GEL Laboratories LLC
a member of The GEL Group INC

PO Box 30712 Charleston, SC 29417
2040 Savage Road Charleston, SC 29407
P 843.556.8171 F 843.766.1178

www.gel.com

December 03, 2009

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

Re: Tronox Henderson
Work Order: 239753

Dear Mr. Hagar:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on November 03, 2009, October 26, 2009, October 27, 2009, October 28, 2009, October 29, 2009, October 30, 2009 and October 31, 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,

Heather Shaffer

for Edith Kent
Project Manager

Chain of Custody: 2027.001.01120, 2027.001.01121, 2027.001.01123, 2027.001.01124, 2027.001.01125, 2027.001.01126, 2027.001.01127, 2027.001.01128, 2027.001.01129, 2027.001.01131 and 2027.001.01134
Enclosures

Tronox LLC
Tronox Henderson
SDG:239753

Table of Contents

Case Narrative **1**

Chain of Custody and Supporting Documentation **4**

Laboratory Certifications **28**

Radiological Analysis **30**
- Sample Data Summary 43
- Quality Control Data 63
- Raw Data 67
  - Thorium 68
    - *923093* *69*
  - Uranium 93
    - *923094* *94*
  - Radium 228 118
    - *922859* *119*
  - Radium 226 126
    - *920697* *127*
- Method Calibration Data 132
  - Alpha Spectroscopy 133
  - Gas Flow Proportional Counters 189
  - Lucas Cell Counters 273
    - *Lucas 1* *274*
    - *Lucas 2* *295*
    - *Lucas 3* *315*
    - *Lucas 4* *335*
    - *Lucas 5* *350*
    - *Lucas 7* *371*
- Background and Efficiency Data 413
- Runlogs 596

Case Narrative

CASE NARRATIVE
for
Tronox LLC
Tronox Henderson
SDG:239753

December 03, 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 November 03, 2009, October 26, 2009, October 27, 2009, October 28, 2009, October 29, 2009, October 30, 2009 and October 31, 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 were no times of collection listed on the chain of custody for 2027.001.01121 and 2027.001.01128. The client was notified that the lab used the times listed on the sample containers. The client also verified that the samples on 2027.001.01125 were field filtered. Please refer to attached e-mails.

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 November 9, 2009 and the turnaround time would start from then. Please see the attached e-mails for further details on all issues.

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: 239753006, 239753014 and 239753016. 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: and 239753018. 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: 239753006, 239753012 and 239753016. 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: 239753001, 239753002, 239753009, 239753011 and 239753017. The following samples did not meet the Tronox QA program sample tracer yield requirements of 70-120% for Alpha Spec Thorium due to matrix issues: and 239753002. The following samples did not meet the Tronox QA program required detection limits for Alpha Spec Thorium due to limited sample volume and were counted for the maximum time: 239753001, 239753002, 239753005, 239753006, 239753011, and the method blank. The following samples did not meet the Tronox QA program required detection limits for Alpha Spec Uranium due to limited sample volume and were counted for the maximum time: 239753003.

Sample Identification
The laboratory received the following samples:

Laboratory ID	Client ID
239753001	M-141B
239753002	M-141009B
239753003	PB102309-A3

239753004	M-145B
239753005	M-139B
239753006	M-146B
239753007	M-144B
239753008	M-138B
239753009	M-138009B
239753010	M-138BDISS
239753011	M-138009BDISS
239753012	M-137B
239753013	M-137BDISS
239753014	M-148B
239753015	EB103009-GWA4
239753016	M-147B
239753017	M-147009B
239753018	EB110209-GWA3

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.

Heather Shaffer

for Edith Kent

Project Manager

Chain of Custody and Supporting Documentation

239753

CHAIN-OF-CUSTODY / Analytical Request Document

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

northgate
environmental management, inc.
1100 Quail Street, Suite 102, Newport Beach, CA 92660
(949) 260-9293

COC No. 2027.001.01125
Page: 1 of 1
Cooler # ____ of ____

Collection Area: III

Required Ship to Lab:

Lab Name:	GEL Laboratories, LLC
Address:	2040 Savage Road
	Charleston, SC 29407
Lab PM:	Edith M. Kent
Phone/Fax:	(843)556-8171
Lab PM email	emk@gel.com
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	TRONOX LLC. HENDERSON
Project #	2027.001
Site Address	560 W. Lake Mead Drive
City	Henderson
State	NV
Site PM Name	Derrick Willis
Phone/Fax:	949-375-7004
Site PM Email:	derrick.willis@ngem.com

Required Invoice Information:

Send Invoice to:	Susan Crowley Tronox LLC
Address:	PO Box 55
City/State	Henderson, NV 89009
Phone #:	(949)260-9293
Reimbursement project?	X
Non-reimbursement project?	Mark one
Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com
CC Hardcopy report to	PDF Electronic Version Only
CC Hardcopy report to	see additional comments below

TAT: Standard 30 day	X	Rush		Mark One	
If Rush, Date due					
QC level Required: Standard		Special	EPA Stage 4	Mark one	
NJ Reduced Deliverable Package?					
MA MCP Cert?		CT RCP Cert?		Mark One	
Lab Project ID (lab use)					

Valid Matrix Codes: DRINKING WATER (WP), GROUND WATER (WG), WASTE WATER (WW), FREE PRODUCT (LF), SOIL (SO), OIL (SW), WIPE (AA), AMBIENT AIR (AE), SVE AIR (GS), SOIL GAS, WATER (W), SURFACE WATER (WS), WATER QC (WQ), SLUDGE (SL), RINSEATE (WH), OTHER (OT), ANIMAL TISSUE (TA)

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE)	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses: EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	M-141B	WG	G	10/23/2009	10:00	1	N			X						X		2 L Poly Clear
2	M-141B	WG	G	10/23/2009	10:00	1	N			X							X	2 L Poly Clear
3	M-141009B	WG	G	10/23/2009	10:00	1	Y			X						X		2 L Poly Clear
4	M-141009B	WG	G	10/23/2009	10:00	1	Y			X							X	2 L Poly Clear
5	PB102309-A3 JWO	WG	G	10/23/2009	12:15	1	Y			X						X		2 L Poly Clear
6	PB102309-A3	WG	G	10/23/2009	12:15	1	Y			X							X	2 L Poly Clear
7																		
8																		
9	JWO																	
10																		
11																		
12																		

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300 **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Josh W Otis / NGEM	10/23	1420	GEL	10/23	1420
GEL	10/23	1600		10/26	0825

Sample Receipt Conditions

	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
Temp in C	Samples on Ice?	Sample intact?	Trip Blank?

