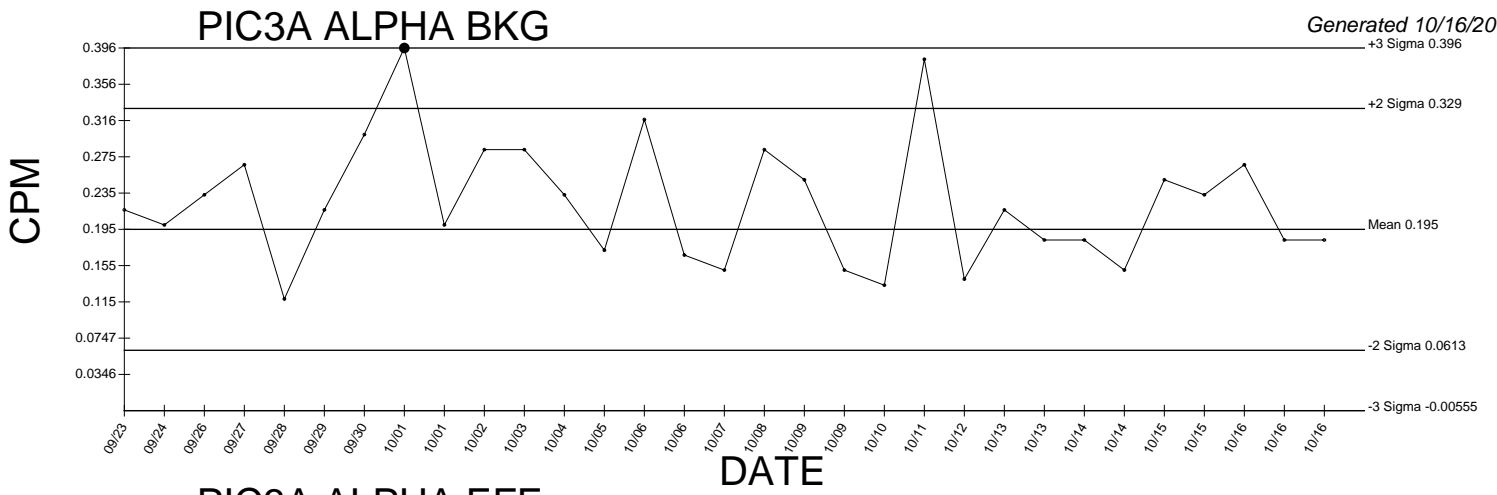
Generated 10/16/2009



# PIC2C BETA EFF Cross Talk



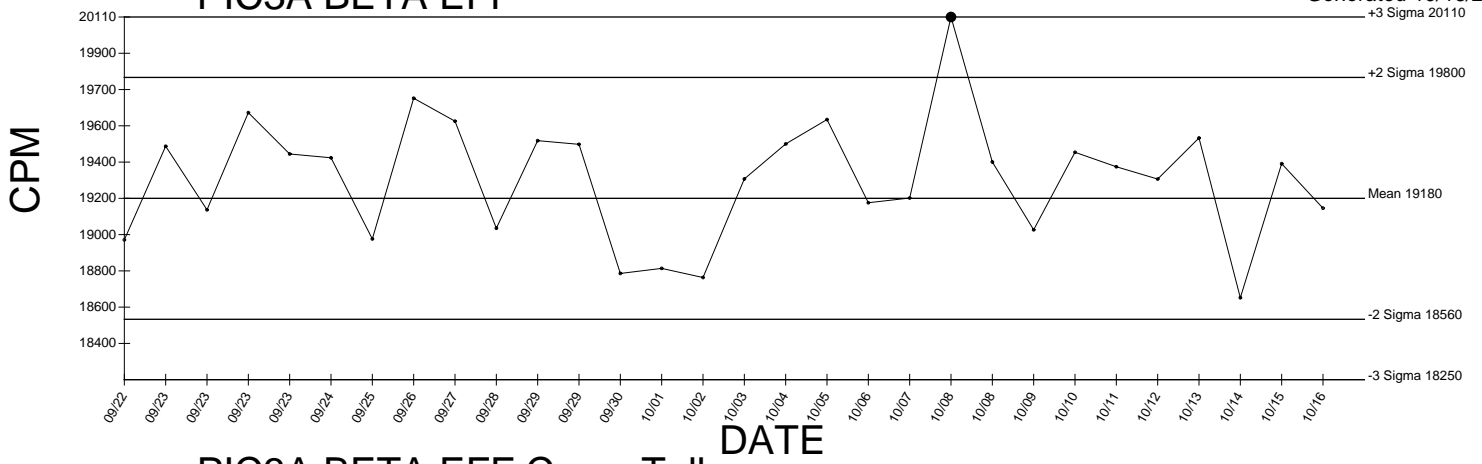
● Denotes Outlier



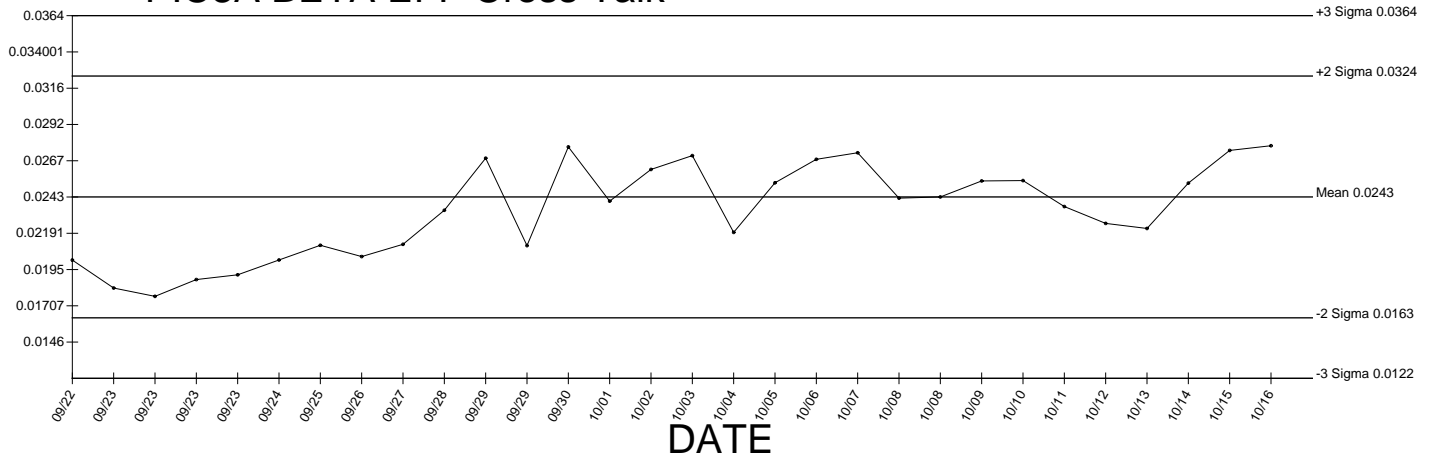
● Denotes Outlier

# PIC3A BETA EFF

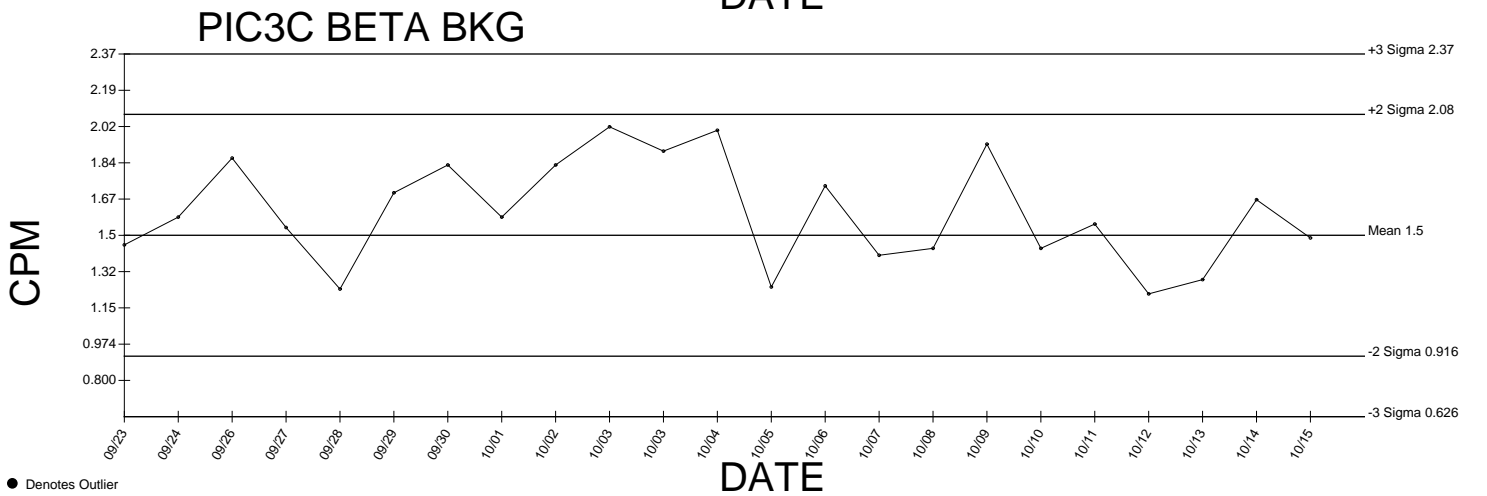
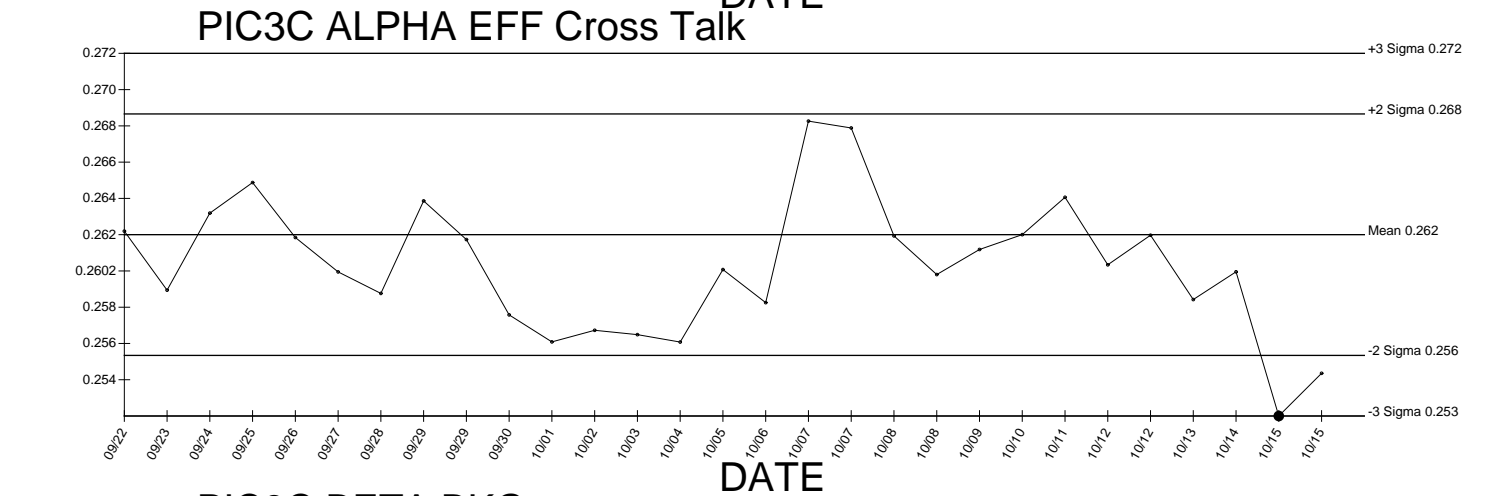
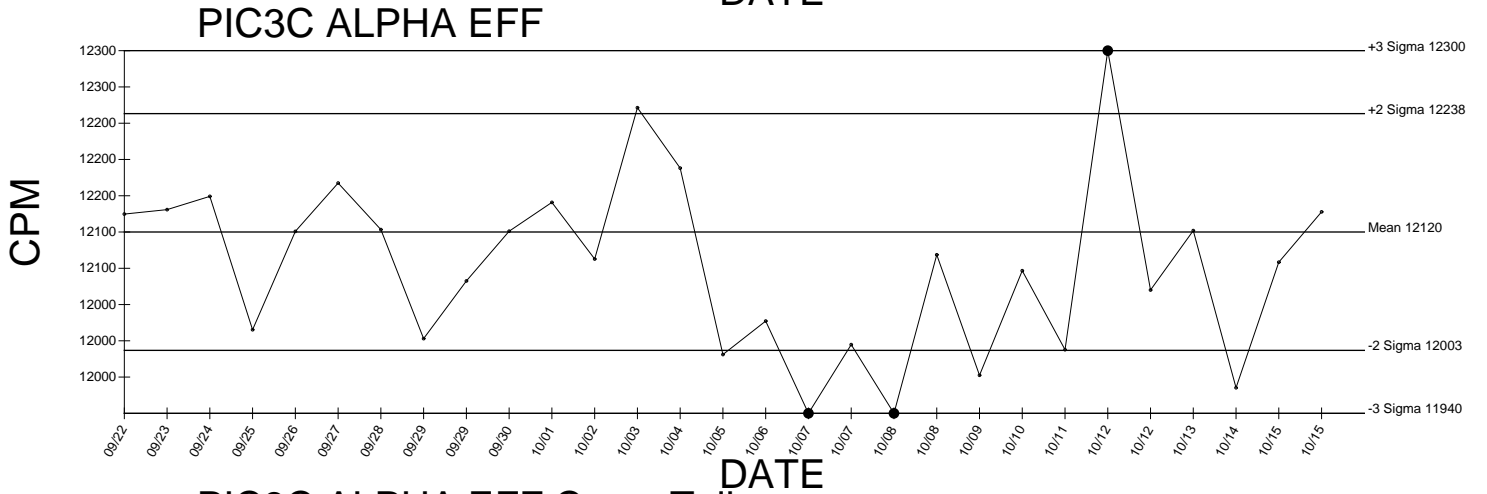
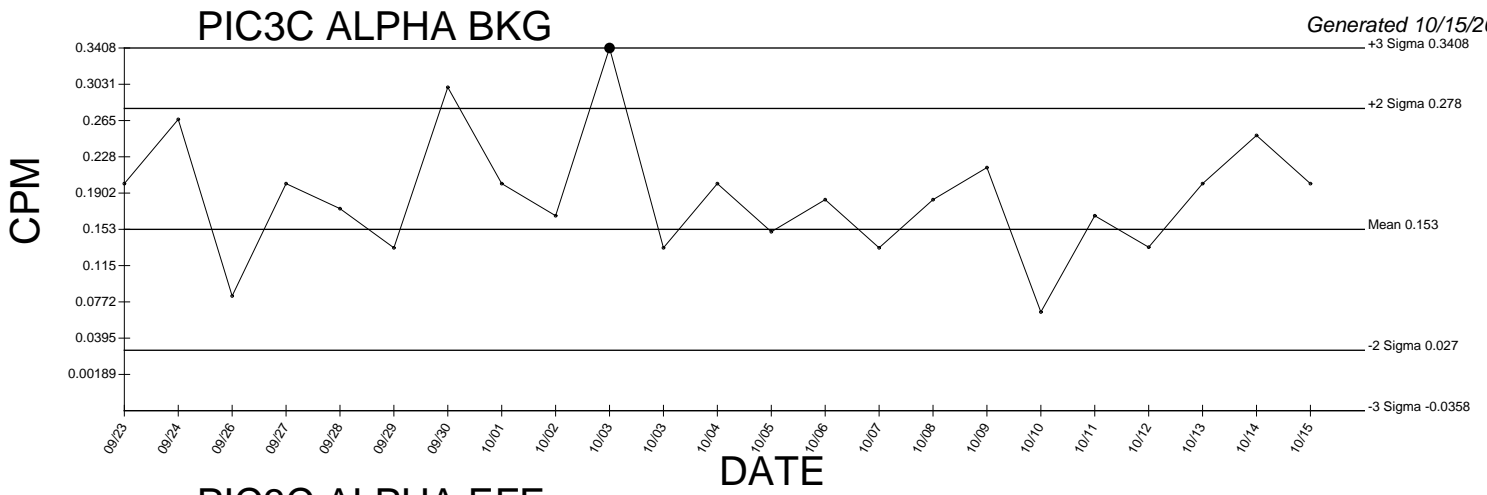
Generated 10/16/2009



# PIC3A BETA EFF Cross Talk



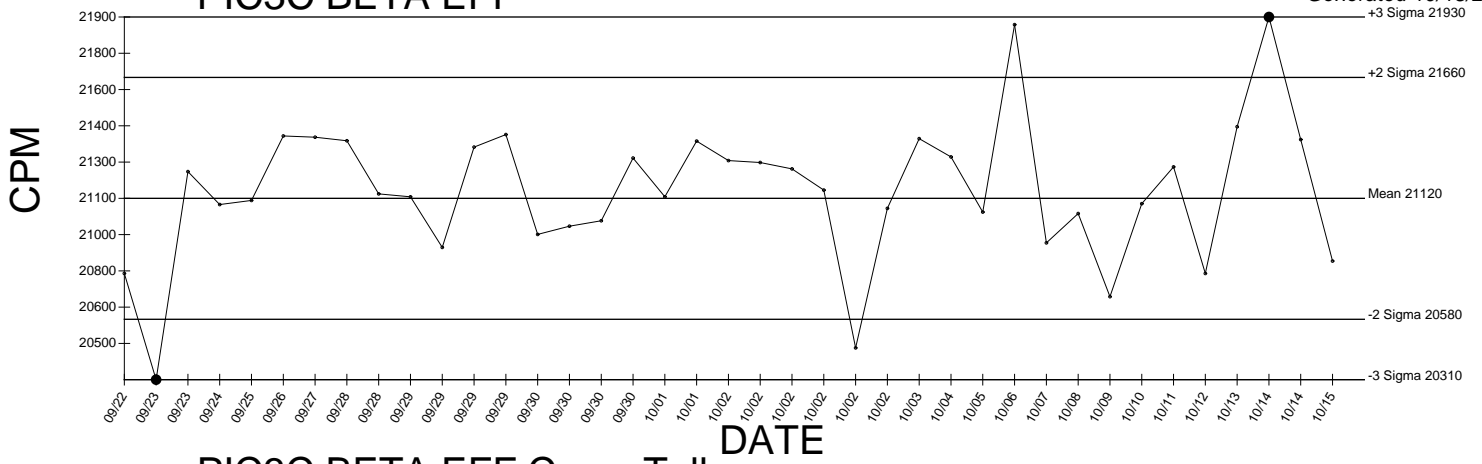
● Denotes Outlier



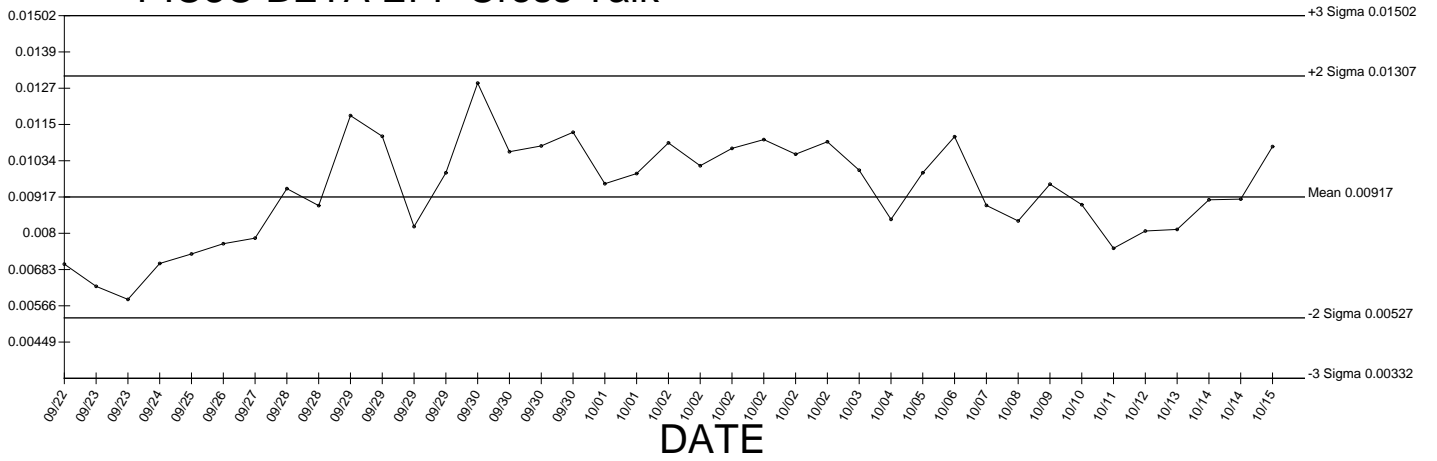
● Denotes Outlier

# PIC3C BETA EFF

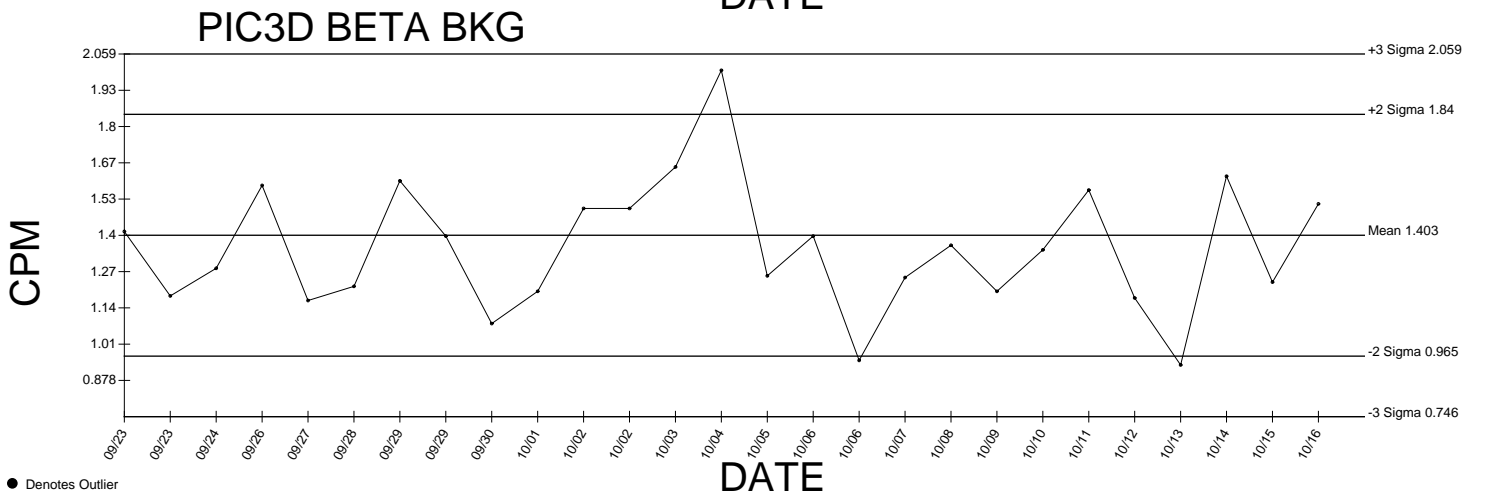
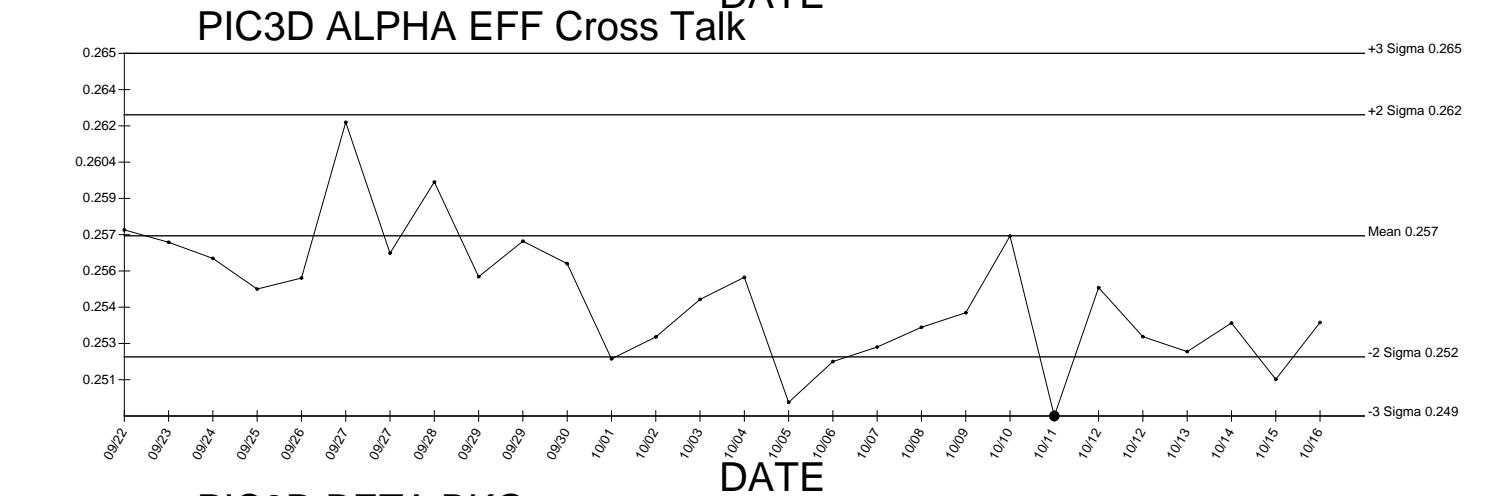
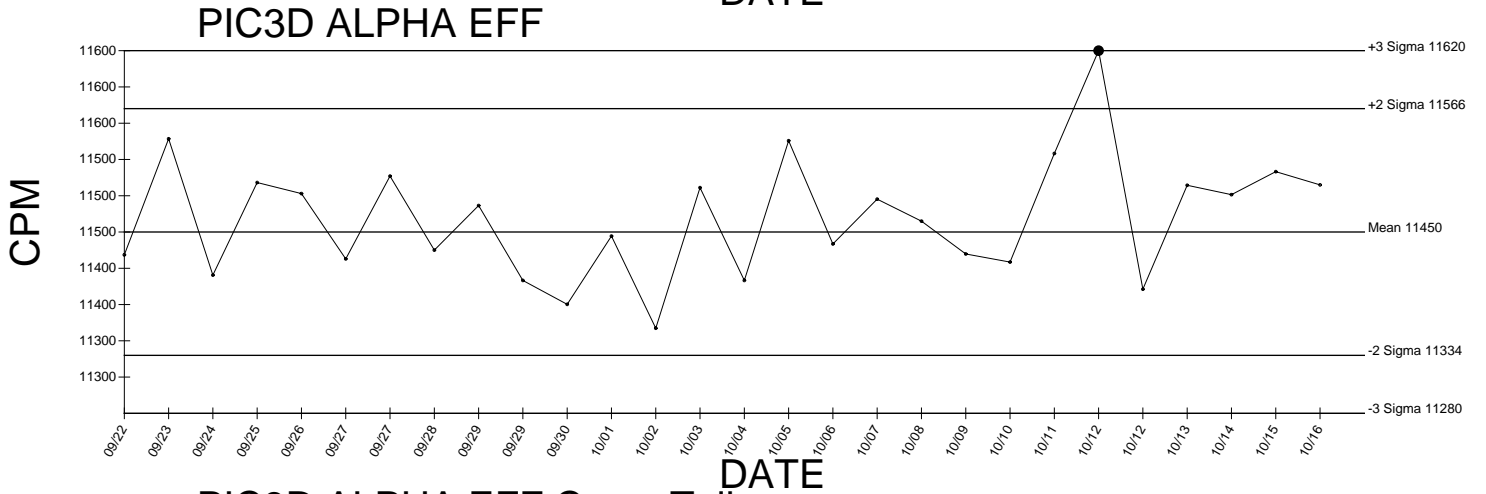
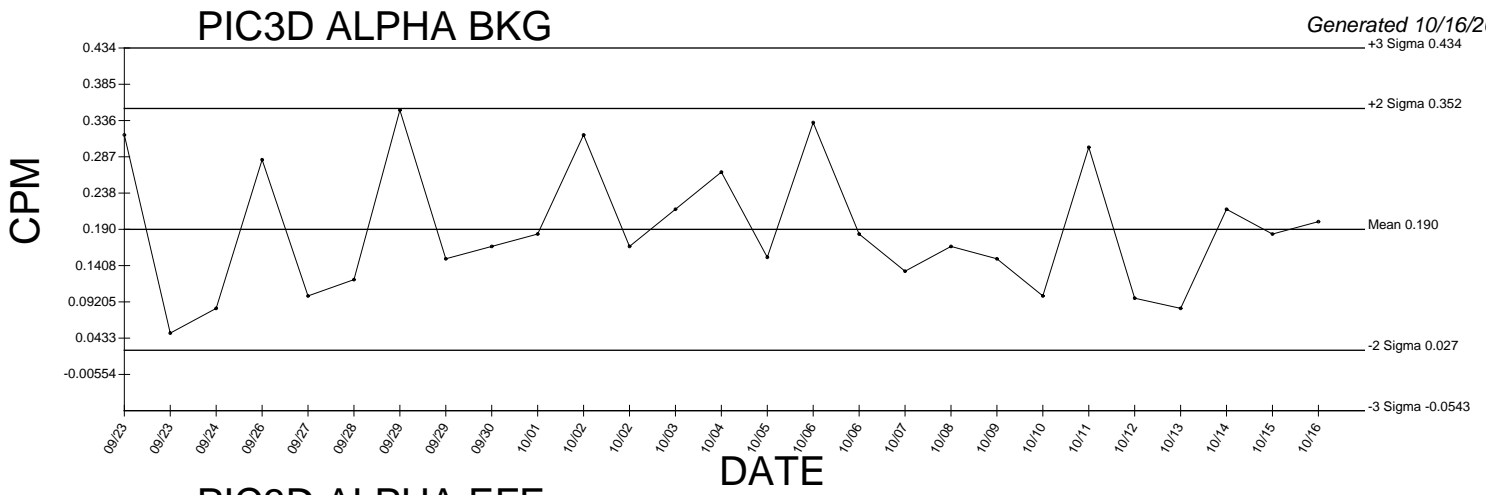
Generated 10/15/2009



# PIC3C BETA EFF Cross Talk

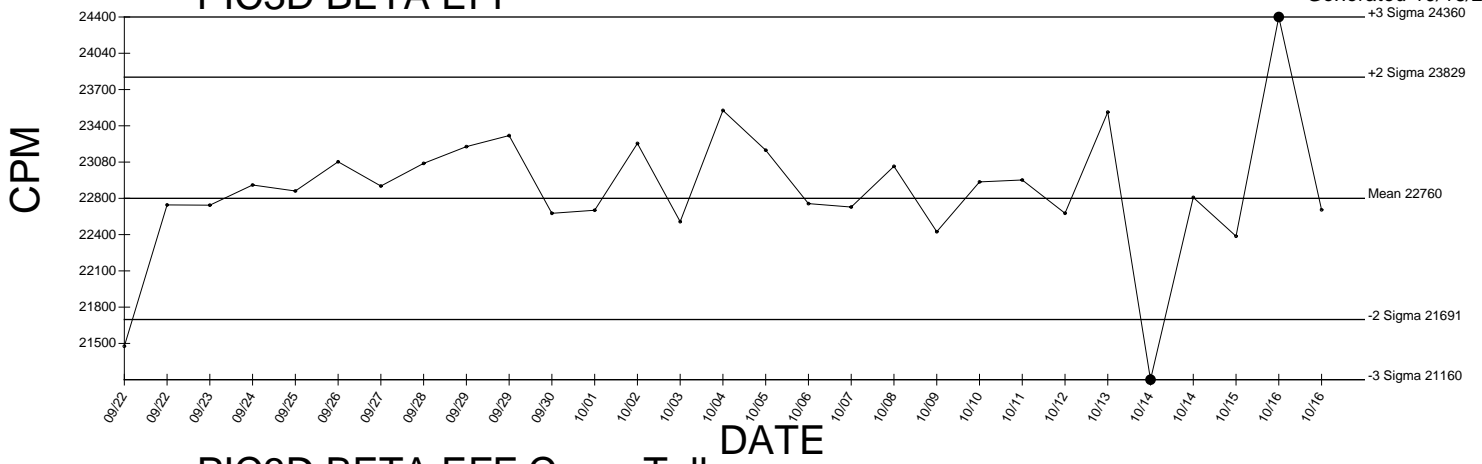


● Denotes Outlier

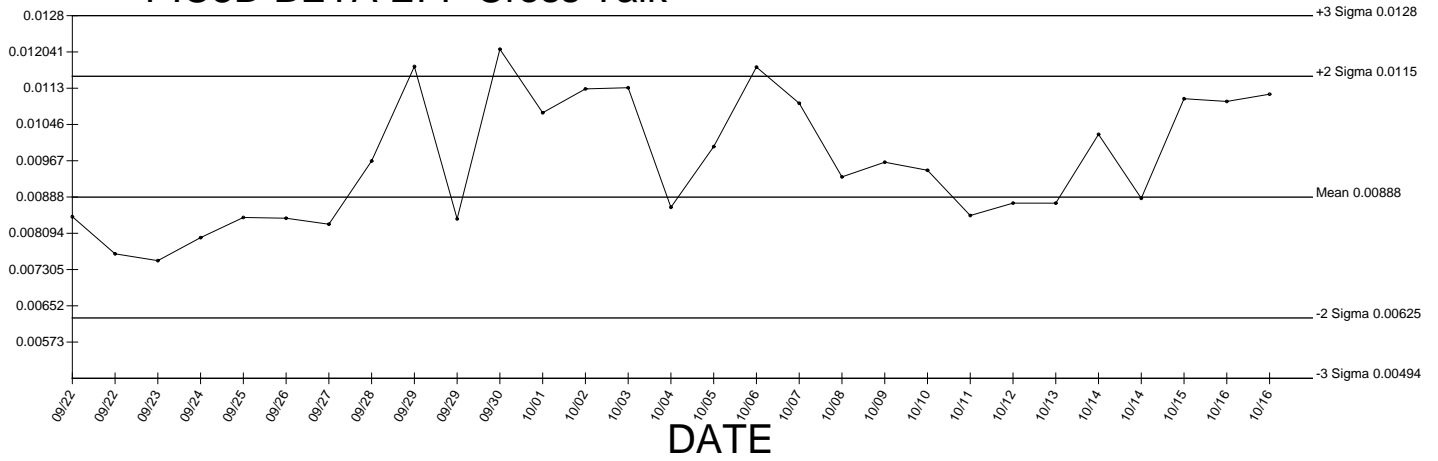


● Denotes Outlier

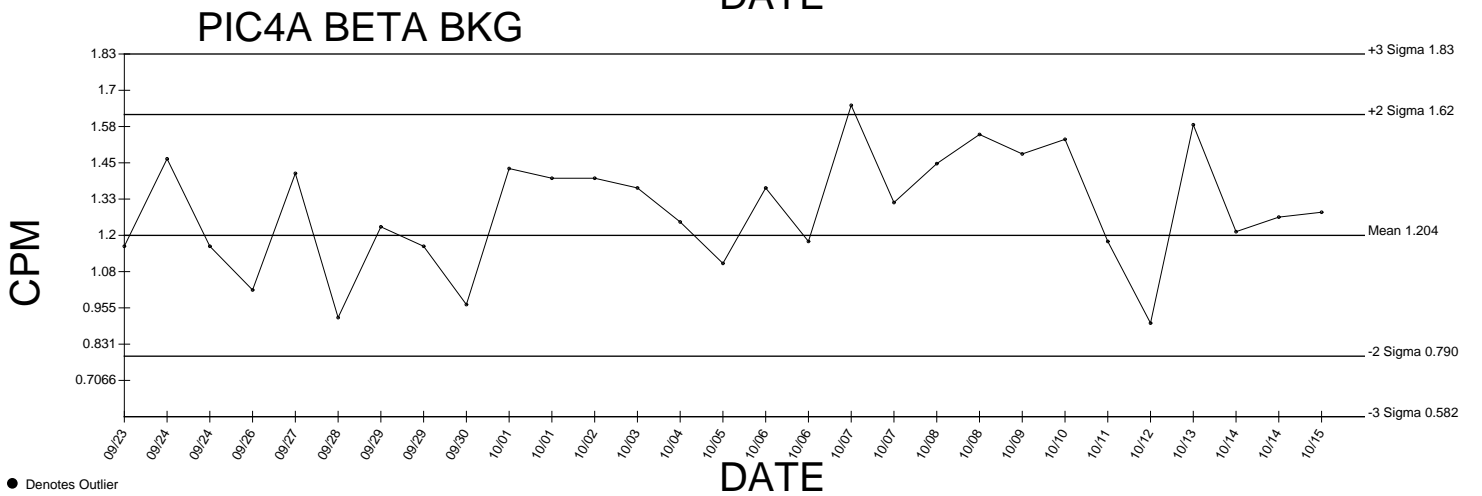
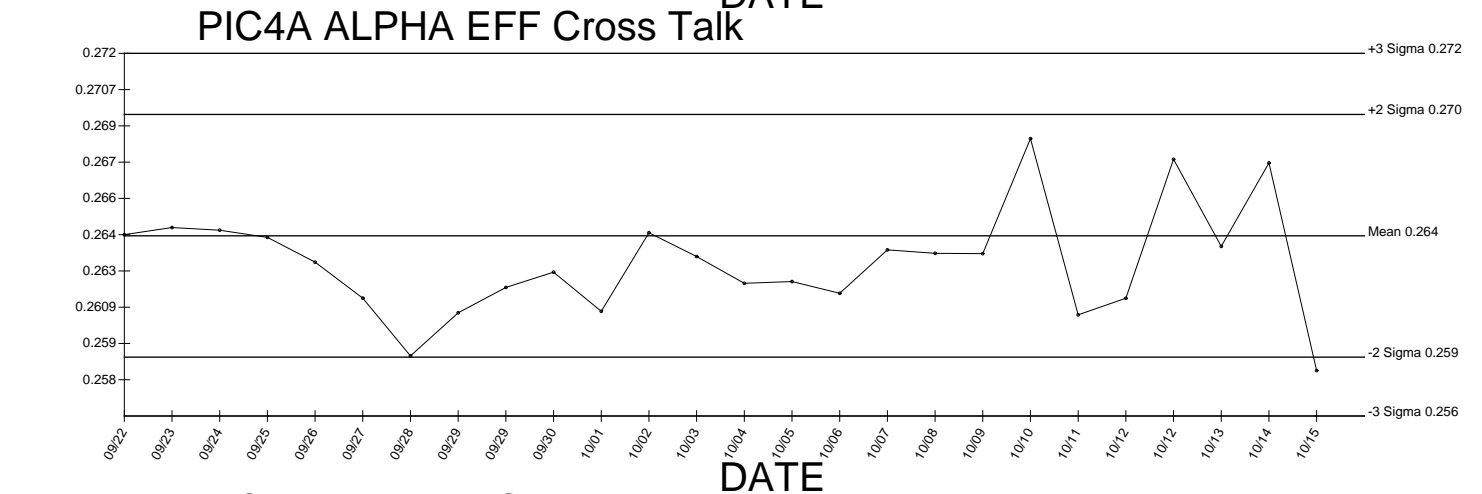
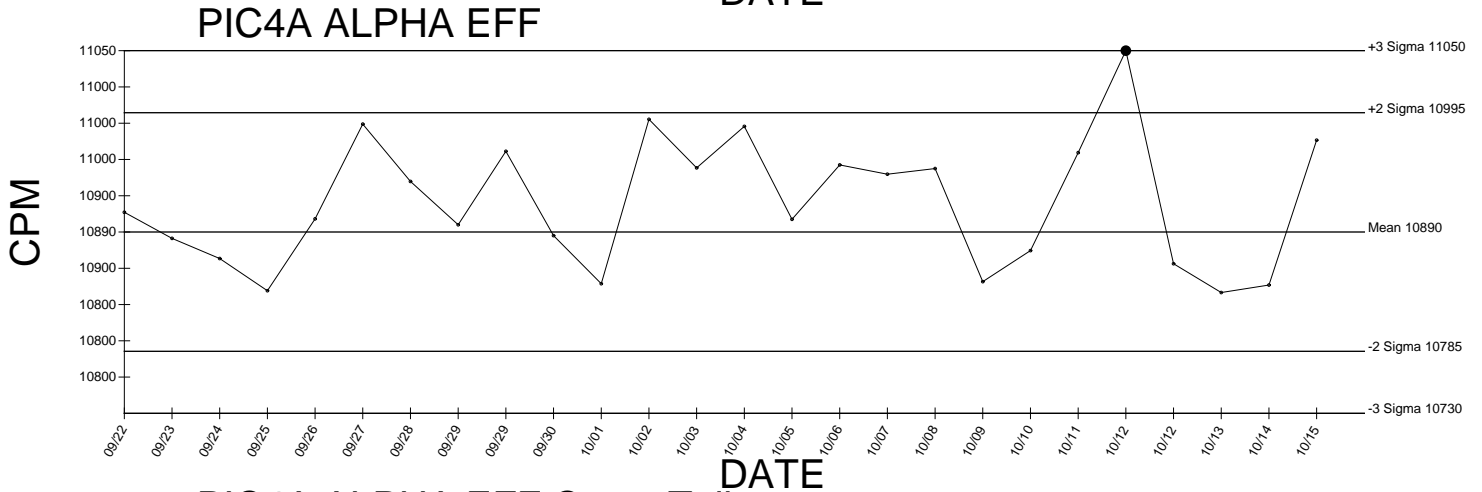
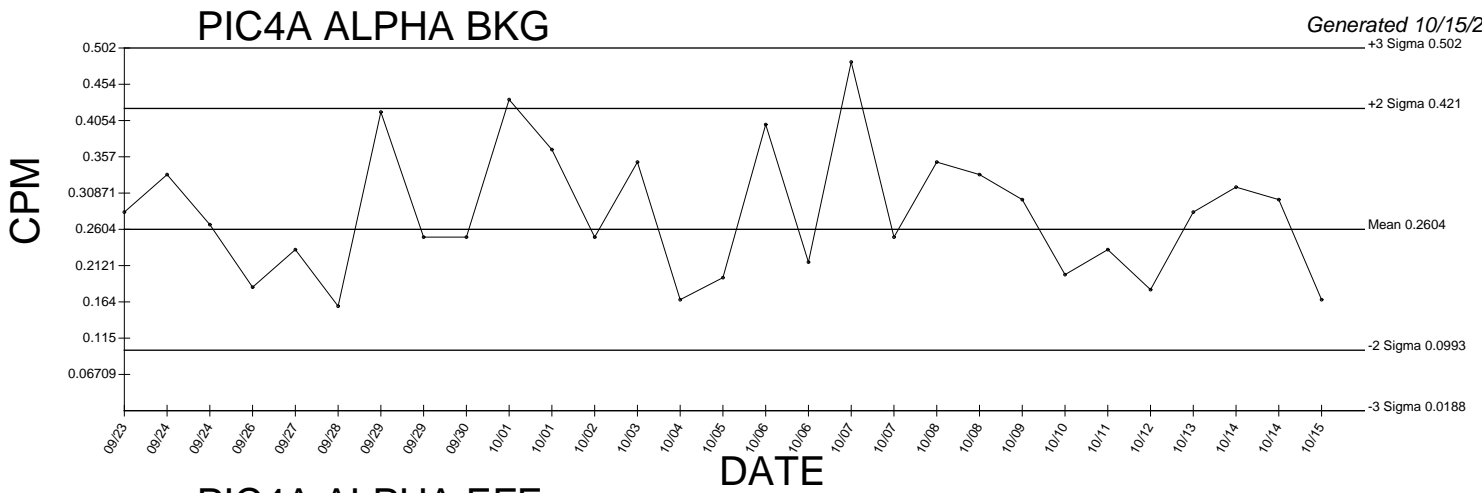
# PIC3D BETA EFF



# PIC3D BETA EFF Cross Talk

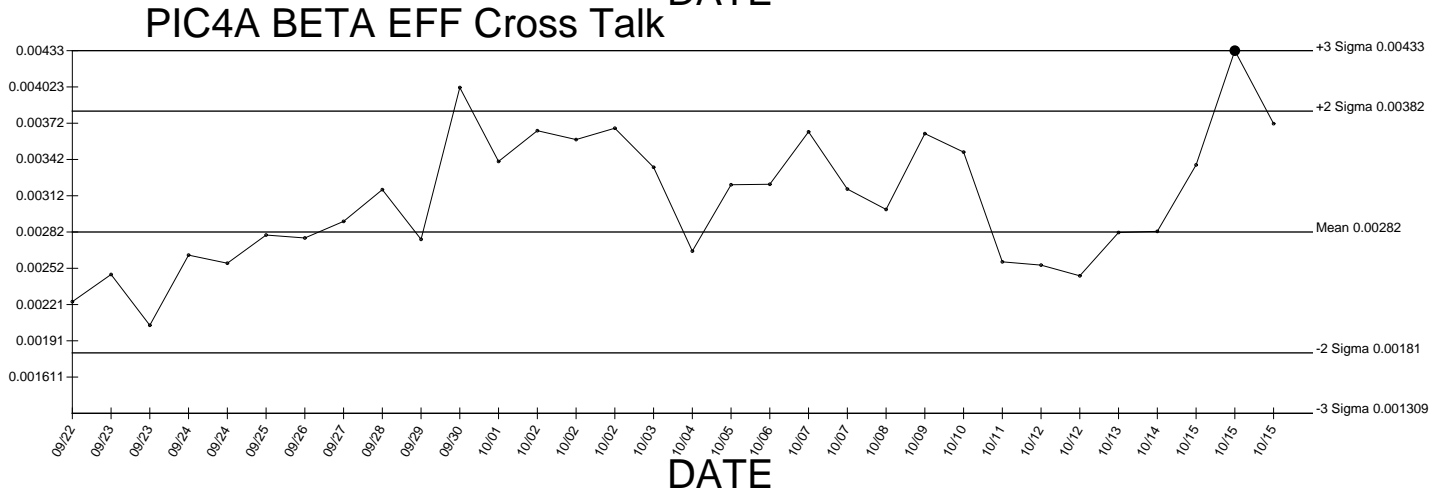
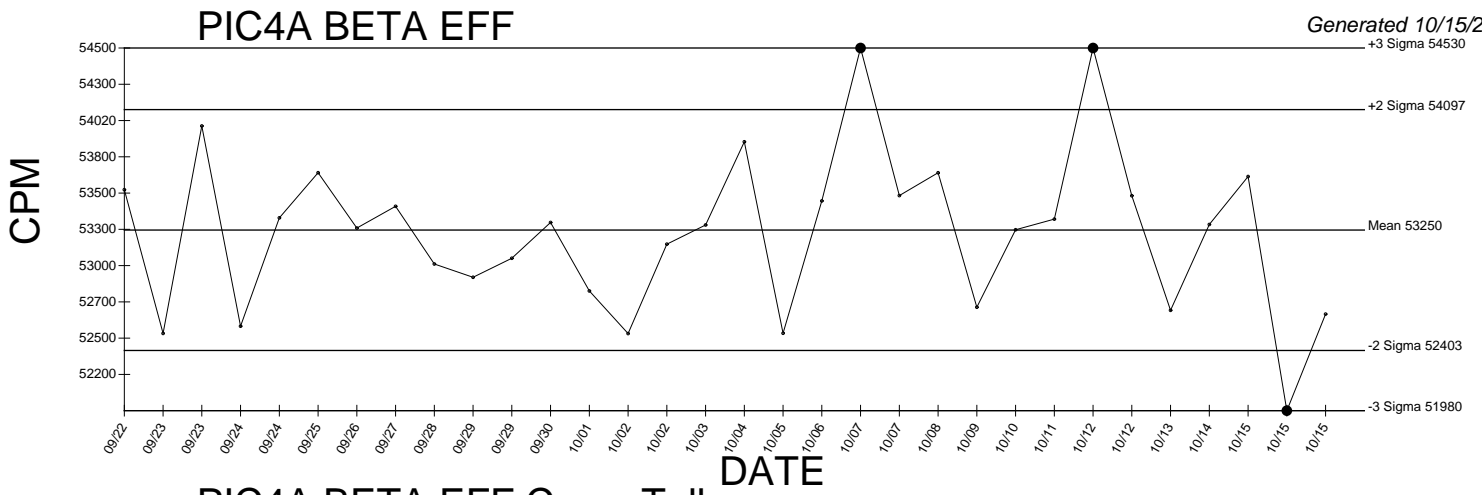


● Denotes Outlier

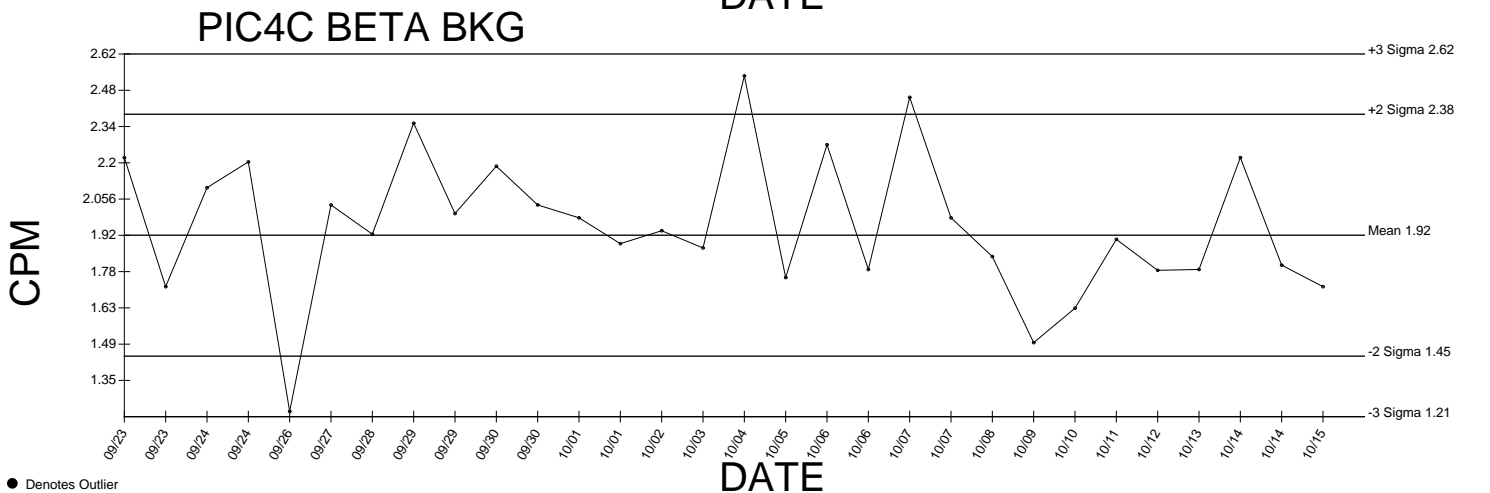
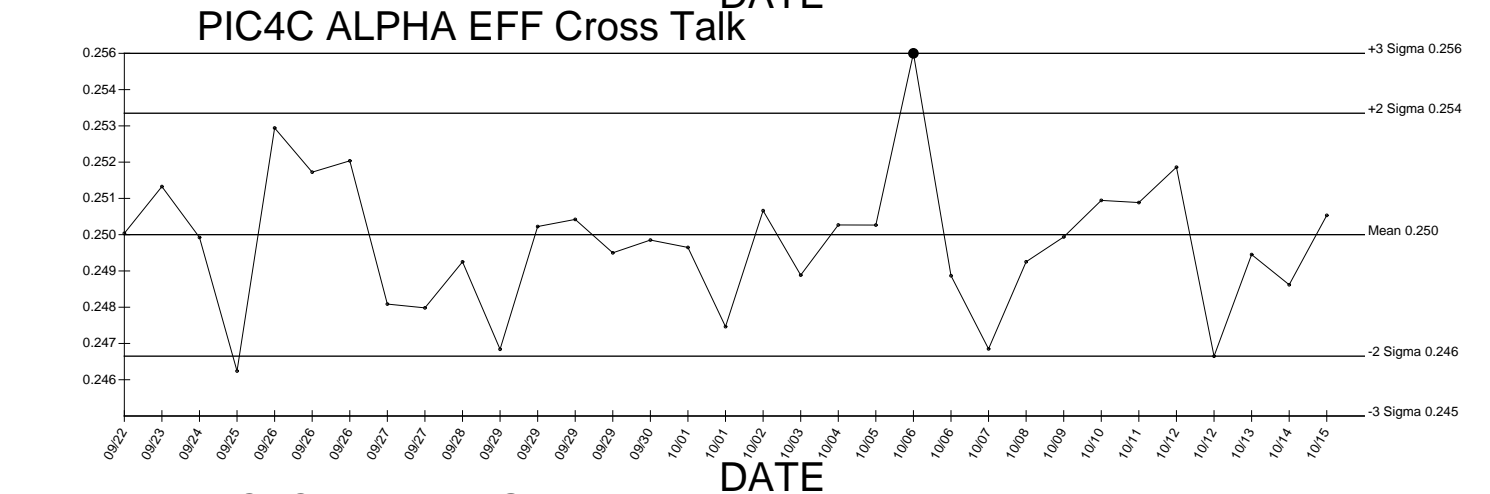
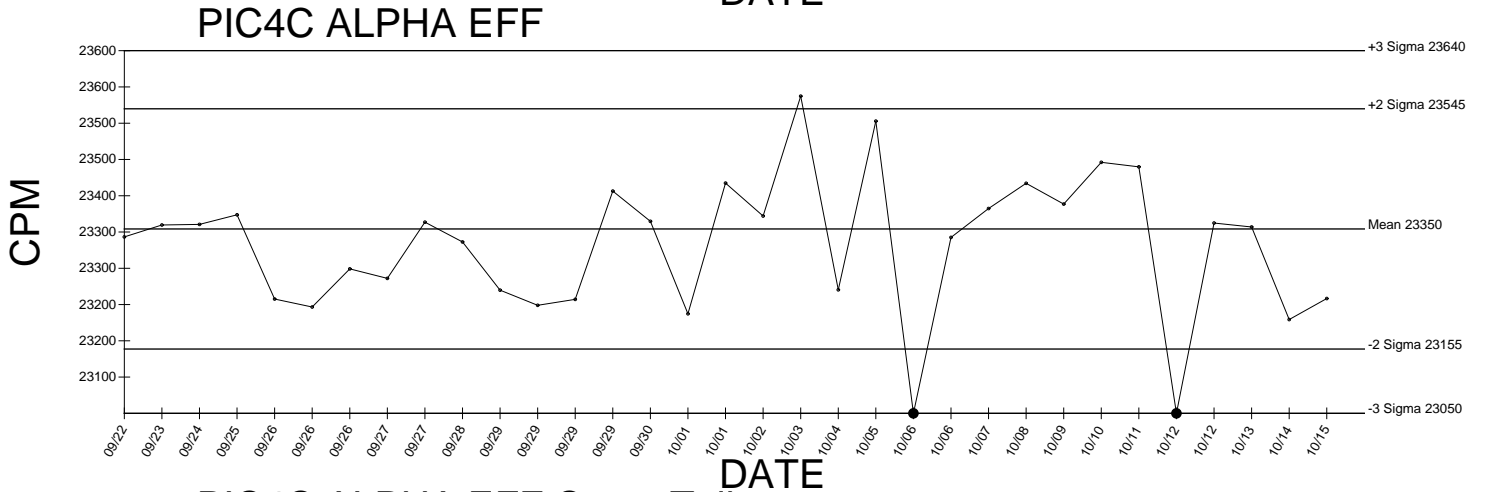
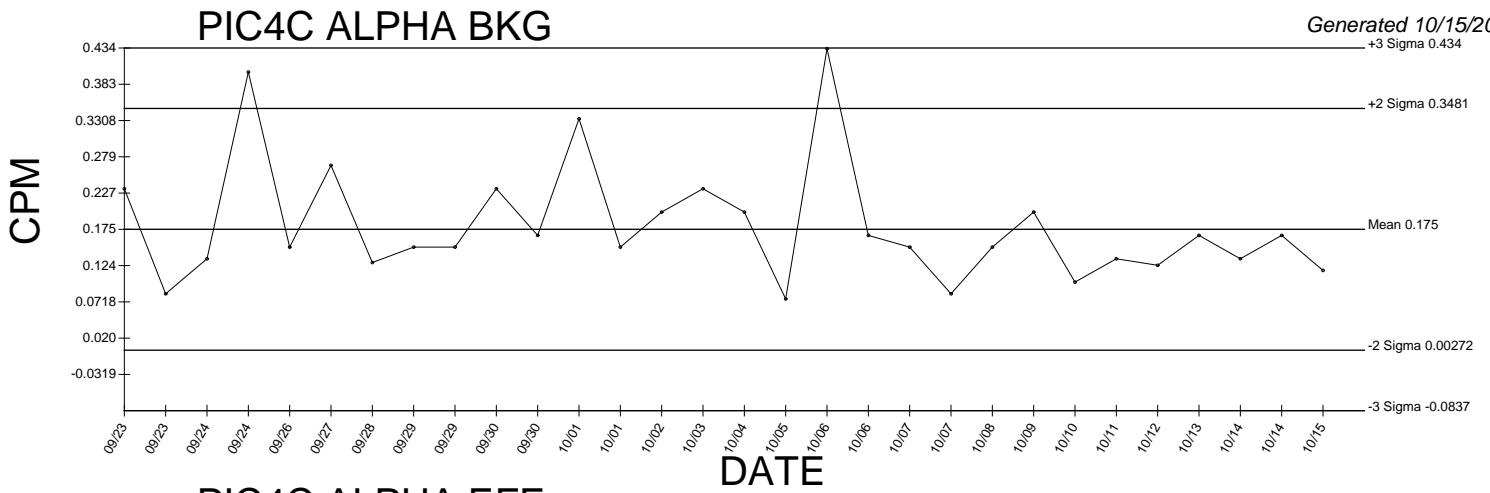


● Denotes Outlier





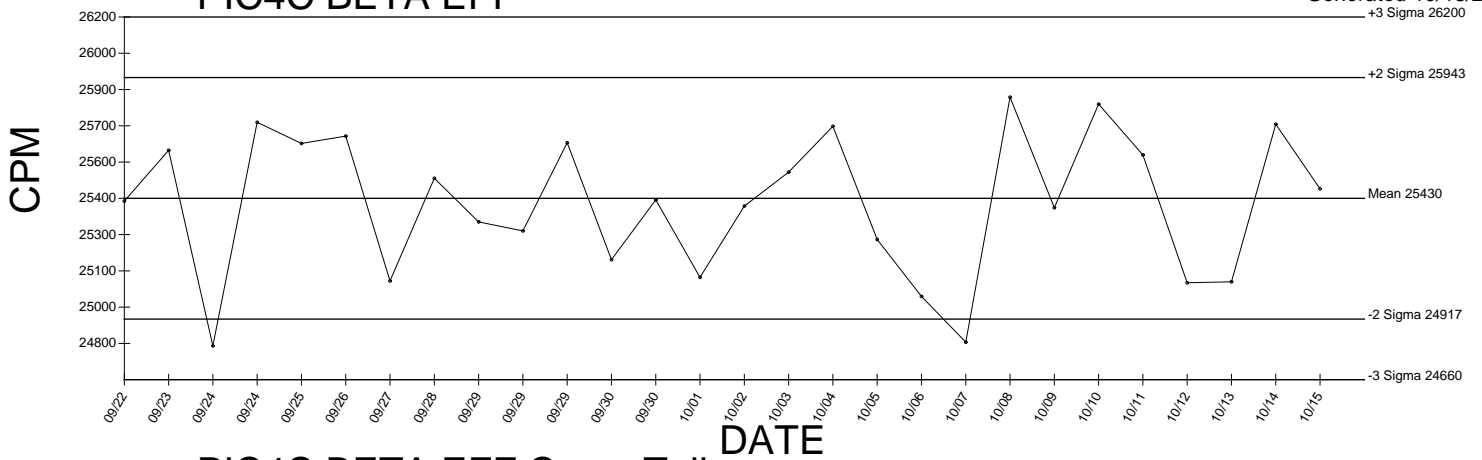
● Denotes Outlier



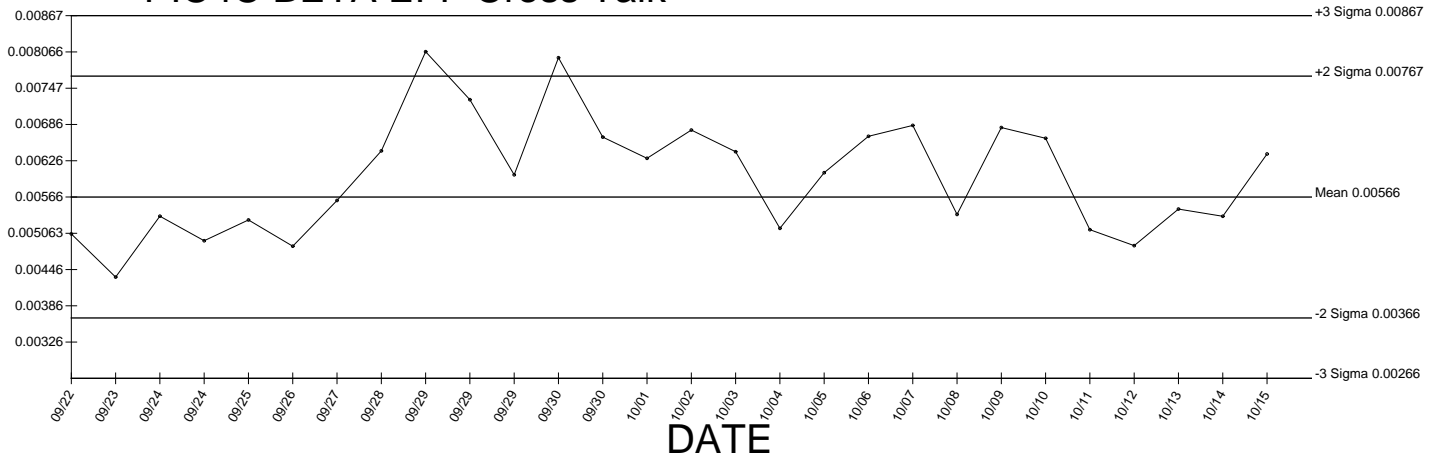
● Denotes Outlier

# PIC4C BETA EFF

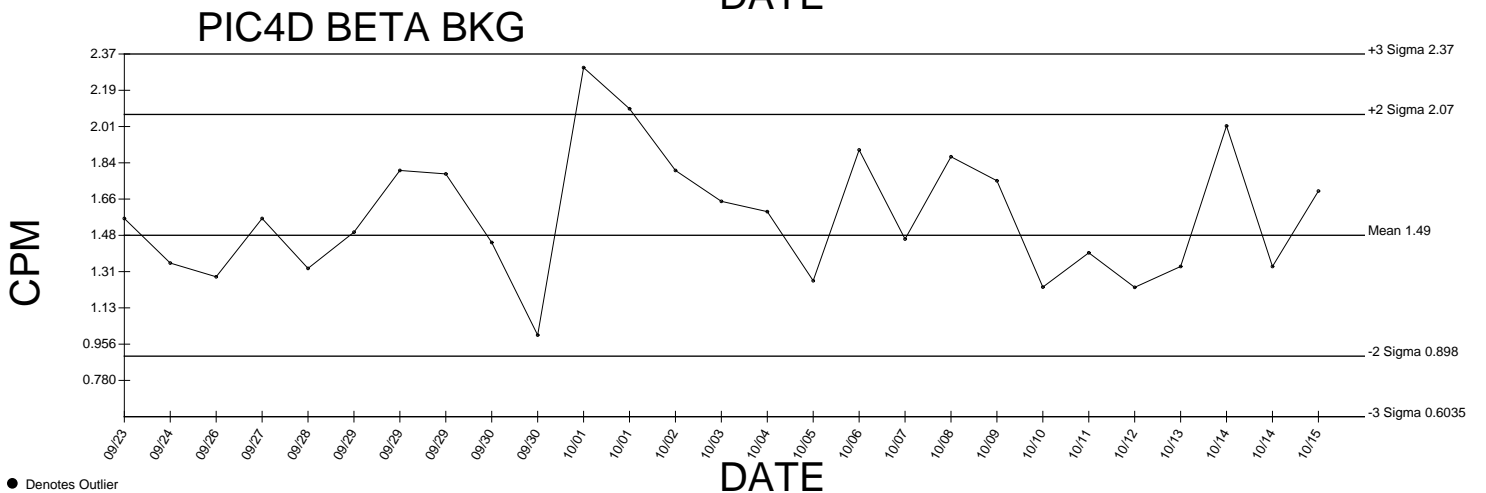
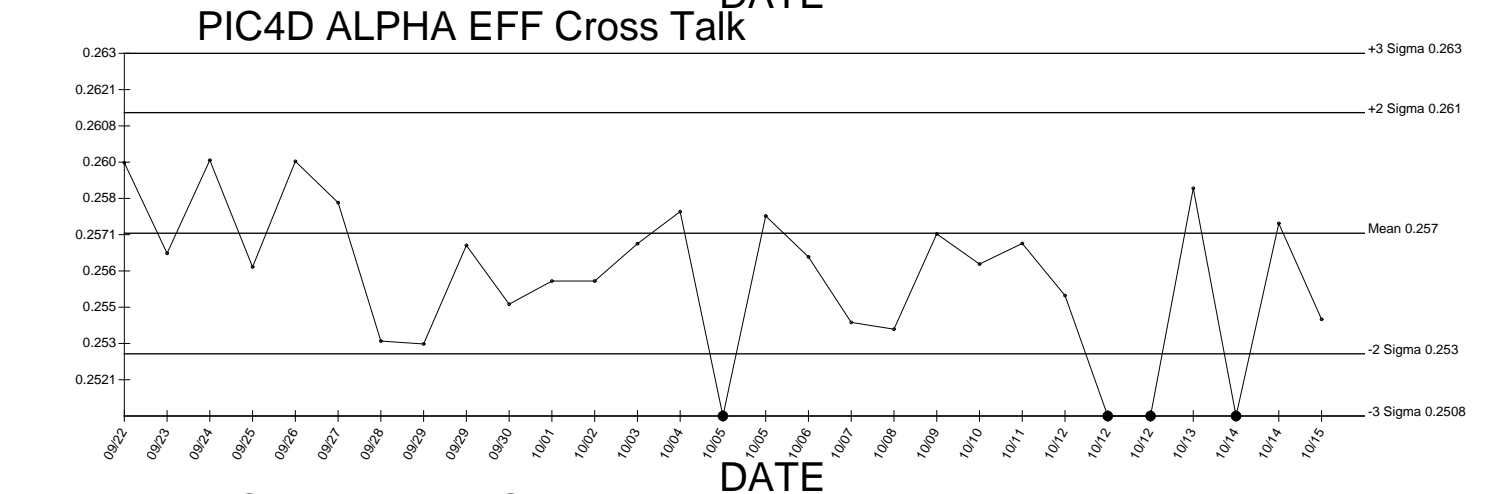
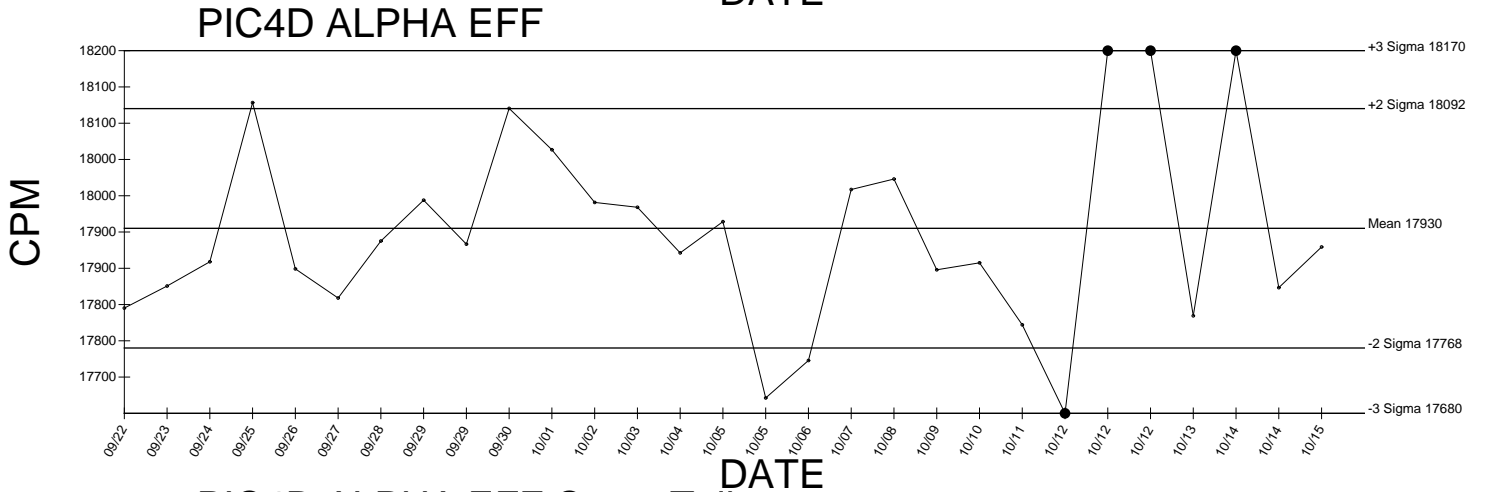
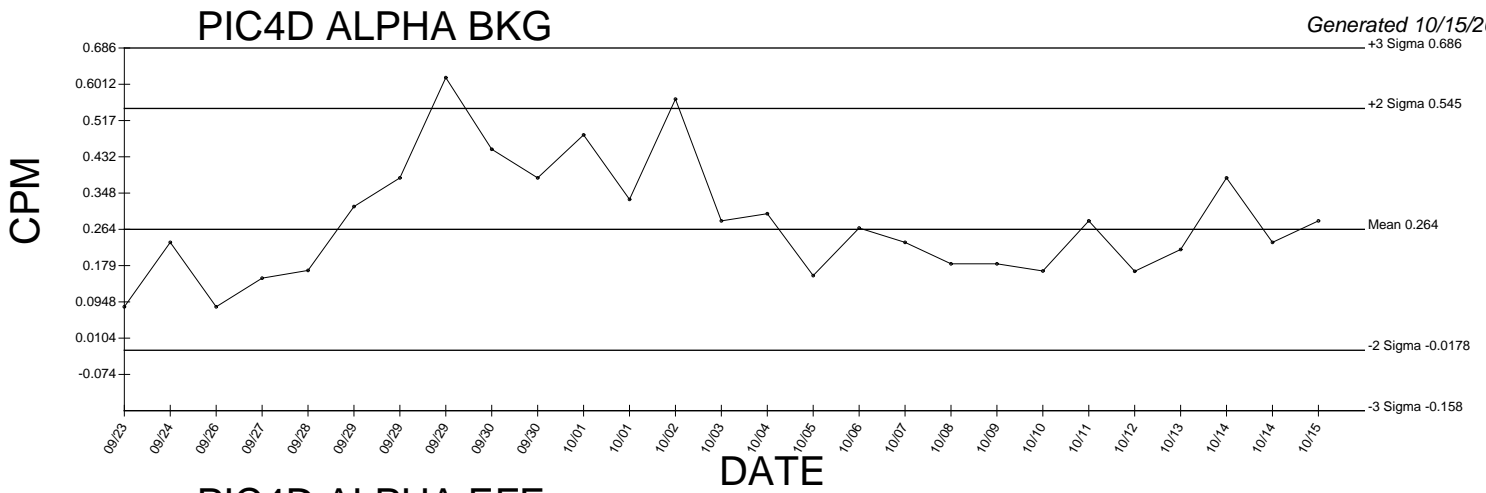
Generated 10/15/2009



# PIC4C BETA EFF Cross Talk



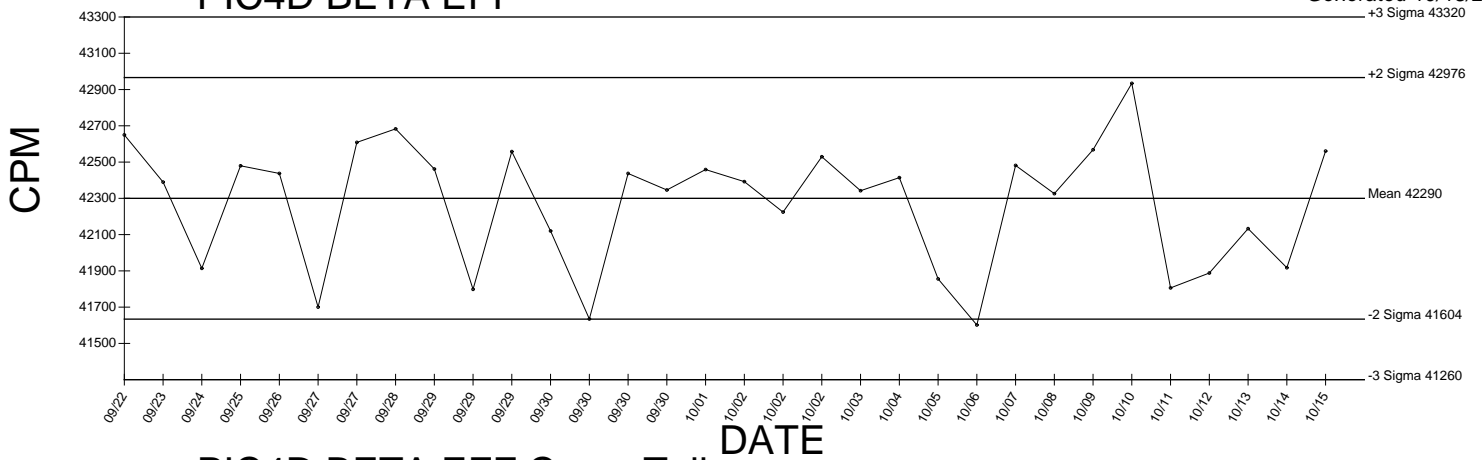
● Denotes Outlier



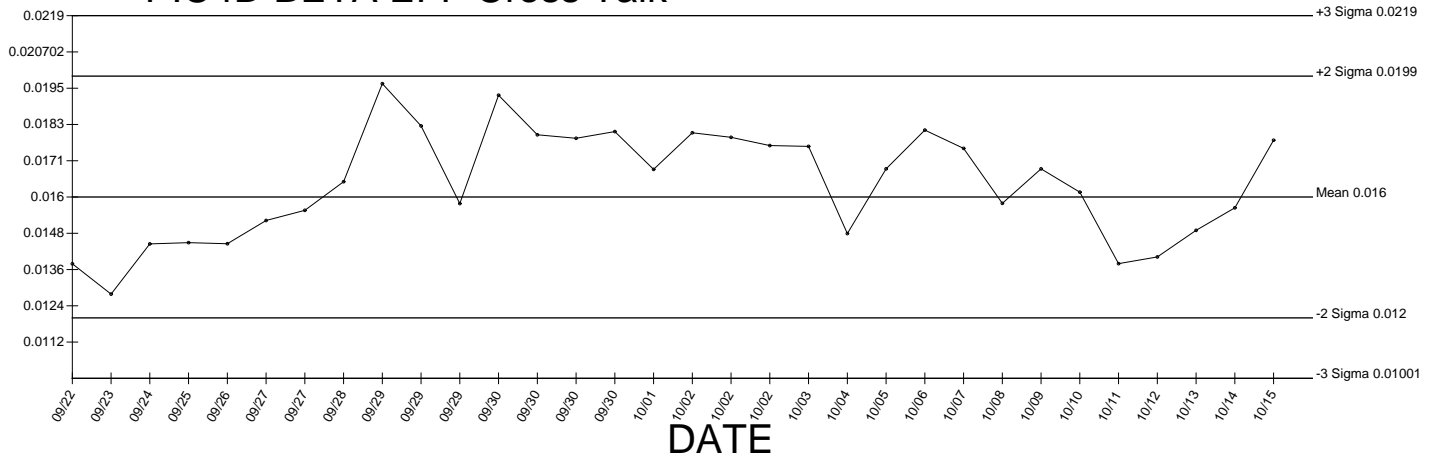
● Denotes Outlier

# PIC4D BETA EFF

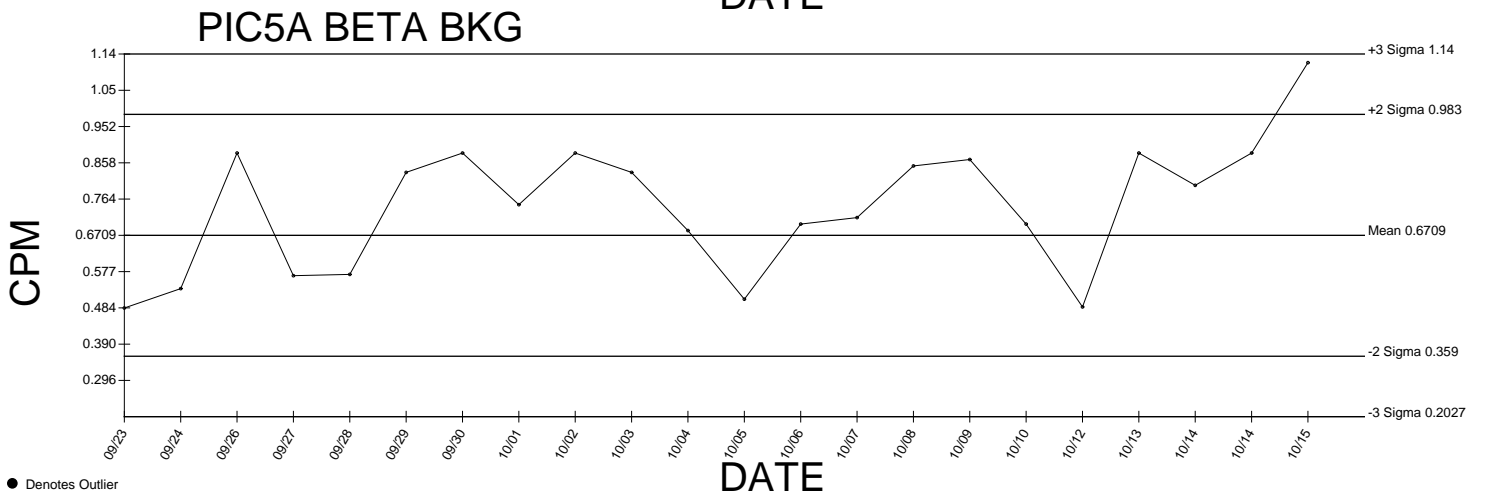
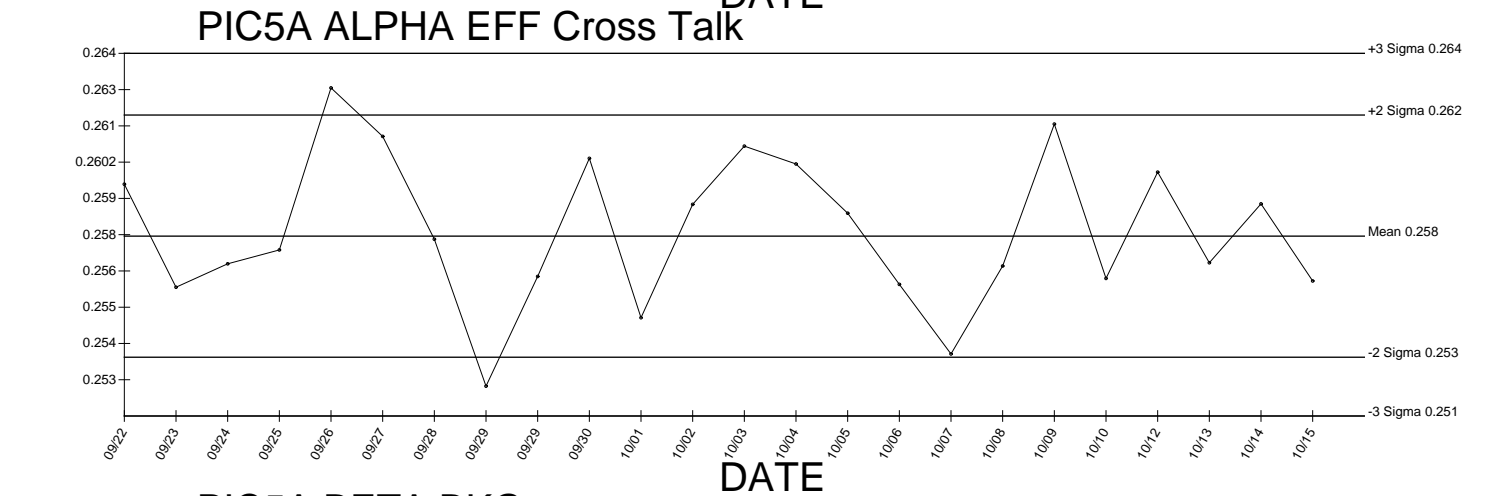
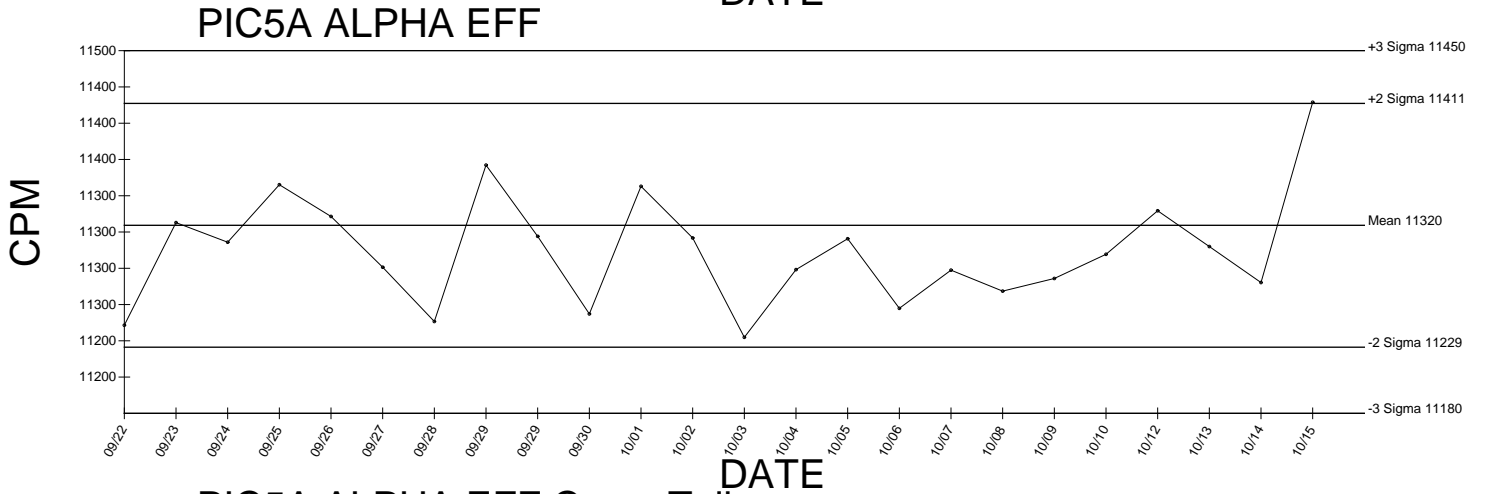
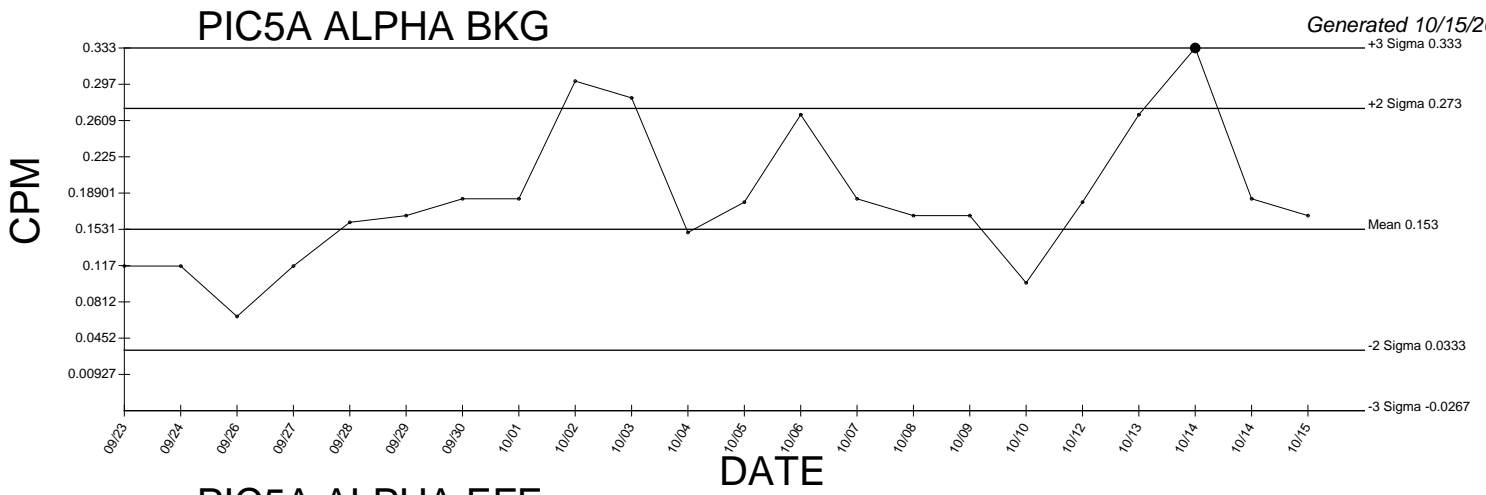
Generated 10/15/2009



# PIC4D BETA EFF Cross Talk



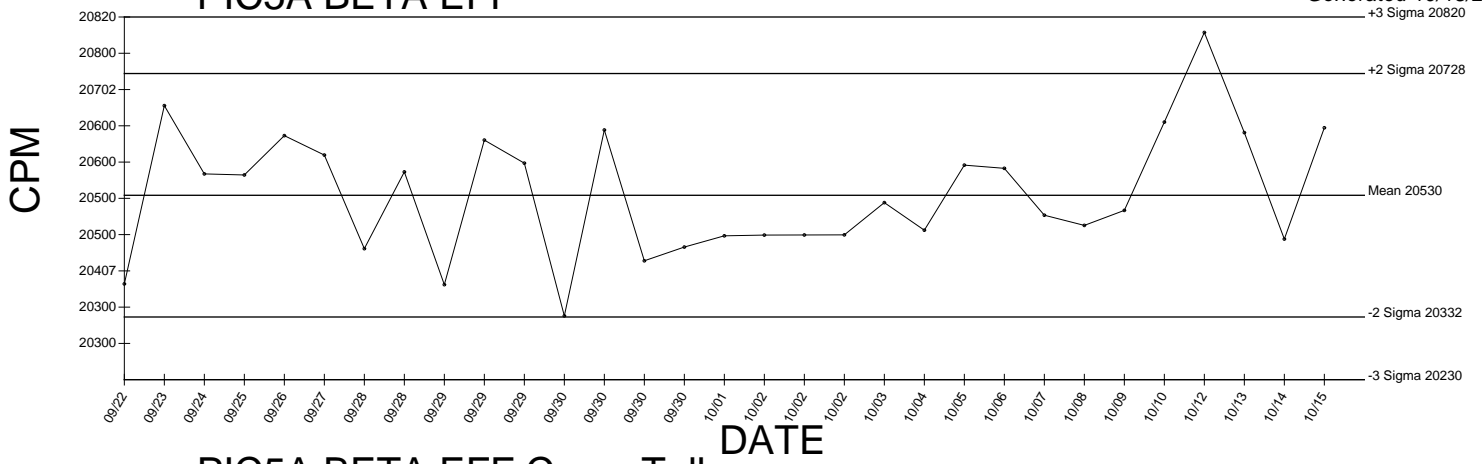
● Denotes Outlier



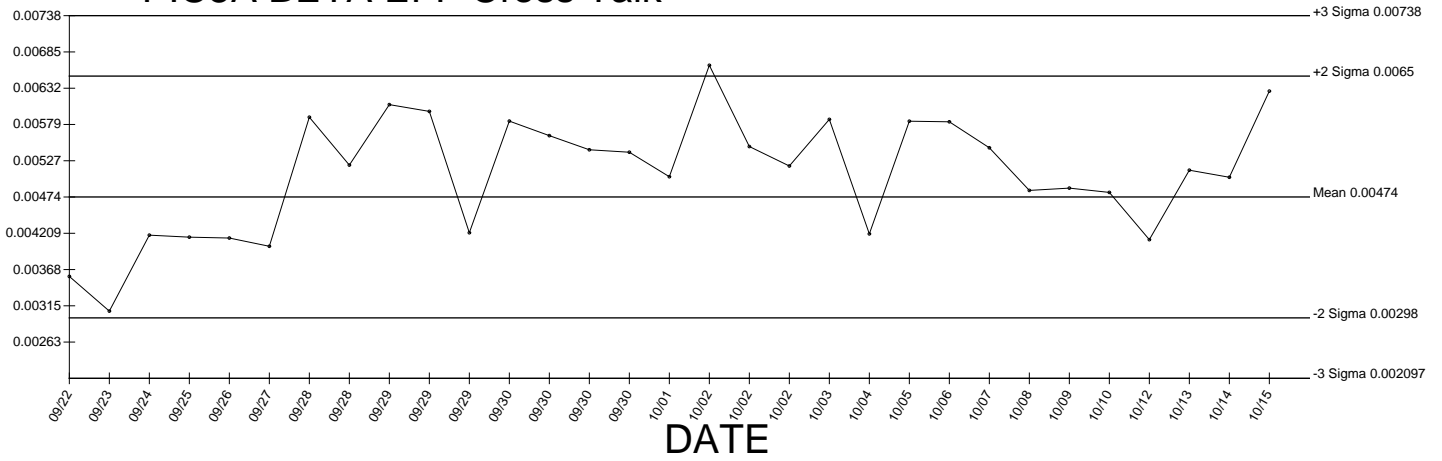
● Denotes Outlier

# PIC5A BETA EFF

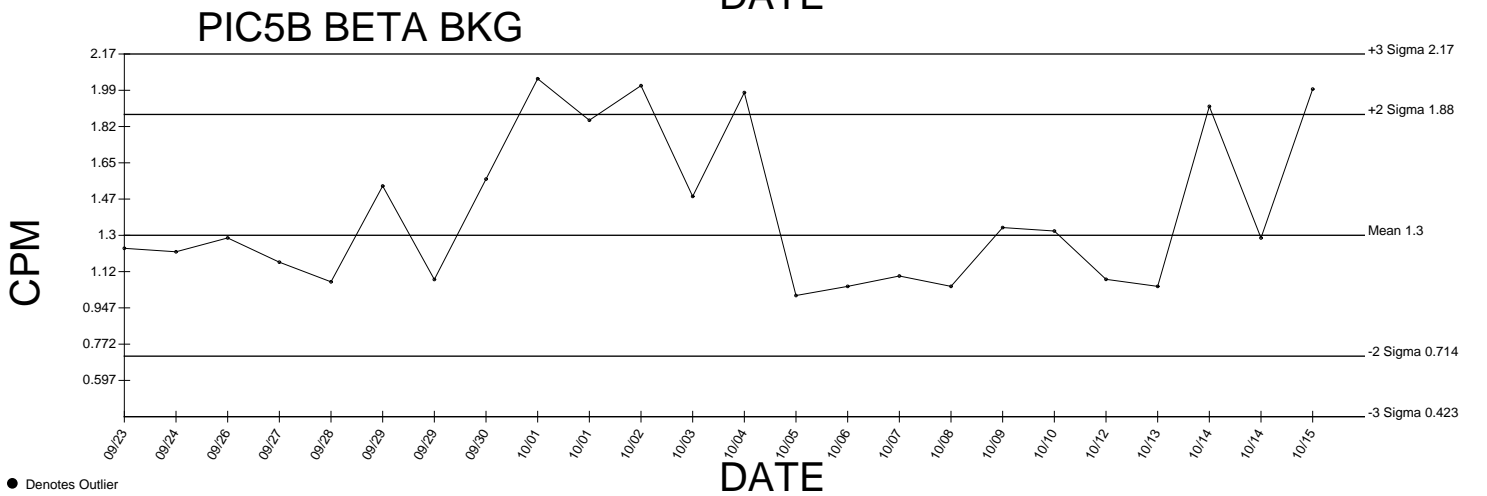
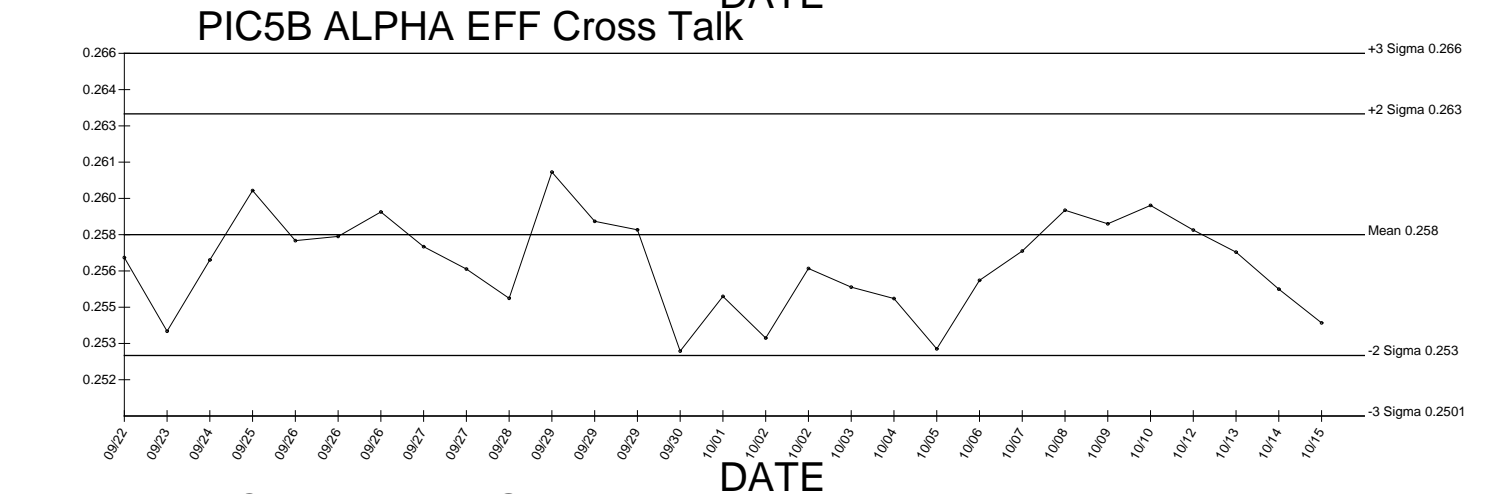
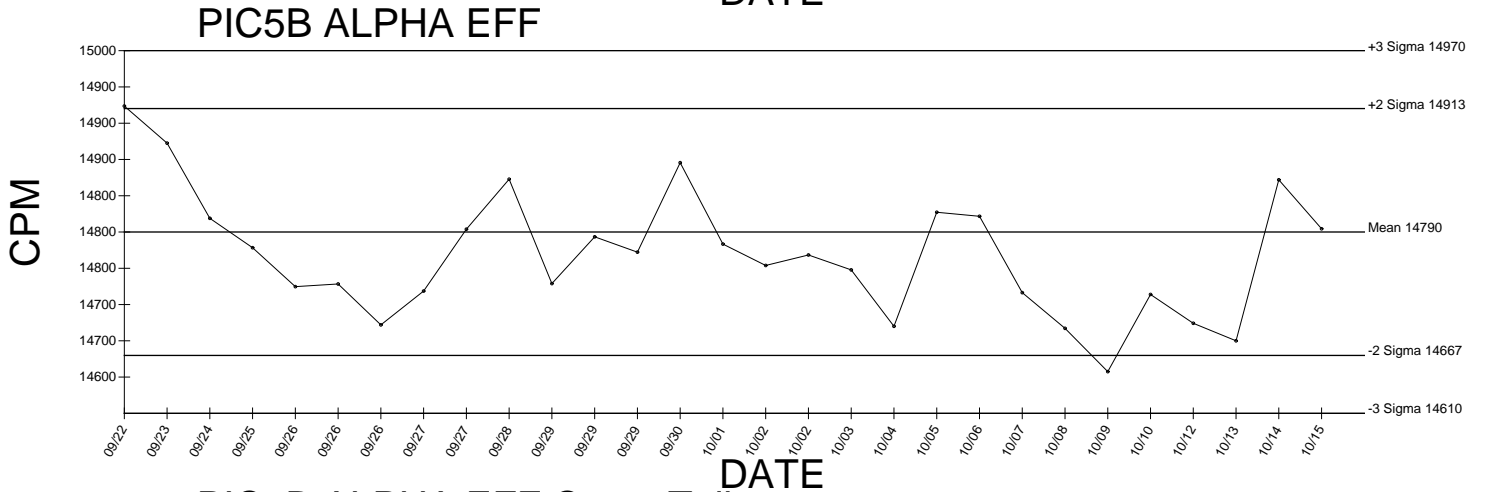
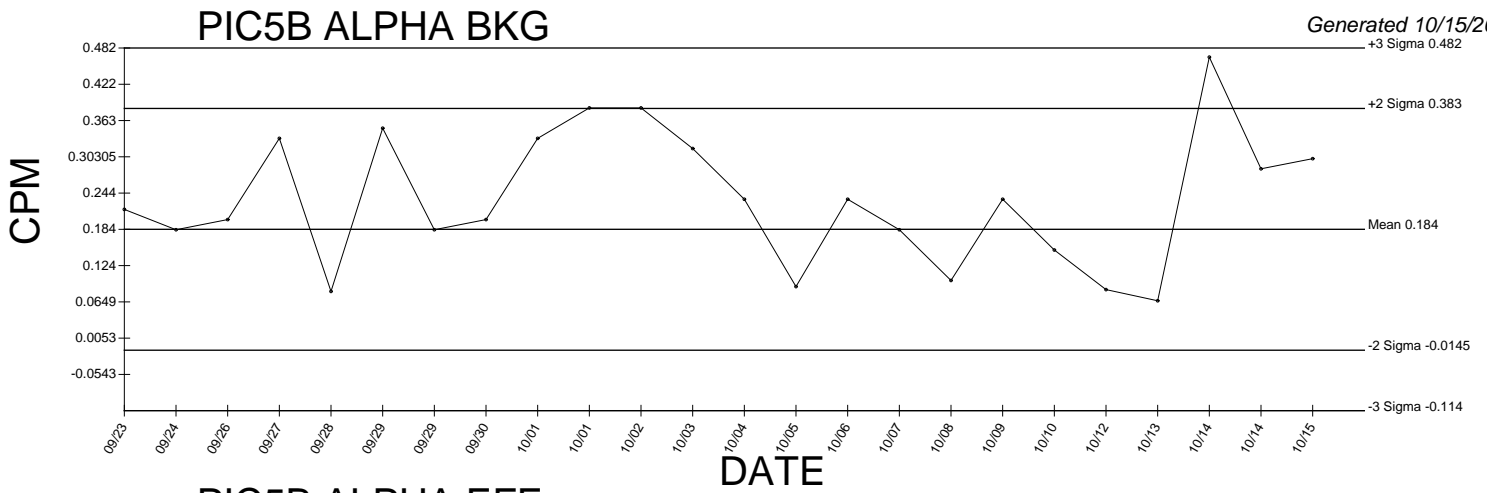
Generated 10/15/2009



# PIC5A BETA EFF Cross Talk



● Denotes Outlier

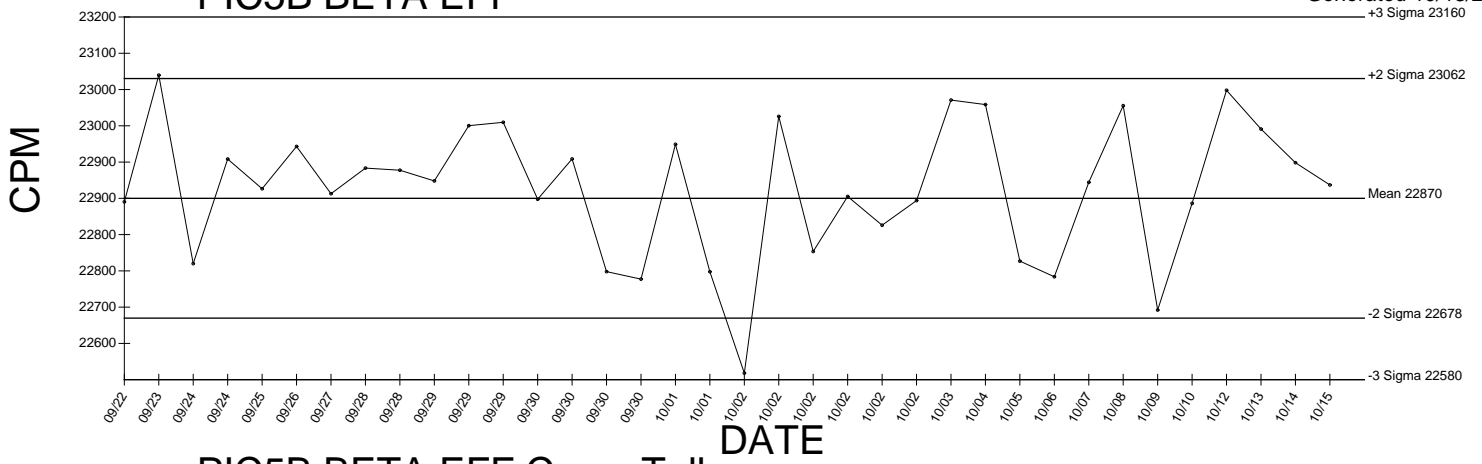


● Denotes Outlier

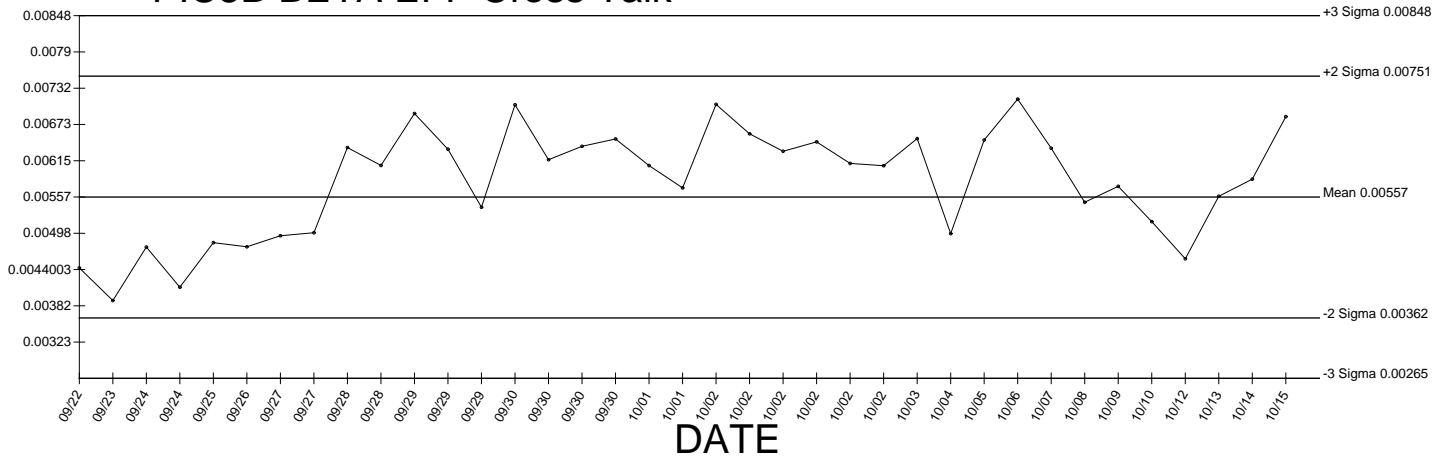


# PIC5B BETA EFF

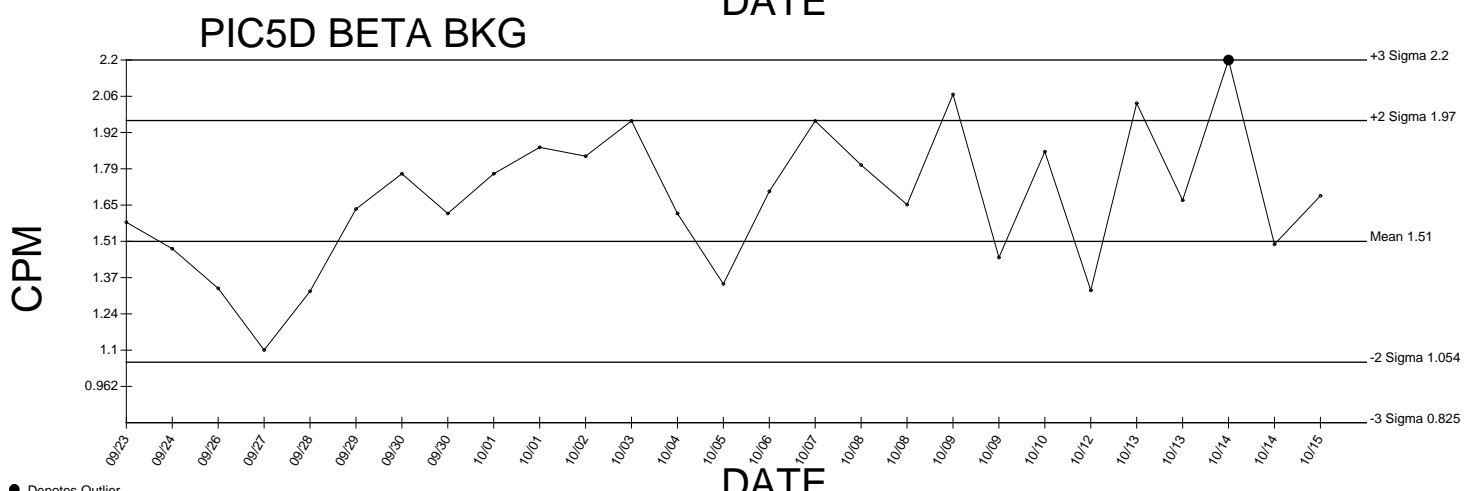
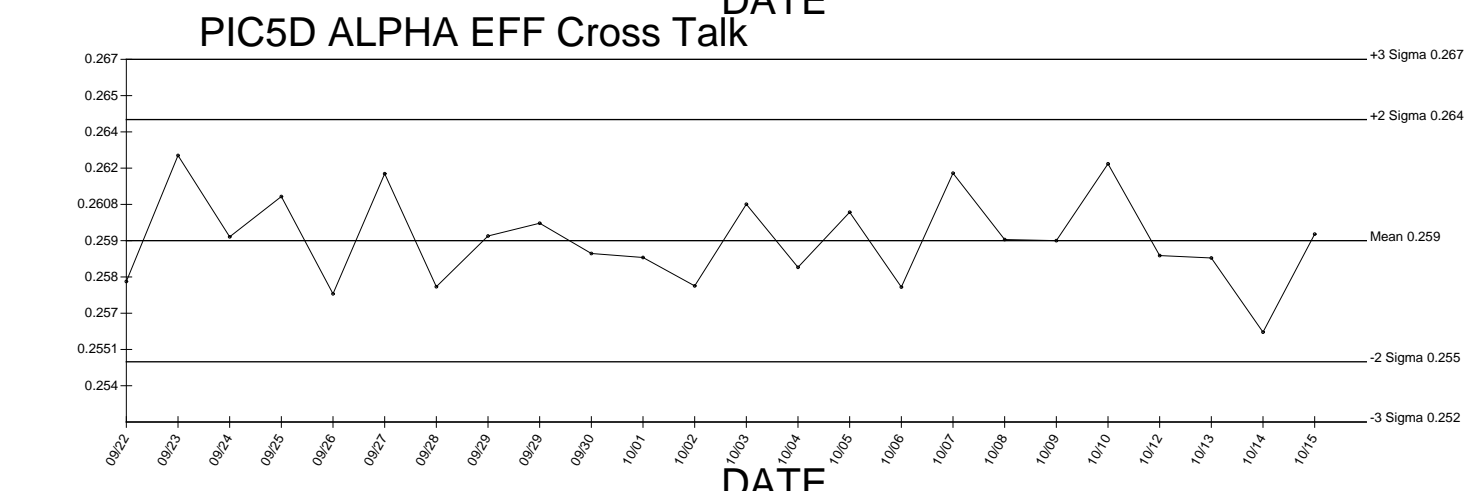
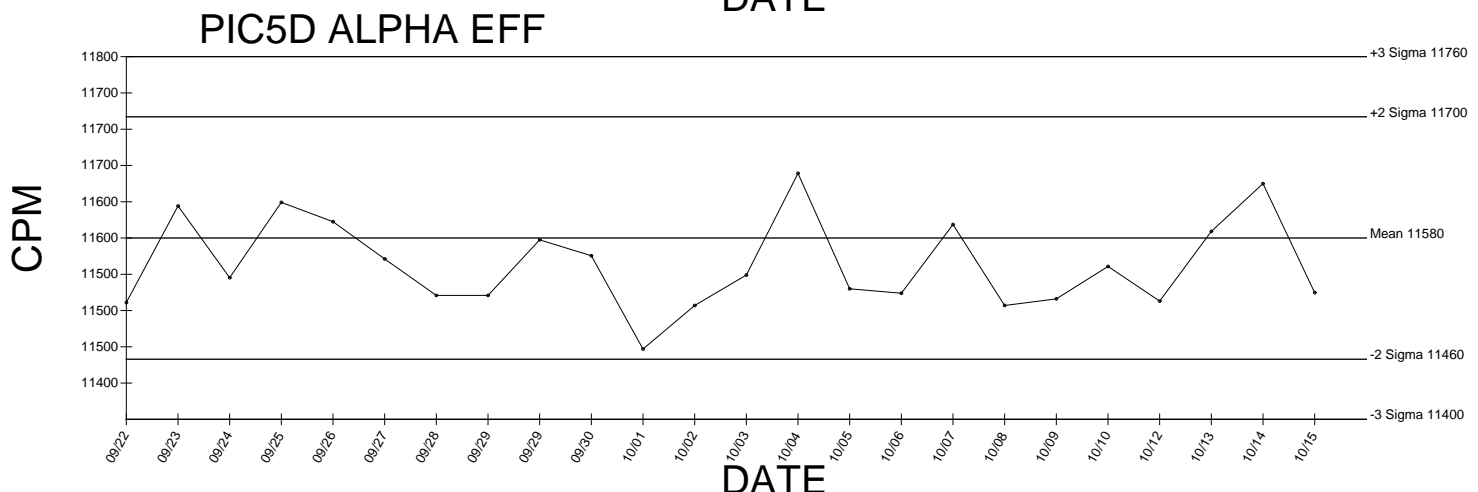
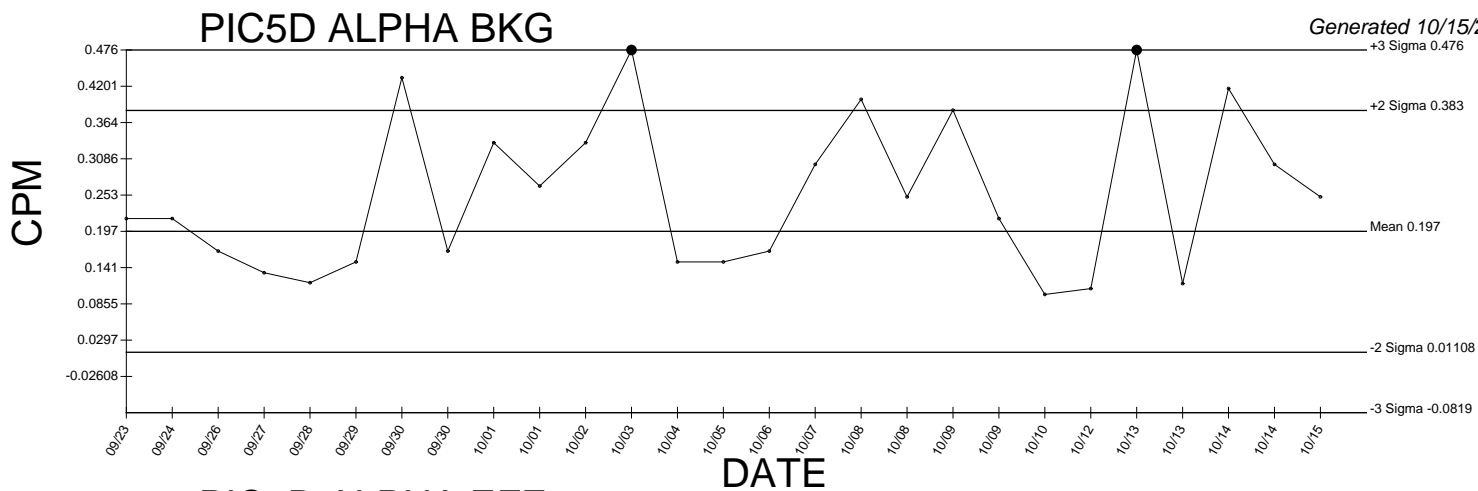
Generated 10/15/2009