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX / US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Josh W. Otis

SIGNATURE of SAMPLER: Josh W Otis

DATE Signed: 10/23

Time: 1400

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client:	TRONOX	**SDG/ARCOC/Work Order:**	239753
Received By:	C. Duff	**Date Received:**	10/26/09

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?		X	Maximum Counts Observed*: 60
Classified Radioactive II or III by RSO?		X	
COC/Samples marked containing PCBs?		X	
Shipped as a DOT Hazardous?		X	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		X	

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

Comments:

7960 0137 0171

PM (or PMA) review: Initials DS Date 10/26/09

20091055803

2397537

northgate environmental management, inc.
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. 2027.001.01124
Page: 1 of 1
Cooler # ____ of ____

Collection Area: III

Required Ship to Lab:		Required Project Information:		Required Invoice Information:			
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC. HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	TAT: Standard 30 day	X Rush ___ Mark One
Address:	2040 Savage Road	Project #	2027.001	Address:	PO Box 55	If Rush, Date due	
Chartleston, SC 29407		Site Address	560 W. Lake Mead Drive	City/State	Henderson, NV 89009 Phone #: (949)260-9293	QC level Required: Standard	Special EPA Stage 4 Mark one
Lab PM:	Edith M. Kent	City	Henderson State NV	Reimbursement project?	X Non-reimbursement project? ___ Mark one	NJ Reduced Deliverable Package?	
Phone/Fax:	(843)556-8171	Site PM Name	Derrick Willis	Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com	MA MCP Cert?	CT RCP Cert? Mark One
Lab PM email	emk@gel.com	Phone/Fax:	949-375-7004	CC Hardcopy report to	PDF Electronic Version Only	Lab Project ID (lab use)	
Applicable Lab Quote #:		Site PM Email:	derrick.willis@ngem.com	CC Hardcopy report to	see additional comments below		

Valid Matrix Codes: MATRIX — DRINKING WATER WP, GROUND WATER WG, WASTE WATER WW, FREE PRODUCT LF, SOIL SO, OIL SW, WIPE AA, AMBIENT AIR AE, SVE AIR GS, SOIL GAS; MATRIX — WATER W, SURFACE WATER WS, WATER QC WQ, SLUDGE SL, OIL RINSEATE WH, OTHER OT, ANIMAL TISSUE TA

ITEM #	SAMPLE ID One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses		EPA 903.1/904.0	EML HASL 300*							Comments/Lab Sample I.D.
1	M-145B	WG	G	10/26/09	1015	1	N			X								X								2 L Poly Clear
2	M-145B	WG	G	⊥	⊥	1	N			X									X							2 L Poly Clear
3	~~M-145BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			~~X~~								~~X~~								~~2 L Poly Clear~~ JWO
4	~~M-145BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			~~X~~									~~X~~							~~2 L Poly Clear~~ JWO
5																										
6																										
7																										
8	JWO																									
9																										
10																										
11																										
12																										

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300* - DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
[signature]	10/26	1405	[signature] GES	10/26	1405
[signature] GES	10/26	1600	Mike Kaslow GES	10-27-09	0900

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Y/N	Y/N	Y/N
23°	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: ~~Dana Brown~~ JWO JOSH W. OTIS
SIGNATURE of SAMPLER: [signature] DATE Signed 10/26 Time: 1045

northgate
environmental management, inc.
1100 Quail Street, Suite 102, Newport Beach, CA 92660
(949) 260-9293

CHAIN-OF-CUSTODY / Analytical Request Document

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COC No. 2027.001.01126
Page: 1 of 1
Cooler # ____ of ____

Collection Area: III

Required Ship to Lab:		Required Project Information:		Required Invoice Information:			
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC. HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	TAT: Standard 30 day	X
Address:	2040 Savage Road	Project #	2027.001	Address:	PO Box 55	If Rush, Date due	
	Charleston, SC 29407	Site Address	560 W. Lake Mead Drive	City/State	Henderson, NV 89009	Phone #:	(949)260-9293
Lab PM:	Edith M. Kent	City	Henderson	State	NV	Reimbursement project?	X
Phone/Fax:	(843)556-8171	Site PM Name	Derrick Willis	Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com		
Lab PM email	emk@gel.com	Phone/Fax:	949-375-7004	CC Hardcopy report to	PDF Electronic Version Only		
Applicable Lab Quote #:		Site PM Email:	derrick.willis@ngem.com	CC Hardcopy report to	see additional comments below		

Rush		Mark One
QC level Required: Standard		Special
NJ Reduced Deliverable Package?		
MA MCP Cert?		CT RCP Cert?

EPA Stage 4 | Mark one | Mark One

Lab Project ID (lab use)

Valid Matrix Codes: MATRIX — DRINKING WATER WP; GROUND WATER WG; WASTE WATER WW; FREE PRODUCT LF; SOIL SO; OIL OL; WIPE AA; AMBIENT AIR AE; SVE AIR SG; SOIL GAS — WATER W; SURFACE WATER WS; WATER QC WQ; SLUDGE SL; RINSEATE WH; OTHER OT; ANIMAL TISSUE TA

ITEM #	SAMPLE ID — One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses: EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	M-139B	WG	G	10/26/09	1255	1	N			X						X		2 L Poly Clear
2	M-139B	WG	G	1	1	1	N			X							X	2 L Poly Clear
3	~~M-139BDISS~~	~~WG~~	~~G~~			1	Y			X						X		~~2 L Poly Clear~~ JWO
4	~~M-139BDISS~~	~~WG~~	~~G~~			1	Y			X							X	~~2 L Poly Clear~~ JWO
5																		
6																		
7																		
8	JWO																	
9																		
10																		
11																		
12																		

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300 **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
	10/26	1405	GCS	10/26	1405
GCS	10/26	1600		102709	0900

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX; US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: ~~Dana Brown~~ JOSH W OTIS
SIGNATURE of SAMPLER:
DATE Signed: 10/23 Time: 1340

Sample Receipt Conditions	Temp in °C	Samples on Ice?	Sample intact?	Trip Blank?
		Y/N	Y/N	Y/N
	23°	Y/N	Y/N	Y/N
		Y/N	Y/N	Y/N
		Y/N	Y/N	Y/N

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client:	KERR/NORTHGATE		**SDG/ARCOC/Work Order:**	239753.
Received By:	MK		**Date Received:**	10-27-09
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?		✓	Maximum Counts Observed*:	Bkgrn 20
Classified Radioactive II or III by RSO?		✓		
COC/Samples marked containing PCBs?		✓		
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped:	UN#:
Samples identified as Foreign Soil?		✓		

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: seals broken damaged container leaking container other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?		✓		Preservation Method: ice bags blue ice dry ice (none) other (describe) 23°
3	Chain of custody documents included with shipment?	✓			
4	Sample containers intact and sealed?	✓			Circle Applicable: seals broken damaged container leaking container other (describe)
5	Samples requiring chemical preservation at proper pH?	✓			Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		✓		Sample ID's and containers affected:
7	Are Encore containers present?			✓	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	✓			Id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✓			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	✓			

Comments:

FX 7970 5312 9534

PM (or PMA) review: Initials ____ Date 10/27/09

northgate
environmental management, inc.
1100 Quail Street, Suite 102, Newport Beach, CA 92660
(949) 260-9293

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COC No. 2027.001.01129
Page: 1 of 1
Cooler # ____ of ____

Collection Area: II

Required Ship to Lab:

Lab Name:	GEL Laboratories, LLC
Address:	2040 Savage Road
	Charleston, SC 29407
Lab PM:	Edith M. Kent
Phone/Fax:	(843)556-8171
Lab PM email	emk@gel.com
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	TRONOX LLC. HENDERSON
Project #	2027.001
Site Address	660 W. Lake Mead Drive
City	Henderson
State	NV
Site PM Name	Derrick Willis
Phone/Fax:	949-375-7004
Site PM Email:	derrick.willis@ngem.com

Required Invoice Information:

Send Invoice to:	Susan Crowley Tronox LLC
Address:	PO Box 55
City/State	Henderson, NV 89009
Phone #:	(949)260-9293
Reimbursement project?	X
Non-reimbursement project?	Mark one
Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com
CC Hardcopy report to	PDF Electronic Version Only
CC Hardcopy report to	see additional comments below