# PIC5B BETA EFF Cross Talk



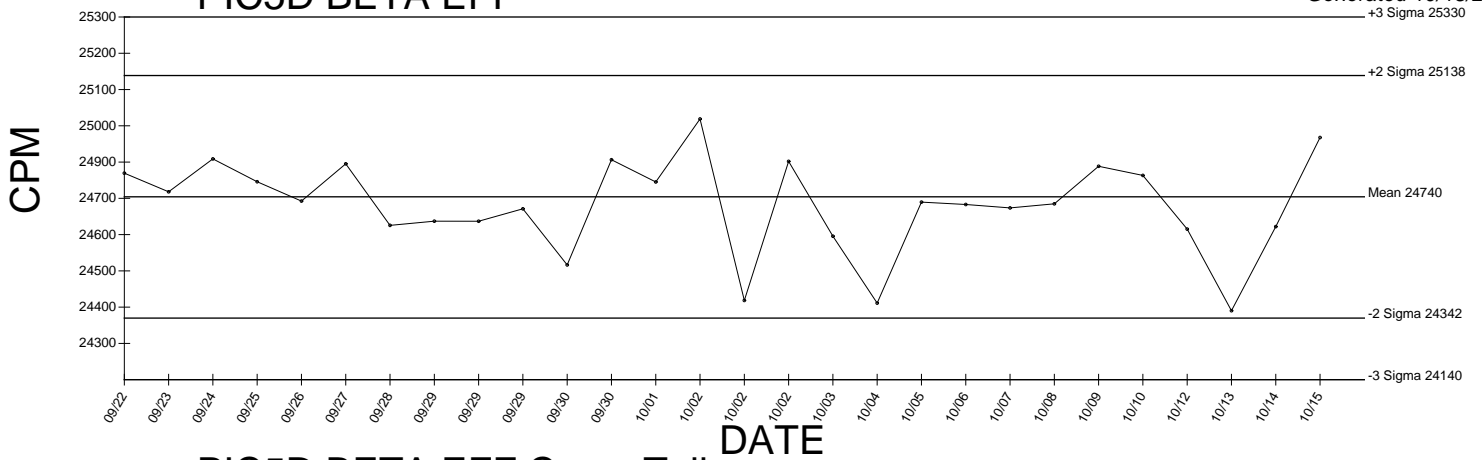
● Denotes Outlier



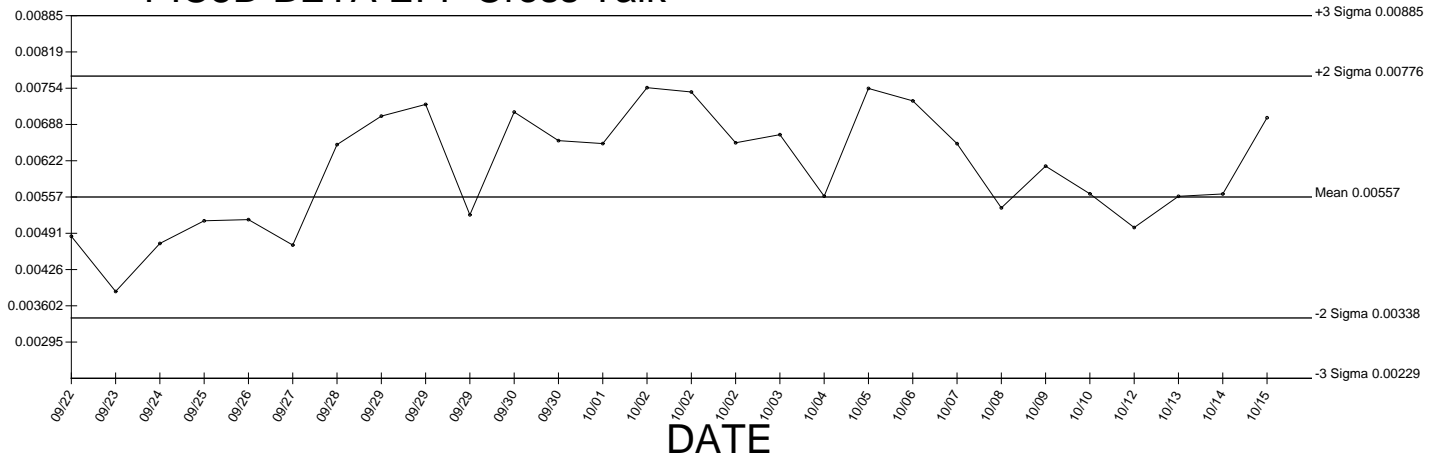
● Denotes Outlier

# PIC5D BETA EFF

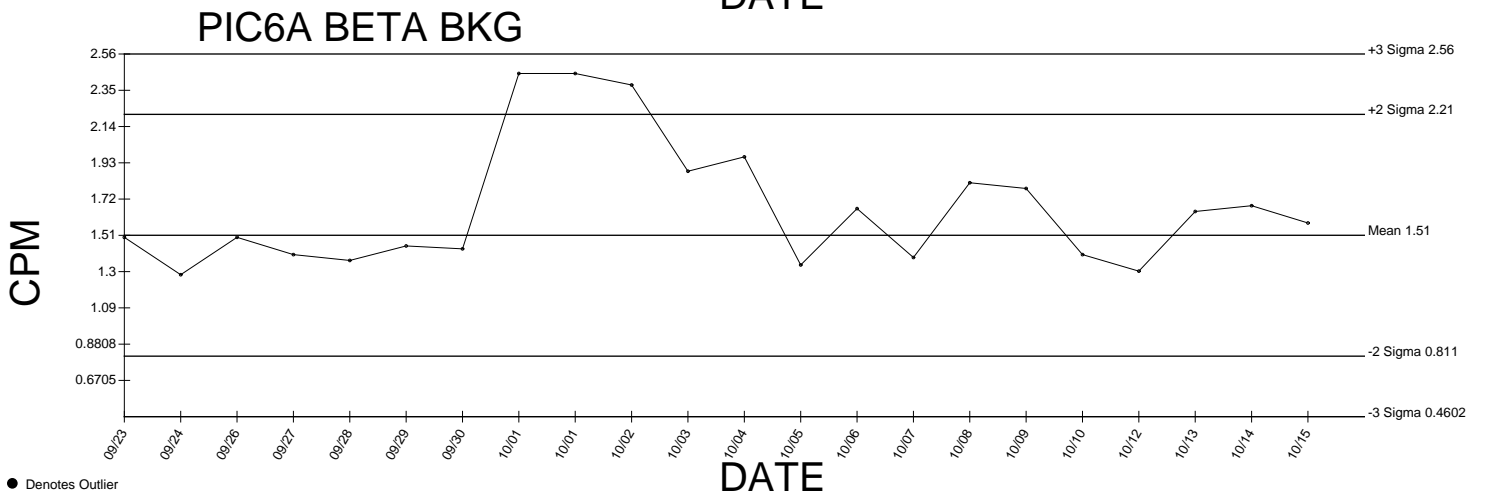
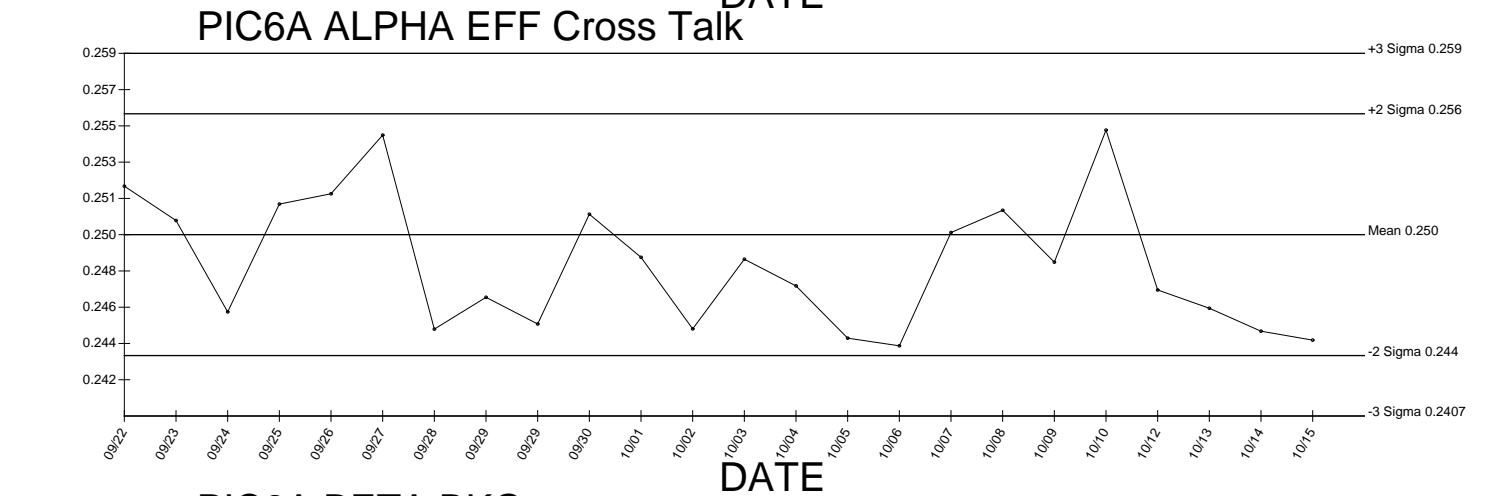
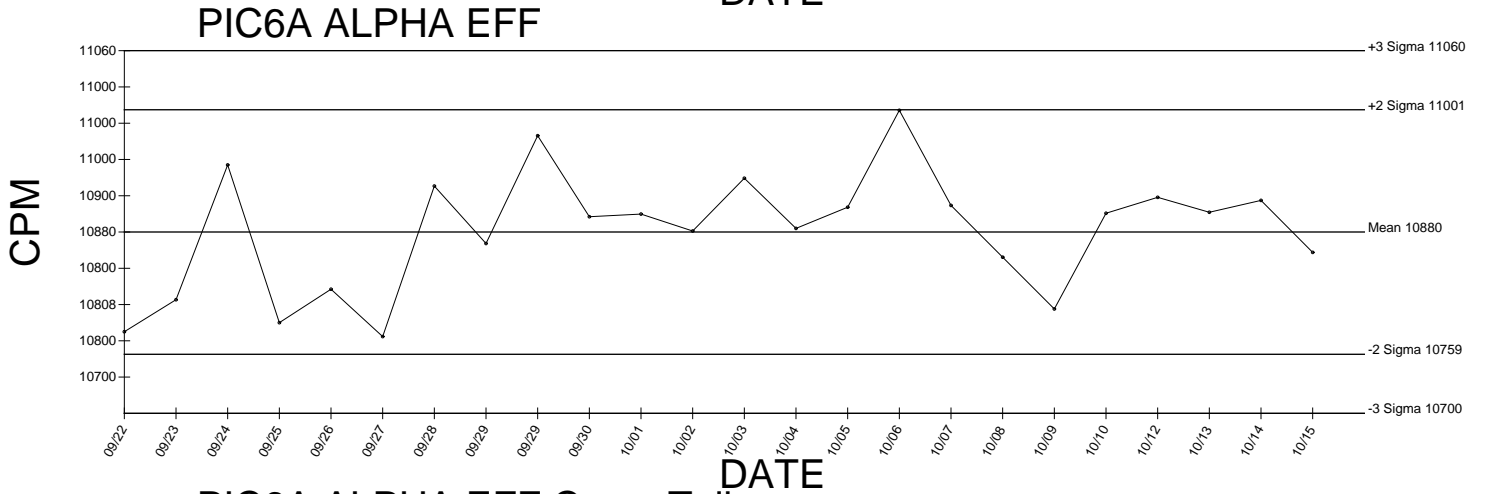
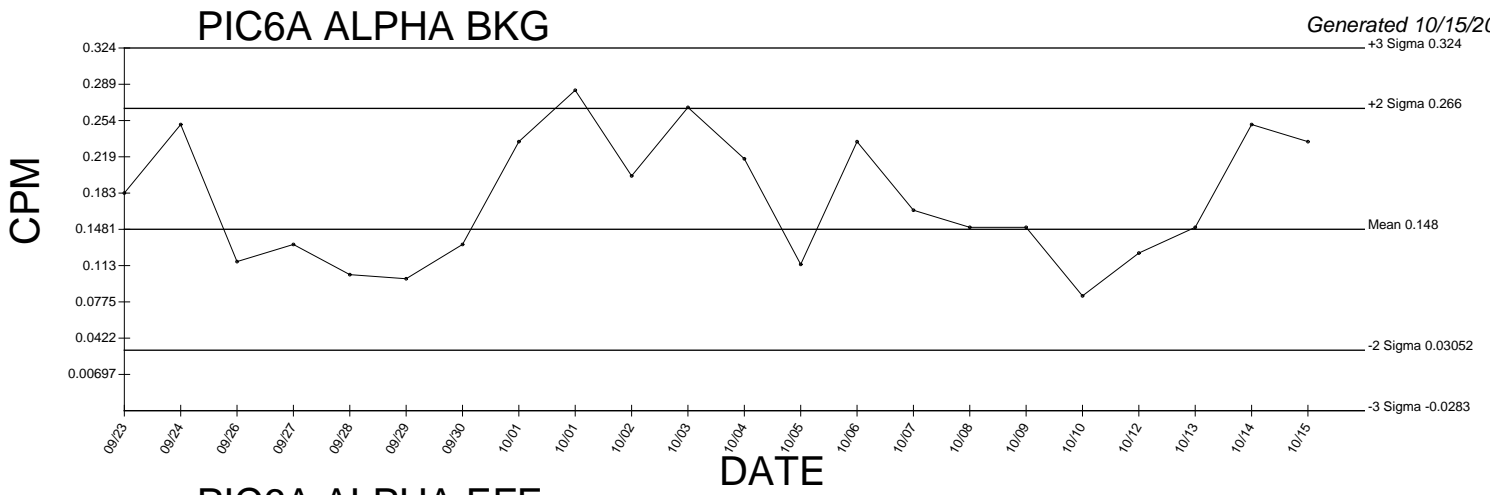
Generated 10/15/2009



# PIC5D BETA EFF Cross Talk



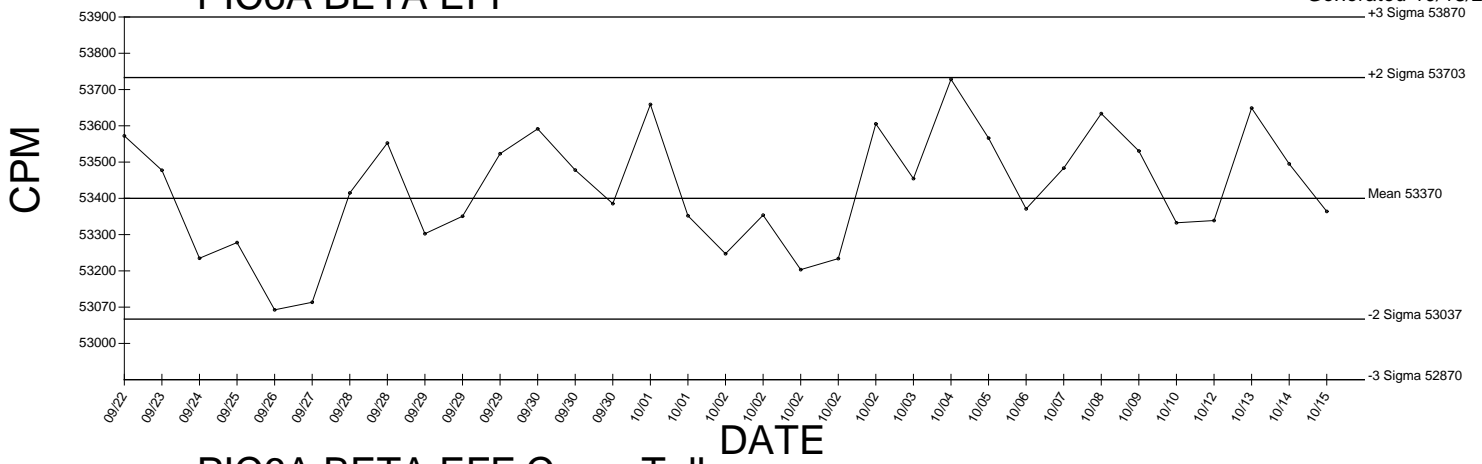
● Denotes Outlier



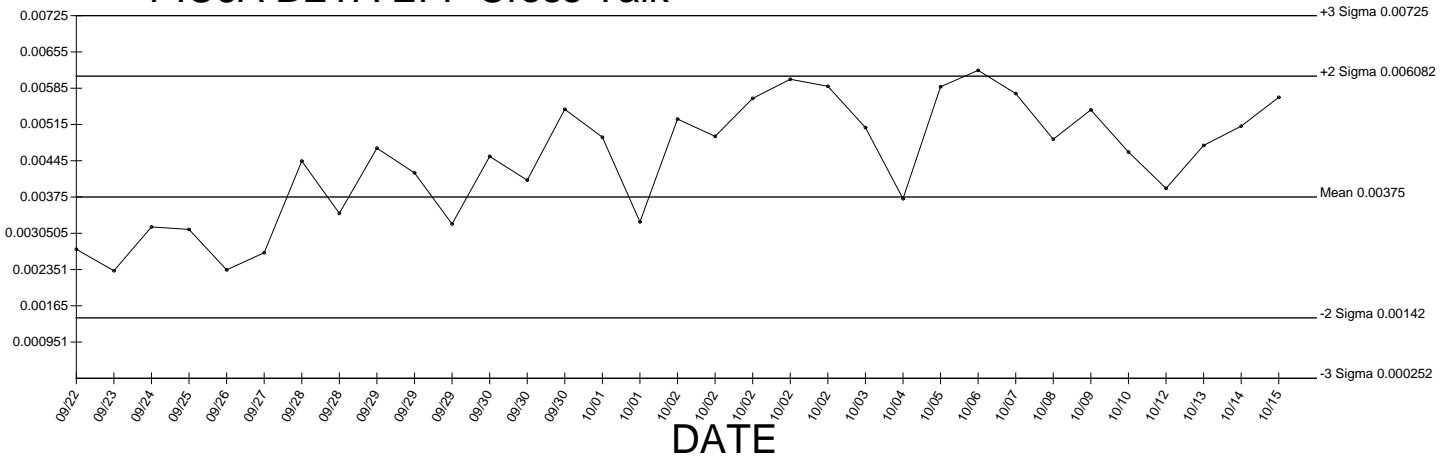
● Denotes Outlier

# PIC6A BETA EFF

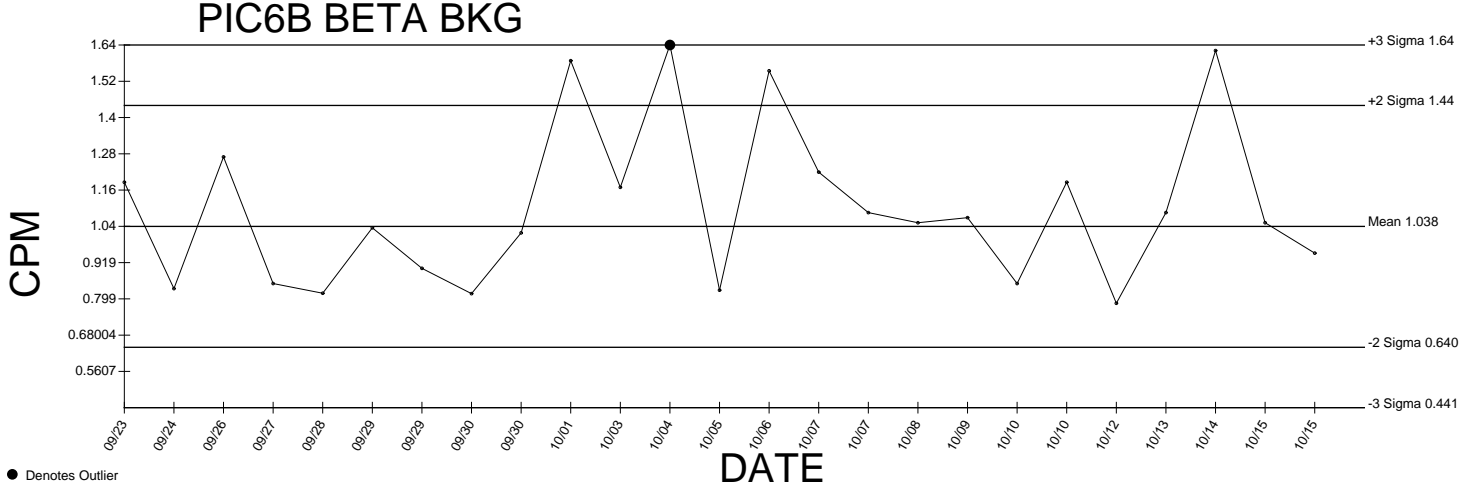
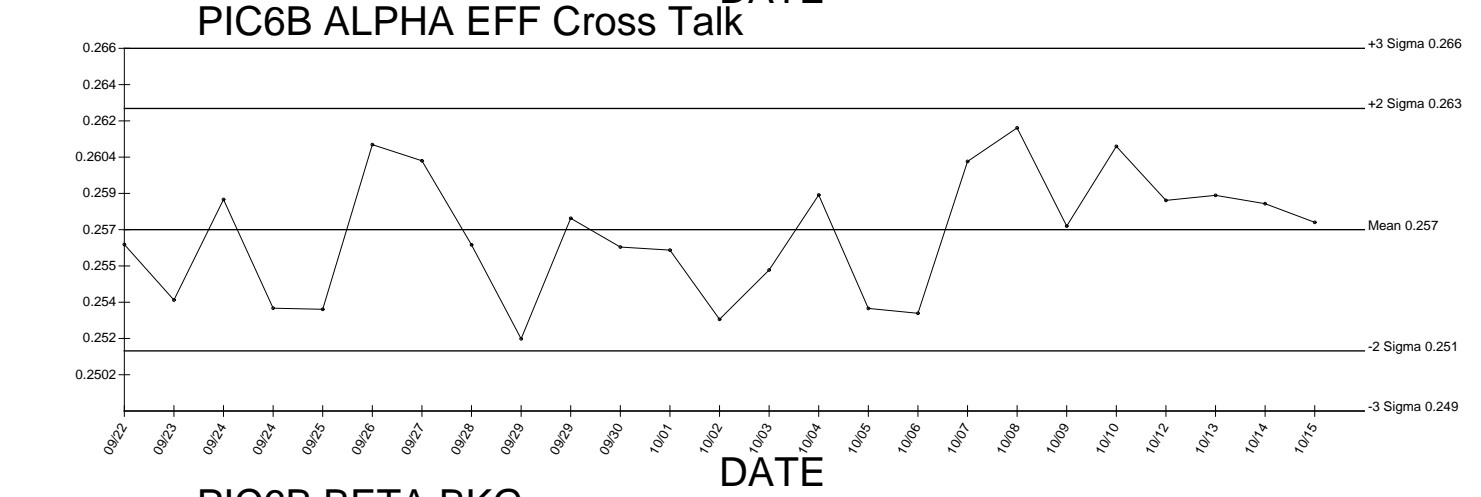
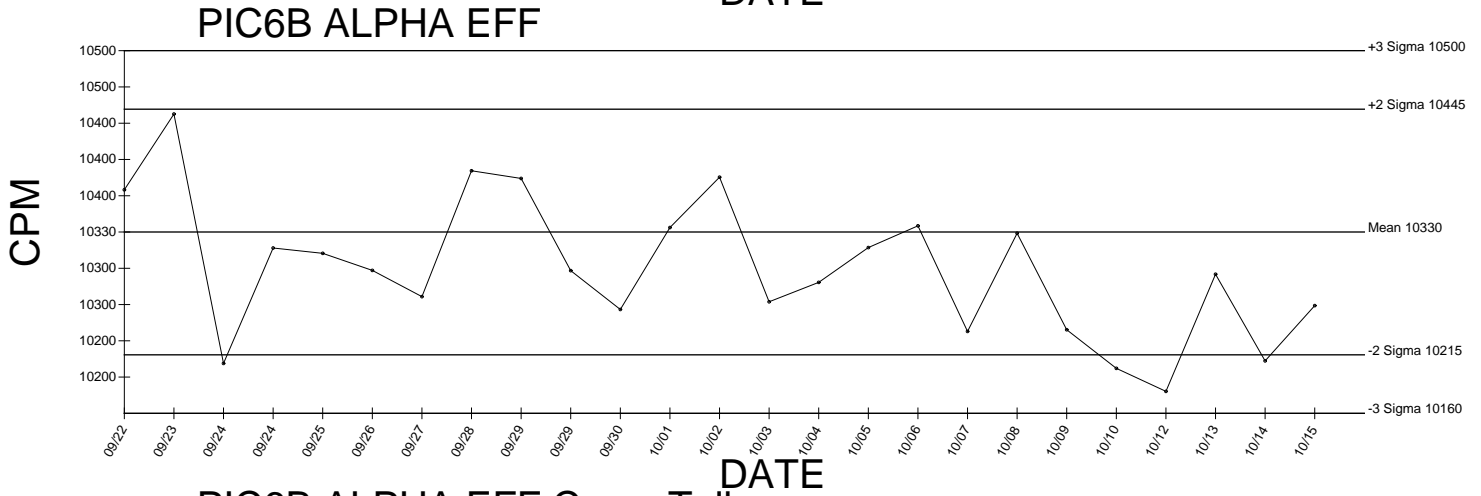
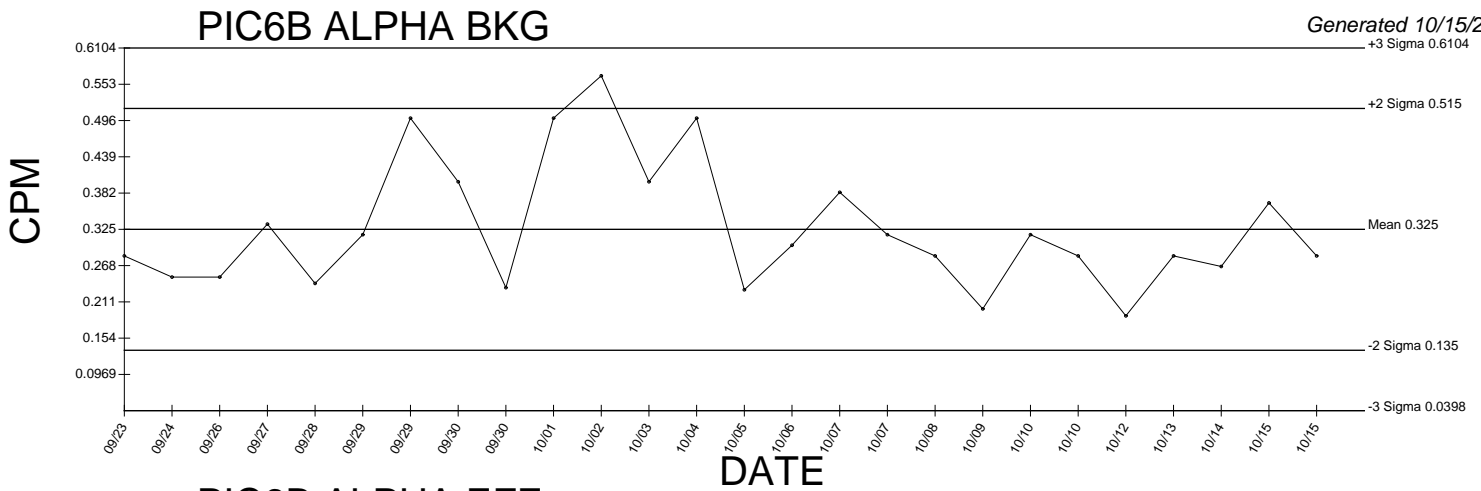
Generated 10/15/2009



# PIC6A BETA EFF Cross Talk



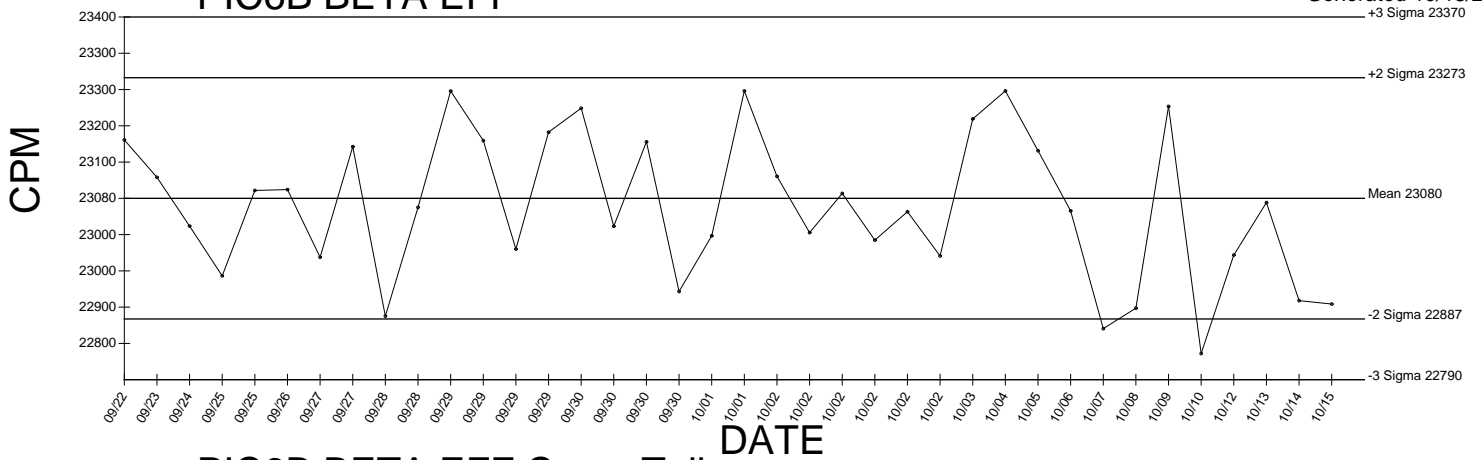
● Denotes Outlier



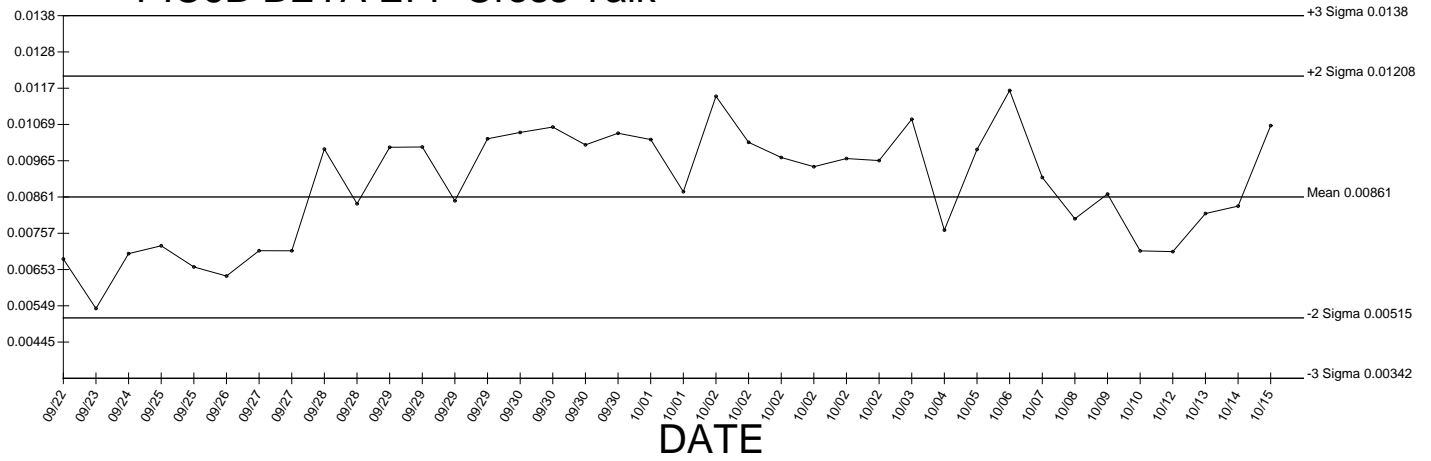
● Denotes Outlier

# PIC6B BETA EFF

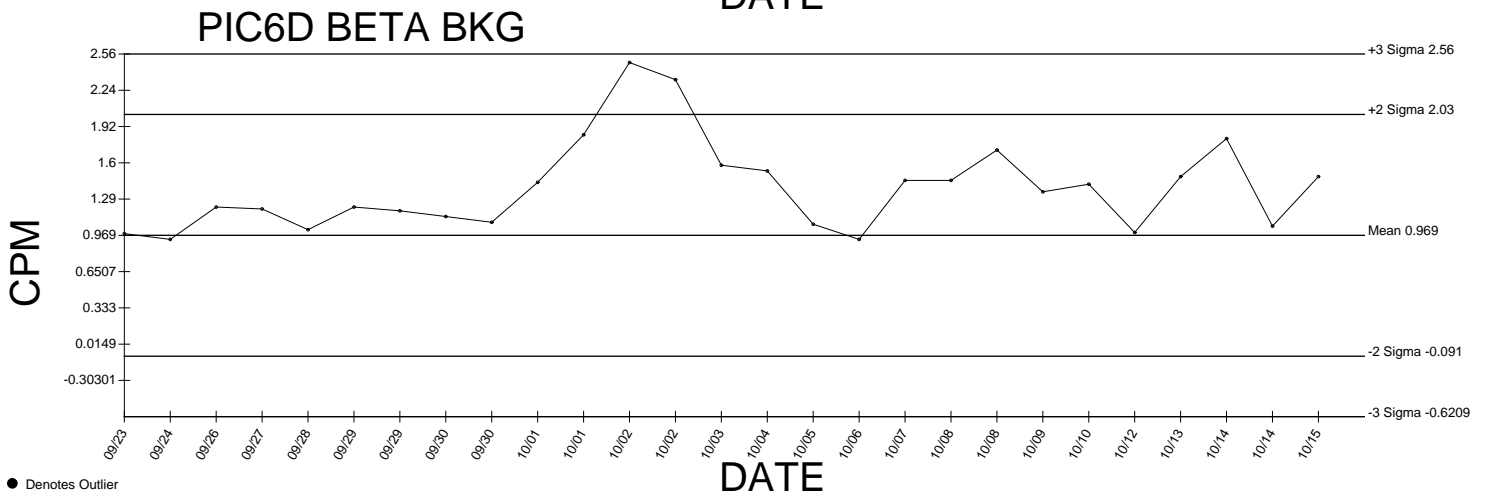
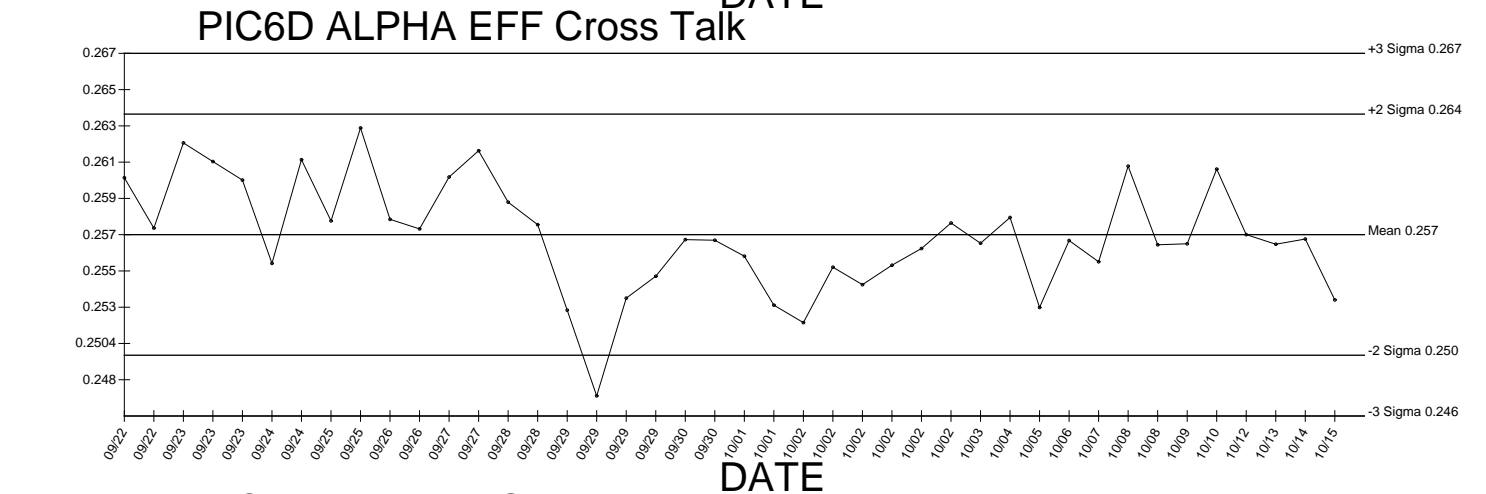
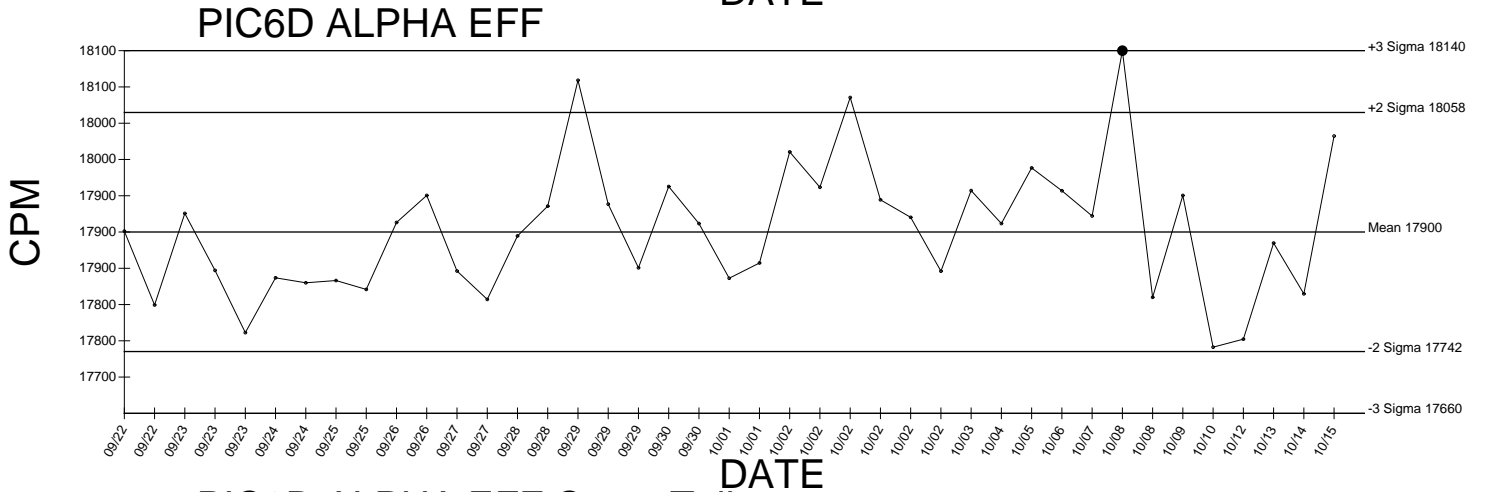
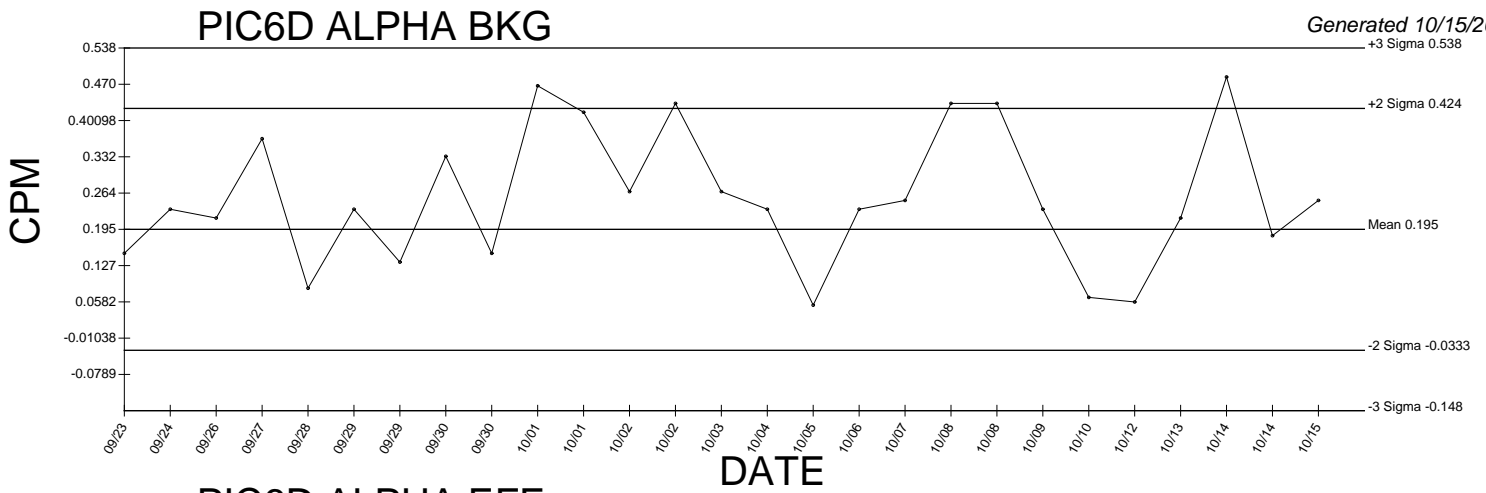
Generated 10/15/2009



# PIC6B BETA EFF Cross Talk



● Denotes Outlier

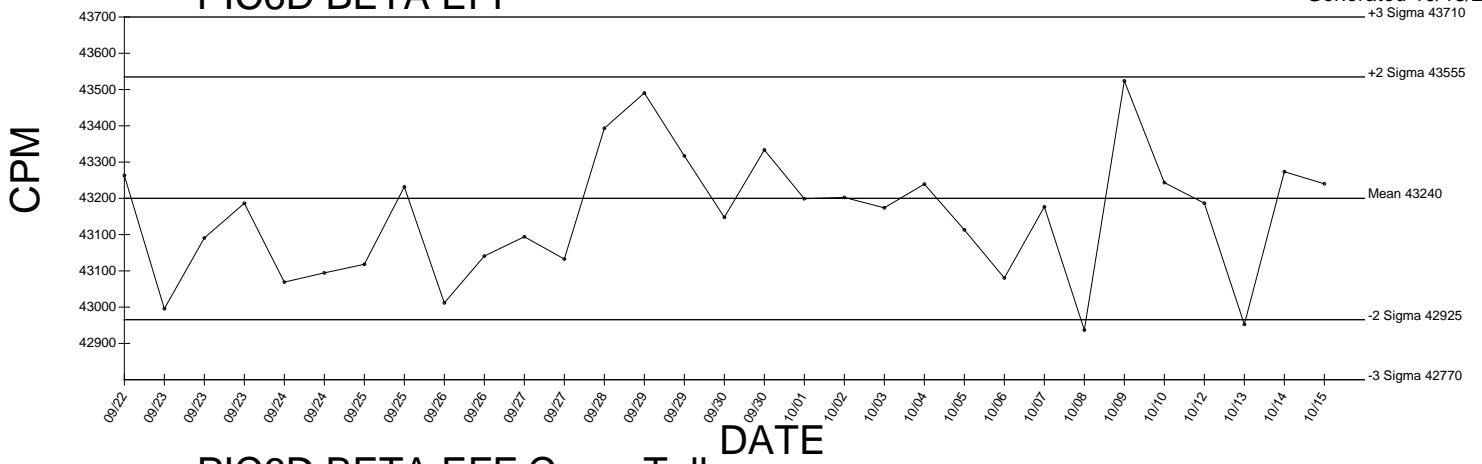


● Denotes Outlier

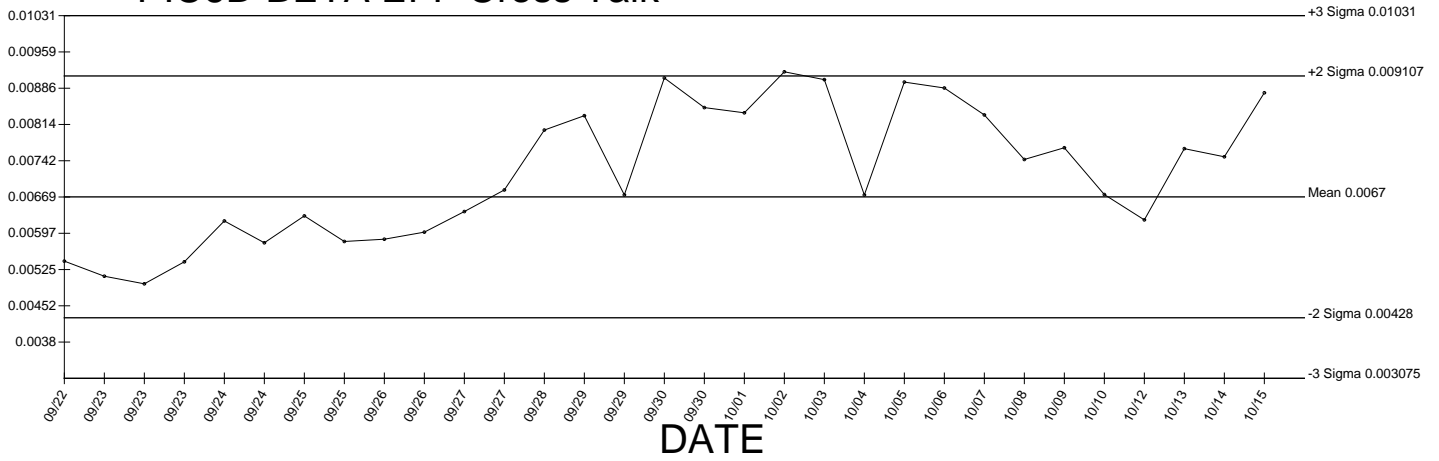


# PIC6D BETA EFF

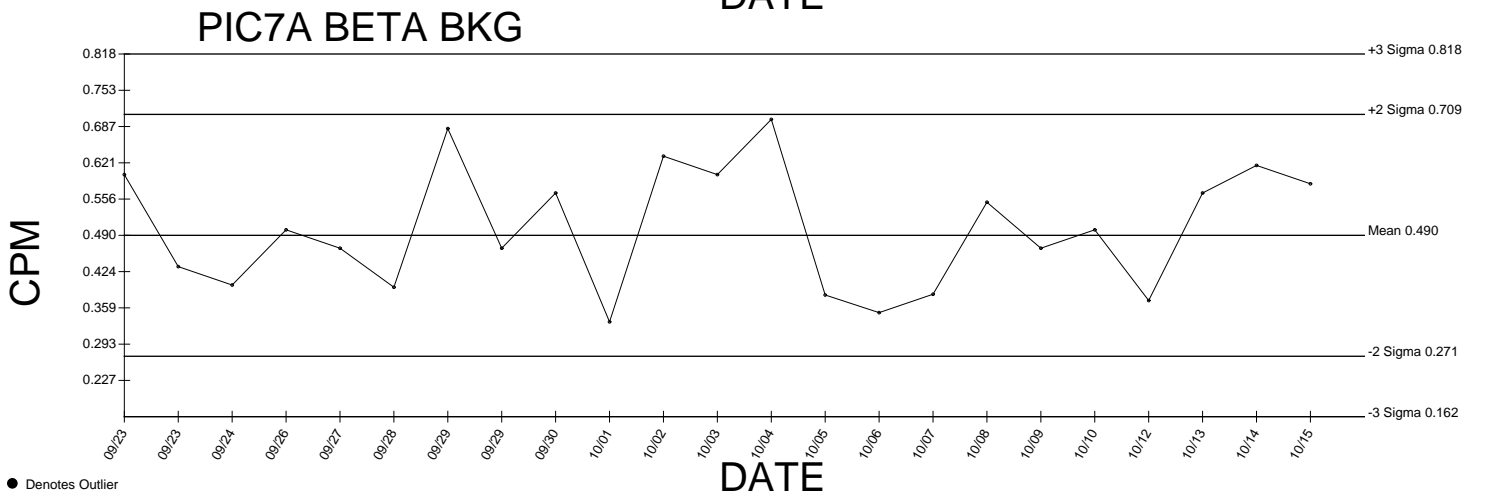
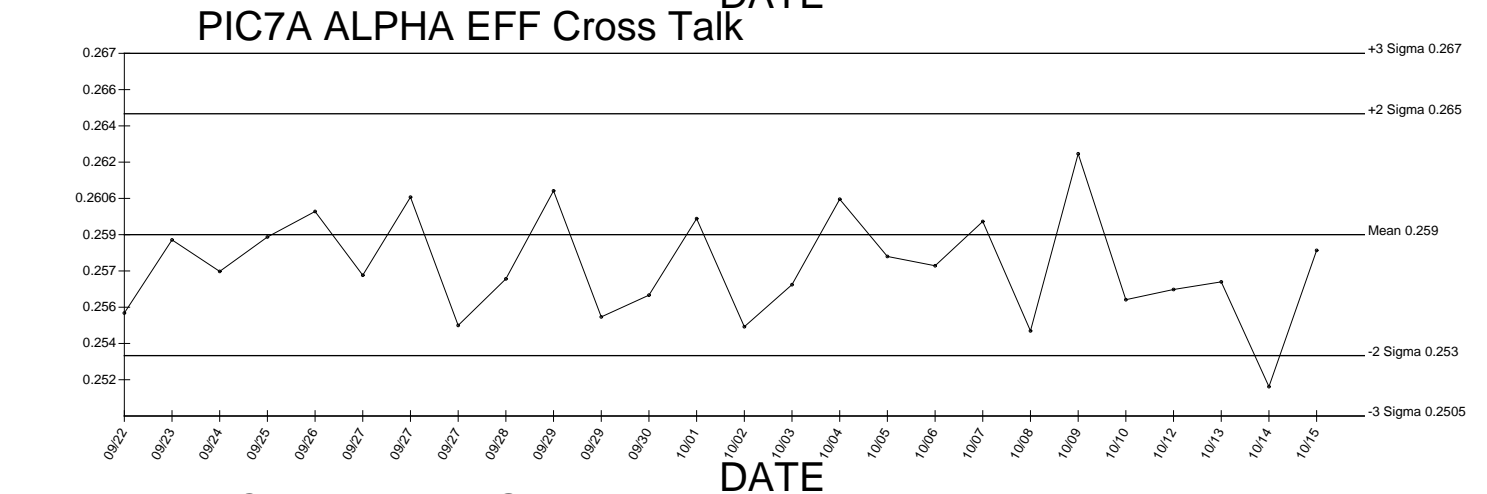
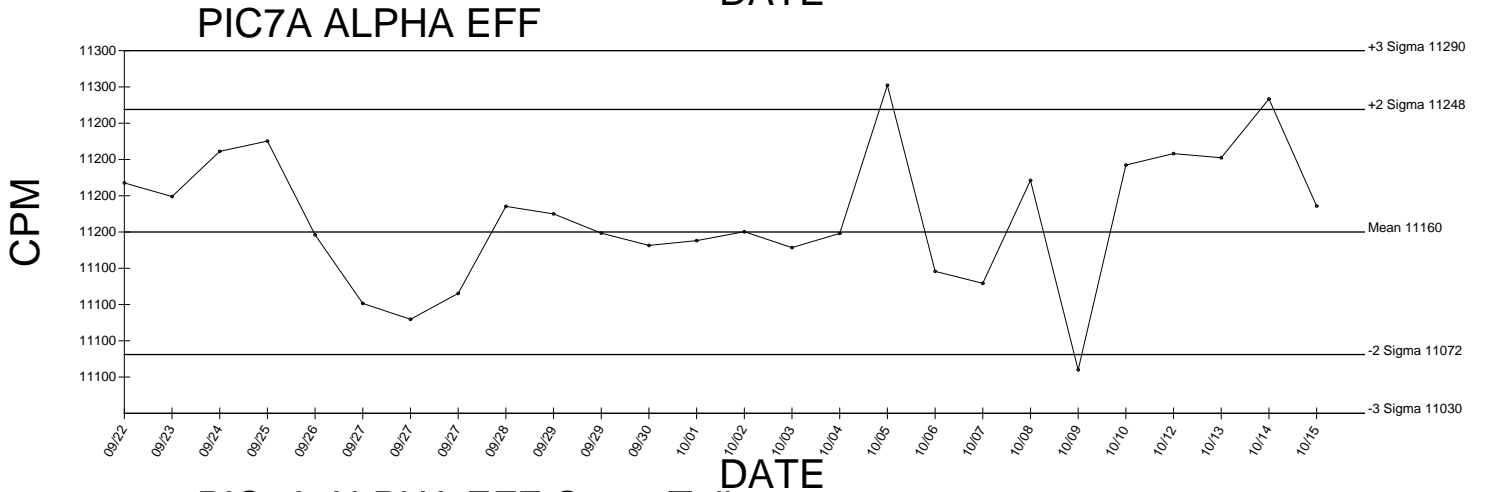
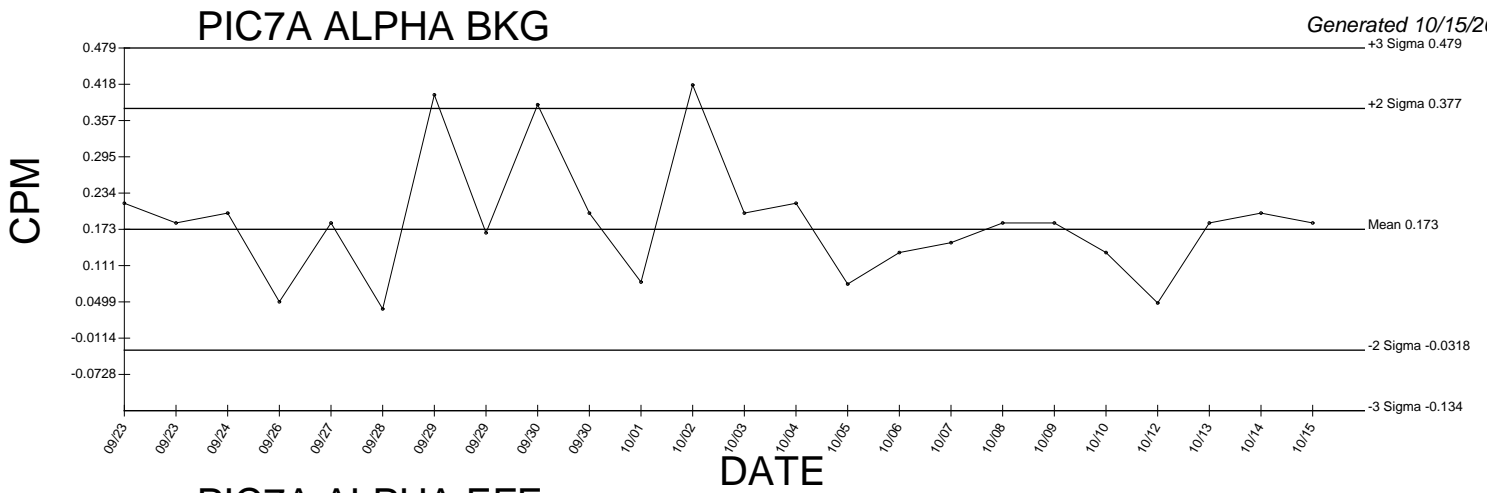
Generated 10/15/2009



# PIC6D BETA EFF Cross Talk



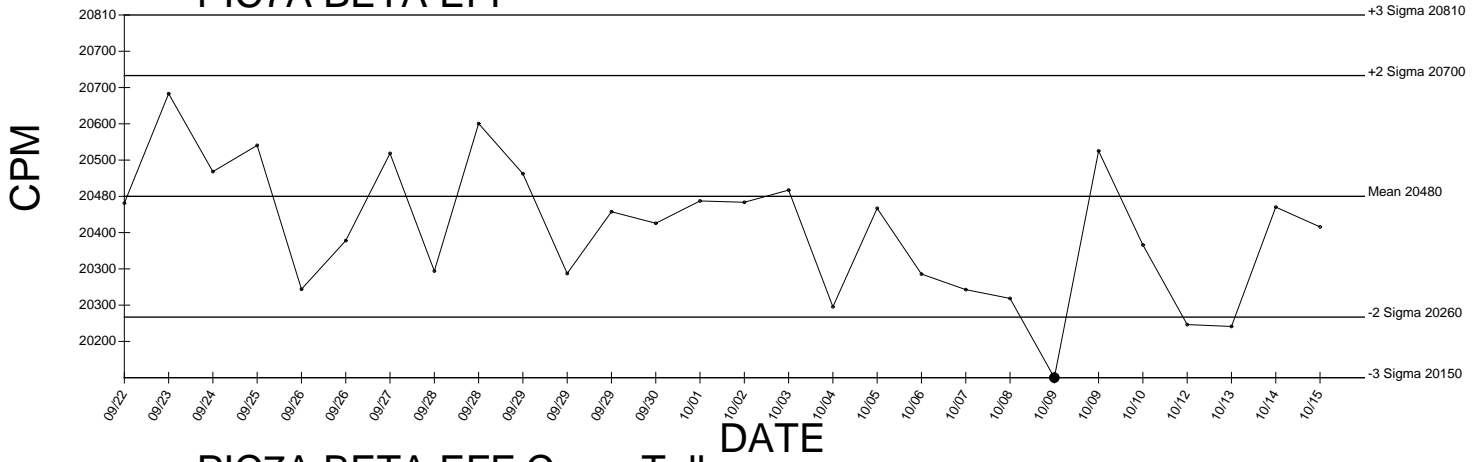
● Denotes Outlier



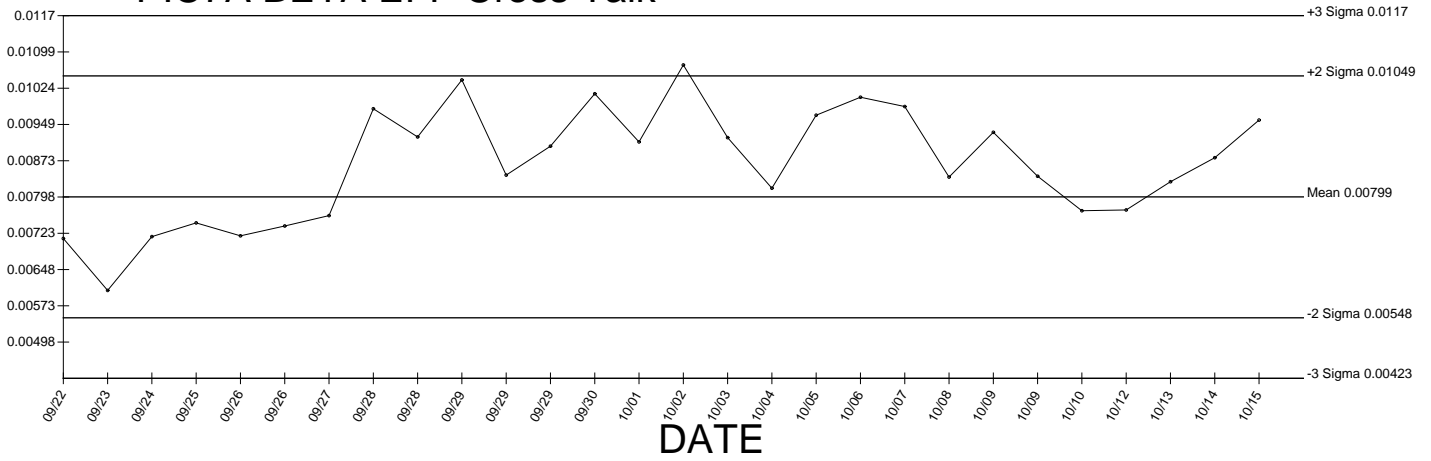
● Denotes Outlier

# PIC7A BETA EFF

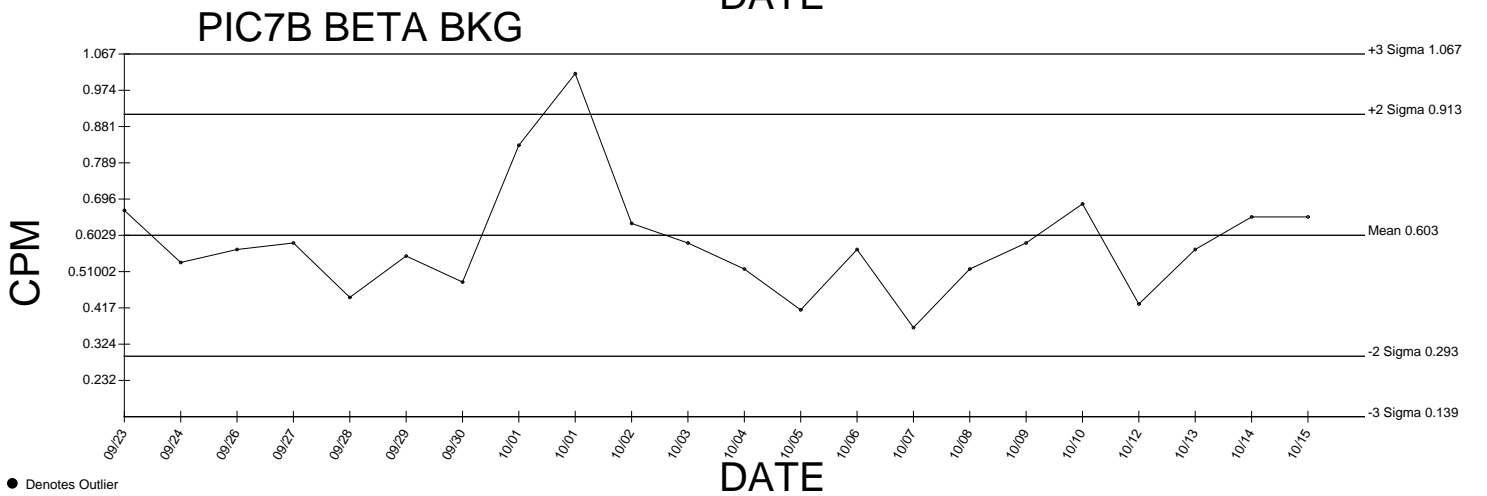
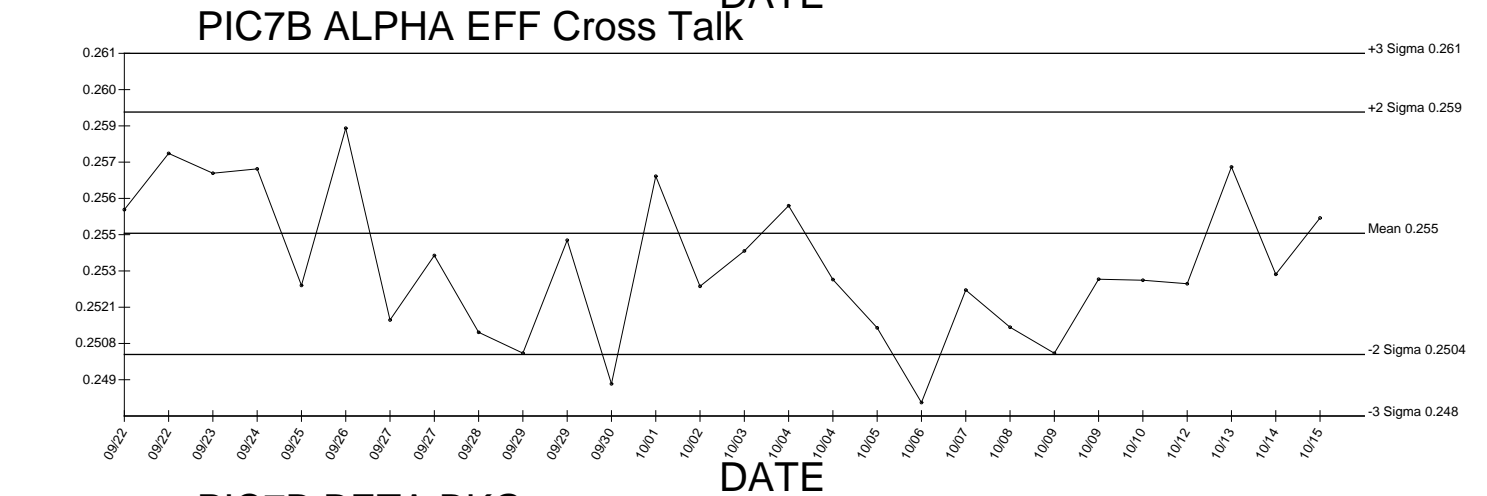
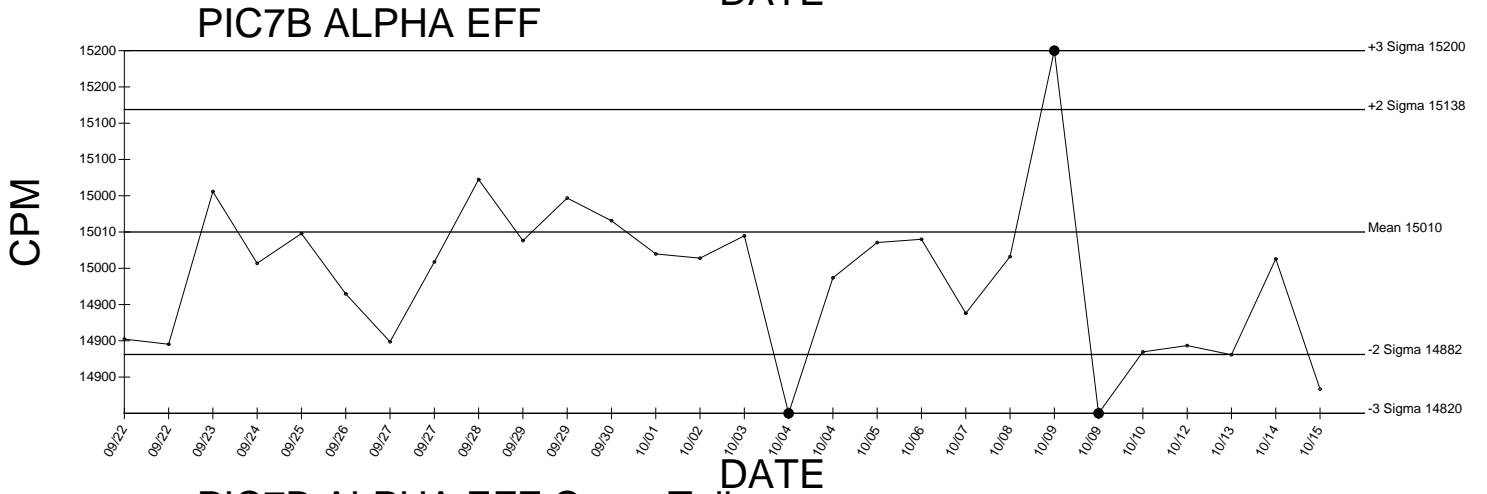
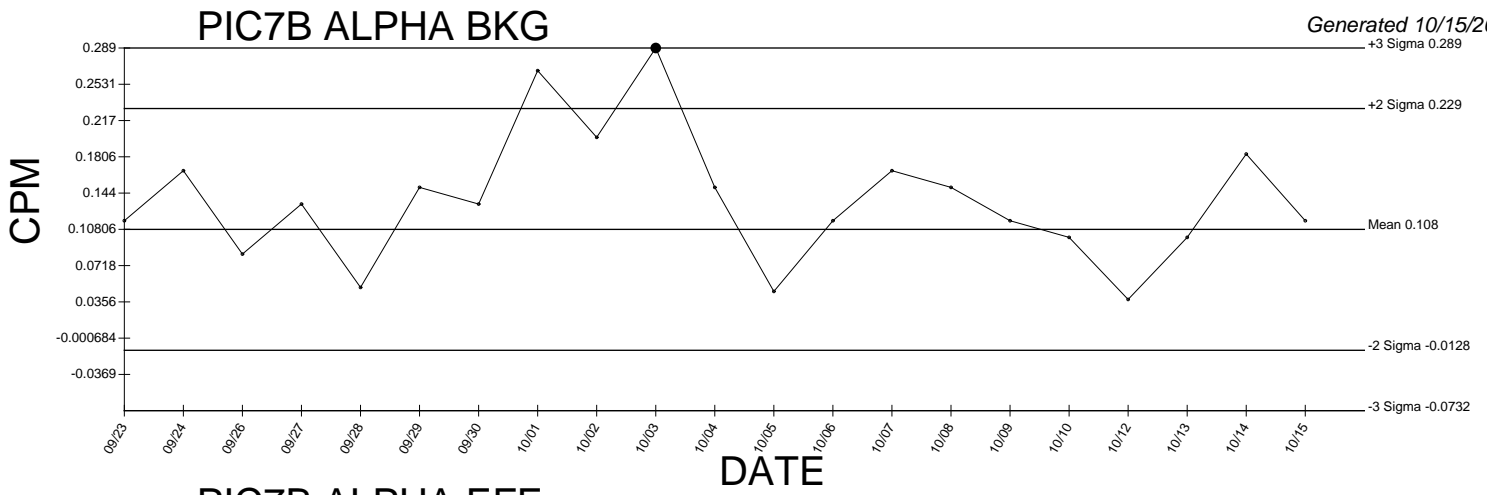
Generated 10/15/2009



# PIC7A BETA EFF Cross Talk



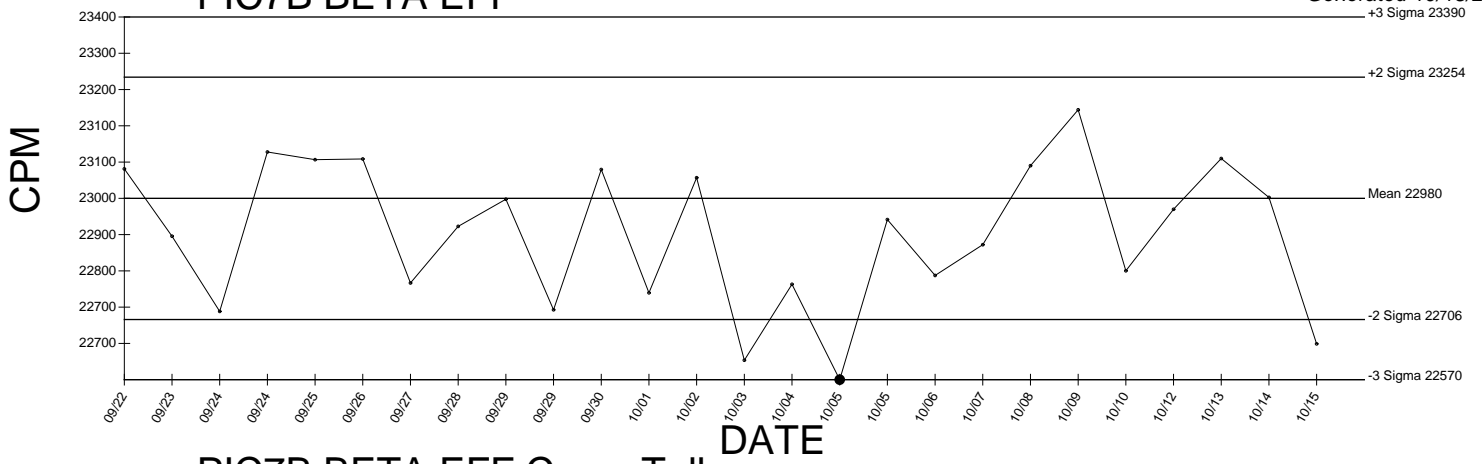
● Denotes Outlier



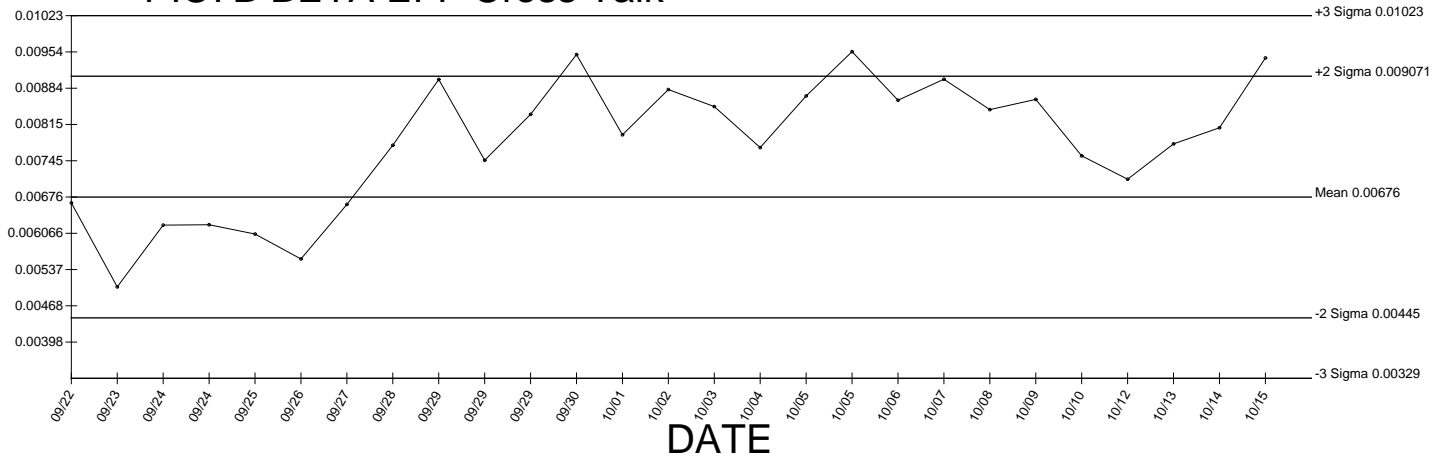
● Denotes Outlier

# PIC7B BETA EFF

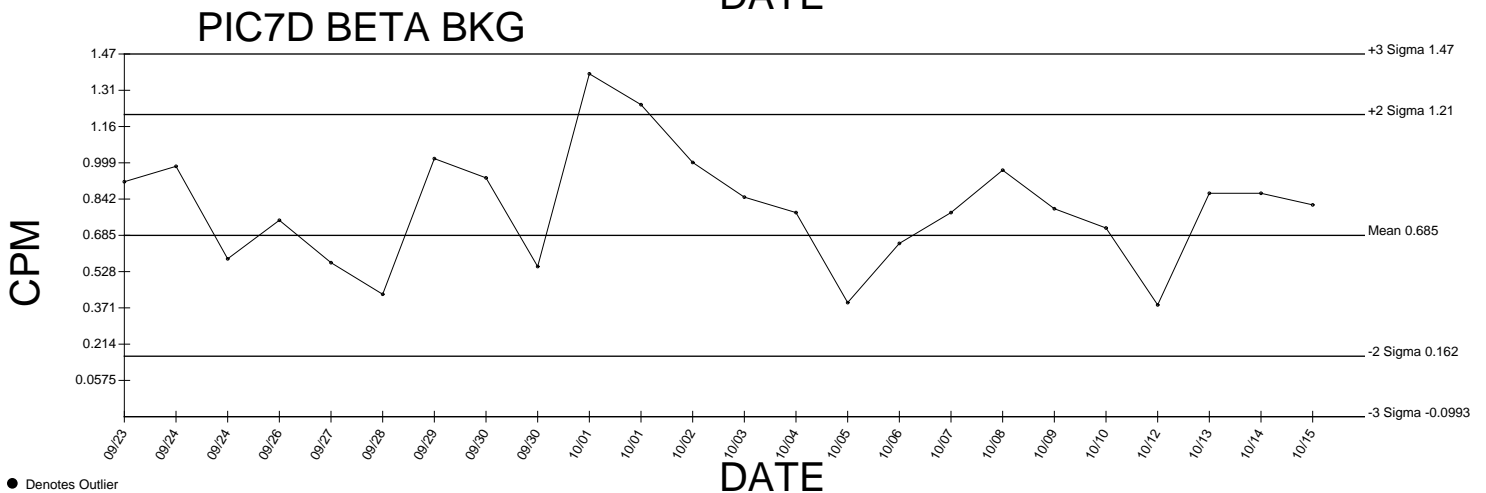
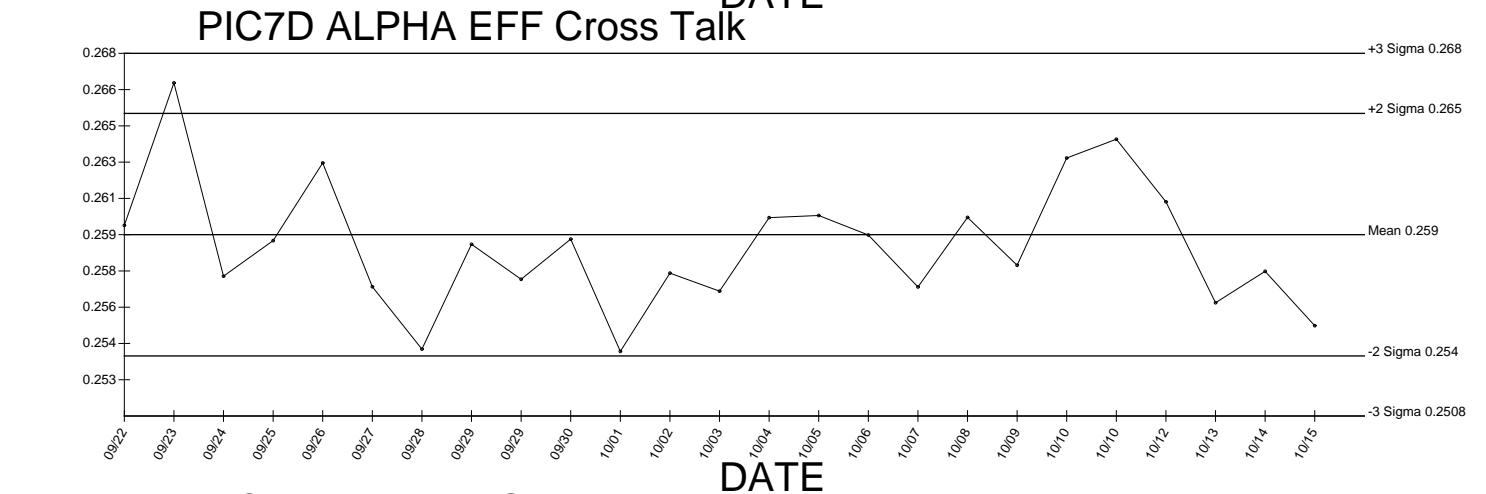
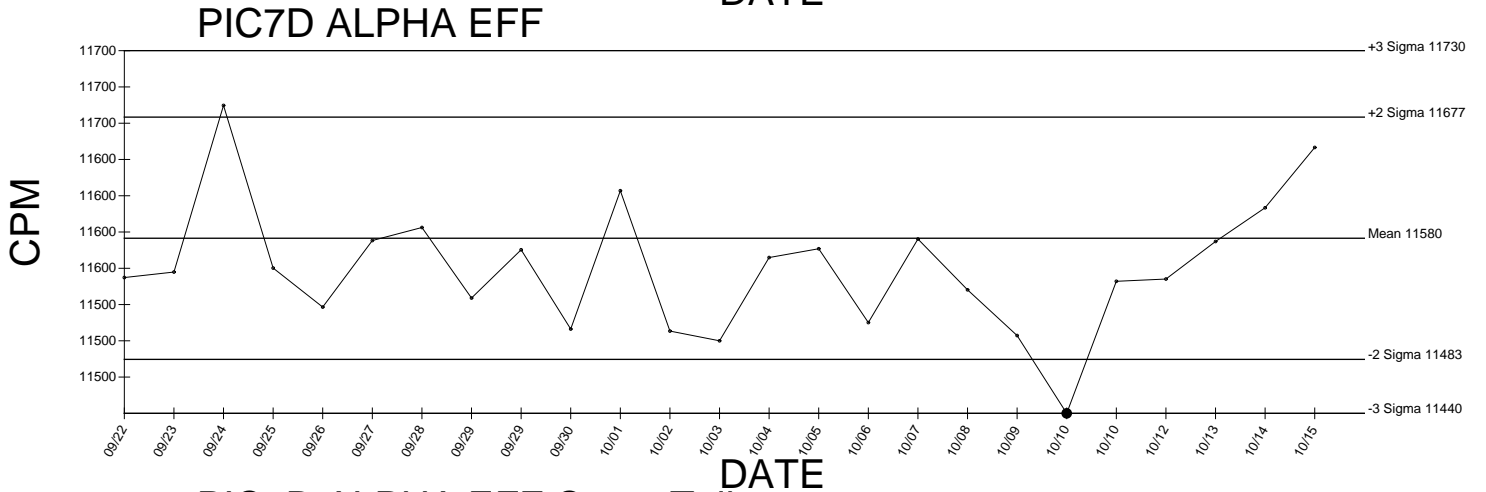
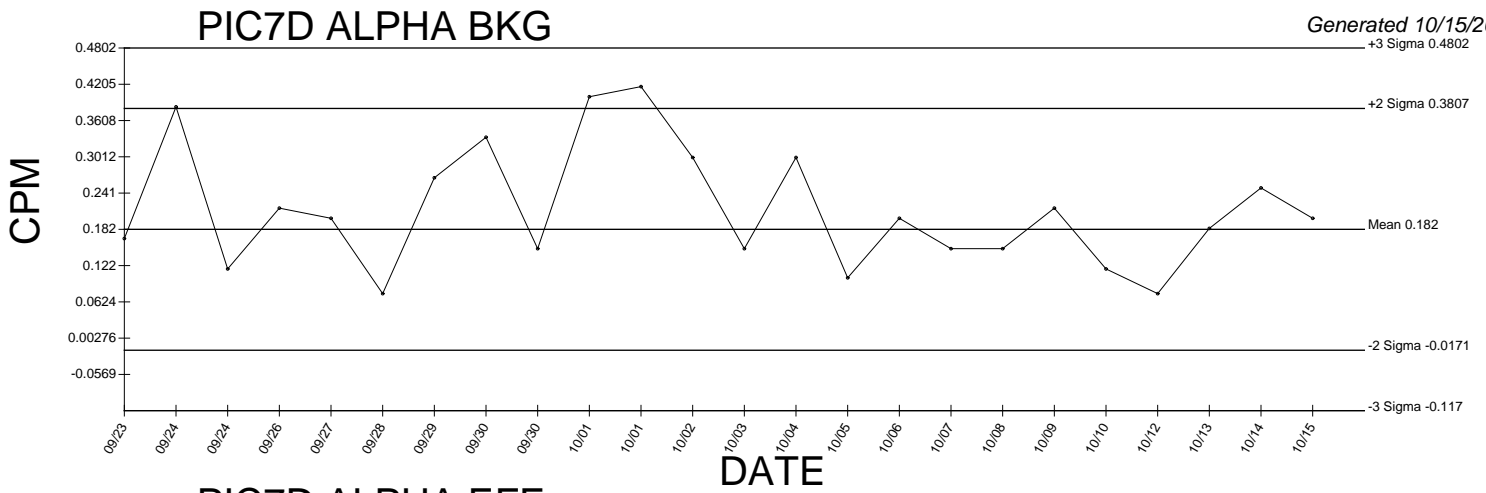
Generated 10/15/2009



# PIC7B BETA EFF Cross Talk



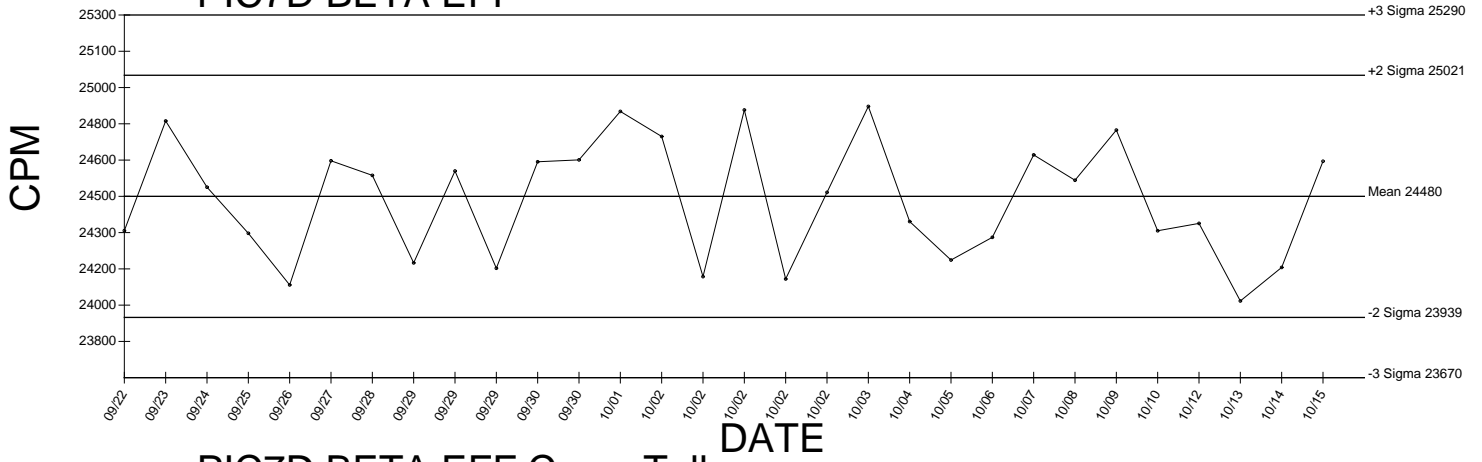
● Denotes Outlier



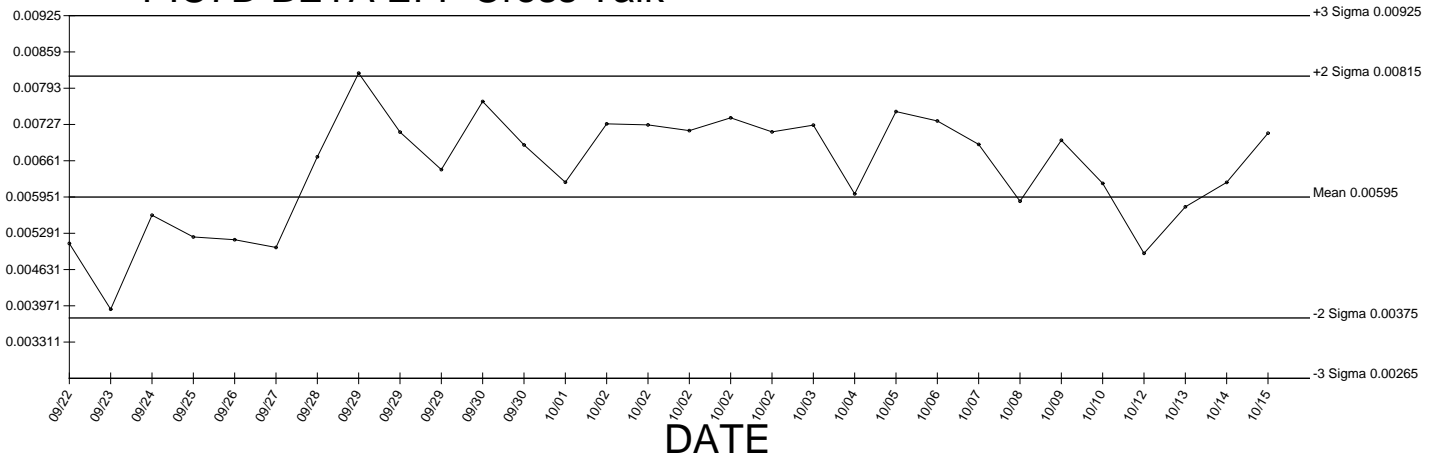
● Denotes Outlier

# PIC7D BETA EFF

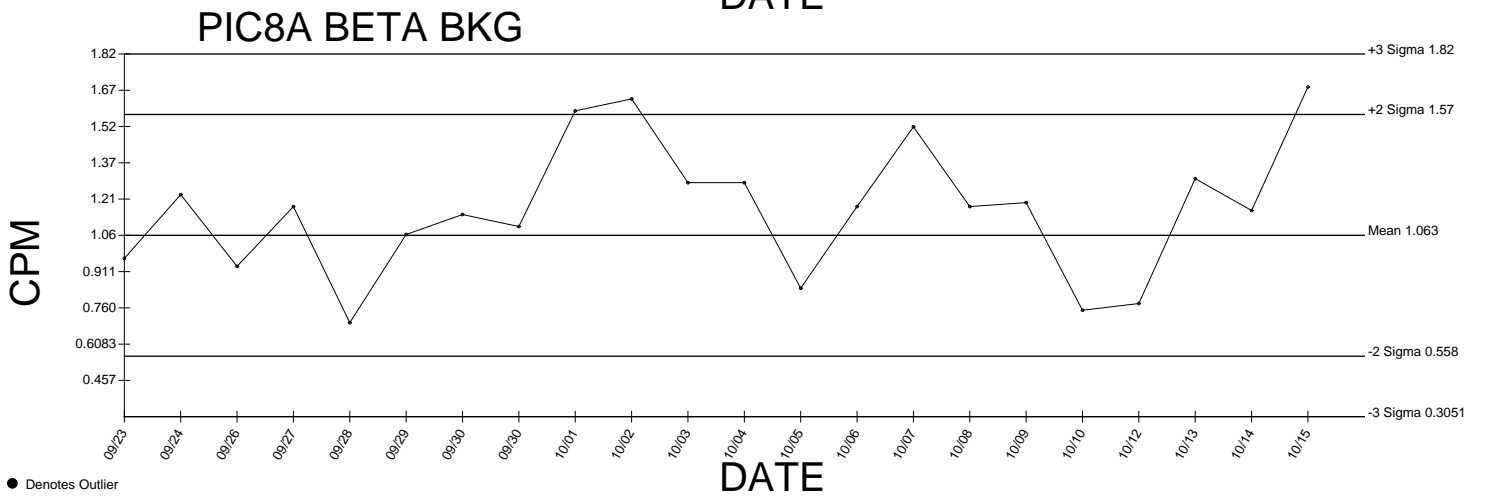
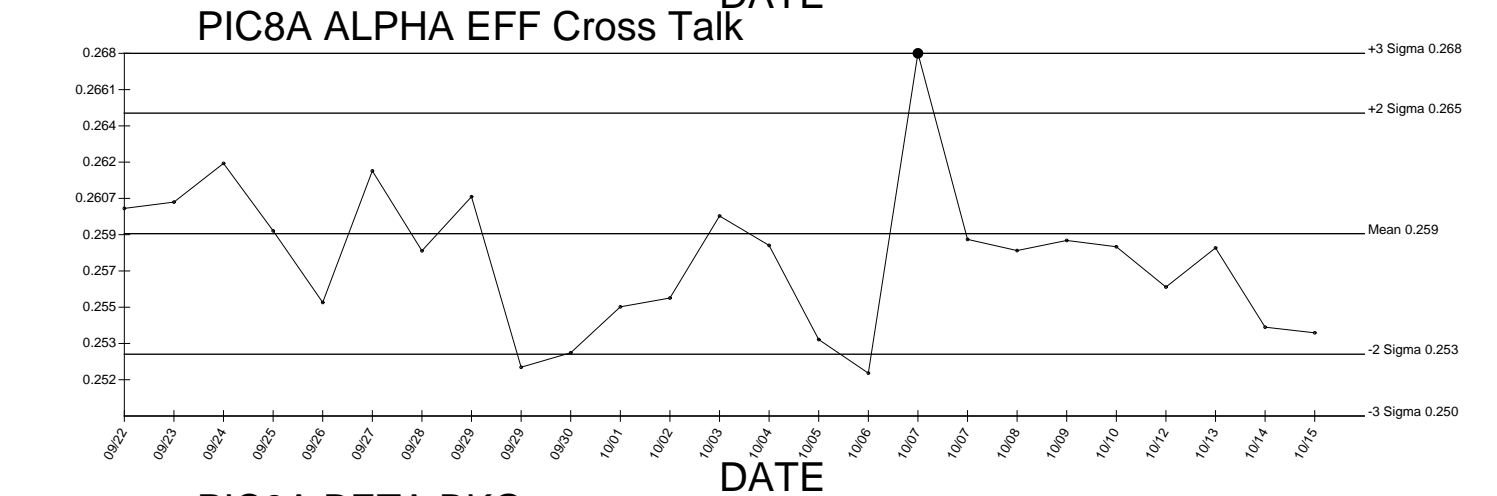
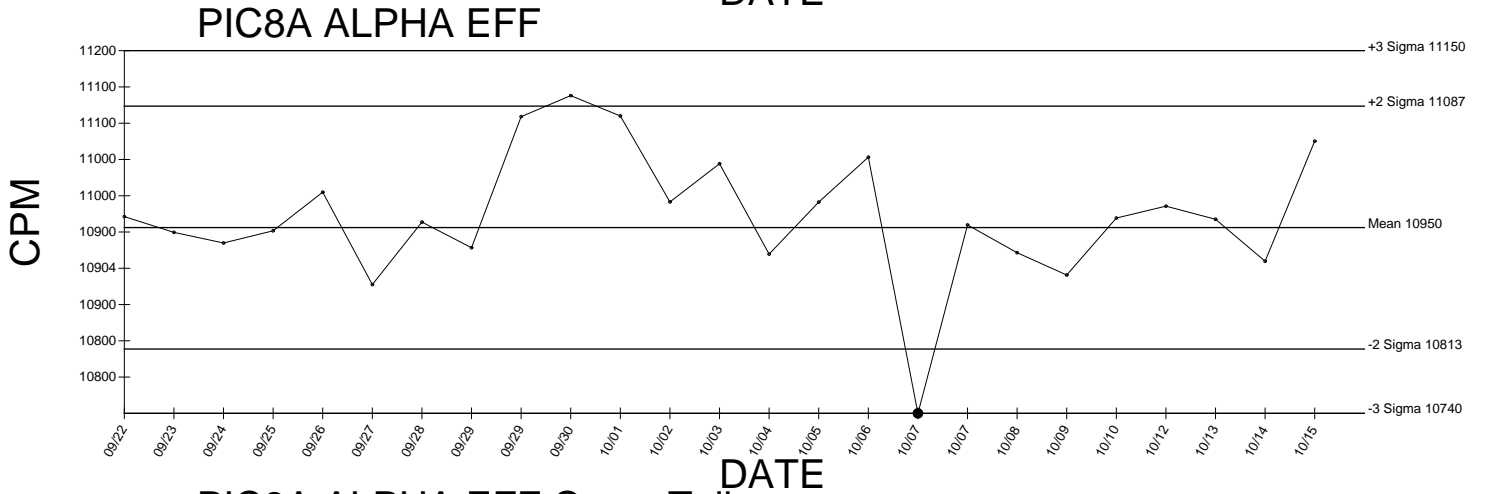
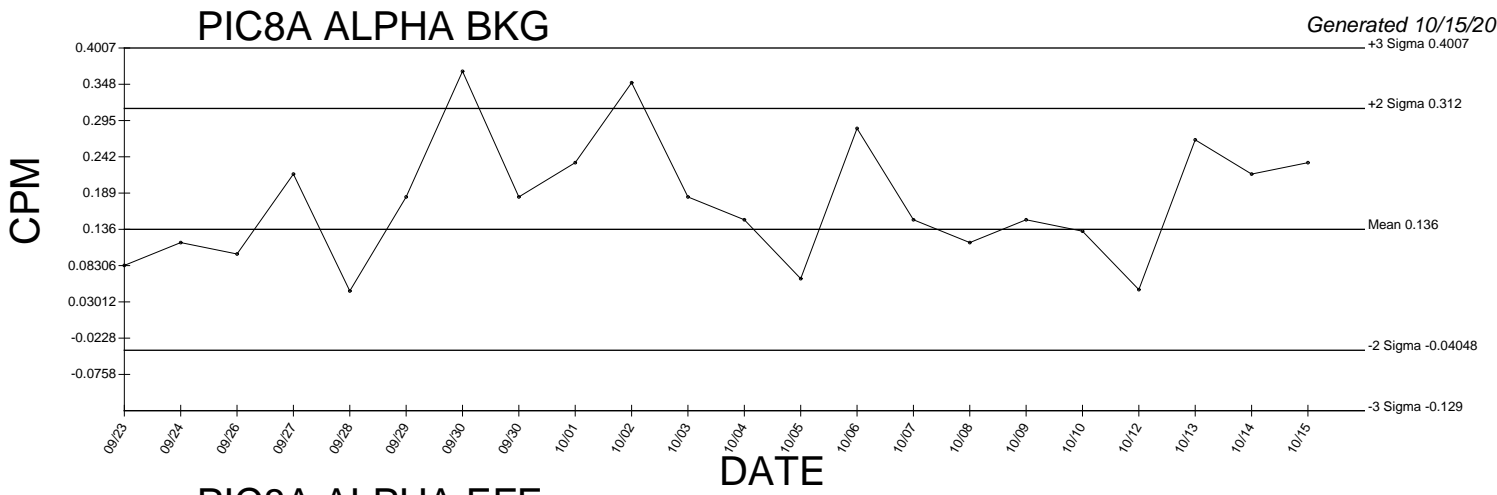
Generated 10/15/2009



# PIC7D BETA EFF Cross Talk



● Denotes Outlier

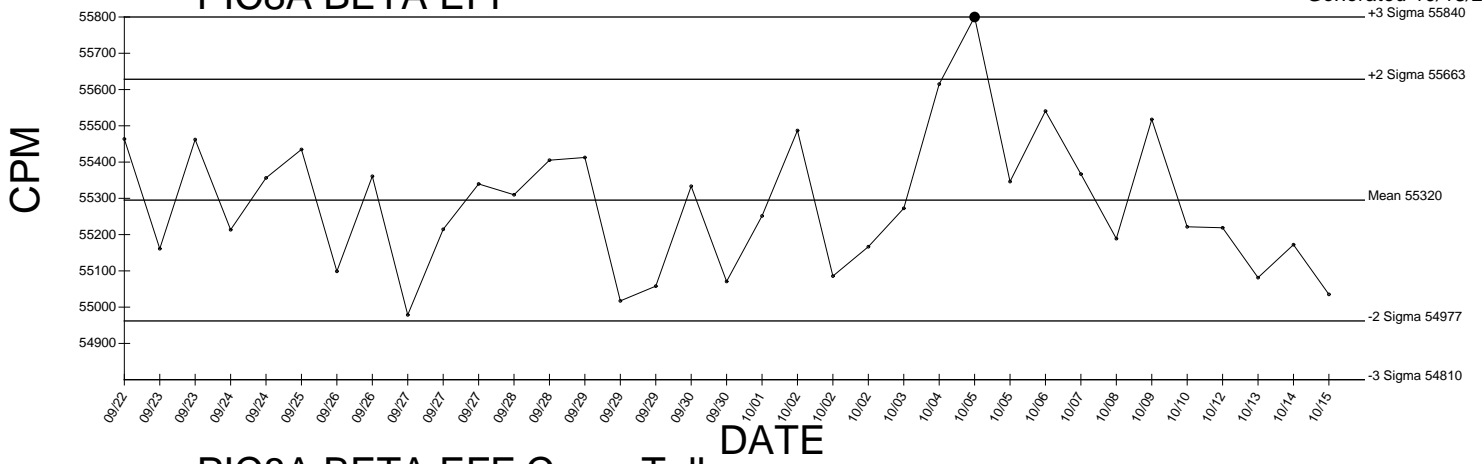


● Denotes Outlier

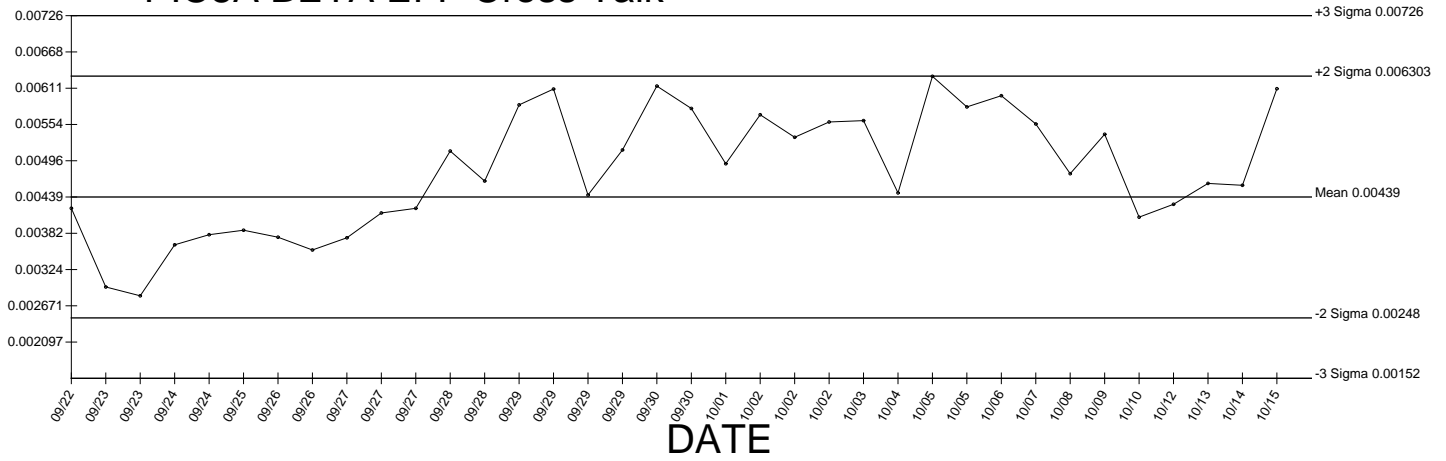


# PIC8A BETA EFF

Generated 10/15/2009

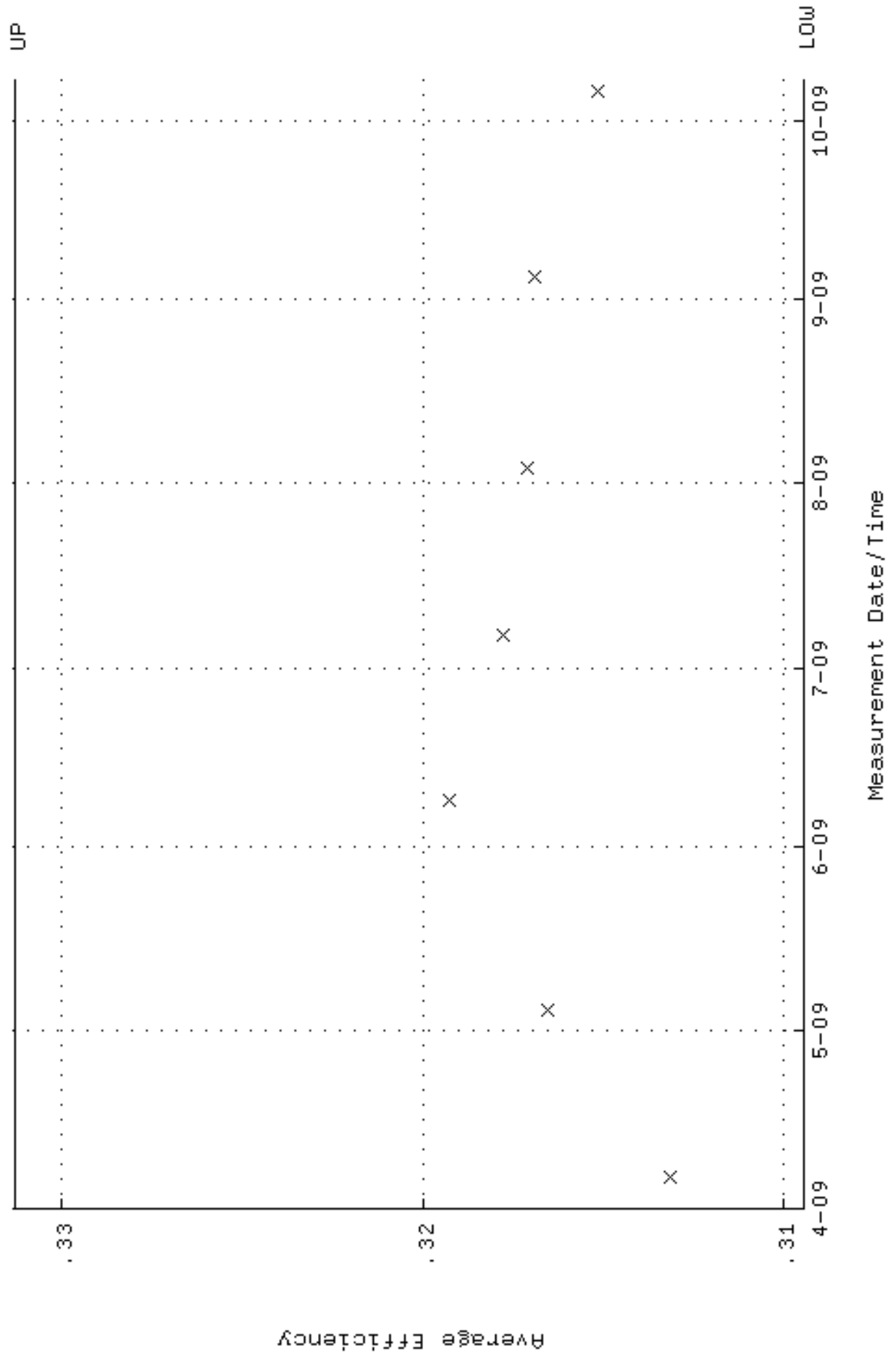


# PIC8A BETA EFF Cross Talk

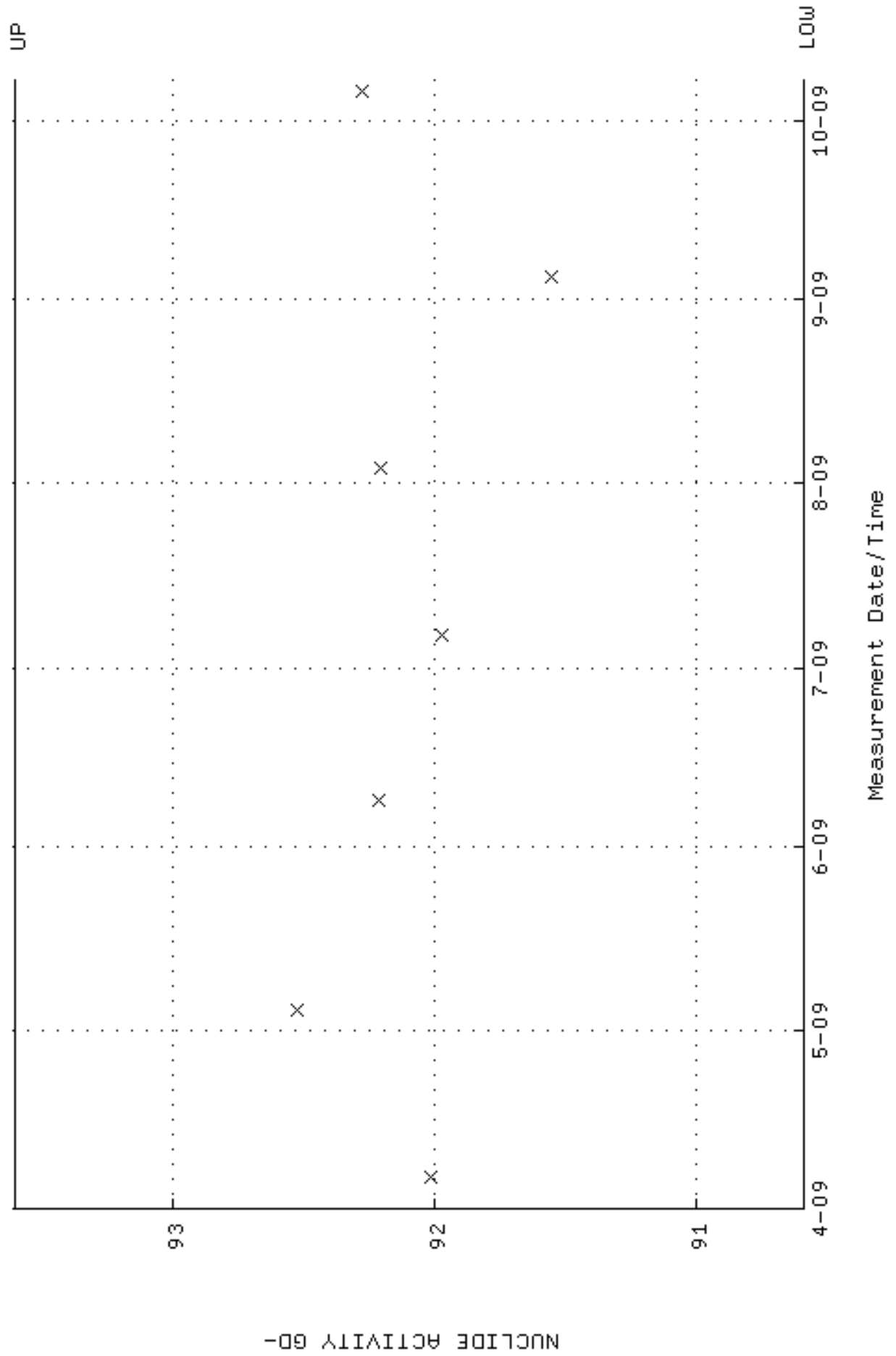


● Denotes Outlier

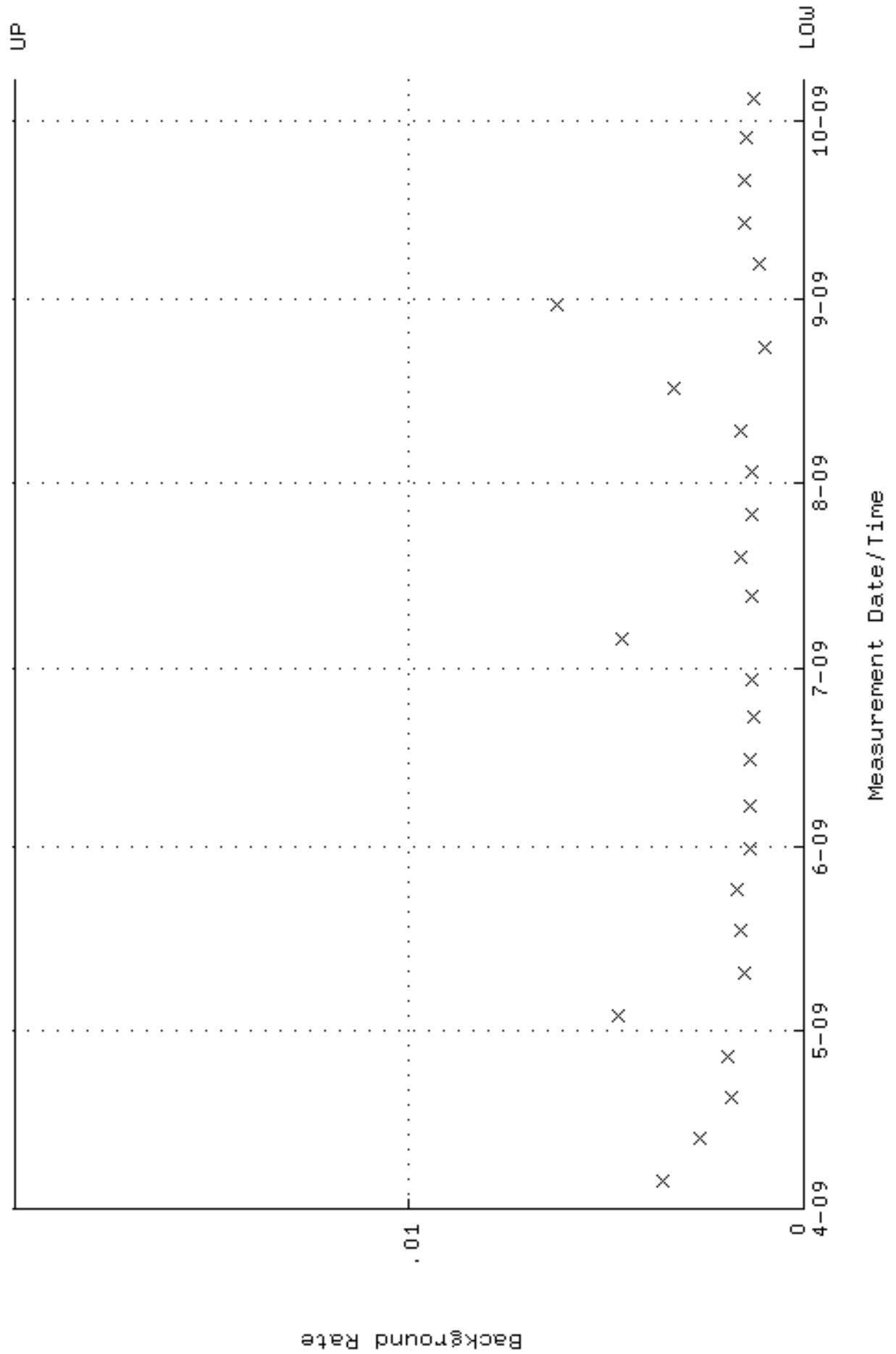
QA filename : DKA100:[ENV\_ALPHA.QA.W]W022.QAF;5  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 6-APR-2009 08:44:03 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.309441 through 0.331295



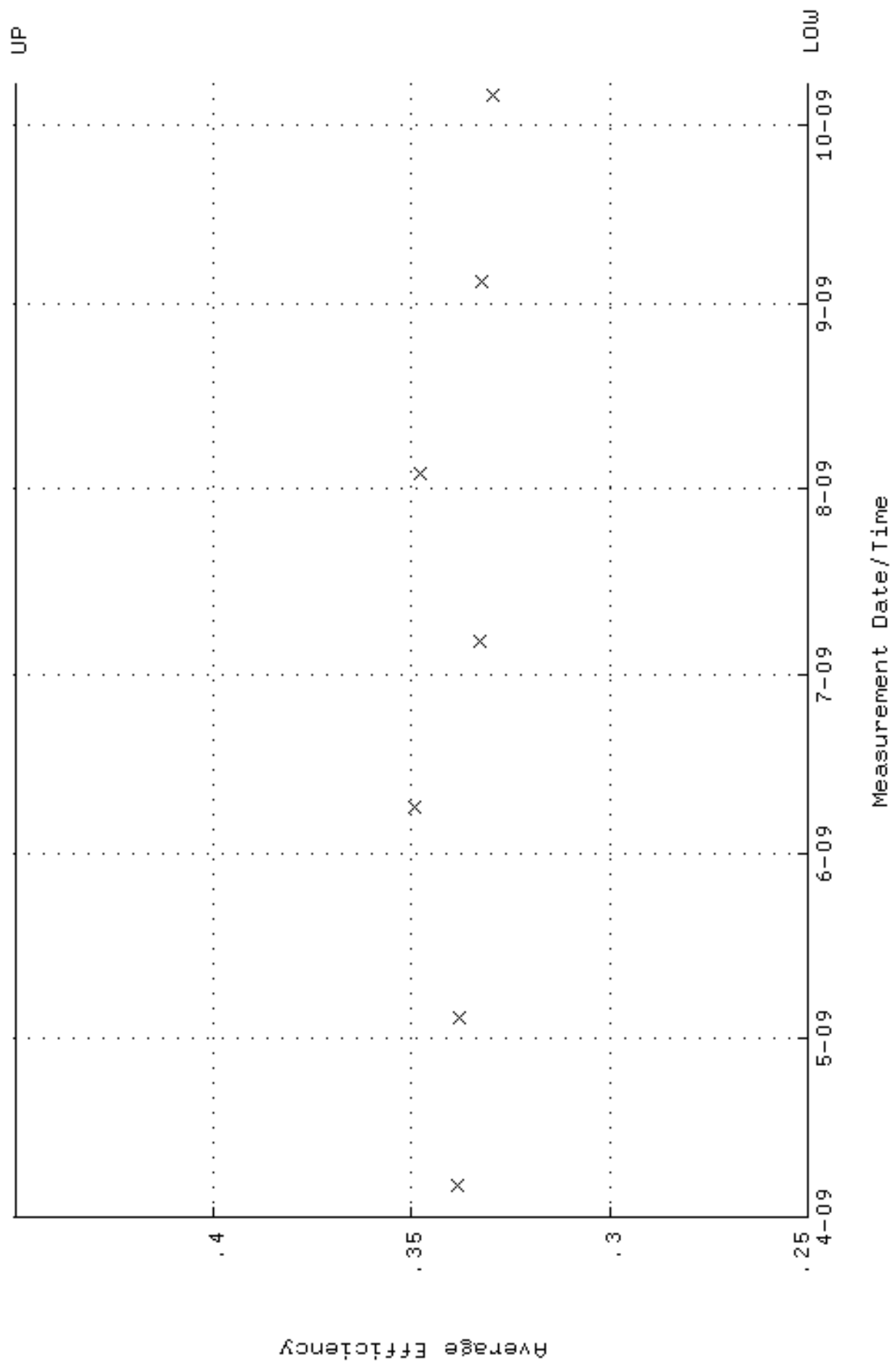
QA filename : DKA100:[ENV\_ALPHA.QA.W]W022.QAF;5  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 6-APR-2009 08:44:03 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 90.5909 through 93.6045



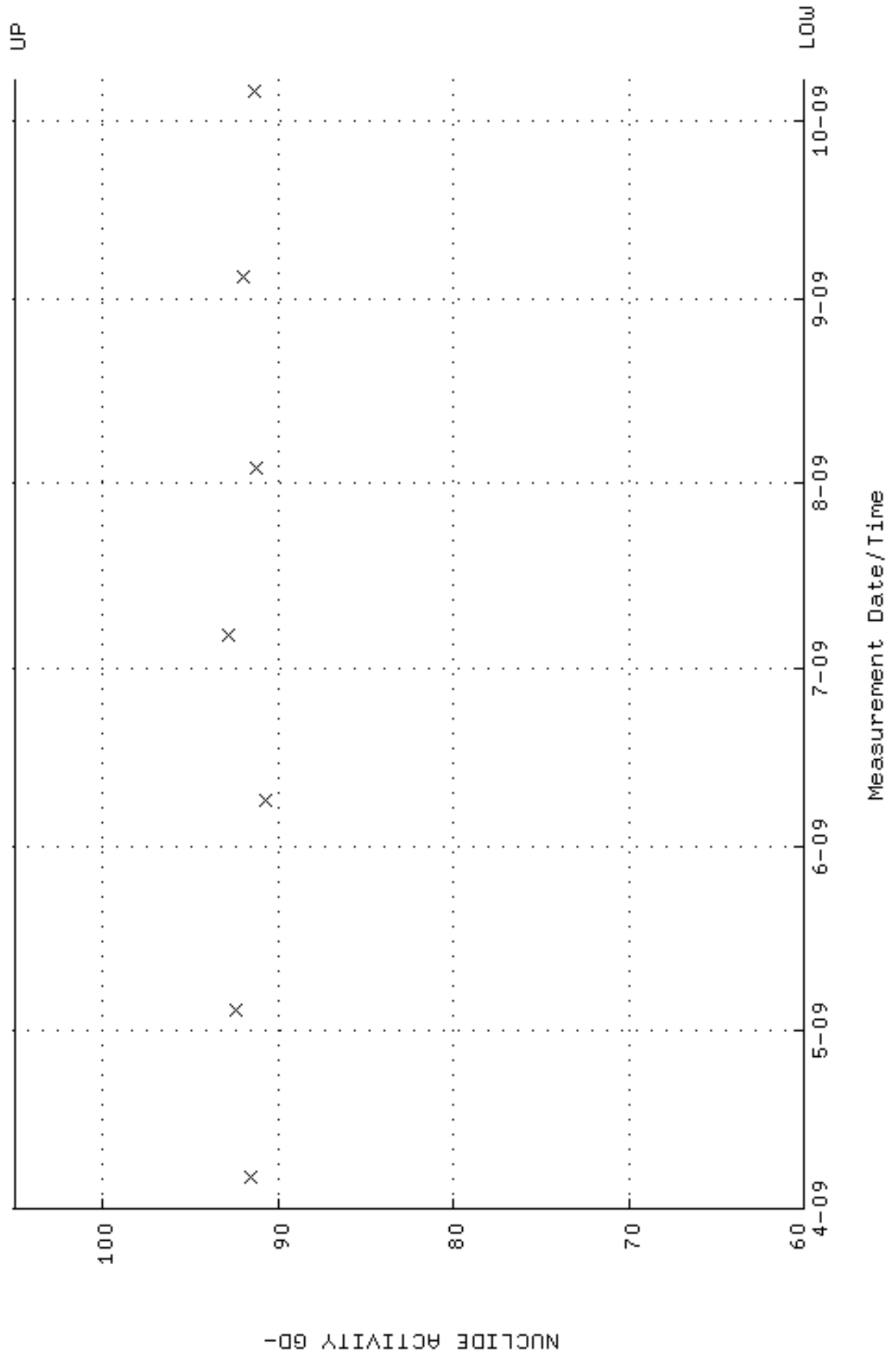
QA filename : DKA100:[ENV\_ALPHA.QA.B]B022.QAF;2  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:33:10 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



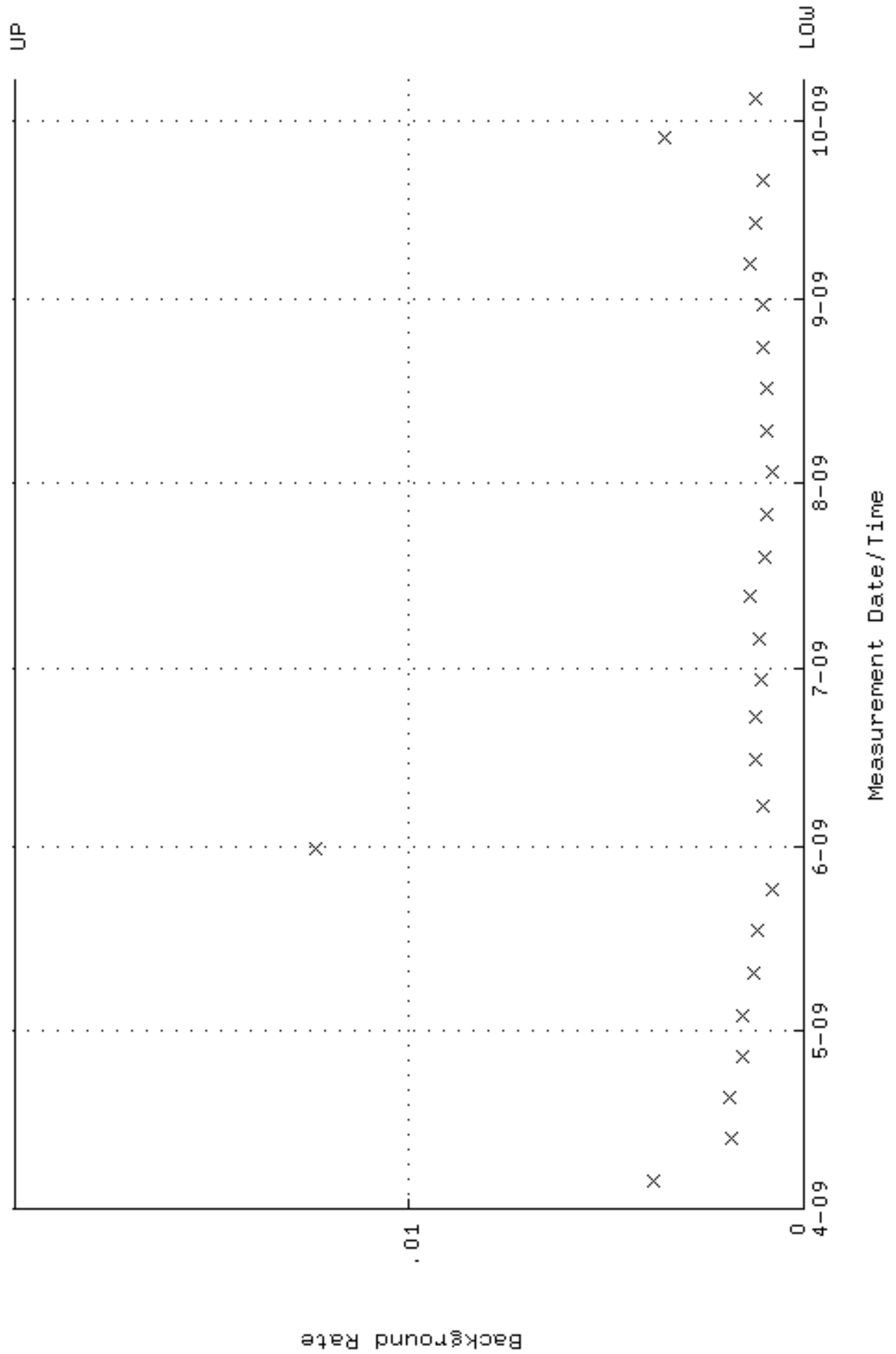
QA filename : DKA100:[ENV\_ALPHA.QA.W]W023.QAF;3  
 Parameter Name : AVRGEFF (Average Efficiency)  
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 Lower/Upper Lmts: 0.250000 through 0.450000



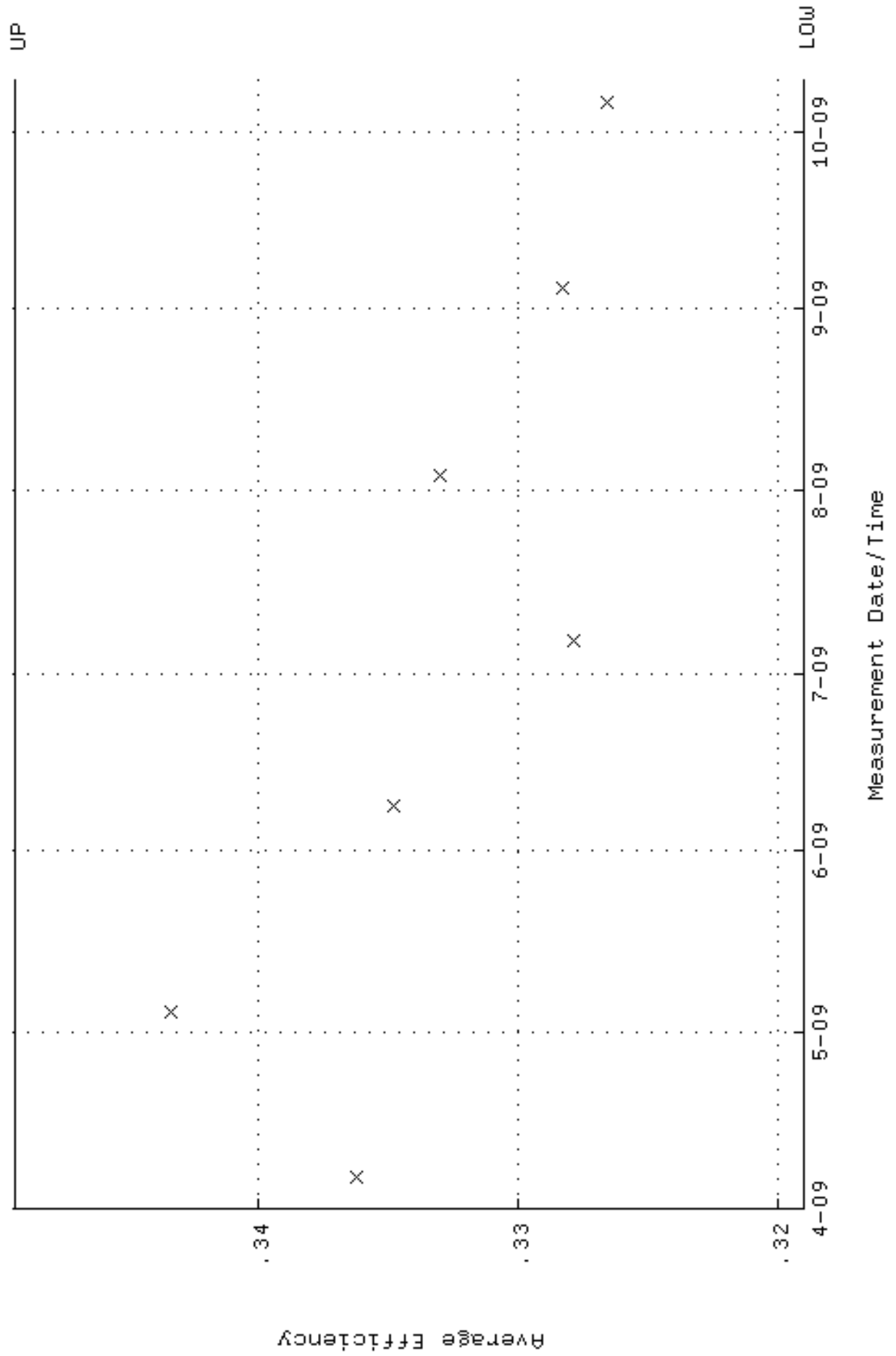
QA filename : DKA100:[ENV\_ALPHA.QA.W]W023.QAF;3  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 6-APR-2009 08:44:03 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 60.0000 through 105.0000



QA filename : DKA100:[ENV\_ALPHA.QA.B]B023.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:33:10 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02

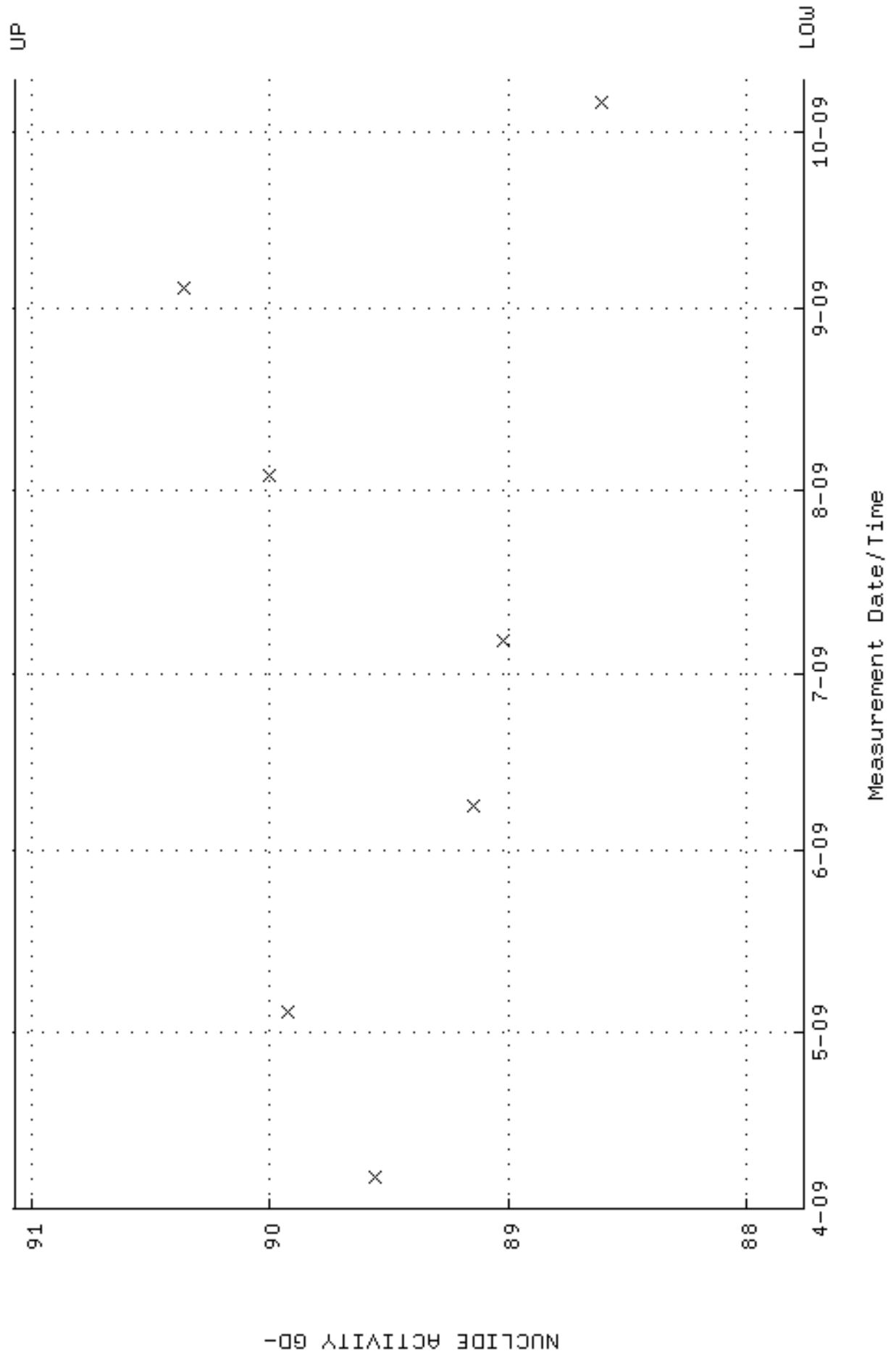


QA filename : DKA100:[ENV\_ALPHA.QA.W]W024.QAF;2  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 6-APR-2009 08:44:03 through 9-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.319004 through 0.349372

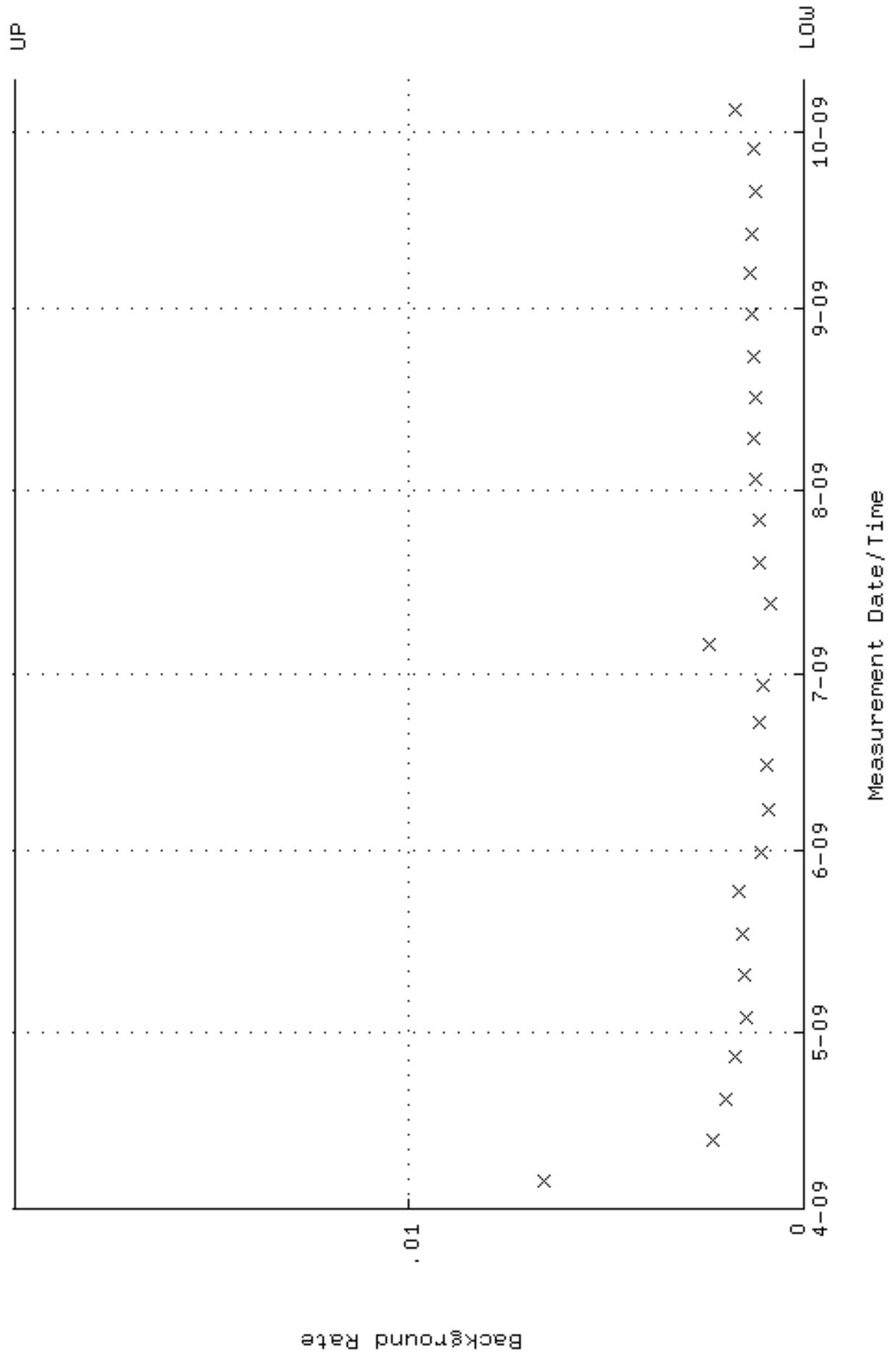




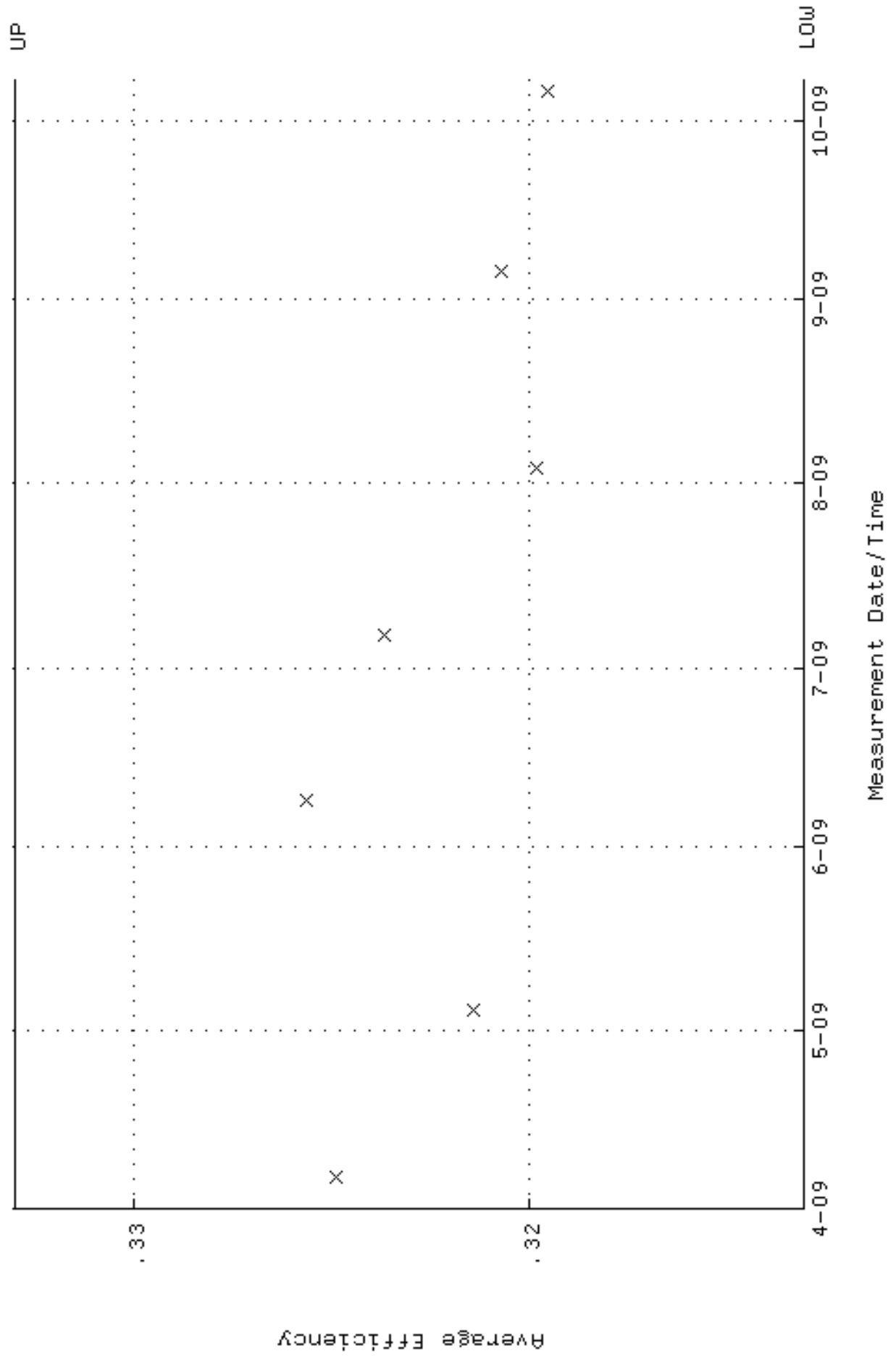
QA filename : DKA100:[ENV\_ALPHA.QA.W]W024.QAF;2  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 6-APR-2009 08:44:03 through 9-OCT-2009 12:00:00  
 Lower/Upper Lmts: 87.7616 through 91.0672



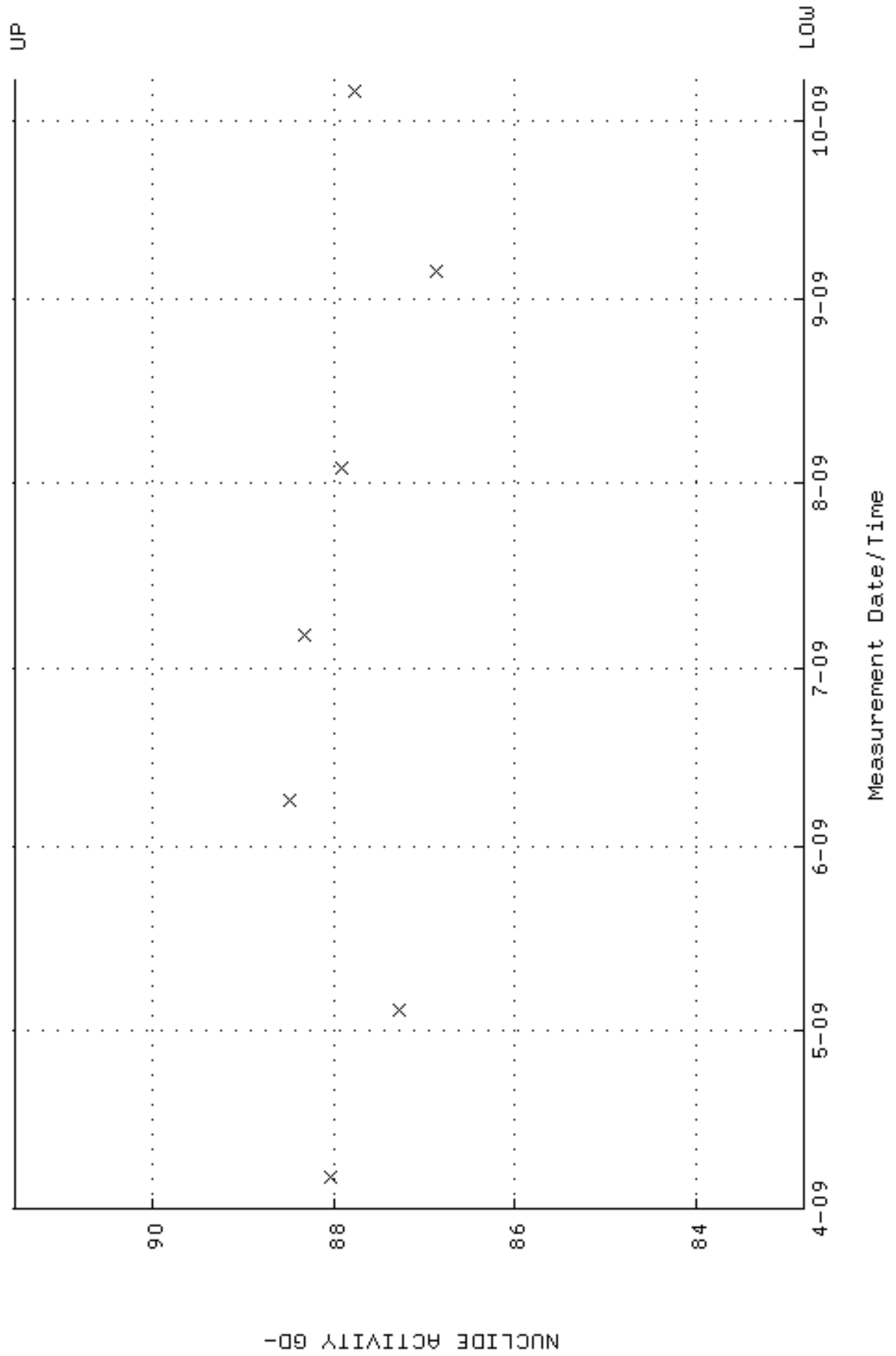
QA filename : DKA100:[ENV\_ALPHA.QA.B]B024.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:33:10 through 9-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



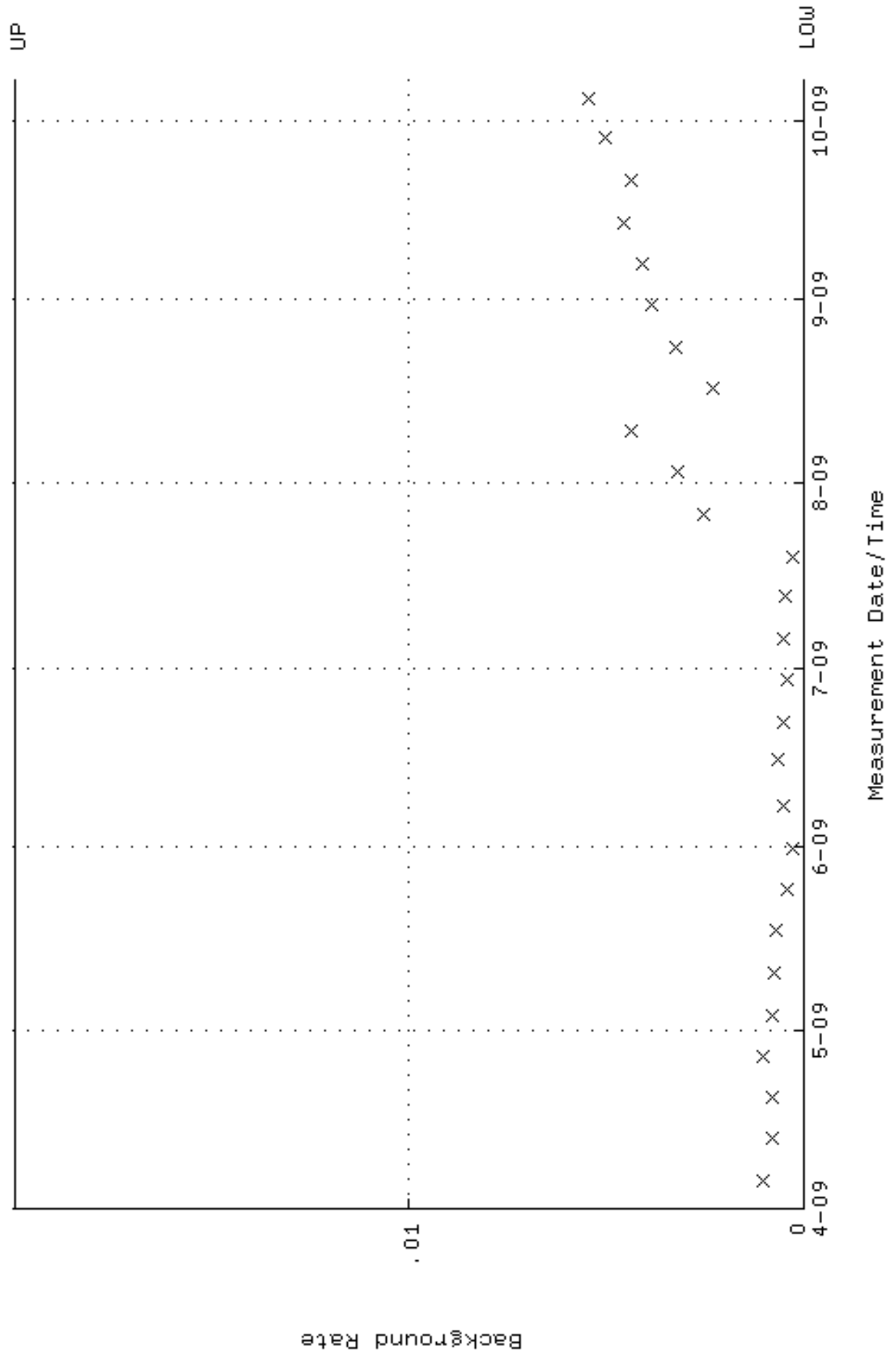
QA filename : DKA100:[ENV\_ALPHA.QA.W]W040.QAF;3  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 6-APR-2009 08:44:06 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.313016 through 0.333016



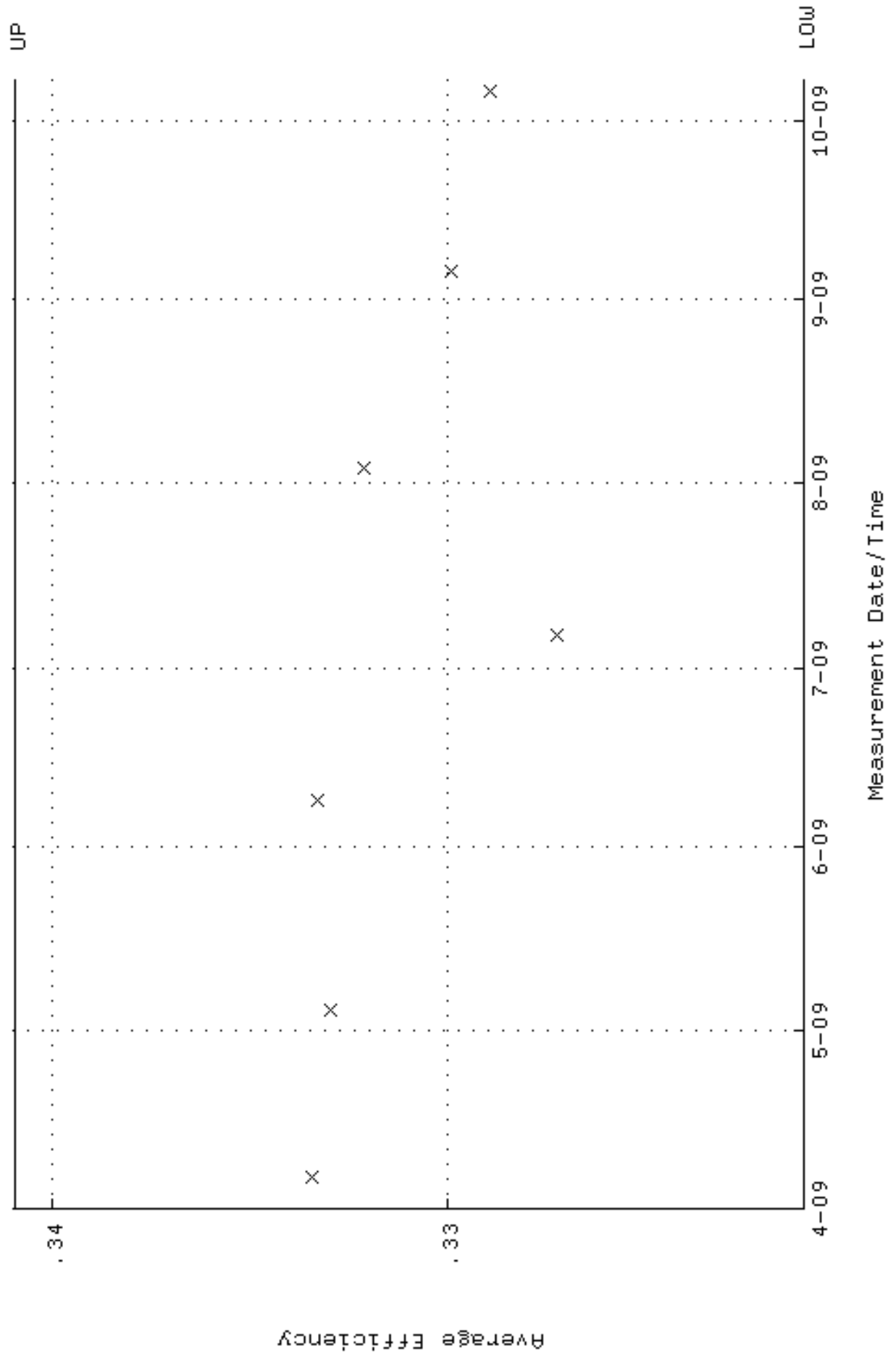
QA filename : DKA100:[ENV\_ALPHA.QA.W]W040.QAF;3  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 6-APR-2009 08:44:06 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 82.8065 through 91.5229



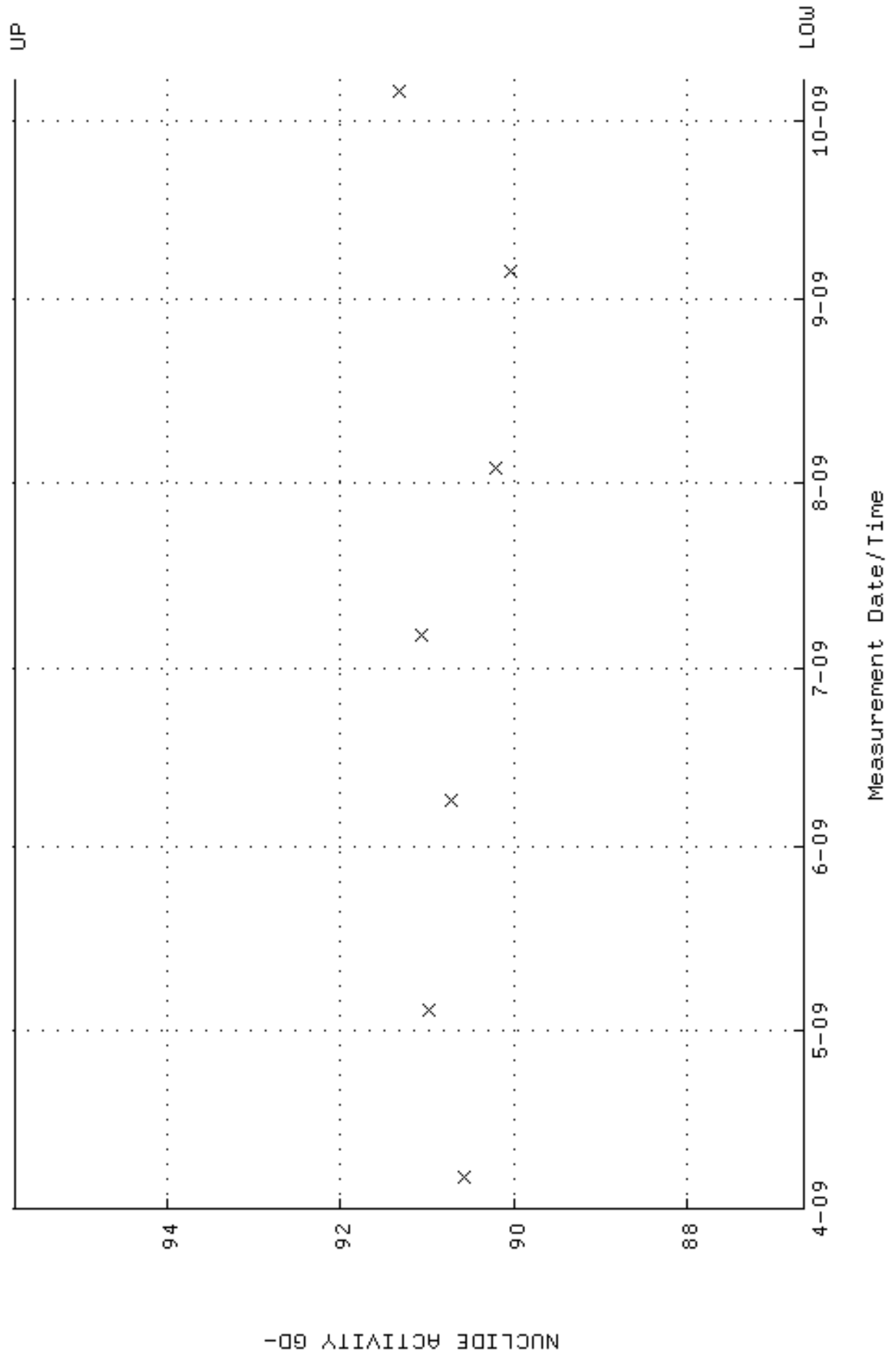
QA filename : DKA100:[ENV\_ALPHA.QA.B]B040.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:33:13 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



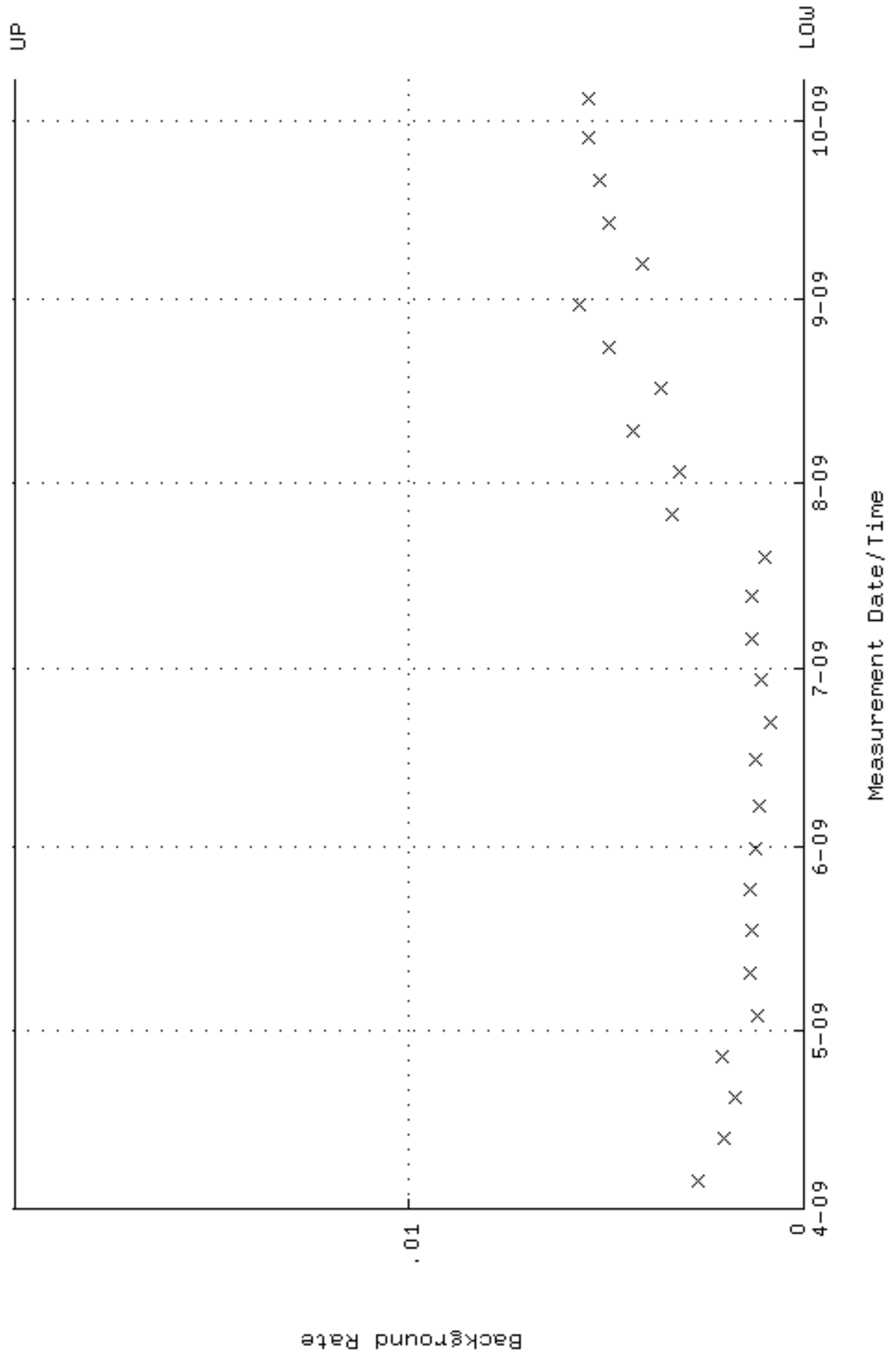
QA filename : DKA100:[ENV\_ALPHA.QA.W]W041.QAF;5  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 6-APR-2009 08:44:06 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.320943 through 0.340943



QA filename : DKA100:[ENV\_ALPHA.QA.W]w041.QAF;5  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 6-APR-2009 08:44:06 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 86.6435 through 95.7639

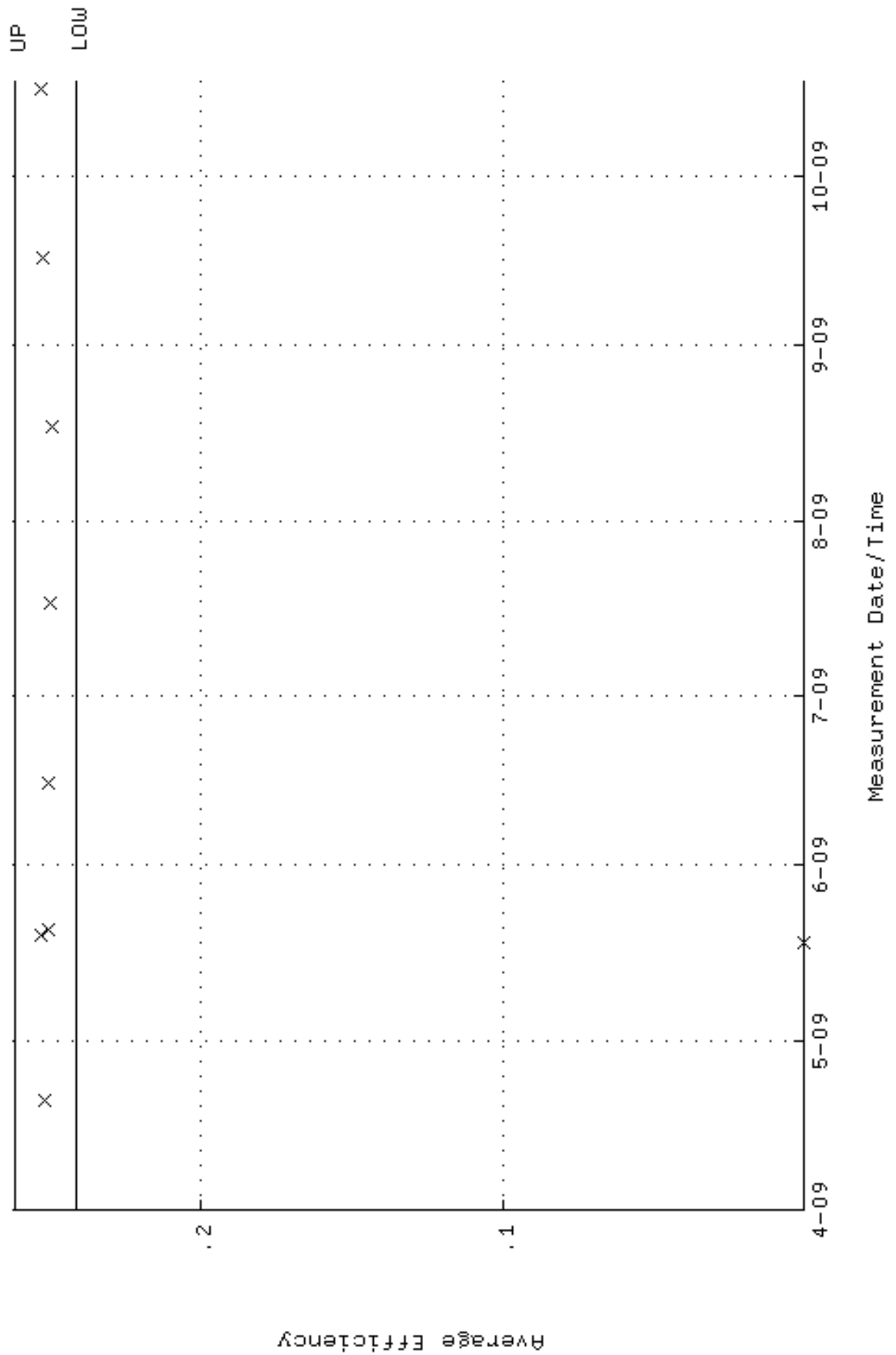


QA filename : DKA100:[ENV\_ALPHA.QA.B]B041.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:33:13 through 7-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02

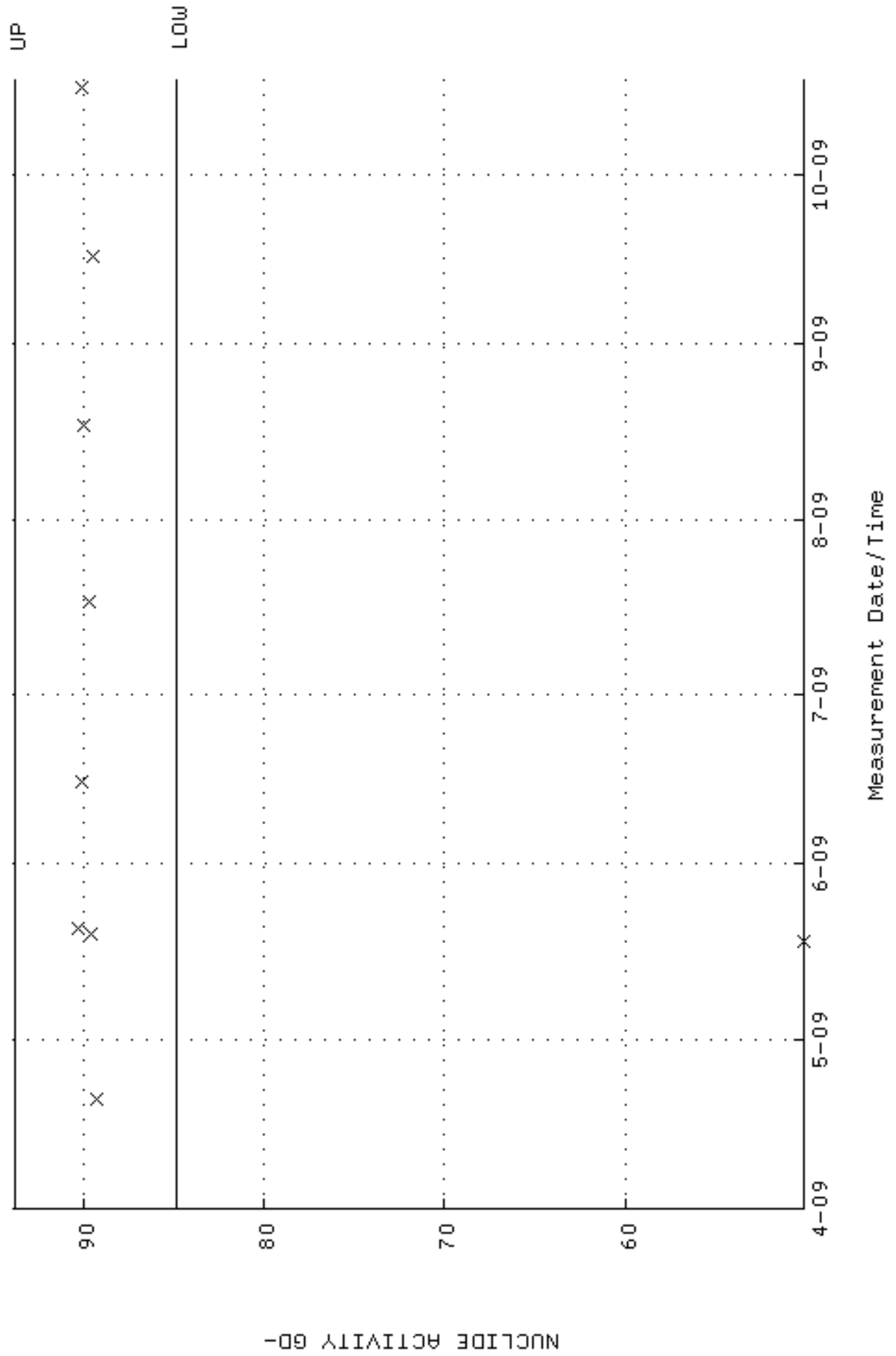




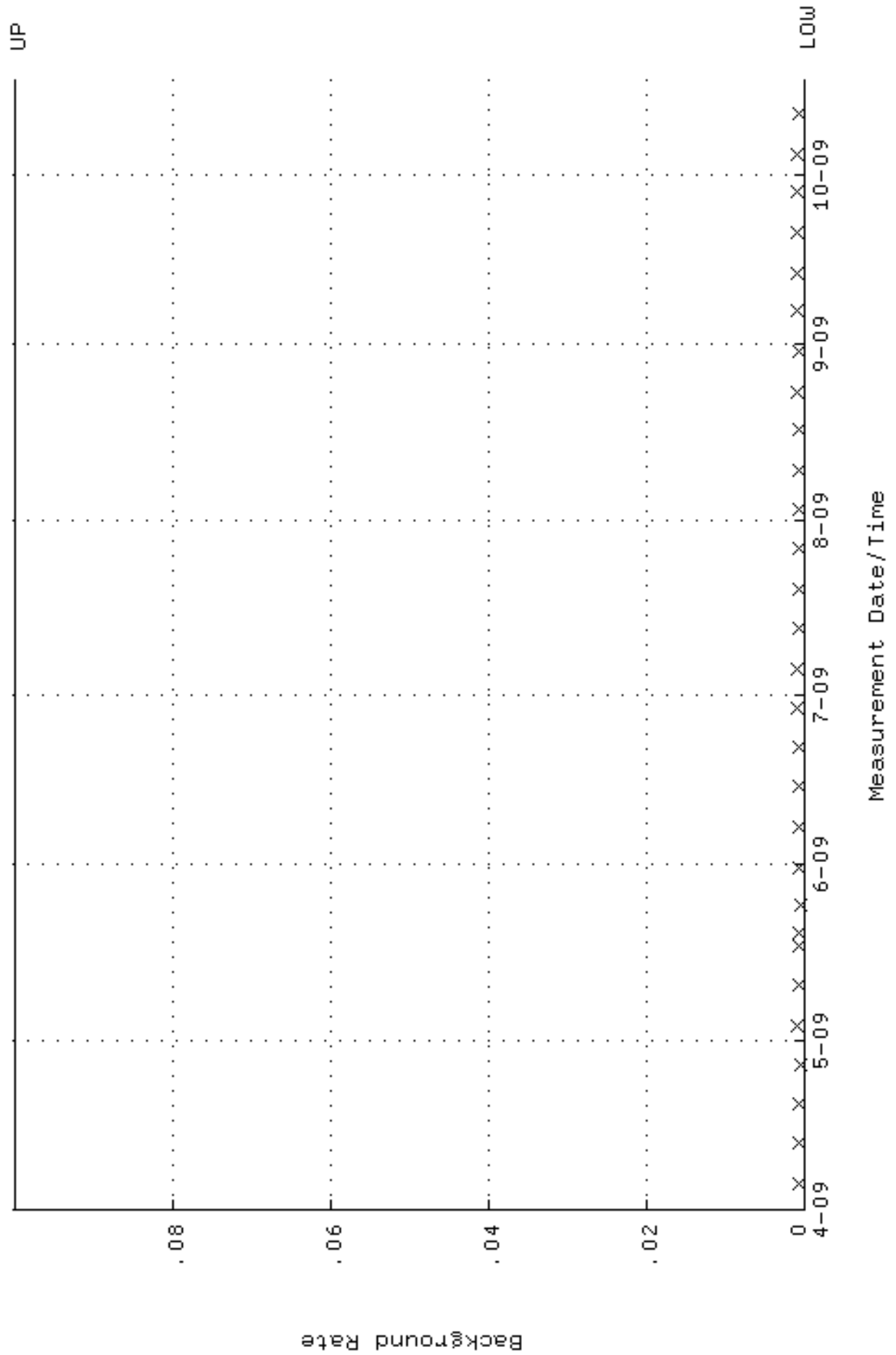
QA filename : DKA100:[ENV\_ALPHA.QA.W]W146.QAF;2  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:38:37 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.241831 through 0.261831



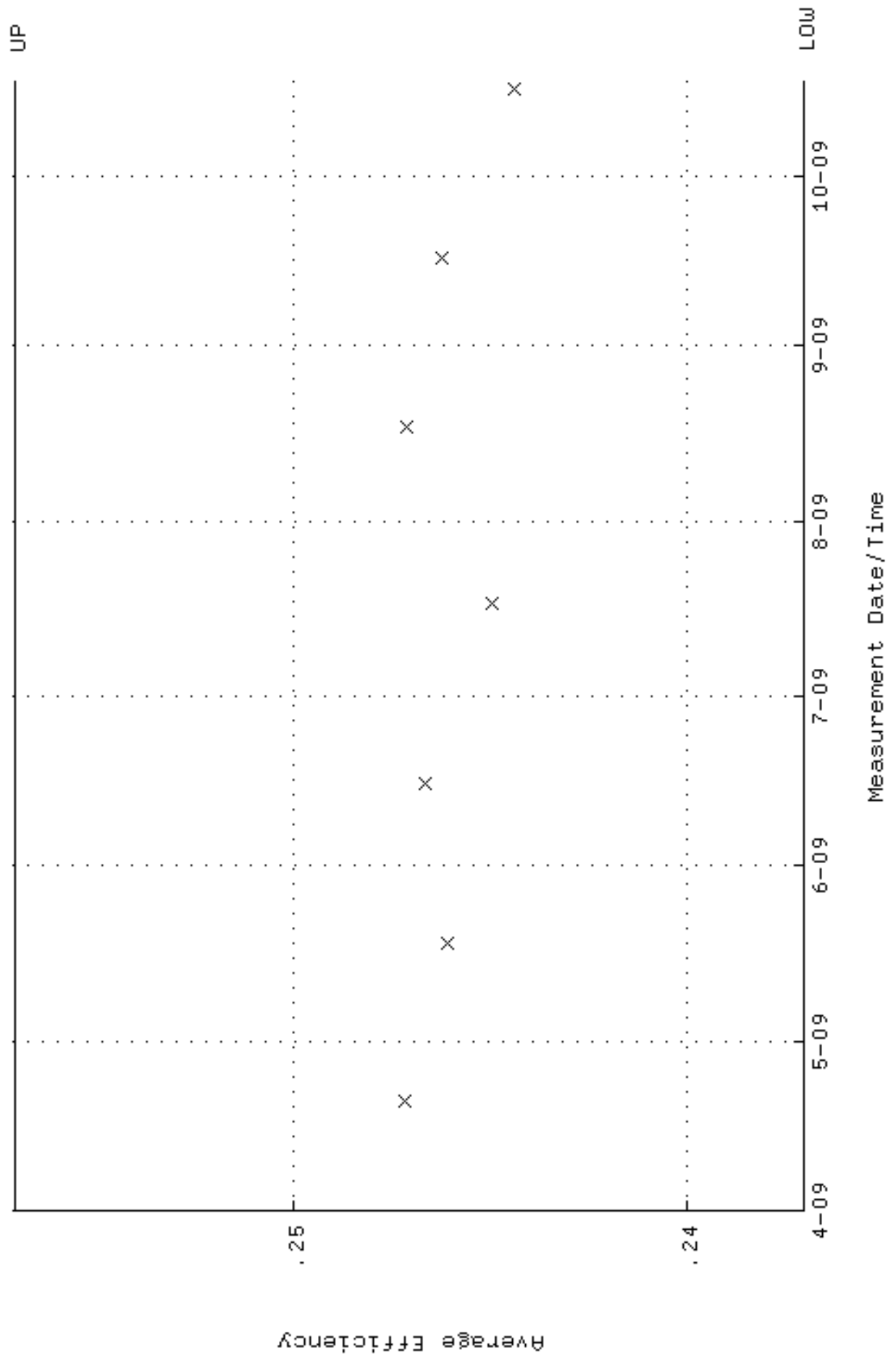
QA filename : DKA100:[ENV\_ALPHA.QA.W]w146.QAF;2  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:38:37 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 84.8578 through 93.7902



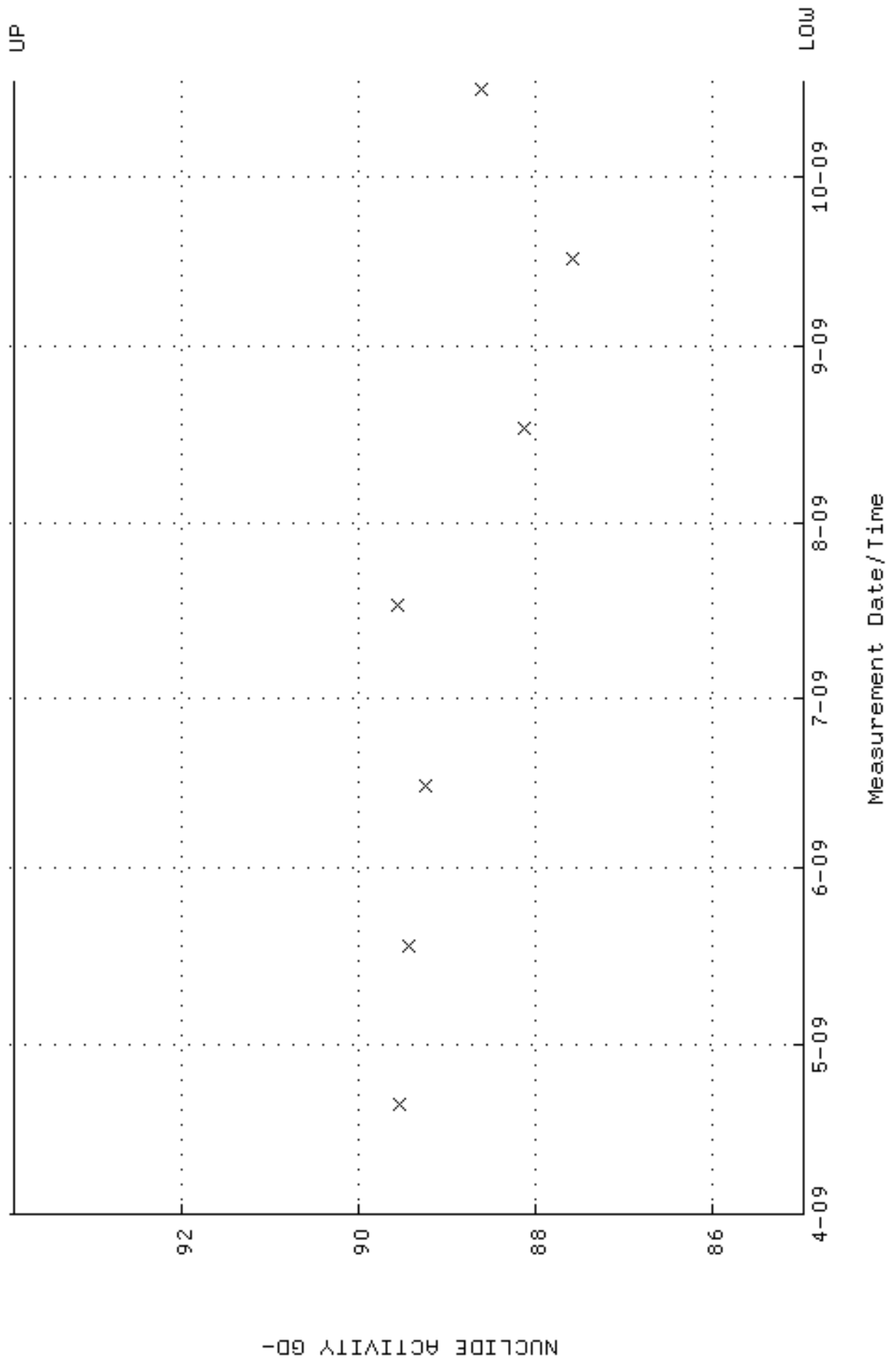
QA filename : DKA100:[ENV\_ALPHA.QA.B]B146.QAF;2  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:17 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



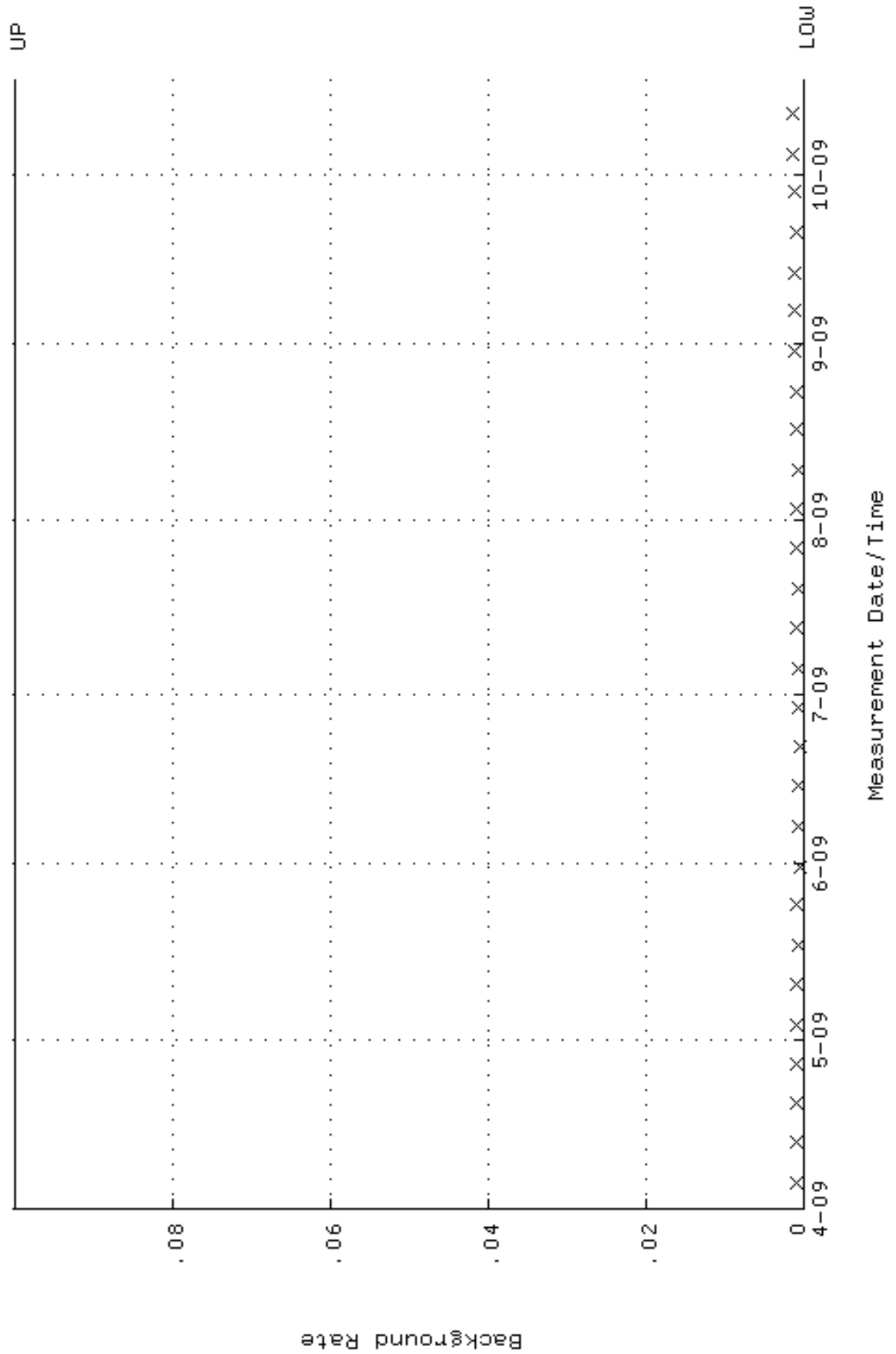
QA filename : DKA100:[ENV\_ALPHA.QA.W]W147.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:38:42 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.237046 through 0.257046



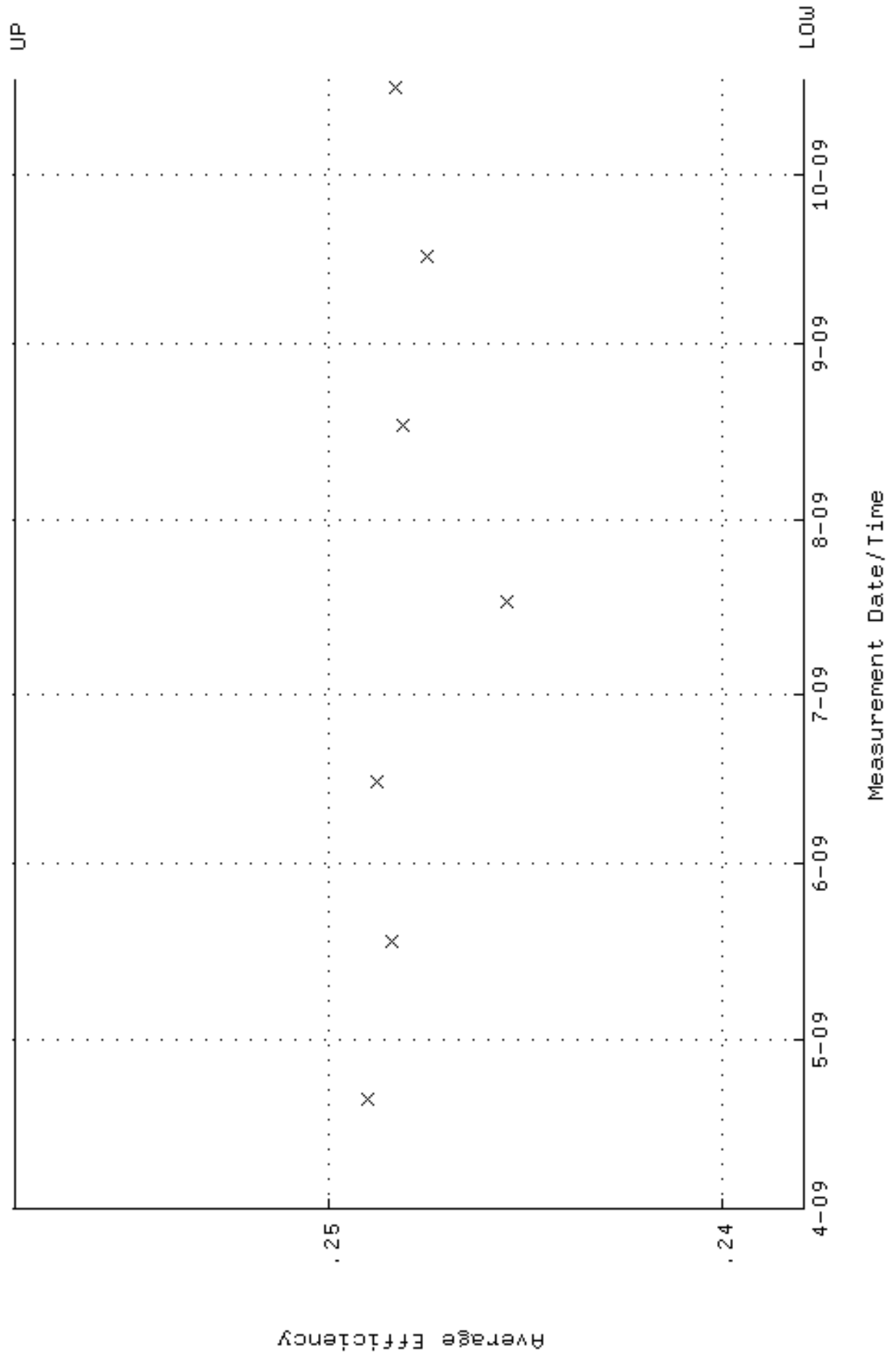
QA filename : DKA100:[ENV\_ALPHA.QA.W]w147.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:38:42 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 84.9777 through 93.9227



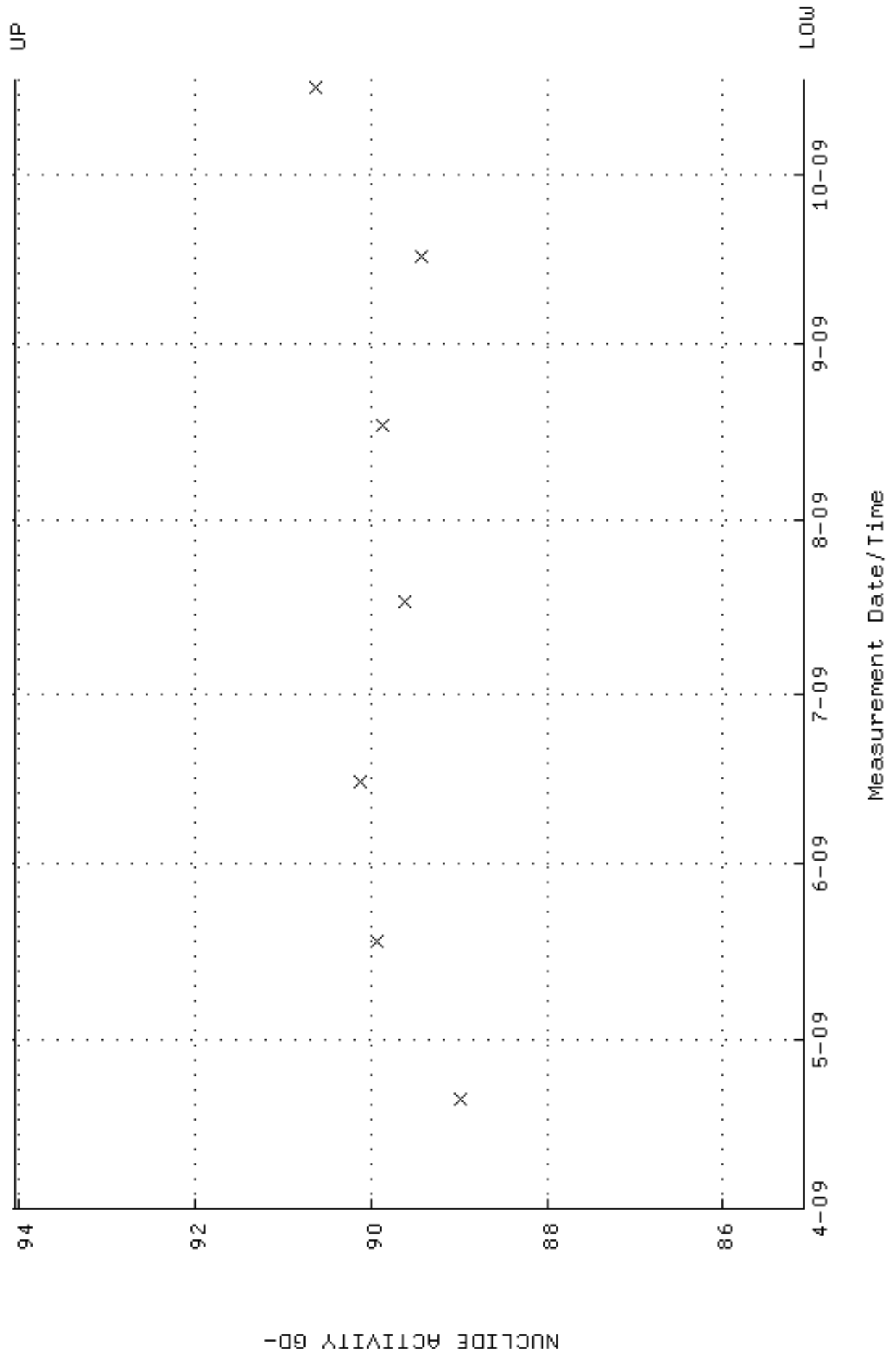
QA filename : DKA100:[ENV\_ALPHA.QA.B]B147.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:22 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



QA filename : DKA100:[ENV\_ALPHA.QA.W]W148.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:38:47 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.237934 through 0.257934

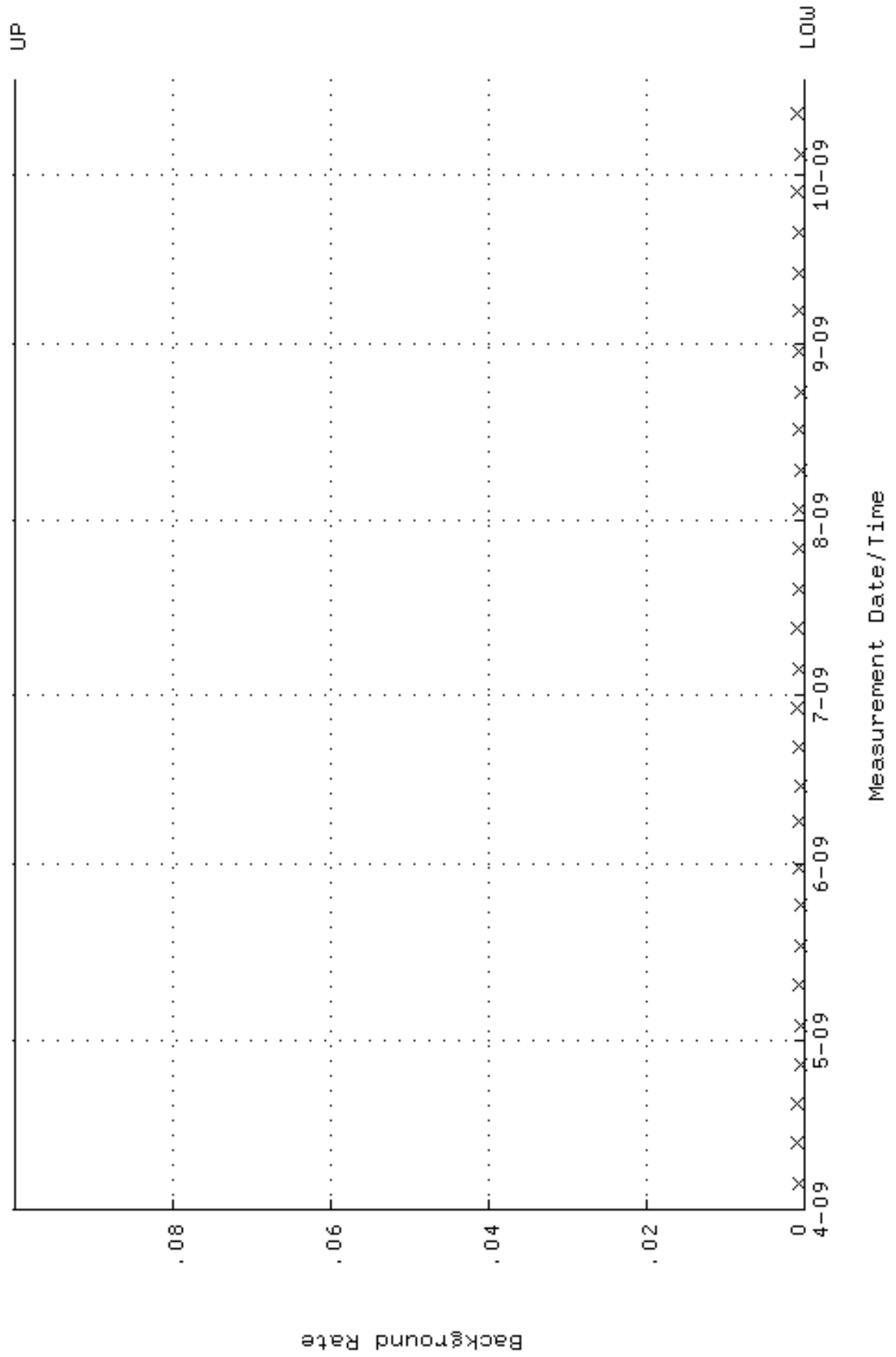


QA filename : DKA100:[ENV\_ALPHA.QA.W]w148.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:38:47 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 85.0831 through 94.0393

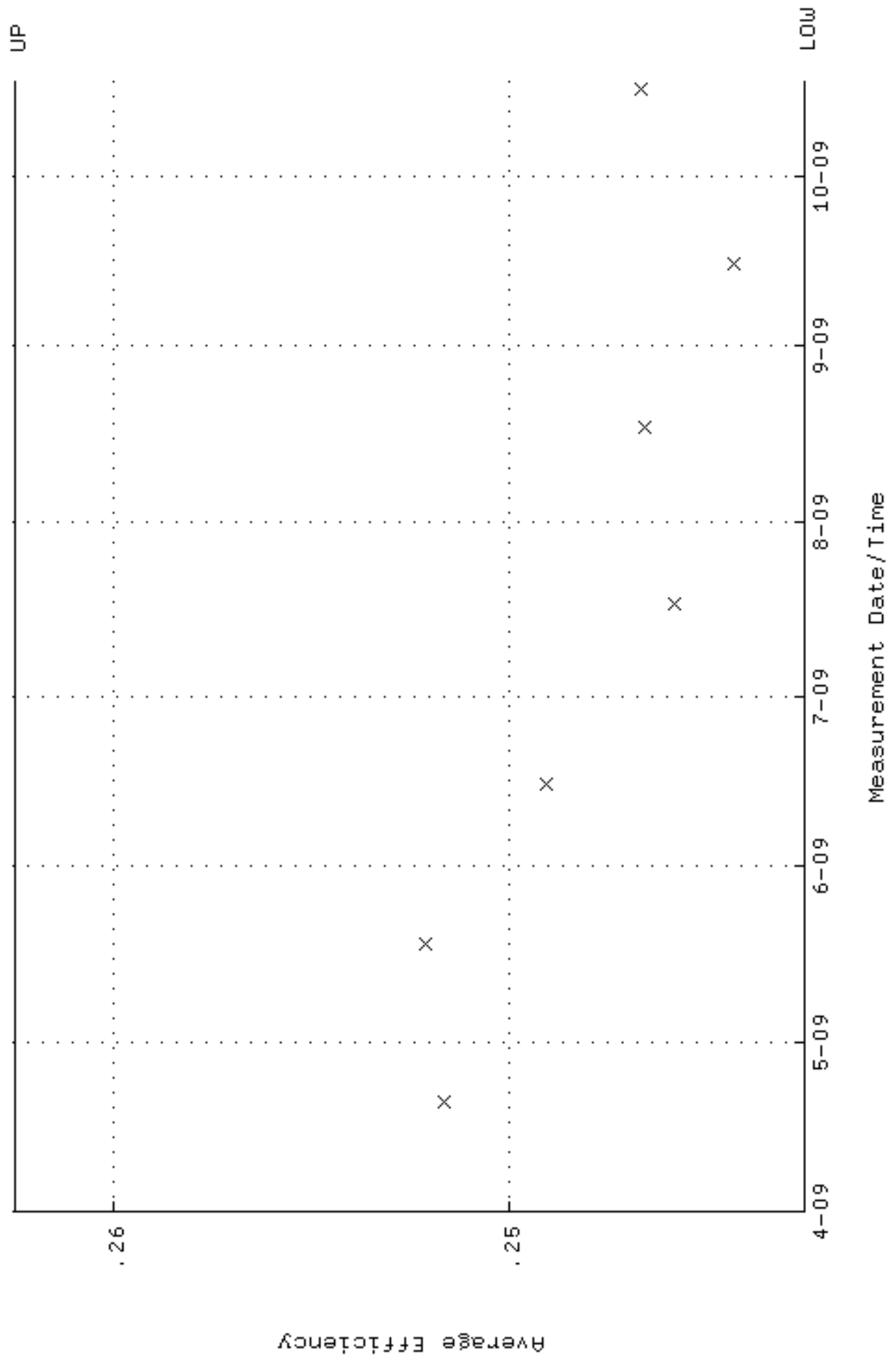




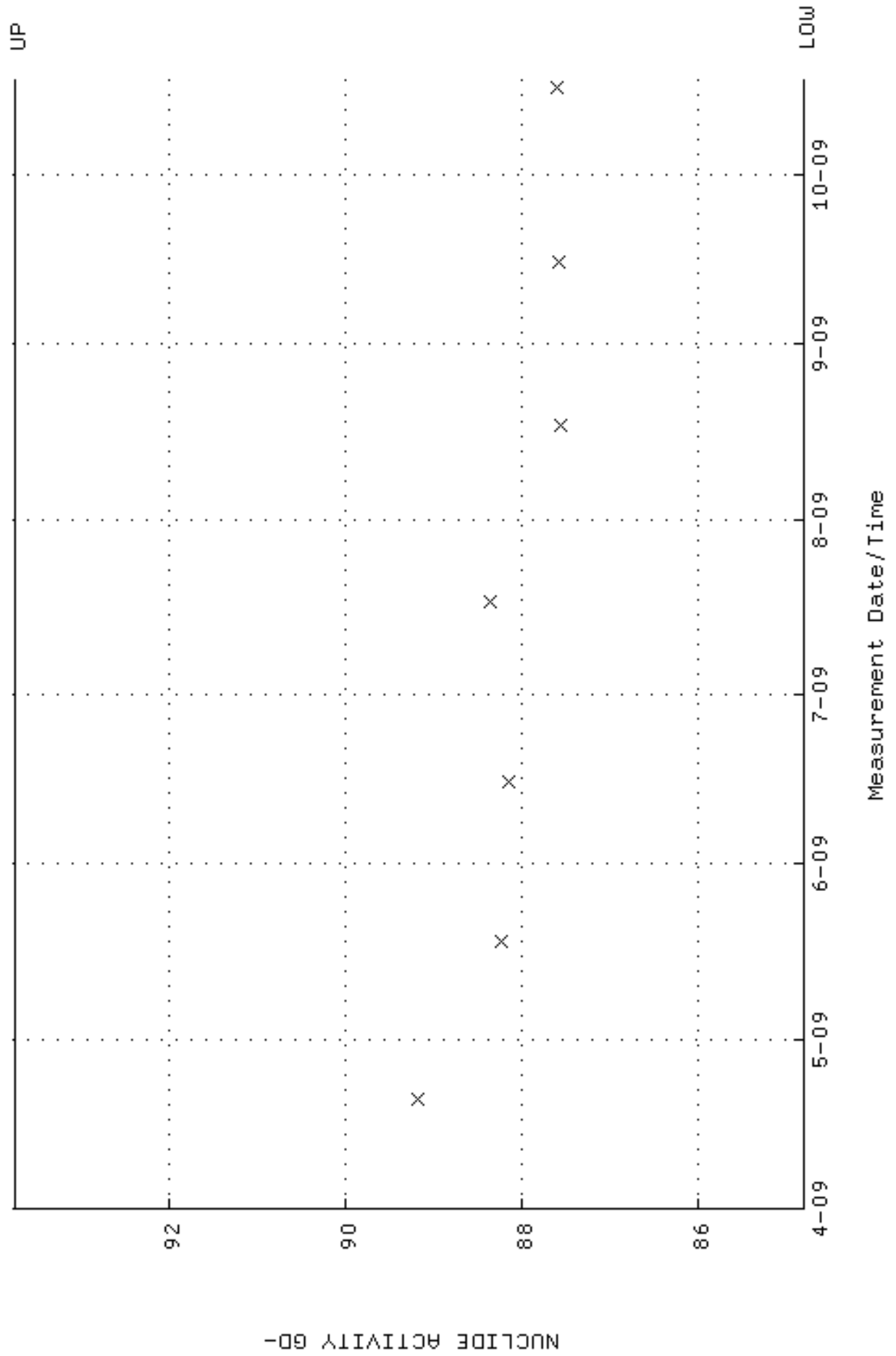
QA filename : DKA100:[ENV\_ALPHA.QA.B]B148.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:26 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



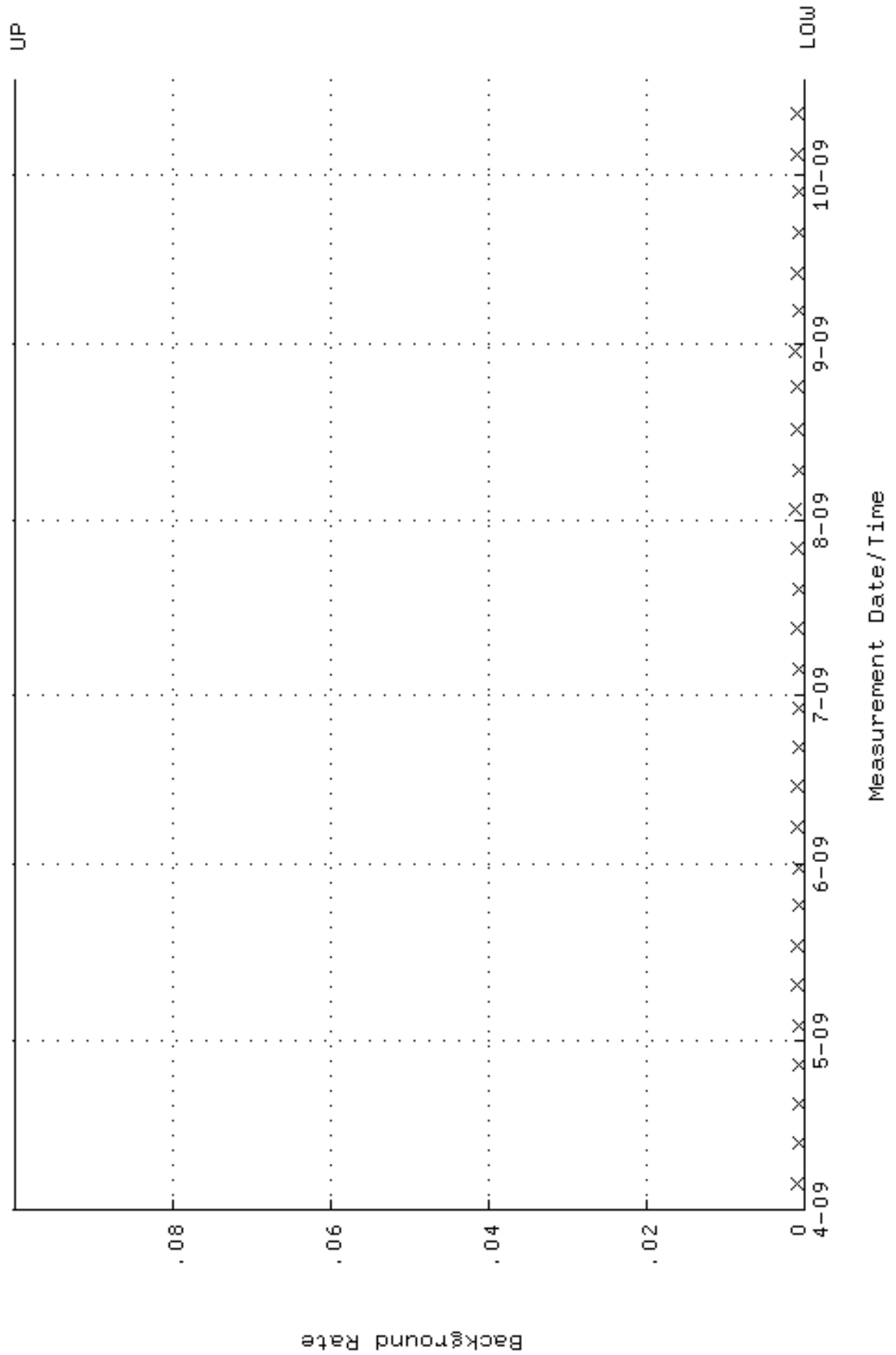
QA filename : DKA100:[ENV\_ALPHA.QA.W]W149.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:38:52 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.242495 through 0.262495



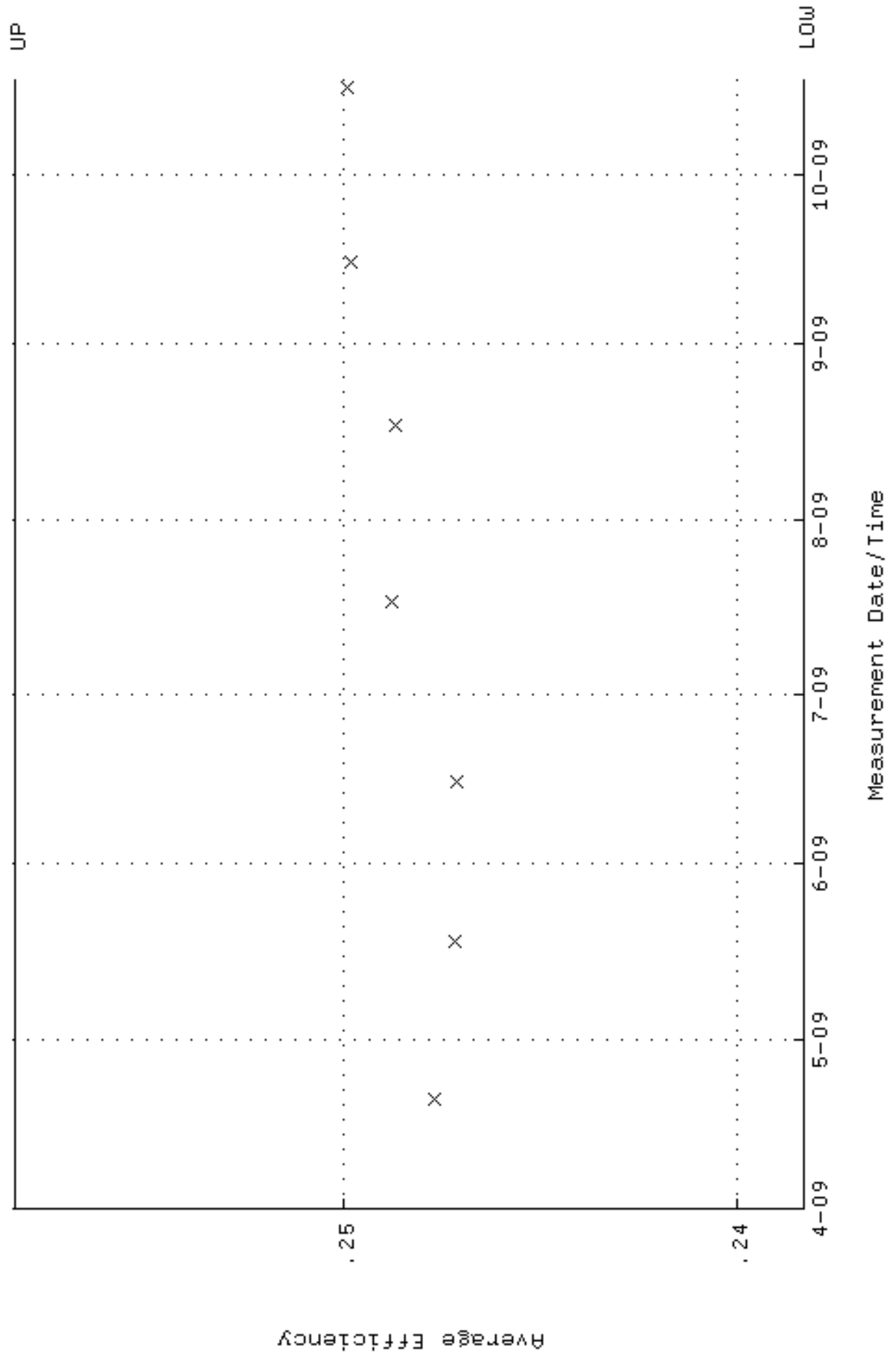
QA filename : DKA100:[ENV\_ALPHA.QA.W]W149.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:38:52 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 84.8126 through 93.7402