TAT: Standard 30 day	X	Rush		Mark One	
If Rush, Date due					
QC level Required: Standard		Special	EPA Stage 4	Mark one	
NJ Reduced Deliverable Package?					
MA MCP Cert?		CT RCP Cert?		Mark One	
Lab Project ID (lab use)					

Valid Matrix Codes: MATRIX — DRINKING WATER WP; GROUND WATER WG; WASTE WATER WW; FREE PRODUCT LP; SOIL SO; OIL OL; WIPE SW; AMBIENT AIR AE; SVE AIR GB; SOIL GAS; WATER W; SURFACE WATER WS; WATER QC WQ; SLUDGE SL; RINSEATE WK; OTHER OT; ANIMAL TISSUE TA

ITEM #	SAMPLE ID — One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses: EPA 903.1/904.0	EML_HASL 300*	Comments/Lab Sample I.D.
1	M-146B	WG	G	10/27/09	0930	1	N			X						X		2 L Poly Clear
2	M-146B	WG	G	1	1	1	N			X							X	2 L Poly Clear
3	~~M-146BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			X						X		~~2 L Poly Clear~~ JWO
4	~~M-146BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			X							X	~~2 L Poly Clear~~ JWO
5																		
6																		
7																		
8	JWO																	
9																		
10																		
11																		
12																		

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300 **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
[signature]	10/27	1410	[signature] GES	10/27	1410
[signature] GES	10/27	1600	[signature] Test America	10/28/09	0905

SHIPPING METHOD: (mark as appropriate) UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Josh W. Otis
SIGNATURE of SAMPLER: [signature]
DATE Signed: 10/27 Time: 1055

Sample Receipt Conditions

Temp in °C	Samples on Ice?	Sample intact?	Trip Blank?
	Y/N	Y/N	Y/N
20°	Y/(N)	(Y)/N	Y (N)
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

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(949) 260-9293

CHAIN-OF-CUSTODY / Analytical Request Document

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COC No. 2027.001.01120
Page: 1 of 1
Cooler # ____ of ____

Collection Area: IV

Required Ship to Lab:		Required Project Information:		Required Invoice Information:			
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC. HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	TAT: Standard 30 day	X Rush ___ Mark One
Address:	2040 Savage Road	Project #	2027.001	Address:	PO Box 55	If Rush, Date due	
Chartleston, SC 29407		Site Address	560 W. Lake Mead Drive	City/State	Henderson, NV 89009 Phone #: (949)260-9293	QC level Required: Standard	Special EPA Stage 4 Mark one
Lab PM:	Edith M. Kent	City	Henderson State NV	Reimbursement project?	X Non-reimbursement project? ___ Mark one	NJ Reduced Deliverable Package?	
Phone/Fax:	(843)556-8171	Site PM Name	Derrick Willis	Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com	MA MCP Cert?	CT RCP Cert? Mark One
Lab PM email	emk@gel.com	Phone/Fax:	949-375-7004	CC Hardcopy report to	PDF Electronic Version Only	Lab Project ID (lab use)	
Applicable Lab Quote #:		Site PM Email:	derrick.willis@ngem.com	CC Hardcopy report to	see additional comments below		

Valid Matrix Codes

MATRIX		MATRIX	
DRINKING WATER	WP	WATER	W
GROUND WATER	WG	SURFACE WATER	WS
WASTE WATER	WW	WATER QC	WQ
FREE PRODUCT	LP	SLUDGE	SL
SOIL	SO	OIL RINSEATE	WH
OIL	SW	OTHER	OT
WIPE	AA	ANIMAL TISSUE	TA
AMBIENT AIR	AE		
SVE AIR	GS		
SOIL GAS			

ITEM #	SAMPLE ID One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses	EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	M-144B	WG	G	10/27/09	1225	1	N			X							X		2 L Poly Clear
2	M-144B	WG	G	⊥	⊥	1	N			X								X	2 L Poly Clear
3	~~M-144BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			~~X~~							~~X~~		~~2 L Poly Clear~~ JWO
4	~~M-144BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			~~X~~								~~X~~	~~2 L Poly Clear~~ JWO
5																			
6																			
7																			
8	JWO																		
9																			
10																			
11																			
12																			

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300* **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
[signature]	10/27	1410	[signature] GES	10/27	1410
[signature] GES	10/27	1600	[signature] GEL	10/28/09	0905

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
20C	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

SHIPPING METHOD: (mark as appropriate) UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Josh W. Otis
SIGNATURE of SAMPLER: [signature] DATE Signed 10/27 Time: 1340

GEL | Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: Kerr/Noblecate	**SDG/ARCOC/Work Order:** 239753.
Received By: MC	**Date Received:** 10-23-09

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?		✓	Maximum Counts Observed*: ~30
Classified Radioactive II or III by RSO?		✓	
COC/Samples marked containing PCBs?		✓	
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		✓	

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: seals broken damaged container leaking container other (describe)
2	Samples requiring cold preservation within 0 ≤ 6 deg. C?		✓		Preservation Method: ice bags blue ice dry ice none other (describe) 20°
3	Chain of custody documents included with shipment?	✓			
4	Sample containers intact and sealed?	✓			Circle Applicable: seals broken damaged container leaking container other (describe)
5	Samples requiring chemical preservation at proper pH?	✓			Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		✓		Sample ID's and containers affected:
7	Are Encore containers present?			✓	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	✓			Id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✓			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	✓			

Comments:

Fx 7970 5726 8507

PM (or PMA) review: Initials CS Date 10/28/09

239753.1.

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CHAIN-OF-CUSTODY / Analytical Request Document

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COC No. 2027.001.01123
Page: 1 of 1
Cooler # ____ of ____

Collection Area: IV

Required Ship to Lab:		Required Project Information:		Required Invoice Information:			
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC. HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	TAT: Standard 30 day	X
Address:	2040 Savage Road	Project #	2027.001	Address:	PO Box 55	If Rush, Date due	
Charleston, SC 29407		Site Address	560 W. Lake Mead Drive	City/State	Henderson, NV 89009	Phone #:	(949)260-9293
Lab PM:	Edith M. Kent	City	Henderson	State	NV	Reimbursement project?	X
Phone/Fax:	(843)566-8171	Site PM Name	Derrick Willis	Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com		
Lab PM email	emk@gel.com	Phone/Fax:	949-375-7004	CC Hardcopy report to	PDF Electronic Version Only		
Applicable Lab Quote #:		Site PM Email:	derrick.willis@ngem.com	CC Hardcopy report to	see additional comments below		

Rush		Mark One
QC level Required: Standard		Special
EPA Stage 4		Mark one
NJ Reduced Deliverable Package?		
MA MCP Cert?		CT RCP Cert?
Mark One		

Lab Project ID (lab use)

Valid Matrix Codes: DRINKING WATER (WP), GROUND WATER (WG), WASTE WATER (WW), FREE PRODUCT (LF), SOIL (SO), OIL (SW), WIPE (AA), AMBIENT AIR (AE), SVE AIR (GS), SOIL GAS; WATER (W), SURFACE WATER (WS), WATER QC (WQ), SLUDGE (SL), OIL RINSEATE (WH), OTHER (OT), ANIMAL TISSUE (TA)

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE)	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses: EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	M-138B	WG	G	10/28/2009	1115	1	N			X						X		2 L Poly Clear
2	M-138B	WG	G	10/28/2009	1115	1	N			X							X	2 L Poly Clear
3	M-138009B	WG	G	10/28/2009	1115	1	N			X						X		2 L Poly Clear
4	M-138009B	WG	G	10/28/2009	1115	1	N			X							X	2 L Poly Clear
5	M-138BDISS	WG	G	10/28/2009	1115	1	Y			X						X		2 L Poly Clear
6	M-138BDISS	WG	G	10/28/2009	1115	1	Y			X							X	2 L Poly Clear
7	M-138009BDISS	WG	G	10/28/2009	1115	1	Y			X						X		2 L Poly Clear
8	M-138009BDISS	WG	G	10/28/2009	1115	1	Y			X							X	2 L Poly Clear
9																		
10																		
11																		
12																		

JWO

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300 **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
	10/28	1340	GES	10/28	1340
GES	10/28	1800		10-29-09	0910

Sample Receipt Conditions

	Y/N	Y/N	Y/N
20°	Y (N)	(Y) N	Y (N)
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

Temp in °C | Samples on Ice? | Sample intact? | Trip Blank?

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX / US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Josh W. Otis

SIGNATURE of SAMPLER:

DATE Signed: 10/28 Time: 1340

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client:	Kerr/Wokhgate		**SDG/ARCOC/Work Order:**	239753·1.
Received By:	MK		**Date Received:**	10-29-09
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?		✓	Maximum Counts Observed*:	Cpm 20
Classified Radioactive II or III by RSO?		✓		
COC/Samples marked containing PCBs?		✓		
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped:	UN#:
Samples identified as Foreign Soil?		✓		

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: seals broken damaged container leaking container other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?		✓		Preservation Method: ice bags blue ice dry ice (none) other (describe) 20 c
3	Chain of custody documents included with shipment?	✓			
4	Sample containers intact and sealed?	✓			Circle Applicable: seals broken damaged container leaking container other (describe)
5	Samples requiring chemical preservation at proper pH?	✓			Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		✓		Sample ID's and containers affected:
7	Are Encore containers present?			✓	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	✓			Id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✓			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	✓			

Comments:

* M 138BDISS
M 138009BDISS
} LABELS = FILTERED: N

Fx 7960 7379 1612

PM (or PMA) review: Initials MS Date 10/29/09

239753%

20091055803

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(949) 260-9293

CHAIN-OF-CUSTODY / Analytical Request Document

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COC No. 2027.001.01121
Page: 1 of 1
Cooler # ___ of ___
Collection Area: IV

Required Ship to Lab:		Required Project Information:		Required Invoice Information:			
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC. HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	TAT: Standard 30 day	X Rush ___ Mark One
Address:	2040 Savage Road	Project #	2027.001	Address:	PO Box 55	If Rush, Date due	
Chartleston, SC 29407		Site Address	560 W. Lake Mead Drive	City/State	Henderson, NV 89009 Phone #: (949)260-9293	QC level Required: Standard	Special EPA Stage 4 Mark one
Lab PM:	Edith M. Kent	City	Henderson State NV	Reimbursement project?	X Non-reimbursement project? ___ Mark one	NJ Reduced Deliverable Package?	
Phone/Fax:	(843)556-8171	Site PM Name	Derrick Willis	Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com	MA MCP Cert?	CT RCP Cert? Mark One
Lab PM email	emk@gel.com	Phone/Fax:	949-375-7004	CC Hardcopy report to	PDF Electronic Version Only	Lab Project ID (lab use)	
Applicable Lab Quote #:		Site PM Email:	derrick.willis@ngem.com	CC Hardcopy report to	see additional comments below		

Valid Matrix Codes

MATRIX		MATRIX	
DRINKING WATER	WP	WATER	W
GROUND WATER	WG	SURFACE WATER	WS
WASTE WATER	WW	WATER QC	WQ
FREE PRODUCT	LF	SLUDGE	SL
SOIL	SO	OIL RINSEATE	WH
OIL	SW	OTHER	OT
WIPE	AA	ANIMAL TISSUE	TA
AMBIENT AIR	AE		
SVE AIR	GS		
SOIL GAS			

ITEM #	SAMPLE ID One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses	EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	M-137B	WG	G			1	N			X							X		2 L Poly Clear
2	M-137B	WG	G			1	N			X								X	2 L Poly Clear
3	M-137BDISS	WG	G			1	Y			X							X		2 L Poly Clear
4	M-137BDISS	WG	G			1	Y			X								X	2 L Poly Clear
5																			
6																			
7	JWO																		
8																			
9																			
10																			
11																			
12																			

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300* **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
[signature]	10/29	1445	[signature] GES	10/29	1445
[signature] GES	10/29	1600	[signature] GEL	10-30-09	0915

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Y/N	Y/N	Y/N
22c	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: ~~Dana Brown~~ JOSH W OTIS
SIGNATURE of SAMPLER: [signature] DATE Signed 10/29 Time: 1415

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environmental management, inc.
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(949) 260-9293

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COC No. 2027.001.01128
Page: 1 of 1
Cooler # ____ of ____

Collection Area: III

Required Ship to Lab:

Lab Name:	GEL Laboratories, LLC
Address:	2040 Savage Road
	Charleston, SC 29407
Lab PM:	Edith M. Kent
Phone/Fax:	(843)556-8171
Lab PM email	emk@gel.com
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	TRONOX LLC. HENDERSON
Project #	2027.001
Site Address	660 W. Lake Mead Drive
City	Henderson
State	NV
Site PM Name	Derrick Willis
Phone/Fax:	949-376-7004
Site PM Email:	derrick.willis@ngem.com

Required Invoice Information:

Send Invoice to:	Susan Crowley, Tronox LLC
Address:	PO Box 55
City/State	Henderson, NV 89009
Phone #:	(949)260-9293
Reimbursement project?	X
Non-reimbursement project?	
Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com
CC Hardcopy report to	PDF Electronic Version Only
CC Hardcopy report to	see additional comments below

TAT: Standard 30 day	X	Rush		Mark One
If Rush, Date due				
QC level Required: Standard		Special	EPA Stage 4	Mark one
NJ Reduced Deliverable Package?				
MA MCP Cert?		CT RCP Cert?		Mark One

Lab Project ID (lab use)

Valid Matrix Codes: MATRIX — DRINKING WATER (WP), GROUND WATER (WG), WASTE WATER (WW), FREE PRODUCT (LF), SOIL (SO), OIL (OL), WIPE (SW), AMBIENT AIR (AA), SVE AIR (AE), SOIL GAS (GS); MATRIX — WATER (W), SURFACE WATER (WG), WATER QC (WQ), SLUDGE (SL), RINSEATE (WH), OTHER (OT), ANIMAL TISSUE (TA)

ITEM #	SAMPLE ID — One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses: EPA 903.1/904.0	EML HASL 300	Comments/Lab Sample I.D.
1	M-148B	WG	G	10/29/09	10/29/09	1	N			X						X		2 L Poly Clear
2	M-148B	WG	G	"	"	1	N			X							X	2 L Poly Clear
3	~~M-148BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			~~X~~						~~X~~		~~2 L Poly Clear~~ JWO
4	~~M-148BDISS~~	~~WG~~	~~G~~			~~1~~	~~Y~~			~~X~~							~~X~~	~~2 L Poly Clear~~ JWO
5																		
6																		
7																		
8	JWO																	
9																		
10																		
11																		
12																		

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300 **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (Isotopic) and Uranium (Isotopic)**

All PDF reports and EDDs will be uploaded to:
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FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
JWO GPES	10/29	1445	GPES	10/29	1445
GPES	10/29	1600	Mike Kaplan GEL	10-30-09	0915

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: ~~Dana Brown~~ JOSH W OTIS