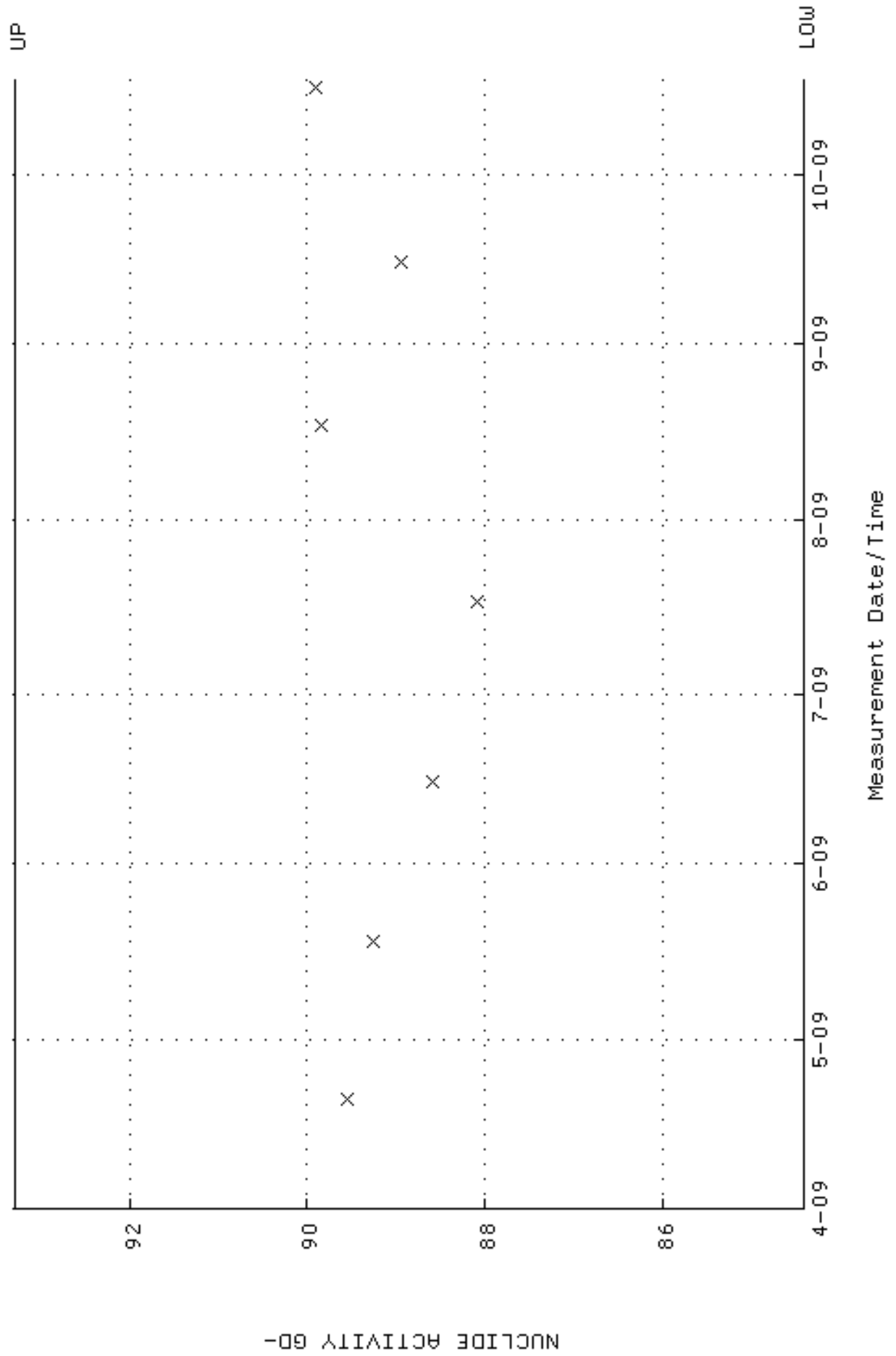
QA filename : DKA100:[ENV\_ALPHA.QA.B]B149.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:30 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



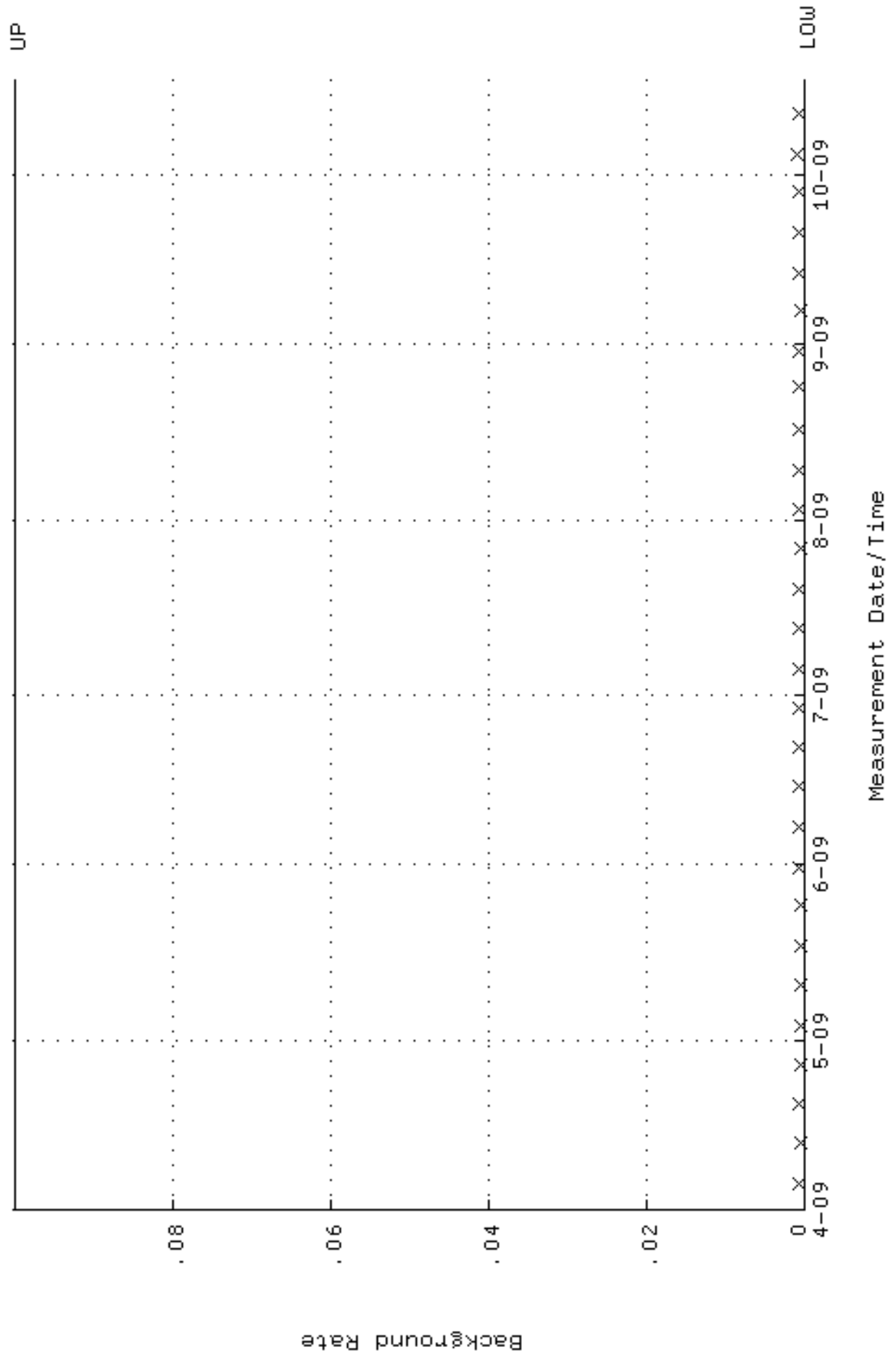
QA filename : DKA100:[ENV\_ALPHA.QA.W]W150.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:38:56 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.238314 through 0.258314



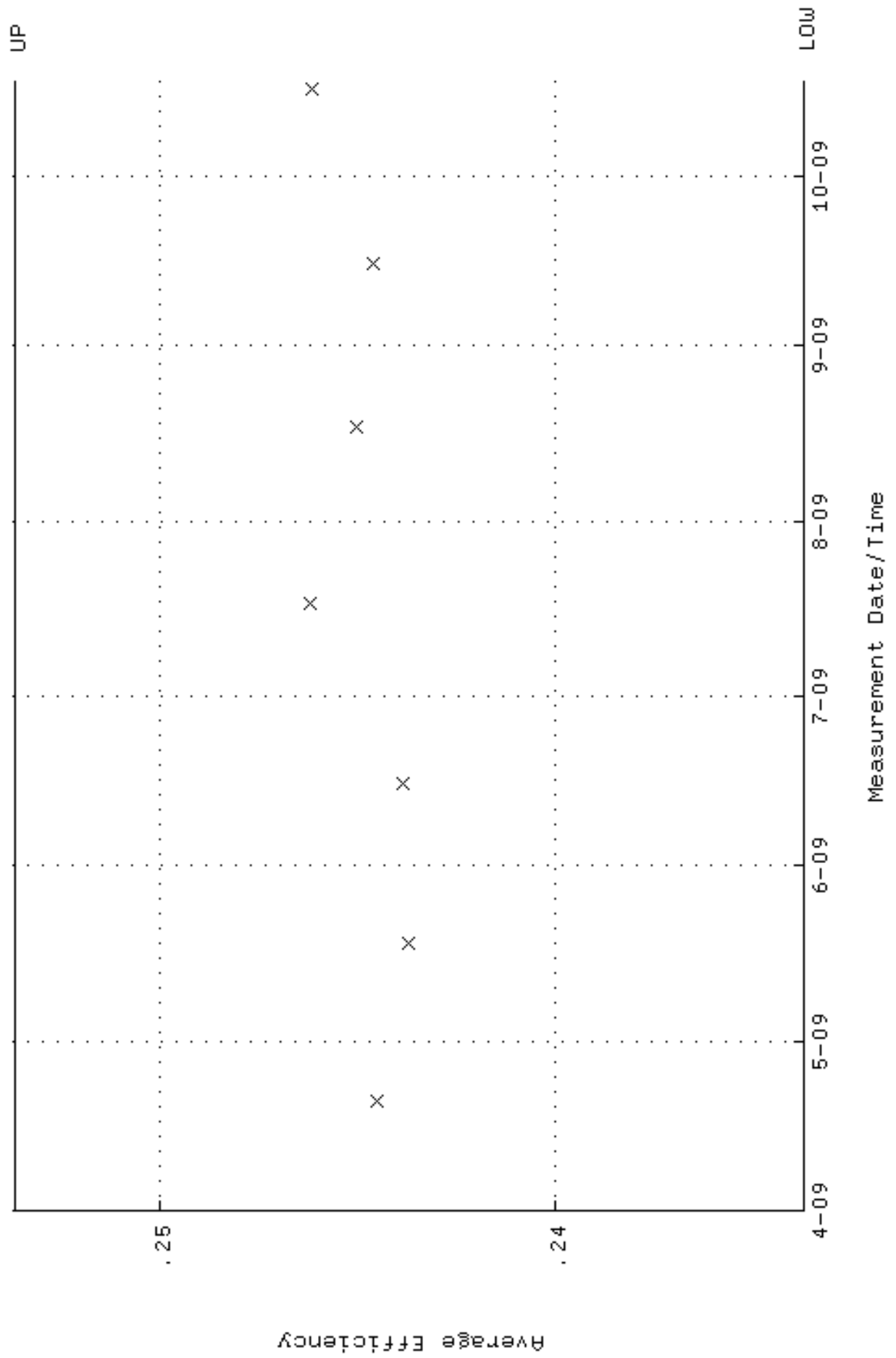
QA filename : DKA100:[ENV\_ALPHA.QA.W]w150.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:38:56 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 84.4039 through 93.2885



QA filename : DKA100:[ENV\_ALPHA.QA.B]B150.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:34 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

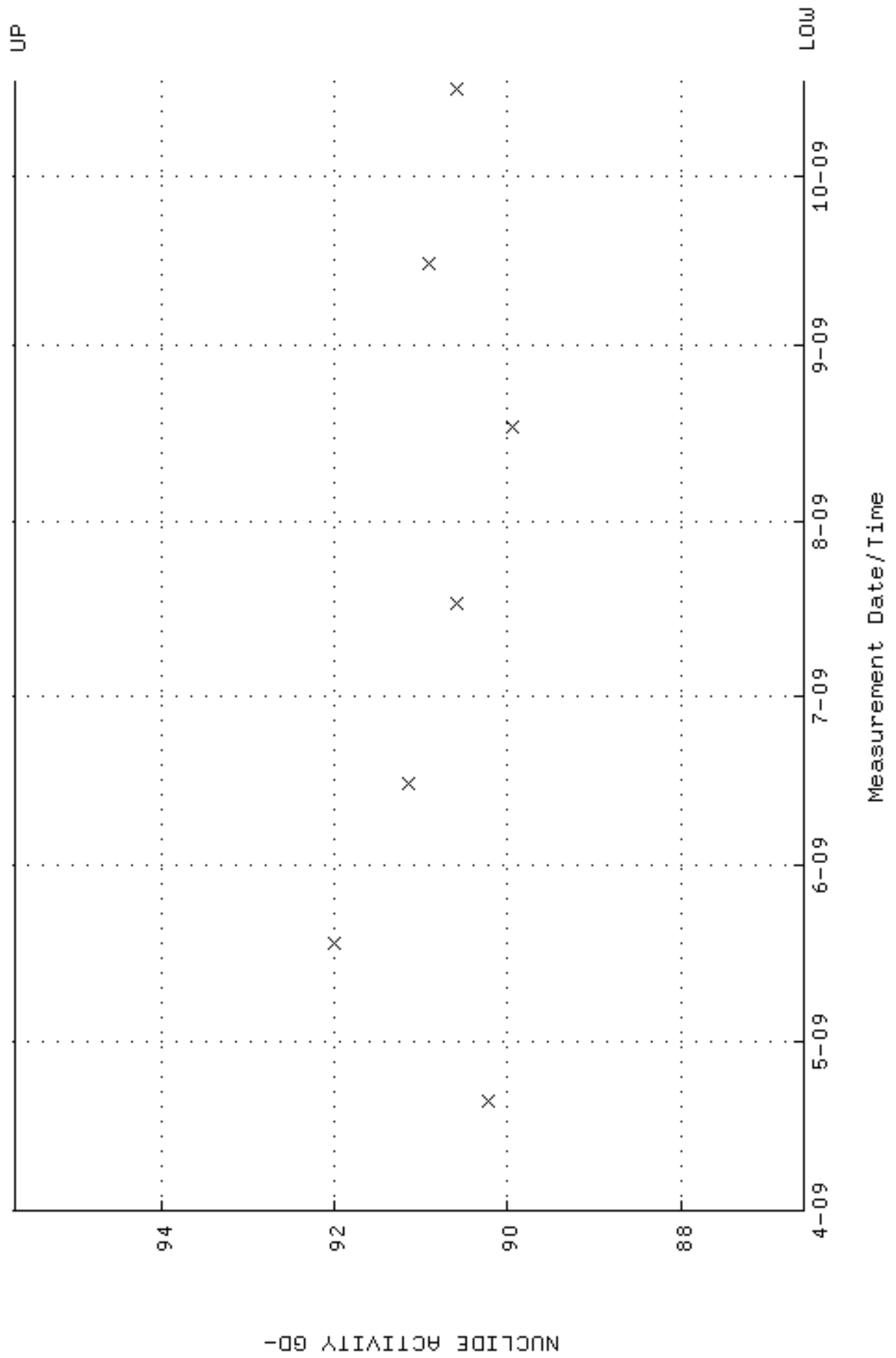


QA filename : DKA100:[ENV\_ALPHA.QA.W]W151.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:01 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.233693 through 0.253693

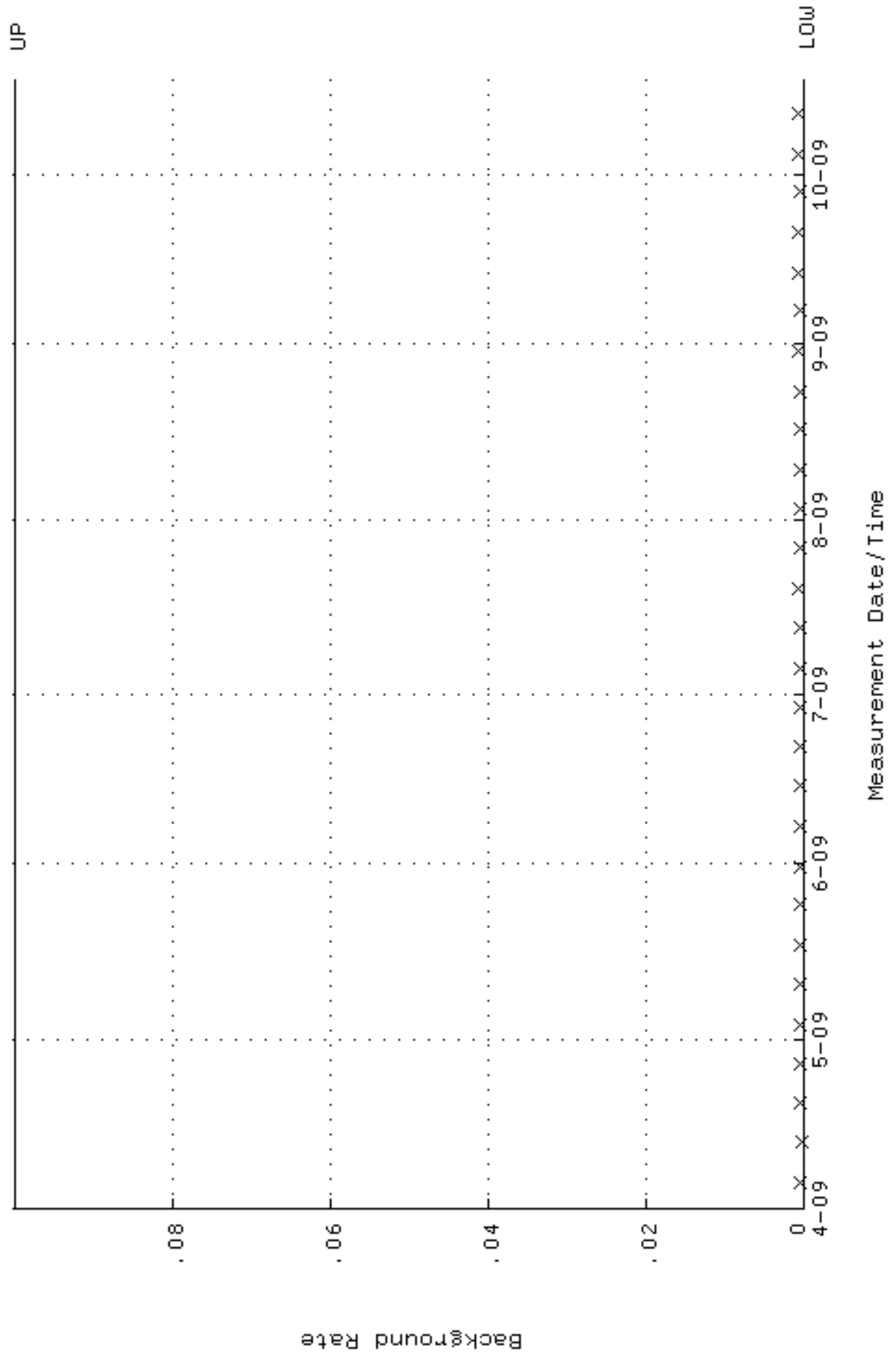




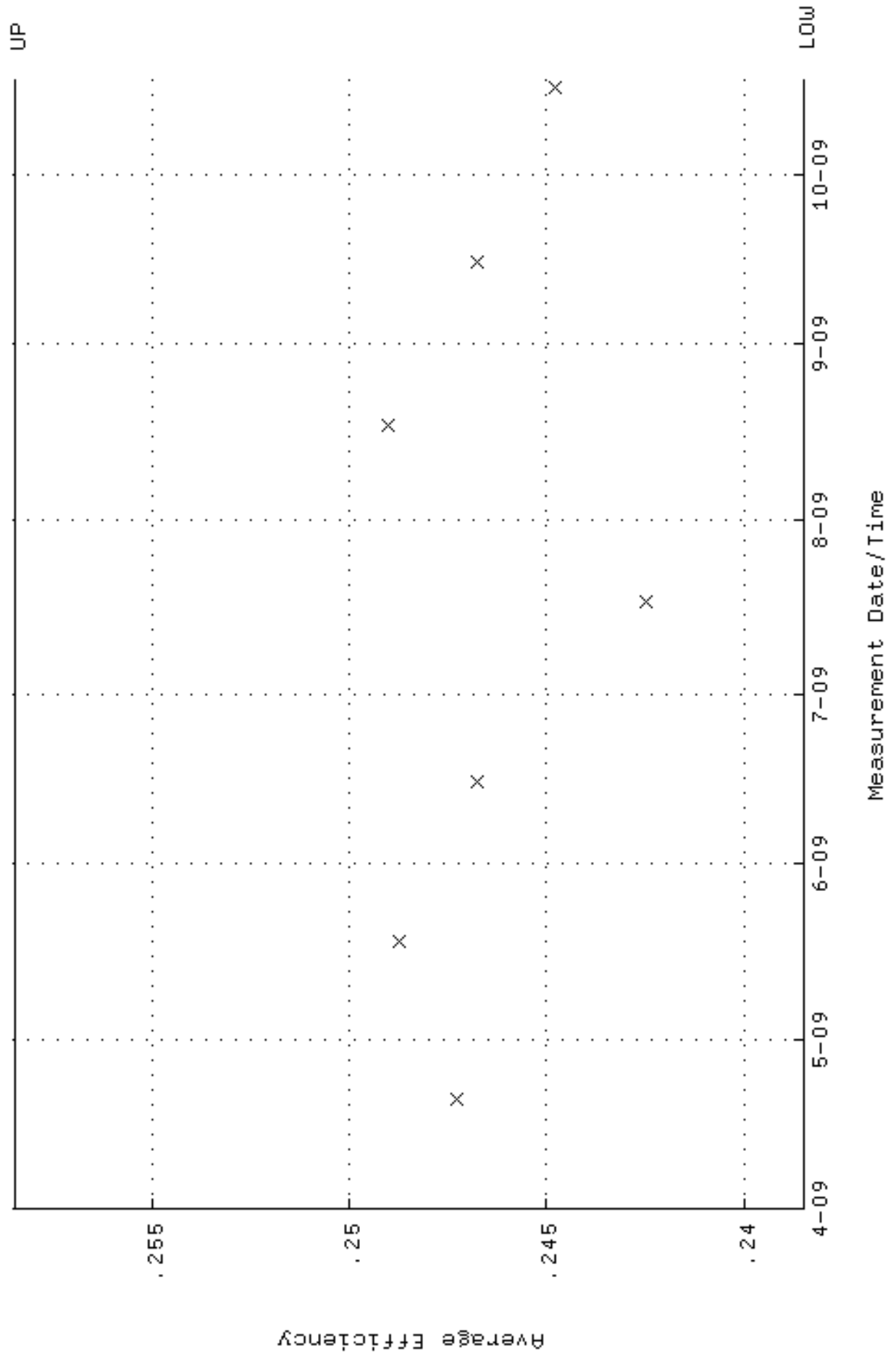
QA filename : DKA100:[ENV\_ALPHA.QA.W]w151.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:01 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 86.5749 through 95.6881



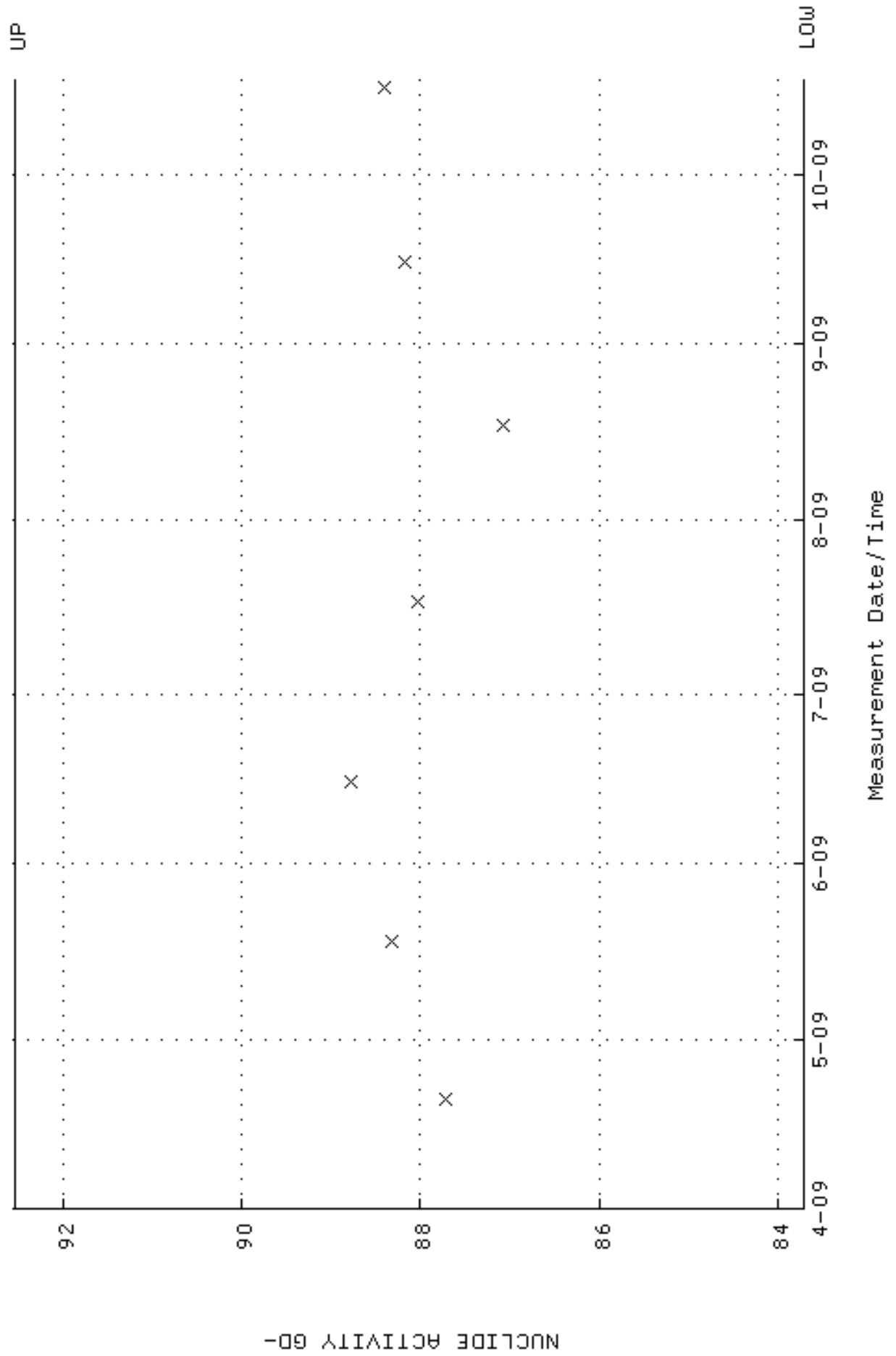
QA filename : DKA100:[ENV\_ALPHA.QA.B]B151.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:38 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



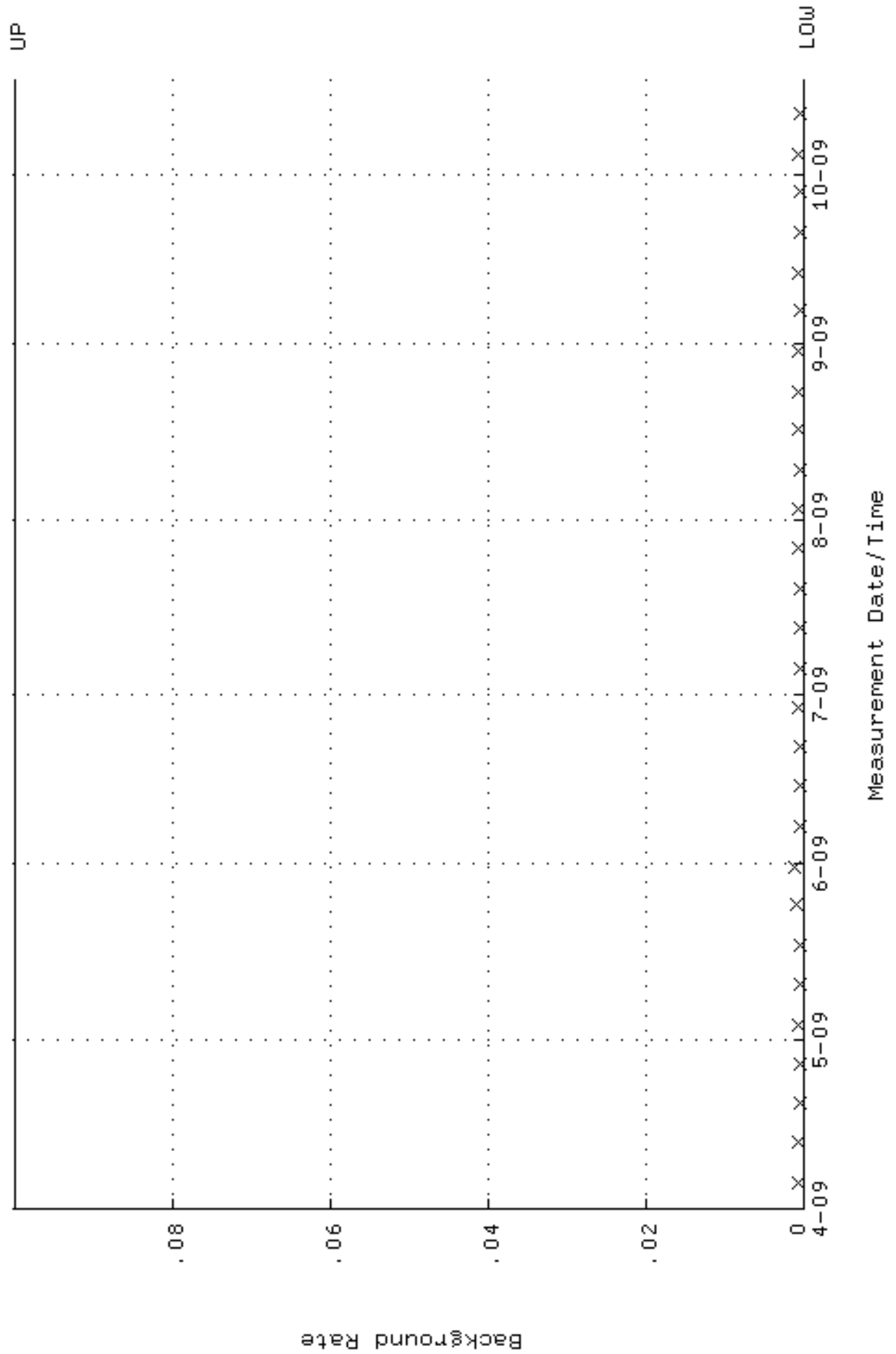
QA filename : DKA100:[ENV\_ALPHA.QA.W]W152.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:05 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.238479 through 0.258479



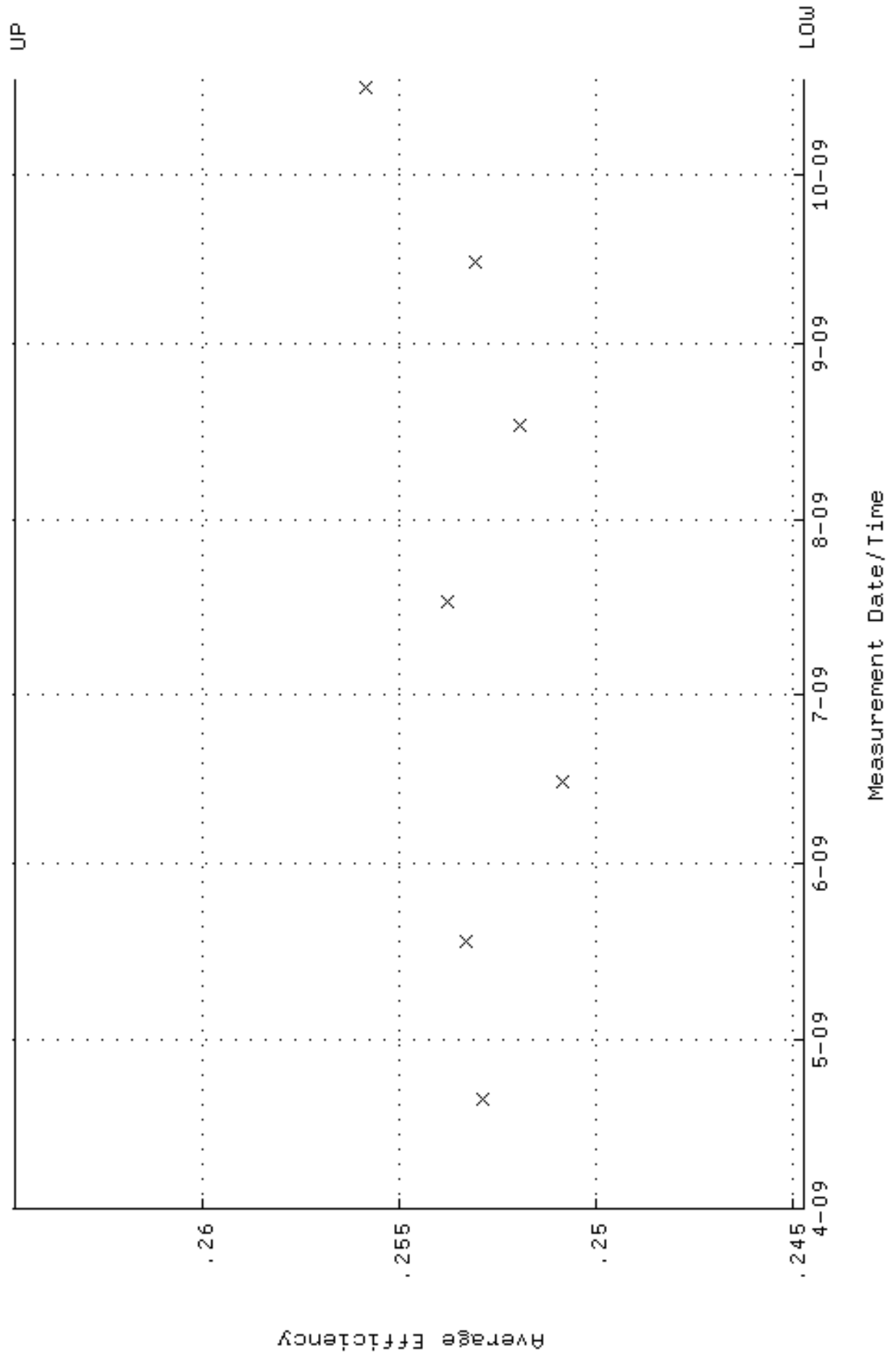
QA filename : DKA100:[ENV\_ALPHA.QA.W]w152.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:05 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 83.7180 through 92.5304



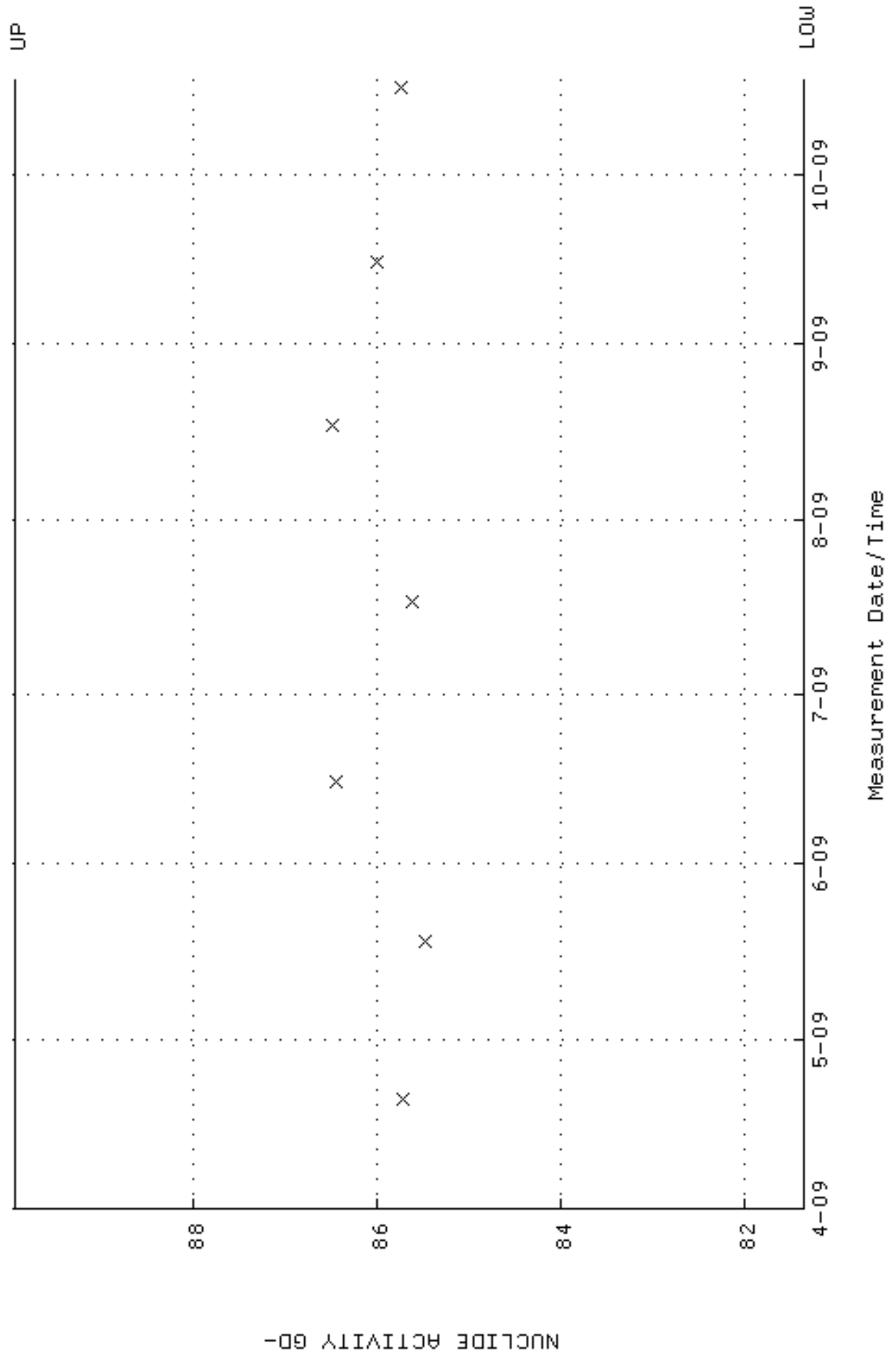
QA filename : DKA100:[ENV\_ALPHA.QA.B]B152.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:43 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



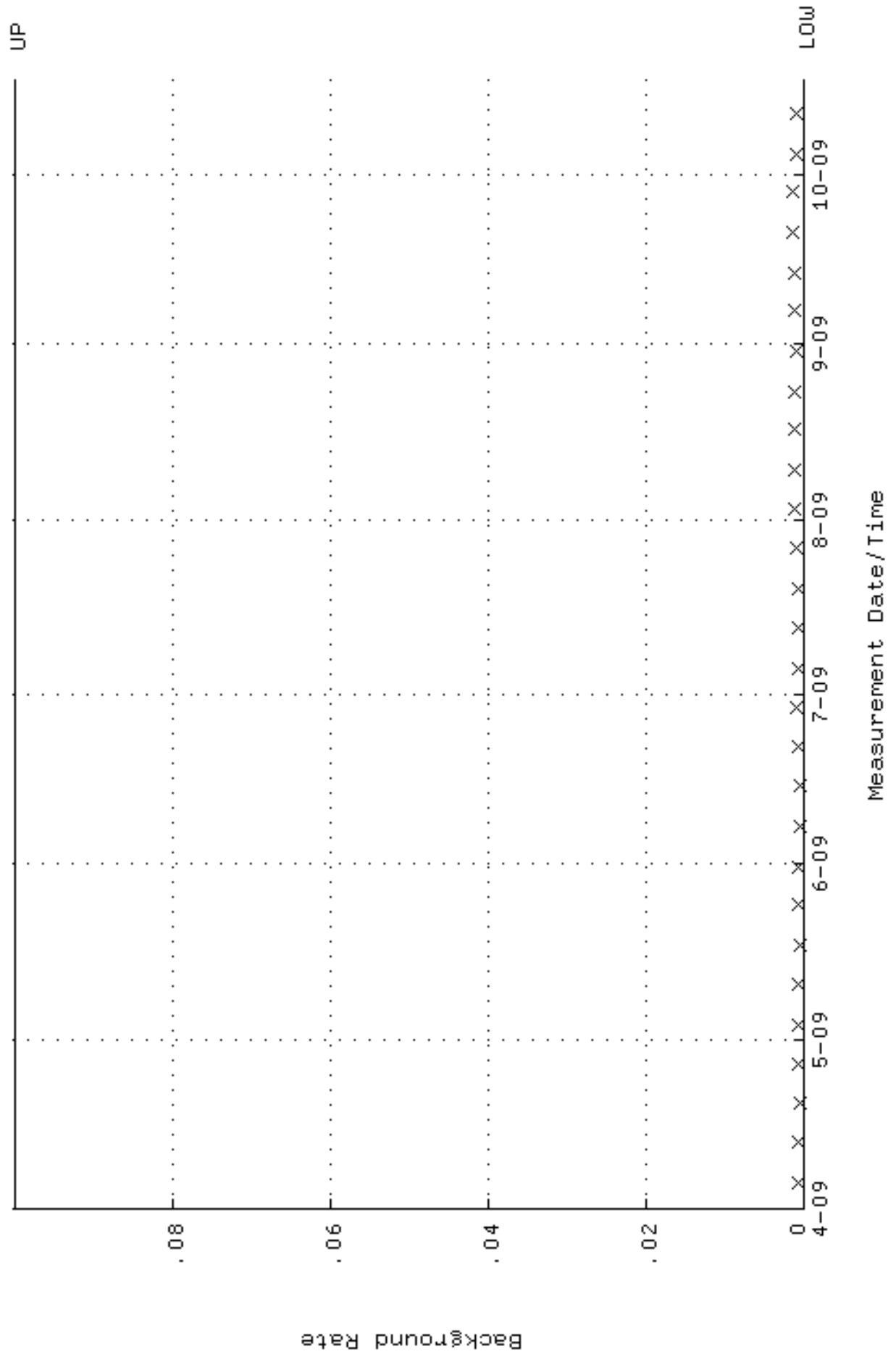
QA filename : DKA100:[ENV\_ALPHA.QA.W]W153.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:10 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.244738 through 0.264738



QA filename : DKA100:[ENV\_ALPHA.QA.W]W153.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:10 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 81.3634 through 89.9280

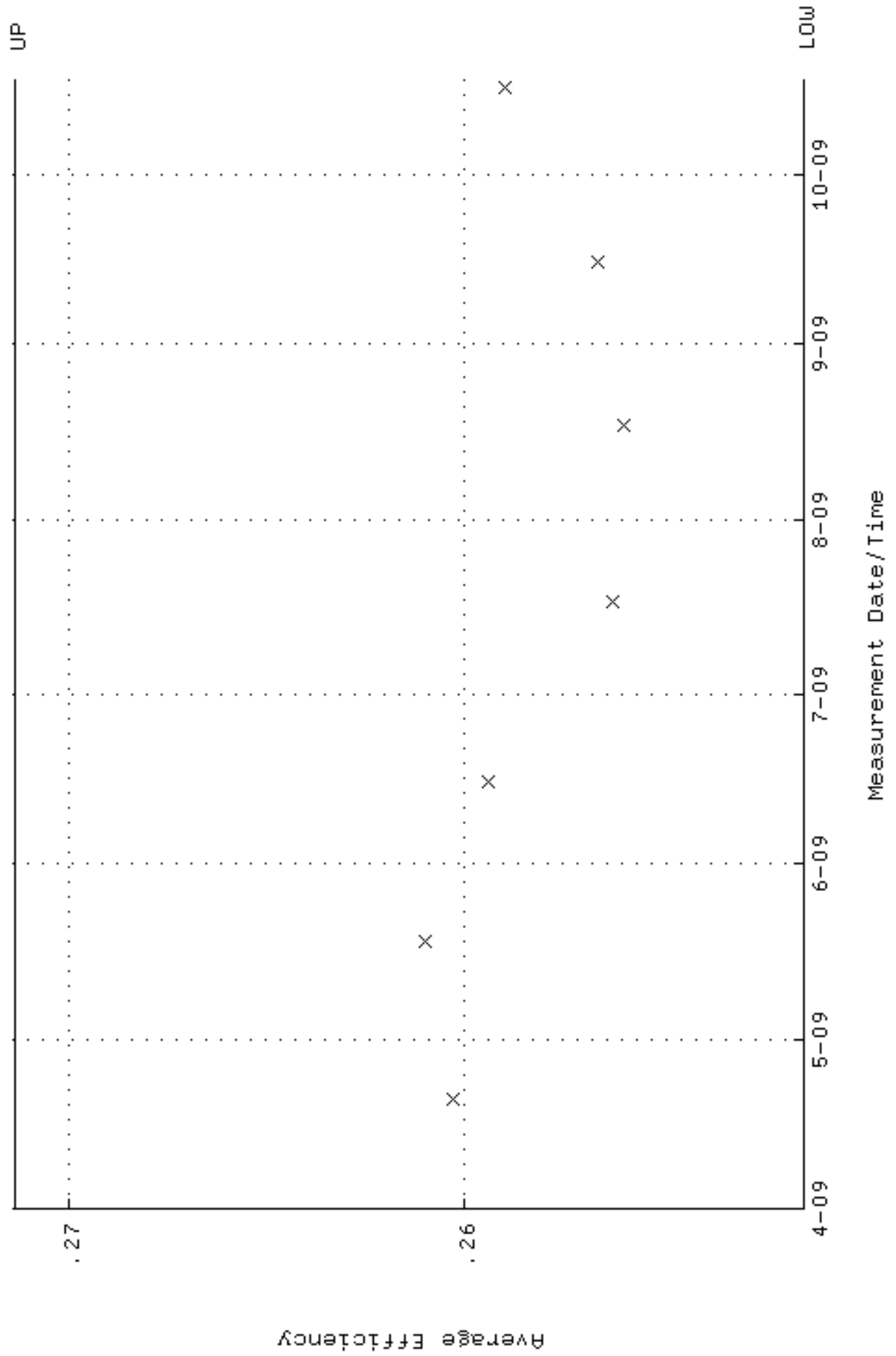


QA filename : DKA100:[ENV\_ALPHA.QA.B]B153.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:46 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

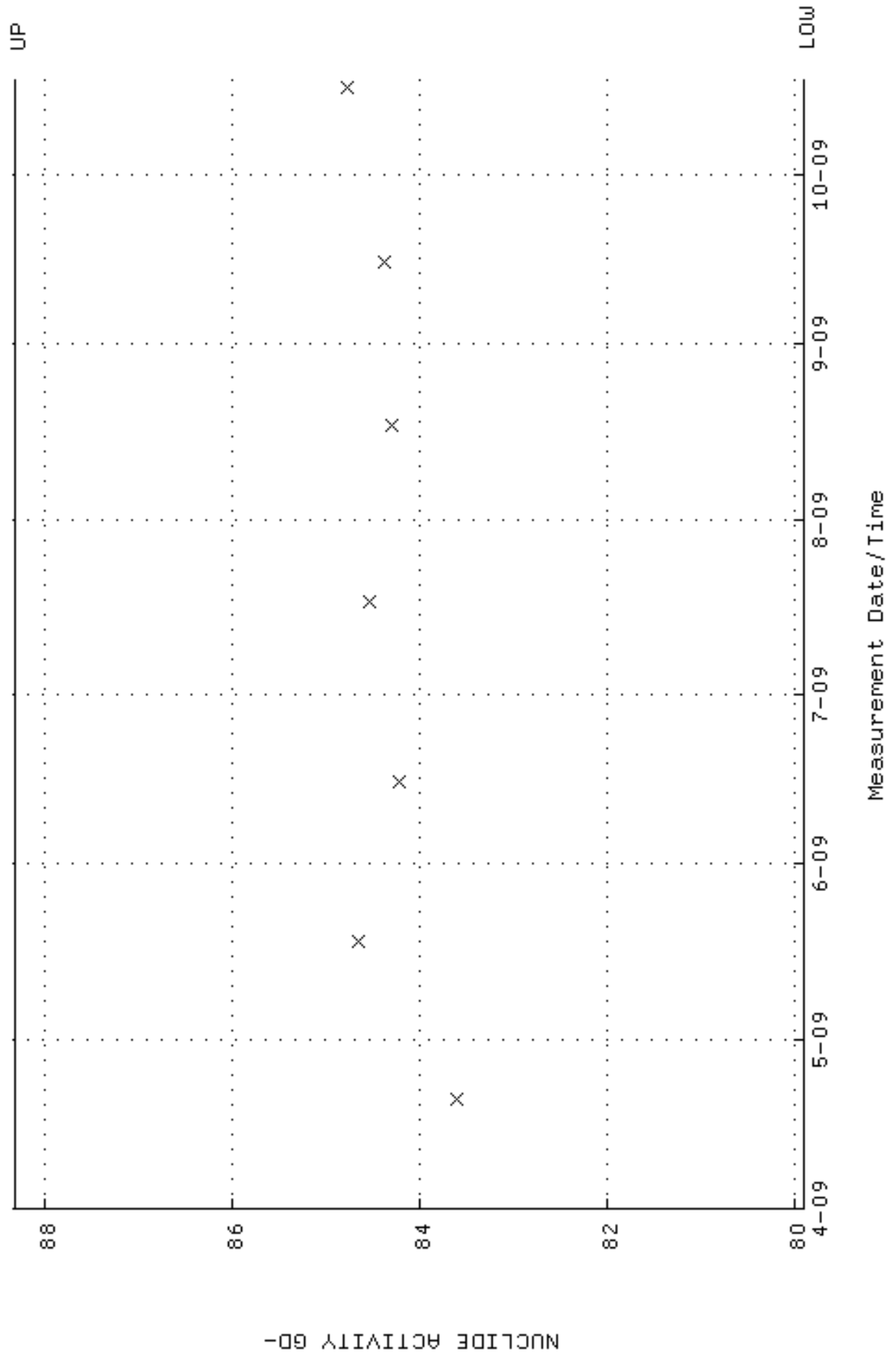




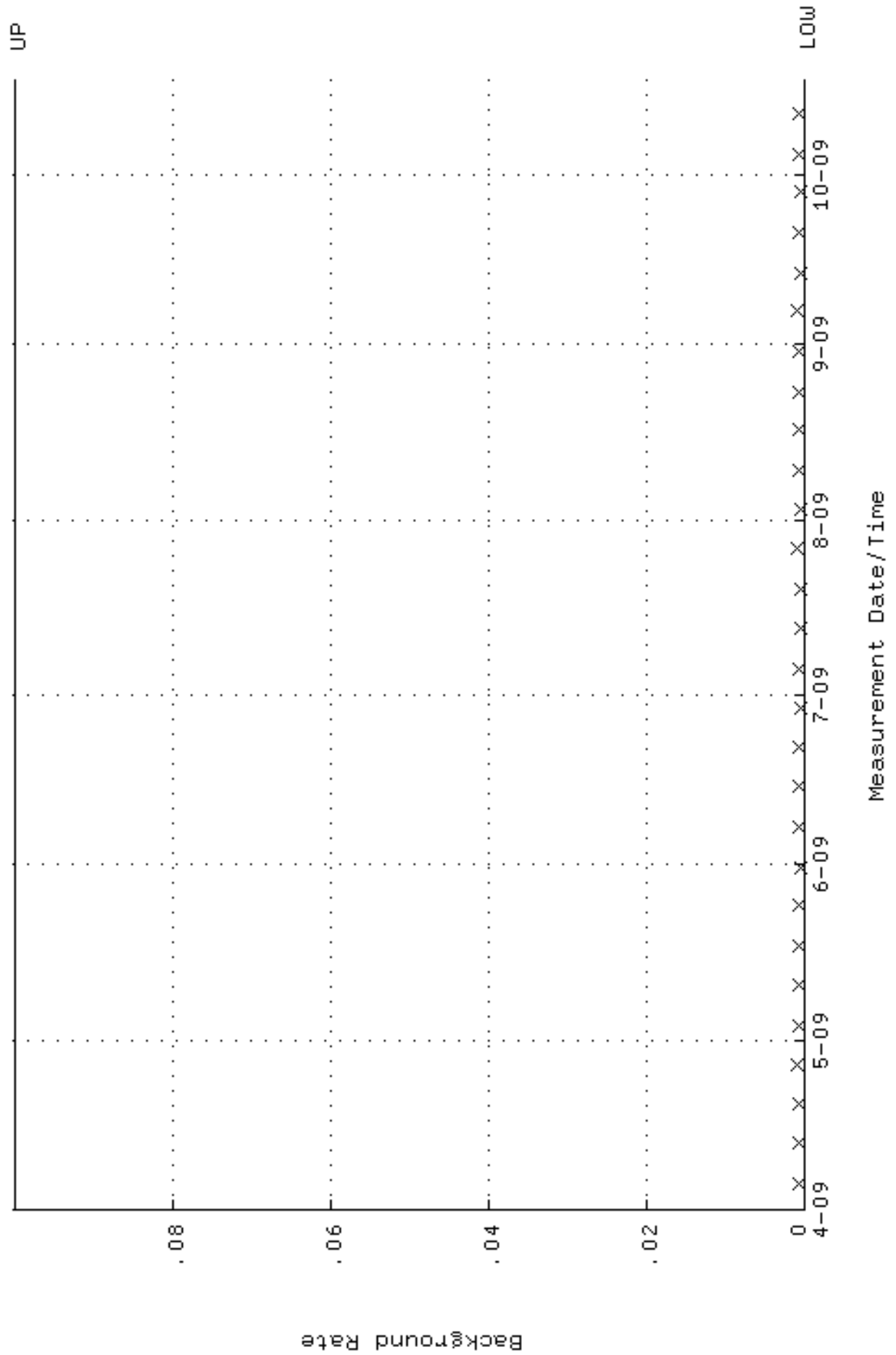
QA filename : DKA100:[ENV\_ALPHA.QA.W]W154.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:15 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.251386 through 0.271386



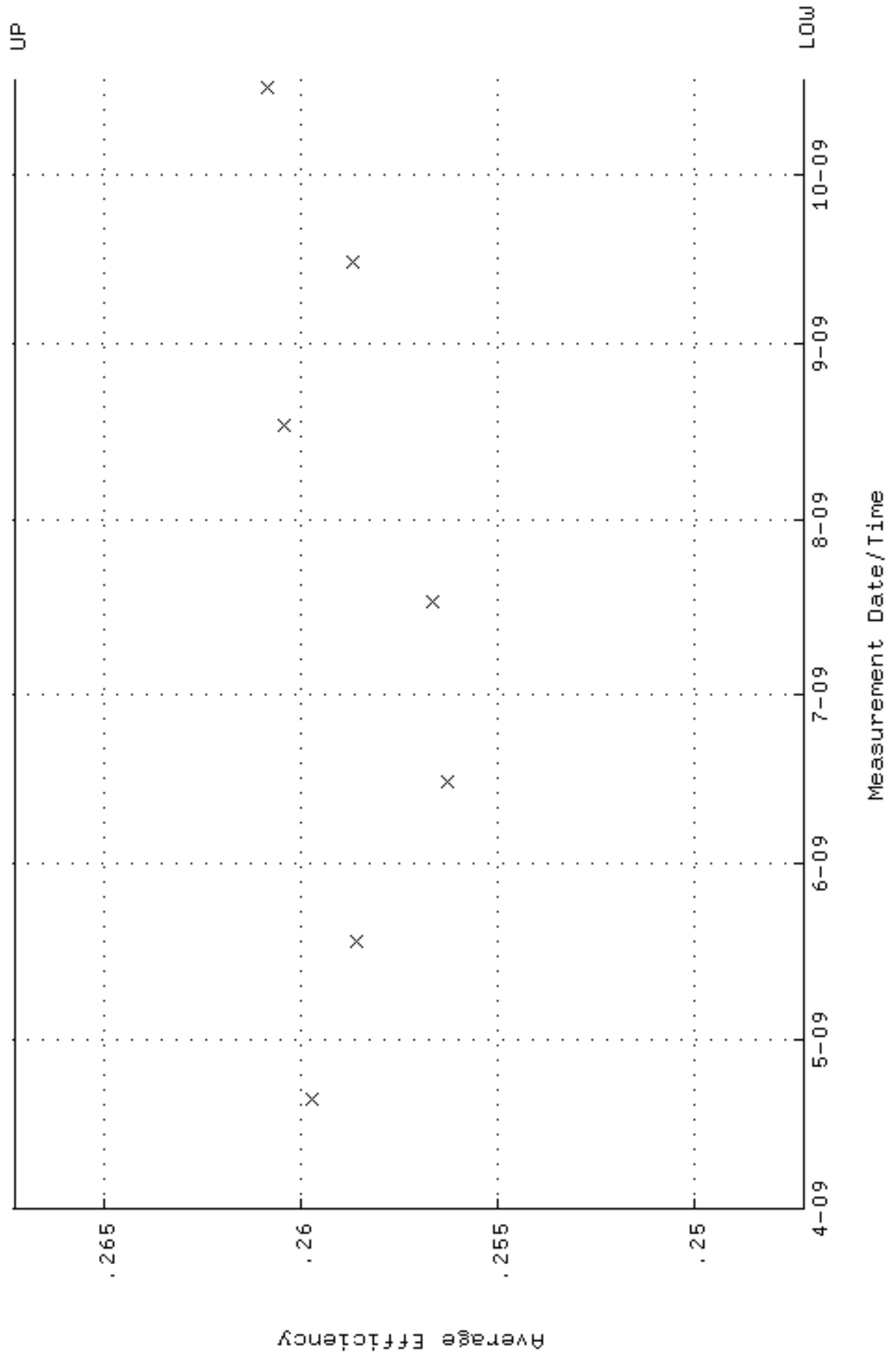
QA filename : DKA100:[ENV\_ALPHA.QA.W]w154.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:15 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 79.9003 through 88.3109



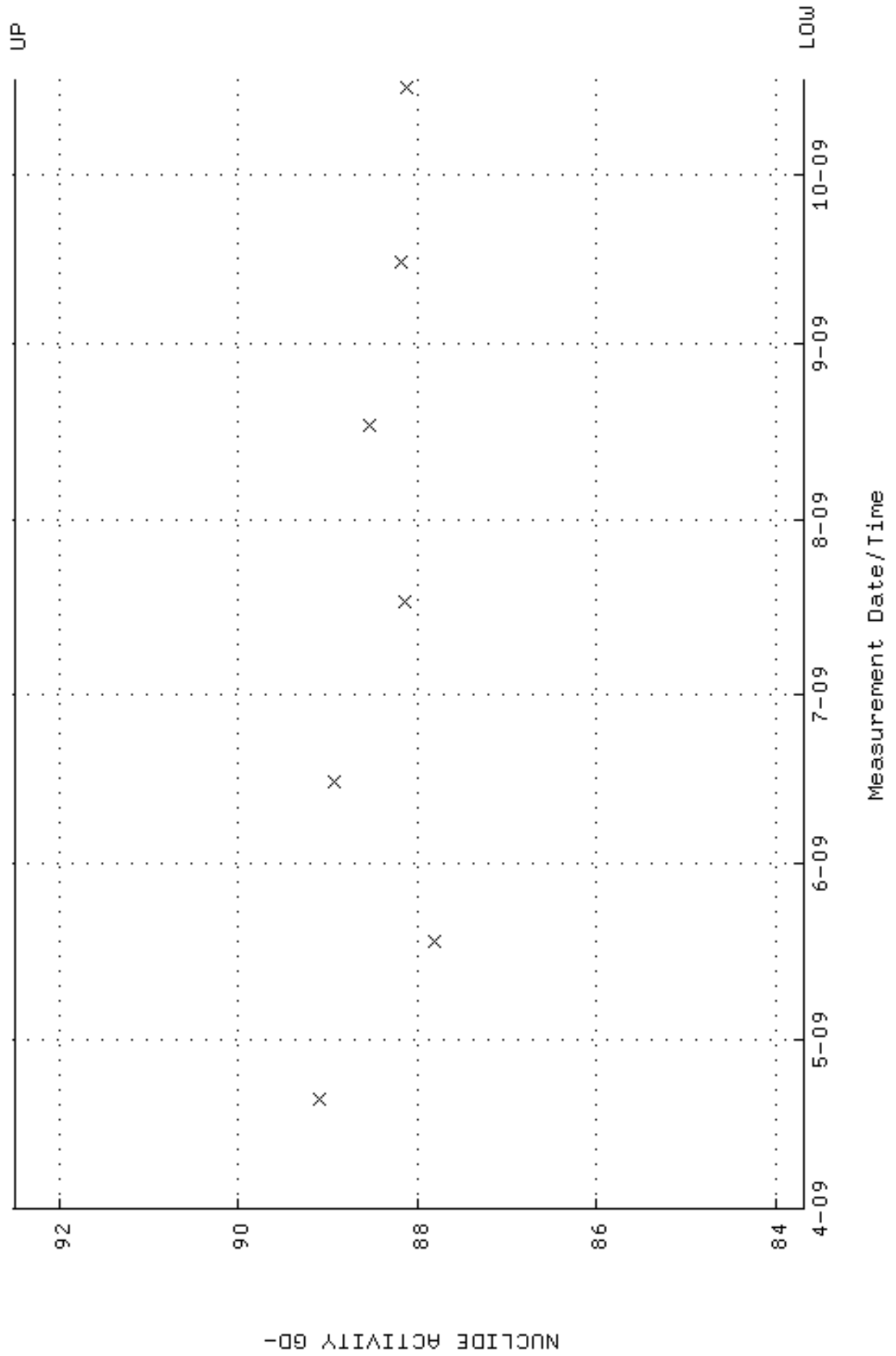
QA filename : DKA100:[ENV\_ALPHA.QA.B]B154.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:50 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



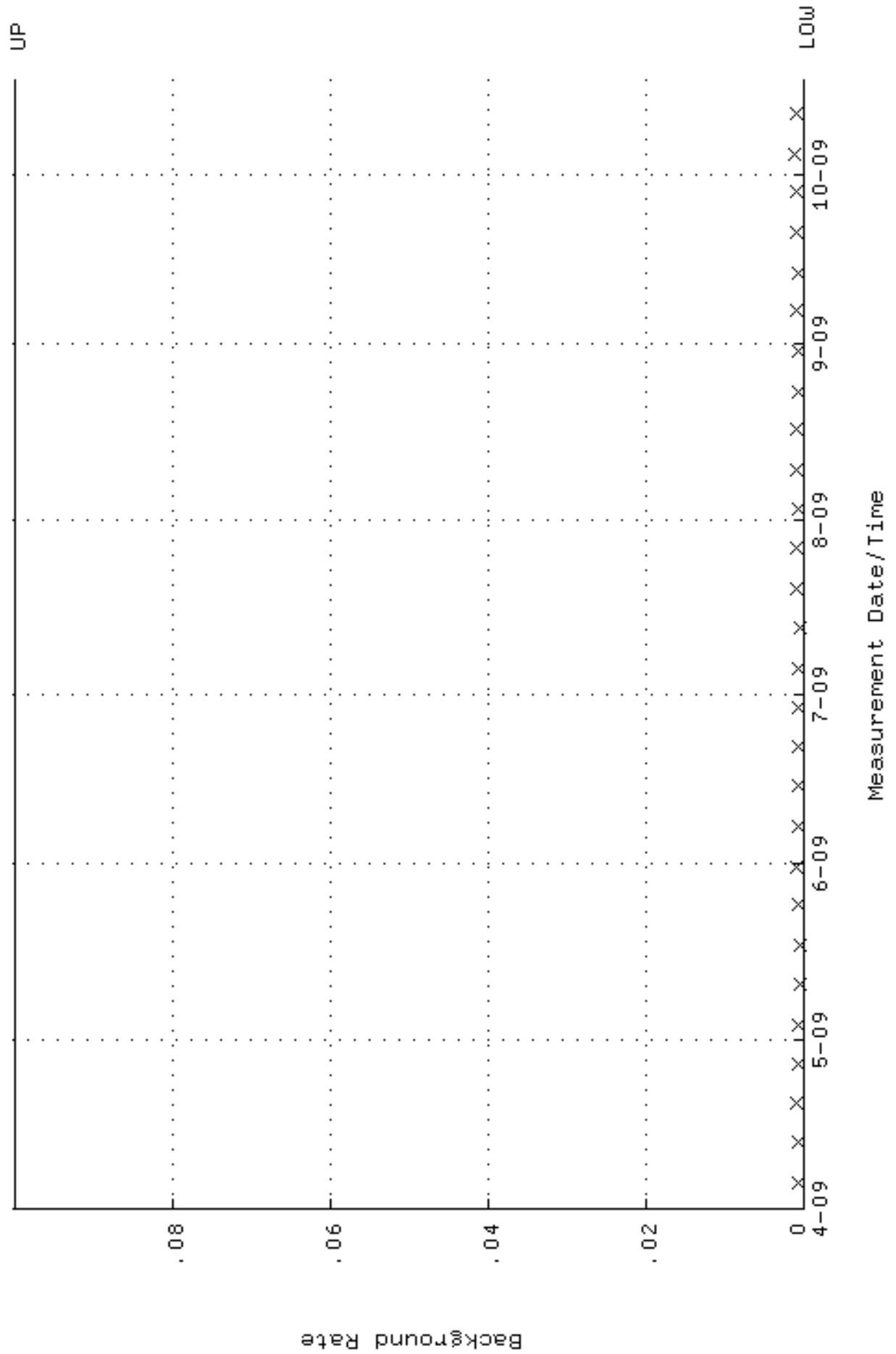
QA filename : DKA100:[ENV\_ALPHA.QA.W]W155.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:20 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.247241 through 0.267241



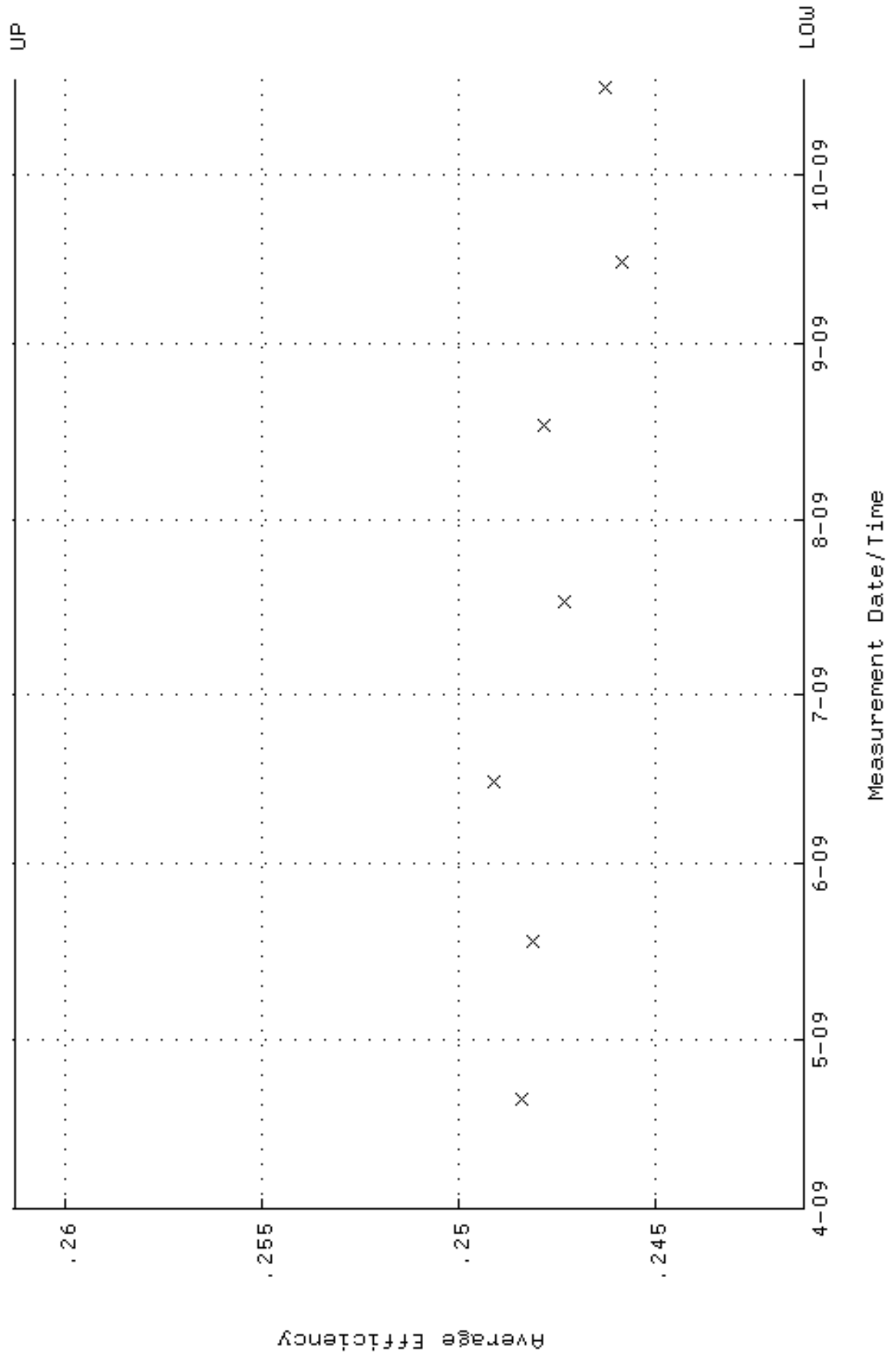
QA filename : DKA100:[ENV\_ALPHA.QA.W]w155.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:20 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 83.6873 through 92.4965



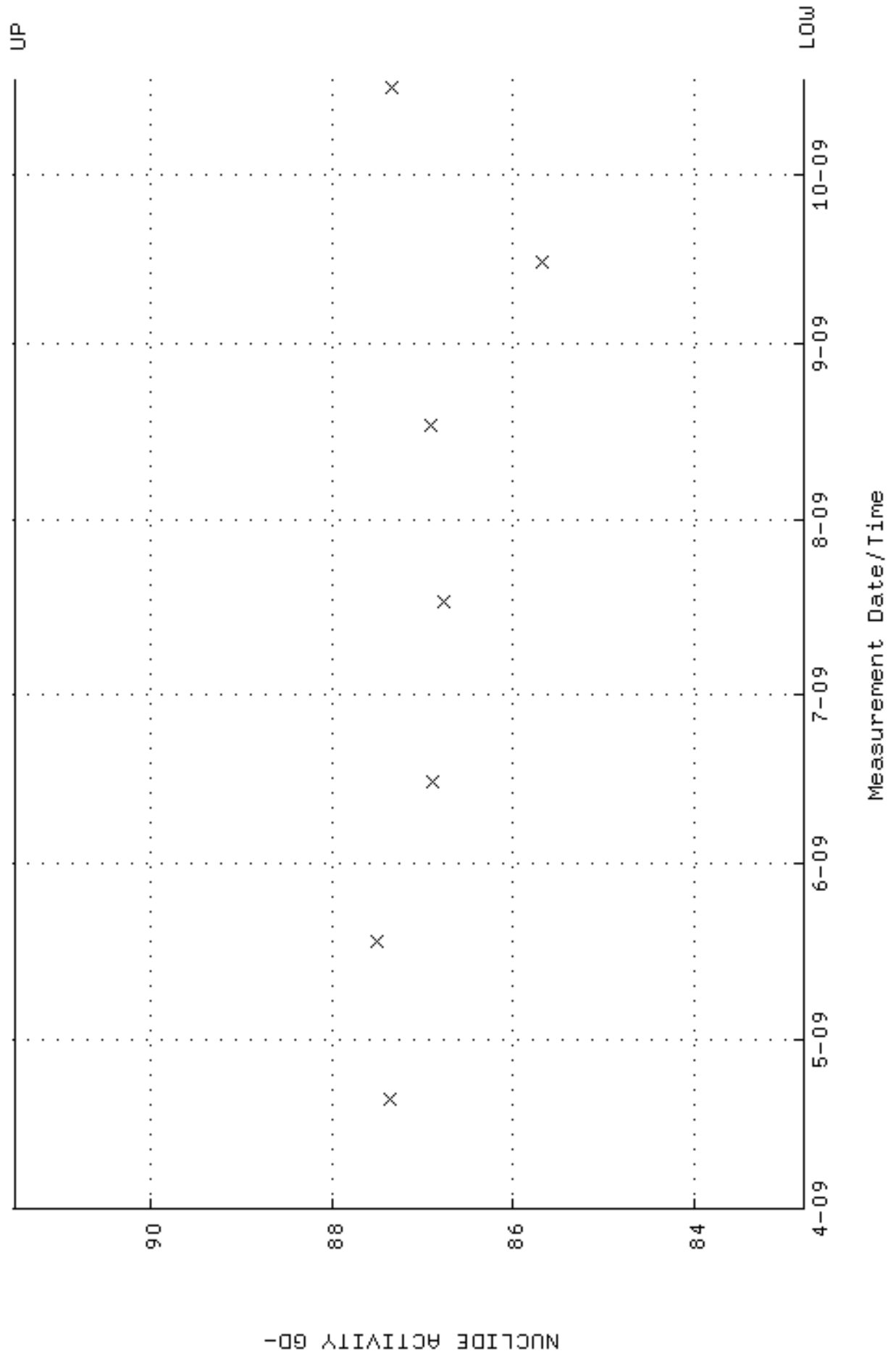
QA filename : DKA100:[ENV\_ALPHA.QA.B]B155.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:54 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



QA filename : DKA100:[ENV\_ALPHA.QA.W]w156.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:25 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.241250 through 0.261250

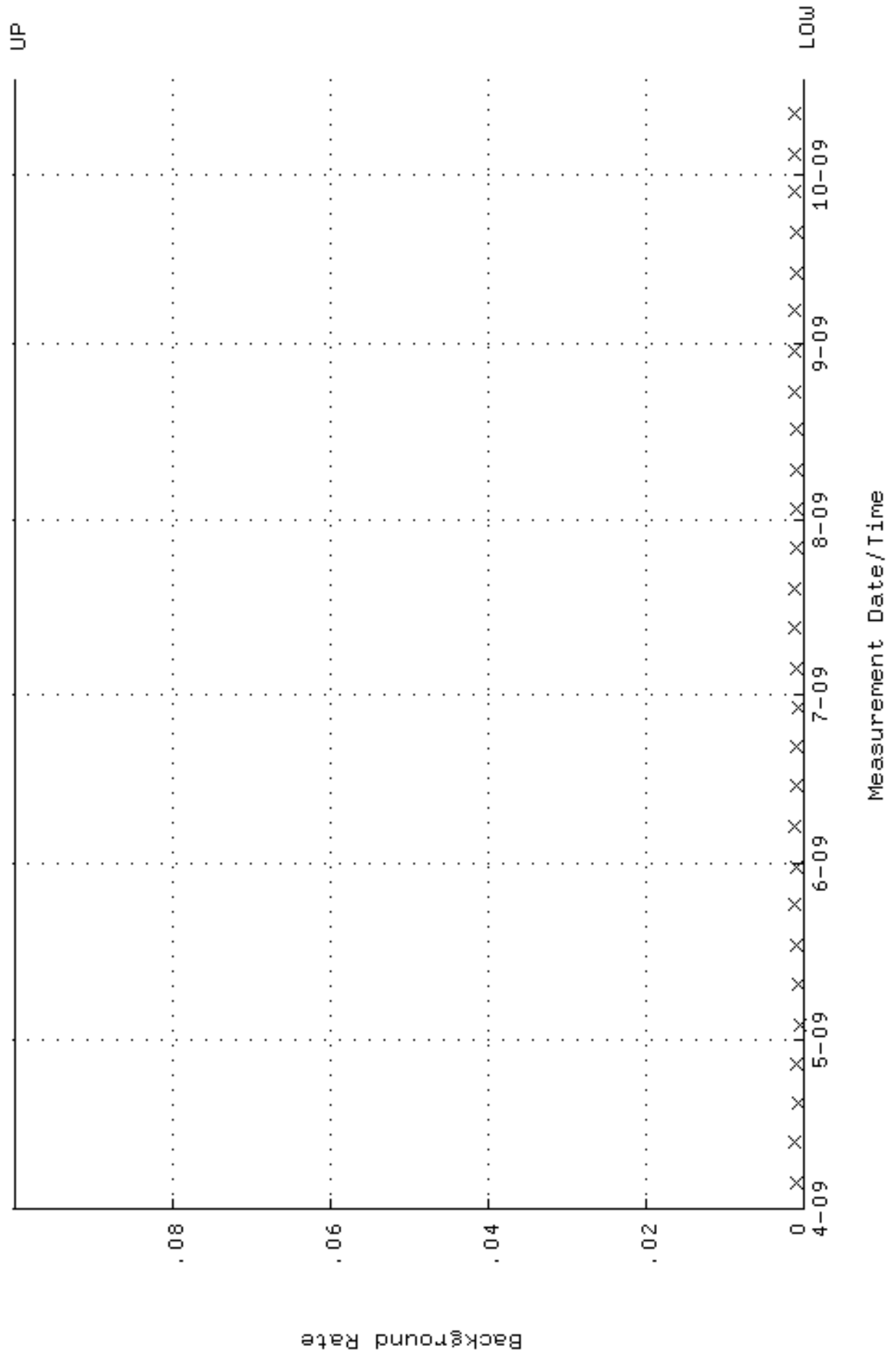


QA filename : DKA100:[ENV\_ALPHA.QA.W]w156.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:25 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 82.7847 through 91.4989

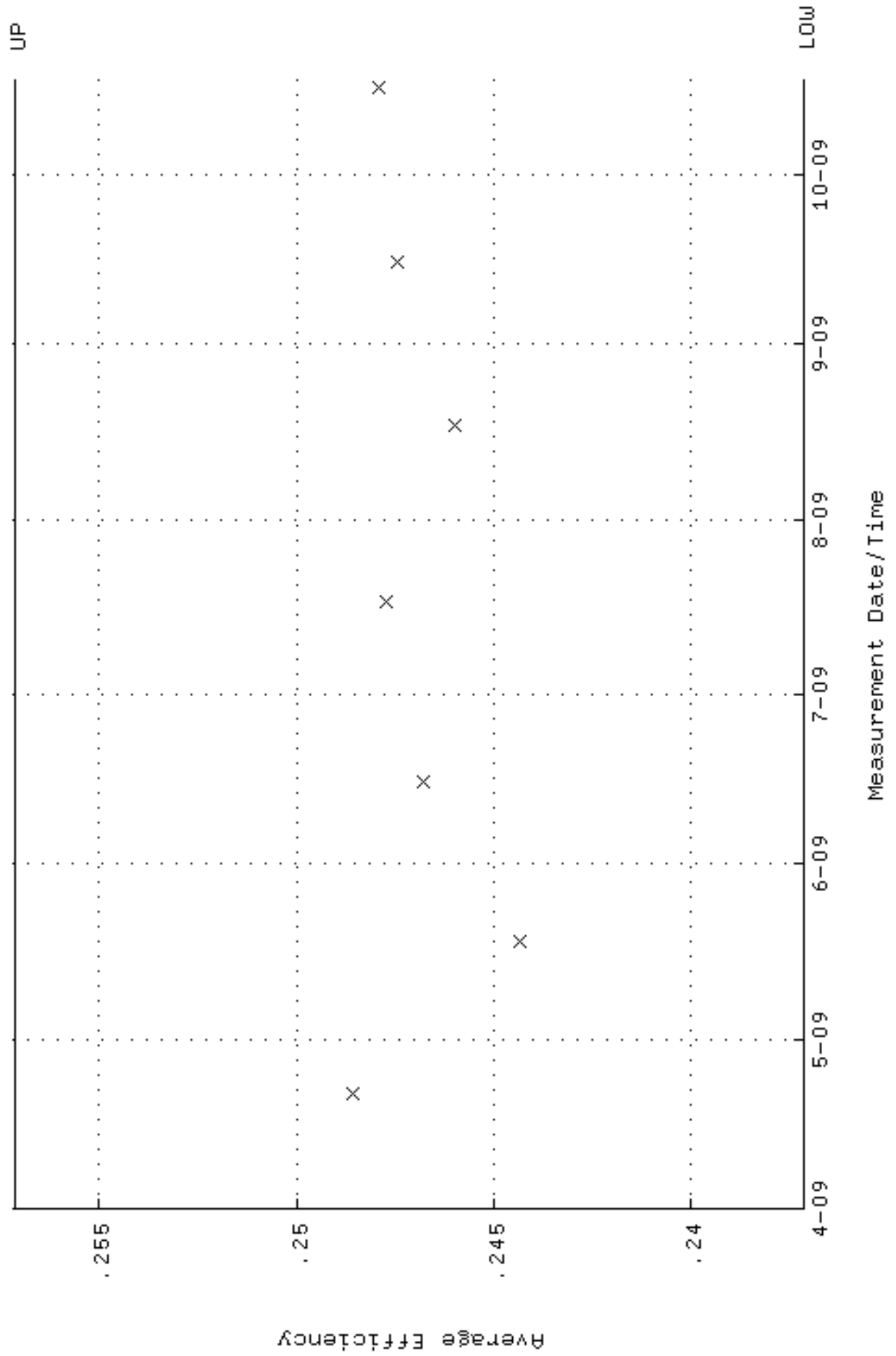




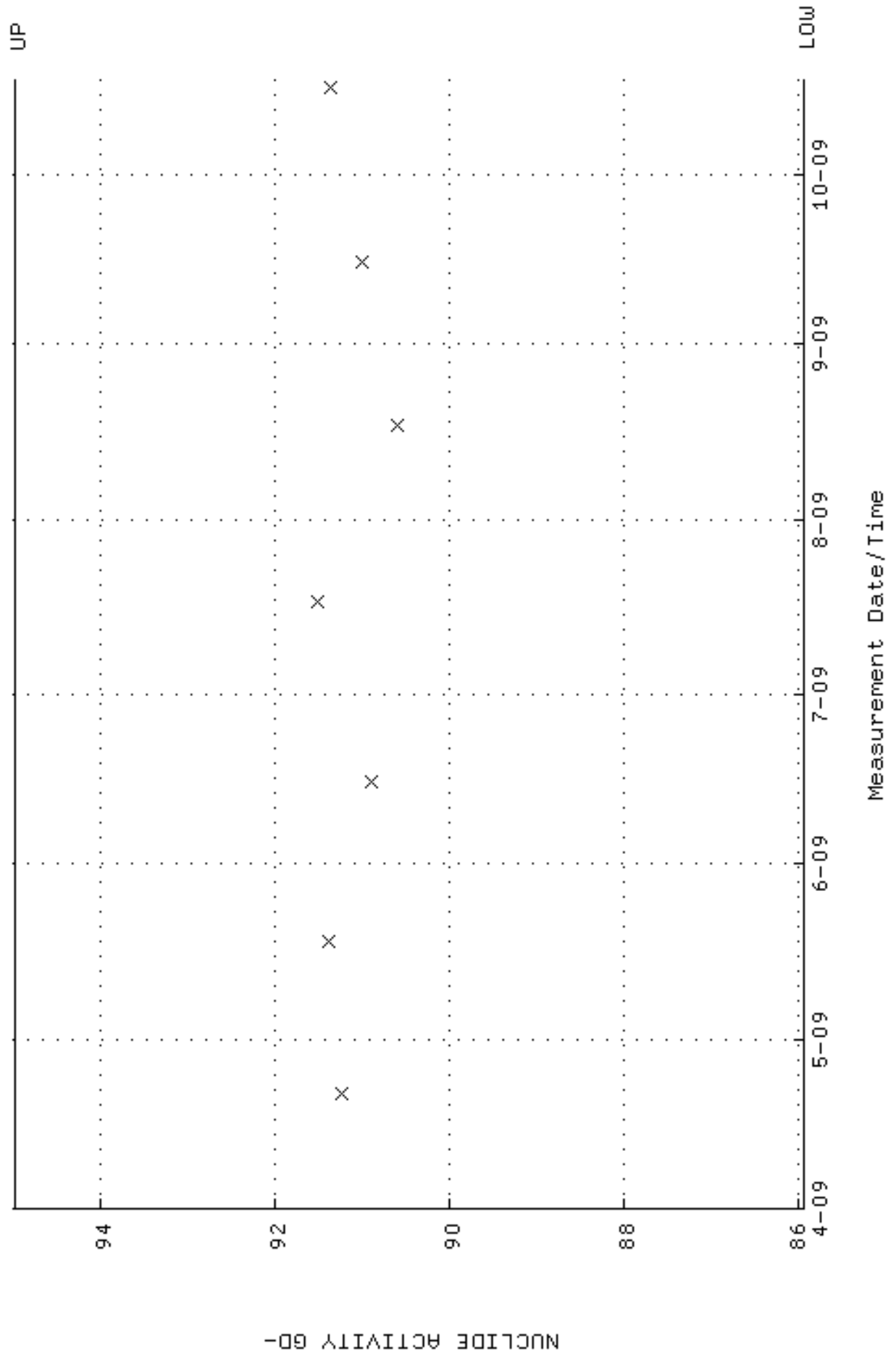
QA filename : DKA100:[ENV\_ALPHA.QA.B]B156.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:36:58 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



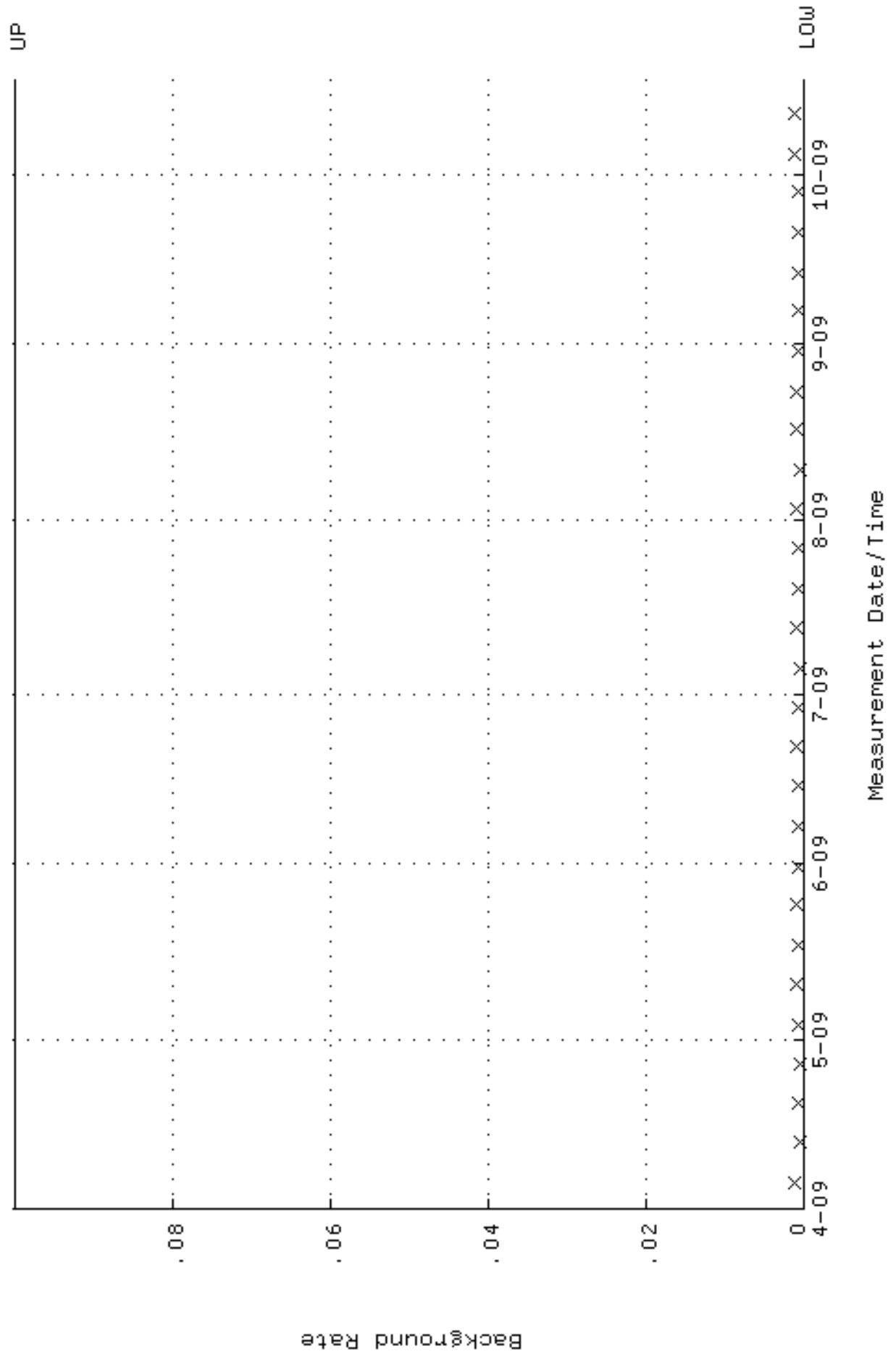
QA filename : DKA100:[ENV\_ALPHA.QA.W]w157.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 21-APR-2009 07:23:09 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.237137 through 0.257137



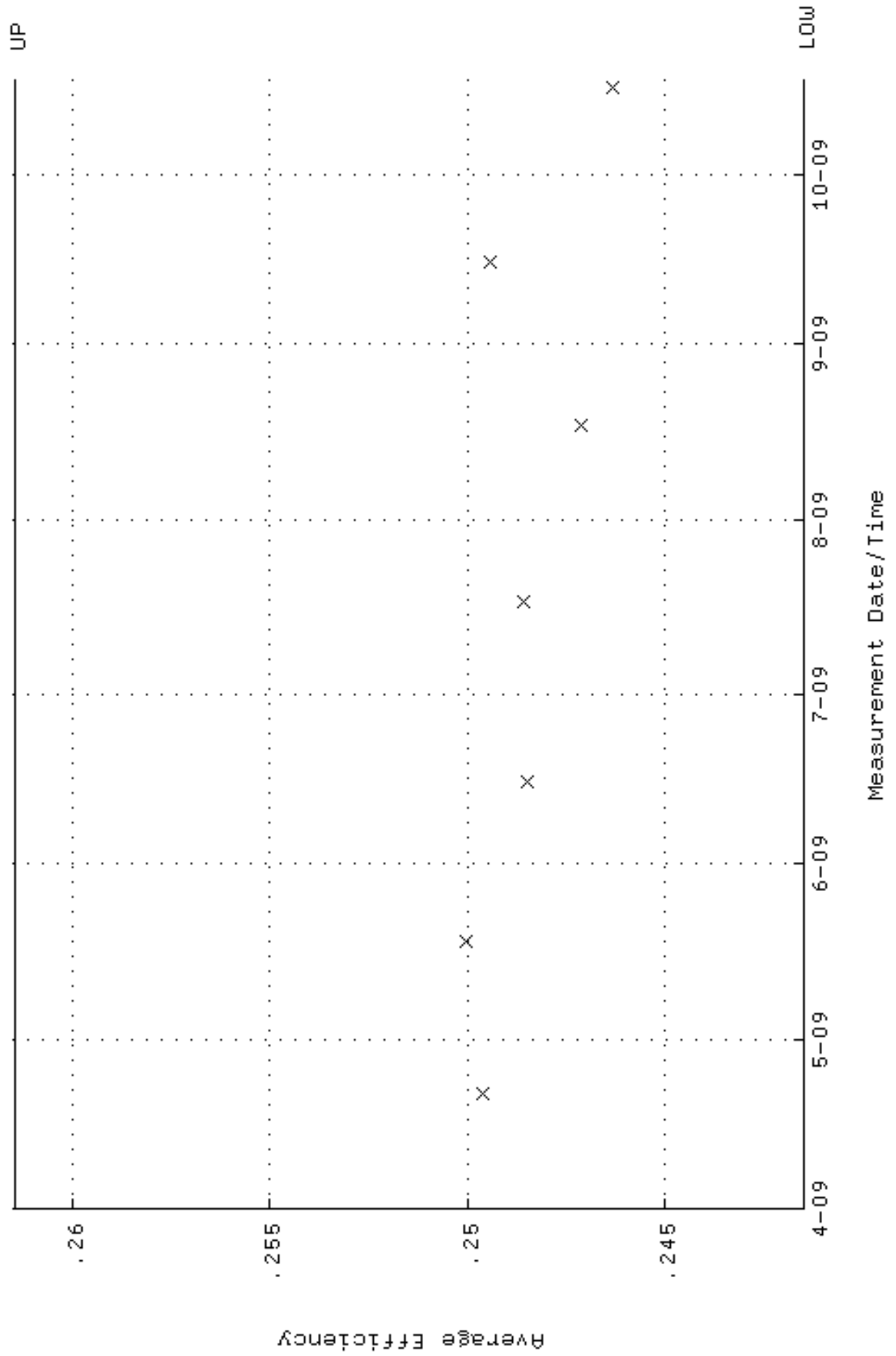
QA filename : DKA100:[ENV\_ALPHA.QA.W]w157.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 21-APR-2009 07:23:09 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 85.9292 through 94.9744



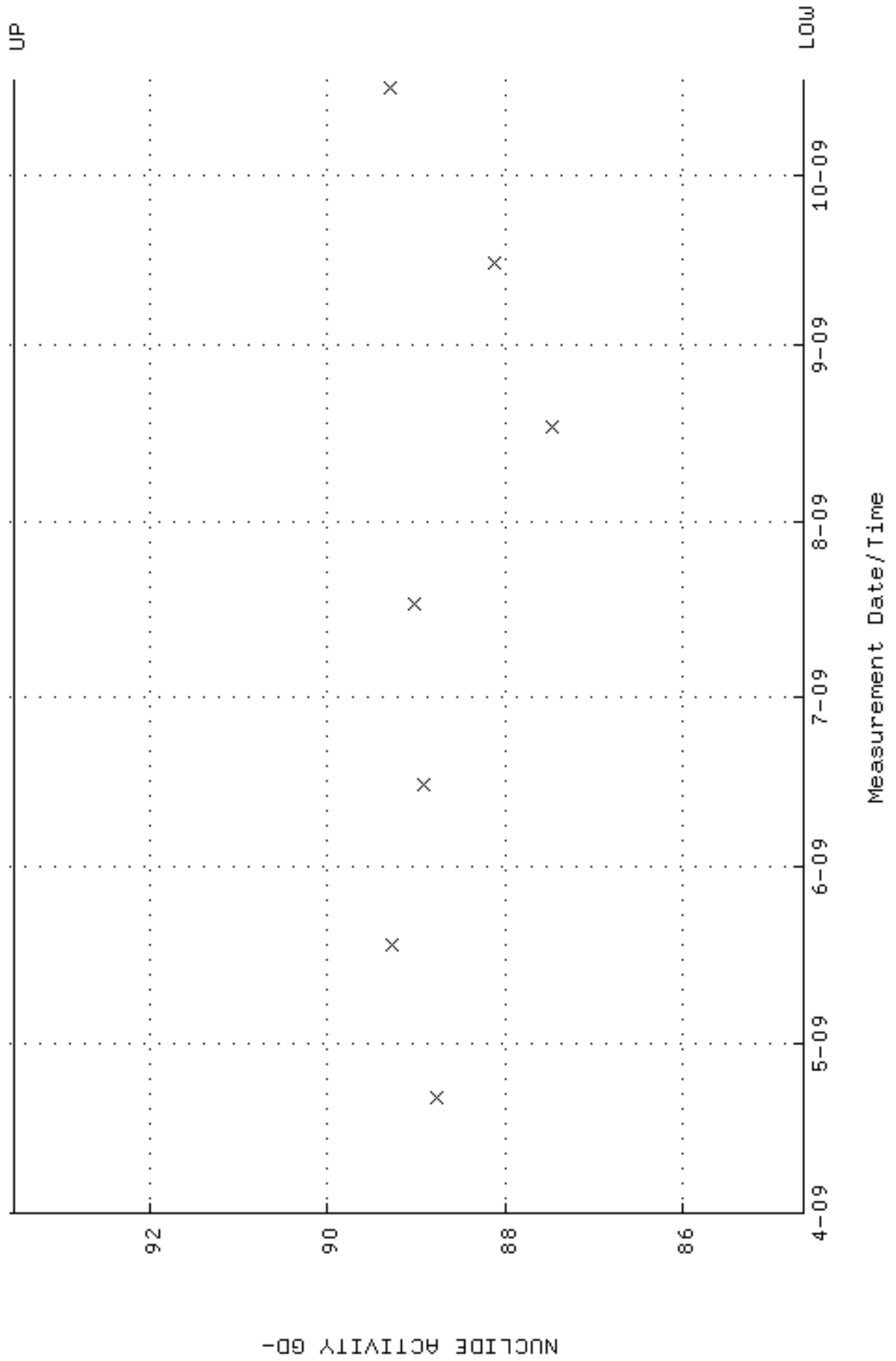
QA filename : DKA100:[ENV\_ALPHA.QA.B]B157.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:37:02 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



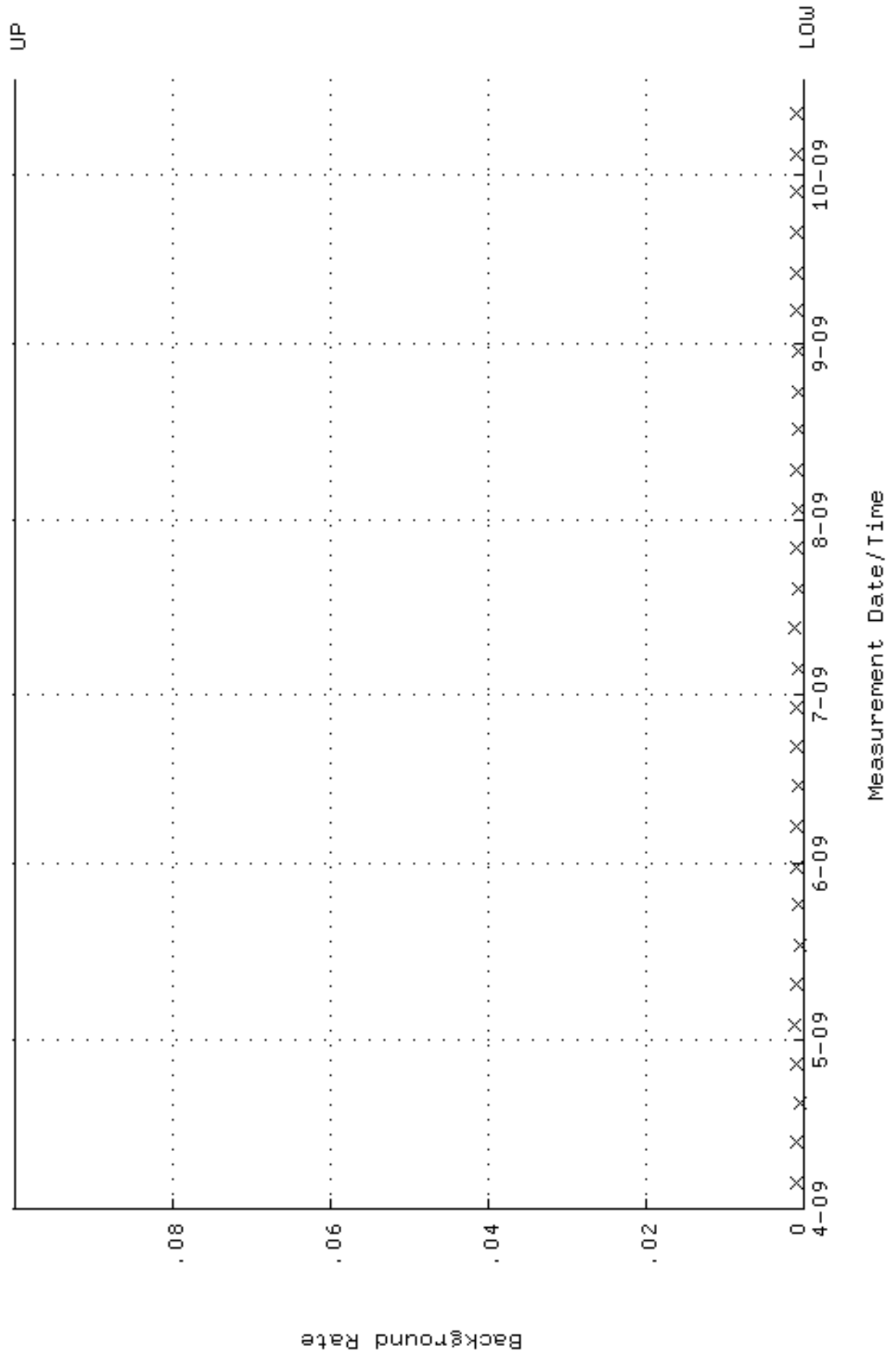
QA filename : DKA100:[ENV\_ALPHA.QA.W]W158.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 21-APR-2009 07:23:21 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.241466 through 0.261466



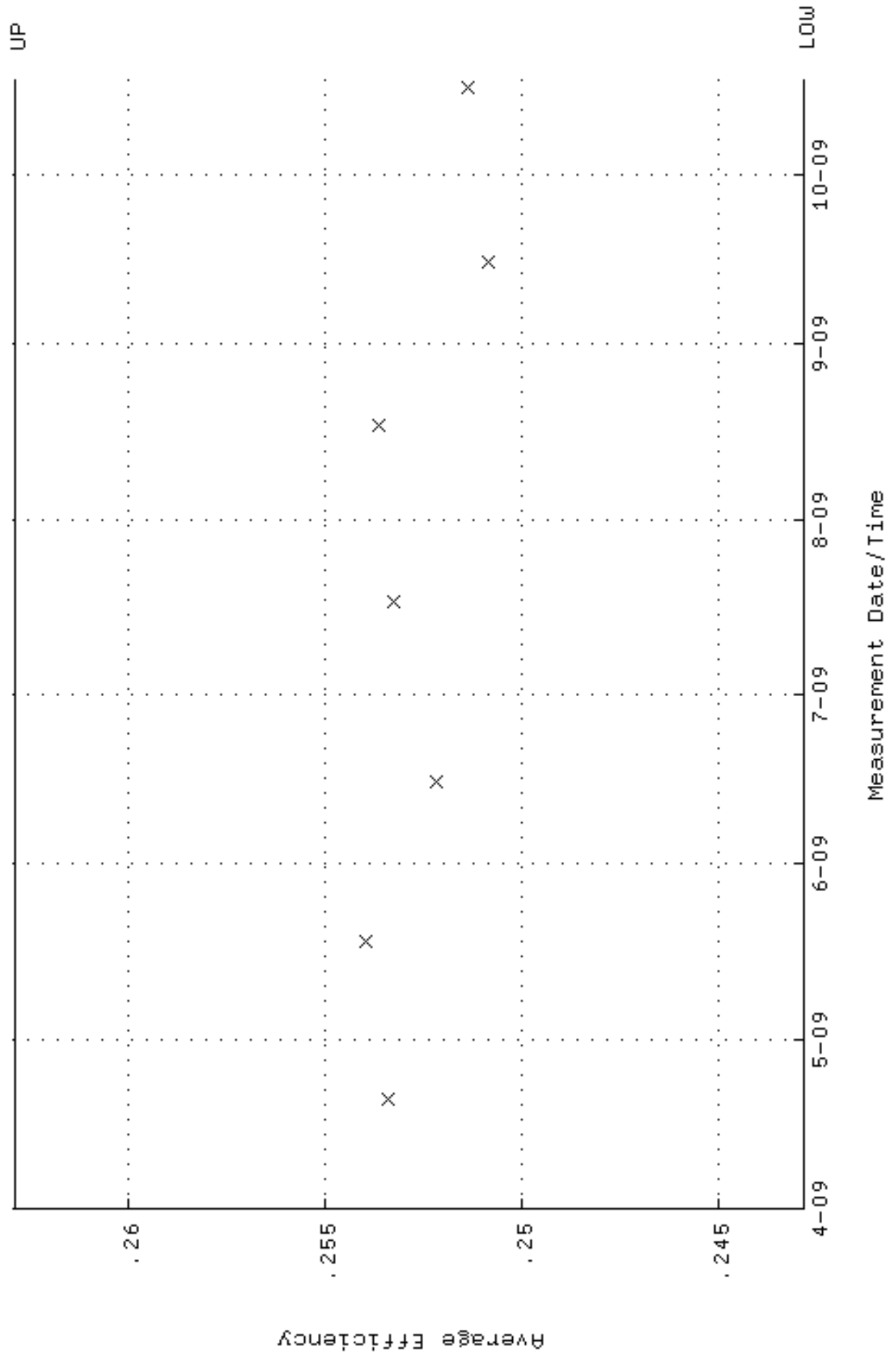
QA filename : DKA100:[ENV\_ALPHA.QA.W]w158.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 21-APR-2009 07:23:21 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 84.6414 through 93.5510



QA filename : DKA100:[ENV\_ALPHA.QA.B]B158.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:37:06 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

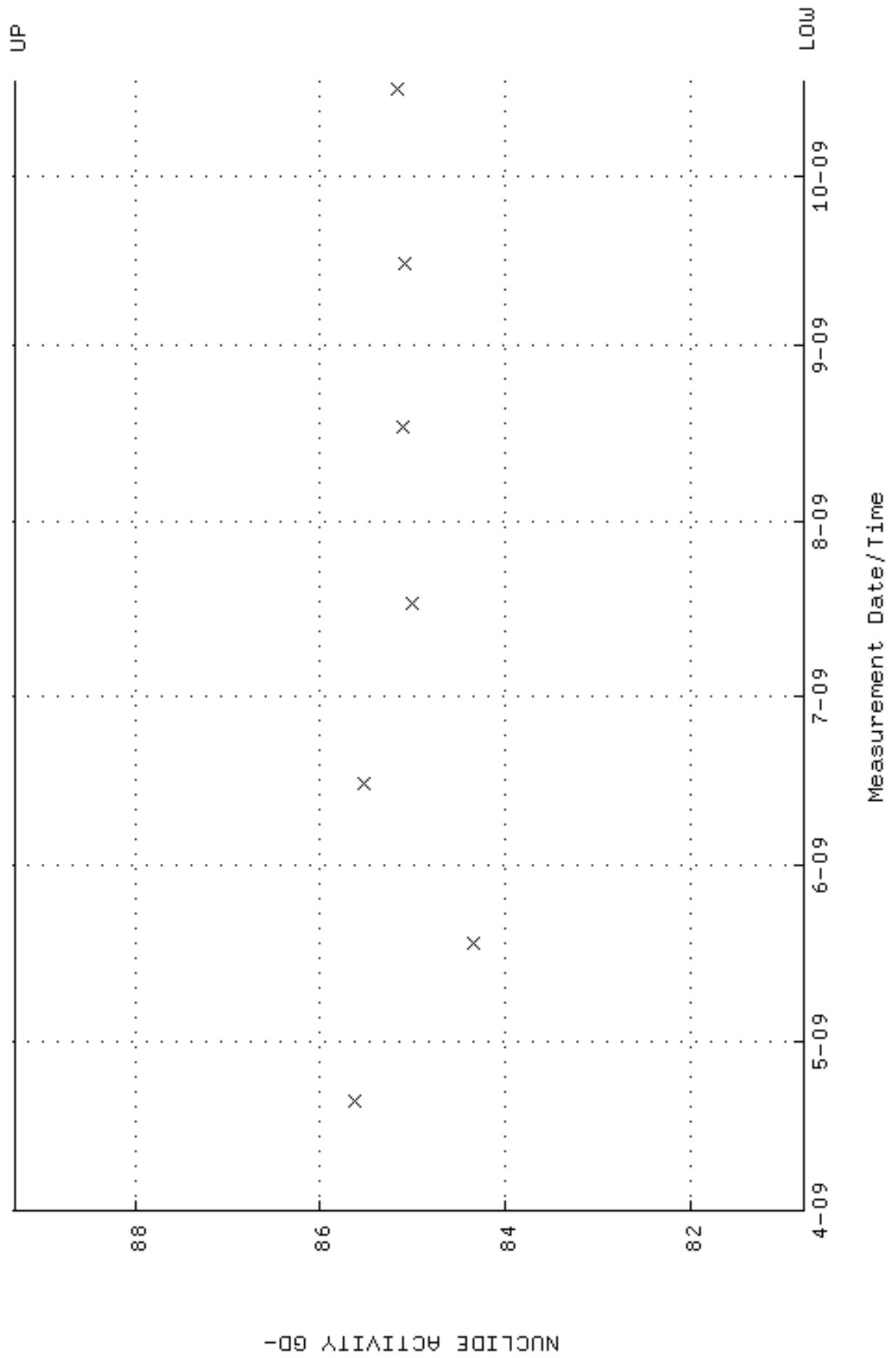


QA filename : DKA100:[ENV\_ALPHA.QA.W]W159.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:38 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.242851 through 0.262851