SIGNATURE of SAMPLER: JWO DATE Signed 10/29 Time: 1000

Sample Receipt Conditions

	Temp in °C	Samples on Ice?	Sample intact?	Trip Blank?
		Y/N	Y/N	Y/N
	22C	Y/N	Y/N	Y/N
		Y/N	Y/N	Y/N
		Y/N	Y/N	Y/N

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client:	KERR / NORTHGATE	**SDG/ARCOC/Work Order:**	239753
Received By:	ML	**Date Received:**	10-30-09

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?		✓	Maximum Counts Observed*: 0.11-30
Classified Radioactive II or III by RSO?		✓	
COC/Samples marked containing PCBs?		✓	
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		✓	

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

Comments:

* NO DATE OR TIME ON CHAIN FOR M-137B + M-137BDISS
NO TIME ON CHAIN FOR M-148B

M-148B - 10-29-09 0910
M-137B - 10-29-09 1330
M-137BDISS - 10-29-09 1330

FX 7970 6563 0421

PM (or PMA) review: Initials ____ Date 10/30/09

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(949) 260-9293

CHAIN-OF-CUSTODY / Analytical Request Document

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COC No. 2027.001.01131
Page: 1 of 1
Cooler # ____ of ____

Collection Area: III

Required Ship to Lab:		Required Project Information:		Required Invoice Information:			
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC. HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	TAT: Standard 30 day	X Rush / Mark One
Address:	2040 Savage Road	Project #	2027.001	Address:	PO Box 55	If Rush, Date due	
Chartleston, SC 29407		Site Address	560 W. Lake Mead Drive	City/State	Henderson, NV 89009	Phone #: (949)260-9293	QC level Required: Standard / Special / EPA Stage 4 / Mark one
Lab PM:	Edith M. Kent	City	Henderson	State	NV	Reimbursement project? X	Non-reimbursement project? / Mark one
Phone/Fax:	(843)556-8171	Site PM Name	Derrick Willis	Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com	NJ Reduced Deliverable Package?	
Lab PM email	emk@gel.com	Phone/Fax:	949-375-7004	CC Hardcopy report to	PDF Electronic Version Only	MA MCP Cert?	CT RCP Cert? / Mark One
Applicable Lab Quote #:		Site PM Email:	derrick.willis@ngem.com	CC Hardcopy report to	see additional comments below	Lab Project ID (lab use)	

Valid Matrix Codes

MATRIX		MATRIX	
DRINKING WATER	WP	WATER	W
GROUND WATER	WG	SURFACE WATER	WS
WASTE WATER	WW	WATER QC	WQ
FREE PRODUCT	LF	SLUDGE	SL
SOIL	SO	OIL RINSEATE	WH
OIL	SW	OTHER	OT
WIPE	AA	ANIMAL TISSUE	TA
AMBIENT AIR	AE		
SVE AIR	GS		
SOIL GAS			

ITEM #	SAMPLE ID One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses	EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	EB103009-GWA4	WG	G	10/30/09	1110	1	N			X							X		2 L Poly Clear
2	EB103009-GWA4	WG	G	↓	↓	1	N			X								X	2 L Poly Clear
3																			
4																			
5																			
6	JWO																		
7																			
8																			
9																			
10																			
11																			
12																			

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300* **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
[signature]	10/30	1350	[signature] GES	10/30	1350
[signature] GES	10/30	1600	[signature] GEL	10-31-09	0920

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
19c	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Josh W Otis
SIGNATURE of SAMPLER: [signature]
DATE Signed 10/30 Time: 1230

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: Kerr / Northeast	**SDG/ARCOC/Work Order:** 239753
Received By: MK	**Date Received:** 10-31-09

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?		✓	Maximum Counts Observed*: cpm 20
Classified Radioactive II or III by RSO?		✓	
COC/Samples marked containing PCBs?		✓	
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		✓	

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: seals broken / damaged container / leaking container / other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?		✓		Preservation Method: ice bags / blue ice / dry ice / (none) / other (describe) 19<
3	Chain of custody documents included with shipment?	✓			
4	Sample containers intact and sealed?	✓			Circle Applicable: seals broken / damaged container / leaking container / other (describe)
5	Samples requiring chemical preservation at proper pH?	✓			Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		✓		Sample ID's and containers affected:
7	Are Encore containers present?			✓	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	✓			Id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	✓			Sample ID's affected:
11	Number of containers received match number indicated on COC?	✓			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	✓			

Comments:

FX 7960 8122 5281

PM (or PMA) review: Initials EK Date 10/31/09

2397537

northgate
environmental management, inc.
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. 2027.001.01127
Page: 1 of 1
Cooler # ____ of ____

Collection Area: III

Required Ship to Lab:		Required Project Information:		Required Invoice Information:			
Lab Name:	GEL Laboratories, LLC	Site ID #:	TRONOX LLC. HENDERSON	Send Invoice to:	Susan Crowley Tronox LLC	TAT: Standard 30 day	X
Address:	2040 Savage Road	Project #	2027.001	Address:	PO Box 55	If Rush, Date due	
Chartleston, SC 29407		Site Address	560 W. Lake Mead Drive	City/State	Henderson, NV 89009	Phone #:	(949)260-9293
Lab PM:	Edith M. Kent	City	Henderson	State	NV	Reimbursement project?	X
Phone/Fax:	(843)556-8171	Site PM Name	Derrick Willis	Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com		
Lab PM email	emk@gel.com	Phone/Fax:	949-375-7004	CC Hardcopy report to	PDF Electronic Version Only		
Applicable Lab Quote #:		Site PM Email:	derrick.willis@ngem.com	CC Hardcopy report to	see additional comments below		

Rush		Mark One
QC level Required: Standard		Special
EPA Stage 4		Mark one
Non-reimbursement project?		Mark one
NJ Reduced Deliverable Package?		
MA MCP Cert?		CT RCP Cert?
Mark One		

Lab Project ID (lab use)

Valid Matrix Codes: MATRIX — DRINKING WATER WP; GROUND WATER WG; WASTE WATER WW; FREE PRODUCT LF; SOIL SO; OIL OL; OIL SW; WIPE WI; AMBIENT AIR AE; SVE AIR GS; SOIL GAS. MATRIX — WATER W; SURFACE WATER WS; WATER QC WQ; SLUDGE SL; R/INSEATE WH; OTHER OT; ANIMAL TISSUE TA

ITEM #	SAMPLE ID — One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses: EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	M-147B	WG	G	11/2/2009	1000	1	N			X						X		2 L Poly Clear
2	M-147B	WG	G	11/2/2009	1000	1	N			X							X	2 L Poly Clear
3	~~M-147BDISS~~	~~WG~~	~~G~~	~~11/2/2009~~		~~1~~	~~Y~~			~~X~~						~~X~~		~~2 L Poly Clear~~ JWO
4	~~M-147BDISS~~	~~WG~~	~~G~~	~~11/2/2009~~		~~1~~	~~Y~~			~~X~~							~~X~~	~~2 L Poly Clear~~ JWO
5	M-147009B	WG	G	11/2/2009	1000	1	N			X						X		2 L Poly Clear
6	M-147009B	WG	G	11/2/2009	1000	1	N			X							X	2 L Poly Clear
7	~~M-147009BDISS~~	~~WG~~	~~G~~	~~11/2/2009~~		~~1~~	~~Y~~			~~X~~						~~X~~		~~2 L Poly Clear~~ JWO
8	~~M-147009BDISS~~	~~WG~~	~~G~~	~~11/2/2009~~		~~1~~	~~Y~~			~~X~~							~~X~~	~~2 L Poly Clear~~ JWO
9																		
10	JWO																	
11																		
12																		