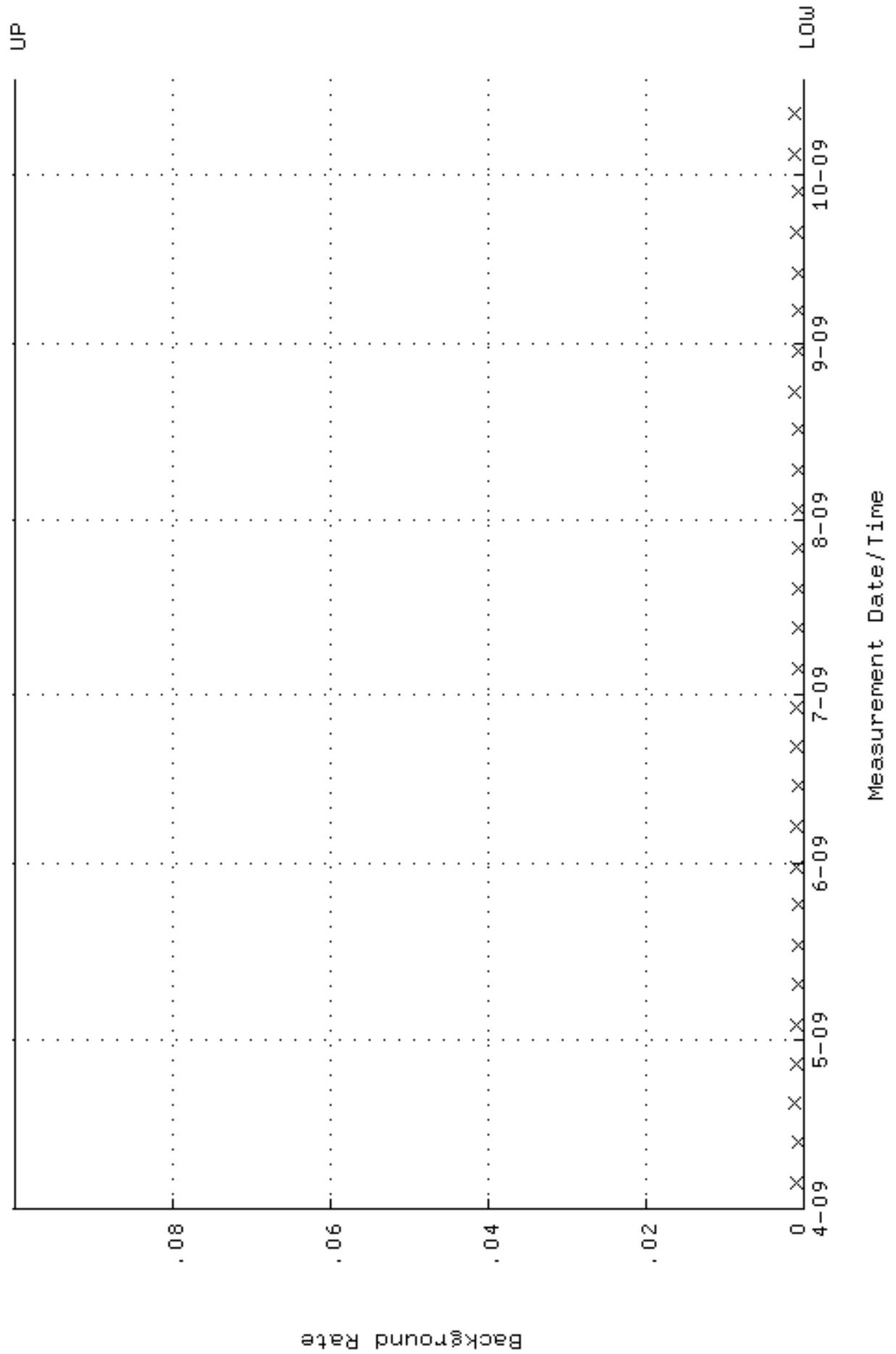




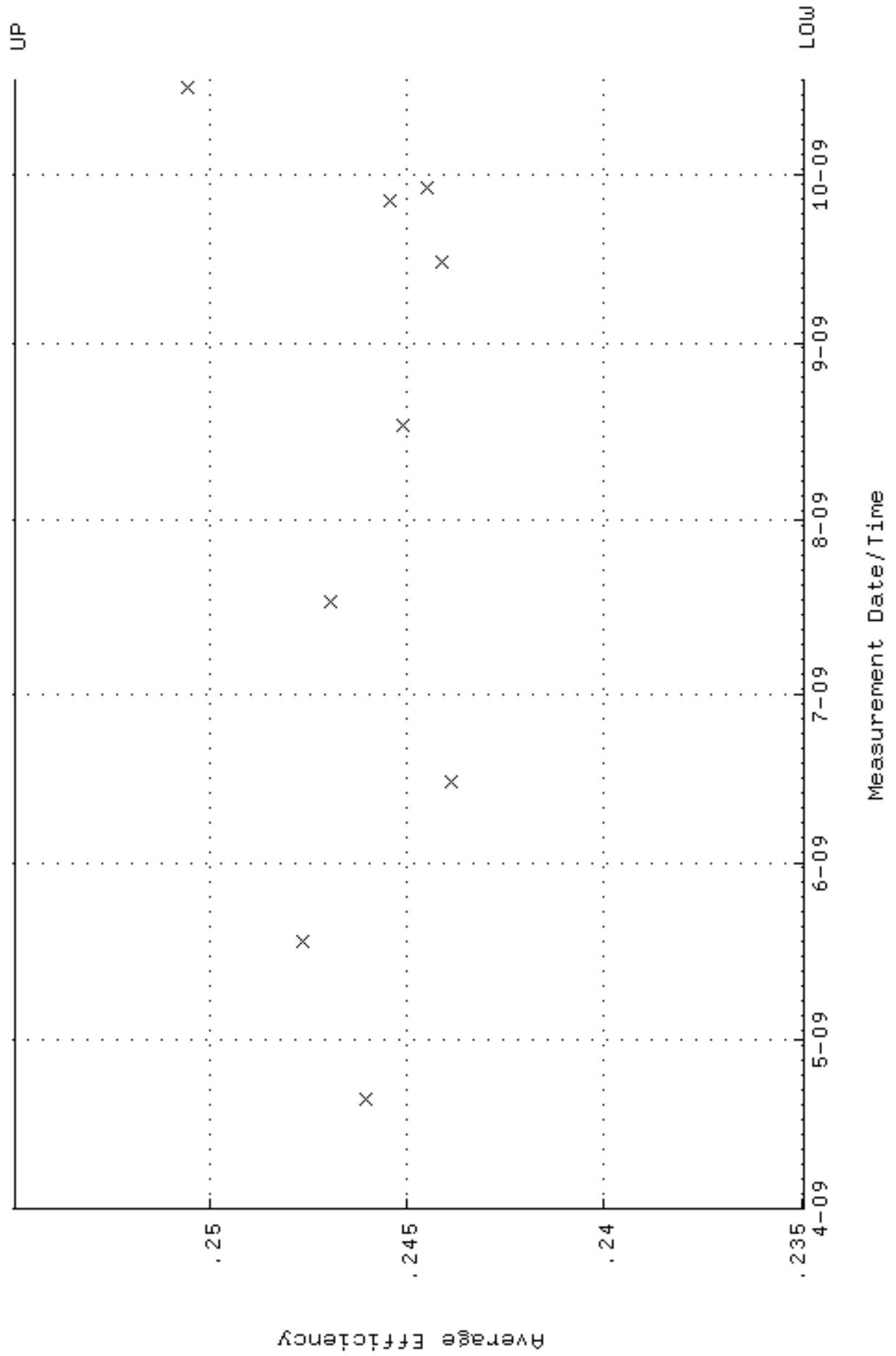
QA filename : DKA100:[ENV\_ALPHA.QA.W]w159.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:38 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 80.7870 through 89.2909



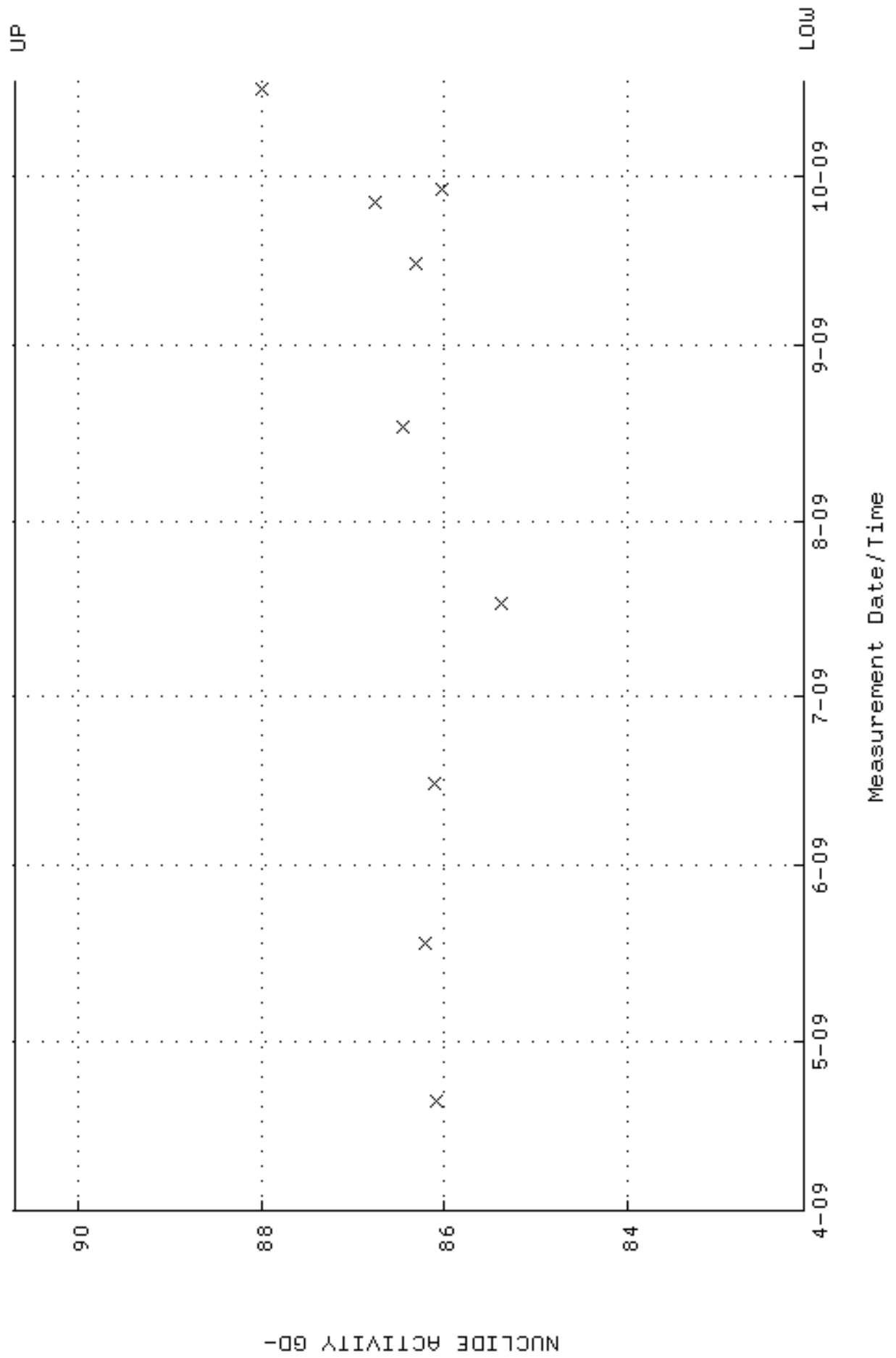
QA filename : DKA100:[ENV\_ALPHA.QA.B]B159.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:37:10 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



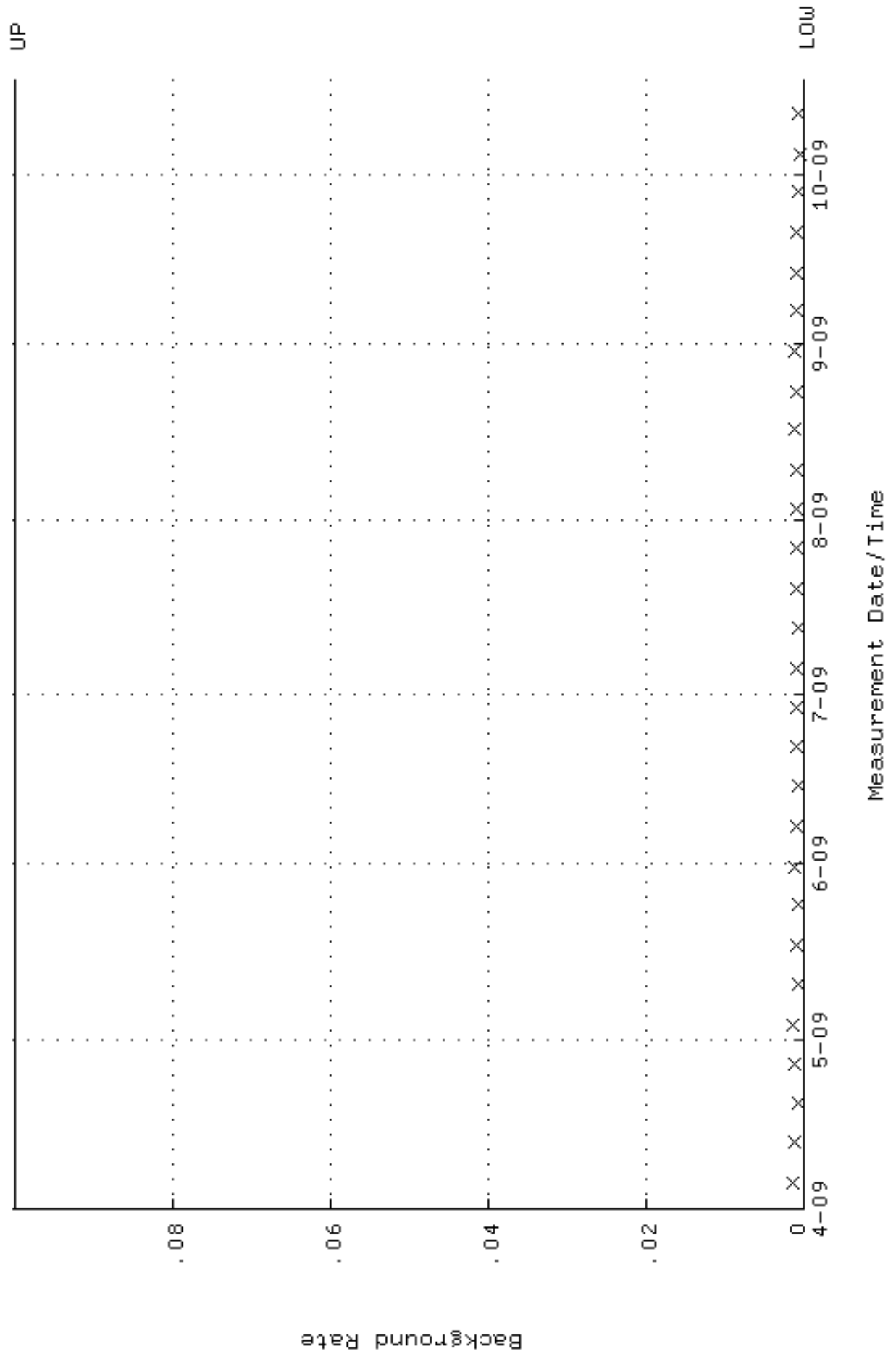
QA filename : DKA100:[ENV\_ALPHA.QA.W]W160.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 20-APR-2009 10:39:42 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.234941 through 0.254941



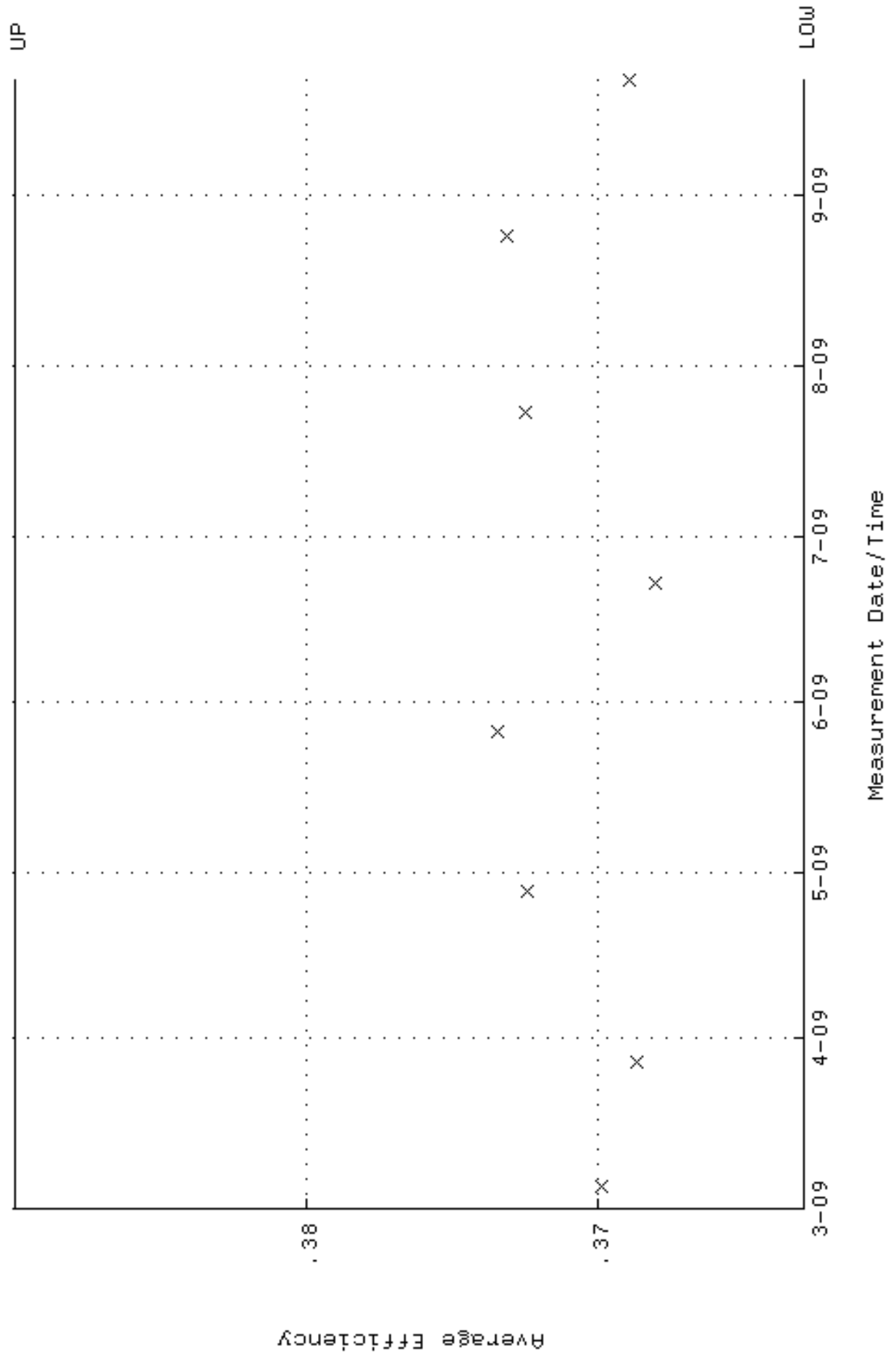
QA filename : DKA100:[ENV\_ALPHA.QA.W]w160.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 20-APR-2009 10:39:42 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 82.0594 through 90.6972



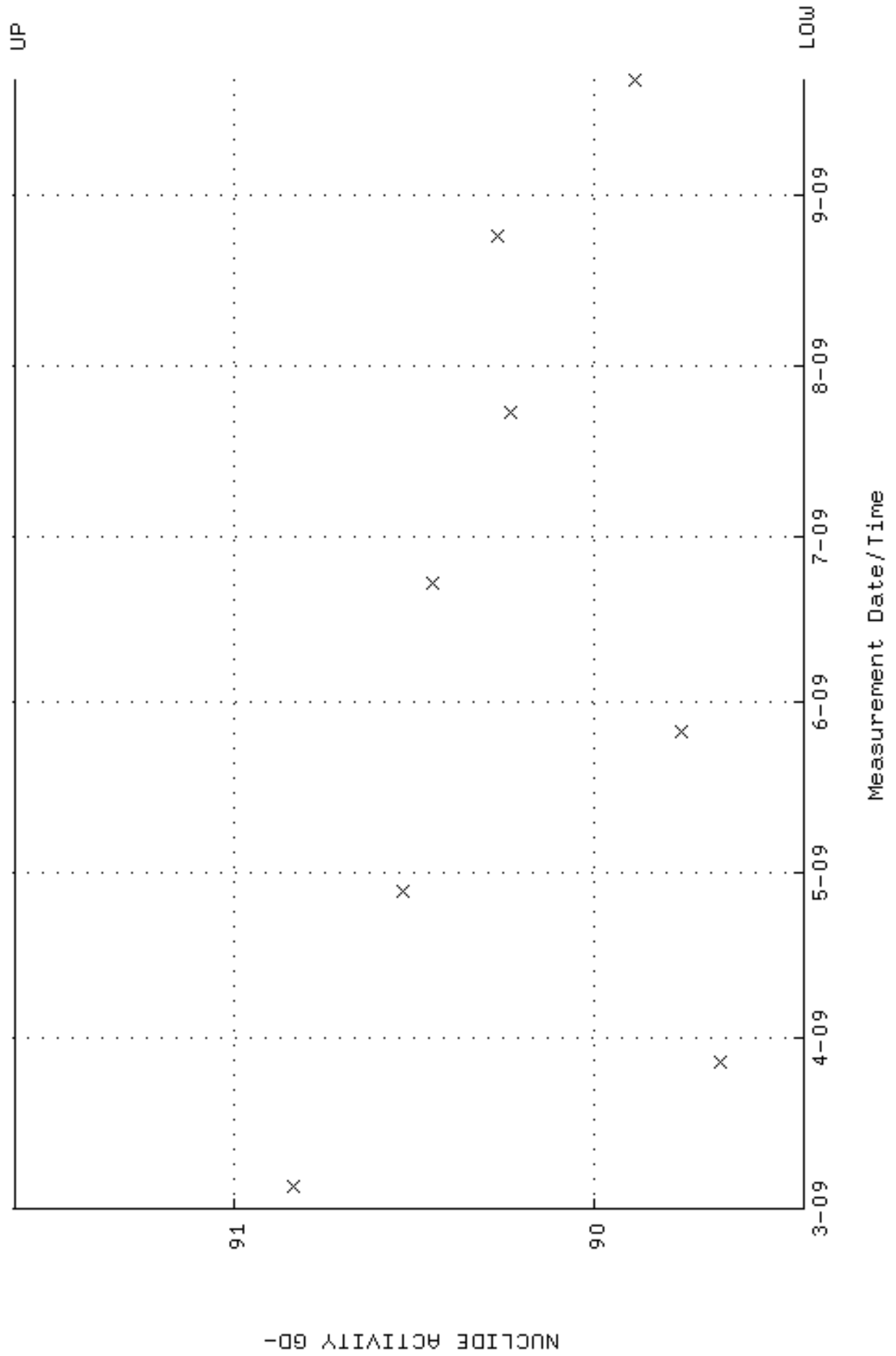
QA filename : DKA100:[ENV\_ALPHA.QA.B]B160.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 5-APR-2009 15:37:14 through 17-OCT-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



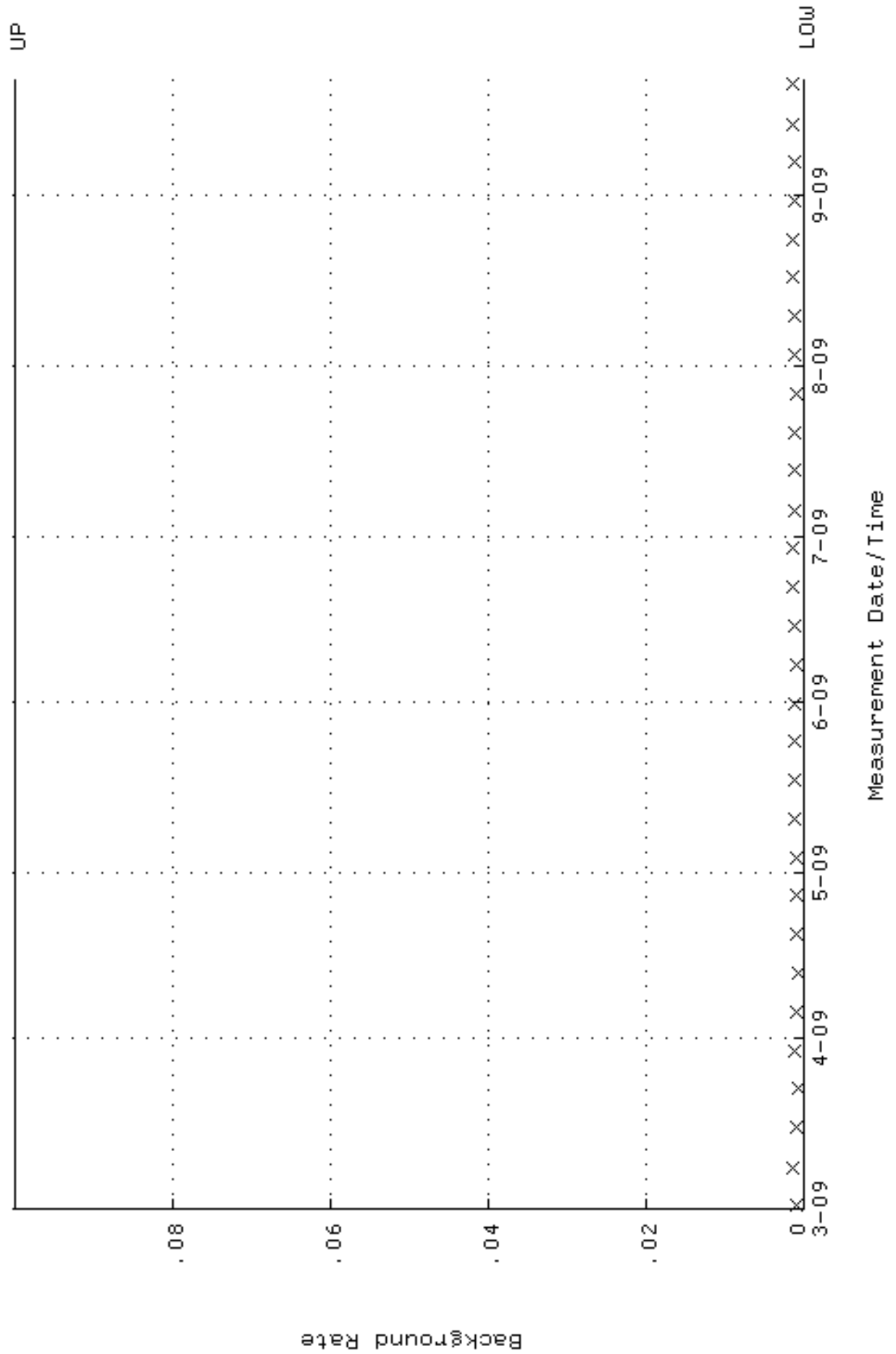
QA filename : DKA100:[ENV\_ALPHA.QA.W]W161.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:37:34 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.362982 through 0.389932



QA filename : DKA100:[ENV\_ALPHA.QA.W]w161.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:37:34 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 89.4216 through 91.6054

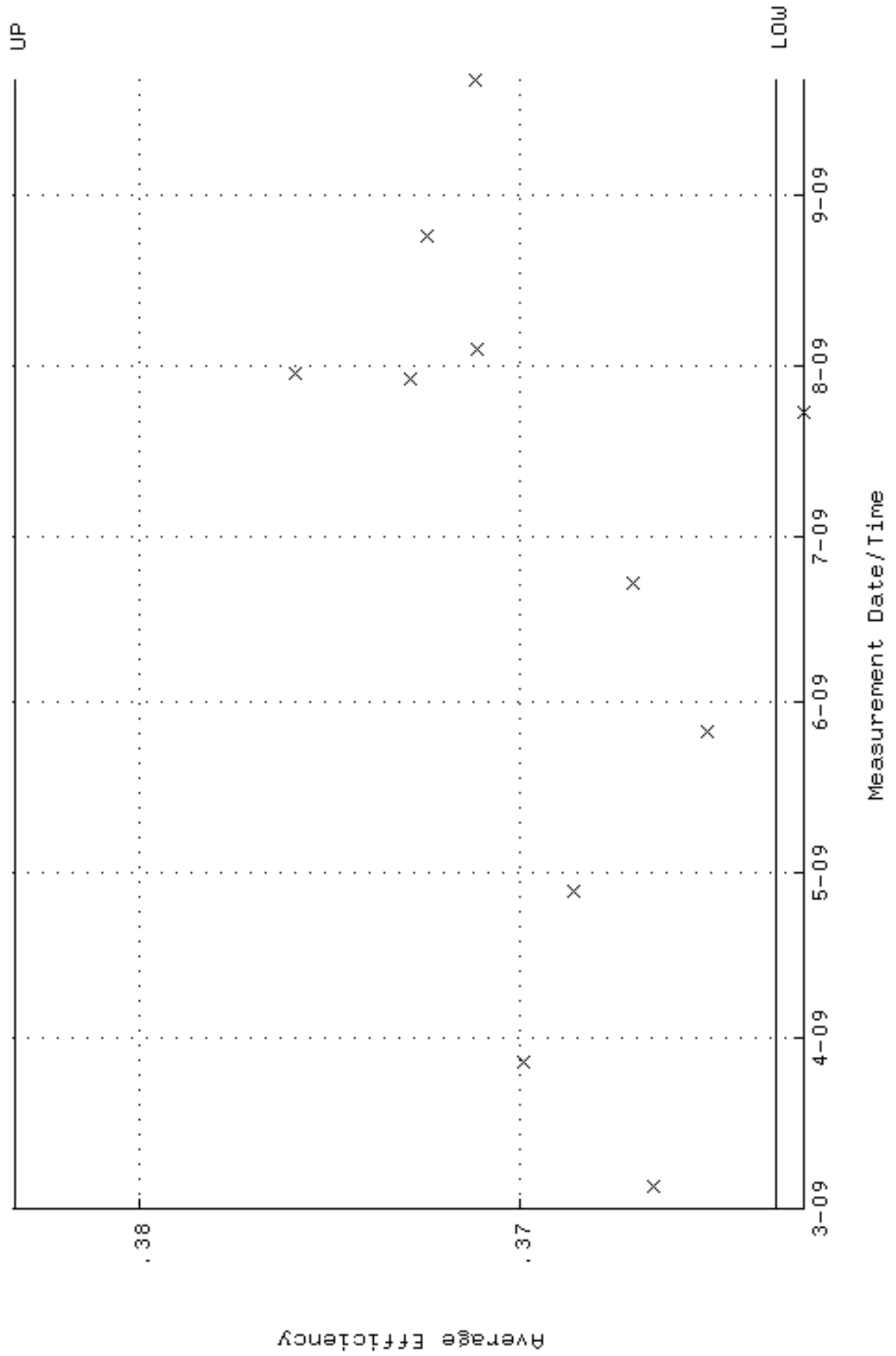


QA filename : DKA100:[ENV\_ALPHA.QA.B]B161.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:03 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

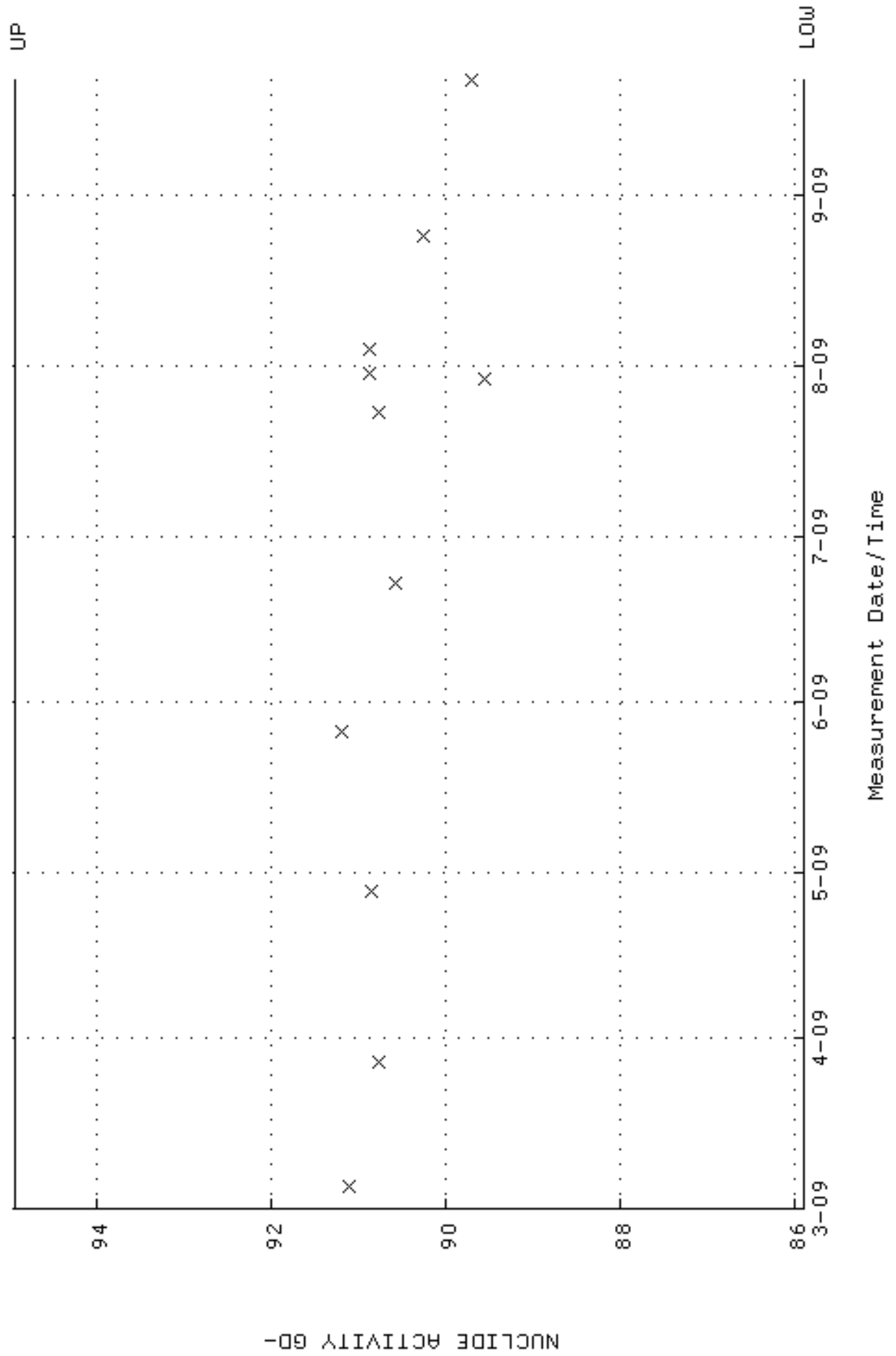




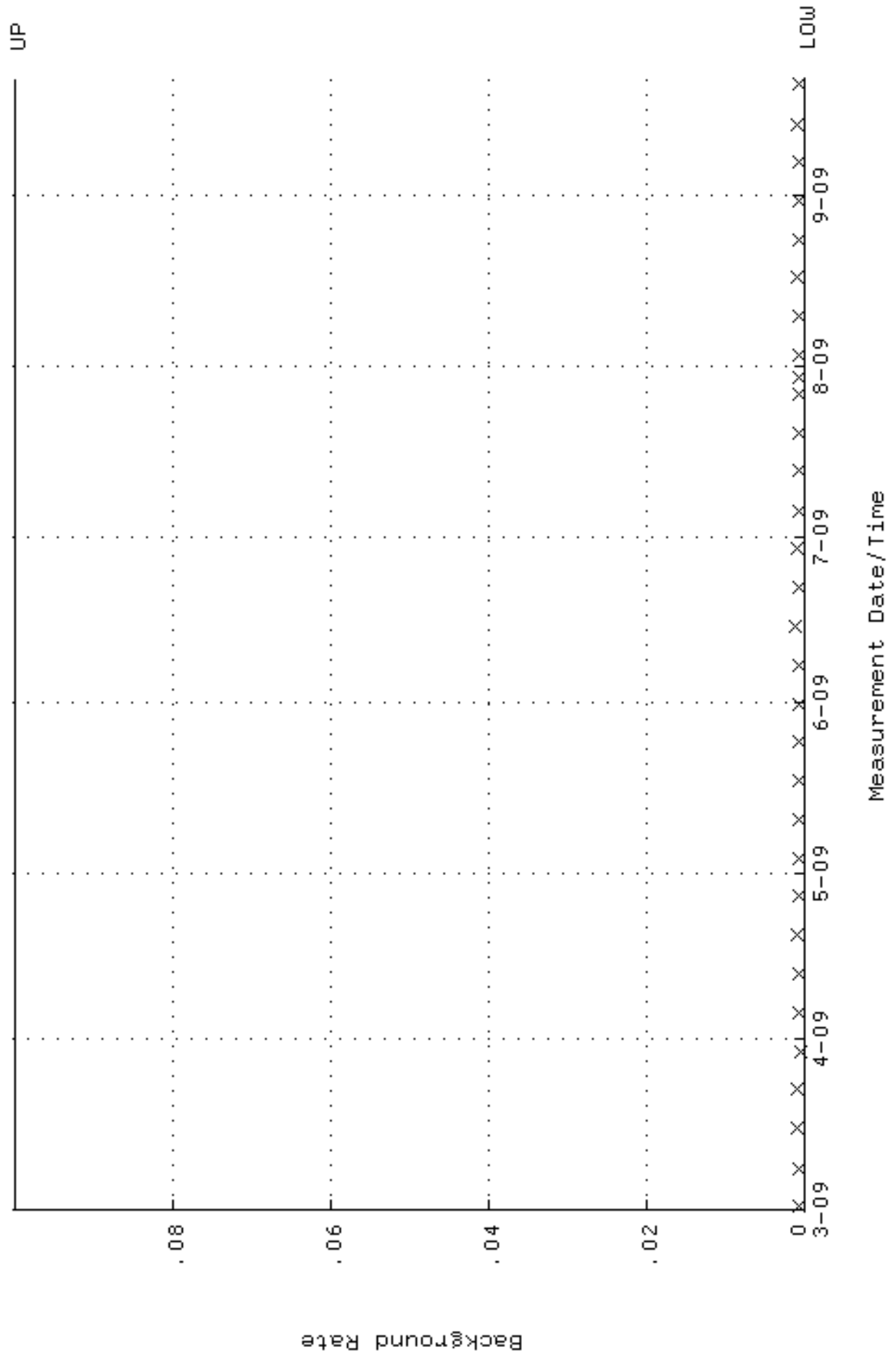
QA filename : DKA100:[ENV\_ALPHA.QA.W]W162.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:37:40 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.363287 through 0.383287



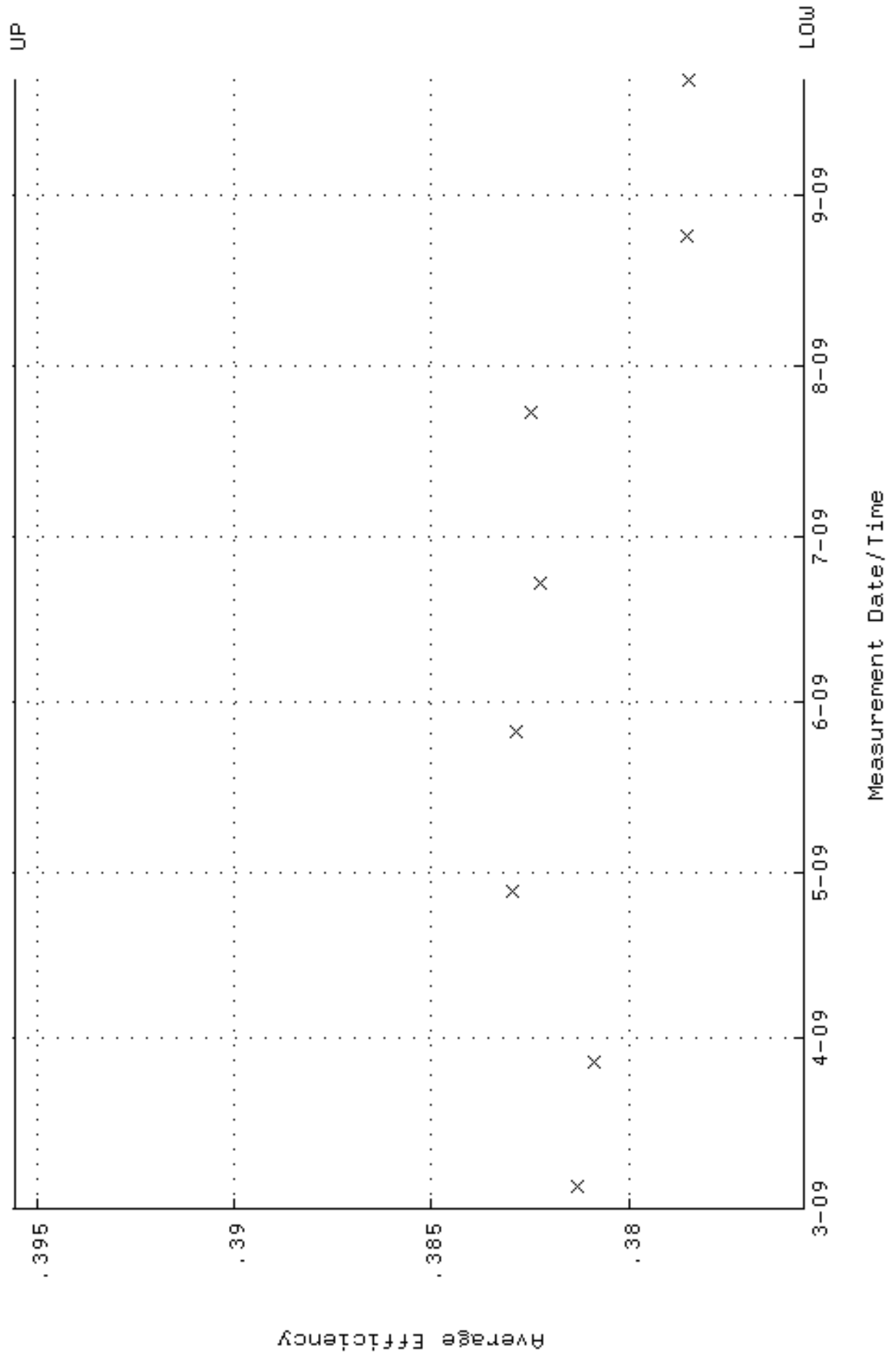
QA filename : DKA100:[ENV\_ALPHA.QA.W]w162.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:37:40 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 85.8969 through 94.9387



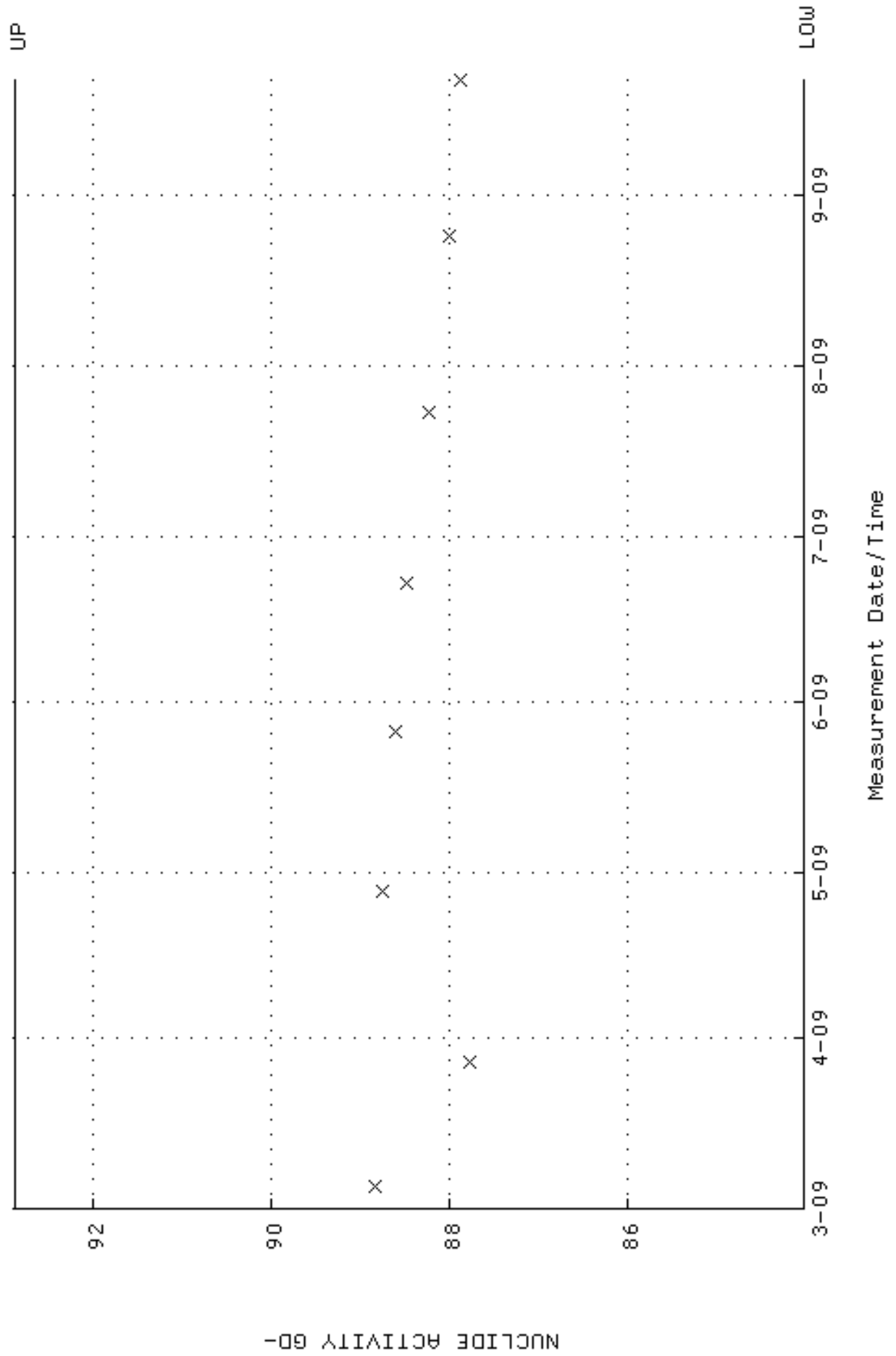
QA filename : DKA100:[ENV\_ALPHA.QA.B]B162.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:06 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



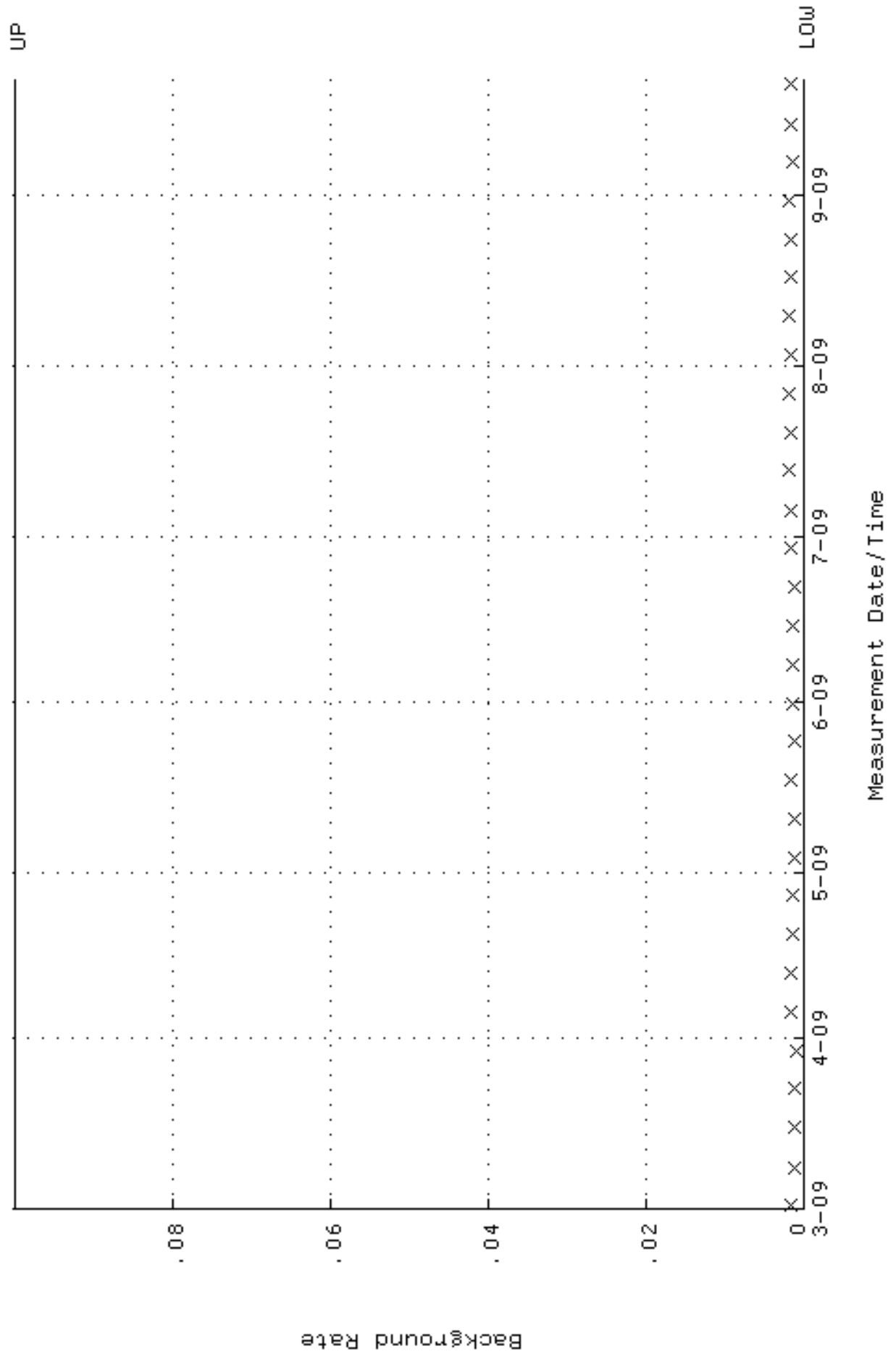
QA filename : DKA100:[ENV\_ALPHA.QA.W]W163.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:37:44 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.375557 through 0.395557



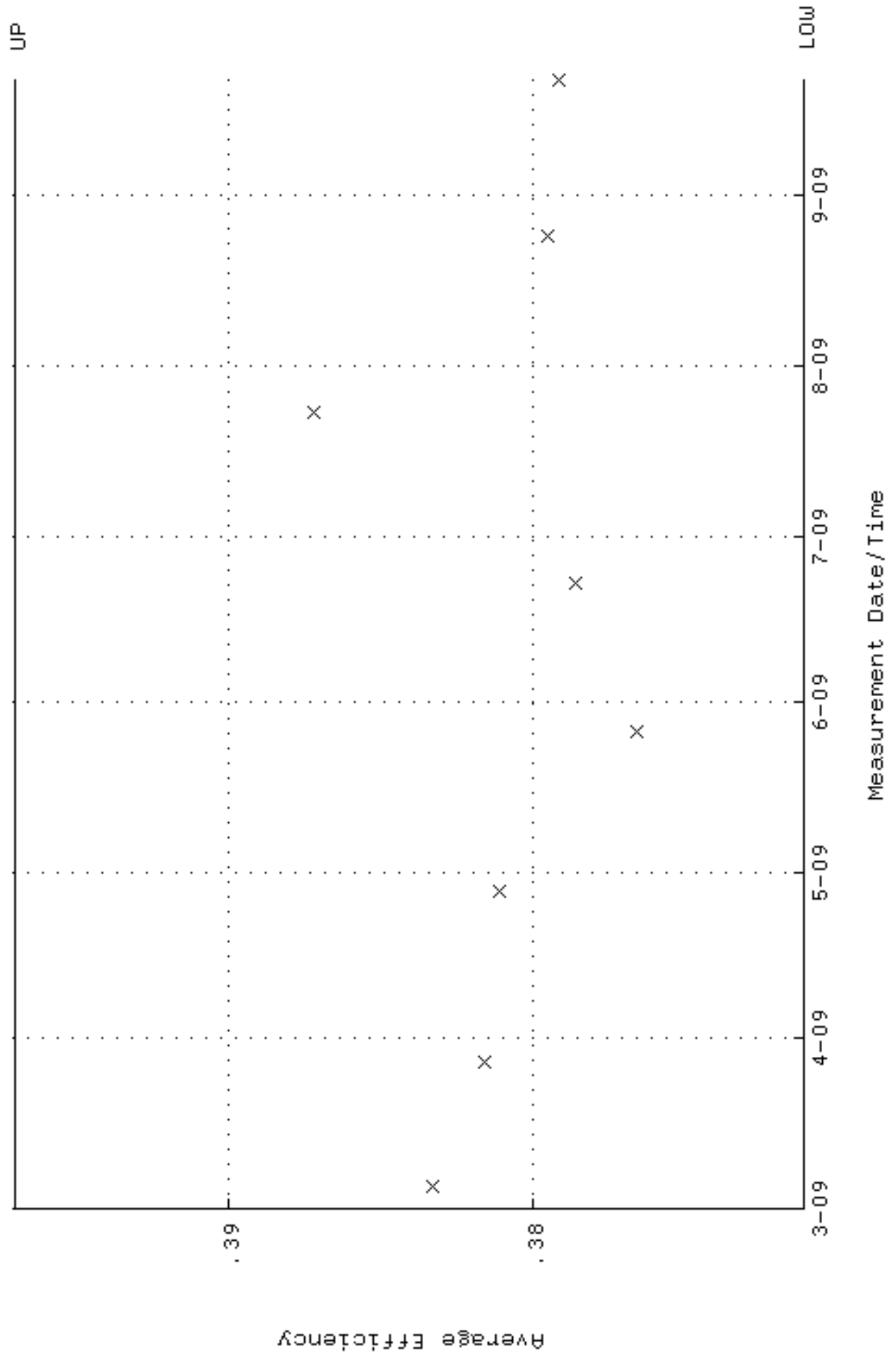
QA filename : DKA100:[ENV\_ALPHA.QA.W]w163.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:37:44 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 84.0322 through 92.8777



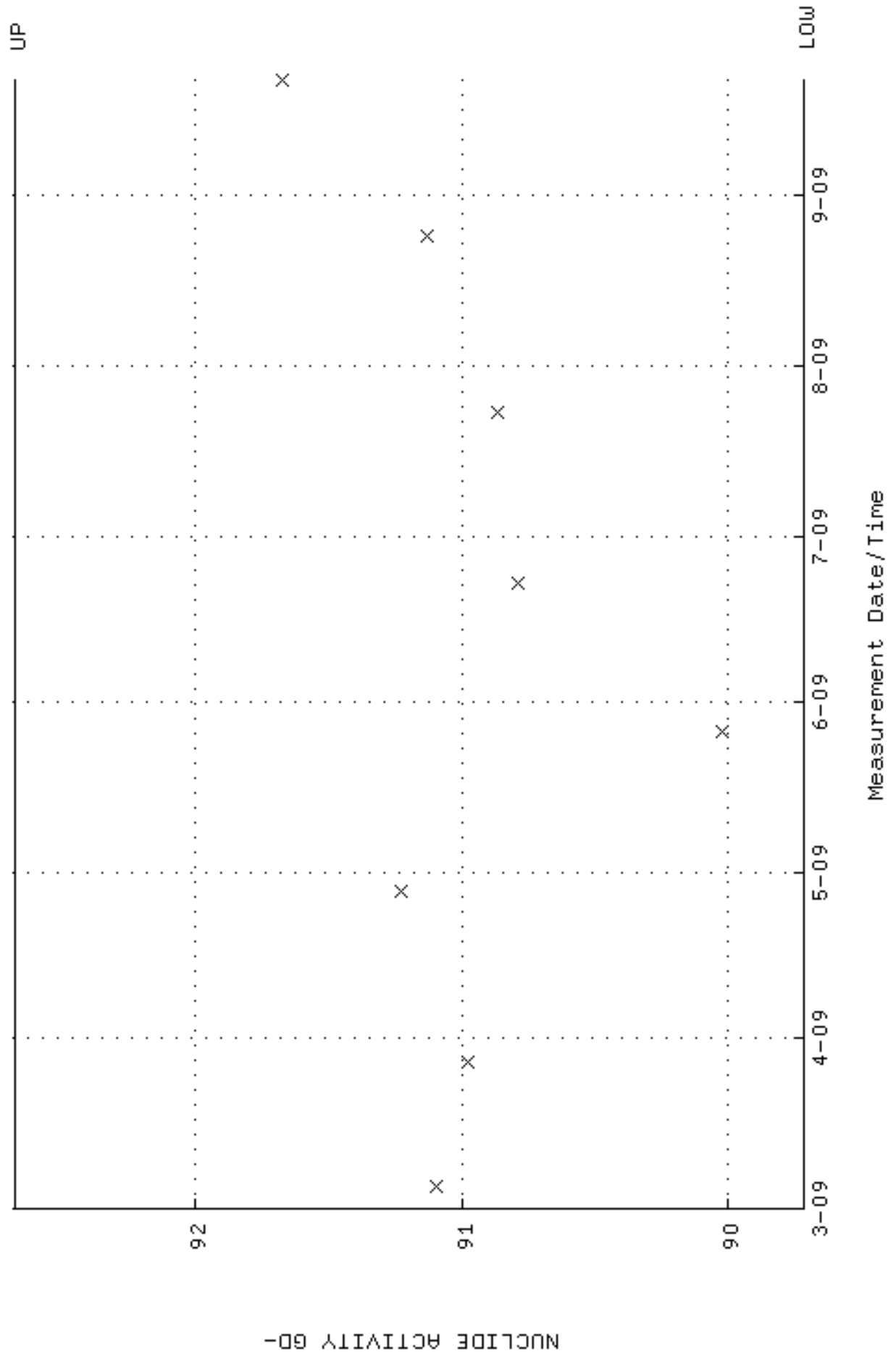
QA filename : DKA100:[ENV\_ALPHA.QA.B]B163.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:10 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



QA filename : DKA100:[ENV\_ALPHA.QA.W]W164.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:37:49 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.371107 through 0.397001

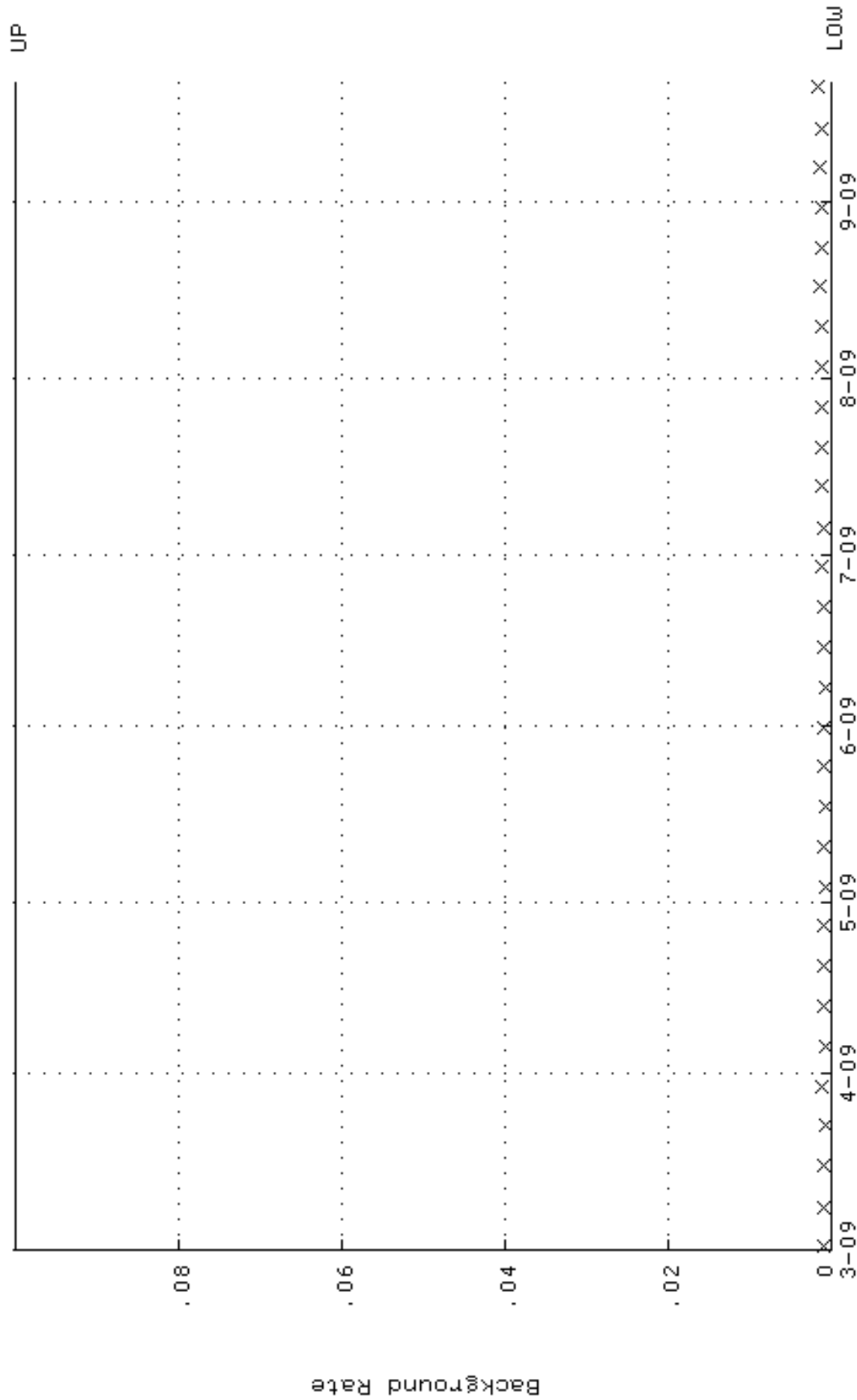


QA filename : DKA100:[ENV\_ALPHA.QA.W]w164.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:37:49 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 89.7107 through 92.6809

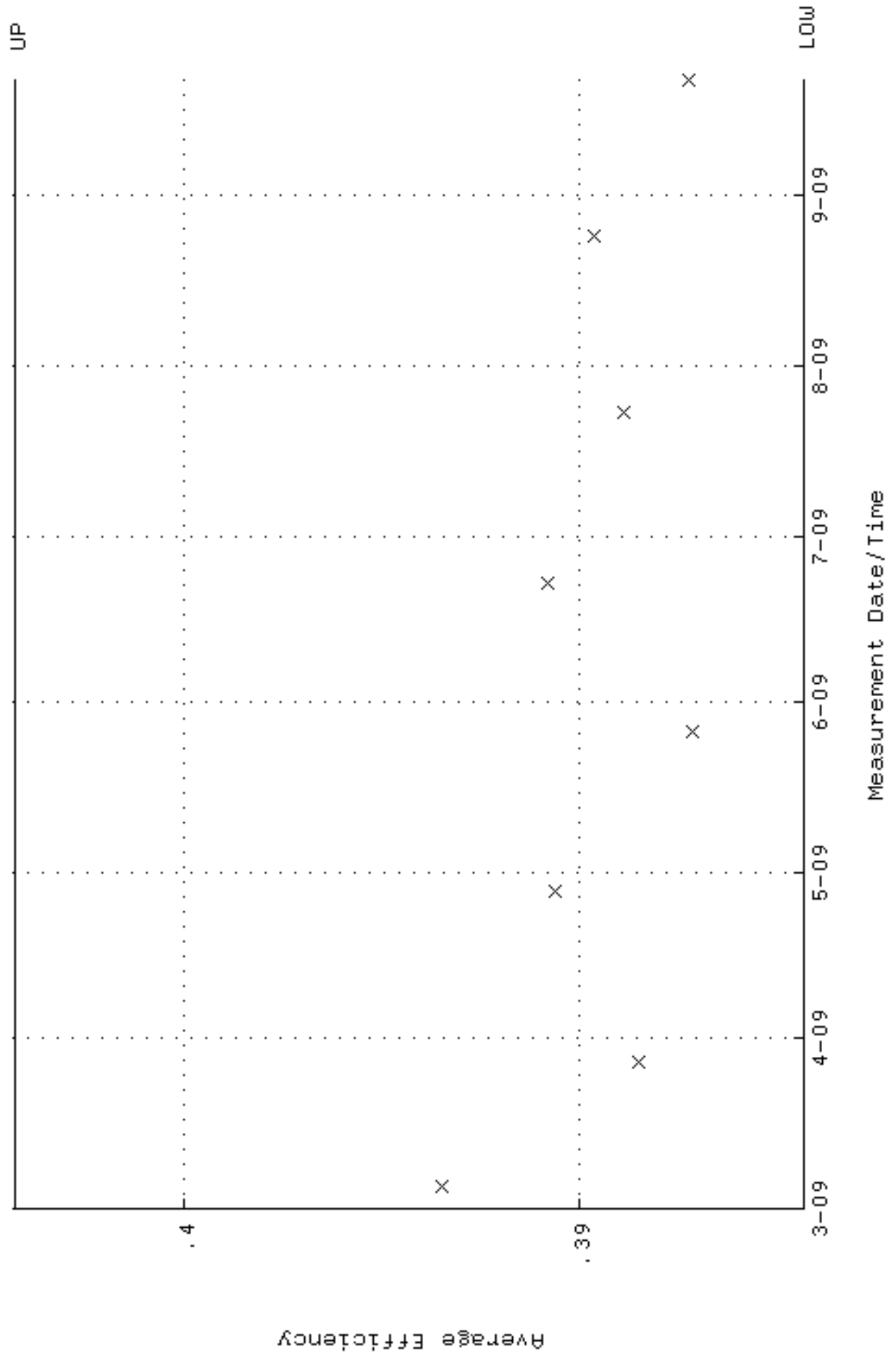




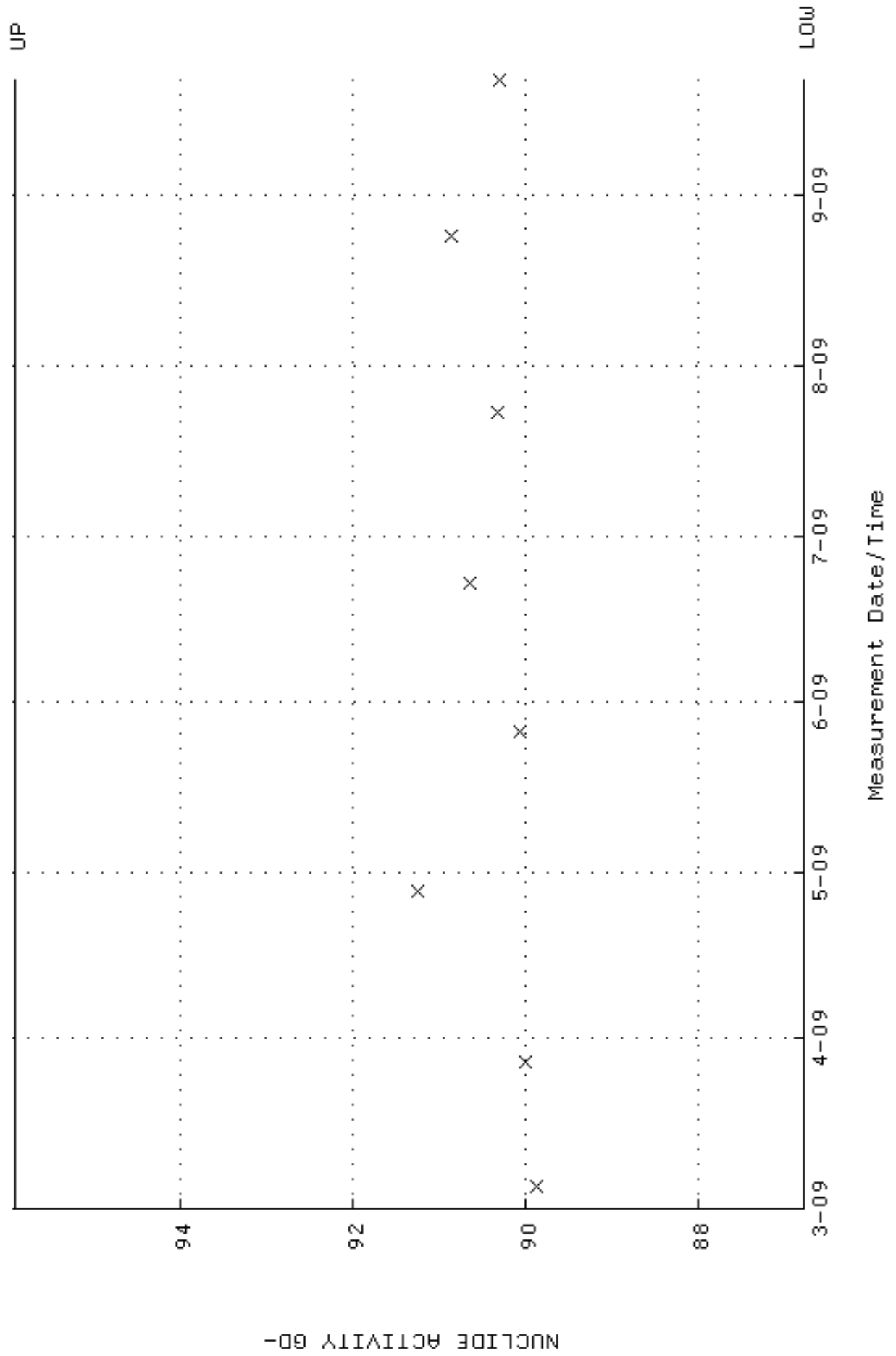
QA filename : DKA100:[ENV\_ALPHA.QA.B]B164.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:14 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



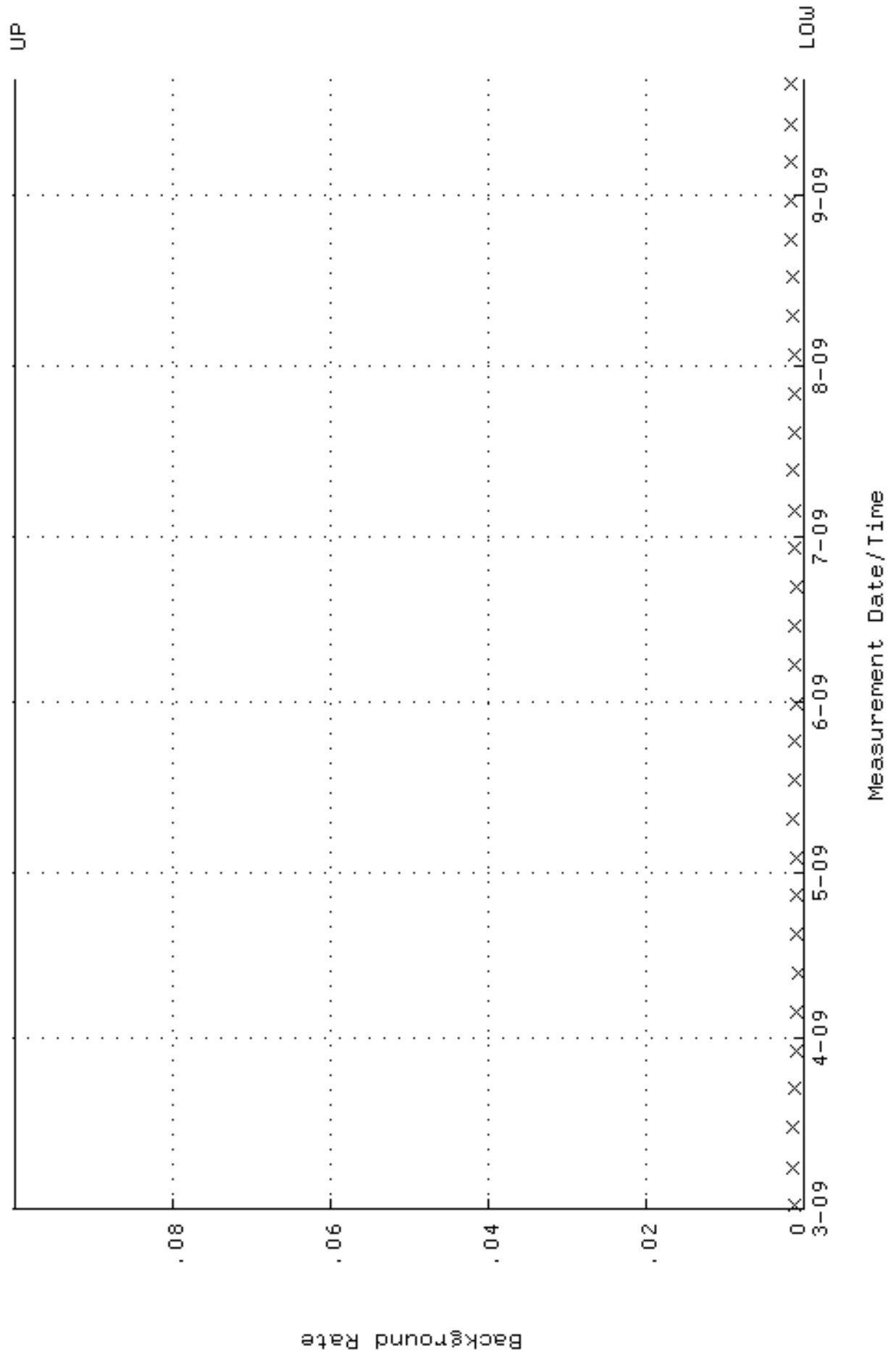
QA filename : DKA100:[ENV\_ALPHA.QA.W]W167.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:02 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.384285 through 0.404285



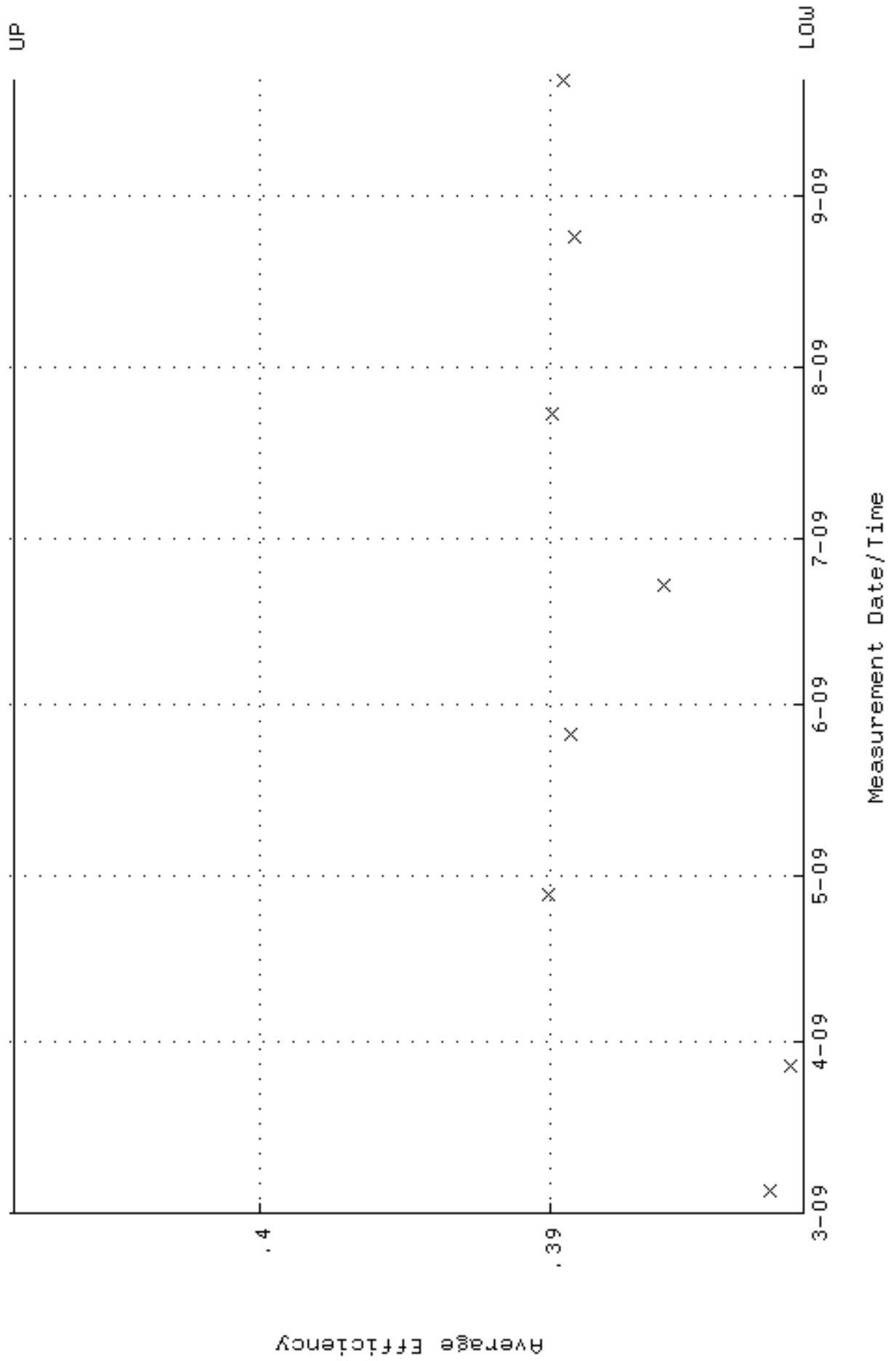
QA filename : DKA100:[ENV\_ALPHA.QA.W]w167.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:38:02 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 86.7740 through 95.9082



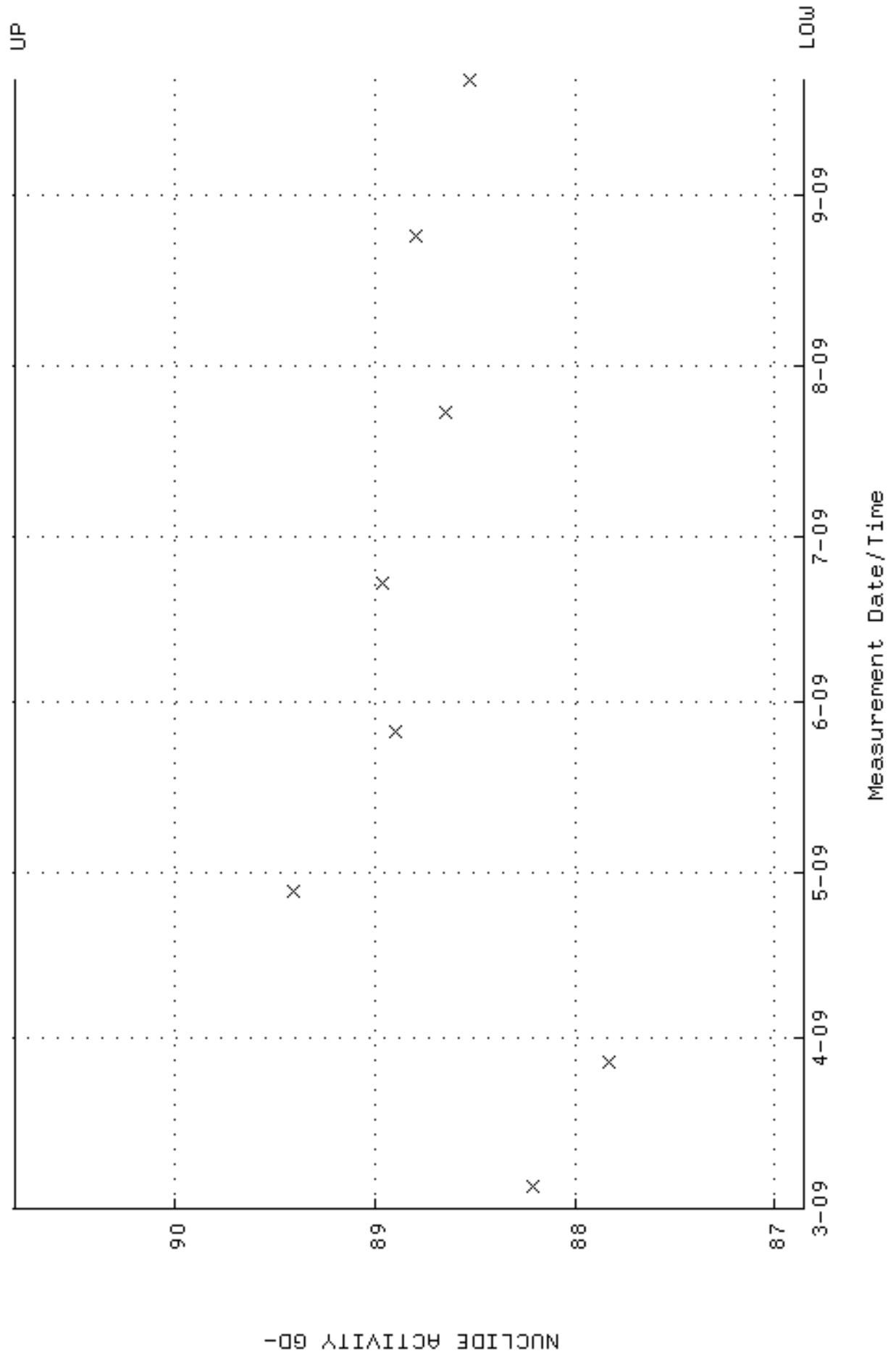
QA filename : DKA100:[ENV\_ALPHA.QA.B]B167.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:24 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



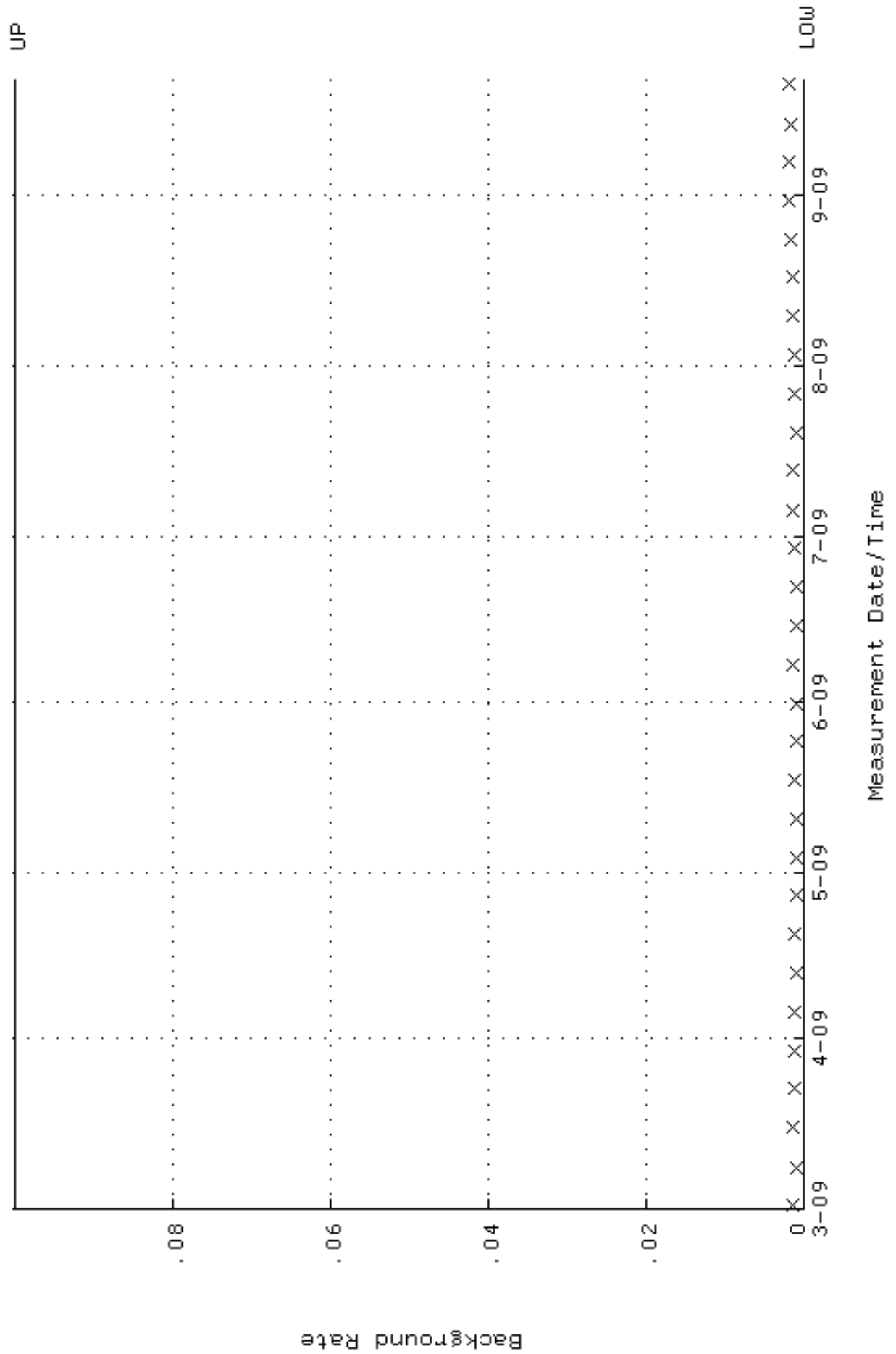
QA filename : DKA100:[ENV\_ALPHA.QA.W]W168.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:06 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.381339 through 0.408495



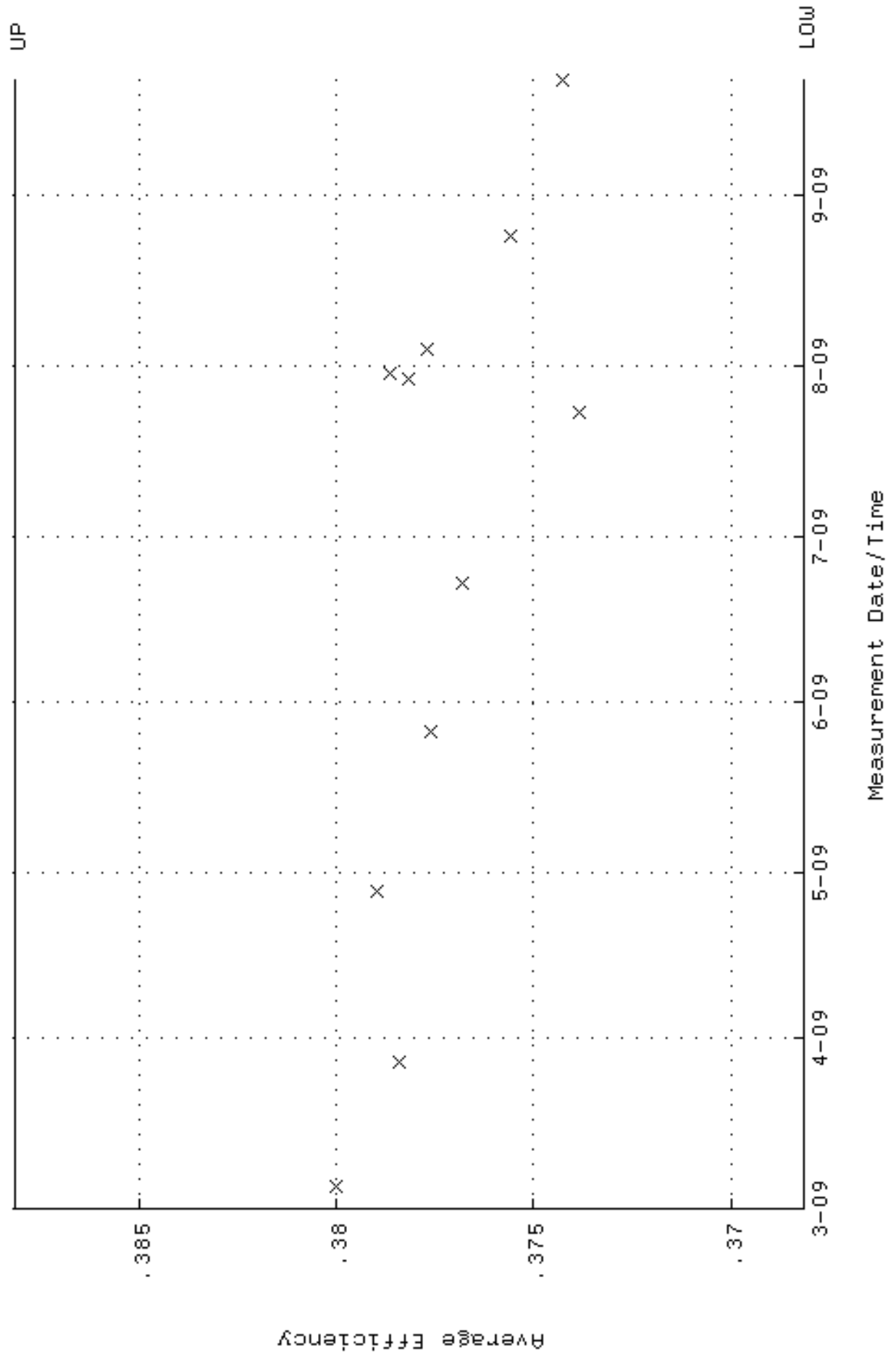
QA filename : DKA100:[ENV\_ALPHA.QA.W]w168.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:38:06 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 86.8544 through 90.7976



QA filename : DKA100:[ENV\_ALPHA.QA.B]B168.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:28 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

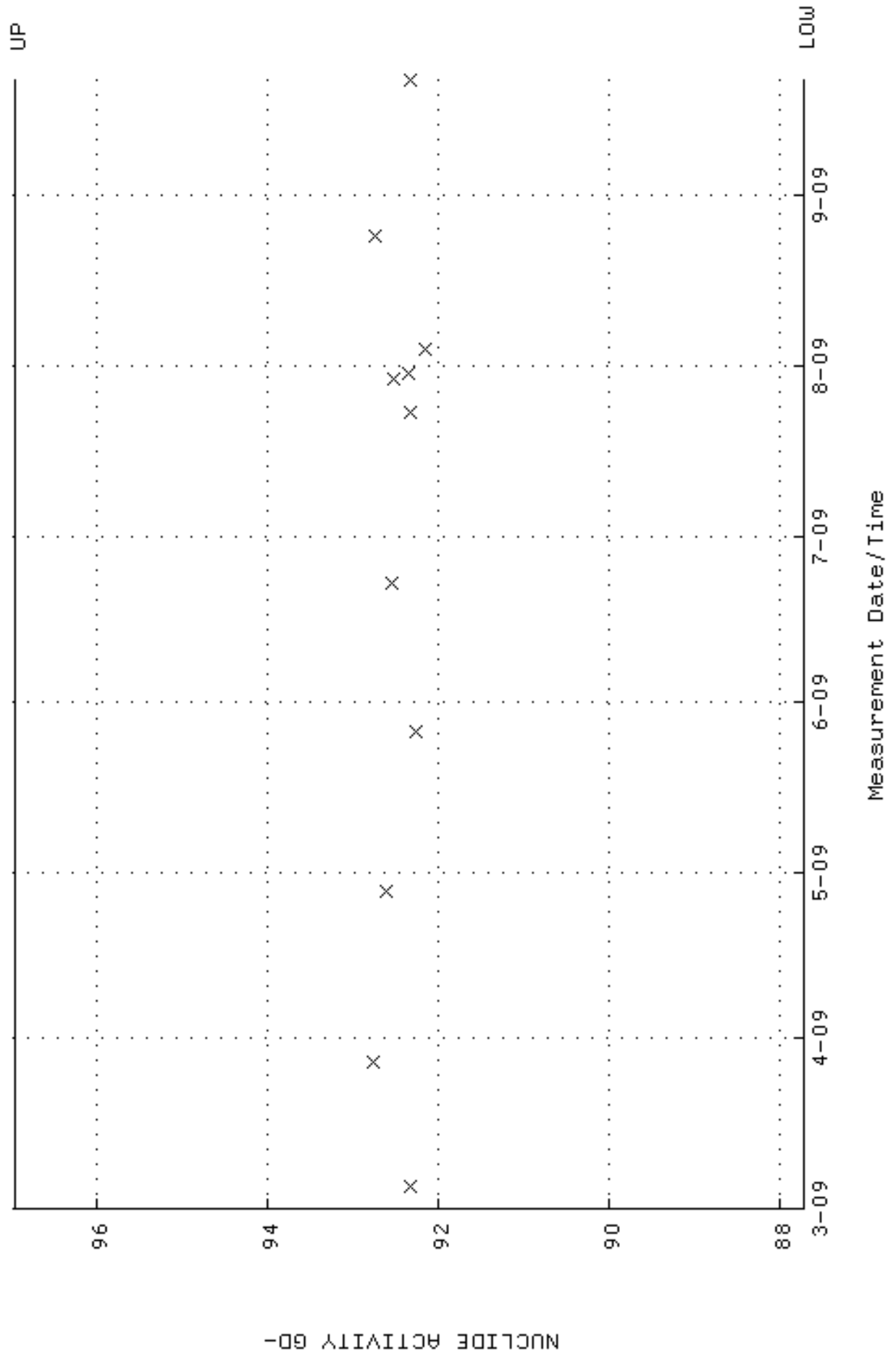


QA filename : DKA100:[ENV\_ALPHA.QA.W]W169.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:11 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.368144 through 0.388144

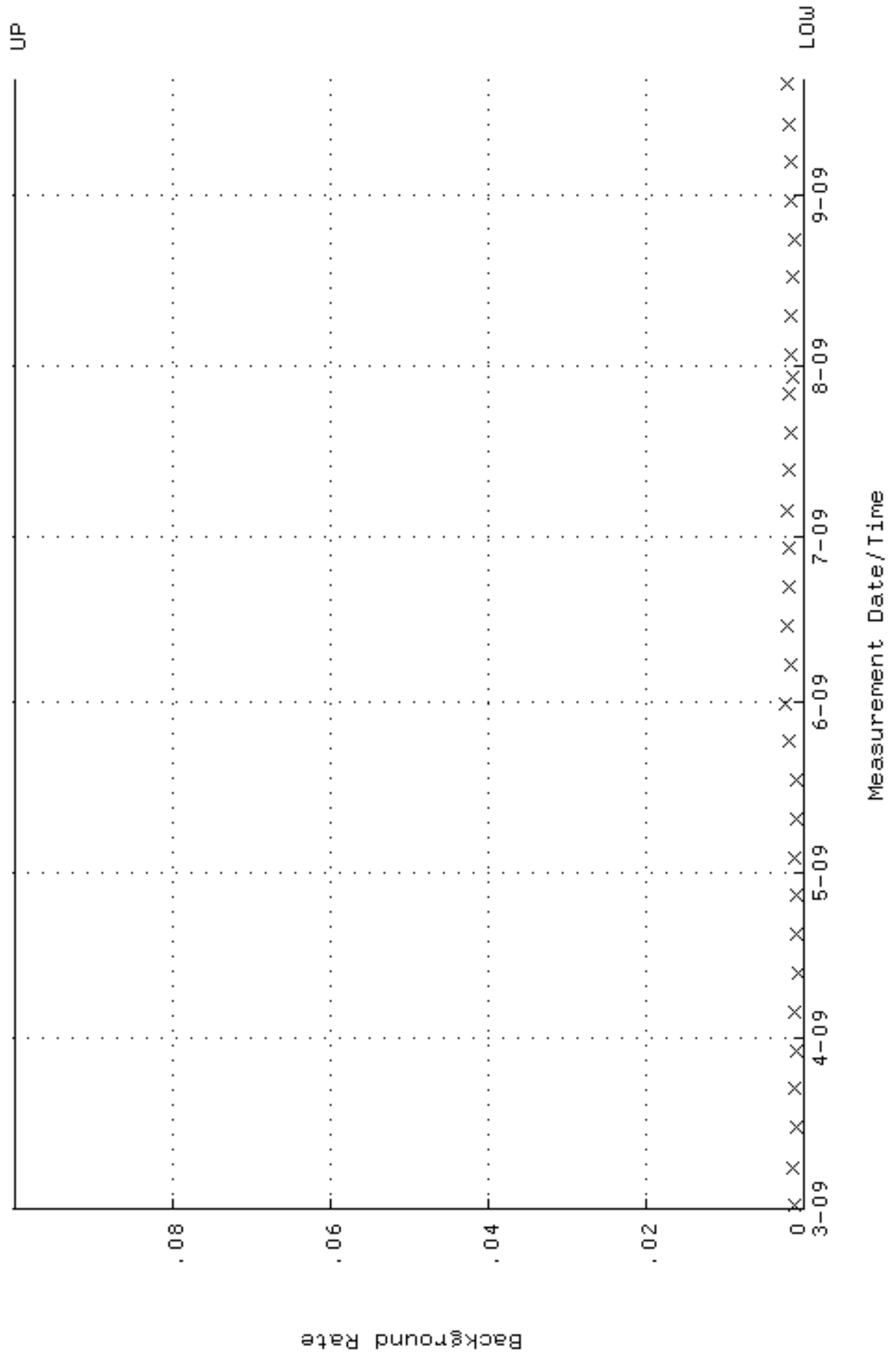




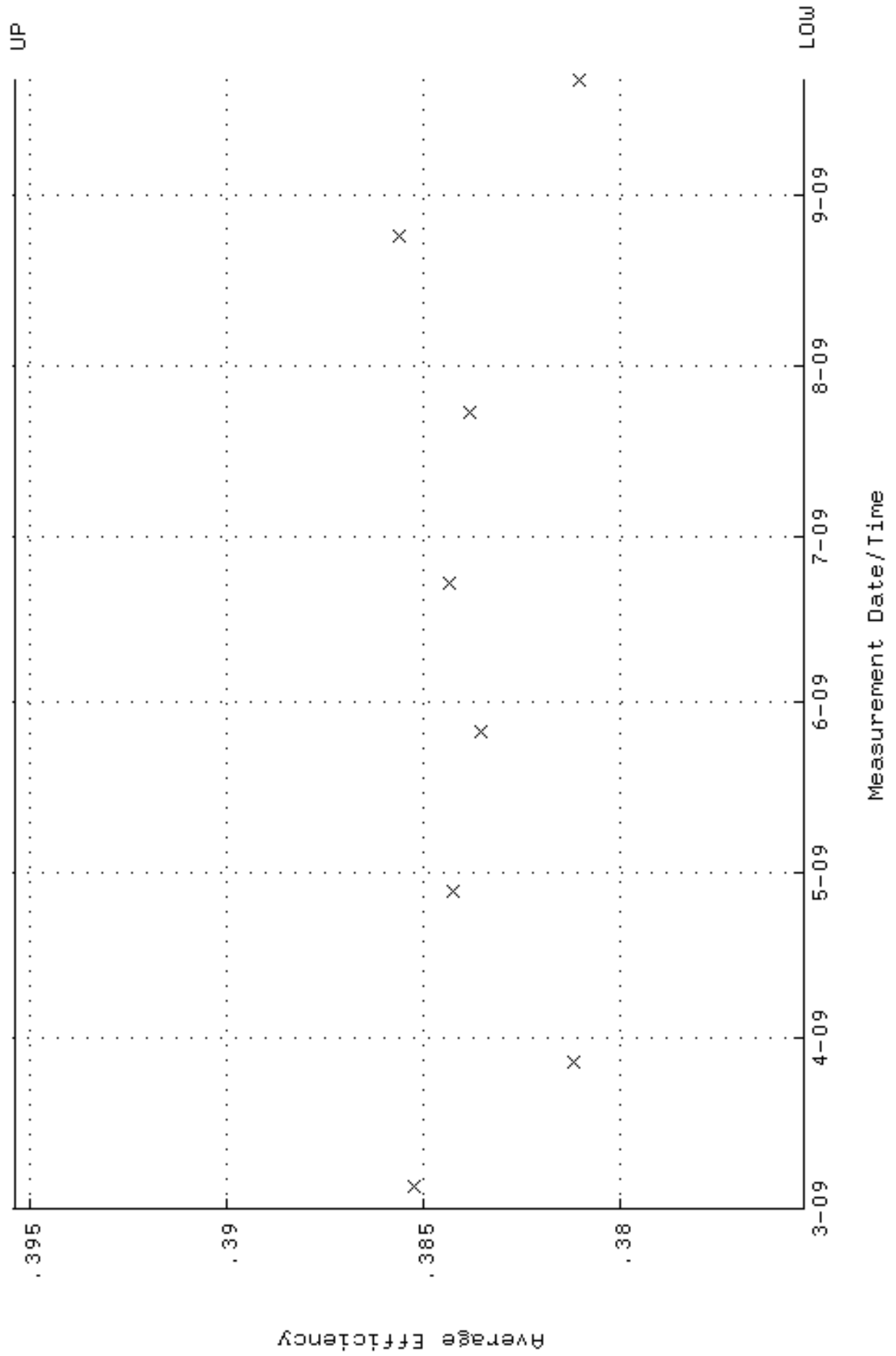
QA filename : DKA100:[ENV\_ALPHA.QA.W]w169.QAF;1  
Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
Start/End Dates : 4-MAR-2009 22:38:11 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 87.7141 through 96.9471



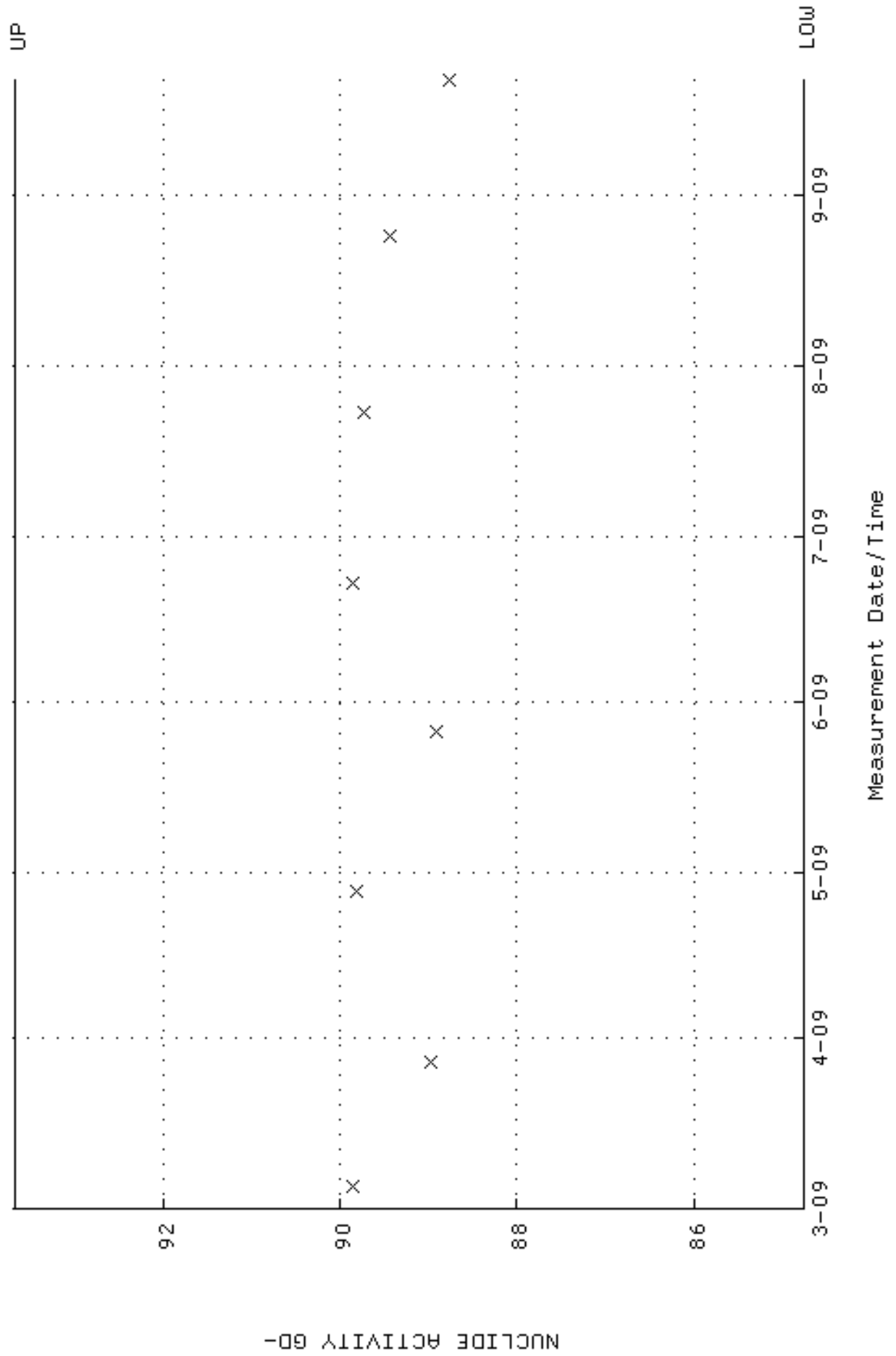
QA filename : DKA100:[ENV\_ALPHA.QA.B]B169.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:32 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



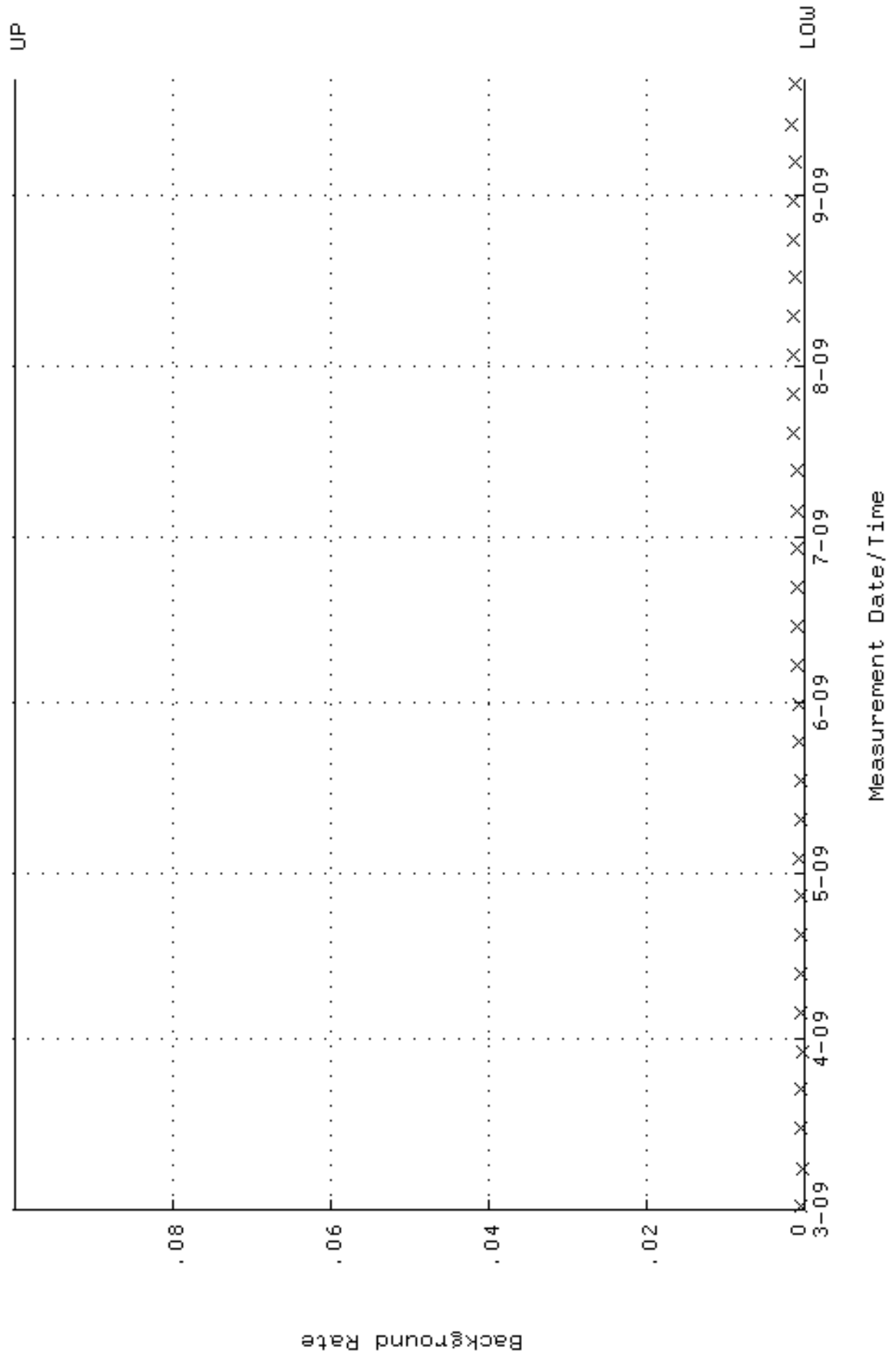
QA filename : DKA100:[ENV\_ALPHA.QA.W]W171.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:20 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.375364 through 0.395364



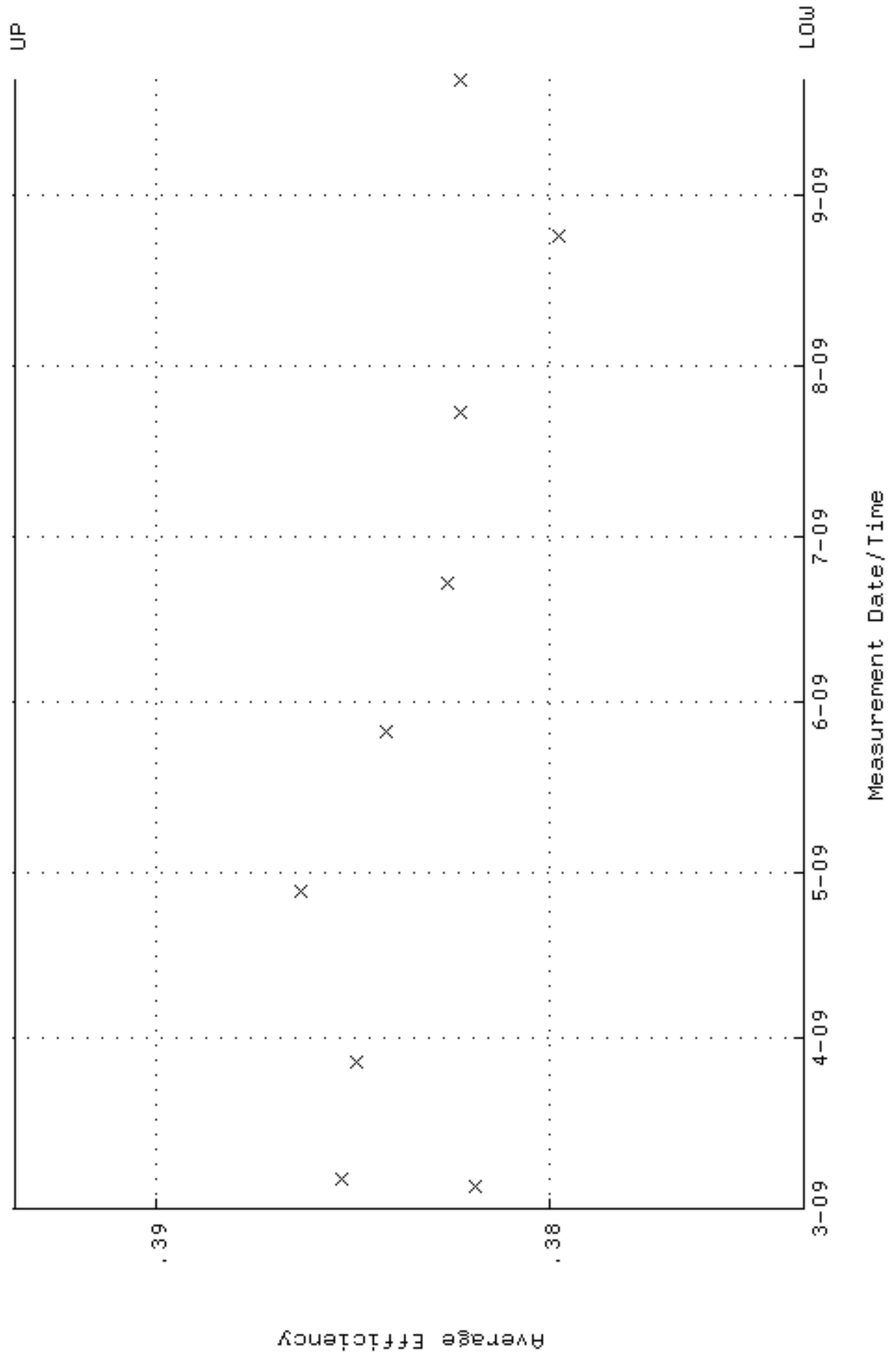
QA filename : DKA100:[ENV\_ALPHA.QA.W]w171.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:38:20 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 84.7539 through 93.6753



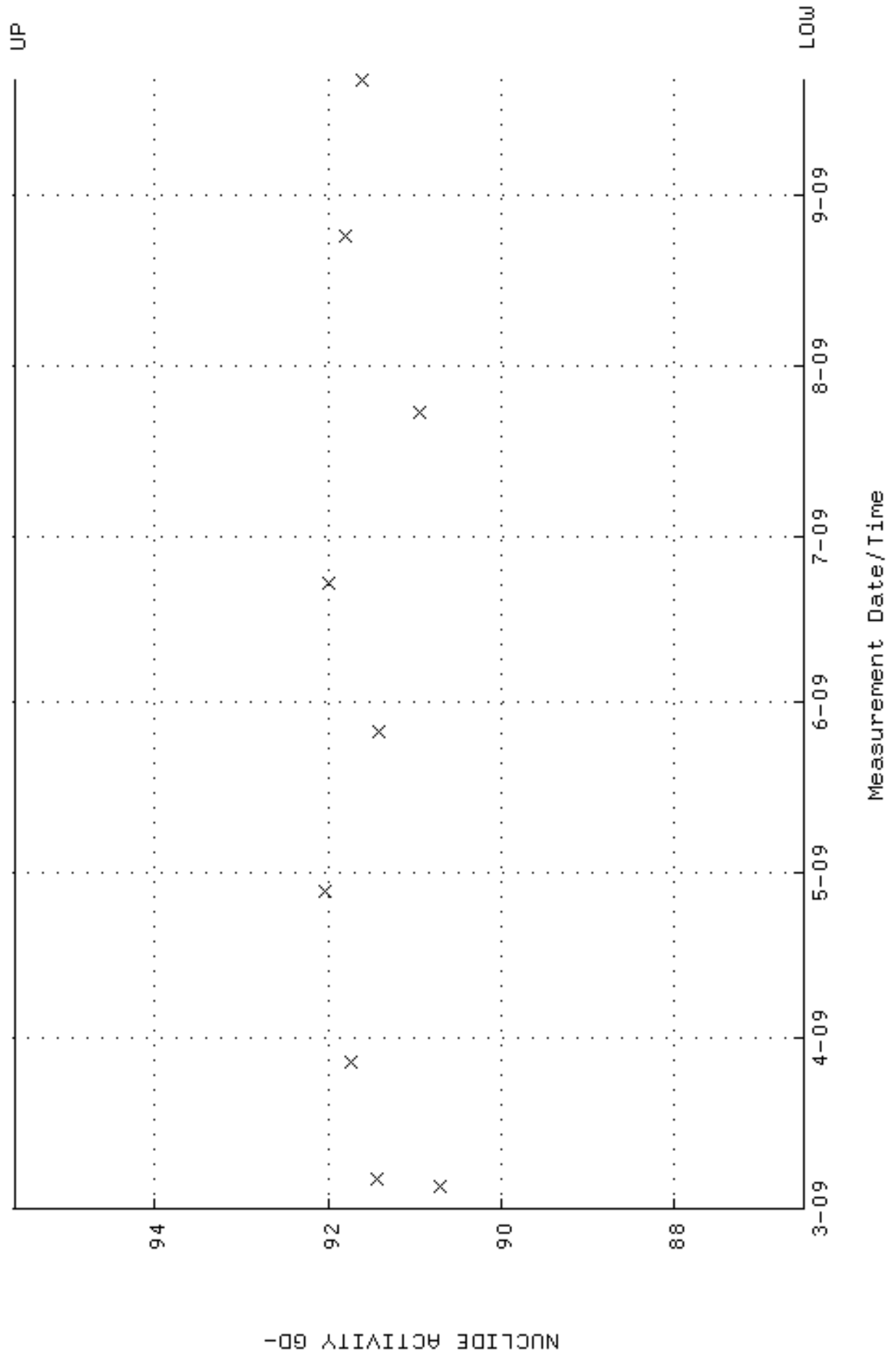
QA filename : DKA100:[ENV\_ALPHA.QA.B]B171.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:39 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



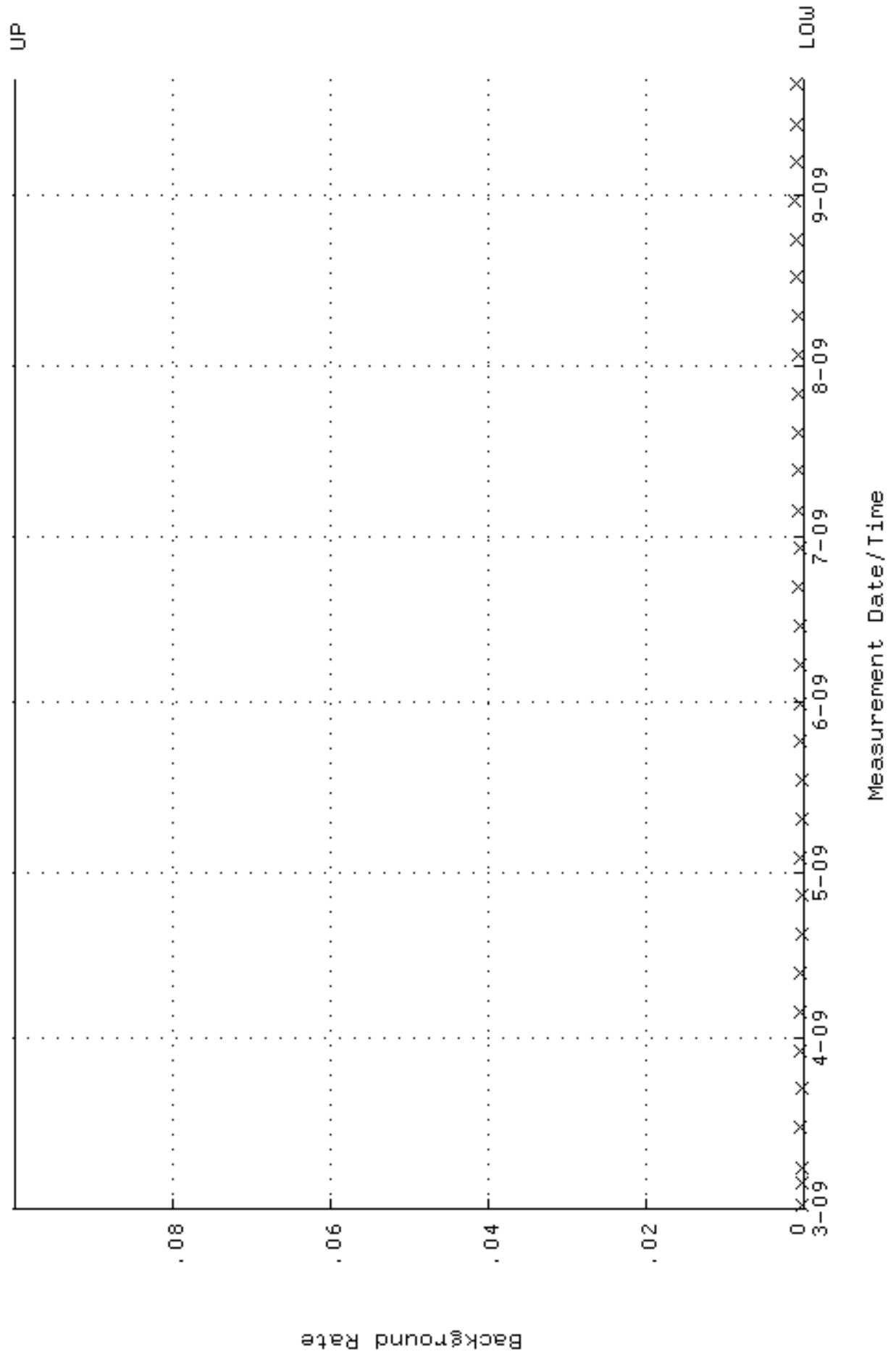
QA filename : DKA100:[ENV\_ALPHA.QA.W]W172.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:24 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.373575 through 0.393575



QA filename : DKA100:[ENV\_ALPHA.QA.W]w172.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:38:24 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 86.5089 through 95.6151

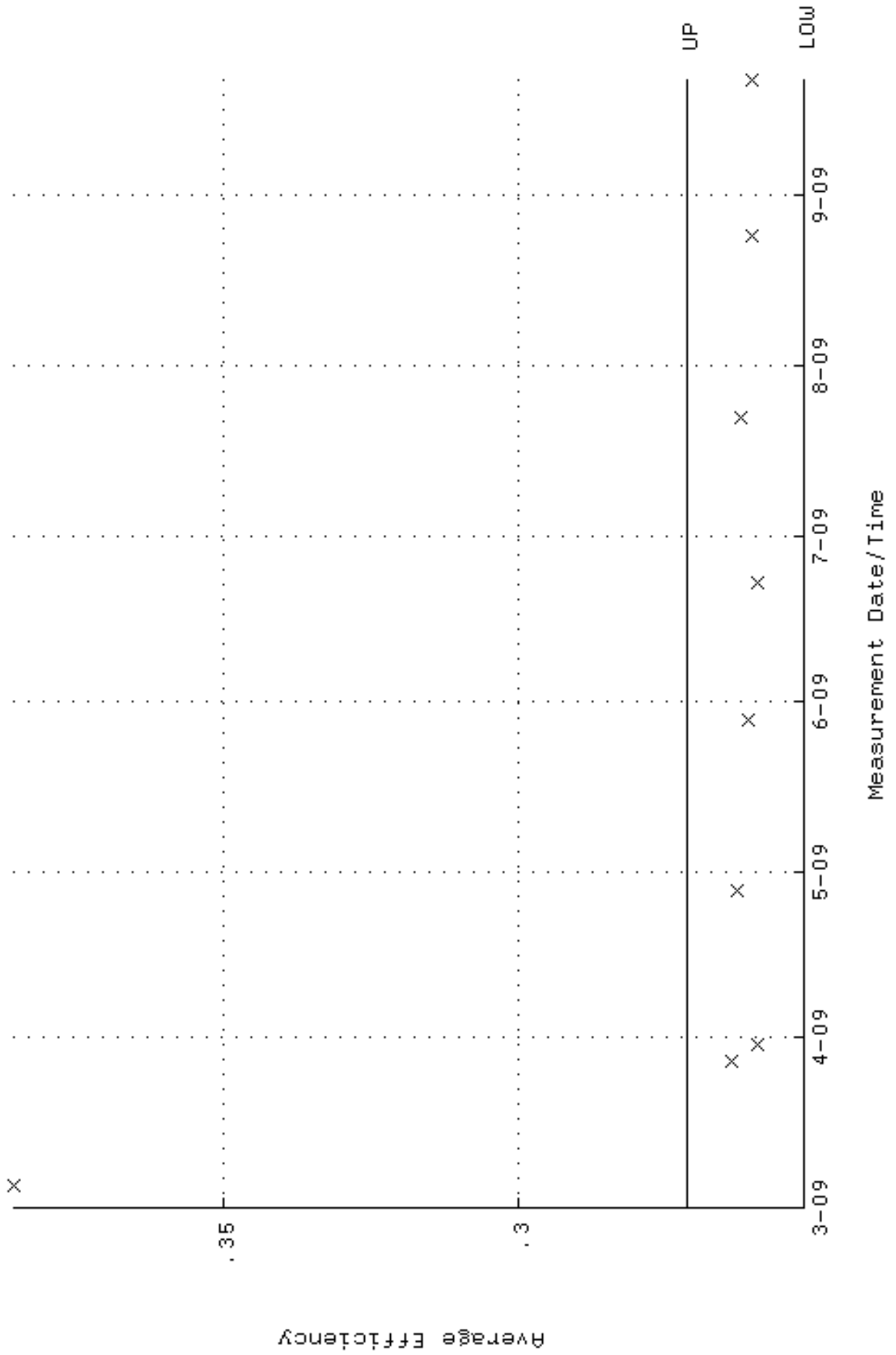


QA filename : DKA100:[ENV\_ALPHA.QA.B]B172.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:43 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

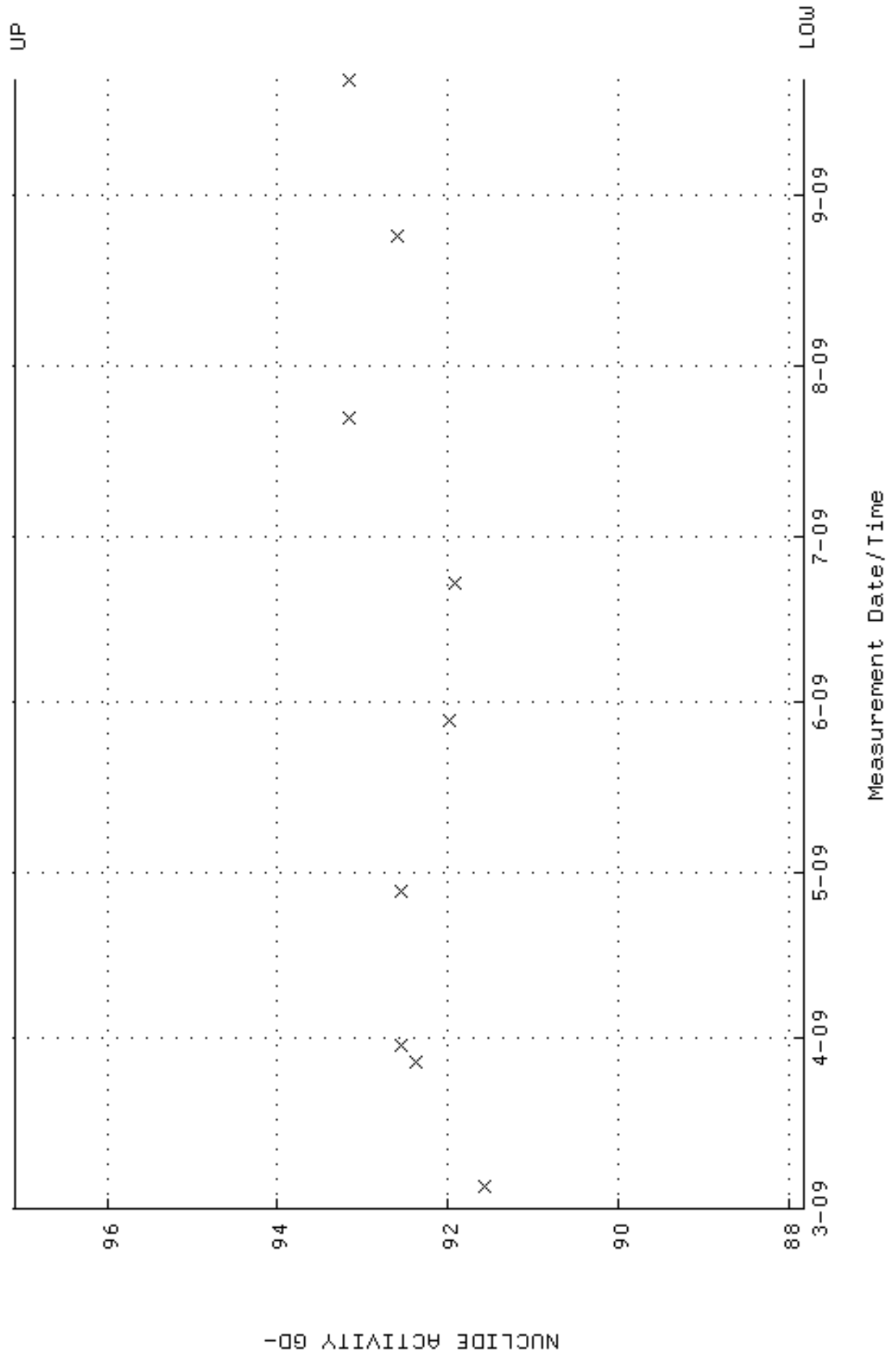




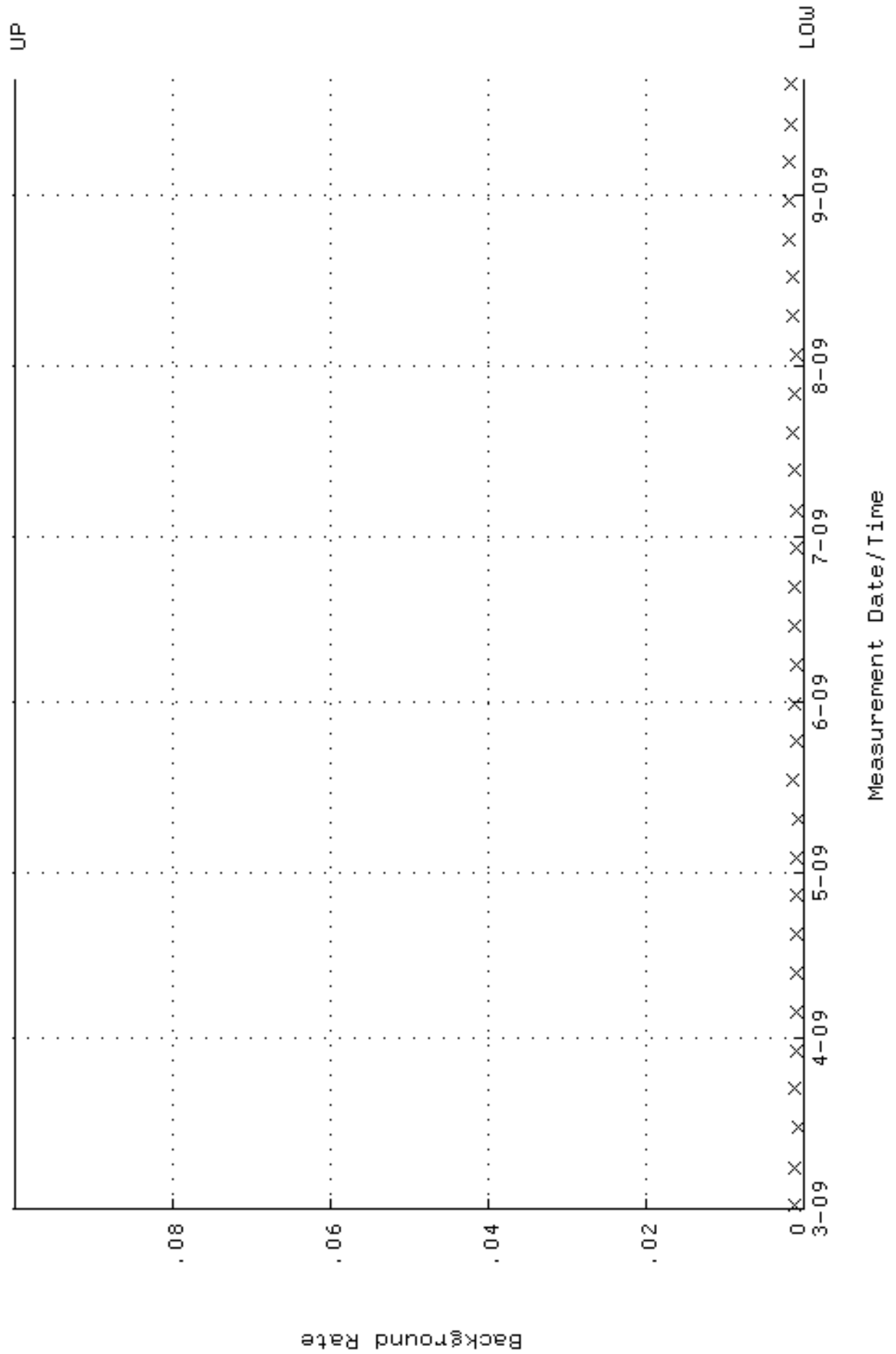
QA filename : DKA100:[ENV\_ALPHA.QA.W]W173.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:28 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.251498 through 0.271498



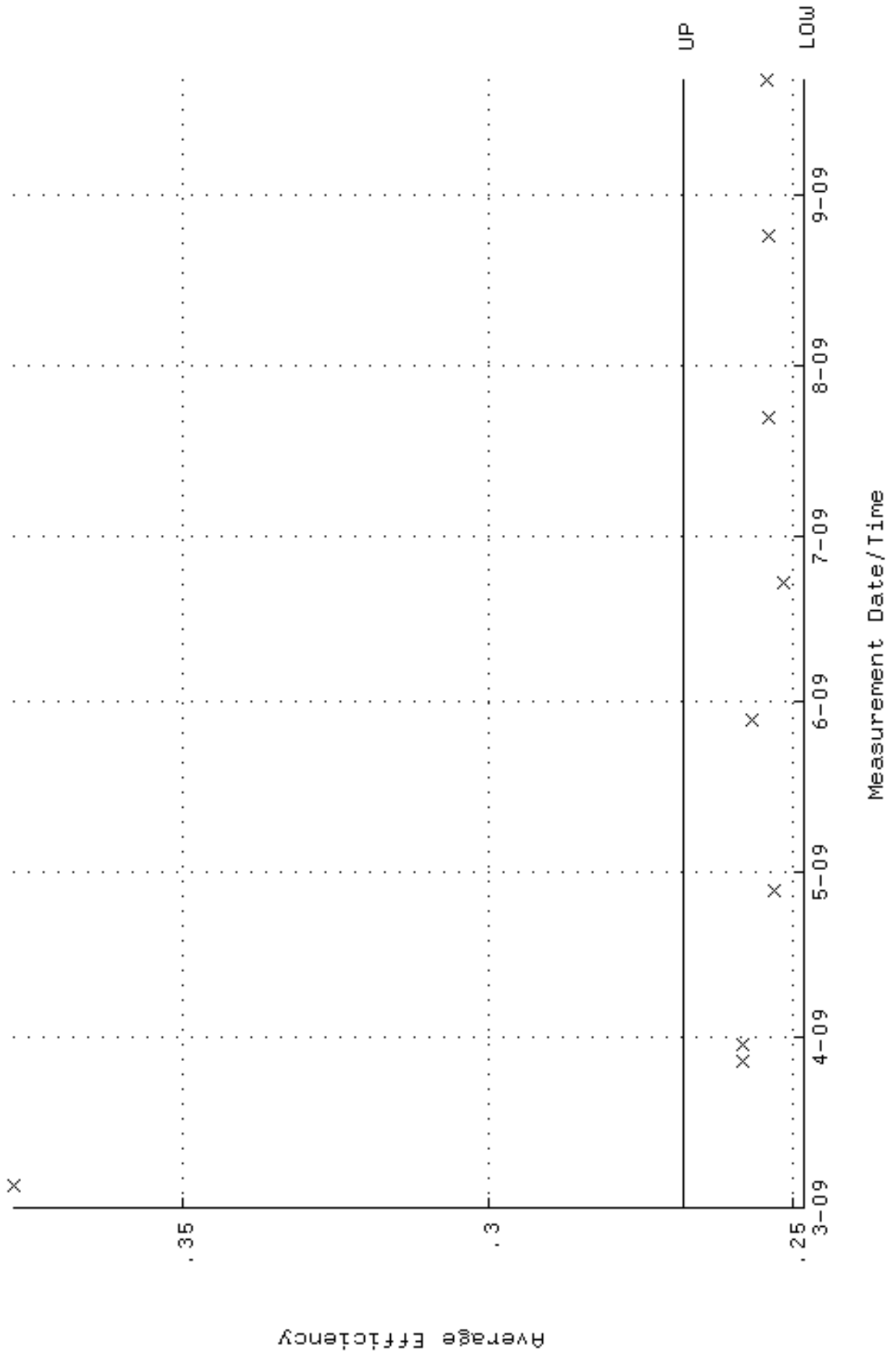
QA filename : DKA100:[ENV\_ALPHA.QA.W]w173.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:38:28 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 87.8322 through 97.0776



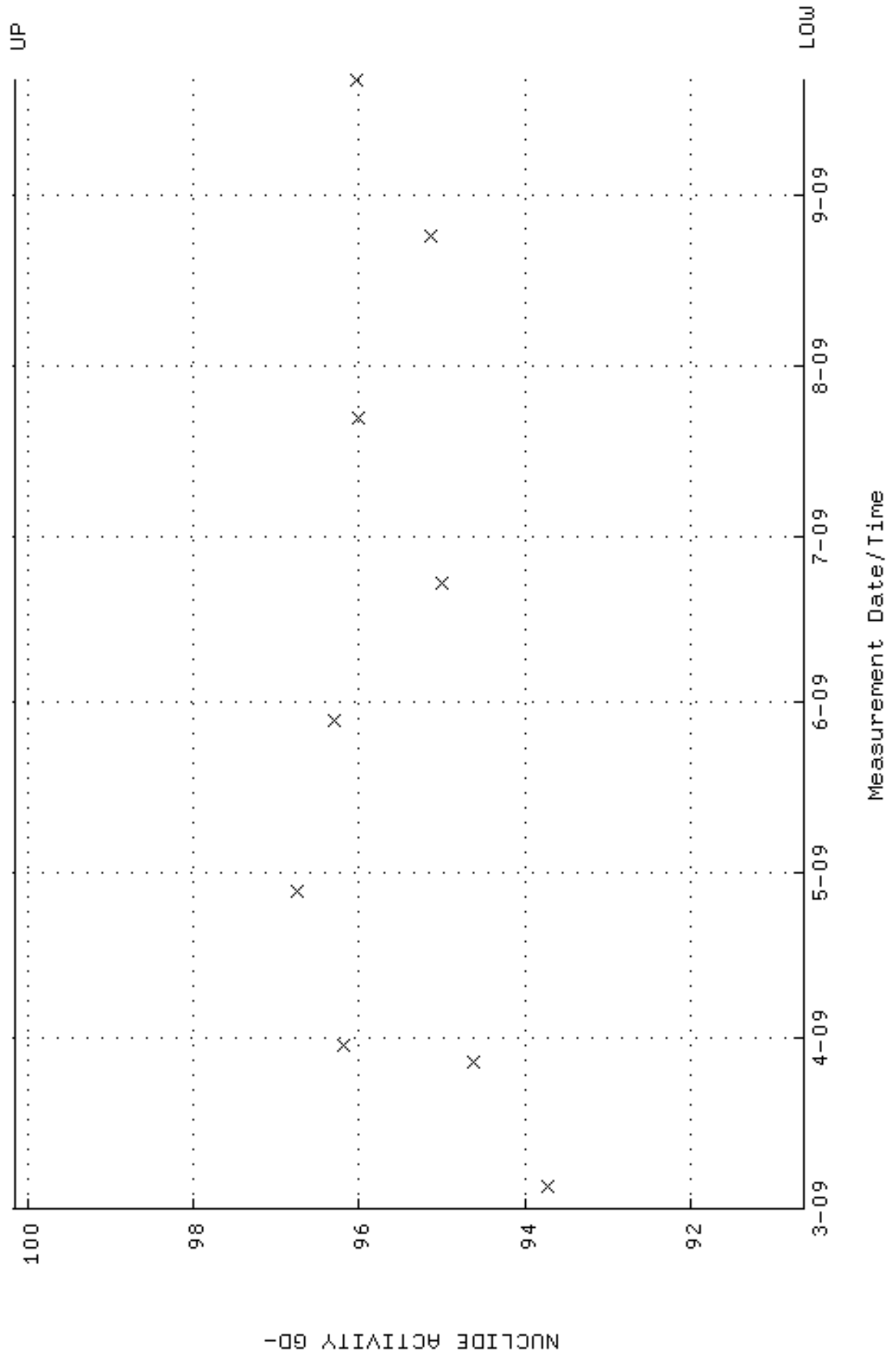
QA filename : DKA100:[ENV\_ALPHA.QA.B]B173.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:46 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



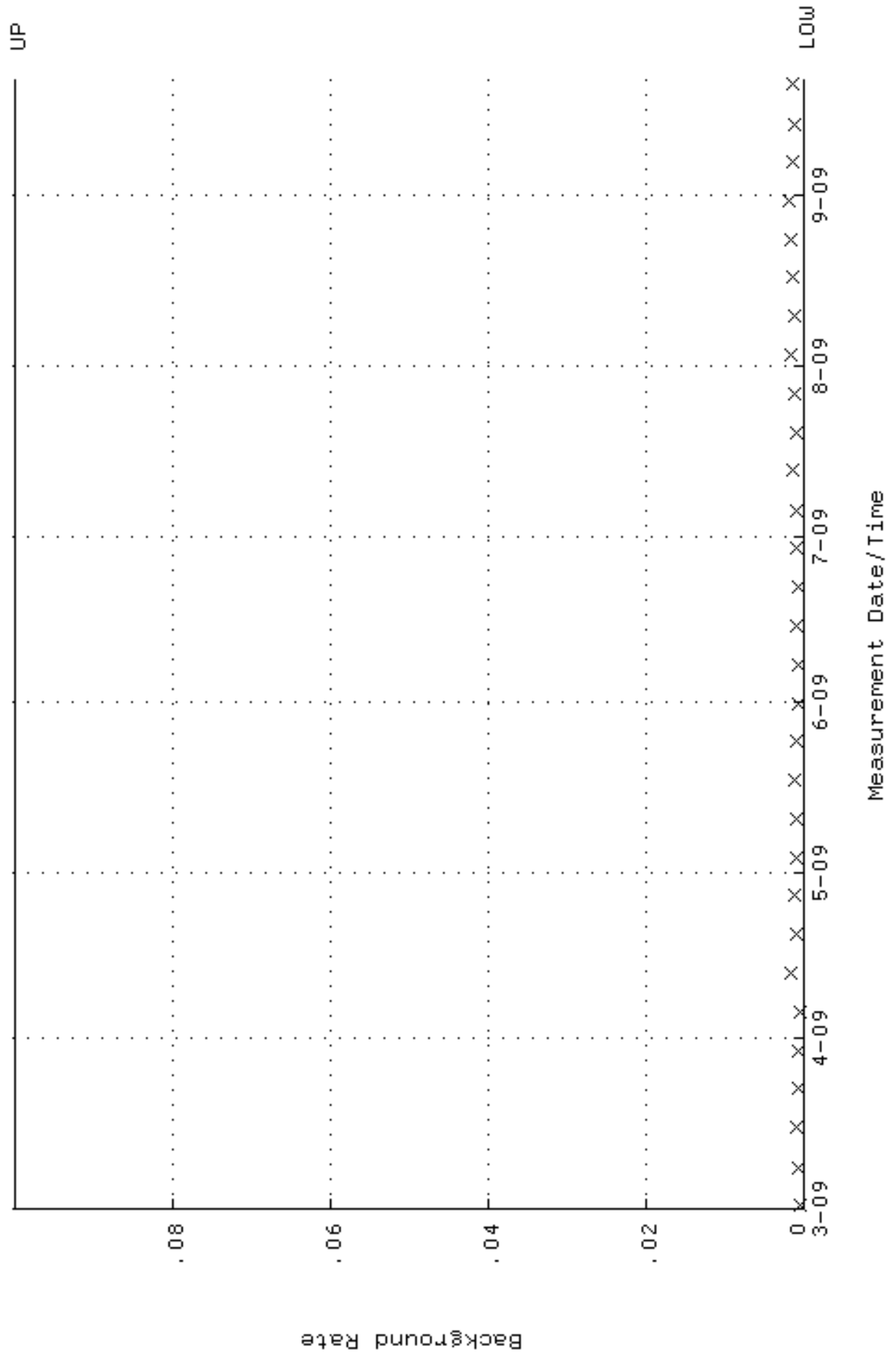
QA filename : DKA100:[ENV\_ALPHA.QA.W]W175.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:37 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.248296 through 0.268296



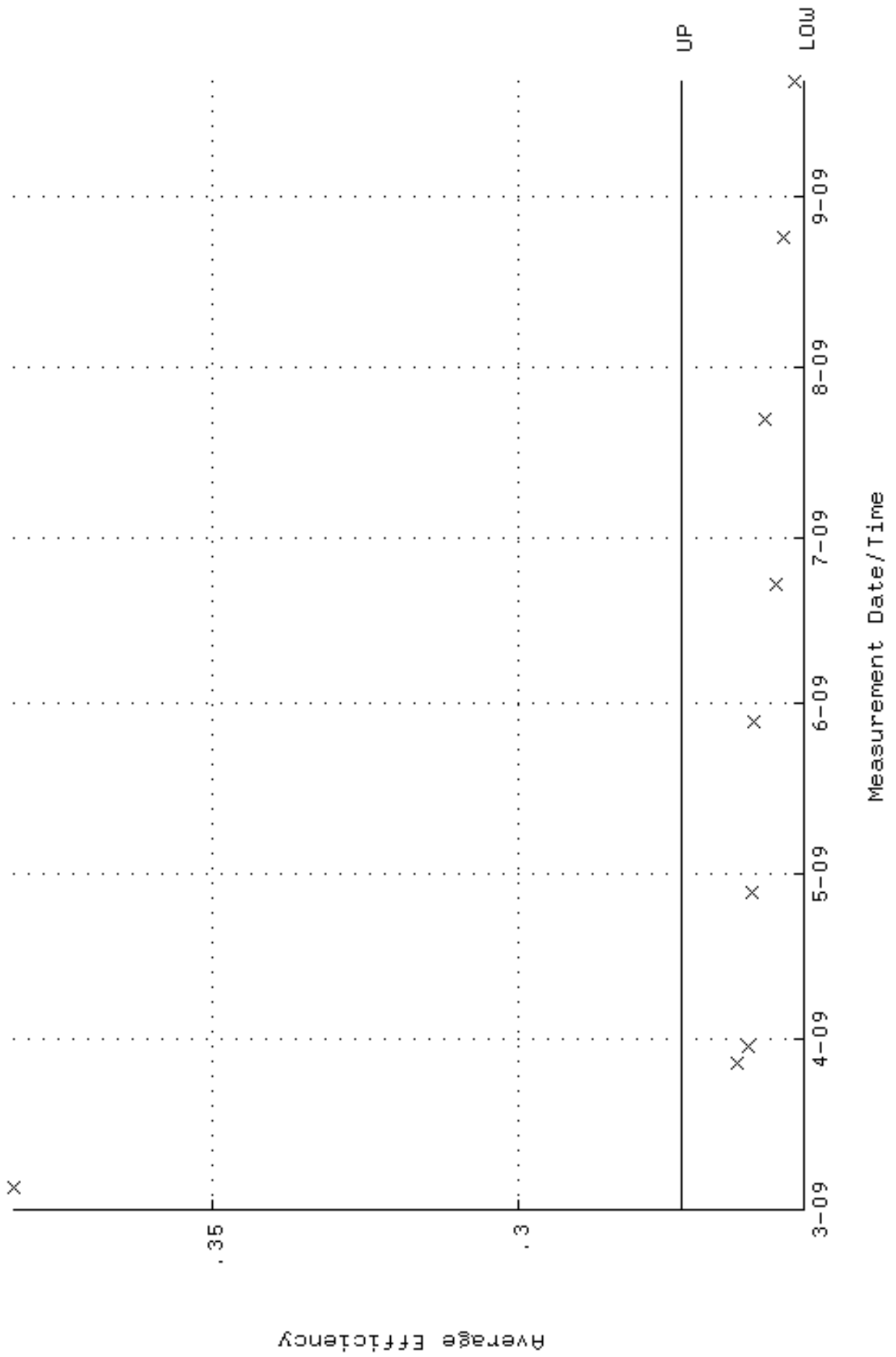
QA filename : DKA100:[ENV\_ALPHA.QA.W]W175.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:38:37 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 90.6224 through 100.162



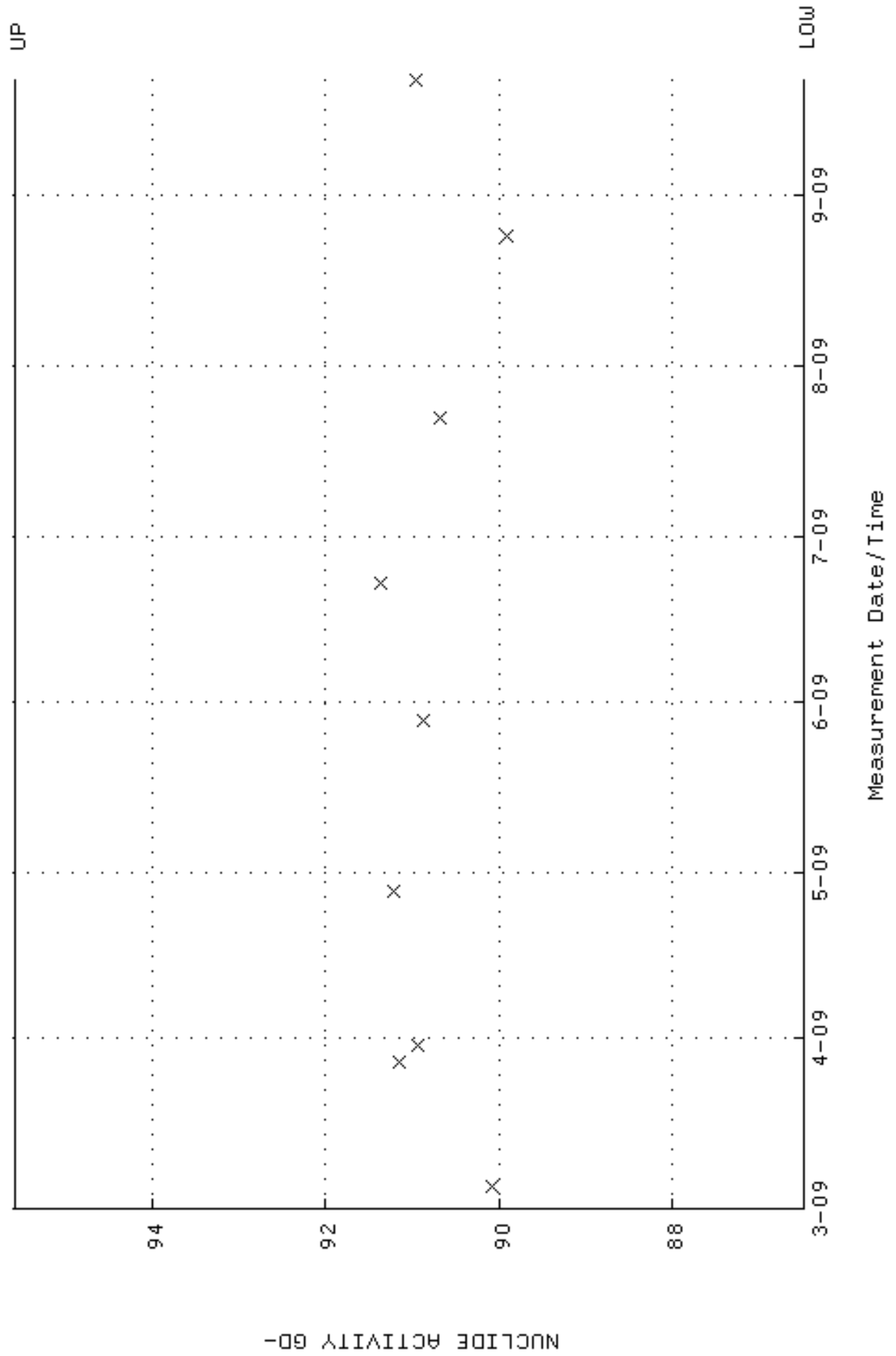
QA filename : DKA100:[ENV\_ALPHA.QA.B]B175.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:54 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



QA filename : DKA100:[ENV\_ALPHA.QA.W]W176.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:38:41 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.253285 through 0.273285

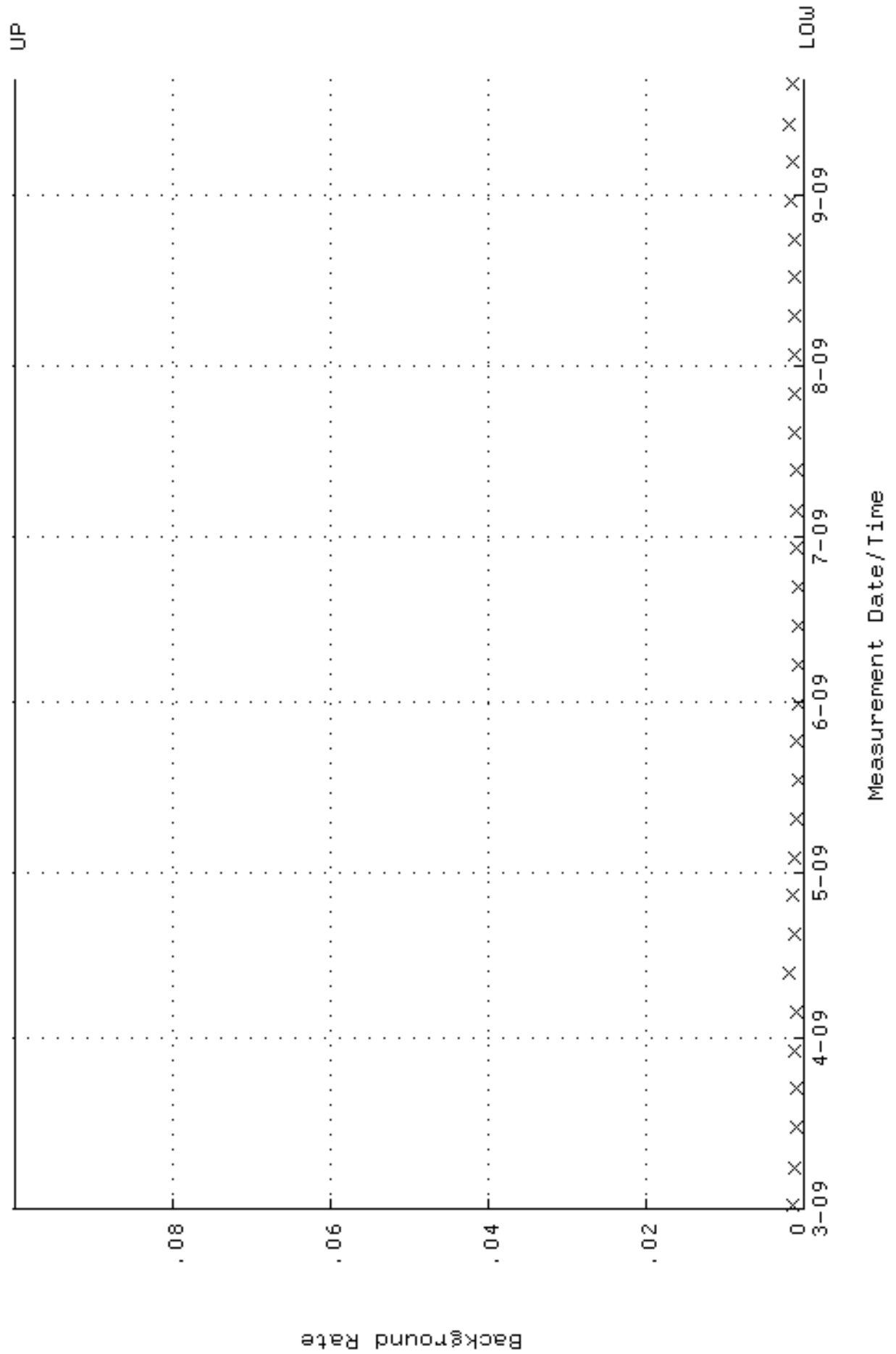


QA filename : DKA100:[ENV\_ALPHA.QA.W]W176.QAF;1  
Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
Start/End Dates : 4-MAR-2009 22:38:41 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 86.4817 through 95.5851

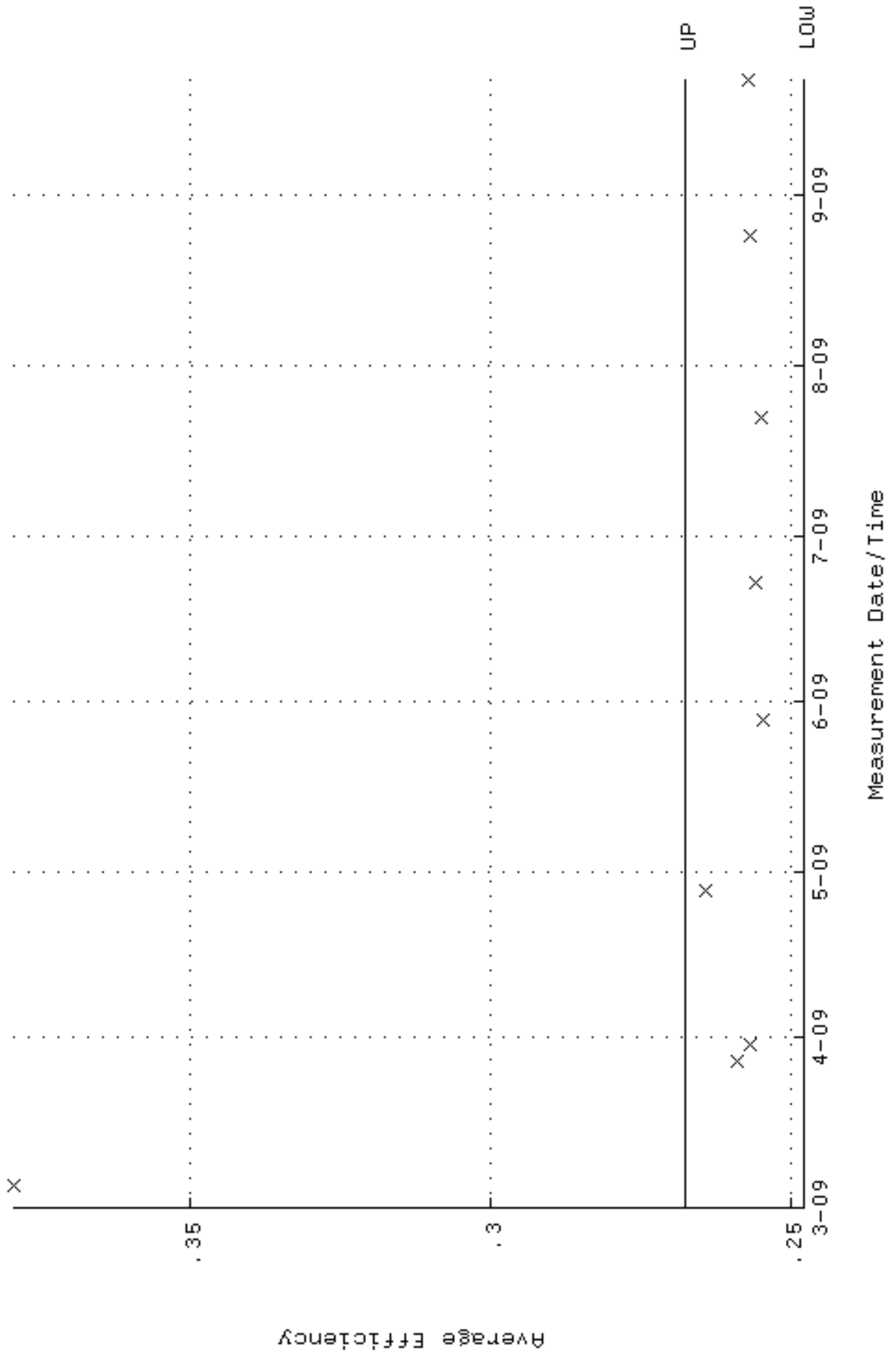




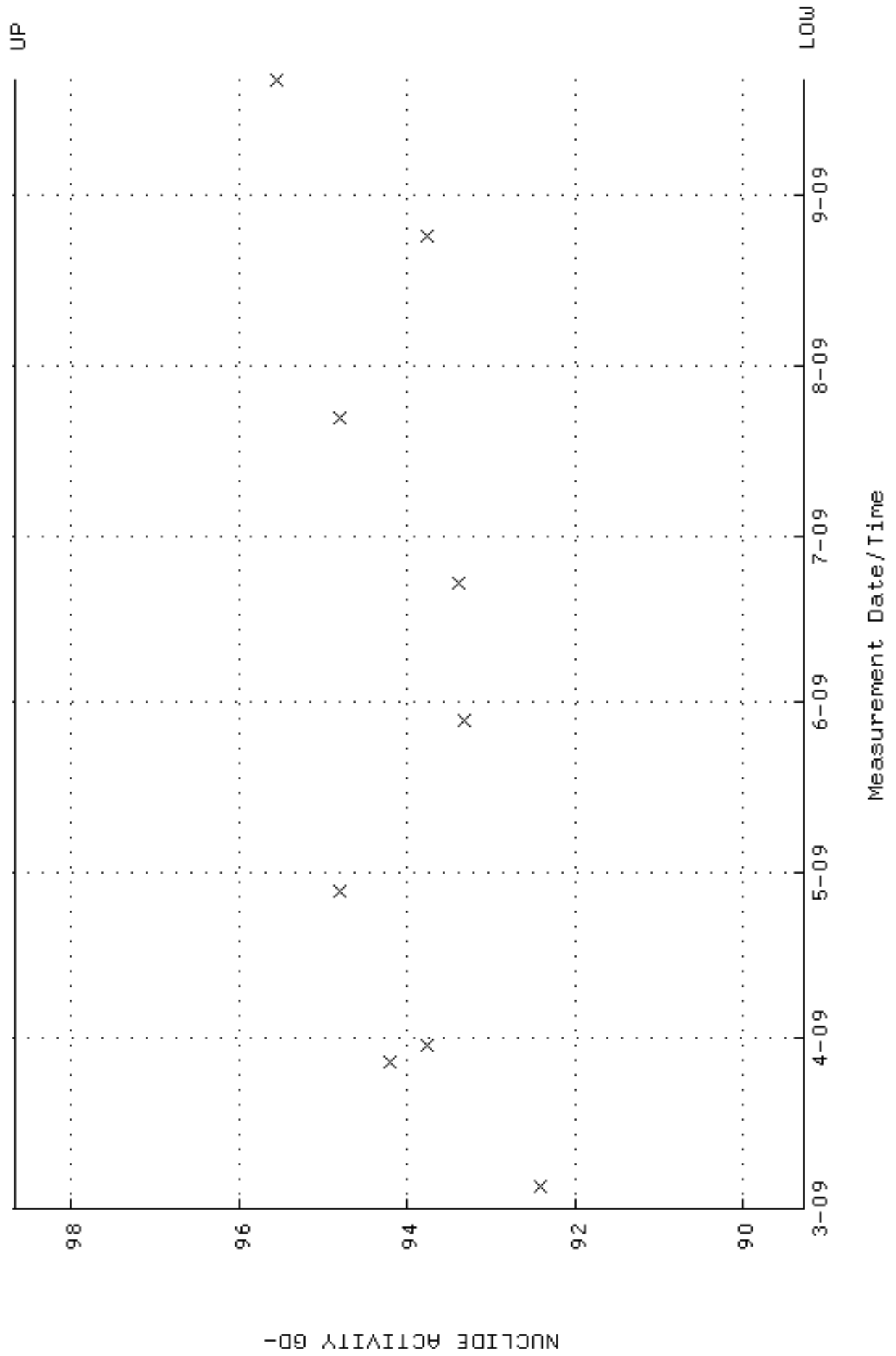
QA filename : DKA100:[ENV\_ALPHA.QA.B]B176.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:21:58 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



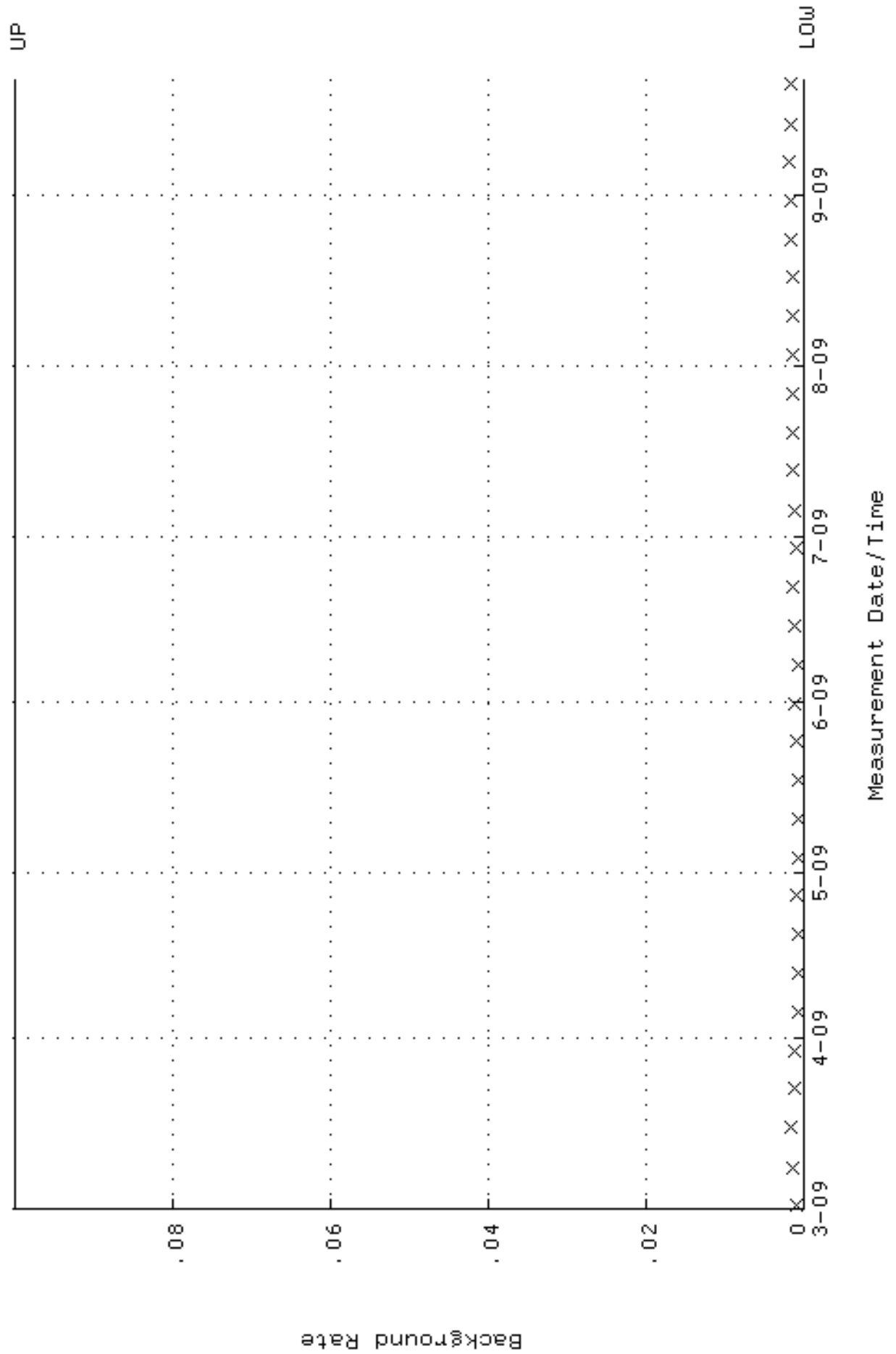
QA filename : DKA100:[ENV\_ALPHA.QA.W]W181.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:03 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.247722 through 0.267722



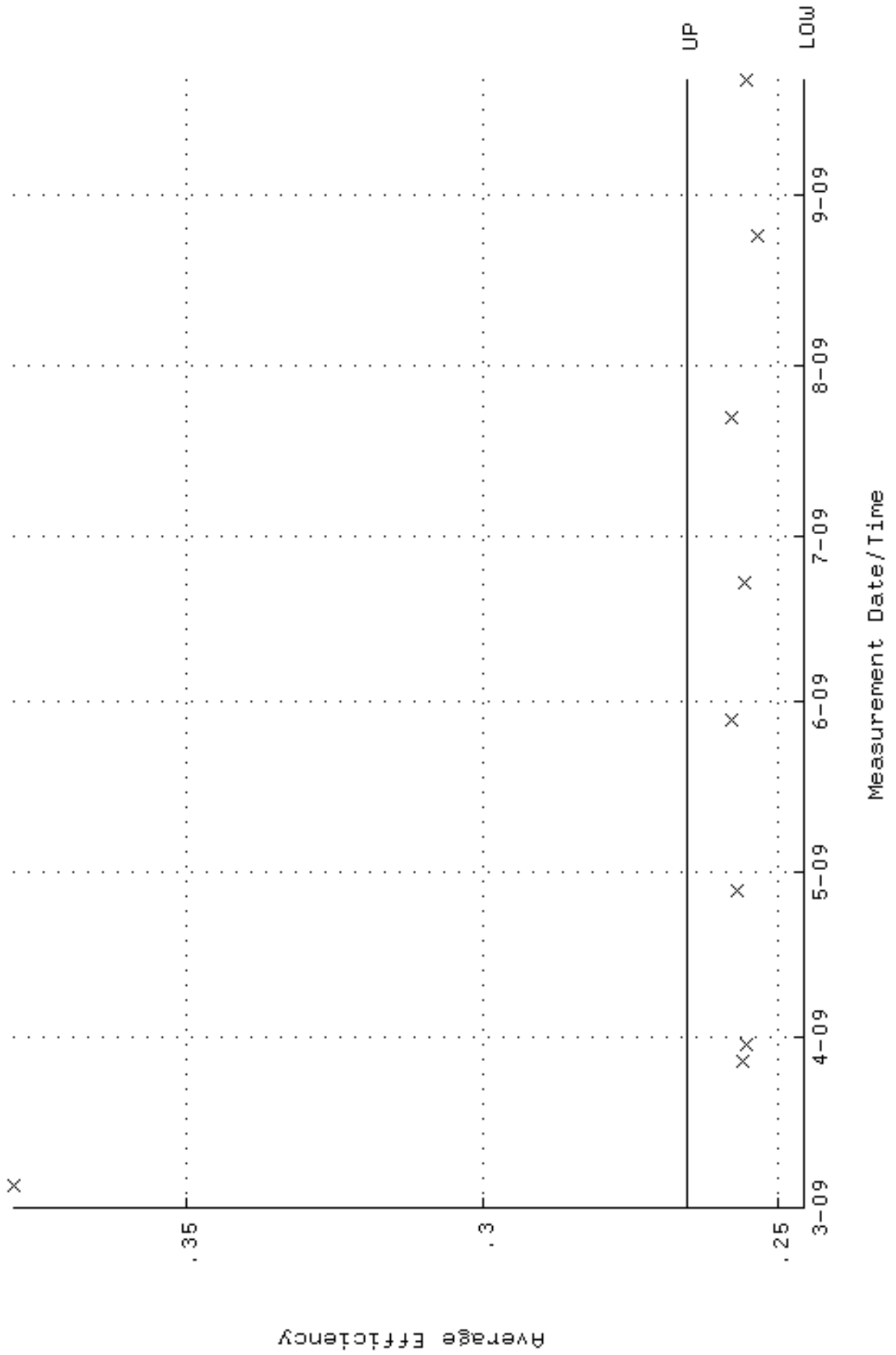
QA filename : DKA100:[ENV\_ALPHA.QA.W]w181.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:03 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 89.2737 through 98.6709



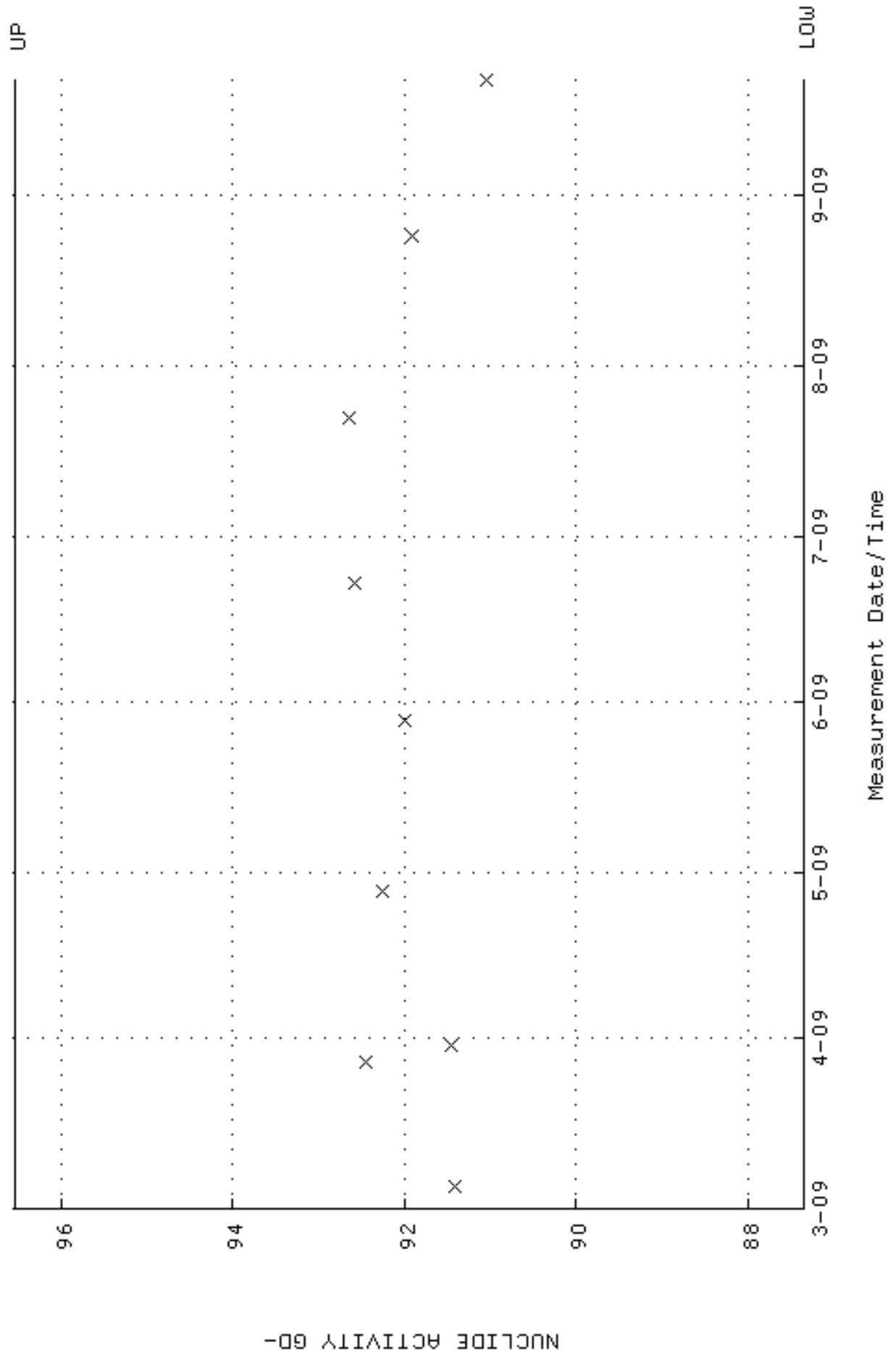
QA filename : DKA100:[ENV\_ALPHA.QA.B]B181.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:17 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



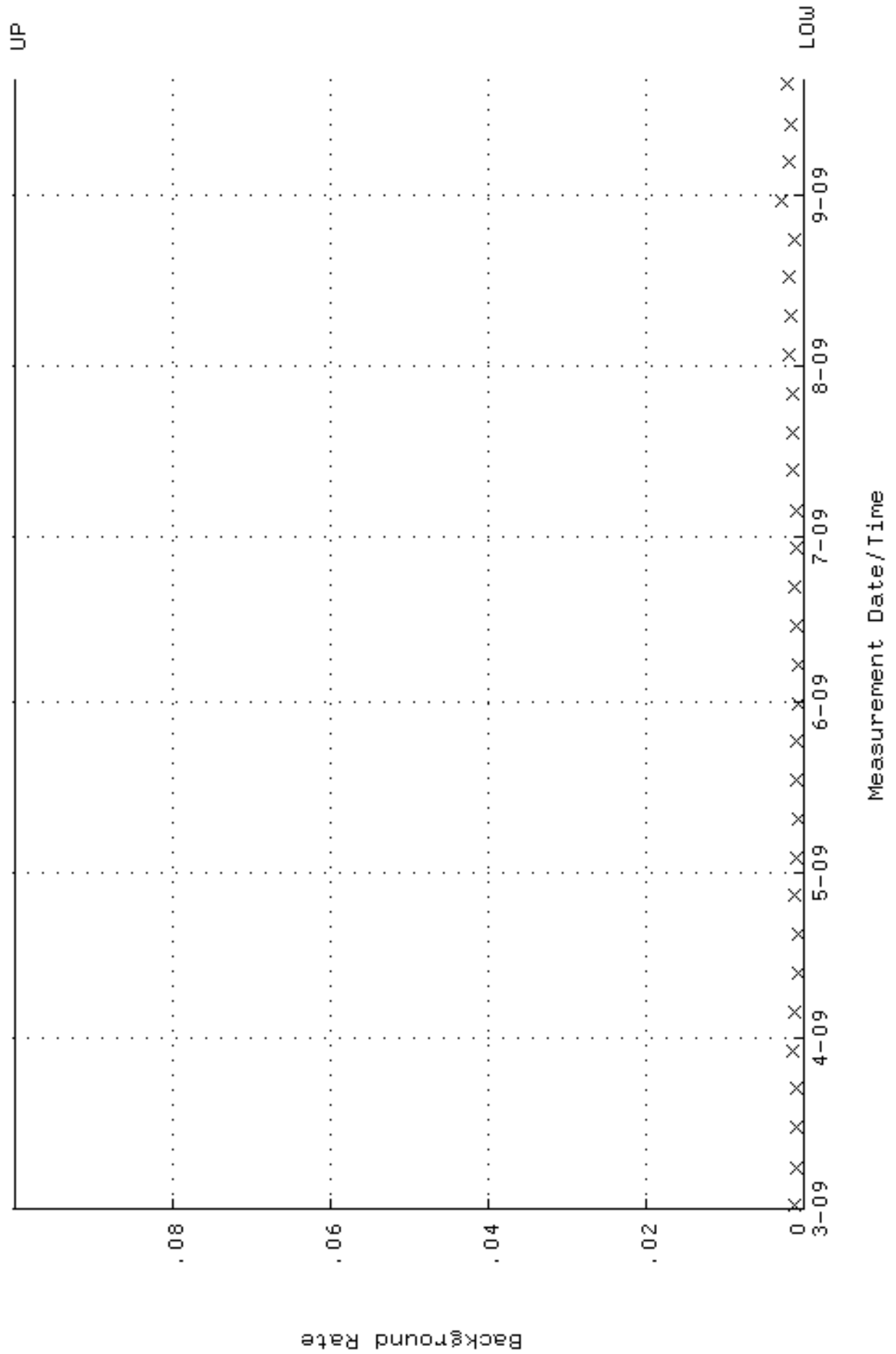
QA filename : DKA100:[ENV\_ALPHA.QA.W]W182.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:07 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.245707 through 0.265707



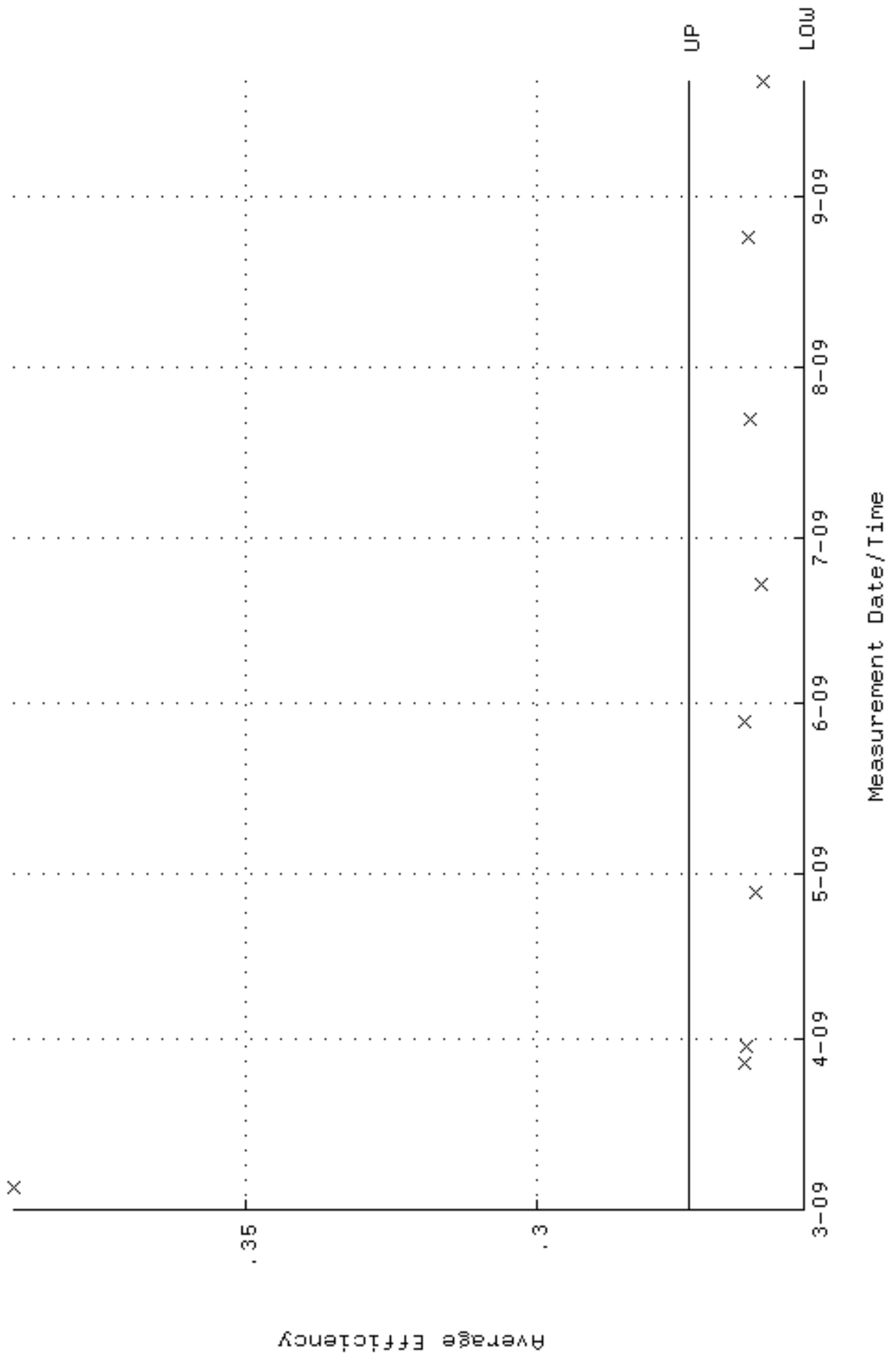
QA filename : DKA100:[ENV\_ALPHA.QA.W]w182.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:07 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 87.3454 through 96.5396



QA filename : DKA100:[ENV\_ALPHA.QA.B]B182.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:20 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

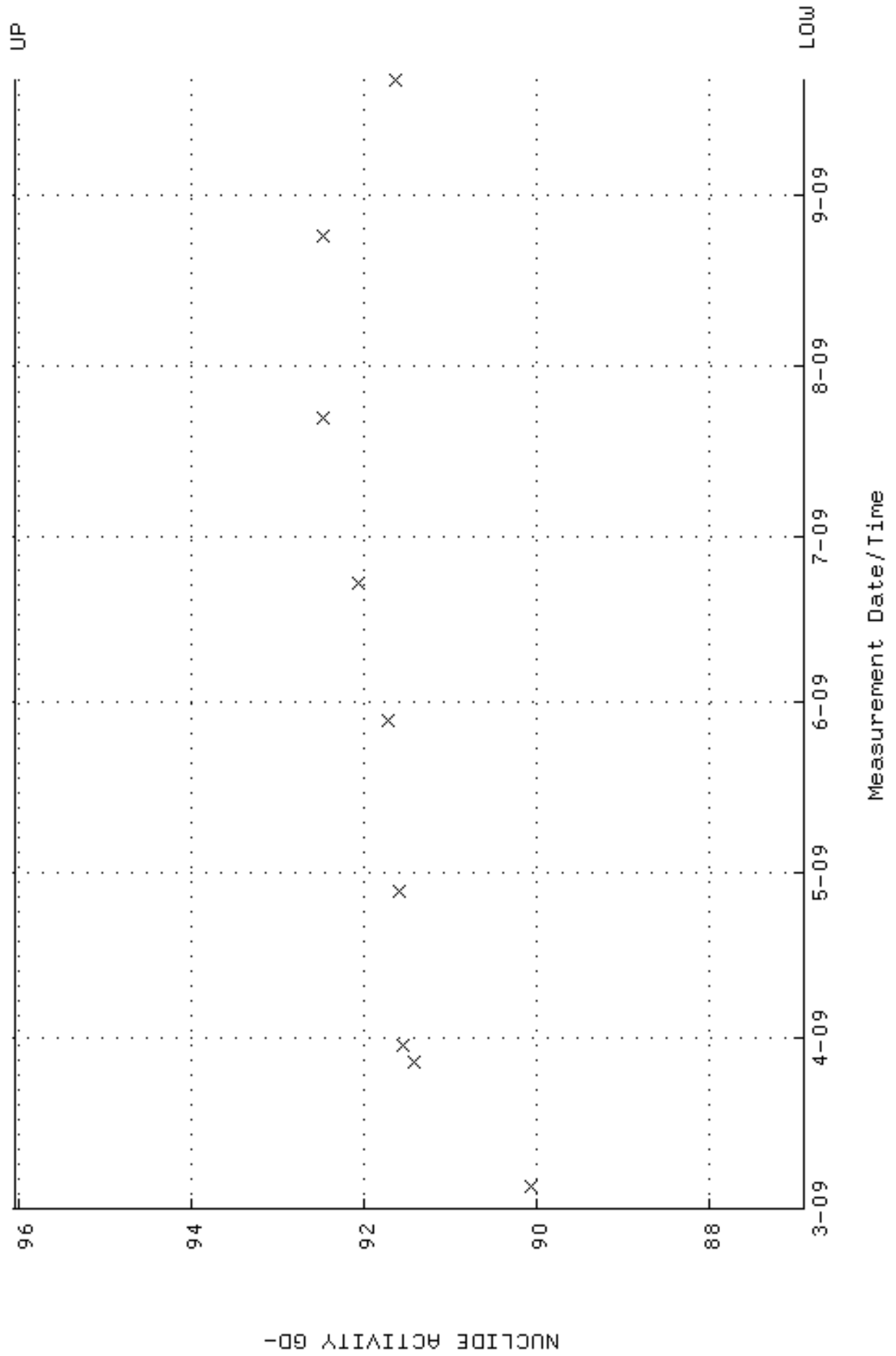


QA filename : DKA100:[ENV\_ALPHA.QA.W]W183.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:11 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.254364 through 0.274364

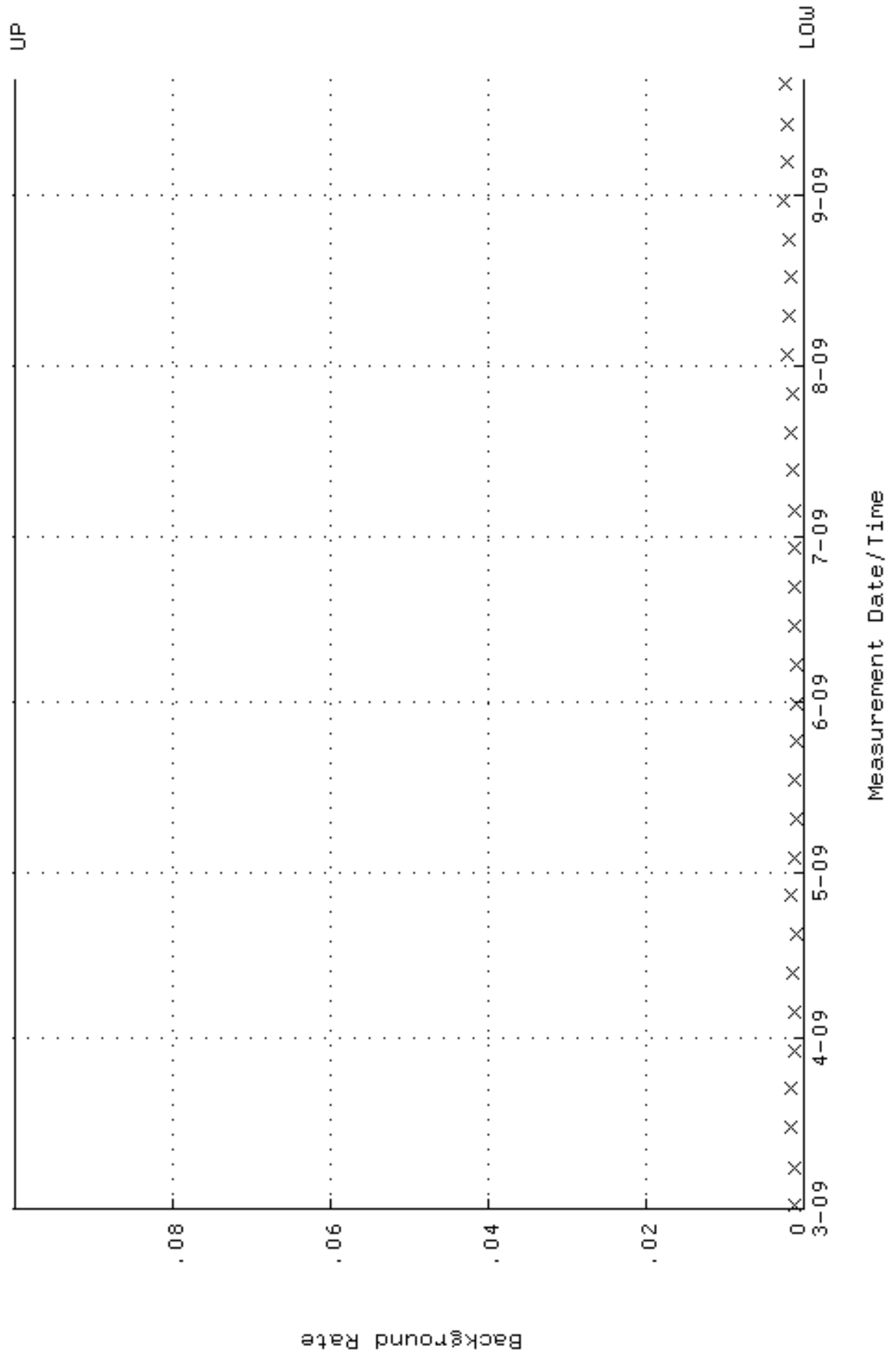




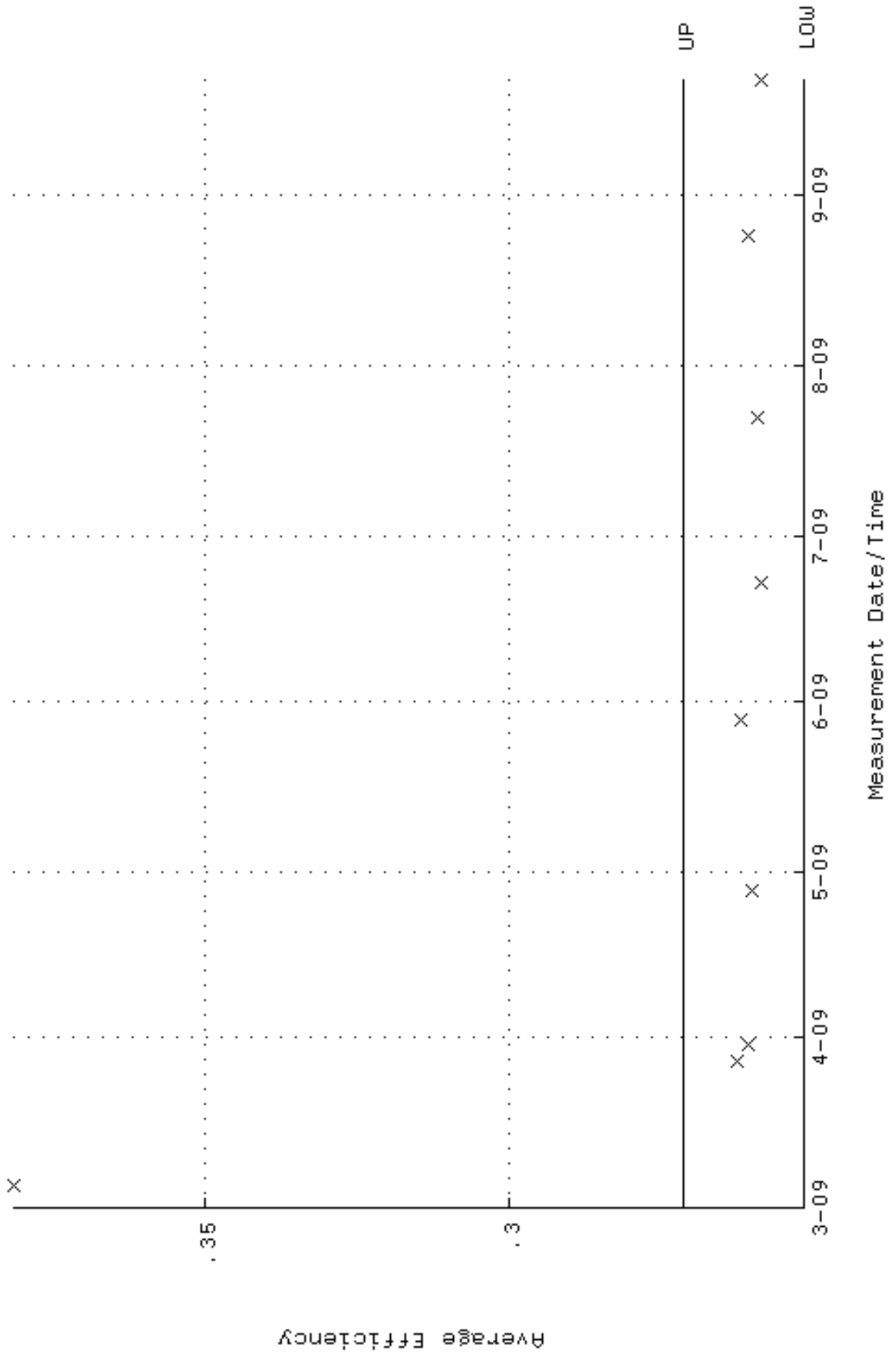
QA filename : DKA100:[ENV\_ALPHA.QA.W]w183.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:11 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 86.8927 through 96.0393



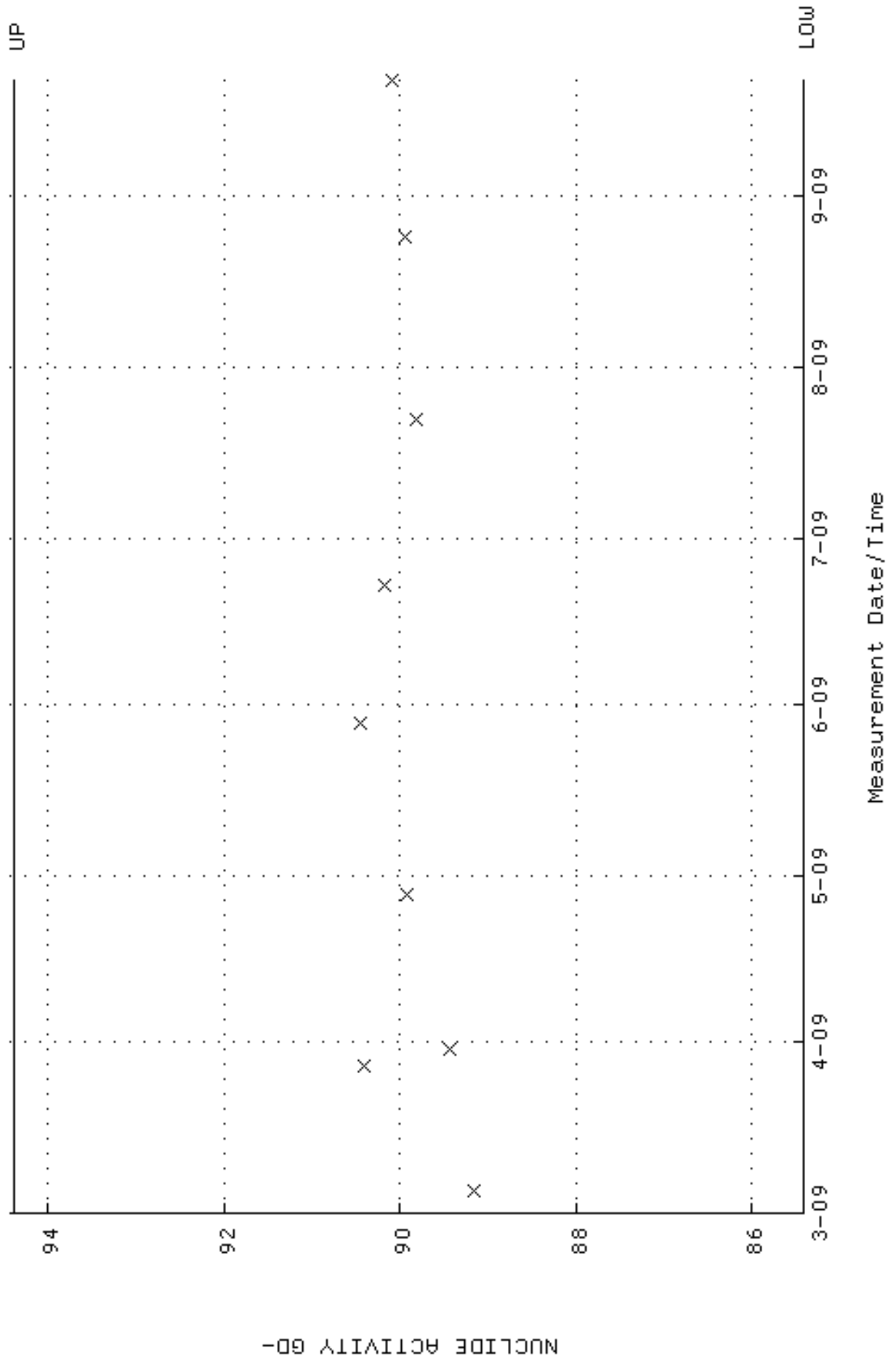
QA filename : DKA100:[ENV\_ALPHA.QA.B]B183.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:24 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



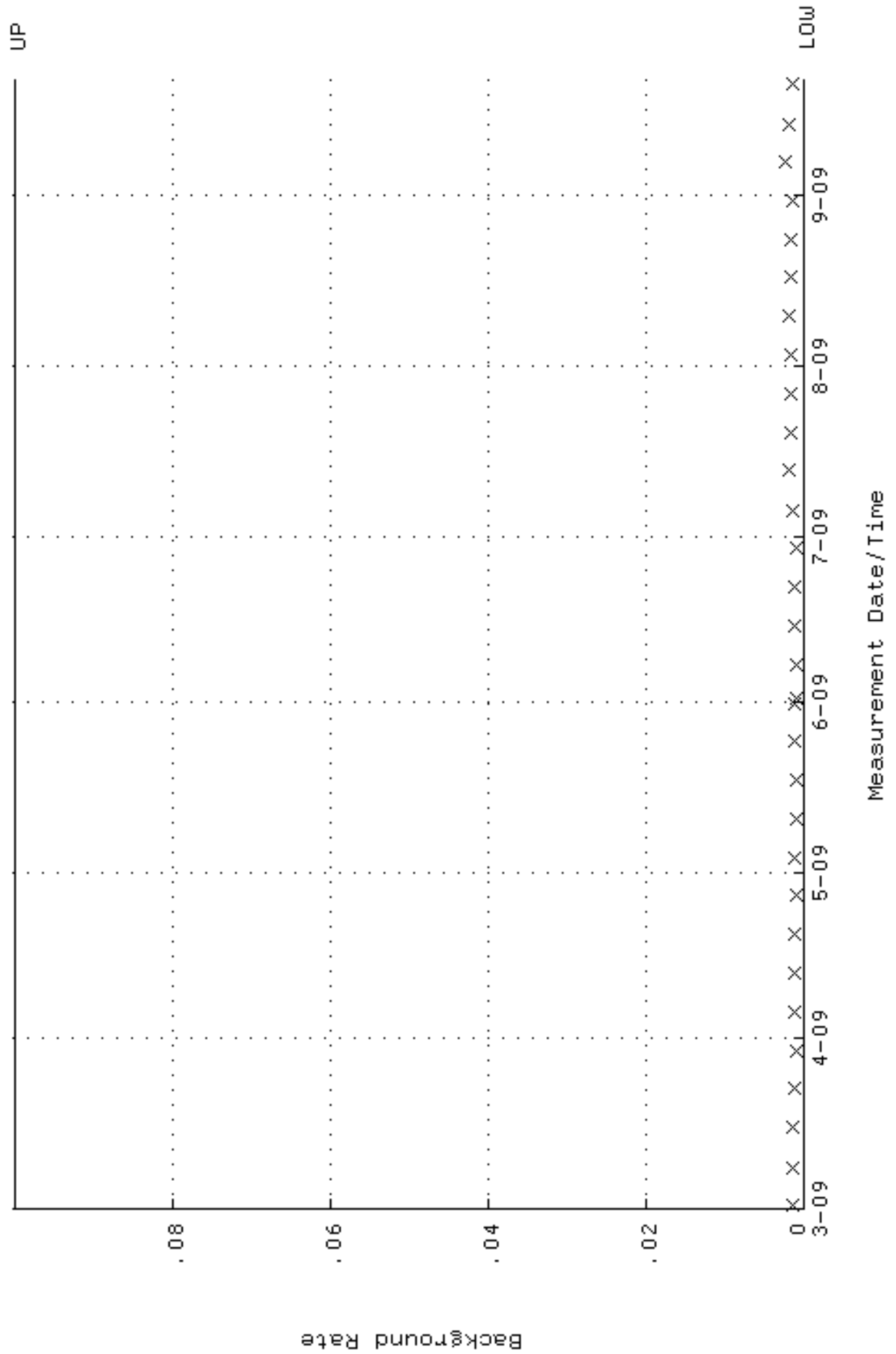
QA filename : DKA100:[ENV\_ALPHA.QA.W]W184.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:15 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.251367 through 0.271367



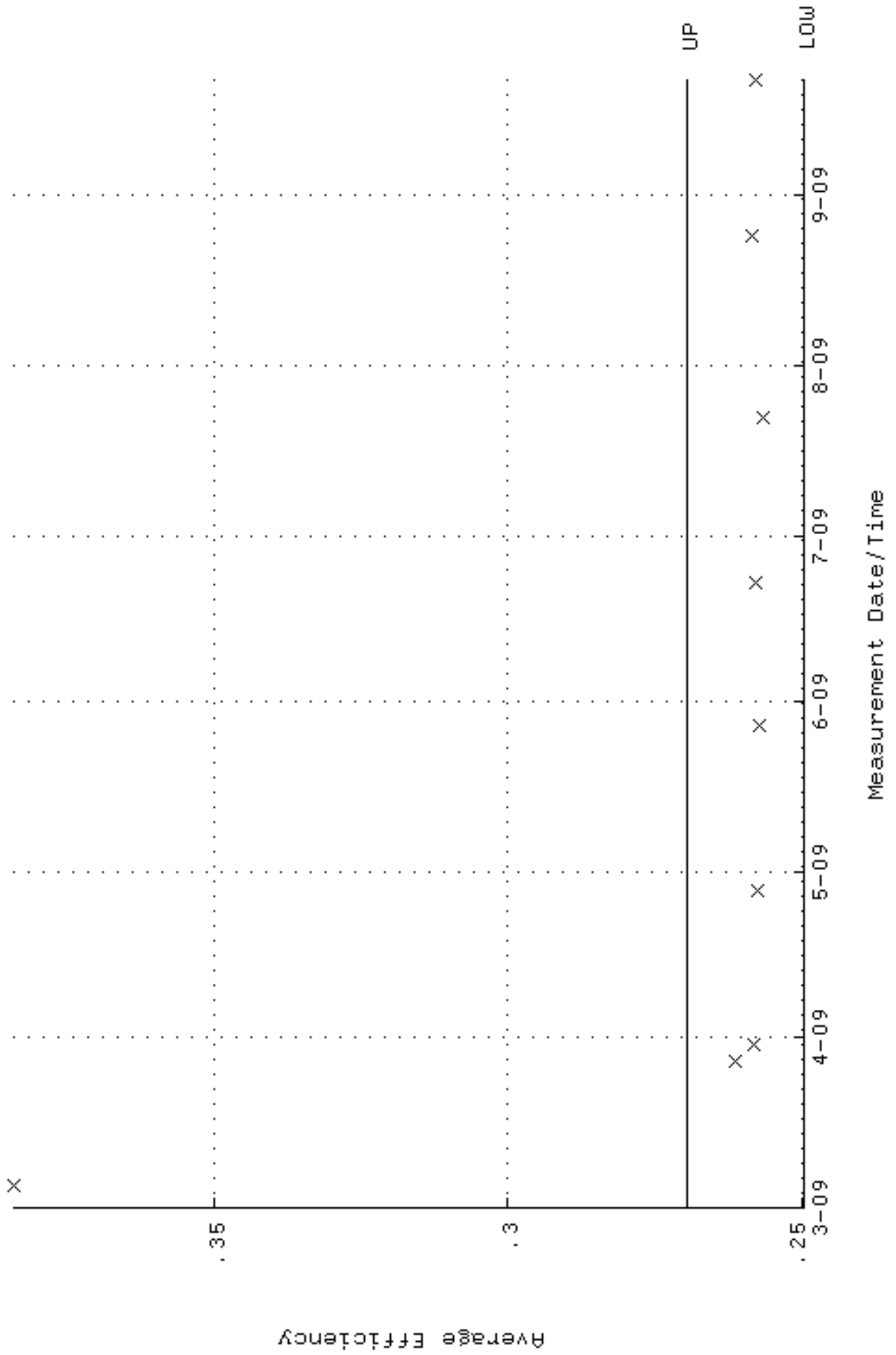
QA filename : DKA100:[ENV\_ALPHA.QA.W]w184.QAF;1  
Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
Start/End Dates : 4-MAR-2009 22:39:15 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 85.4139 through 94.4049



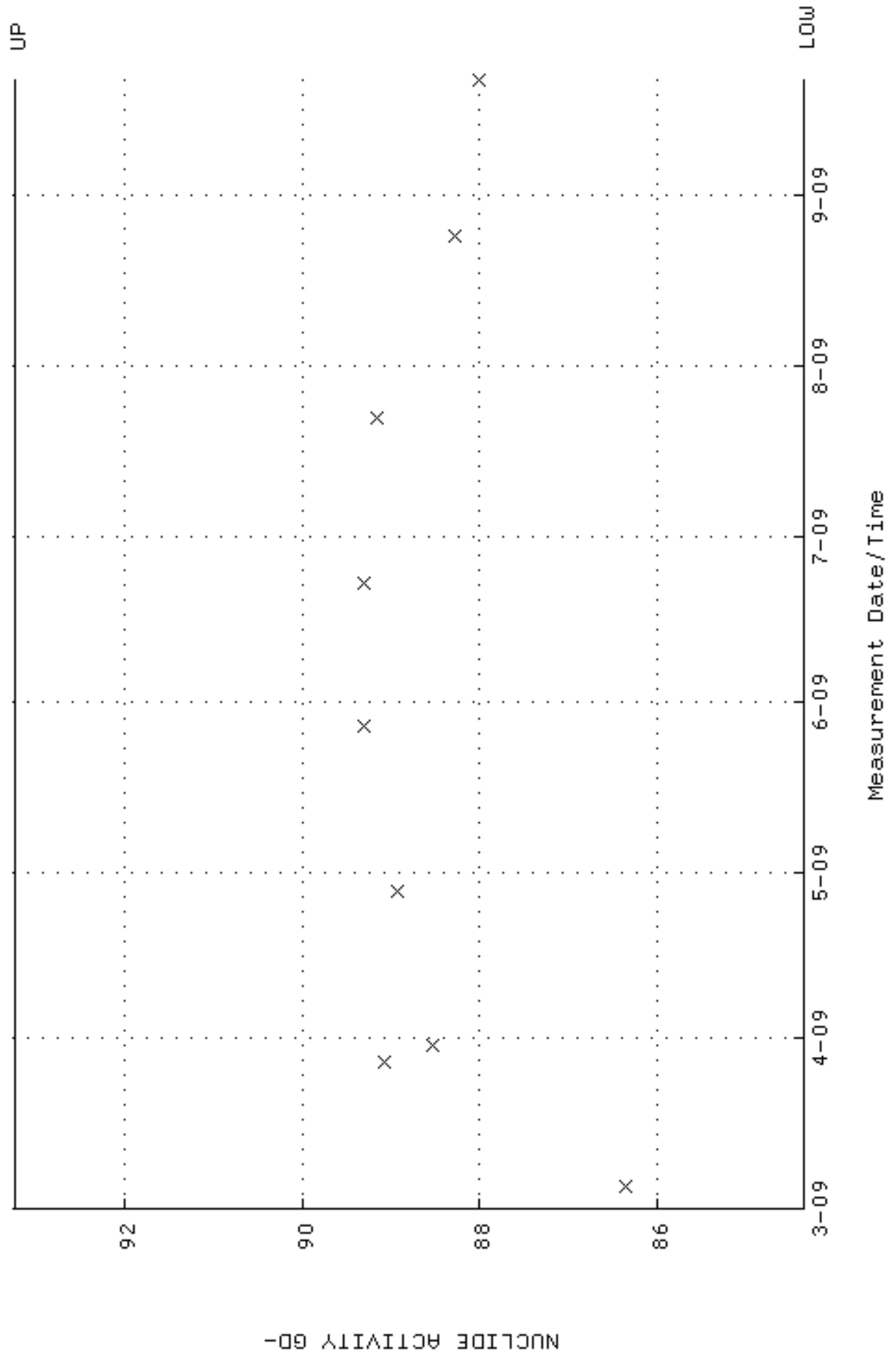
QA filename : DKA100:[ENV\_ALPHA.QA.B]B184.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:28 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



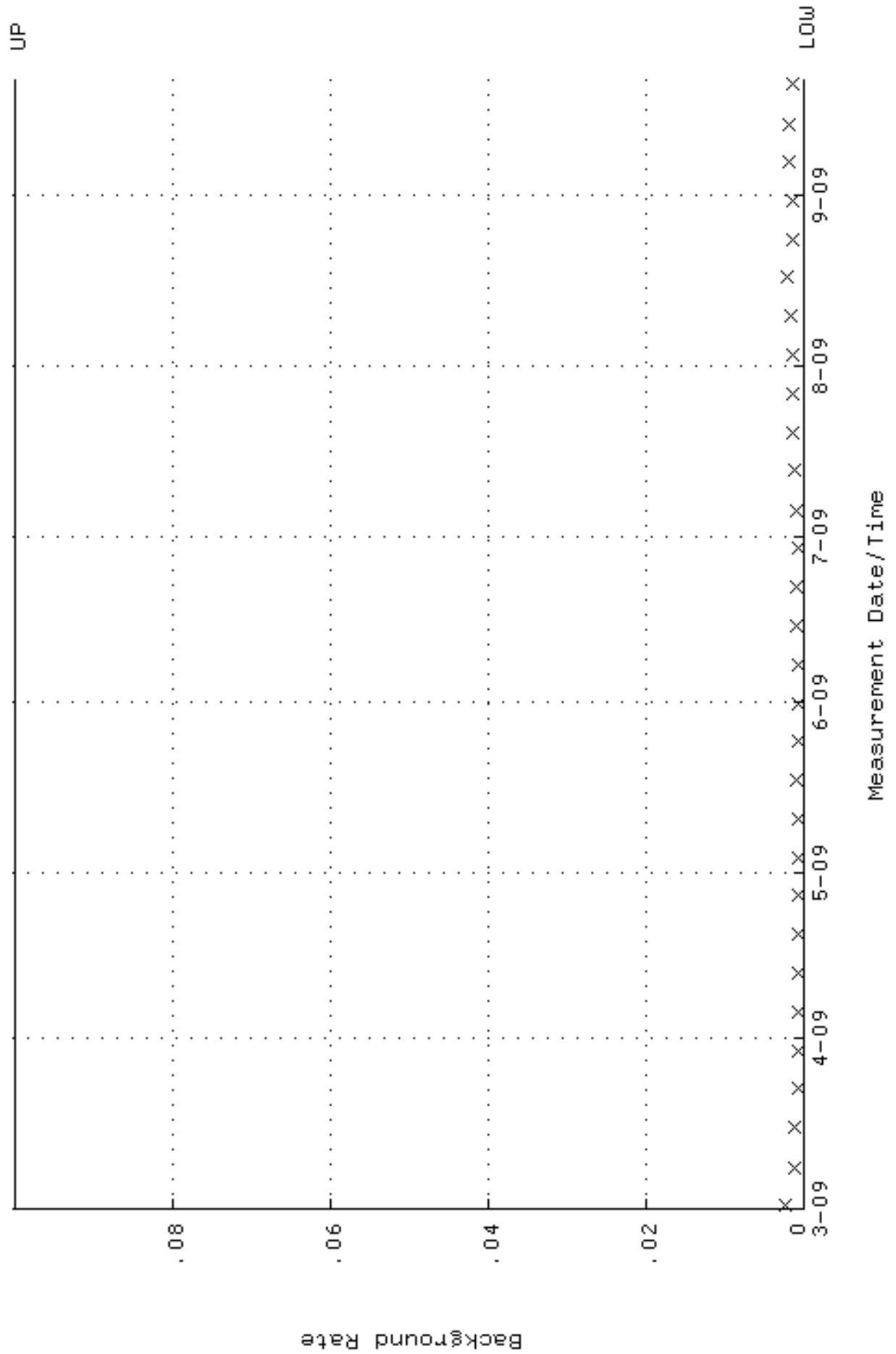
QA filename : DKA100:[ENV\_ALPHA.QA.W]W185.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:19 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.249628 through 0.269628



QA filename : DKA100:[ENV\_ALPHA.QA.W]w185.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:19 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 84.3502 through 93.2292