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300 **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Josh W Otis GES	11/2	1400	[illegible] GES	11/2	1400
[illegible] GES	11/2	1600	Mike Kanduri GEL	11-3-09	0845

Sample Receipt Conditions			
	Y/N	Y/N	Y/N
24°	Y (N)	(Y) N	Y (N)
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD: (mark as appropriate)	SAMPLER NAME AND SIGNATURE				
UPS COURIER FEDEX	PRINT Name of SAMPLER:	Josh W Otis			
US MAIL	SIGNATURE of SAMPLER:	Josh W Otis	DATE Signed	11/2	Time: 1210

Temp in C° | Samples on Ice? | Sample intact? | Trip Blank?

northgate
environmental management, inc.
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. 2027.001.01134
Page: 1 of 1
Cooler # ____ of ____

Collection Area: III

Required Ship to Lab:

Lab Name:	GEL Laboratories, LLC
Address:	2040 Savage Road
	Charleston, SC 29407
Lab PM:	Edith M. Kent
Phone/Fax:	(843)556-8171
Lab PM email	emk@gel.com
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	TRONOX LLC. HENDERSON
Project #	2027.001
Site Address	560 W. Lake Mead Drive
City	Henderson
State	NV
Site PM Name	Derrick Willis
Phone/Fax:	949-375-7004
Site PM Email:	derrick.willis@ngem.com

Required Invoice Information:

Send Invoice to:	Susan Crowley, Tronox LLC
Address:	PO Box 55
City/State	Henderson, NV 89009
Phone #:	(949)260-9293
Reimbursement project?	X
Non-reimbursement project?	Mark one
Send EDD to	Frank Hagar Northgate Environmental Management, Inc frank.hagar@ngem.com
CC Hardcopy report to	PDF Electronic Version Only
CC Hardcopy report to	see additional comments below

TAT: Standard 30 day	X	Rush	Mark One
If Rush, Date due			
QC level Required: Standard		Special	EPA Stage 4 / Mark one
NJ Reduced Deliverable Package?			
MA MCP Cert?		CT RCP Cert?	Mark One

Lab Project ID (lab use)

Valid Matrix Codes: DRINKING WATER WP; GROUND WATER WG; WASTE WATER WW; FREE PRODUCT LF; SOIL SO; OIL SW; WIPE AA; AMBIENT AIR AE; SVE AIR GB; SOIL GAS; WATER W; SURFACE WATER WS; WATER QC WQ; SLUDGE SL; OIL RINSEATE WH; OTHER OT; ANIMAL TISSUE TA

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / ,-) Samples IDs MUST BE UNIQUE)	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	FIELD FILTERED? (Y/N)	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analyses: EPA 903.1/904.0	EML HASL 300*	Comments/Lab Sample I.D.
1	EB110209-GWA3	WG	G	11/2/2009	1240	1	N			X						X		2 L Poly Clear
2	EB110209-GWA3	WG	G	11/2/2009	1	1	N			X							X	2 L Poly Clear
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		

JWO

Additional Comments/Special Instructions:

FULL DIGESTION SPECIFICATION
EMSL HASL 300 **- DOE EMSL HASL 300 modified (alpha spectroscopy) Thorium (isotopic) and Uranium (isotopic)**

All PDF reports and EDDs will be uploaded to:
Northgate Environmental Management, Inc.
FTP site address provided to labs
Notifications provided to:
cindy.arnold@ngem.com
frank.hagar@ngem.com

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
GES	11/2	1400	GES	11/2	1400
GES	11/2	1600	Fedex GES	11-3-09	0845

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Josh W Otis
SIGNATURE of SAMPLER:
DATE Signed: 11/2 Time: 1330

Sample Receipt Conditions

Temp in °C	Samples on Ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
24°	Y (N)	(Y) N	Y (N)
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: Kell/Northgate	**SDG/ARCOC/Work Order:** 239753-1
Received By: MK	**Date Received:** 11-3-09

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?		✓	Maximum Counts Observed*: up 20
Classified Radioactive II or III by RSO?		✓	
COC/Samples marked containing PCBs?		✓	
Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		✓	

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

Comments:

FX 7970 7371 6153

PM (or PMA) review: Initials EM Date 11/3/09

Subject: RE: COC 2027.001.01123, Please verify
From: <frank.hagar@ngem.com>
Date: Thu, 29 Oct 2009 17:52:46 -0700
To: "'Heather Shaffer'" <Heather.Shaffer@gel.com>

The DISS samples are fleld filtered

From: Heather Shaffer [mailto:Heather.Shaffer@gel.com]
Sent: Thursday, October 29, 2009 12:50 PM
To: Cindy Arnold; Frank Hagar; Derrick Willis; Vivian Willis
Cc: Edie Kent
Subject: COC 2027.001.01123, Please verify

The containers for M-138BDISS and M-138009BDISS are marked on the label as "N" filtered. The chain of custody lists these samples as "Y" Filtered. Please verify if these two samples are or are not field filtered.

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
Web: www.gel.com

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Subject: RE: Henderson Samples Received Today, 10/30/09 - Condition on Receipt
From: "Cindy Arnold" <carnold@ngem.com>
Date: Fri, 30 Oct 2009 18:18:58 +0000
To: emk@gel.com, Cindy.Arnold@ngem.com, Frank.Hagar@ngem.com, Derrick.Willis@ngem.com, Team.Kent@gel.com, vivian.willis@verdant-solutions.com

Thats fine Edie. Thank you, Cindy

------- Original Message ------- On 10/30/2009 3:34 PM Edie Kent wrote:
For samples M-137B and M-137BDISS, COC# 2027.001.01121, there is no date or time of collection listed on the chain of custody. For sample M-148B, COC# 2027.001.01128, the time of collection is listed in both the sample date and sample time column on the chain of custody. GEL will use the following dates and times taken from the sample containers:

M-137B: 10/29/09 @ 13:30
M-137BDISS: 10/29/09 @ 13:30
M-148B: 10/29/09 @ 0910

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
Web: www.gel.com

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Subject: GEL Closed SDGs 239753
From: Heather Shaffer <Heather.Shaffer@gel.com>
Date: Mon, 09 Nov 2009 12:53:46 -0500
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>, Mercedes Simmons <mer01583@gel.com>

As of today we closed water SDG 239753.
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
Web: www.gel.com

239753.xls	**Content-Type:**	application/msexcel
	Content-Encoding:	base64

Subject: Re: SDG 239753 QC Issues - Alpha Spec Th, Alpha Spec U, Ra-226
From: Heather Shaffer <Heather.Shaffer@gel.com>
Date: Thu, 03 Dec 2009 12:53:23 -0500
To: Cindy Arnold <Cindy.Arnold@ngem.com>, Derrick Willis <Derrick.Willis@ngem.com>
CC: Edie Kent <emk@gel.com>

CORRECTION: THIS EMAIL IS FOR WORK ORDER **239753**

Heather Shaffer wrote:

> The following are the QC issues regarding this SDG for Ra-226, Alpha Spec Th and Alpha Spec U:
>
> **Ra-226 Issues**
>
> The following samples do 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: 239753006, 239753014 and 239753016.
>
> ***Thorium Issues:***
>
> Samples 239753001, 239753002, 239753005, 239753006 and 239753011 do not meet the Th-228 detection limits. The samples were analyzed with an appropriate aliquot for the method and matrix. Additionally, the samples were counted the maximum count time to achieve the lowest possible MDAs.
>
> The method blank does not meet the Th-232 detection limits due to keeping the blank aliquot consistent with the other sample aliquots.
>
> The following samples did not meet the Tronox QA program tracer yield requirement of 70-120%: 239753002. The samples met GEL's standard tracer yield requirements. The blank, LCS, and all other samples met the contract tracer yield requirements.
>
> The following samples do 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: 239753006, 239753012, and 239753016.
>
> ***Uranium Issues:***
>
> The following samples did not meet the Tronox QA program tracer yield requirement of 70-120%: 239753001, 239753002, 239753009, 239753011, and 239753017. The samples met GEL's standard tracer yield requirements. The blank, LCS, and all other samples met the contract tracer yield requirements.
>
> Sample 239753003 did not meet the Tronox QA program detection limit for U-233/234, U-235/236, and U-238. The sample size is restricted in the attempt to assure achieved yield recoveries meet the program yield requirements and to reduce the chance of tailing from U-233/234 activity into the U-235/236 region of interest. The samples were counted the maximum possible count time in order

to achieve the lowest possible MDA.

The following samples do 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: 239753018.

Please note: The lab noticed that the levels of Uranium in these water samples were high compared to what they were used to seeing for this project. Attached is a Results greater than MDA report from the lab.

- This will be noted in the case narrative.

--
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
Web: www.gel.com

--
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
Web: www.gel.com

Laboratory Certifications

List of current GEL Certifications as of 03 December 2009

State	Certification
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 (ENSR)
SDG 239753

Method/Analysis Information

Product:	**Alphaspec Th, Liquid**
Analytical Method:	DOE EML HASL-300, Th-01-RC Modified
Analytical Batch Number:	923093

Sample ID	Client ID
239753001	M-141B
239753002	M-141009B
239753003	PB102309-A3
239753004	M-145B
239753005	M-139B
239753006	M-146B
239753007	M-144B
239753008	M-138B
239753009	M-138009B
239753010	M-138BDISS
239753011	M-138009BDISS
239753012	M-137B
239753013	M-137BDISS
239753014	M-148B
239753015	EB103009-GWA4
239753016	M-147B
239753017	M-147009B
239753018	EB110209-GWA3
1201973223	Method Blank (MB)
1201973224	239753003(PB102309-A3) Sample Duplicate (DUP)
1201973225	239753003(PB102309-A3) Matrix Spike (MS)
1201973226	Laboratory Control Sample (LCS)

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 volume in this batch.

Designated QC
The following sample was used for QC: 239753003 (PB102309-A3).

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 762500 was generated due to RDL less than MDA, Failed Recovery for Surrogate or Tracer and Other. 1. Samples 239753001, 239753002, 239753005, 239753006 and 239753011 do not meet the required detection limit for Th228. The blank, 1201973223, does not meet the required detection limit for Th232. 2. Sample 239753002 does not meet the client's tracer yield requirement of 70 - 120%. 3. Sample 239753006 has Thorium-230 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Samples 239753006 and 239753012 have Thorium-232 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Sample 239753016 has Thorium-228 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. 1. The blank, 1201973223, did not meet the detection limit due to keeping the blank volume consistent with the other sample aliquots. The samples were analyzed with an appropriate aliquot for the method and matrix. Additionally, the samples were counted 1000 minutes. Per GELs accredited methods and SOPs, further corrective action is not required. PM notified, reporting results. 2. The sample does meet the GEL standard tracer yield requirement. The Method Blank and the Laboratory Control sample meet the client's tracer yield requirement. PM notified, reporting results. 3. 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:	**Alphaspec U, Liquid**
Analytical Method:	DOE EML HASL-300, U-02-RC Modified
Analytical Batch Number:	923094

Sample ID	Client ID
239753001	M-141B
239753002	M-141009B
239753003	PB102309-A3
239753004	M-145B
239753005	M-139B
239753006	M-146B
239753007	M-144B
239753008	M-138B
239753009	M-138009B
239753010	M-138BDISS
239753011	M-138009BDISS
239753012	M-137B
239753013	M-137BDISS
239753014	M-148B
239753015	EB103009-GWA4
239753016	M-147B
239753017	M-147009B
239753018	EB110209-GWA3
1201973227	Method Blank (MB)
1201973228	239753004(M-145B) Sample Duplicate (DUP)
1201973229	239753004(M-145B) Matrix Spike (MS)
1201973230	Laboratory Control Sample (LCS)

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# 18.

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: 239753004 (M-145B).

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. The following NCR was generated for this SDG:
NCR 762566 was generated due to RDL less than MDA, Failed Recovery for Surrogate or Tracer and Other. 1. Samples 239753001, 239753002, 239753009, 239753011, and 239753017 do not meet the client tracer yield requirements of 70 to 120 percent due to the matrix of the samples. 2. Sample 239753003 did not meet the detection limits for U-233/234, U-235/6, and U-233/234 as a result of the restricted size of the aliquot used. 3. Sample 239753018 has Uranium-233/234 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. 1. The GEL standard tracer yield requirements of 15 to 125 percent were met and the Method blank and the LCS for the batch did meet the client tracer yield recovery requirements. PM notified, reporting results. 2. The aliquot size used was appropriate for the analysis method used and a larger aliquot could lead to resolution and yield recovery issues. The sample was counted 1000 minutes to achieve the lowest possible MDA's. PM notified, reporting results. 3. Sample was 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 U-235/236 blank result is equal to the MDA but less than the detection limit.

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:	922859

Sample ID	Client ID
239753001	M-141B
239753002	M-141009B
239753003	PB102309-A3
239753004	M-145B
239753005	M-139B
239753006	M-146B
239753007	M-144B
239753008	M-138B
239753009	M-138009B
239753010	M-138BDISS
239753011	M-138009BDISS
239753012	M-137B
239753013	M-137BDISS
239753014	M-148B
239753015	EB103009-GWA4
239753016	M-147B
239753017	M-147009B
239753018	EB110209-GWA3
1201972468	Method Blank (MB)
1201972469	239753001(M-141B) Sample Duplicate (DUP)
1201972470	239753001(M-141B) Matrix Spike (MS)
1201972471	Laboratory Control Sample (LCS)

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
The following sample was used for QC: 239753001 (M-141B).

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.

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

Product:	**Lucas Cell, Ra226, liquid**
Analytical Method:	EPA 903.1 Modified
Analytical Batch Number:	920697

Sample ID	Client ID
239753001	M-141B
239753002	M-141009B
239753003	PB102309-A3
239753004	M-145B
239753005	M-139B
239753006	M-146B
239753007	M-144B
239753008	M-138B
239753009	M-138009B
239753010	M-138BDISS
239753011	M-138009BDISS
239753012	M-137B
239753013	M-137BDISS
239753014	M-148B
239753015	EB103009-GWA4
239753016	M-147B
239753017	M-147009B
239753018	EB110209-GWA3
1201967363	Method Blank (MB)
1201967364	239753012(M-137B) Sample Duplicate (DUP)
1201967365	239753012(M-137B) Matrix Spike (MS)
1201967366	Laboratory Control Sample (LCS)

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# 13.

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: 239753012 (M-137B).

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. The following NCR was generated for this SDG:
NCR 764411 was generated due to Other. 1. Samples 239753006, 239753014 and 239753016 have Radium-226 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Samples were all 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.