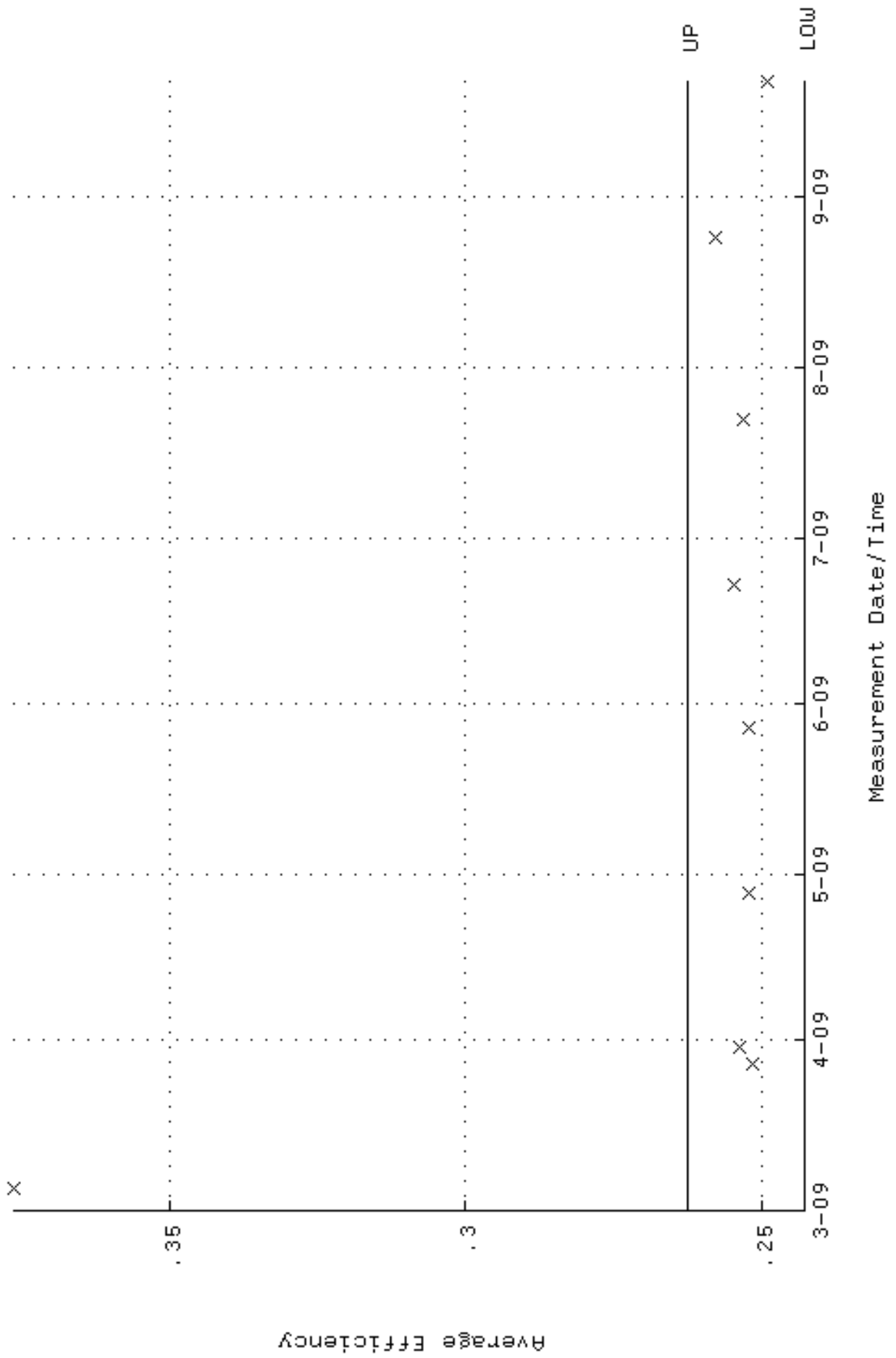


QA filename : DKA100:[ENV\_ALPHA.QA.B]B185.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:31 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

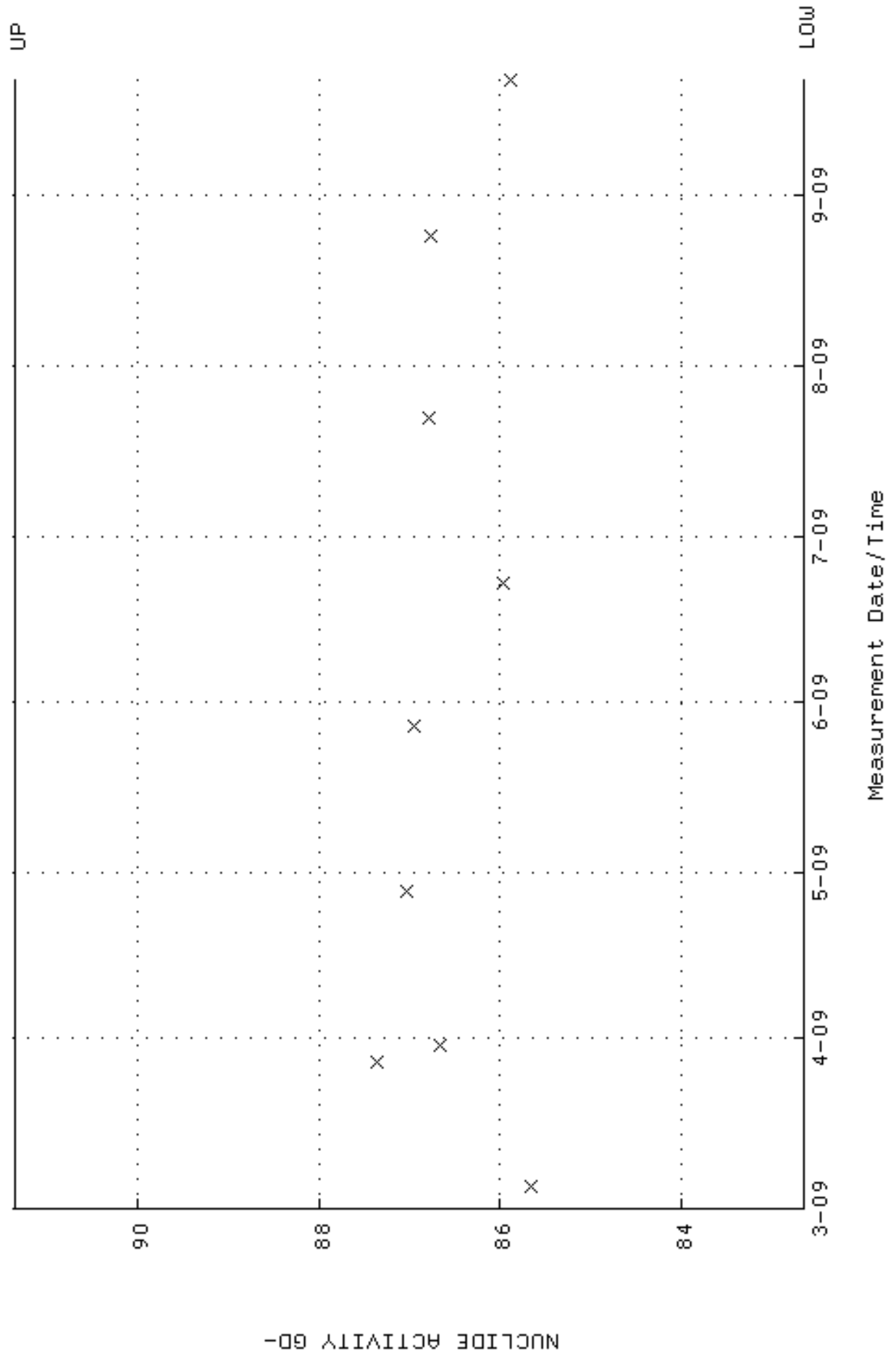




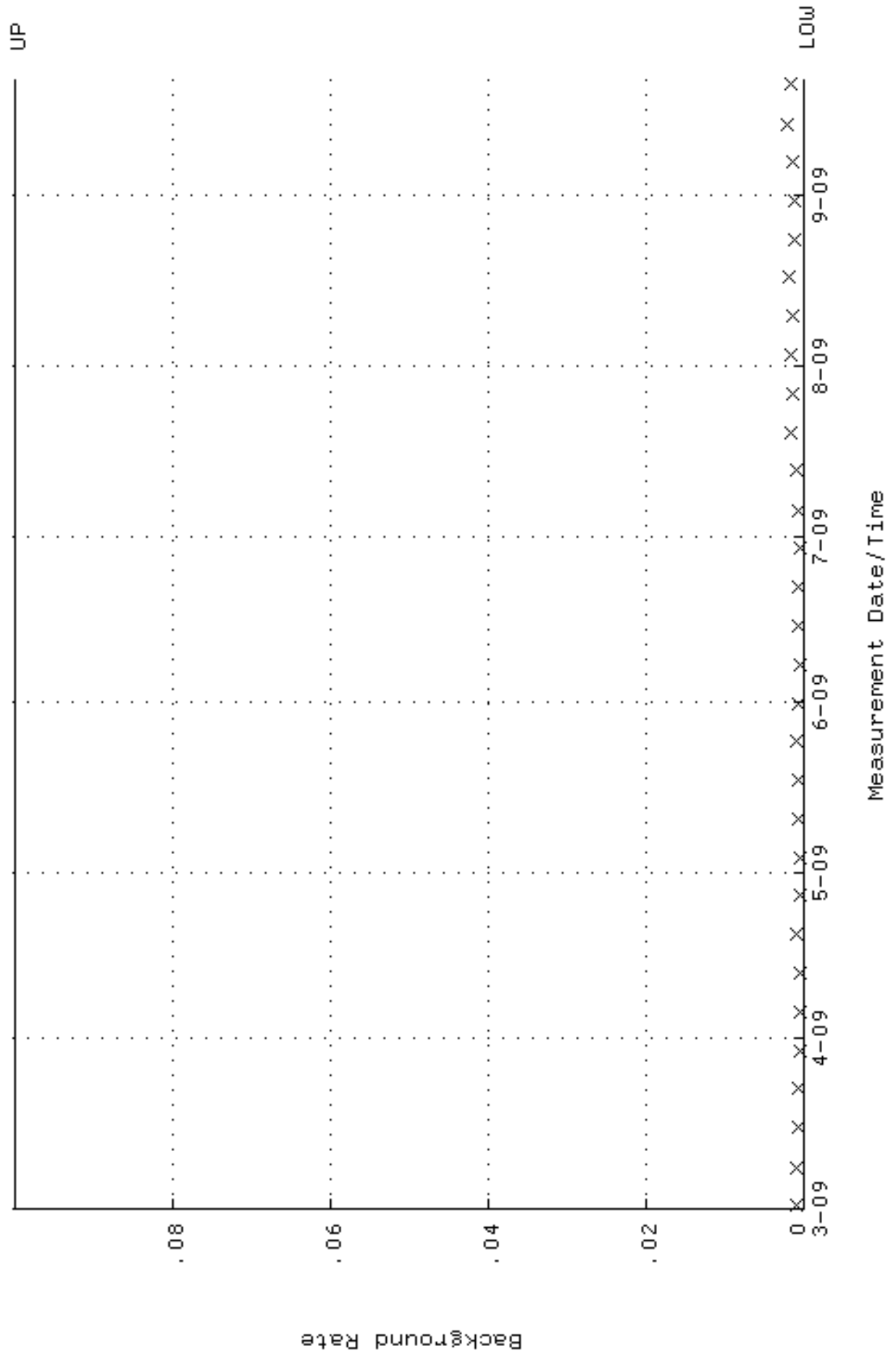
QA filename : DKA100:[ENV\_ALPHA.QA.W]W186.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:23 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.242649 through 0.262649



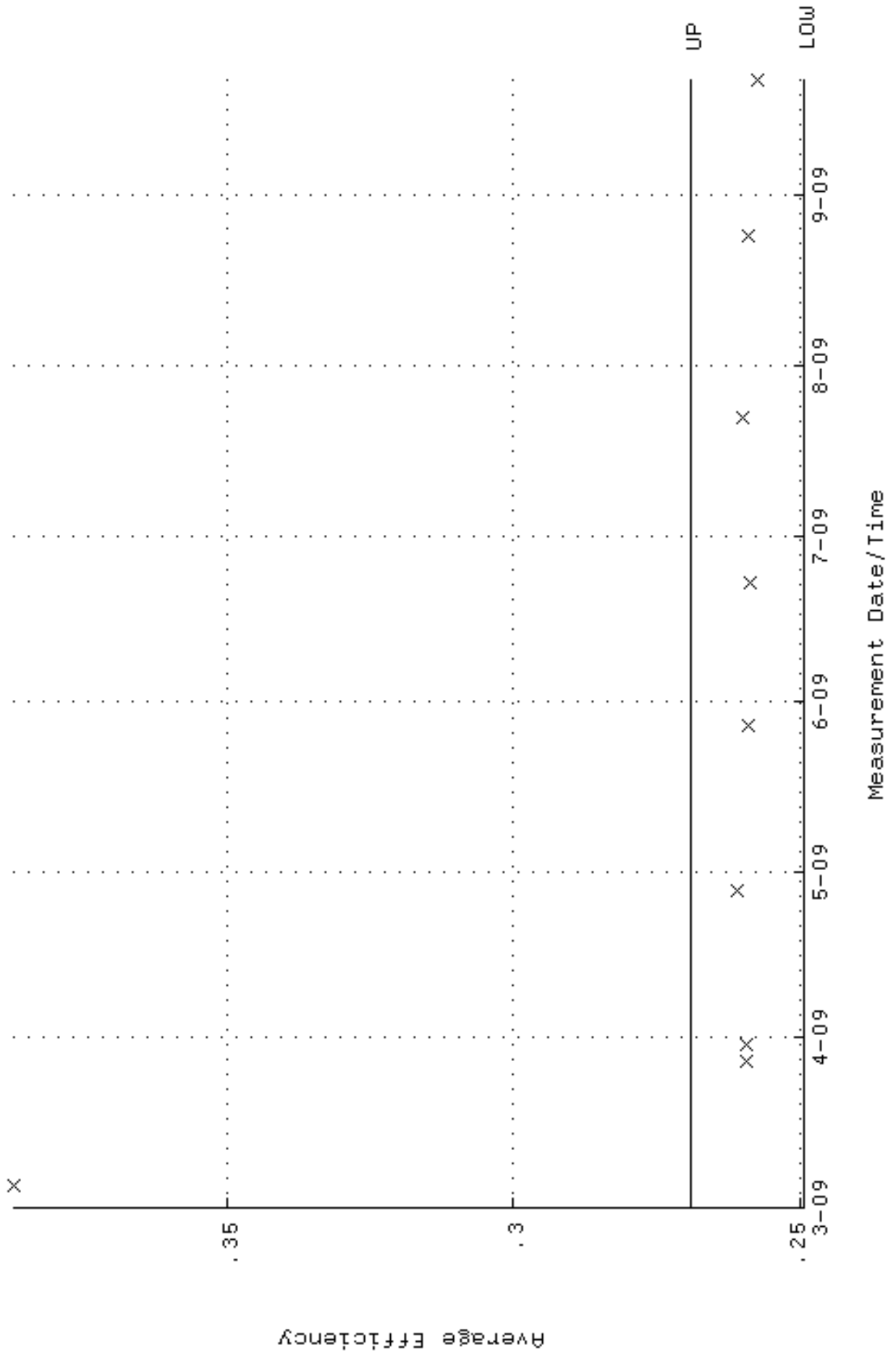
QA filename : DKA100:[ENV\_ALPHA.QA.W]W186.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:23 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 82.6495 through 91.3495



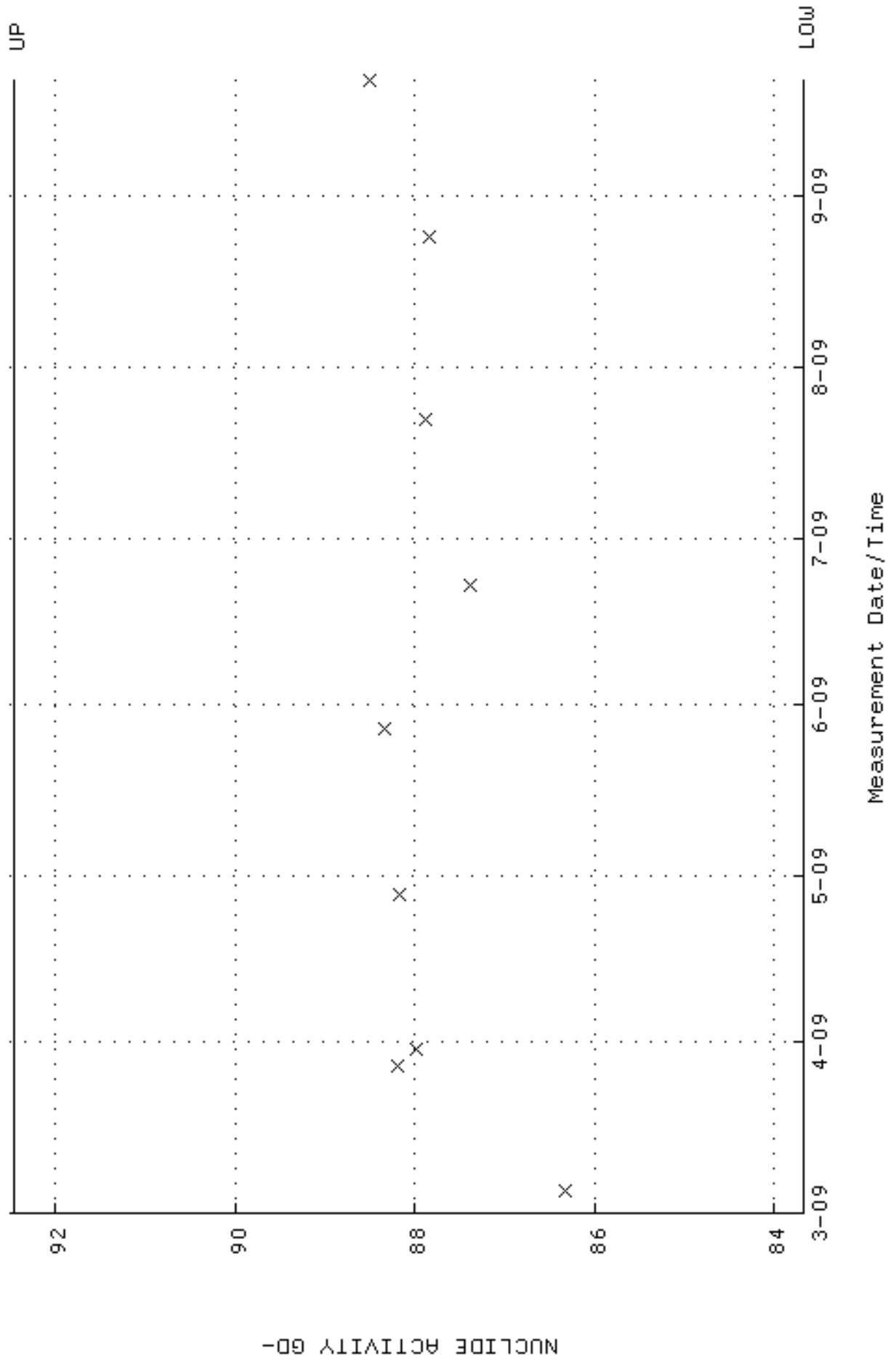
QA filename : DKA100:[ENV\_ALPHA.QA.B]B186.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:35 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



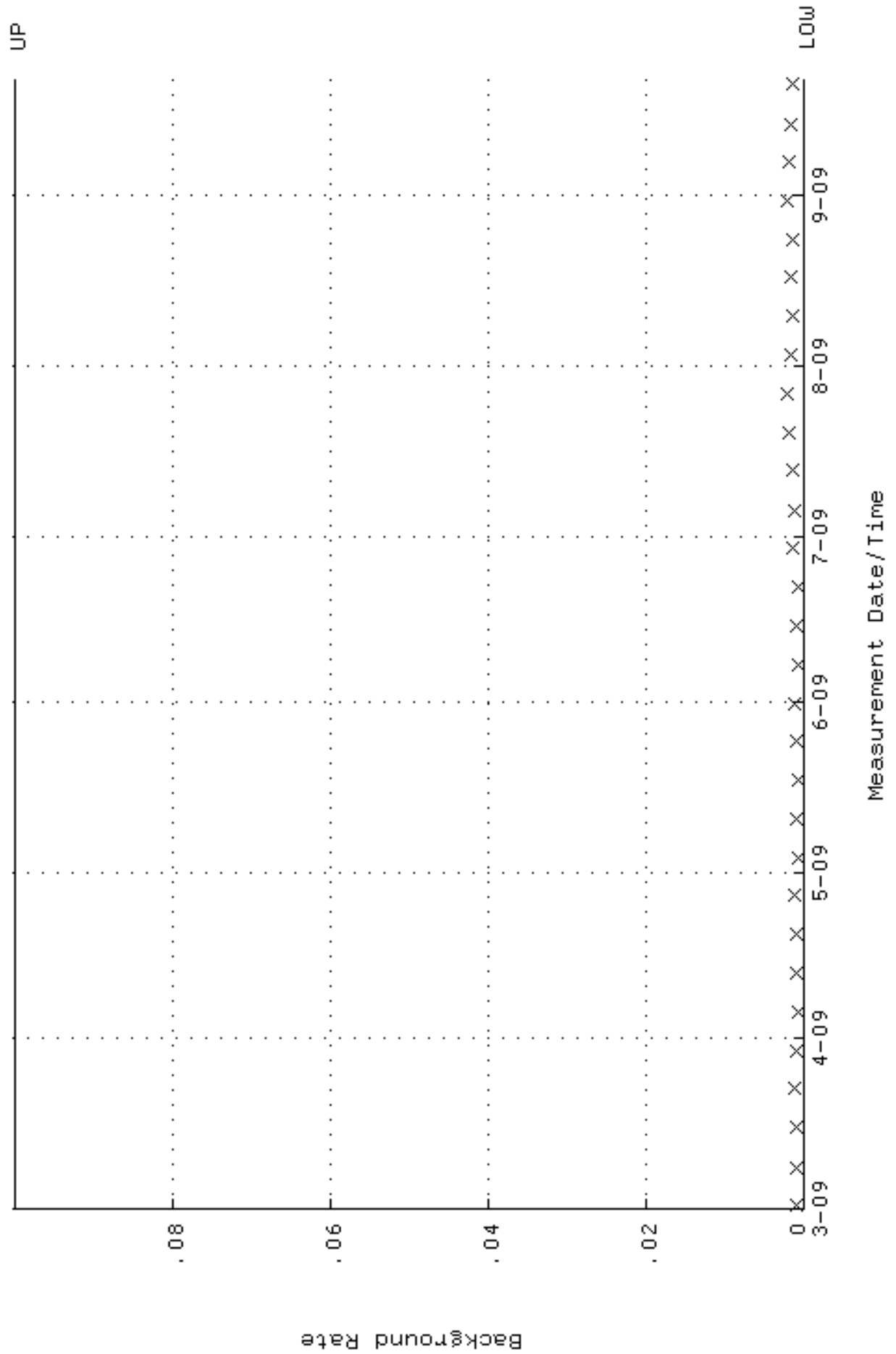
QA filename : DKA100:[ENV\_ALPHA.QA.W]W188.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:30 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.249341 through 0.269341



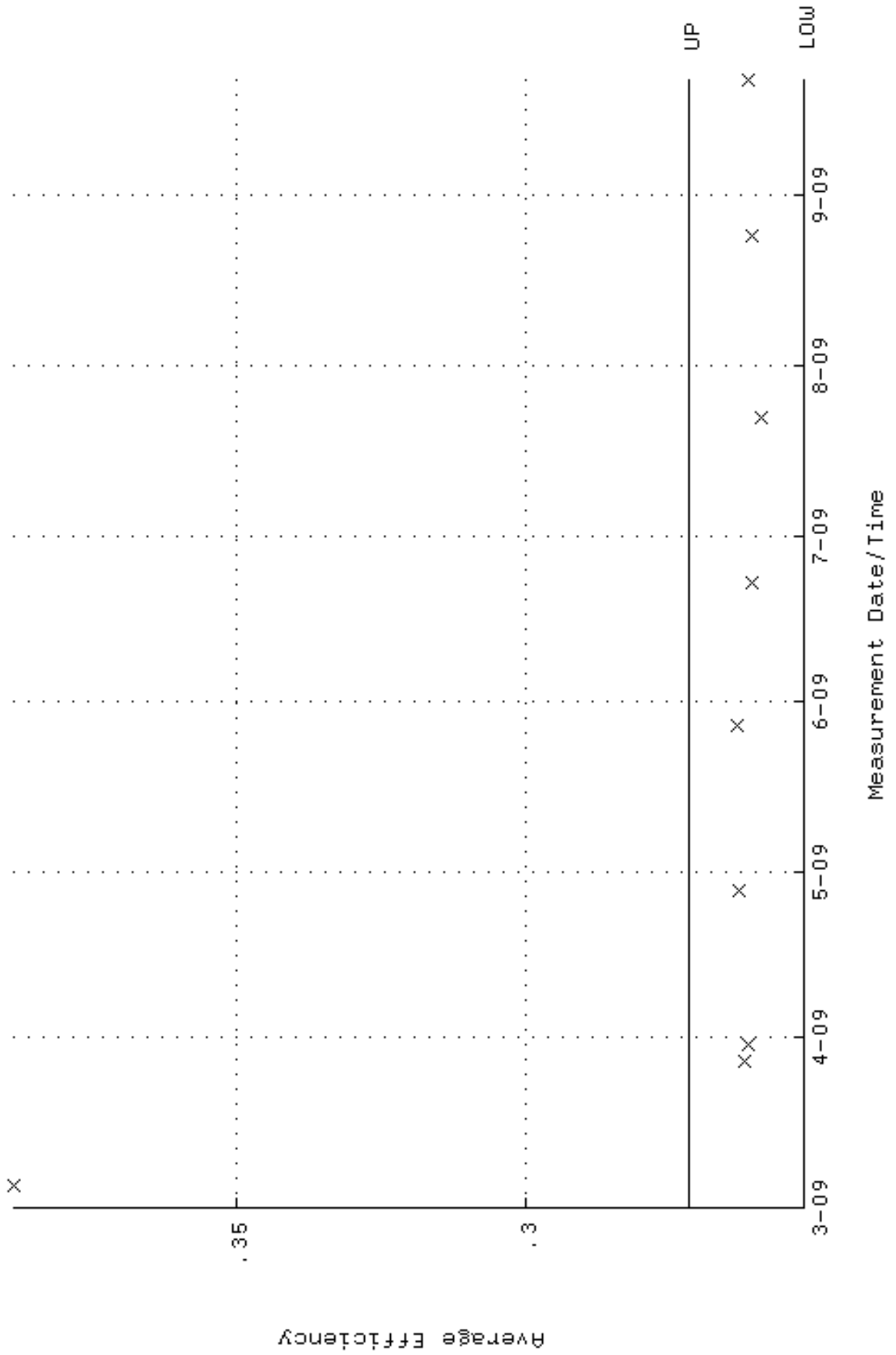
QA filename : DKA100:[ENV\_ALPHA.QA.W]w188.QAF;1  
Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
Start/End Dates : 4-MAR-2009 22:39:30 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 83.6747 through 92.4825



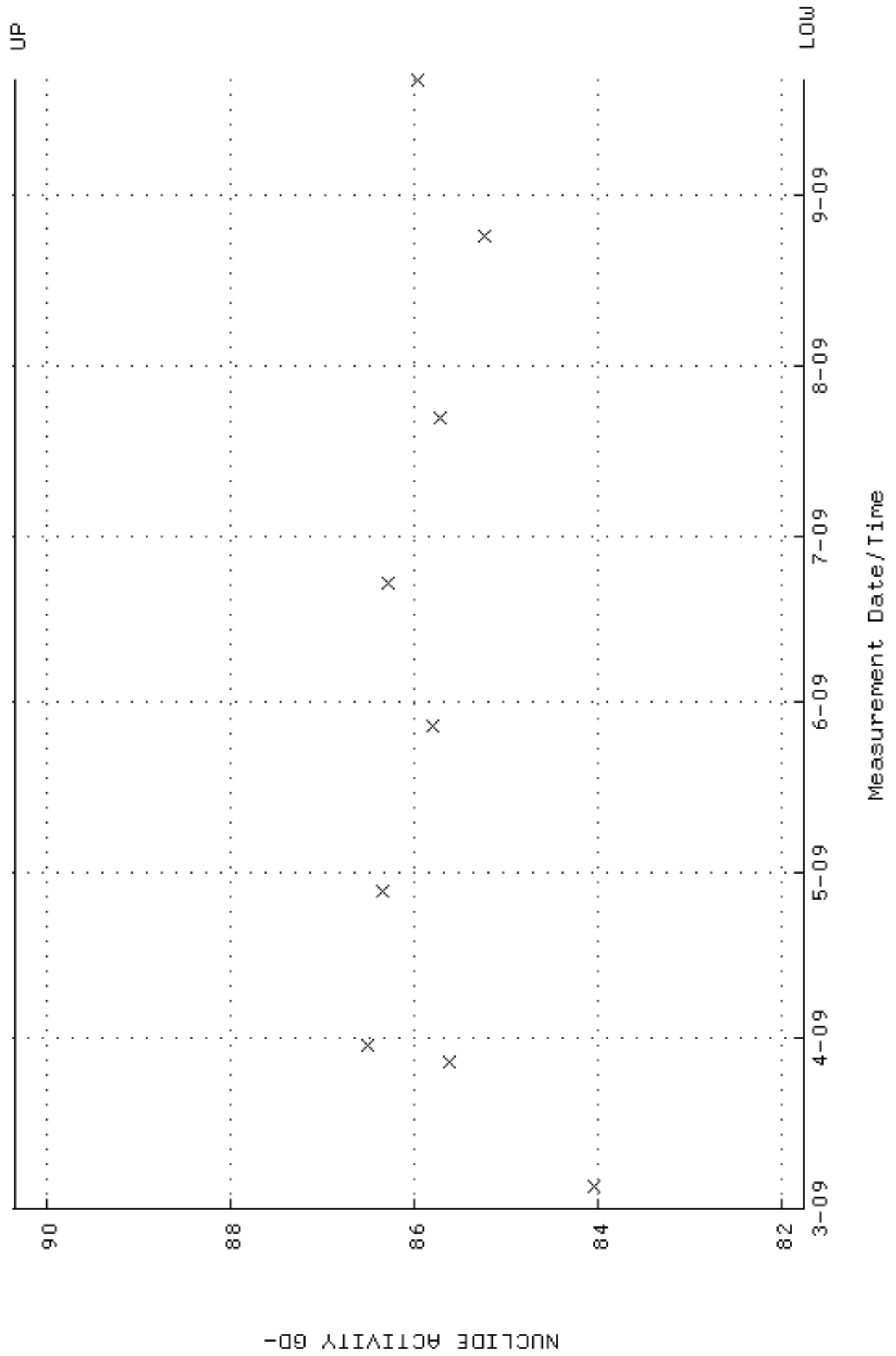
QA filename : DKA100:[ENV\_ALPHA.QA.B]B188.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:42 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



QA filename : DKA100:[ENV\_ALPHA.QA.W]W189.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:34 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.251590 through 0.271590

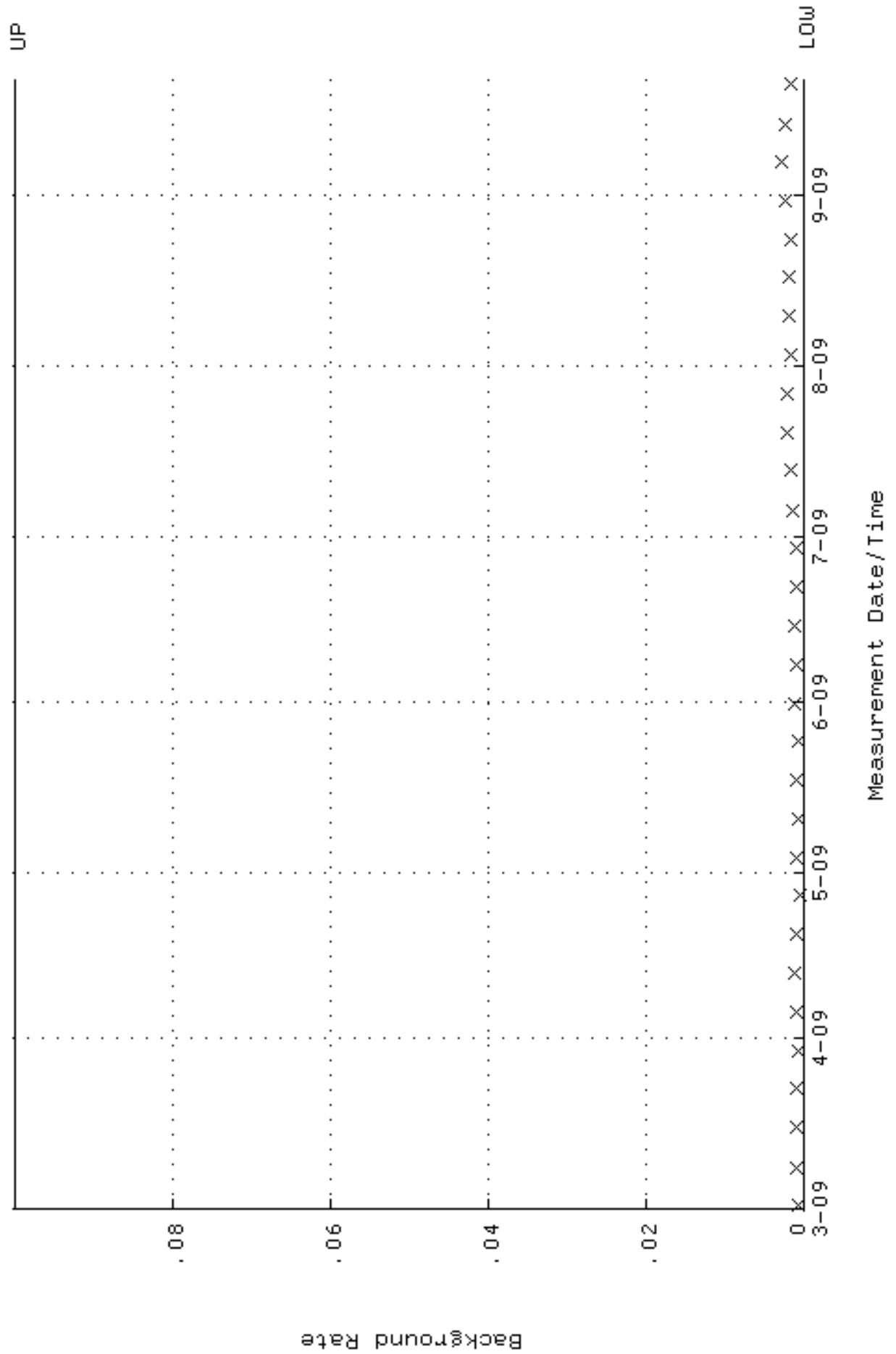


QA filename : DKA100:[ENV\_ALPHA.QA.W]w189.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:34 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 81.7473 through 90.3523

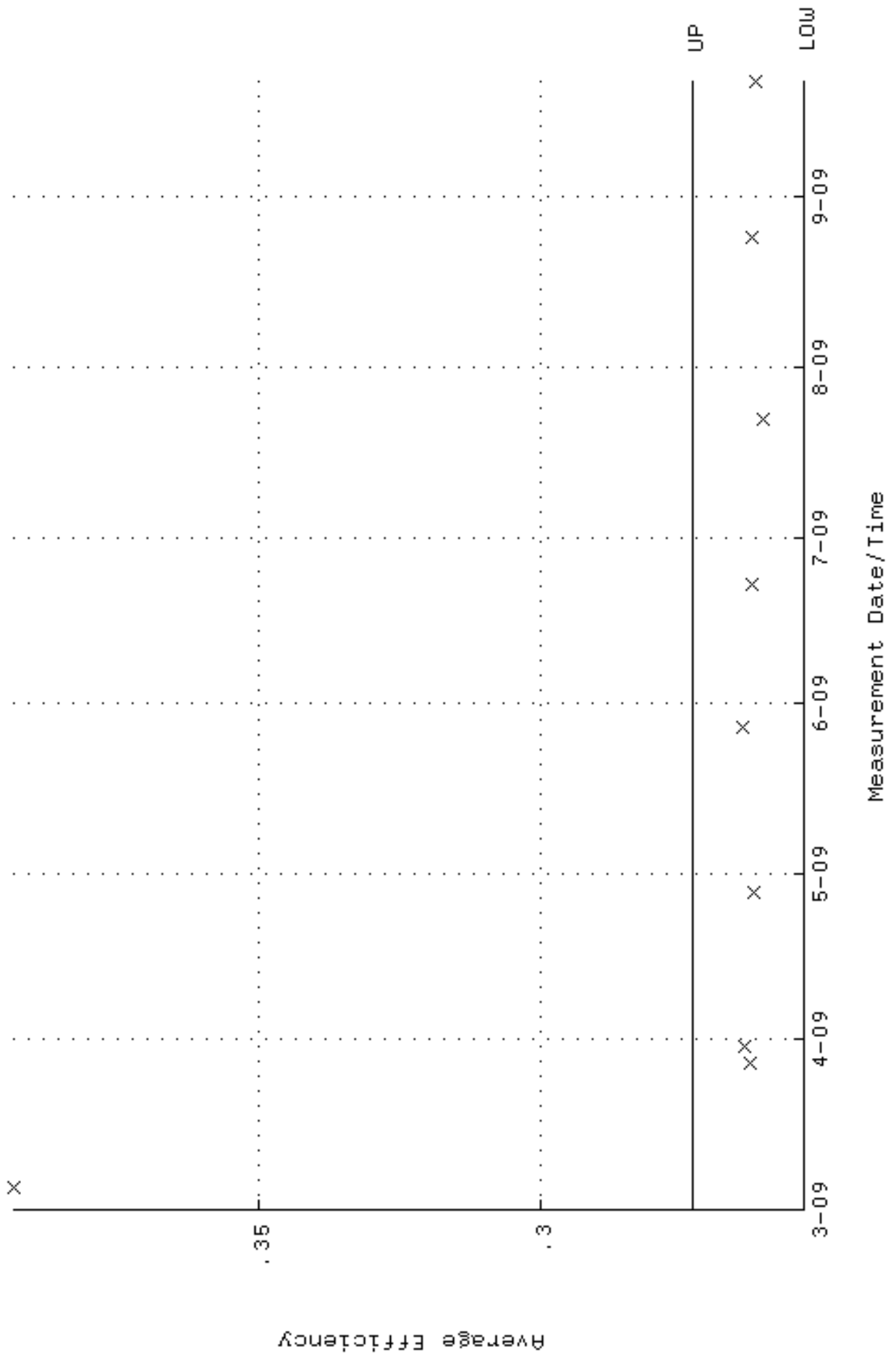




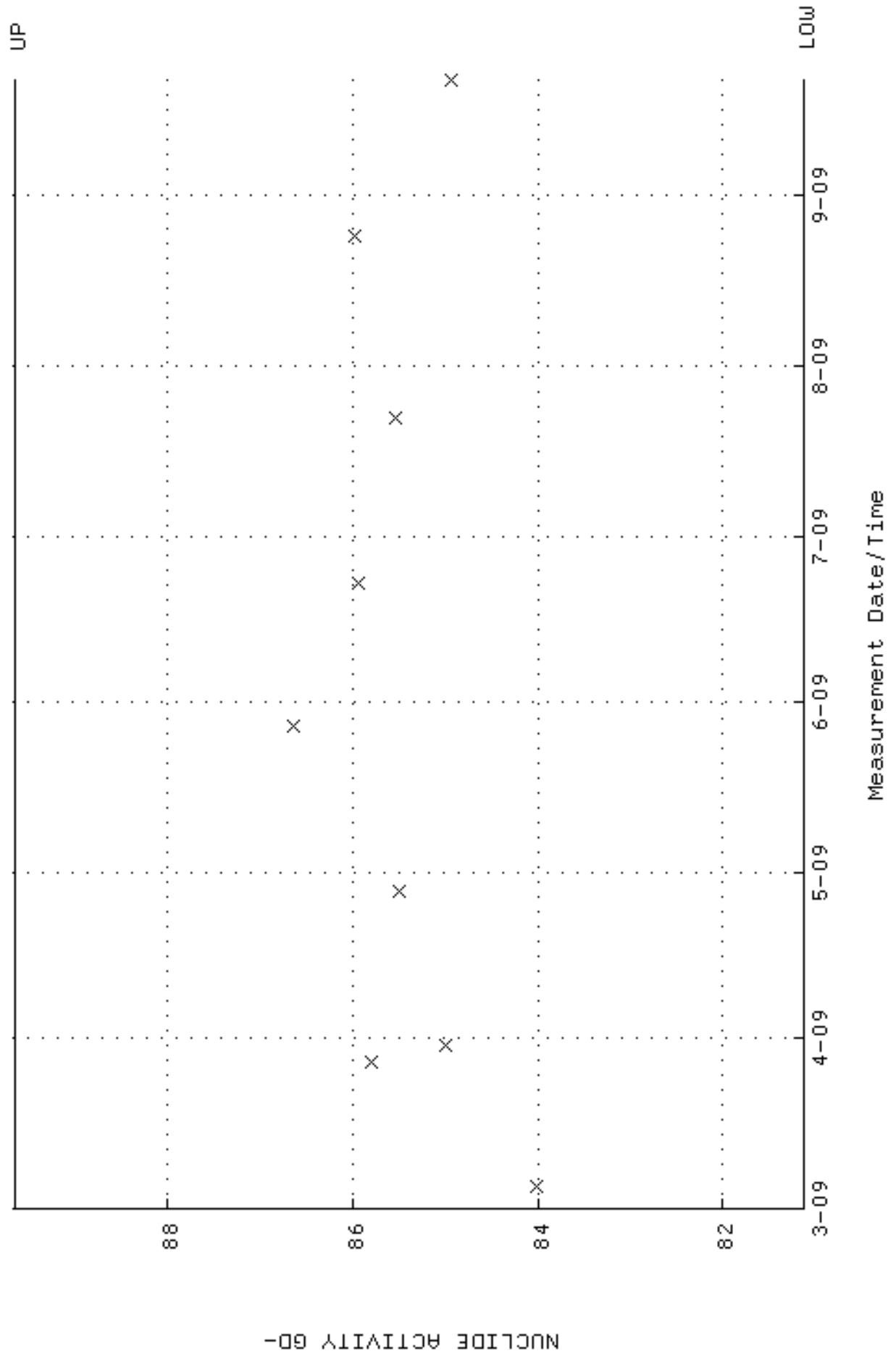
QA filename : DKA100:[ENV\_ALPHA.QA.B]B189.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:46 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



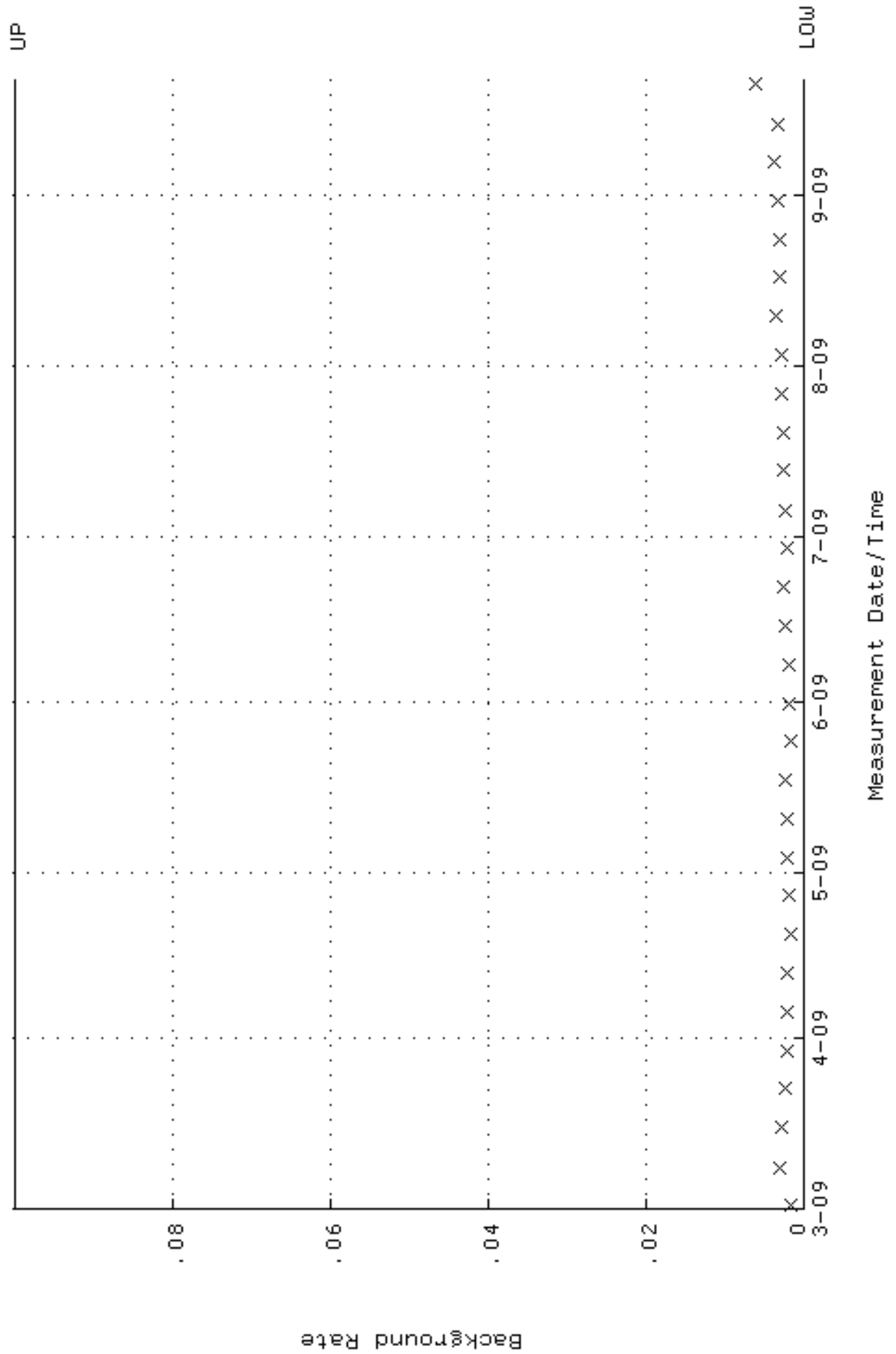
QA filename : DKA100:[ENV\_ALPHA.QA.W]W190.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:38 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.253504 through 0.273504



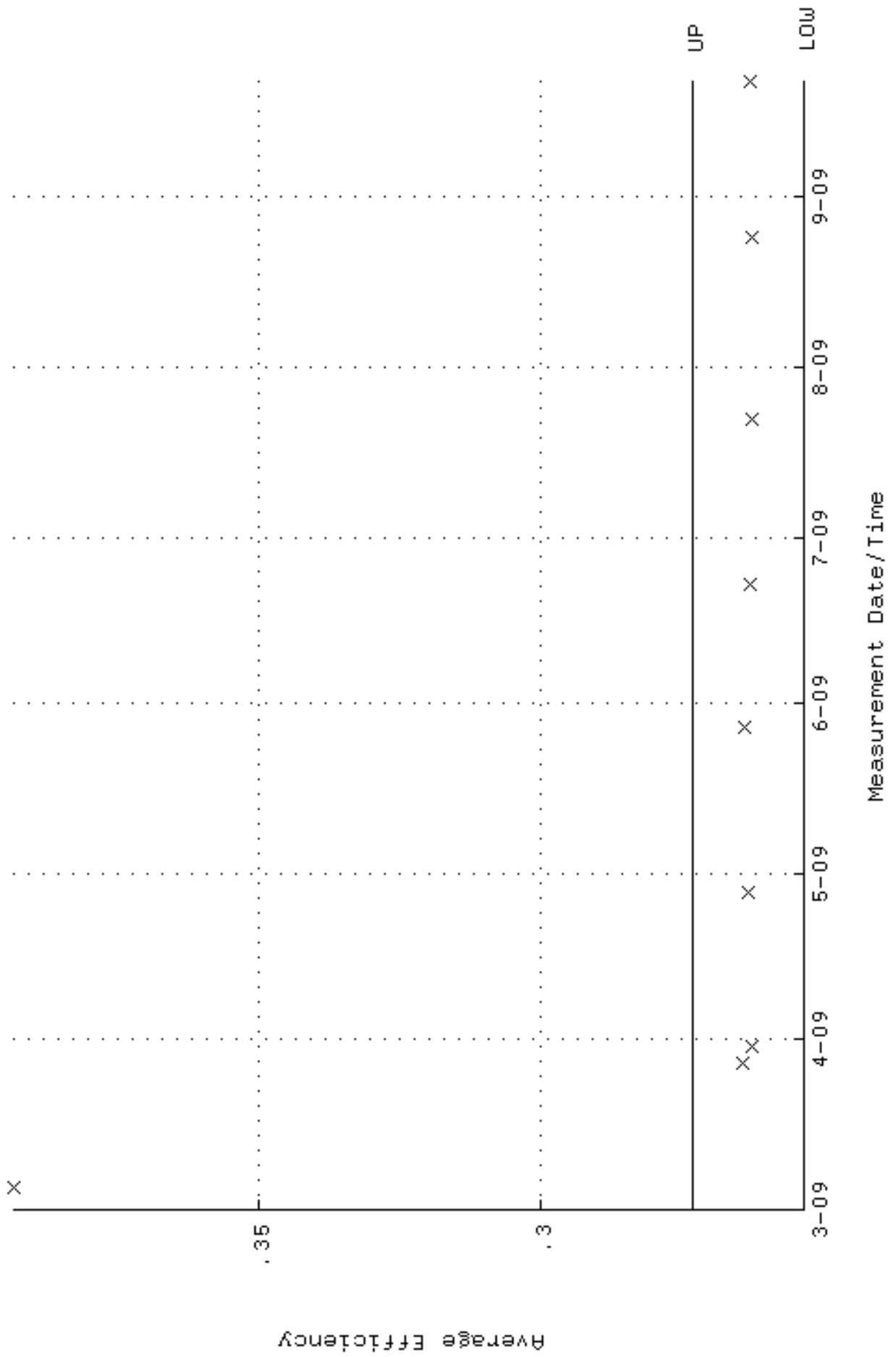
QA filename : DKA100:[ENV\_ALPHA.QA.W]W190.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:38 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 81.1176 through 89.6562



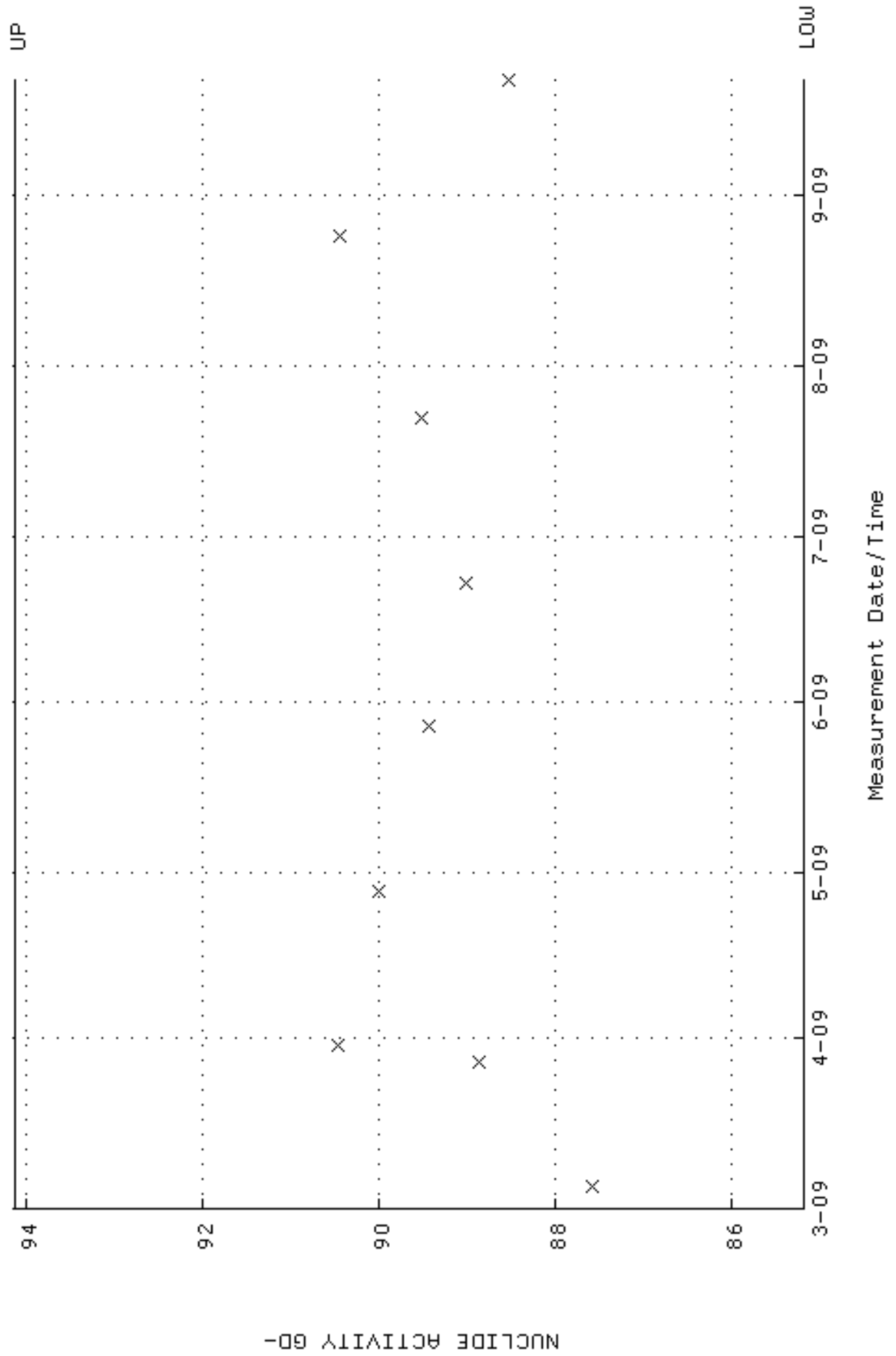
QA filename : DKA100:[ENV\_ALPHA.QA.B]B190.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:50 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



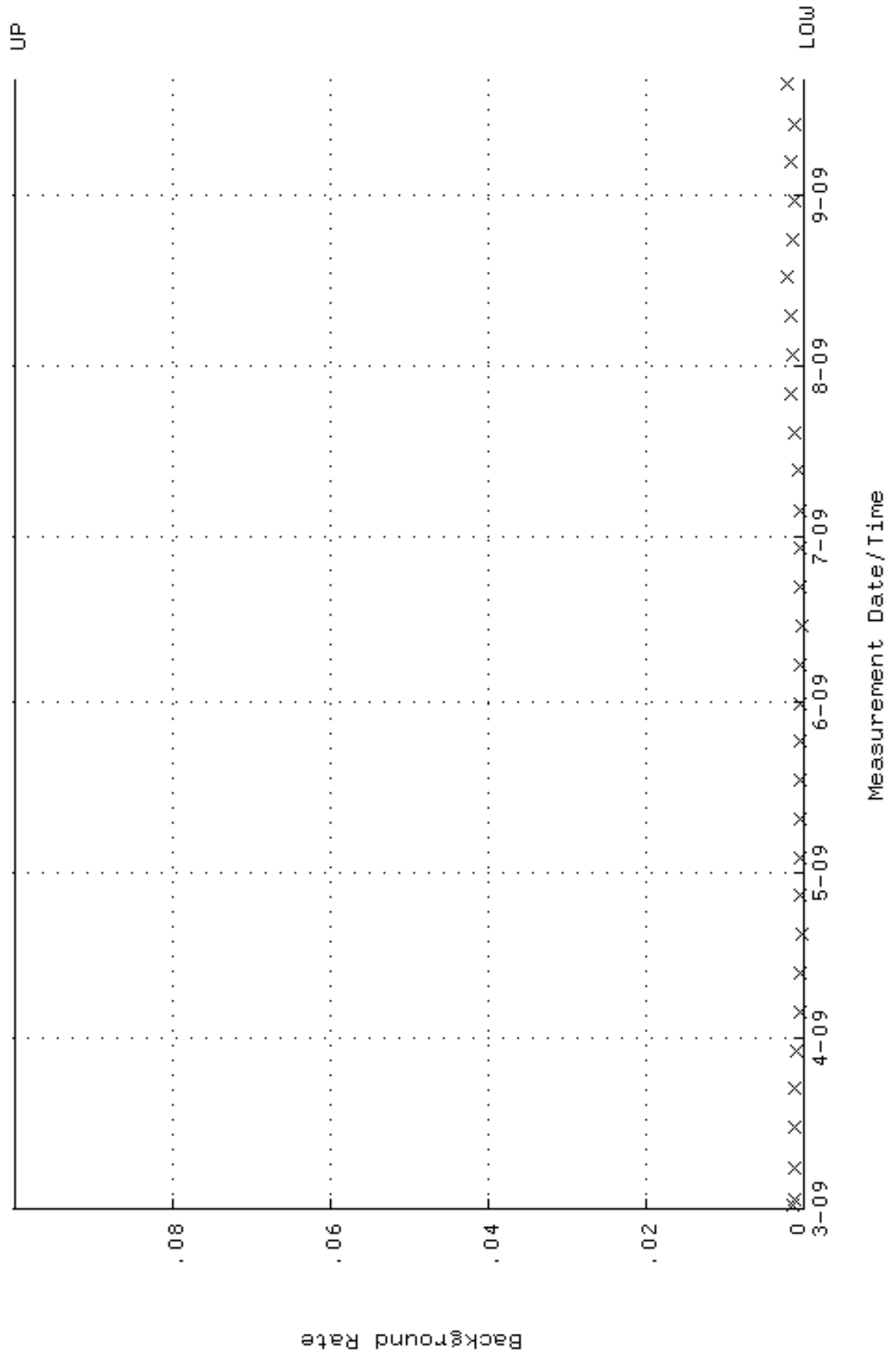
QA filename : DKA100:[ENV\_ALPHA.QA.W]W191.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:42 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.252993 through 0.272993



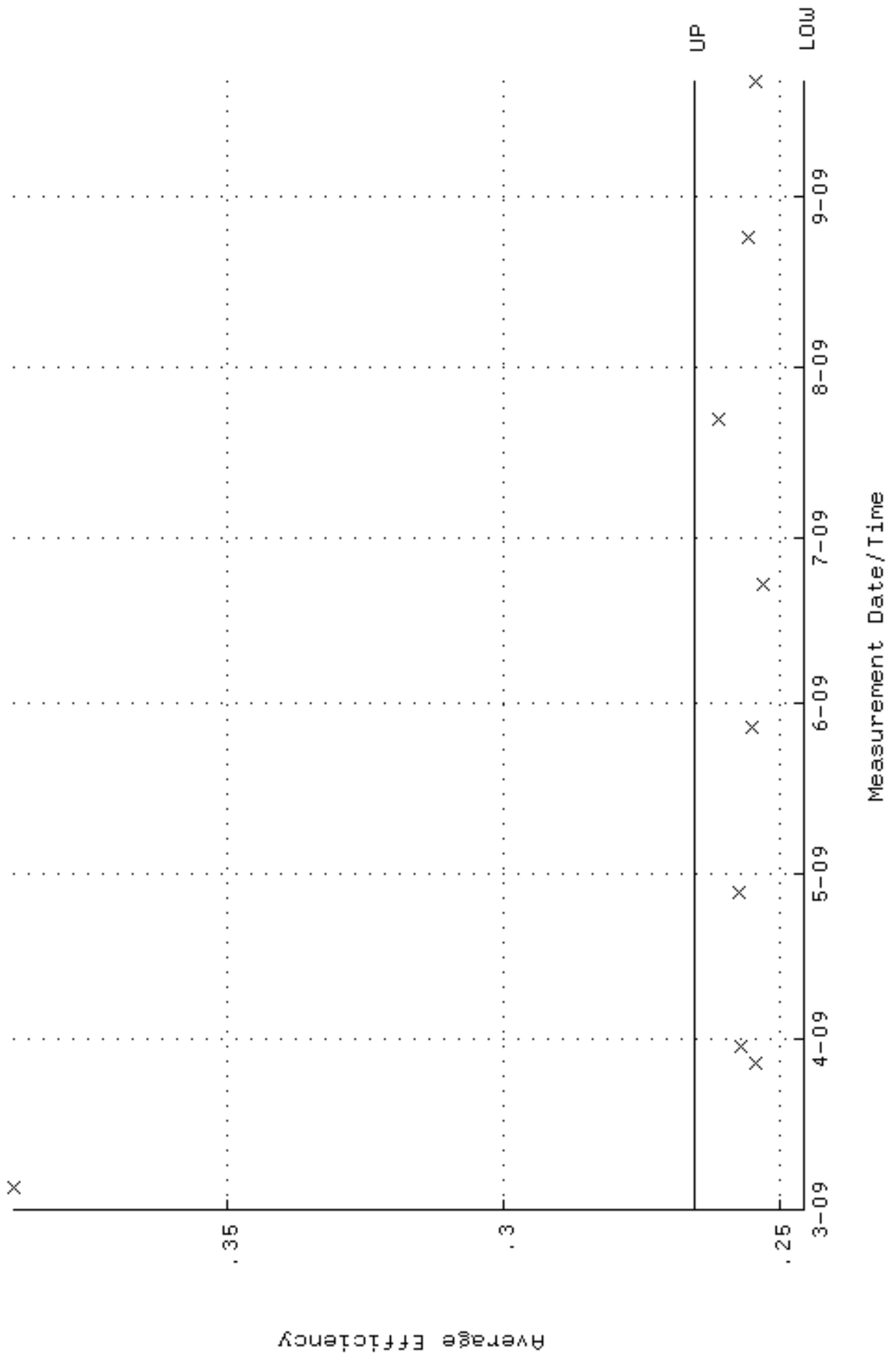
QA filename : DKA100:[ENV\_ALPHA.QA.W]W191.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:42 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 85.1712 through 94.1366



QA filename : DKA100:[ENV\_ALPHA.QA.B]B191.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:54 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

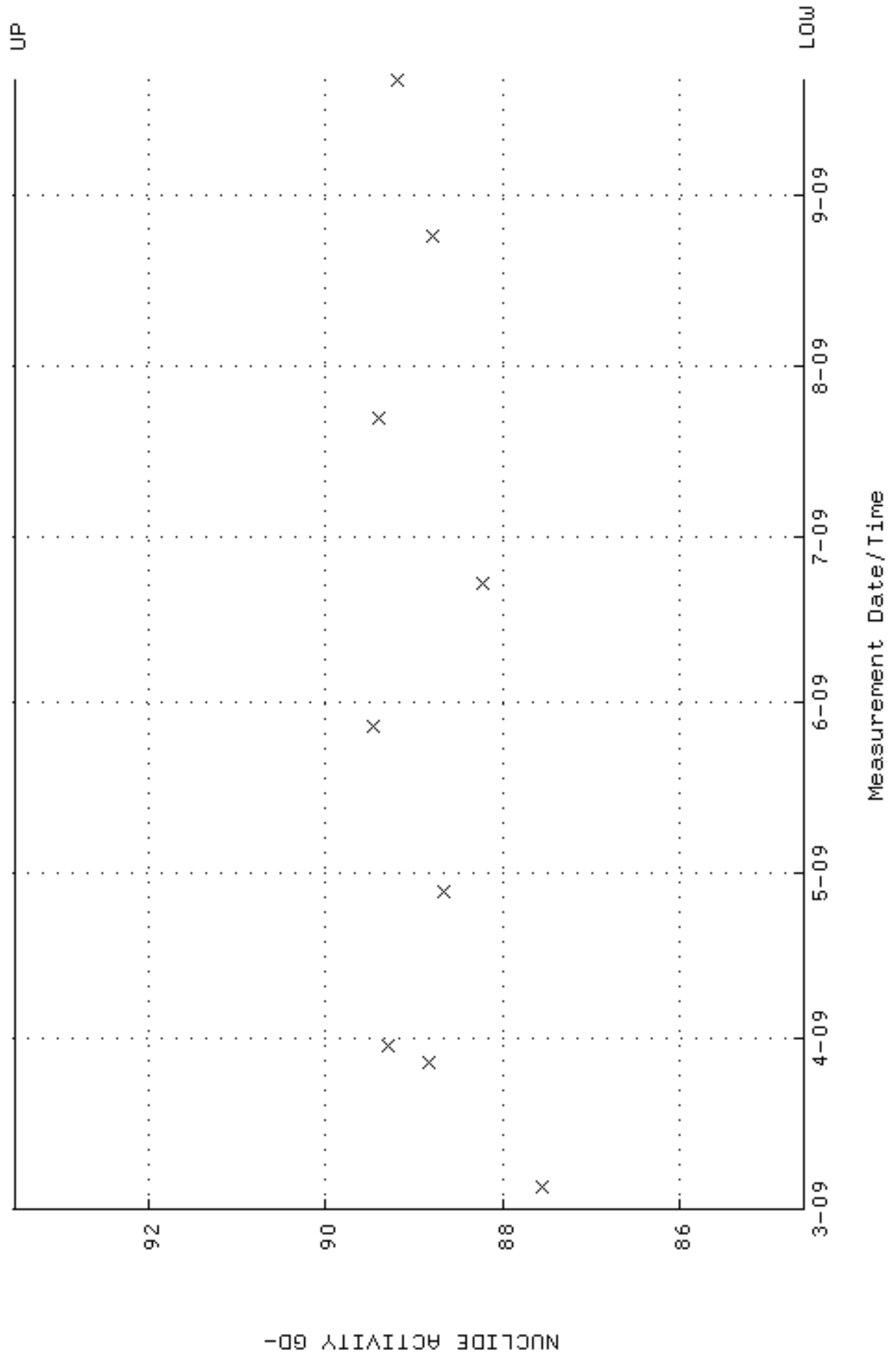


QA filename : DKA100:[ENV\_ALPHA.QA.W]W192.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:46 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.245663 through 0.265663

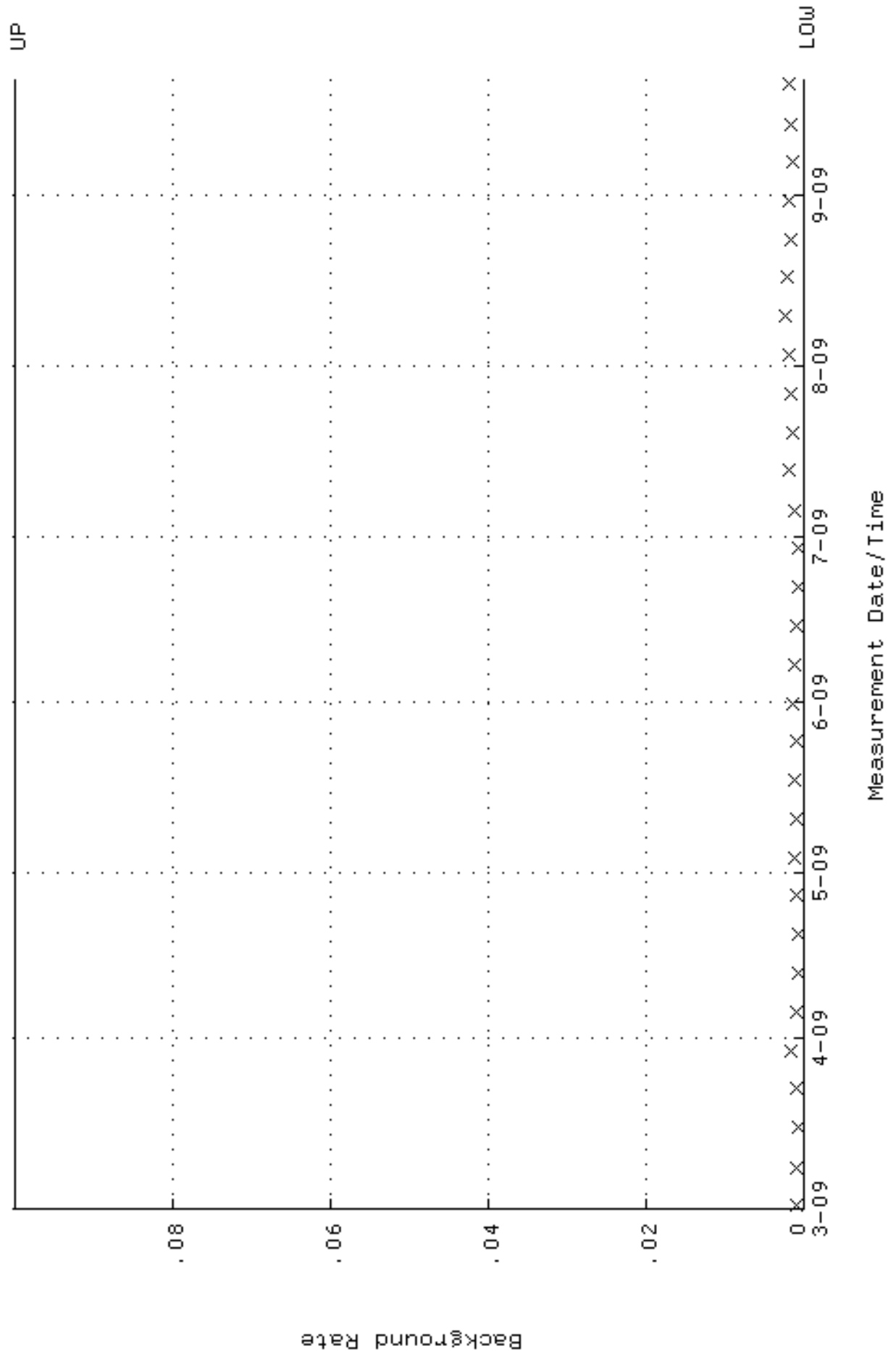




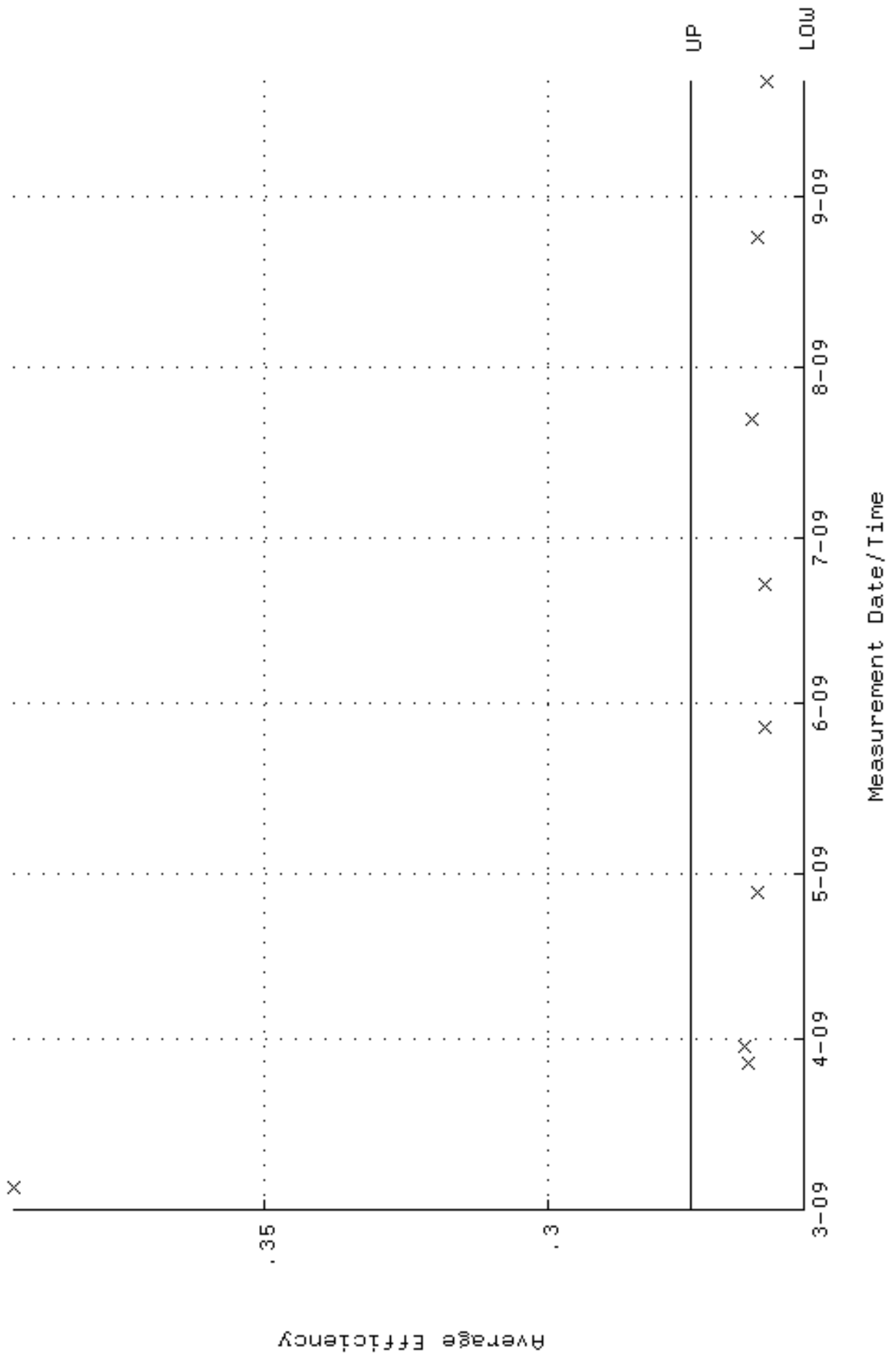
QA filename : DKA100:[ENV\_ALPHA.QA.W]W192.QAF;1  
Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
Start/End Dates : 4-MAR-2009 22:39:46 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 84.6037 through 93.5093



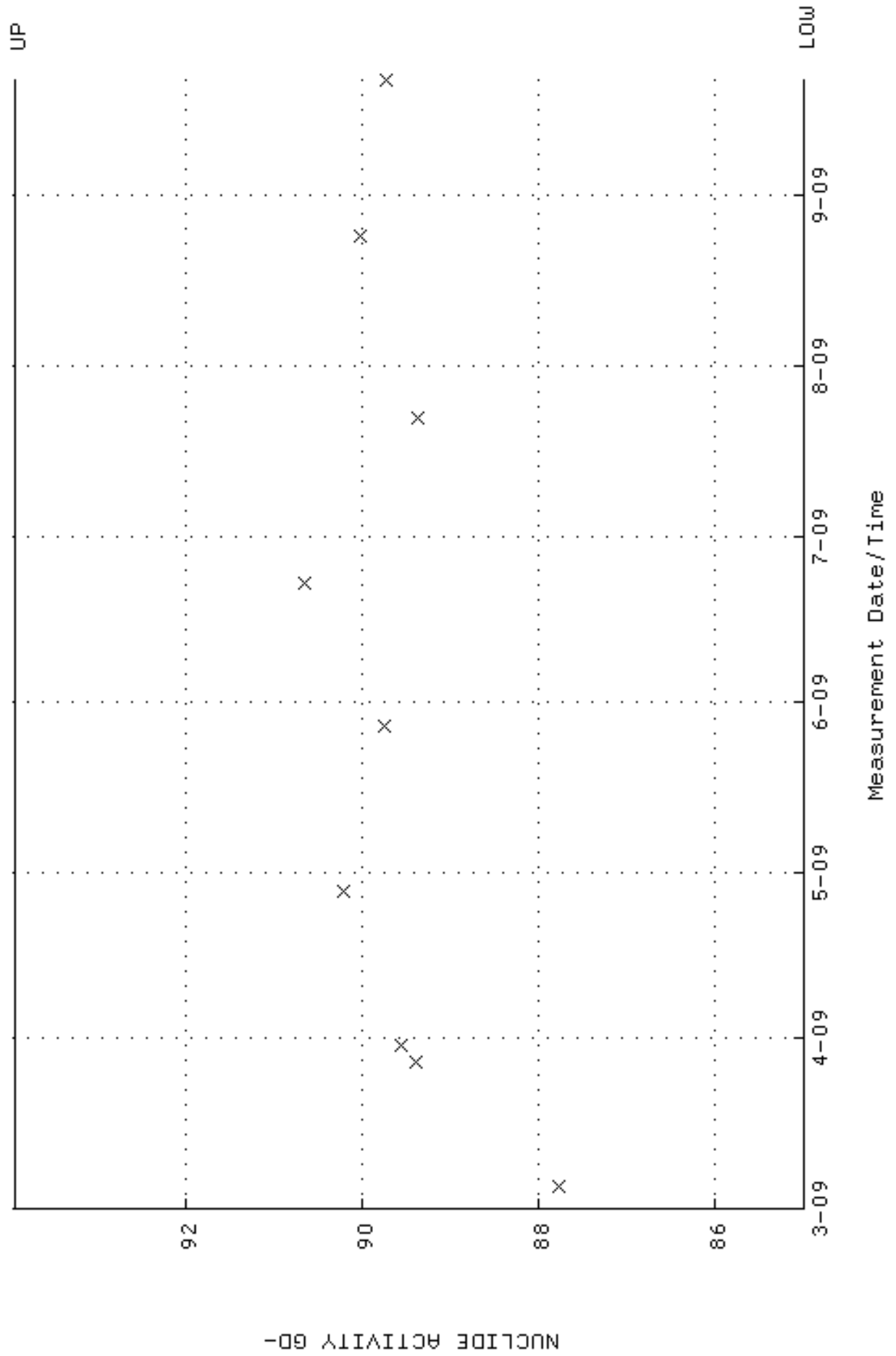
QA filename : DKA100:[ENV\_ALPHA.QA.B]B192.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:22:57 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



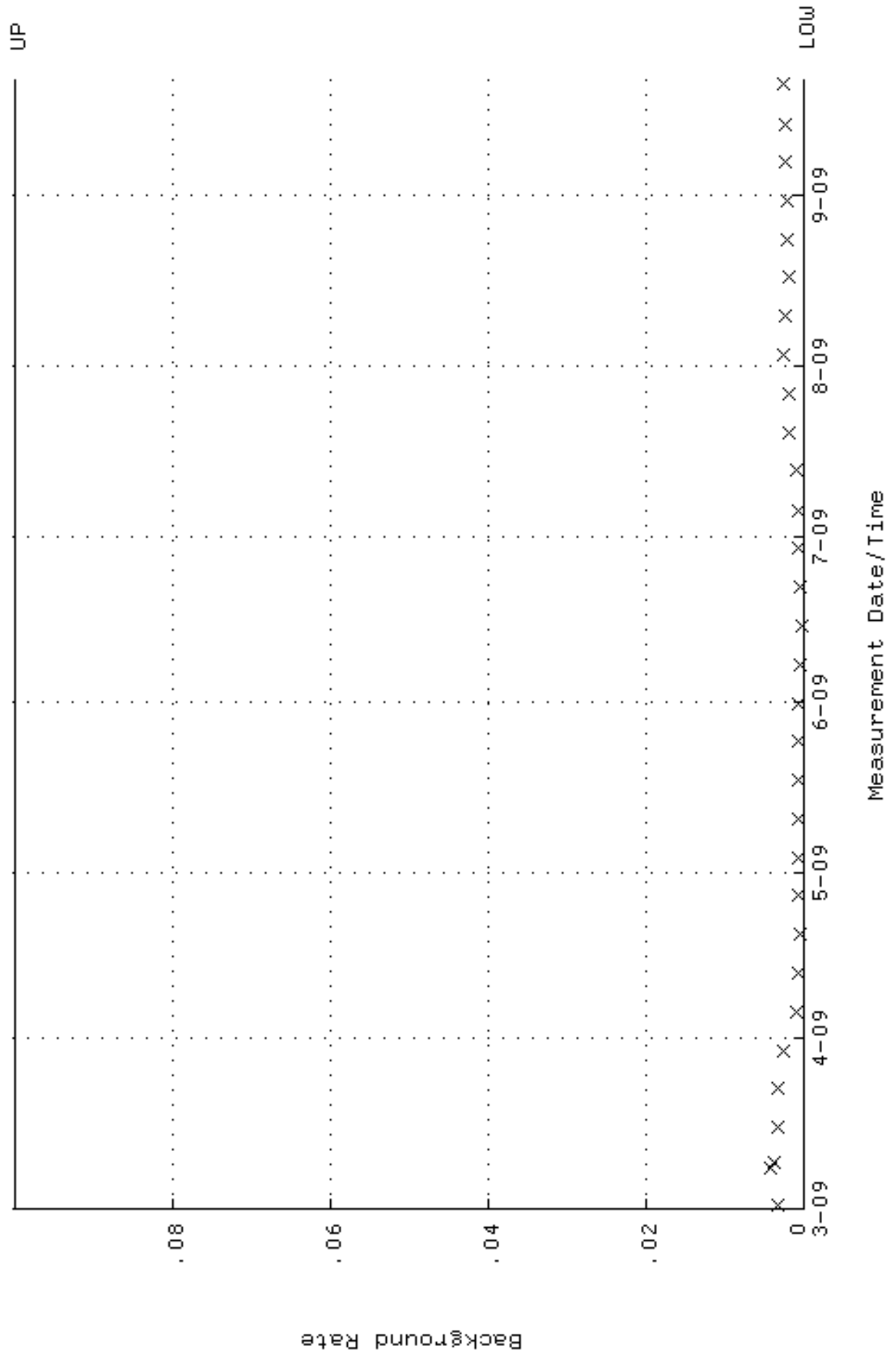
QA filename : DKA100:[ENV\_ALPHA.QA.W]W193.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:50 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.254861 through 0.274861



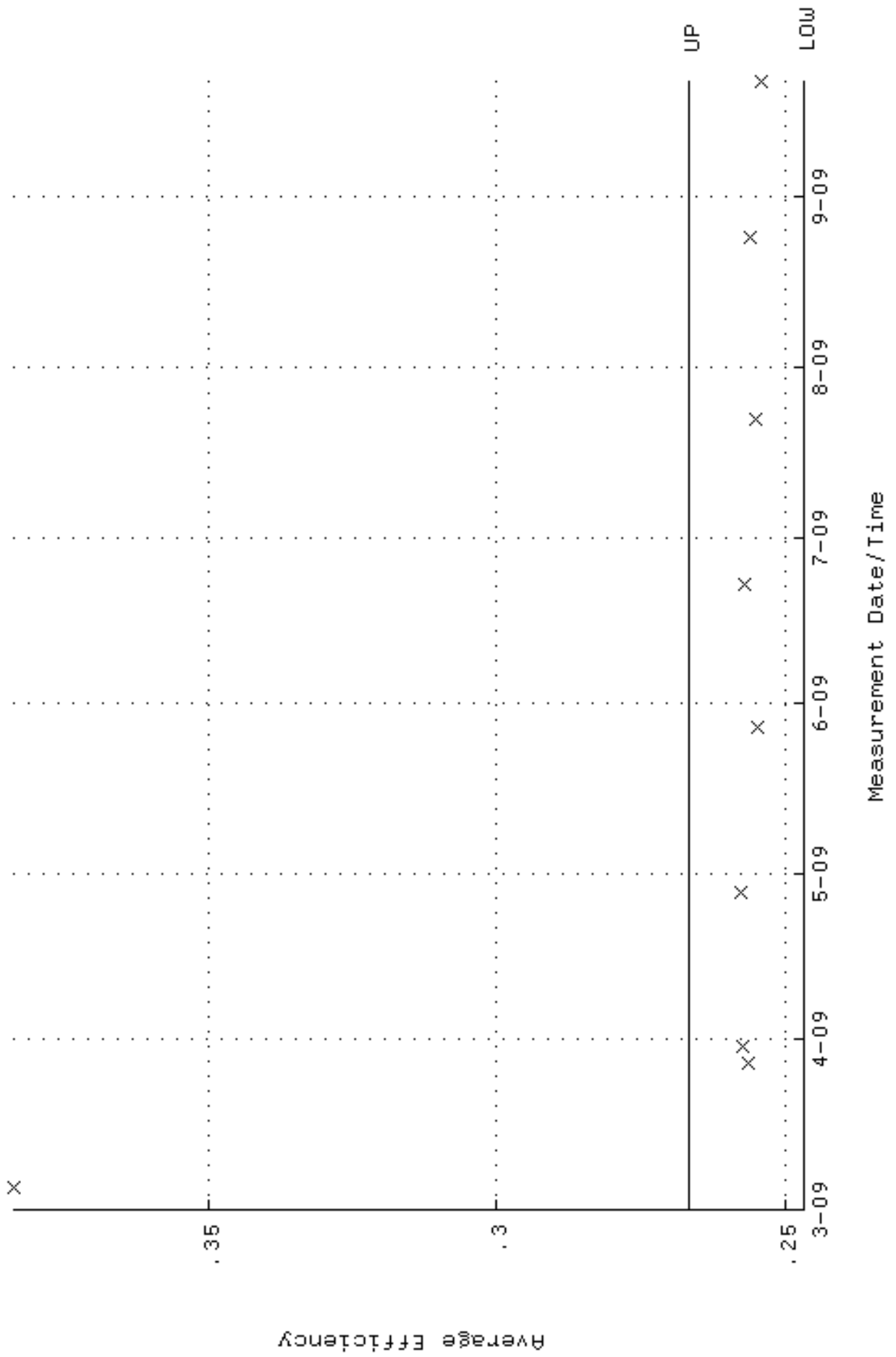
QA filename : DKA100:[ENV\_ALPHA.QA.W]W193.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:50 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 84.9815 through 93.9269



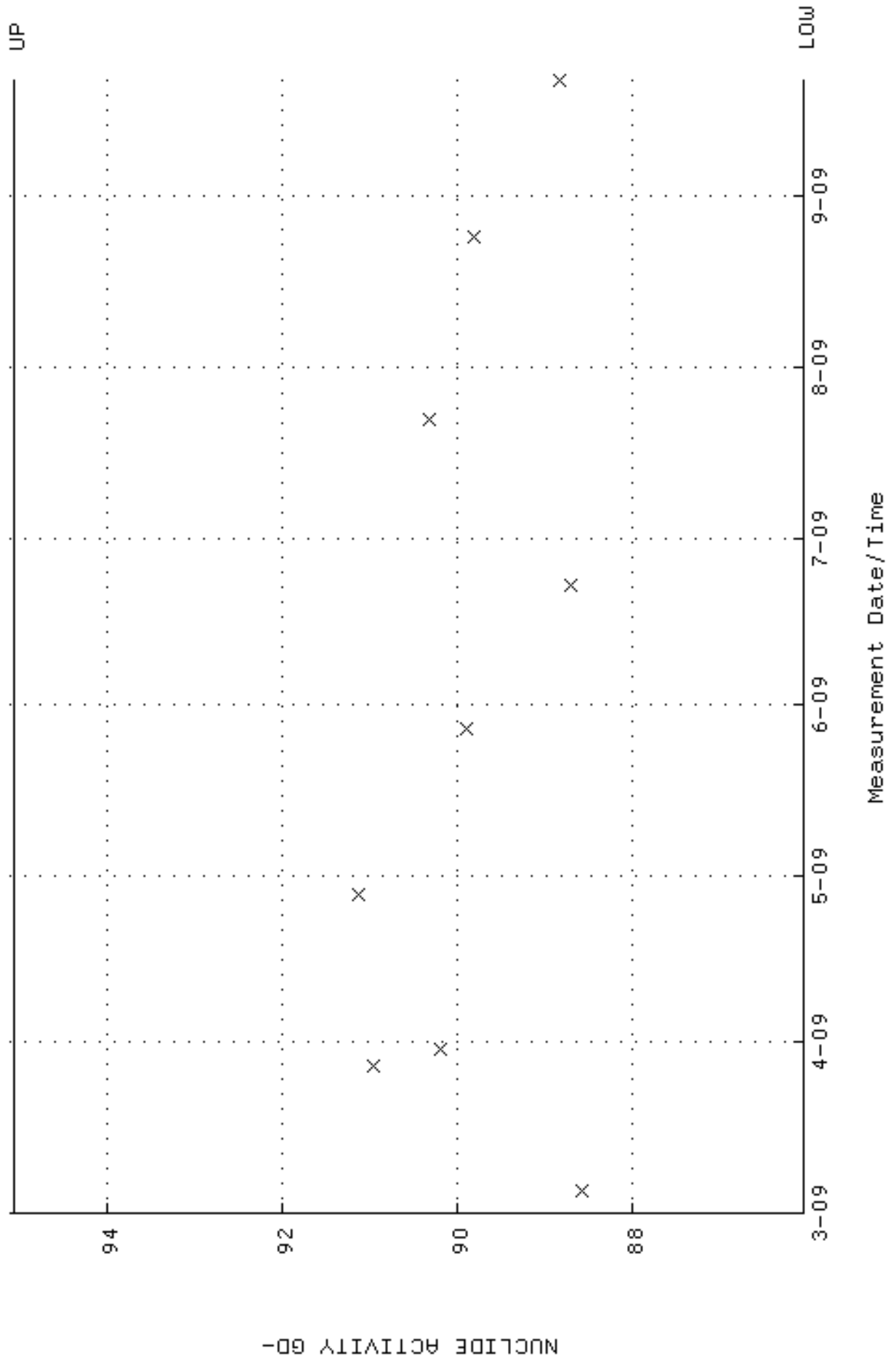
QA filename : DKA100:[ENV\_ALPHA.QA.B]B193.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:23:01 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



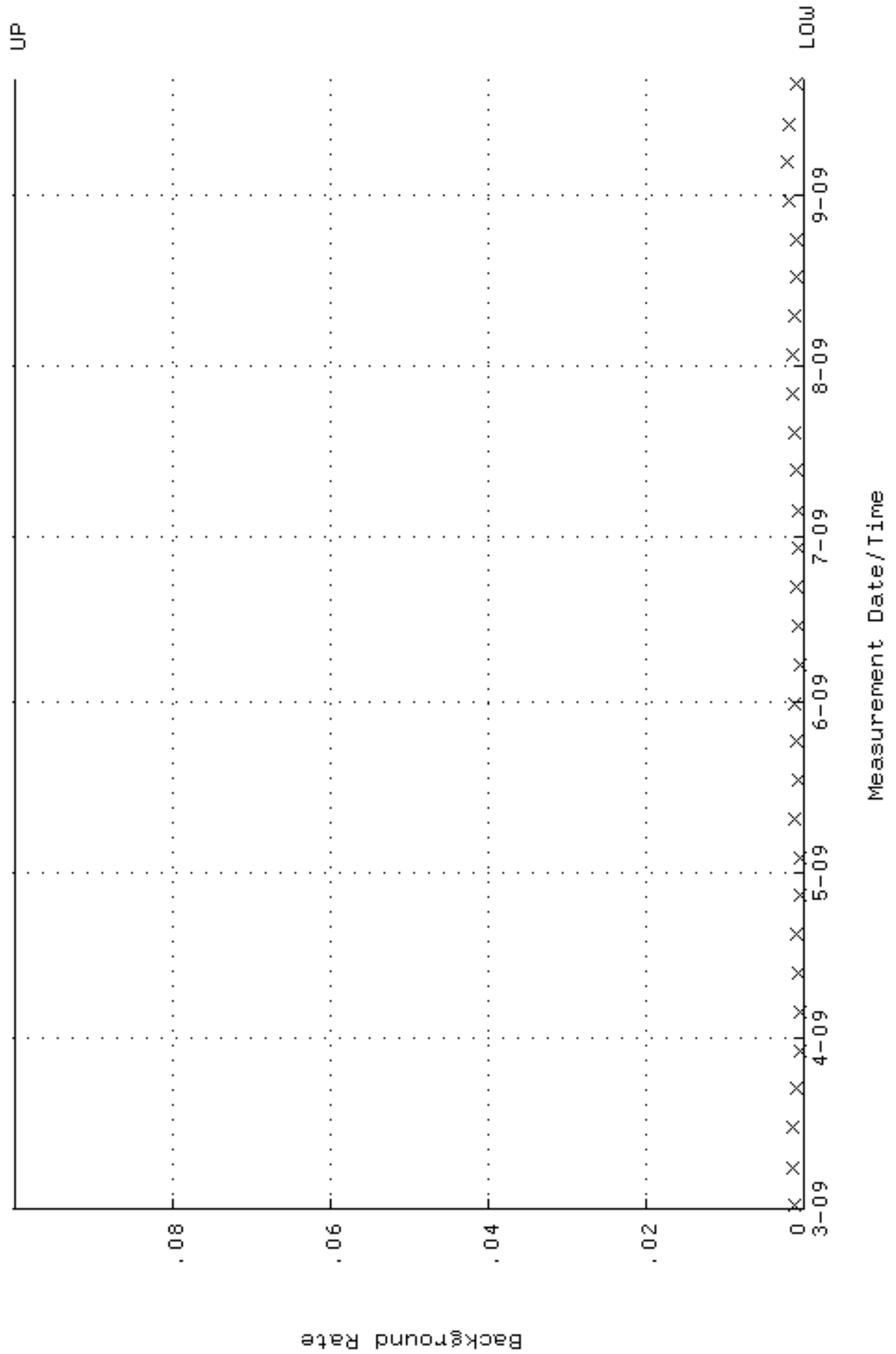
QA filename : DKA100:[ENV\_ALPHA.QA.W]W194.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:54 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.246760 through 0.266760



QA filename : DKA100:[ENV\_ALPHA.QA.W]w194.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:39:54 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 86.0376 through 95.0942

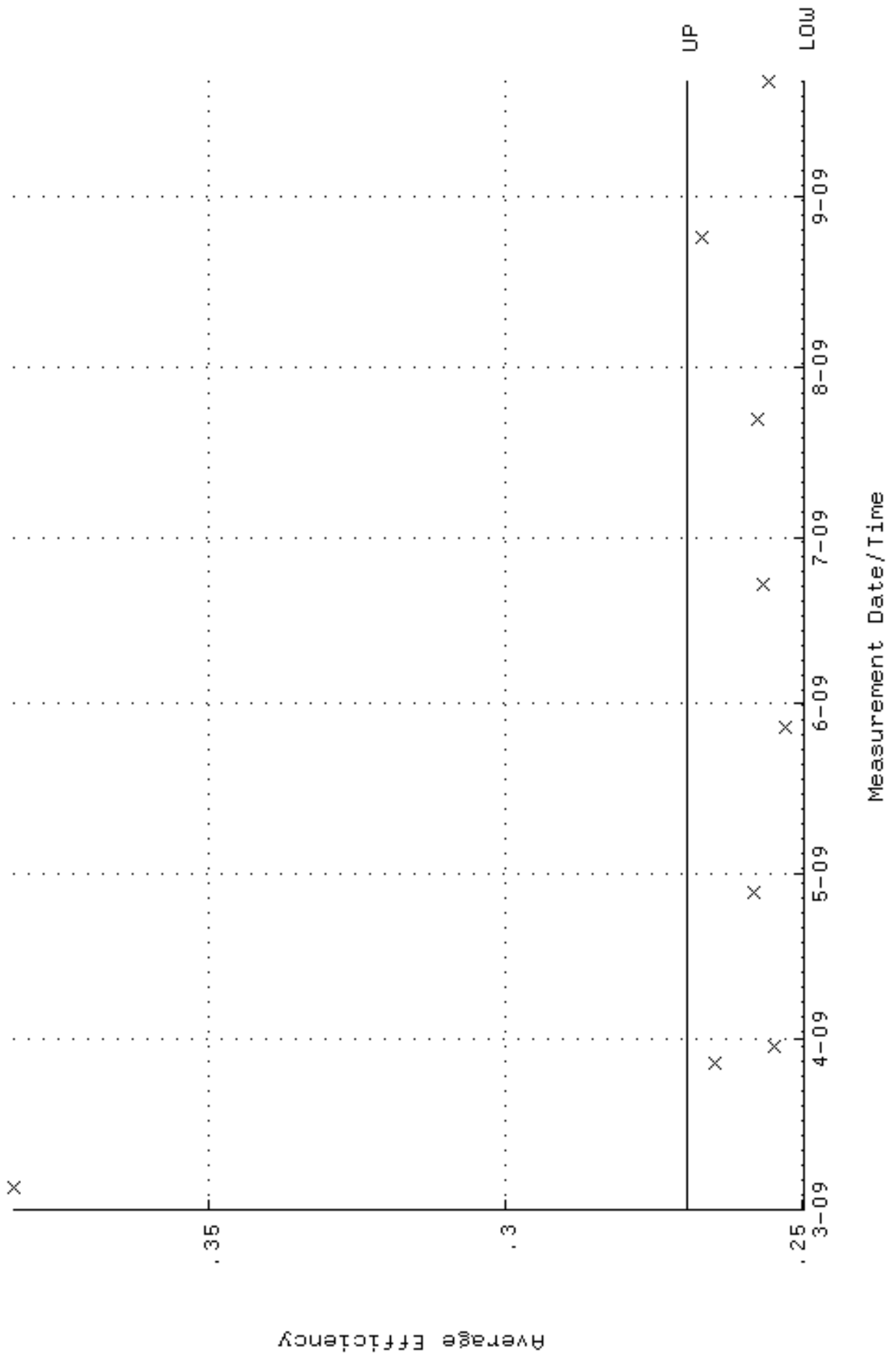


QA filename : DKA100:[ENV\_ALPHA.QA.B]B194.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:23:05 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

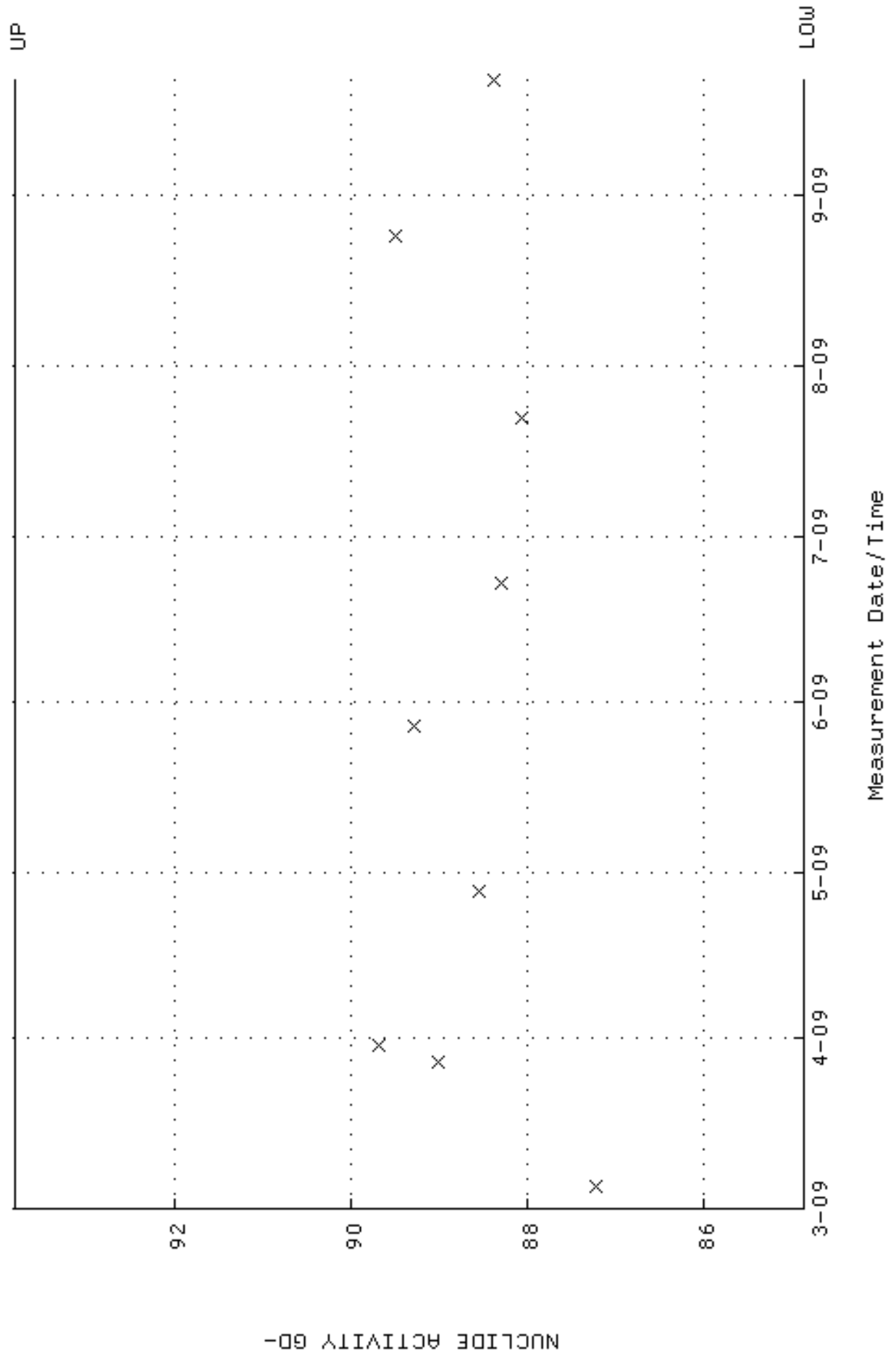




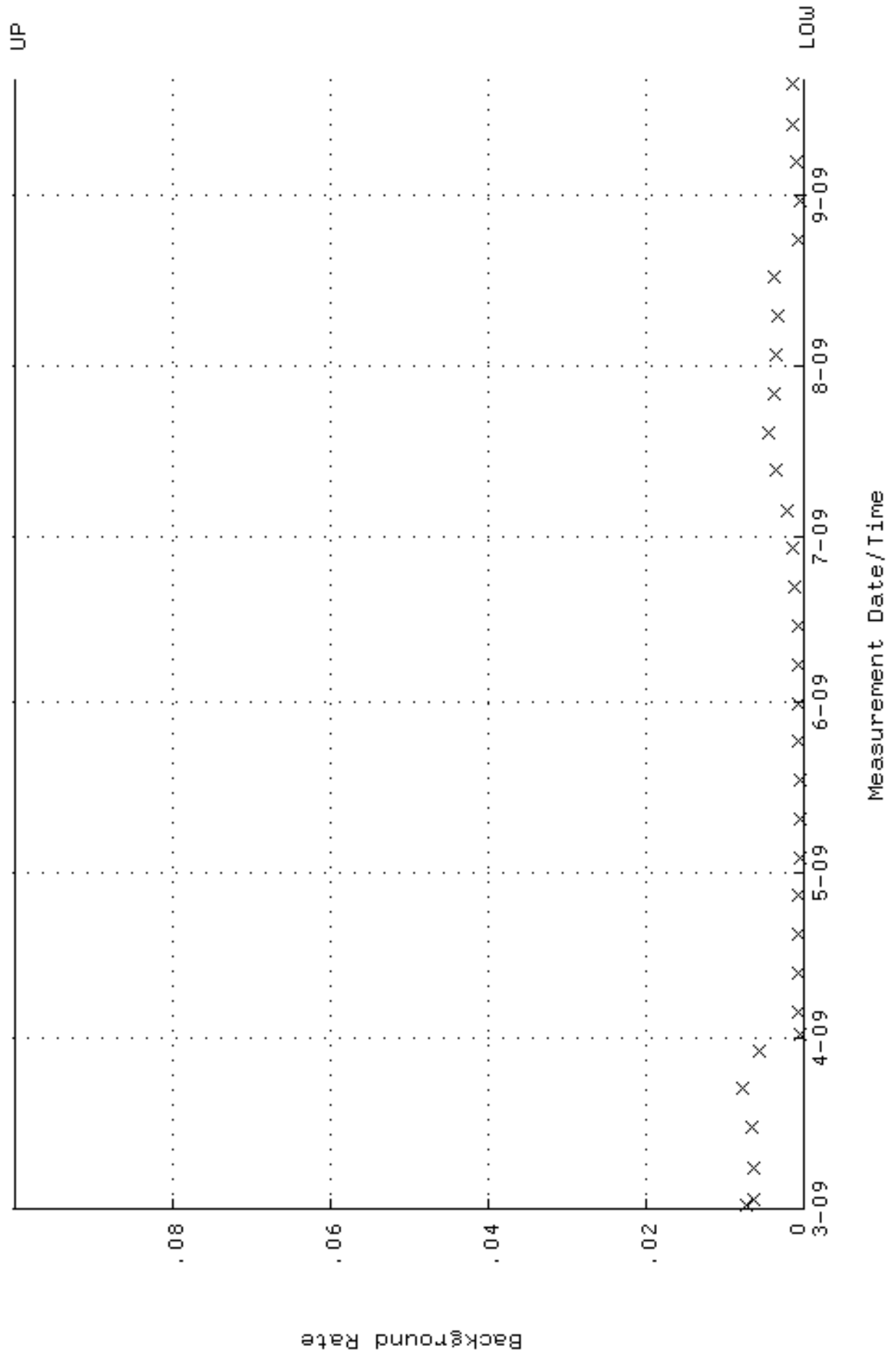
QA filename : DKA100:[ENV\_ALPHA.QA.W]W195.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:39:58 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.249622 through 0.269622



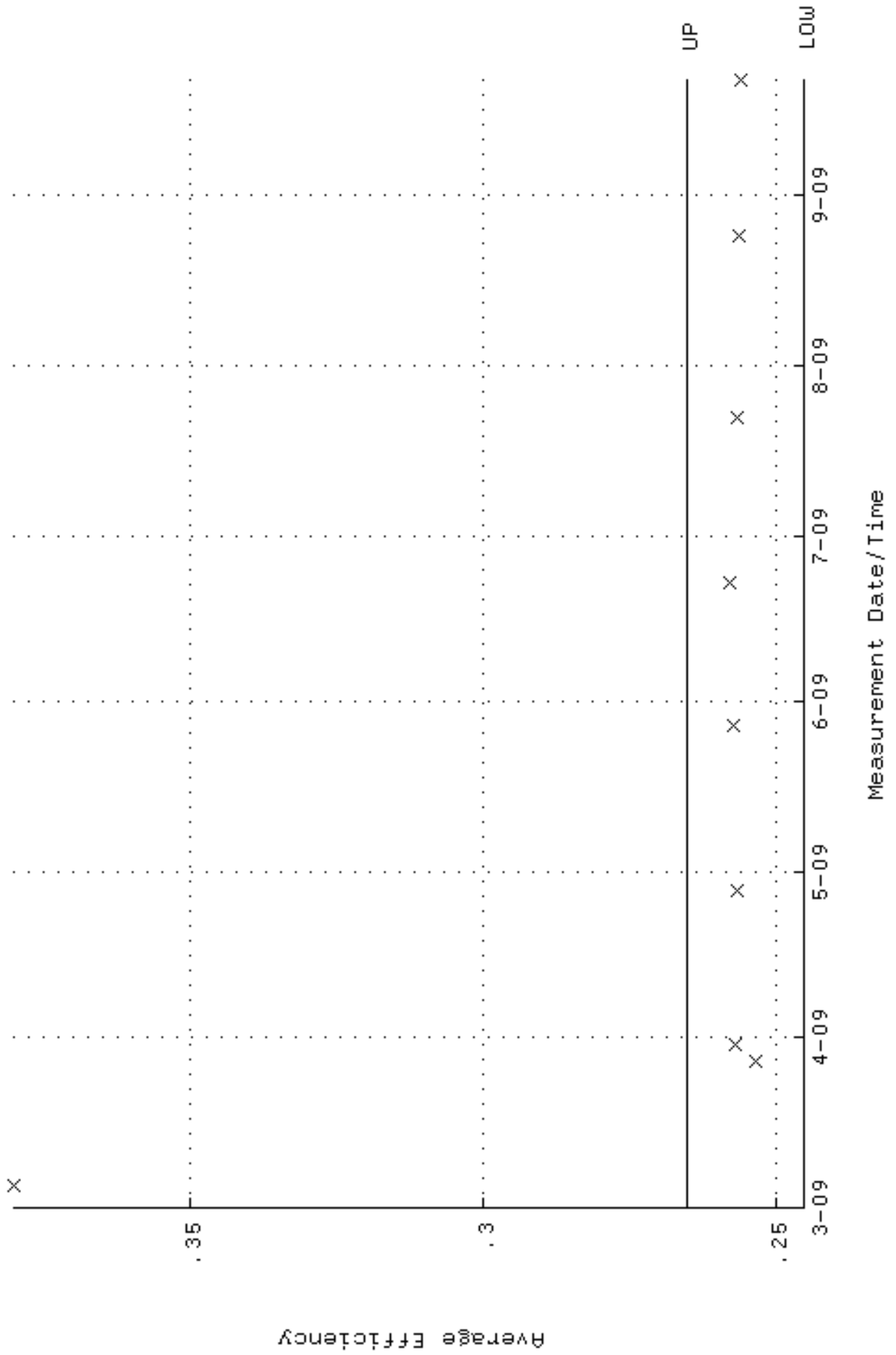
QA filename : DKA100:[ENV\_ALPHA.QA.W]W195.QAF;1  
Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
Start/End Dates : 4-MAR-2009 22:39:58 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 84.8653 through 93.7985



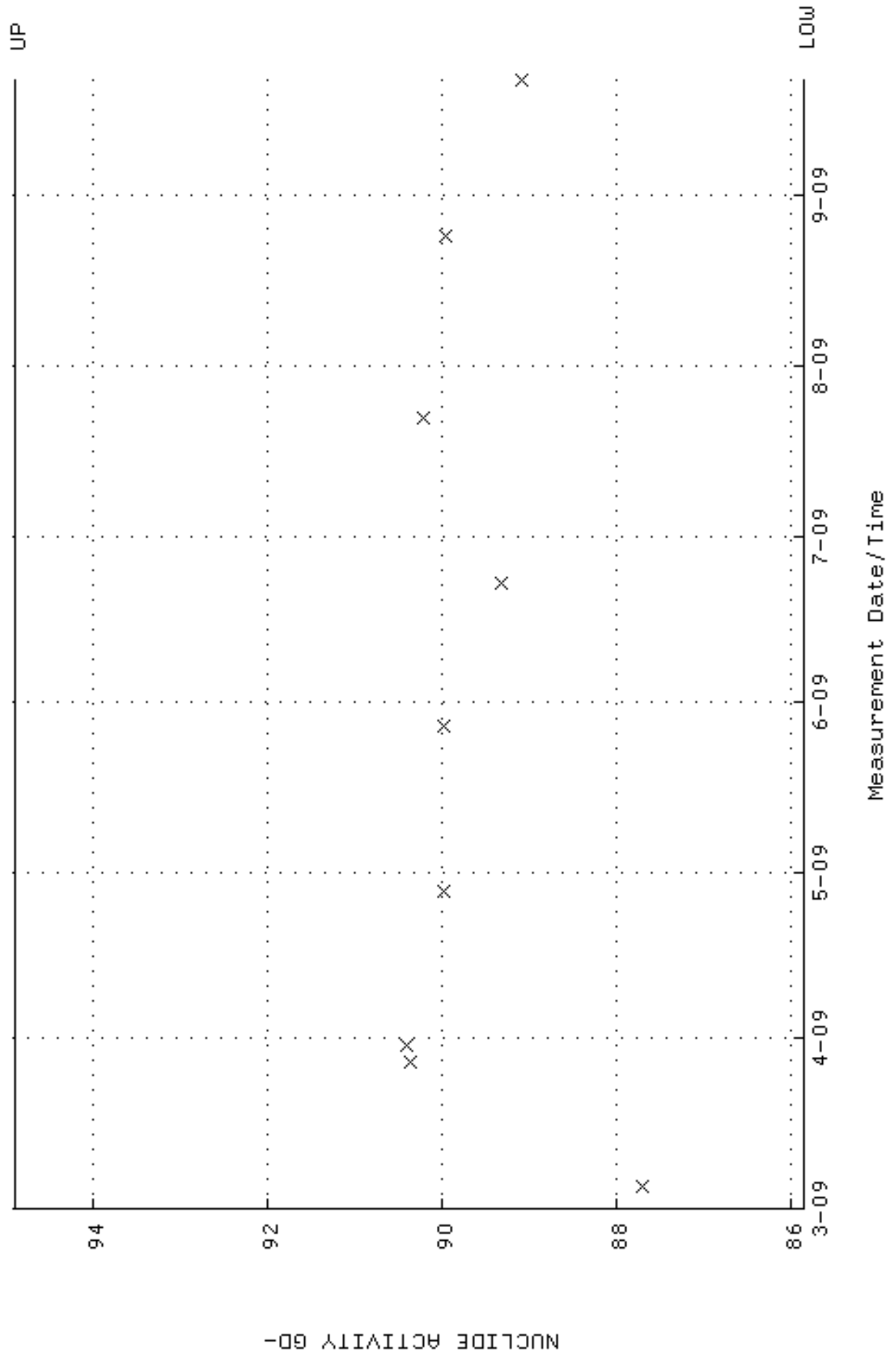
QA filename : DKA100:[ENV\_ALPHA.QA.B]B195.QAF;1  
Parameter Name : BACKRATE (Background Rate)  
Start/End Dates : 1-MAR-2009 17:23:09 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 0.000000E+00 through 0.100000



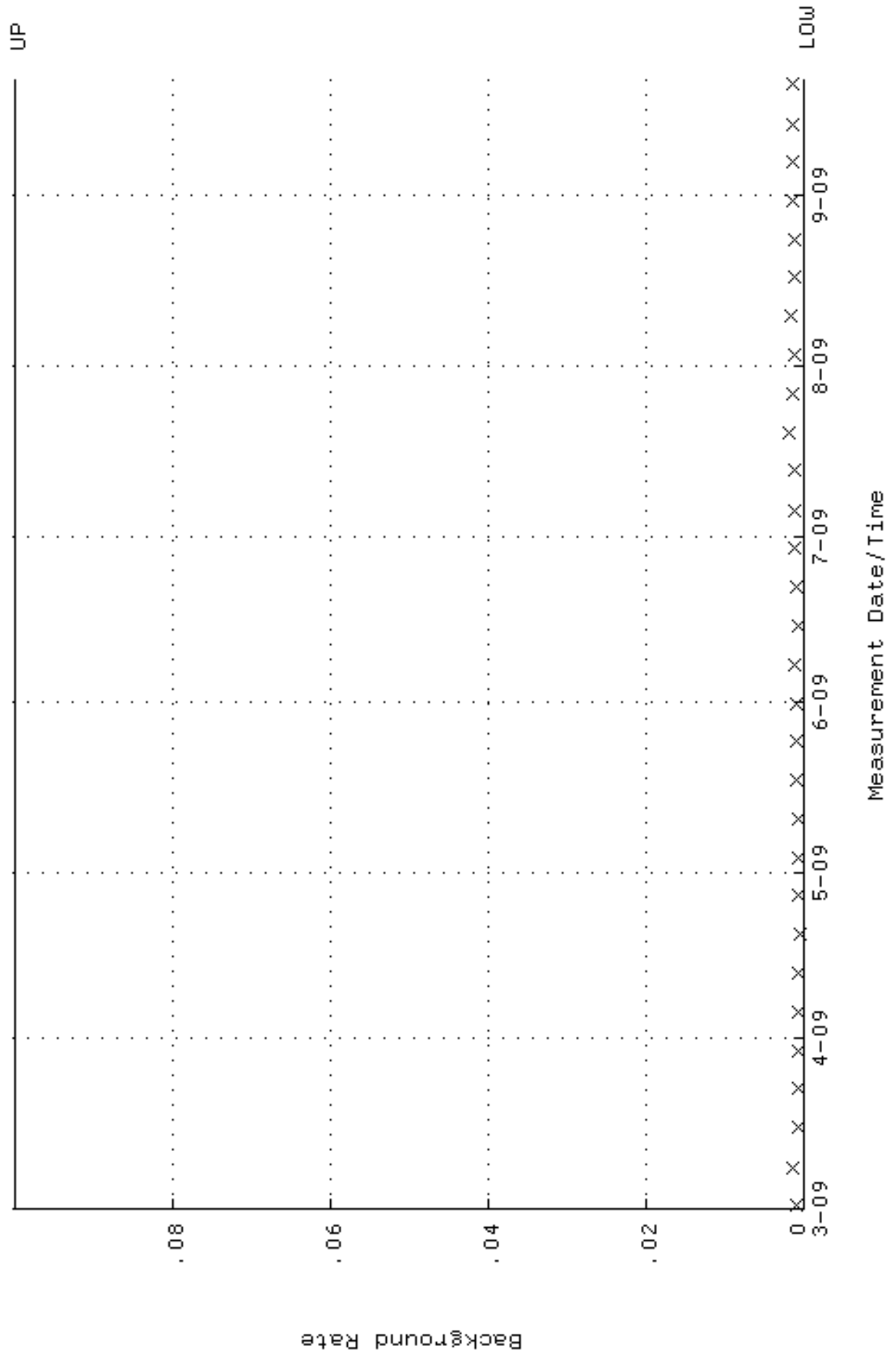
QA filename : DKA100:[ENV\_ALPHA.QA.W]W196.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 4-MAR-2009 22:40:02 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.245168 through 0.265168



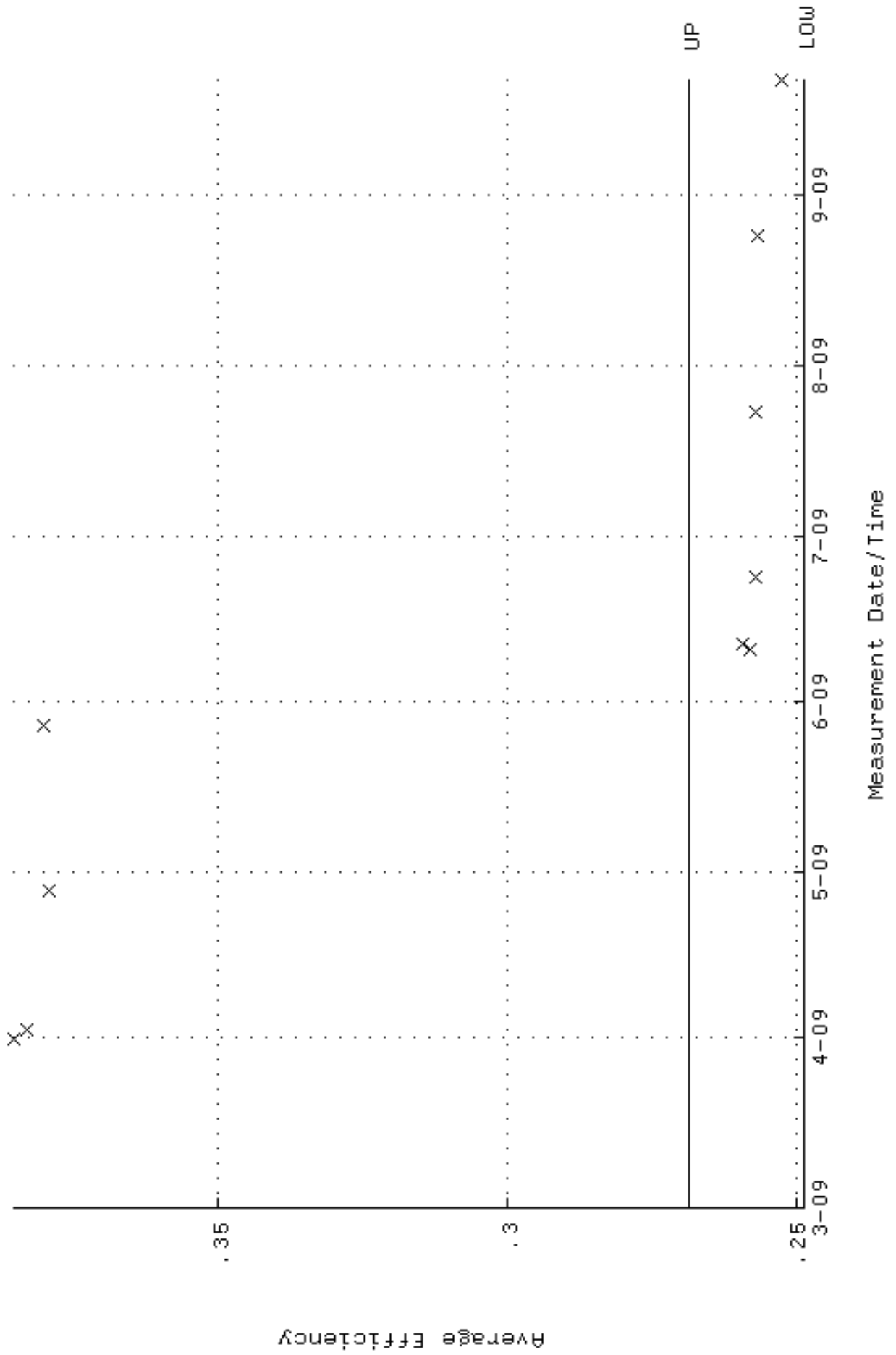
QA filename : DKA100:[ENV\_ALPHA.QA.W]w196.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 4-MAR-2009 22:40:02 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 85.8592 through 94.8970



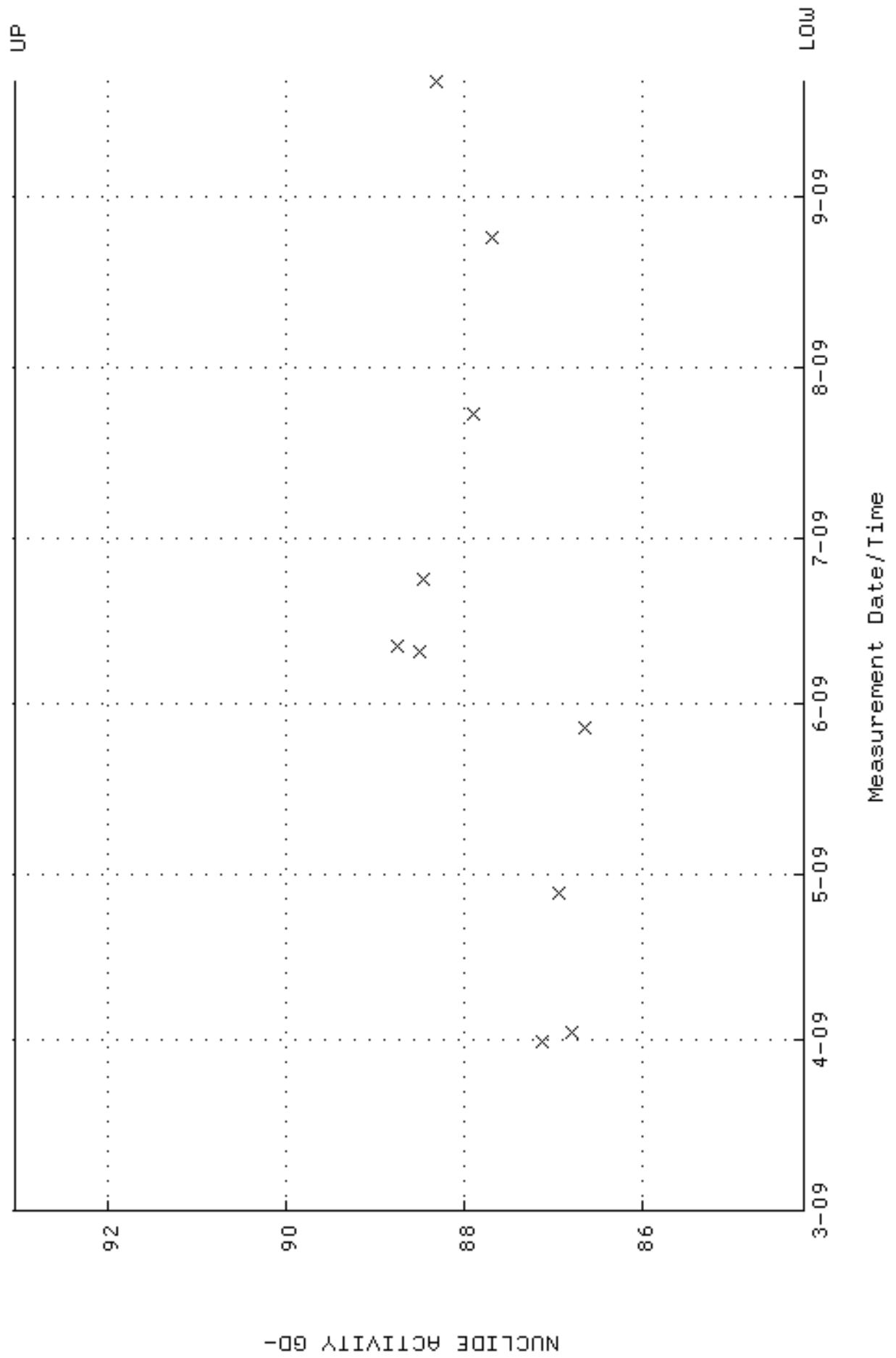
QA filename : DKA100:[ENV\_ALPHA.QA.B]B196.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-MAR-2009 17:23:13 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



QA filename : DKA100:[ENV\_ALPHA.QA.W]W197.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 31-MAR-2009 15:03:56 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.248572 through 0.268572

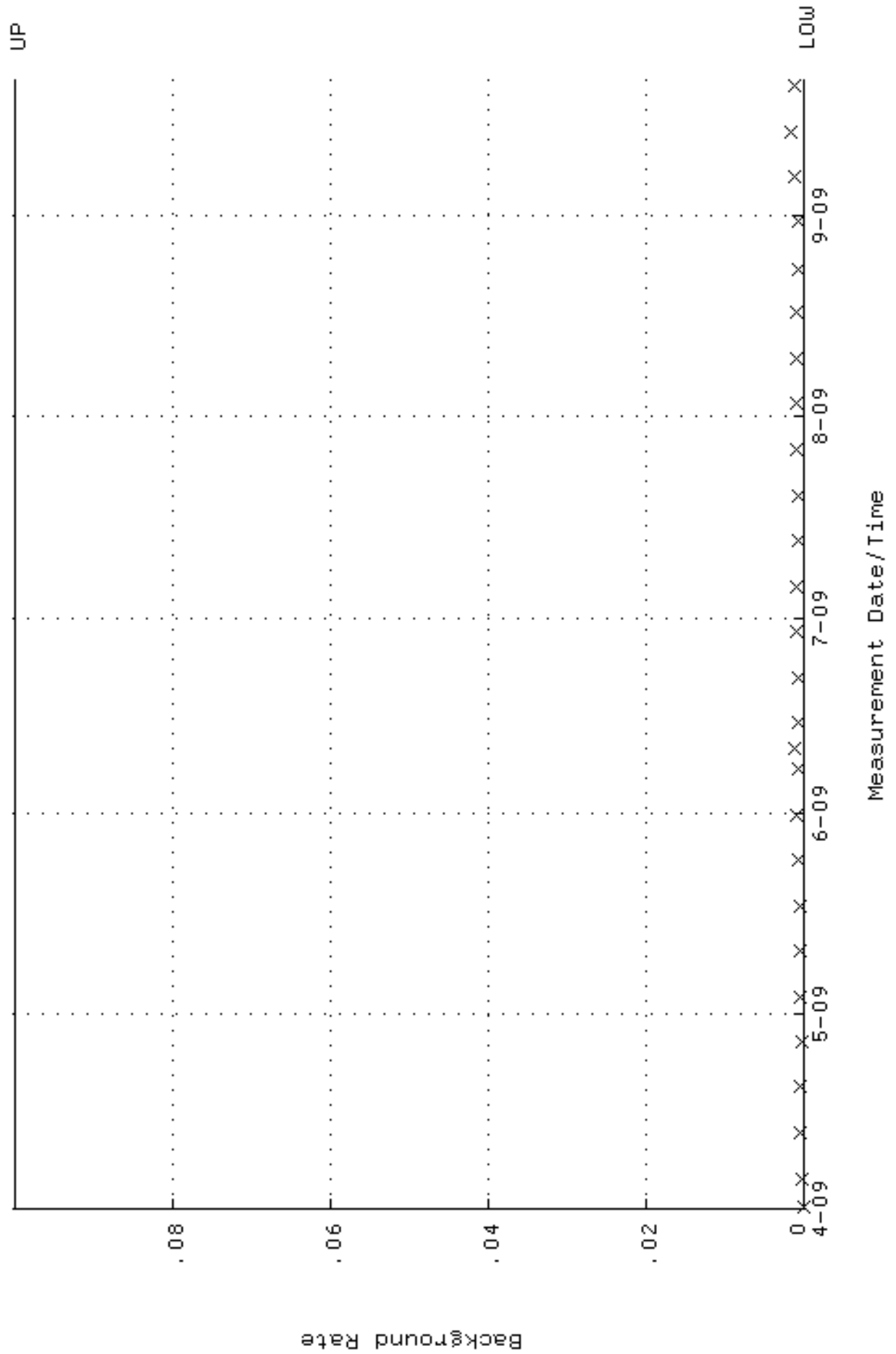


QA filename : DKA100:[ENV\_ALPHA.QA.W]w197.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 31-MAR-2009 15:03:56 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 84.1772 through 93.0380

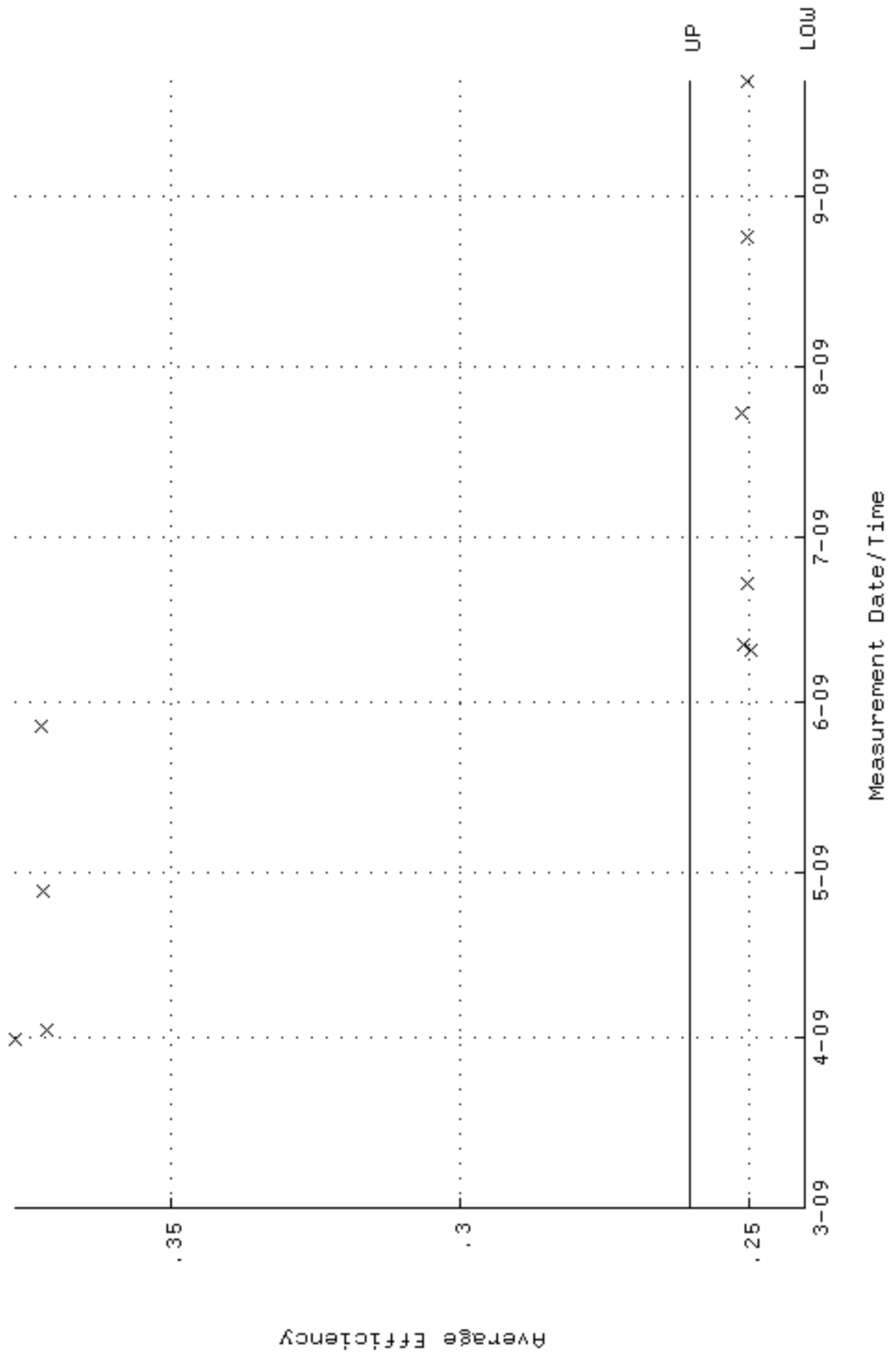




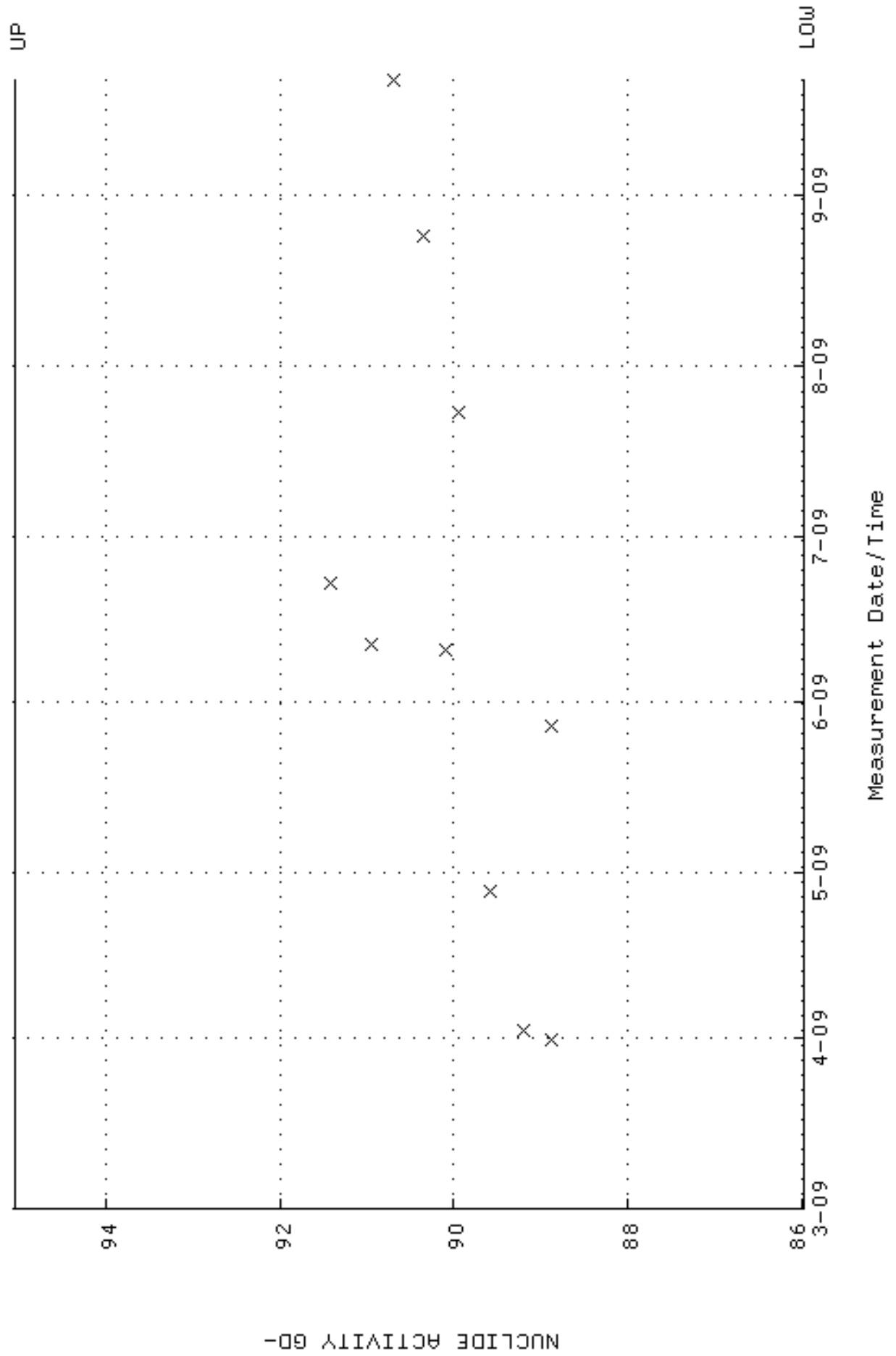
QA filename : DKA100:[ENV\_ALPHA.QA.B]B197.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-APR-2009 08:02:18 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



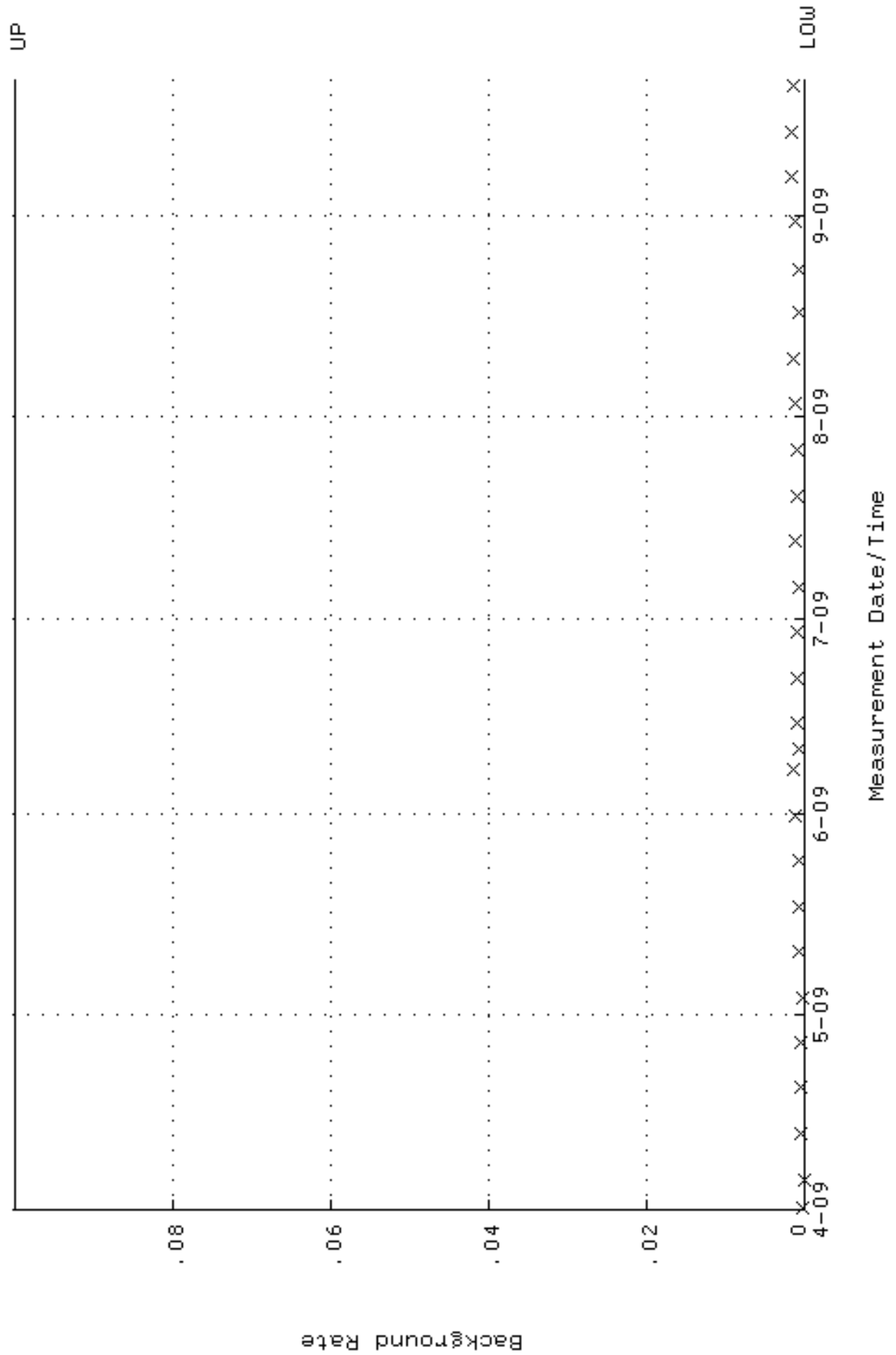
QA filename : DKA100:[ENV\_ALPHA.QA.W]W199.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 31-MAR-2009 15:10:22 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.240278 through 0.260278



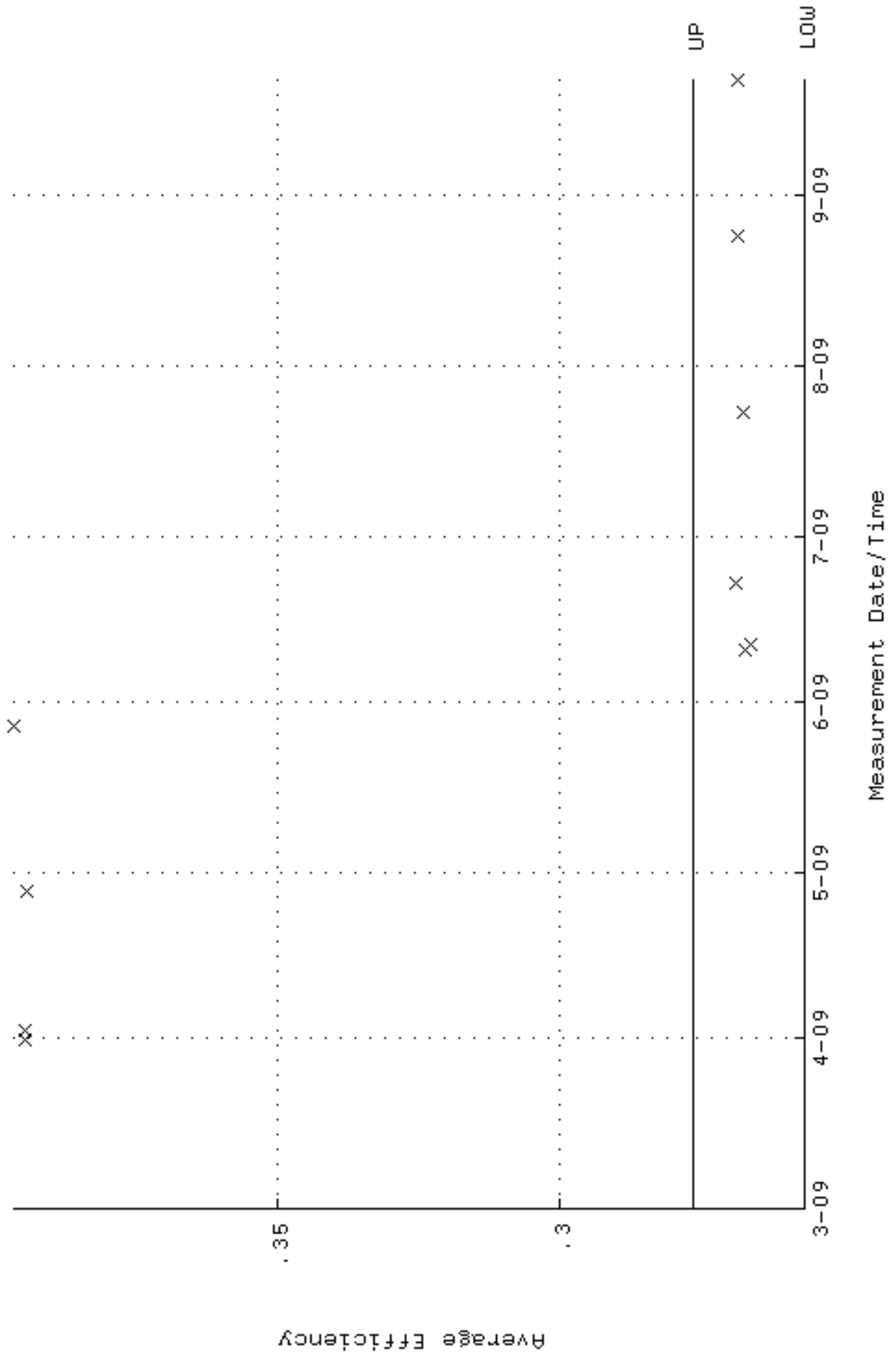
QA filename : DKA100:[ENV\_ALPHA.QA.W]w199.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 31-MAR-2009 15:10:22 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 85.9853 through 95.0363



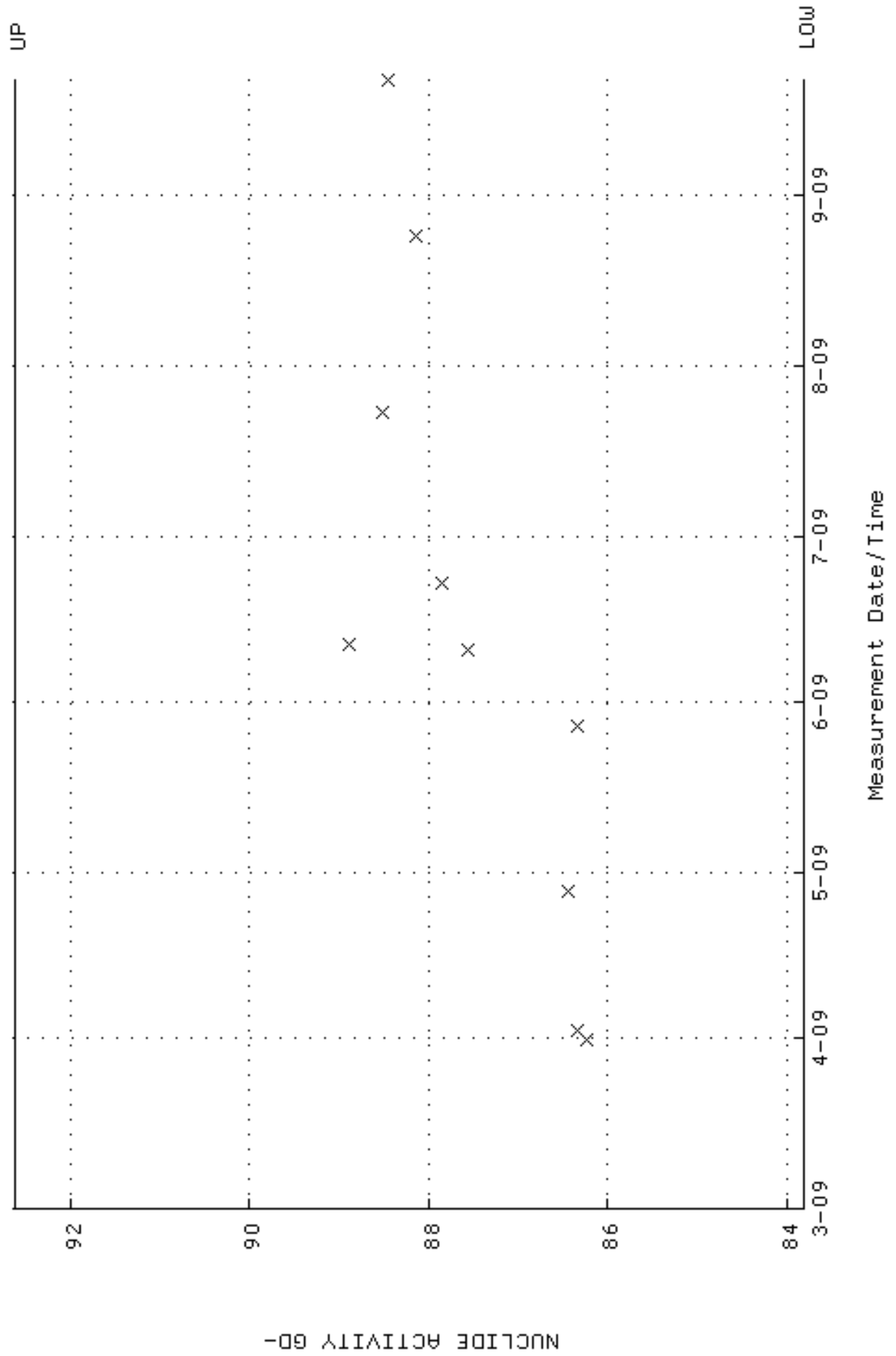
QA filename : DKA100:[ENV\_ALPHA.QA.B]B199.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-APR-2009 08:02:28 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



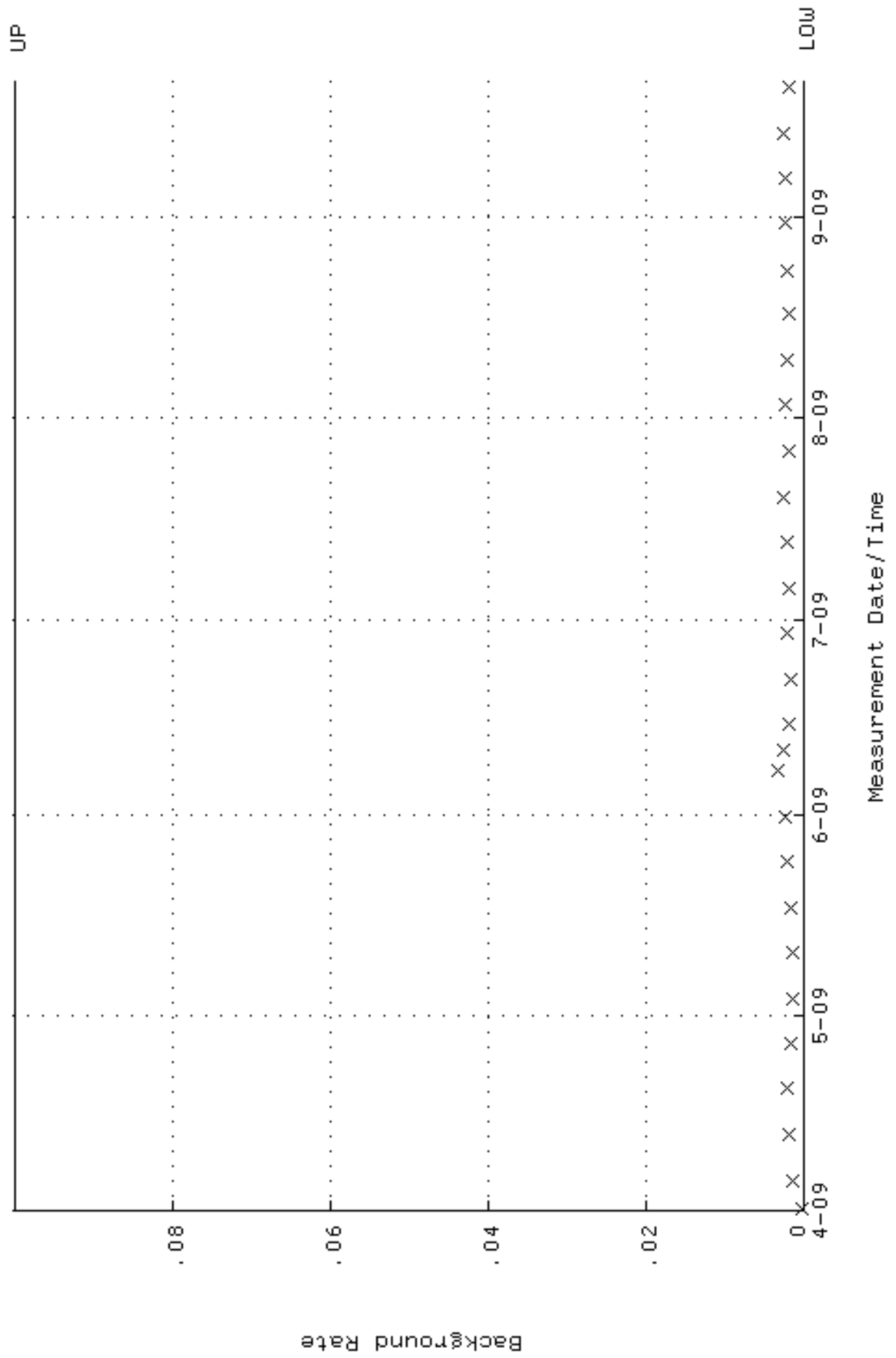
QA filename : DKA100:[ENV\_ALPHA.QA.W]w200.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 31-MAR-2009 15:10:24 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.256586 through 0.276586



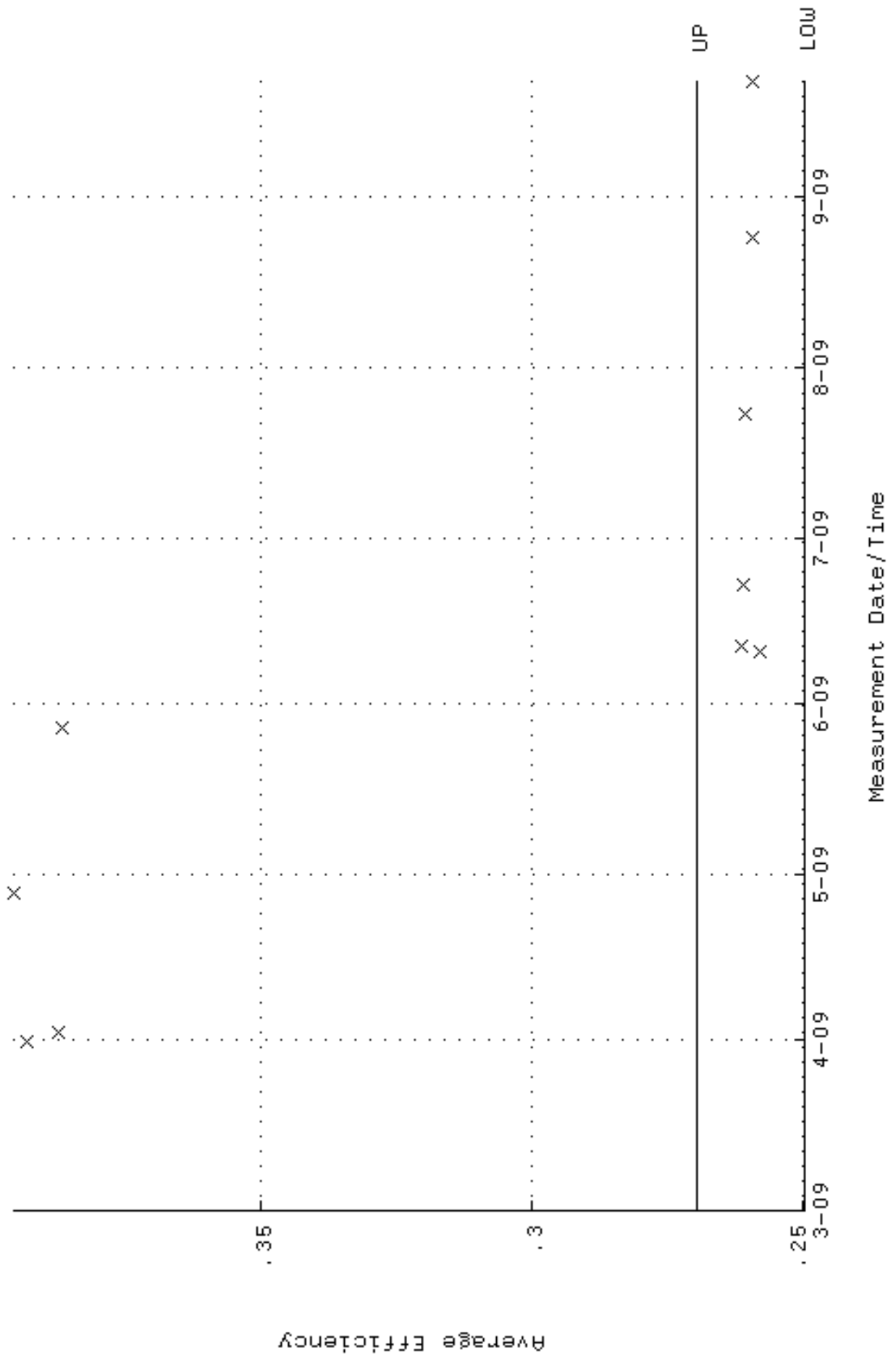
QA filename : DKA100:[ENV\_ALPHA.QA.W]w200.QAF;1  
Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
Start/End Dates : 31-MAR-2009 15:10:24 through 21-SEP-2009 12:00:00  
Lower/Upper Lmts: 83.8028 through 92.6242



QA filename : DKA100:[ENV\_ALPHA.QA.B]B200.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-APR-2009 08:02:33 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

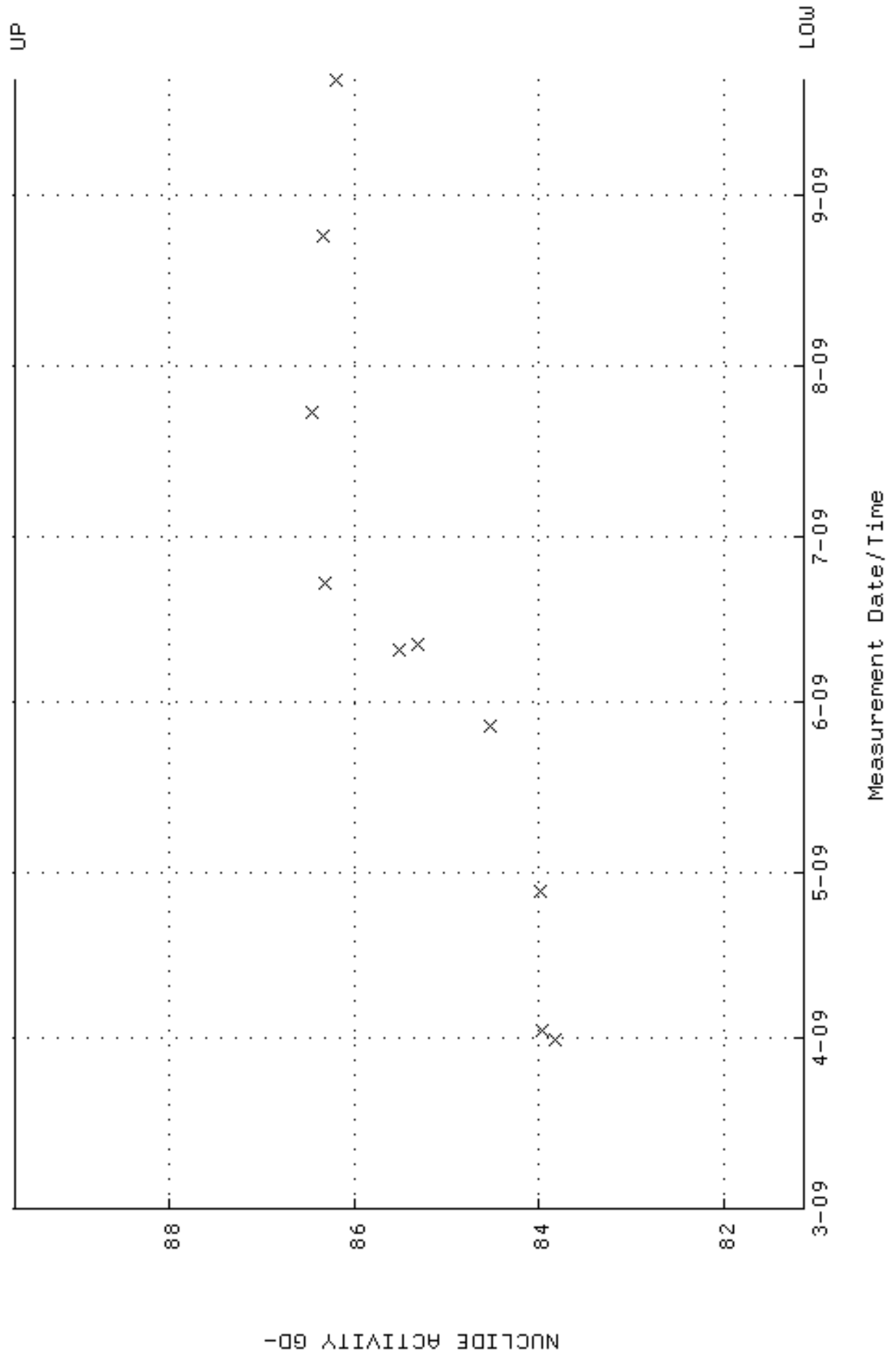


QA filename : DKA100:[ENV\_ALPHA.QA.W]w201.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 31-MAR-2009 15:10:26 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.249568 through 0.269568

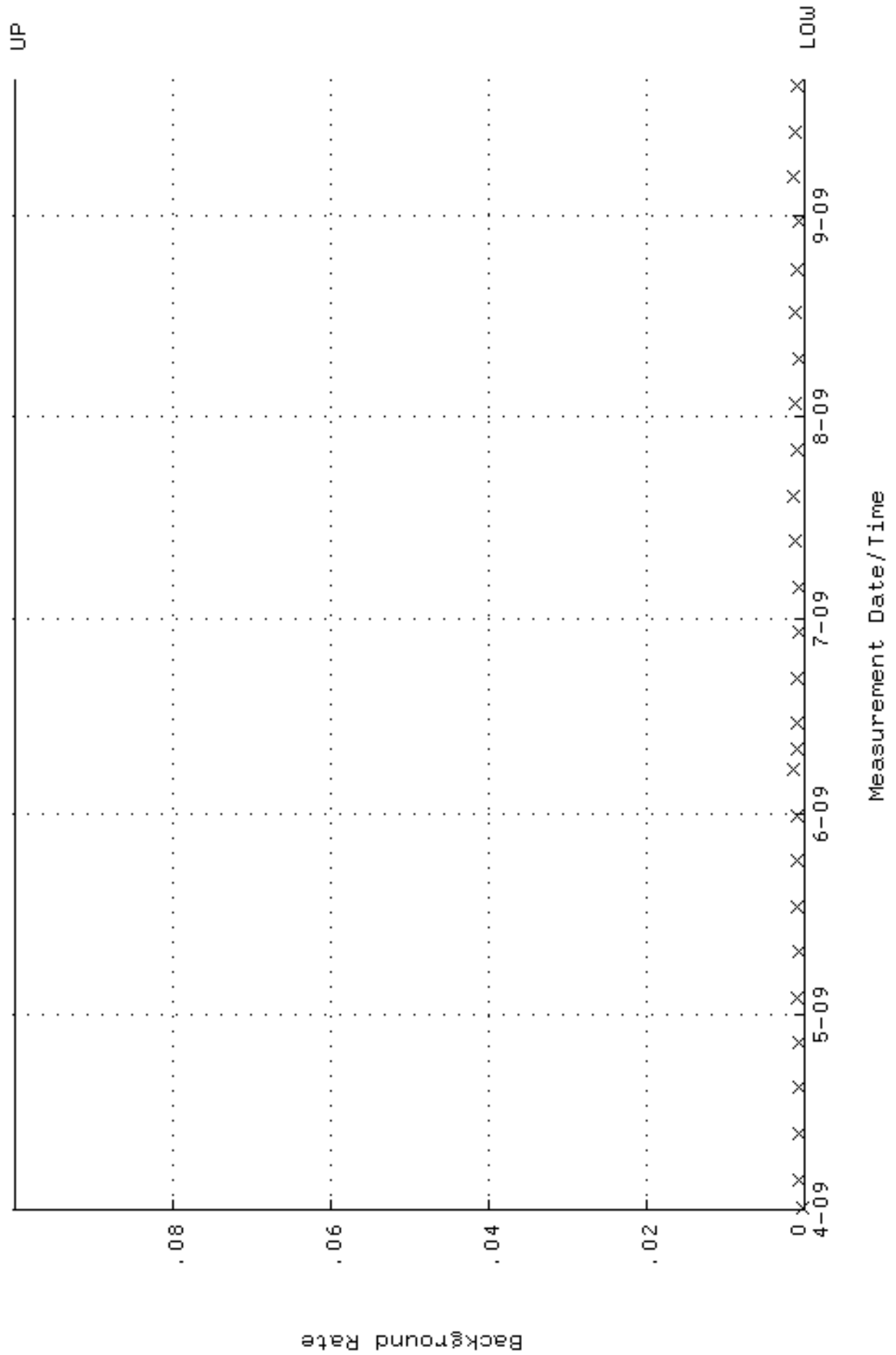




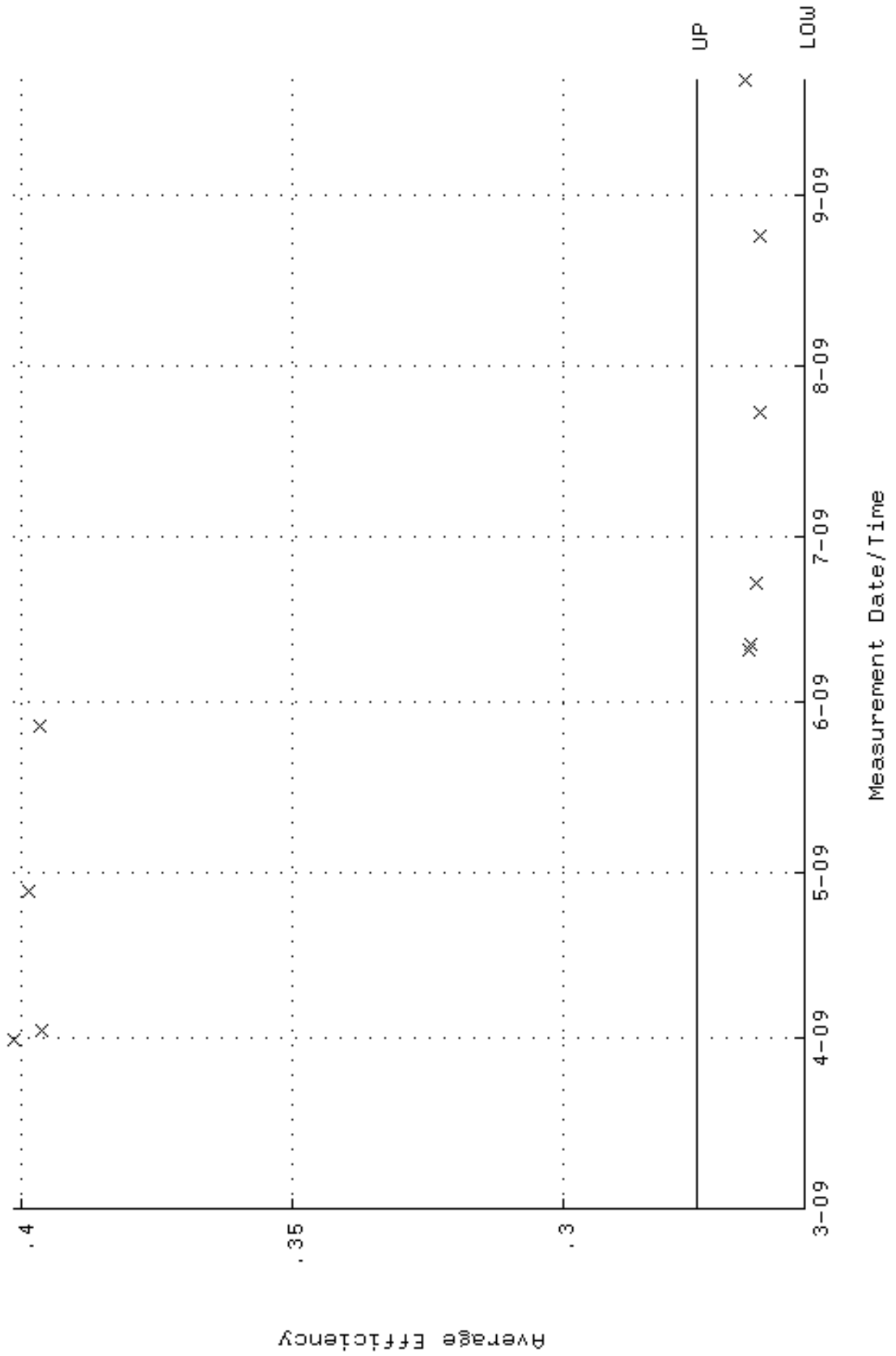
QA filename : DKA100:[ENV\_ALPHA.QA.W]w201.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 31-MAR-2009 15:10:26 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 81.1299 through 89.6699



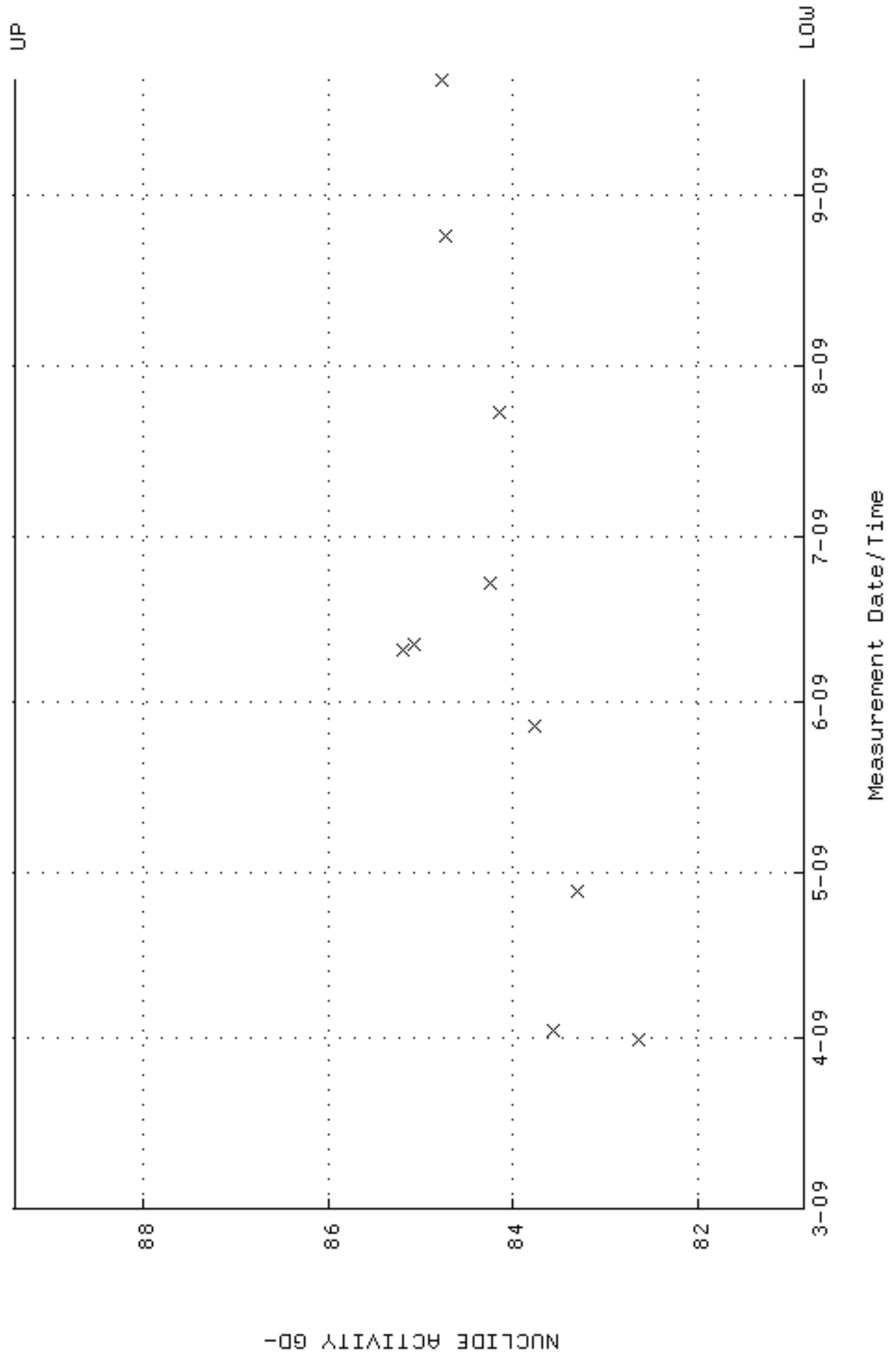
QA filename : DKA100:[ENV\_ALPHA.QA.B]B201.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-APR-2009 08:02:39 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



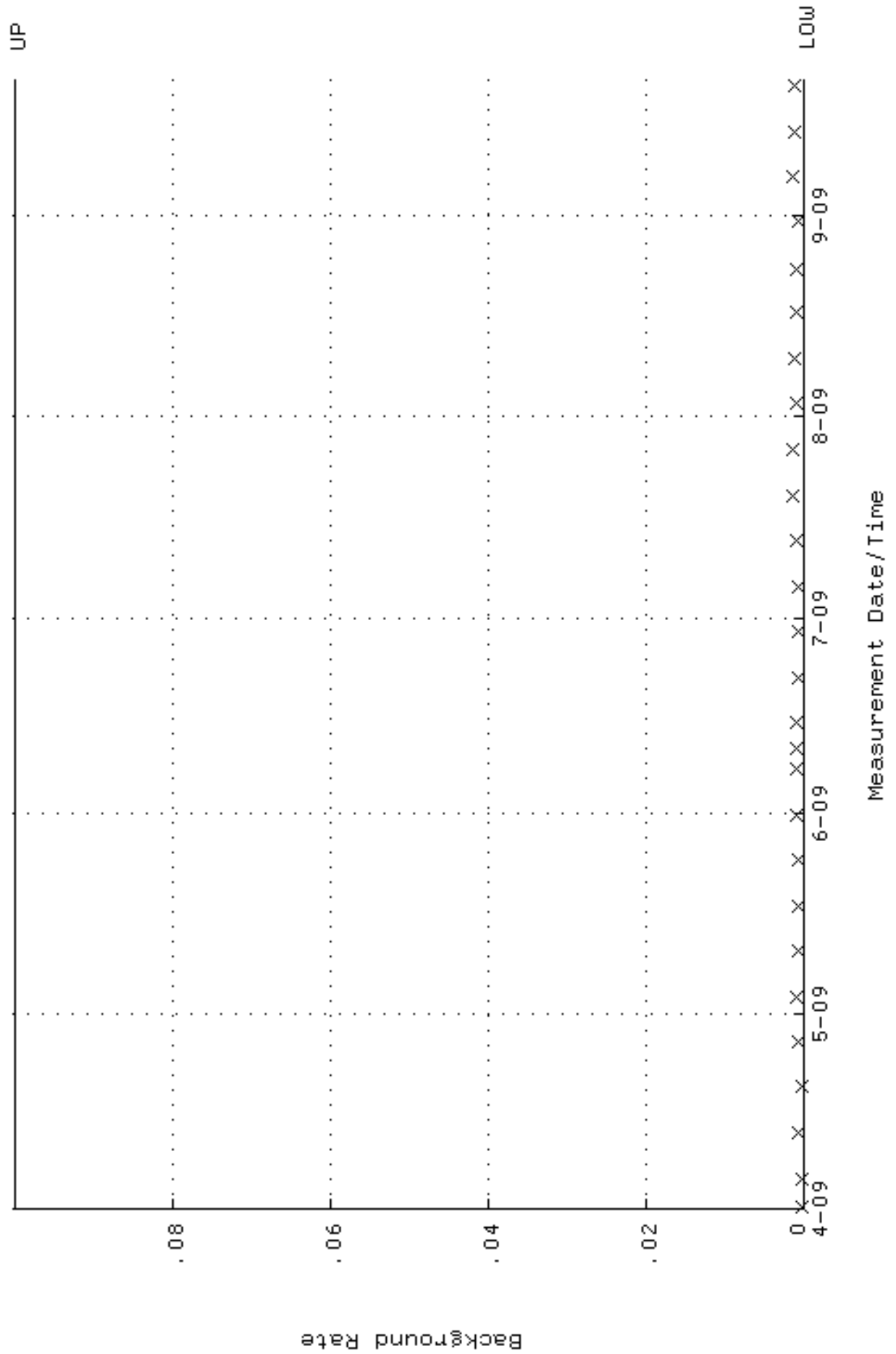
QA filename : DKA100:[ENV\_ALPHA.QA.W]W202.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 31-MAR-2009 15:10:28 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.255511 through 0.275511



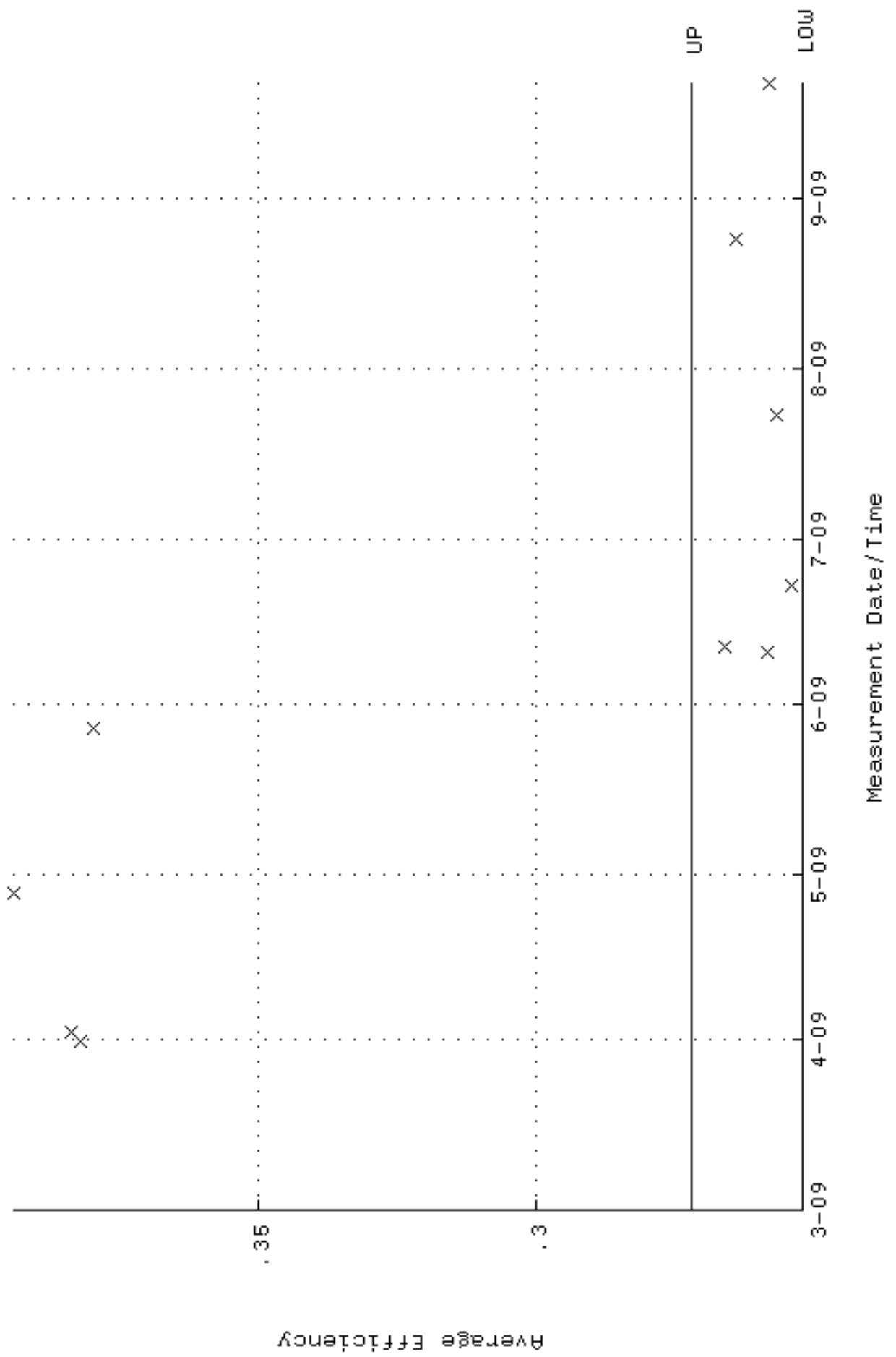
QA filename : DKA100:[ENV\_ALPHA.QA.W]w202.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 31-MAR-2009 15:10:28 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 80.8649 through 89.3769



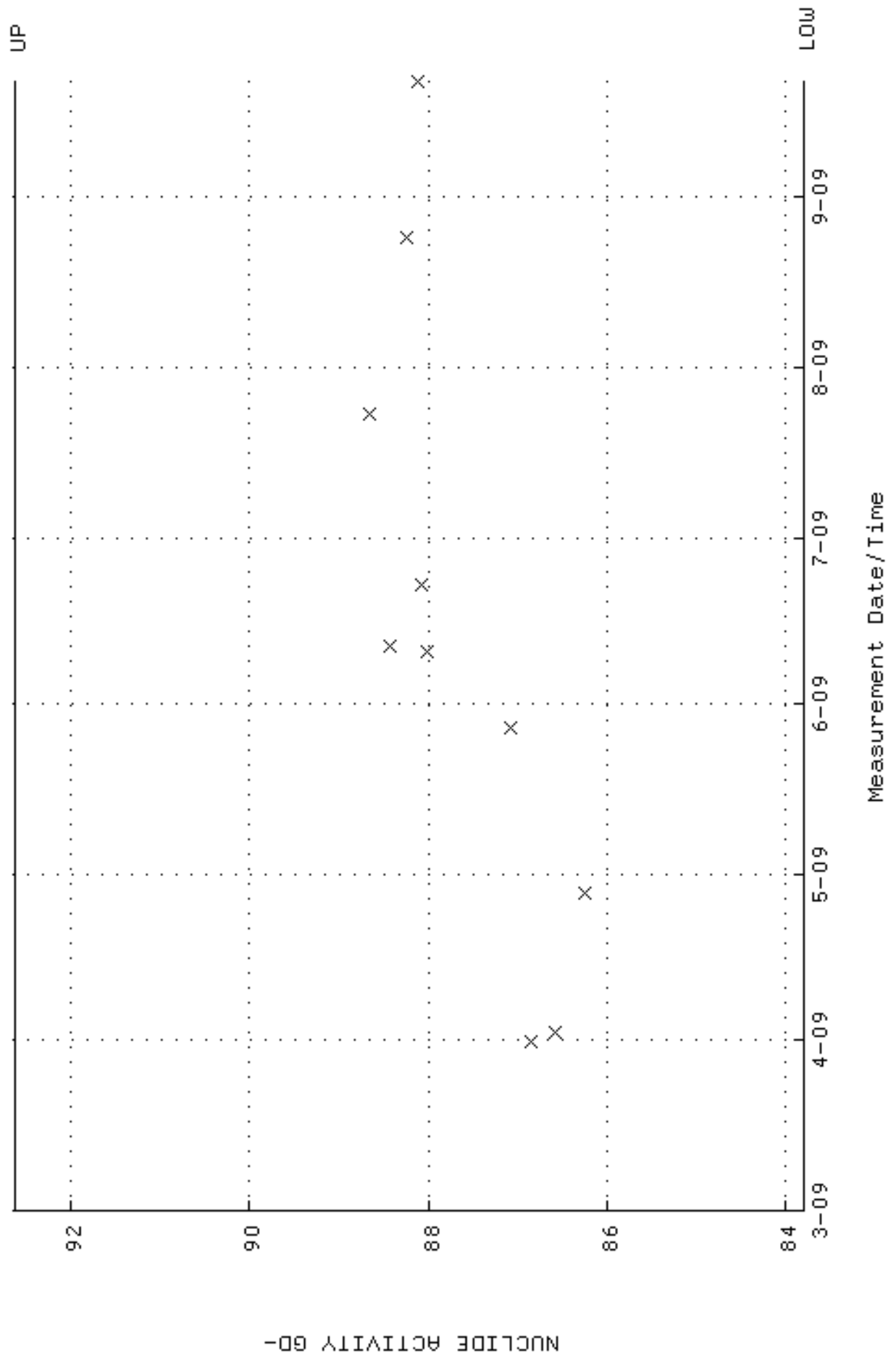
QA filename : DKA100:[ENV\_ALPHA.QA.B]B202.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-APR-2009 08:02:44 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



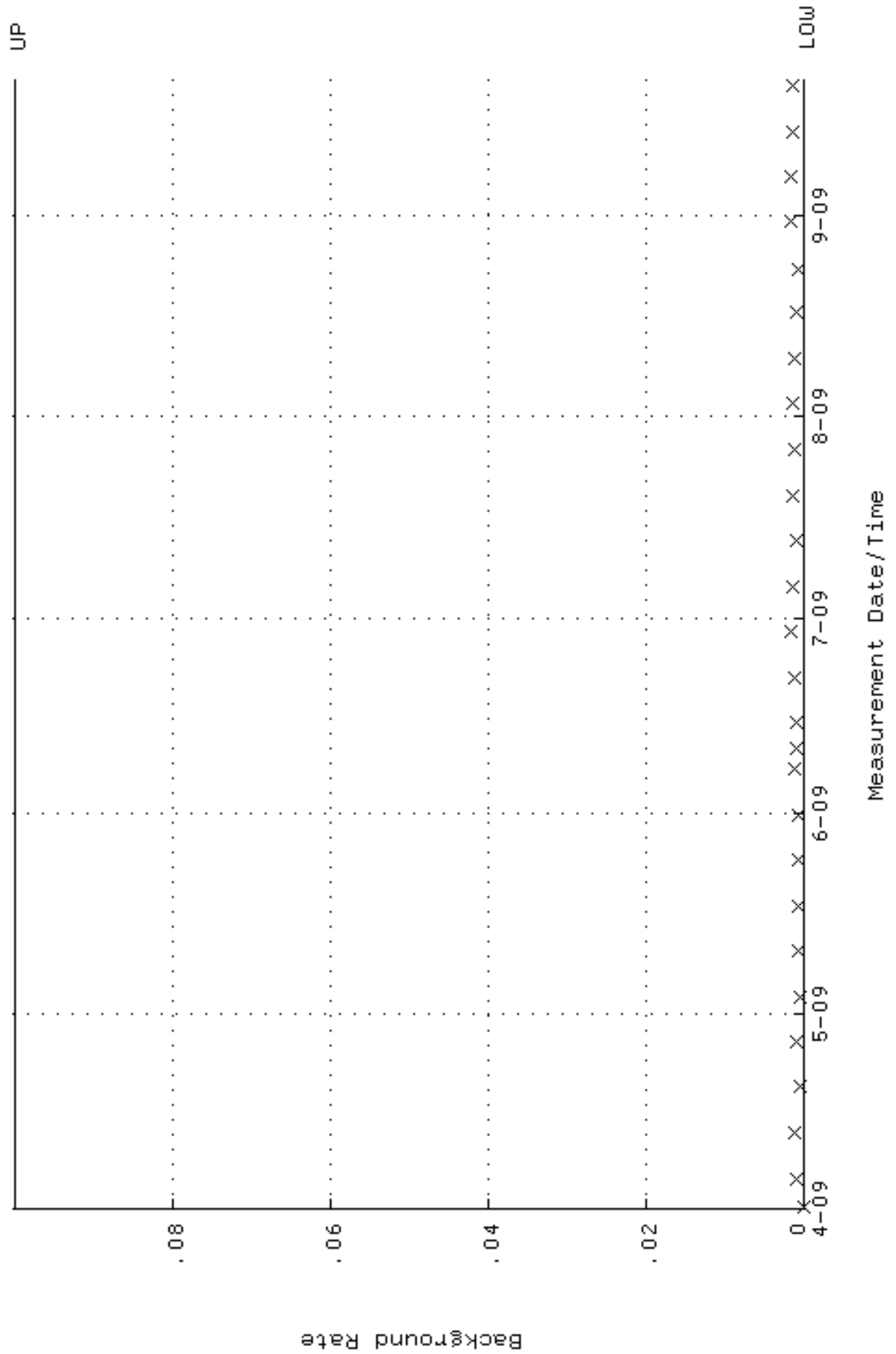
QA filename : DKA100:[ENV\_ALPHA.QA.W]W203.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 31-MAR-2009 15:10:29 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.252203 through 0.272203



QA filename : DKA100:[ENV\_ALPHA.QA.W]w203.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 31-MAR-2009 15:10:29 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 83.7993 through 92.6203

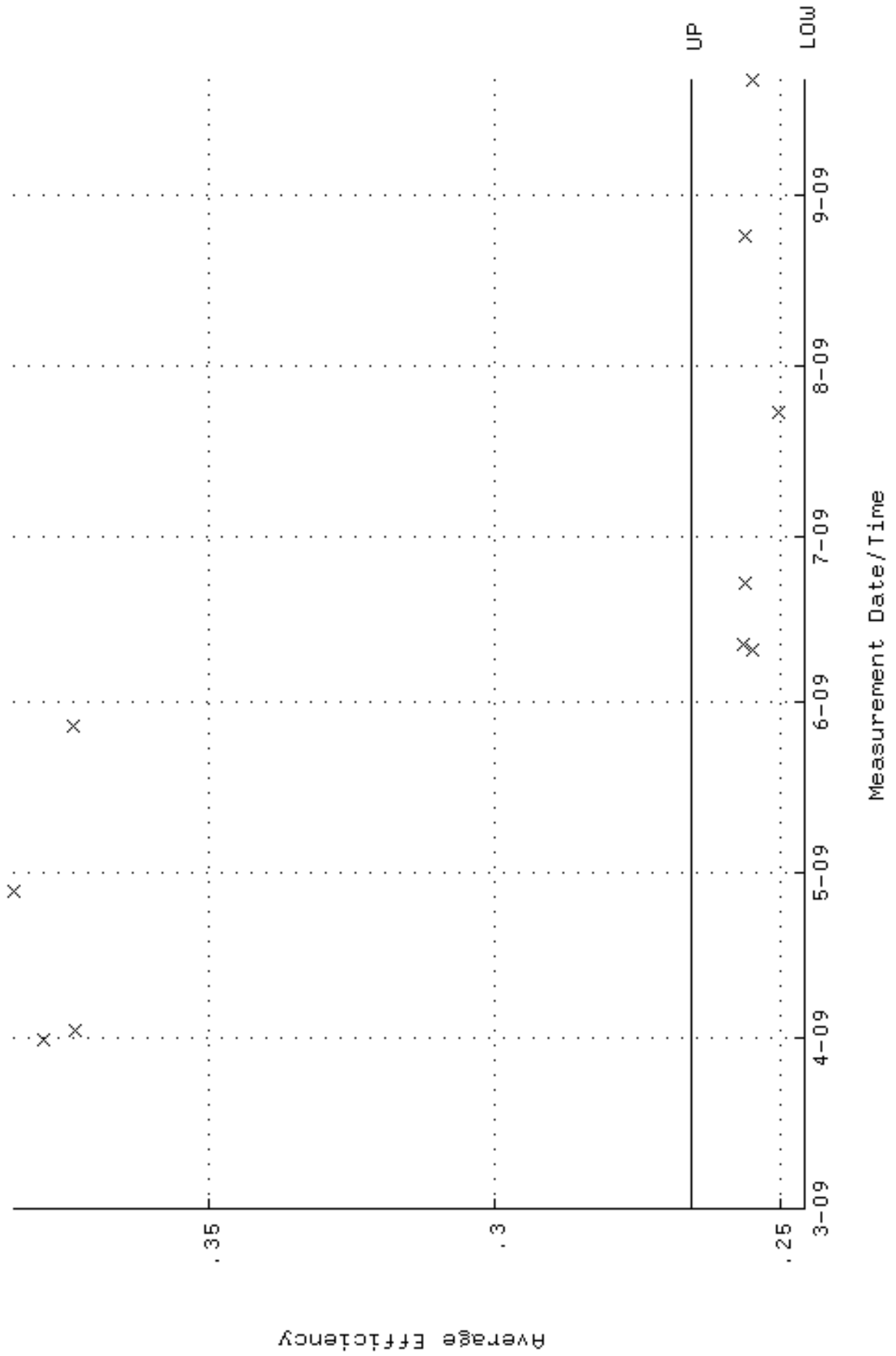


QA filename : DKA100:[ENV\_ALPHA.QA.B]B203.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-APR-2009 08:02:49 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000

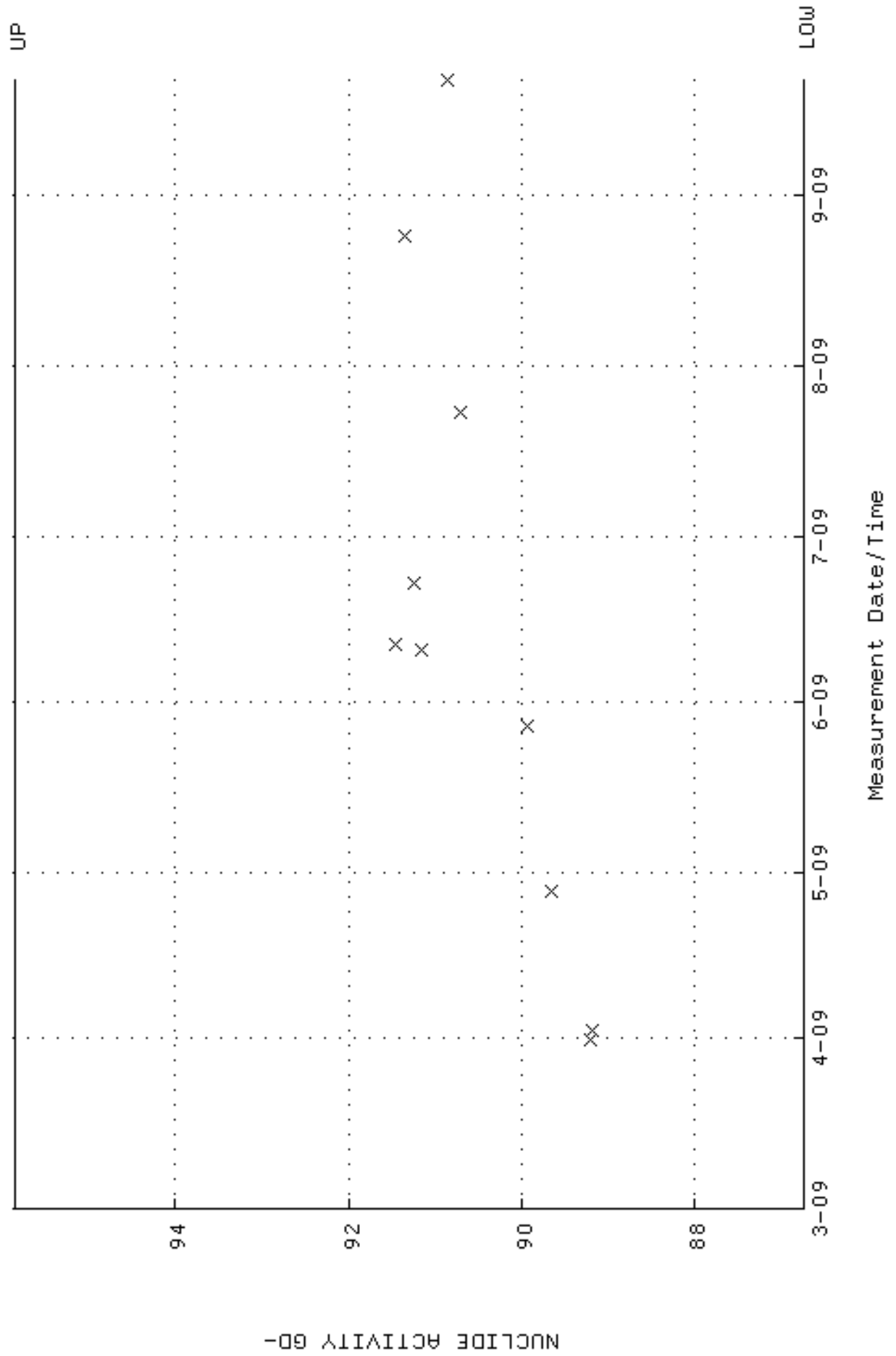




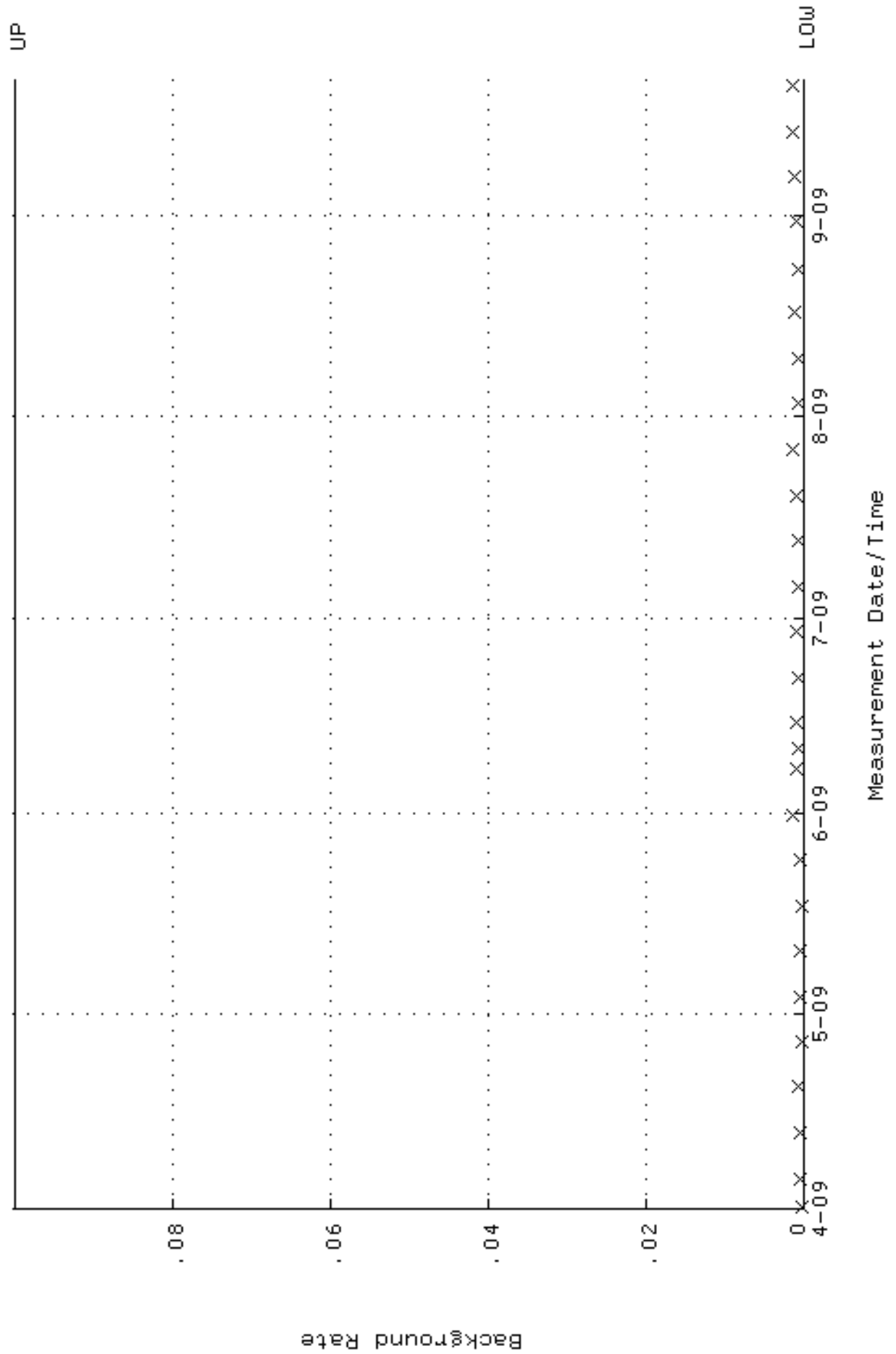
QA filename : DKA100:[ENV\_ALPHA.QA.W]W205.QAF;1  
 Parameter Name : AVRGEFF (Average Efficiency)  
 Start/End Dates : 31-MAR-2009 15:10:33 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.245702 through 0.265702



QA filename : DKA100:[ENV\_ALPHA.QA.W]w205.QAF;1  
 Parameter Name : NLAIVITY-GD148 (NUCLIDE ACTIVITY GD-148)  
 Start/End Dates : 31-MAR-2009 15:10:33 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 86.7285 through 95.8579



QA filename : DKA100:[ENV\_ALPHA.QA.B]B205.QAF;1  
 Parameter Name : BACKRATE (Background Rate)  
 Start/End Dates : 1-APR-2009 08:03:01 through 21-SEP-2009 12:00:00  
 Lower/Upper Lmts: 0.000000E+00 through 0.100000



# RUNLOGS

# Instrument Run Log

Instrument Type: GFPC

Batch ID: 905326

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
1201930327	LCS	MXS2	PIC3A	28-SEP-09 19:41	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201930328	LCSD	MXS2	PIC3D	28-SEP-09 19:41	DONE	CeF on 25mm Filter	02-JUL-09 00:00
236938020	SAMPLE	MXS2	PIC1A	28-SEP-09 19:42	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237010013	SAMPLE	MXS2	PIC1B	28-SEP-09 19:42	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237170005	SAMPLE	MXS2	PIC1C	28-SEP-09 19:42	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237170020	SAMPLE	MXS2	PIC1D	28-SEP-09 19:42	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237343006	SAMPLE	MXS2	PIC2A	28-SEP-09 19:42	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521010	SAMPLE	MXS2	PIC2C	28-SEP-09 19:42	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201930326	MB	MXS2	PIC3A	28-SEP-09 20:55	DONE	CeF on 25mm Filter	02-JUL-09 00:00

# Instrument Run Log

Instrument Type: ALPHA SPECTROMETER

Batch ID: 905546

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
236699016	SAMPLE	AXD2	1025	02-OCT-09 09:19	DUSE		
236938020	SAMPLE	AXD2	1027	02-OCT-09 09:19	DONE		
237010013	SAMPLE	AXD2	1028	02-OCT-09 09:19	DONE		
237170005	SAMPLE	AXD2	1029	02-OCT-09 09:19	DUSE		
237170020	SAMPLE	AXD2	1030	02-OCT-09 09:19	DUSE		
237343006	SAMPLE	AXD2	1037	02-OCT-09 09:19	DUSE		
237521010	SAMPLE	AXD2	1038	02-OCT-09 09:19	DUSE		
1201930820	MB	AXD2	1039	02-OCT-09 09:19	DUSE		
1201930821	LCS	AXD2	1040	02-OCT-09 09:19	DONE		
1201930822	LCSD	AXD2	1041	02-OCT-09 09:19	DONE		
236817014	SAMPLE	AXD2	1042	02-OCT-09 09:19	DUSE		
236699016	SAMPLE	AXD2	1197	05-OCT-09 20:51	DONE		
236817014	SAMPLE	AXD2	1198	05-OCT-09 20:51	DONE		
237170005	SAMPLE	AXD2	1199	05-OCT-09 20:51	DONE		
237170020	SAMPLE	AXD2	1201	05-OCT-09 20:51	DONE		
237343006	SAMPLE	AXD2	1202	05-OCT-09 20:51	DONE		
237521010	SAMPLE	AXD2	1203	05-OCT-09 20:51	DONE		
1201930820	MB	AXD2	1205	05-OCT-09 20:51	DONE		

# Instrument Run Log

Instrument Type: ALPHA SPECTROMETER

Batch ID: 905548

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
1201930842	MB	AXD2	1022	02-OCT-09 13:49	DONE		
1201930843	LCS	AXD2	1023	02-OCT-09 13:49	DONE		
1201930844	LCSD	AXD2	1024	02-OCT-09 13:49	DONE		
236699016	SAMPLE	AXD2	1143	02-OCT-09 20:25	DUSE		
236817014	SAMPLE	AXD2	1144	02-OCT-09 20:25	DUSE		
236938020	SAMPLE	AXD2	1145	02-OCT-09 20:25	DONE		
237010013	SAMPLE	AXD2	1146	02-OCT-09 20:25	DUSE		
237170005	SAMPLE	AXD2	1147	02-OCT-09 20:25	DUSE		
237170020	SAMPLE	AXD2	1148	02-OCT-09 20:25	DUSE		
237343006	SAMPLE	AXD2	1161	02-OCT-09 20:26	DONE		
237521010	SAMPLE	AXD2	1162	02-OCT-09 20:26	DONE		
236817014	SAMPLE	AXD2	1113	05-OCT-09 20:48	DONE		
236699016	SAMPLE	AXD2	1114	05-OCT-09 20:48	DONE		
237010013	SAMPLE	AXD2	1117	05-OCT-09 20:48	DONE		
237170005	SAMPLE	AXD2	1132	05-OCT-09 20:48	DONE		
237170020	SAMPLE	AXD2	1135	05-OCT-09 20:48	DONE		

# Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 905702

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
237521001	SAMPLE	KSD1	LUCAS3	15-OCT-09 19:15	DONE	Lucas Cell	04-FEB-09 00:00
237521003	SAMPLE	KSD1	LUCAS5	15-OCT-09 19:15	DONE	Lucas Cell	25-MAR-09 00:00
237521004	SAMPLE	KSD1	LUCAS6	15-OCT-09 19:15	DONE	Lucas Cell	04-AUG-09 00:00
237521005	SAMPLE	KSD1	LUCAS7	15-OCT-09 19:15	DONE	Lucas Cell	30-SEP-09 00:00
237521006	SAMPLE	KSD1	LUCAS1	15-OCT-09 19:50	DONE	Lucas Cell	31-AUG-09 00:00
237521007	SAMPLE	KSD1	LUCAS2	15-OCT-09 19:50	DONE	Lucas Cell	19-DEC-08 00:00
237521008	SAMPLE	KSD1	LUCAS3	15-OCT-09 19:50	DONE	Lucas Cell	04-FEB-09 00:00
237521009	SAMPLE	KSD1	LUCAS4	15-OCT-09 19:50	DONE	Lucas Cell	02-MAR-09 00:00
237521011	SAMPLE	KSD1	LUCAS5	15-OCT-09 19:50	DONE	Lucas Cell	25-MAR-09 00:00
237521012	SAMPLE	KSD1	LUCAS6	15-OCT-09 19:50	DONE	Lucas Cell	04-AUG-09 00:00
237521013	SAMPLE	KSD1	LUCAS7	15-OCT-09 19:50	DONE	Lucas Cell	30-SEP-09 00:00
237521014	SAMPLE	KSD1	LUCAS1	15-OCT-09 20:25	DONE	Lucas Cell	31-AUG-09 00:00
237521015	SAMPLE	KSD1	LUCAS2	15-OCT-09 20:25	DONE	Lucas Cell	19-DEC-08 00:00
237521016	SAMPLE	KSD1	LUCAS3	15-OCT-09 20:25	DONE	Lucas Cell	04-FEB-09 00:00
237521017	SAMPLE	KSD1	LUCAS4	15-OCT-09 20:25	DONE	Lucas Cell	02-MAR-09 00:00
237521018	SAMPLE	KSD1	LUCAS5	15-OCT-09 20:25	DONE	Lucas Cell	25-MAR-09 00:00
237521019	SAMPLE	KSD1	LUCAS7	15-OCT-09 20:25	DONE	Lucas Cell	30-SEP-09 00:00
237521020	SAMPLE	KSD1	LUCAS1	15-OCT-09 21:00	DONE	Lucas Cell	31-AUG-09 00:00
1201931196	MB	KSD1	LUCAS2	15-OCT-09 21:00	DONE	Lucas Cell	19-DEC-08 00:00
1201931197	DUP	KSD1	LUCAS3	15-OCT-09 21:50	DONE	Lucas Cell	04-FEB-09 00:00
237521002	SAMPLE	KSD1	LUCAS4	15-OCT-09 21:50	DONE	Lucas Cell	02-MAR-09 00:00
1201931198	MS	KSD1	LUCAS5	15-OCT-09 21:50	DONE	Lucas Cell	25-MAR-09 00:00
1201931199	LCS	KSD1	LUCAS7	15-OCT-09 22:20	DONE	Lucas Cell	30-SEP-09 00:00



# Instrument Run Log

Instrument Type: GFPC

Batch ID: 907662

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
1201935881	MS	JXC5	PIC14A	15-OCT-09 12:06	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201935879	MB	JXC5	PIC1D	15-OCT-09 12:09	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521001	SAMPLE	JXC5	PIC2A	15-OCT-09 12:09	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521002	SAMPLE	JXC5	PIC2B	15-OCT-09 12:09	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521004	SAMPLE	JXC5	PIC3C	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521006	SAMPLE	JXC5	PIC4A	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521007	SAMPLE	JXC5	PIC4C	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521008	SAMPLE	JXC5	PIC4D	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521013	SAMPLE	JXC5	PIC5D	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521009	SAMPLE	JXC5	PIC5A	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521011	SAMPLE	JXC5	PIC5B	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521016	SAMPLE	JXC5	PIC6D	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521014	SAMPLE	JXC5	PIC6A	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521015	SAMPLE	JXC5	PIC6B	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521017	SAMPLE	JXC5	PIC7A	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521018	SAMPLE	JXC5	PIC7B	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521020	SAMPLE	JXC5	PIC8A	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521019	SAMPLE	JXC5	PIC7D	15-OCT-09 12:10	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201935882	LCS	JXC5	PIC10D	15-OCT-09 12:12	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521003	SAMPLE	JXC5	PIC11C	15-OCT-09 14:25	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521005	SAMPLE	JXC5	PIC14A	15-OCT-09 14:25	DONE	CeF on 25mm Filter	02-JUL-09 00:00
237521012	SAMPLE	JXC5	LB4100D2	15-OCT-09 16:41	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201935880	DUP	JXC5	LB4100D3	15-OCT-09 16:41	DONE	CeF on 25mm Filter	02-JUL-09 00:00

# Instrument Run Log

Instrument Type: ALPHA SPECTROMETER

Batch ID: 909125

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
237521001	SAMPLE	CXM2	1205	12-OCT-09 11:42	DUSE		
237521002	SAMPLE	CXM2	1206	12-OCT-09 11:42	DUSE		
237521003	SAMPLE	CXM2	1208	12-OCT-09 11:42	DUSE		
237521020	SAMPLE	CXM2	1026	12-OCT-09 11:51	DUSE		
1201939560	MB	CXM2	1027	12-OCT-09 11:51	DUSE		
1201939561	DUP	CXM2	1028	12-OCT-09 11:51	DUSE		
1201939562	MS	CXM2	1029	12-OCT-09 11:51	DUSE		
1201939563	LCS	CXM2	1030	12-OCT-09 11:51	DUSE		
237521004	SAMPLE	CXM2	1033	12-OCT-09 11:51	DUSE		
237521005	SAMPLE	CXM2	1035	12-OCT-09 11:51	DUSE		
237521006	SAMPLE	CXM2	1036	12-OCT-09 11:51	DUSE		
237521007	SAMPLE	CXM2	1037	12-OCT-09 11:51	DUSE		
237521008	SAMPLE	CXM2	1038	12-OCT-09 11:51	DUSE		
237521009	SAMPLE	CXM2	1039	12-OCT-09 11:51	DUSE		
237521011	SAMPLE	CXM2	1040	12-OCT-09 11:51	DUSE		
237521012	SAMPLE	CXM2	1041	12-OCT-09 11:51	DUSE		
237521013	SAMPLE	CXM2	1042	12-OCT-09 11:51	DUSE		
237521014	SAMPLE	CXM2	1043	12-OCT-09 11:51	DUSE		
237521015	SAMPLE	CXM2	1044	12-OCT-09 11:51	DUSE		
237521016	SAMPLE	CXM2	1045	12-OCT-09 11:51	DUSE		
237521017	SAMPLE	CXM2	1046	12-OCT-09 11:51	DUSE		
237521018	SAMPLE	CXM2	1047	12-OCT-09 11:51	DUSE		
237521019	SAMPLE	CXM2	1048	12-OCT-09 11:51	DUSE		
1201939560	MB	CXM2	1173	13-OCT-09 13:16	DONE		
237521001	SAMPLE	CXM2	1181	15-OCT-09 20:10	DONE		
237521003	SAMPLE	CXM2	1183	15-OCT-09 20:10	DONE		
237521005	SAMPLE	CXM2	1185	15-OCT-09 20:10	DONE		
237521006	SAMPLE	CXM2	1186	15-OCT-09 20:10	DONE		
237521008	SAMPLE	CXM2	1188	15-OCT-09 20:10	DONE		
237521009	SAMPLE	CXM2	1189	15-OCT-09 20:10	DONE		
237521011	SAMPLE	CXM2	1190	15-OCT-09 20:10	DONE		
237521012	SAMPLE	CXM2	1191	15-OCT-09 20:10	DONE		
237521013	SAMPLE	CXM2	1192	15-OCT-09 20:11	DONE		
237521014	SAMPLE	CXM2	1193	15-OCT-09 20:11	DONE		
237521015	SAMPLE	CXM2	1194	15-OCT-09 20:11	DONE		
237521016	SAMPLE	CXM2	1195	15-OCT-09 20:11	DONE		
237521017	SAMPLE	CXM2	1196	15-OCT-09 20:11	DONE		
237521018	SAMPLE	CXM2	1197	15-OCT-09 20:11	DONE		
237521020	SAMPLE	CXM2	1199	15-OCT-09 20:11	DONE		
1201939561	DUP	CXM2	1200	15-OCT-09 20:11	DONE		
1201939562	MS	CXM2	1201	15-OCT-09 20:11	DONE		
1201939563	LCS	CXM2	1202	15-OCT-09 20:11	DONE		
237521002	SAMPLE	CXM2	1182	16-OCT-09 09:55	DONE		
237521004	SAMPLE	CXM2	1184	16-OCT-09 10:01	DONE		

# Instrument Run Log

Instrument Type: ALPHA SPECTROMETER

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
237521007	SAMPLE	CXM2	1175	19-OCT-09 12:28	DONE		
237521019	SAMPLE	CXM2	1176	19-OCT-09 12:28	DONE		

# Instrument Run Log

Instrument Type: ALPHA SPECTROMETER

Batch ID: 909129

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
237521017	SAMPLE	CXM2	1161	10-OCT-09 15:22	DONE		
237521018	SAMPLE	CXM2	1163	10-OCT-09 15:22	DONE		
237521019	SAMPLE	CXM2	1164	10-OCT-09 15:22	DONE		
237521020	SAMPLE	CXM2	1167	10-OCT-09 15:22	DONE		
1201939568	MB	CXM2	1168	10-OCT-09 15:22	DONE		
1201939569	DUP	CXM2	1169	10-OCT-09 15:22	DONE		
1201939570	MS	CXM2	1171	10-OCT-09 15:22	DONE		
1201939571	LCS	CXM2	1172	10-OCT-09 15:22	DONE		
237521001	SAMPLE	CXM2	1146	10-OCT-09 15:32	DONE		
237521002	SAMPLE	CXM2	1147	10-OCT-09 15:32	DONE		
237521003	SAMPLE	CXM2	1148	10-OCT-09 15:32	DONE		
237521004	SAMPLE	CXM2	1149	10-OCT-09 15:32	DONE		
237521005	SAMPLE	CXM2	1150	10-OCT-09 15:32	DONE		
237521006	SAMPLE	CXM2	1151	10-OCT-09 15:32	DONE		
237521007	SAMPLE	CXM2	1152	10-OCT-09 15:32	DONE		
237521008	SAMPLE	CXM2	1153	10-OCT-09 15:32	DONE		
237521009	SAMPLE	CXM2	1154	10-OCT-09 15:32	DONE		
237521011	SAMPLE	CXM2	1155	10-OCT-09 15:32	DONE		
237521012	SAMPLE	CXM2	1156	10-OCT-09 15:32	DONE		
237521013	SAMPLE	CXM2	1157	10-OCT-09 15:32	DONE		
237521014	SAMPLE	CXM2	1158	10-OCT-09 15:32	DONE		
237521015	SAMPLE	CXM2	1159	10-OCT-09 15:32	DONE		
237521016	SAMPLE	CXM2	1160	10-OCT-09 15:32	DONE		

# Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 911018

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
237521010	SAMPLE	KSD1	LUCAS1	15-OCT-09 08:25	DONE	Lucas Cell	31-AUG-09 00:00
237822006	SAMPLE	KSD1	LUCAS2	15-OCT-09 08:25	DONE	Lucas Cell	19-DEC-08 00:00
237941008	SAMPLE	KSD1	LUCAS3	15-OCT-09 08:25	DONE	Lucas Cell	04-FEB-09 00:00
237941009	SAMPLE	KSD1	LUCAS4	15-OCT-09 08:25	DONE	Lucas Cell	02-MAR-09 00:00
237941019	SAMPLE	KSD1	LUCAS5	15-OCT-09 08:25	DONE	Lucas Cell	25-MAR-09 00:00
238030010	SAMPLE	KSD1	LUCAS6	15-OCT-09 08:25	DONE	Lucas Cell	04-AUG-09 00:00
238030020	SAMPLE	KSD1	LUCAS7	15-OCT-09 08:25	DONE	Lucas Cell	30-SEP-09 00:00
238055012	SAMPLE	KSD1	LUCAS1	15-OCT-09 09:15	DONE	Lucas Cell	31-AUG-09 00:00
238055022	SAMPLE	KSD1	LUCAS2	15-OCT-09 09:15	DONE	Lucas Cell	19-DEC-08 00:00
238199019	SAMPLE	KSD1	LUCAS3	15-OCT-09 09:15	DONE	Lucas Cell	04-FEB-09 00:00
238405013	SAMPLE	KSD1	LUCAS4	15-OCT-09 09:15	DONE	Lucas Cell	02-MAR-09 00:00
238405019	SAMPLE	KSD1	LUCAS5	15-OCT-09 09:15	DONE	Lucas Cell	25-MAR-09 00:00
1201943894	MB	KSD1	LUCAS6	15-OCT-09 09:15	DONE	Lucas Cell	04-AUG-09 00:00
1201943895	LCS	KSD1	LUCAS7	15-OCT-09 09:15	DONE	Lucas Cell	30-SEP-09 00:00
1201943896	LCSD	KSD1	LUCAS1	15-OCT-09 09:45	DONE	Lucas Cell	31-AUG-09 00:00