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:

COMPANY - WIDE NONCONFORMANCE REPORT

Mo.Day Yr.	**Division:**	**Quality Criteria:**	**Type:**
25-NOV-09	Radiochemistry	Specifications	Process
Instrument Type:	**Test / Method:**	**Matrix Type:**	**Client Code:**
ALPHA SPECTROMETER	DOE EML HASL-300, Th-01-RC Modified	Liquid	KERR
Batch ID:	**Sample Numbers:**		
923093	See Below		

Potentially affected work order(s)(SDG): 239753

Application Issues:

RDL less than MDA

Failed Recovery for Surrogate or Tracer

Other

Specification and Requirements Nonconformance Description:	**NRG Disposition:**
1. Samples 239753001, 239753002, 239753005, 239753006 and 239753011 do not meet the required detection limit for Th228. The blank, 1201973223, does not meet the required detection limit for Th232. 2. Sample 239753002 does not meet the client's tracer yield requirement of 70 - 120%. 3. Sample 239753006 has Thorium-230 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Samples 239753006 and 239753012 have Thorium-232 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Sample 239753016 has Thorium-228 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity.	1. The blank, 1201973223, did not meet the detection limit due to keeping the blank volume consistent with the other sample aliquots. The samples were analyzed with an appropriate aliquot for the method and matrix. Additionally, the samples were counted 1000 minutes. Per GELs accredited methods and SOPs, further corrective action is not required. PM notified, reporting results. 2. The sample does meet the GEL standard tracer yield requirement. The Method Blank and the Laboratory Control sample meet the client's tracer yield requirement. PM notified, reporting results. 3. 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 25-NOV-09

Data Validator/Group Leader:

Eric Brimstin 25-NOV-09

COMPANY - WIDE NONCONFORMANCE REPORT

Mo.Day Yr.	Division:	Quality Criteria:	Type:
25-NOV-09	Radiochemistry	Specifications	Process
Instrument Type:	**Test / Method:**	**Matrix Type:**	**Client Code:**
ALPHA SPECTROMETER	DOE EML HASL-300, U-02-RC Modified	Liquid	KERR
Batch ID:	**Sample Numbers:**		
923094	See Below		

Potentially affected work order(s)(SDG): 239753

Application Issues:

RDL less than MDA

Failed Recovery for Surrogate or Tracer

Other

Specification and Requirements Nonconformance Description:	NRG Disposition:
1. Samples 239753001, 239753002, 239753009, 239753011, and 239753017 do not meet the client tracer yield requirements of 70 to 120 percent due to the matrix of the samples. 2. Sample 239753003 did not meet the detection limits for U-233/234, U-235/6, and U-233/234 as a result of the restricted size of the aliquot used. 3. Sample 239753018 has Uranium-233/234 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity.	1. The GEL standard tracer yield requirements of 15 to 125 percent were met and the Method blank and the LCS for the batch did meet the client tracer yield recovery requirements. PM notified, reporting results. 2. The aliquot size used was appropriate for the analysis method used and a larger aliquot could lead to resolution and yield recovery issues. The sample was counted 1000 minutes to achieve the lowest possible MDA's. PM notified, reporting results. 3. Sample was counted the maximum count time of 1000 minutes to achieve the best possible uncertainties. PM notified, reporting results.

Originator's Name:

Jessica Downey 25-NOV-09

Data Validator/Group Leader:

Scott Moreland 30-NOV-09

COMPANY - WIDE NONCONFORMANCE REPORT

Mo.Day Yr.	**Division:**	**Quality Criteria:**	**Type:**
02-DEC-09	Radiochemistry	Specifications	Process
Instrument Type:	**Test / Method:**	**Matrix Type:**	**Client Code:**
LUCAS CELL DETECTOR	EPA 903.1 Modified	Liquid	KERR
Batch ID:	**Sample Numbers:**		
920697	See below		

Potentially affected work order(s)(SDG): 239753

Application Issues:

Other

Specification and Requirements Nonconformance Description:	**NRG Disposition:**
1. Samples 239753006, 239753014 and 239753016 have Radium-226 activity between two and five times the MDA and uncertainty greater than 30% of that respective activity. Samples were all counted the maximum count time of 30 minutes to achieve the best possible uncertainties.	1. PM notified, reporting results.

Originator's Name:

Lyndsey Pace 02-DEC-09

Data Validator/Group Leader:

Lesley Anderson 02-DEC-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: 239753 GEL Work Order: 239753

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.

Reviewed by 12/2/09

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: December 2, 2009

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

Client Sample ID: M-141B
Sample ID: 239753001
Matrix: WG
Collect Date: 23-OCT-09 10:00
Receive Date: 26-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.0254	+/-0.037	0.0638	0.030	pCi/L		KXM4 11/20/09	1604	923093	1
Thorium-230	U	0.00978	+/-0.0136	0.0234	0.030	pCi/L					
Thorium-232	U	0.00734	+/-0.0107	0.0187	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		76.5	+/-1.05	0.0887	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		2.85	+/-0.226	0.0567	0.030	pCi/L					
Uranium-238		49.2	+/-0.840	0.0571	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	2.40	+/-1.63	2.49	3.00	pCi/L		JXC5 11/23/09	1726	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226	U	0.228	+/-0.177	0.256	1.00	pCi/L		KSD1 12/01/09	1805	920697	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"			70.1	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			59.4	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			75.9	(15%-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: December 2, 2009

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

Client Sample ID:	M-141009B	Project:	KERRHenderson
Sample ID:	239753002	Client ID:	KERR003
Matrix:	WG		
Collect Date:	23-OCT-09 10:00		
Receive Date:	26-OCT-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.00331	+/-0.0219	0.0436	0.030	pCi/L		KXM4 11/20/09	1604	923093	1
Thorium-230	U	-0.00786	+/-0.0115	0.0322	0.030	pCi/L					
Thorium-232	U	-0.00524	+/-0.0126	0.0322	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		75.1	+/-1.32	0.140	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		2.95	+/-0.291	0.0569	0.030	pCi/L					
Uranium-238		50.7	+/-1.08	0.0973	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228		2.39	+/-1.51	2.29	3.00	pCi/L		JXC5 11/23/09	1723	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.458	+/-0.222	0.241	1.00	pCi/L		KSD1 12/01/09	1840	920697	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"			67.5	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			37.6	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			90.8	(15%-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: December 2, 2009

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

Client Sample ID:	PB102309-A3	Project:	KERRHenderson
Sample ID:	239753003	Client ID:	KERR003
Matrix:	WG		
Collect Date:	23-OCT-09 12:15		
Receive Date:	26-OCT-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.00702	+/-0.0175	0.0322	0.030	pCi/L		KXM4 11/20/09	1604	923093	1
Thorium-230	U	0.00819	+/-0.0106	0.0181	0.030	pCi/L					
Thorium-232	U	0.00164	+/-0.00718	0.0157	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234	U	-0.00298	+/-0.0295	0.0599	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236	U	0.00	+/-0.0152	0.0371	0.030	pCi/L					
Uranium-238	U	-0.00627	+/-0.0174	0.042	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	1.54	+/-1.72	2.89	3.00	pCi/L		JXC5 11/23/09	1726	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226	U	0.275	+/-0.211	0.317	1.00	pCi/L		KSD1 12/01/09	1840	920697	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"			101	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			70.4	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			87.4	(15%-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: December 2, 2009

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

Client Sample ID: M-145B
Sample ID: 239753004
Matrix: WG
Collect Date: 26-OCT-09 10:15
Receive Date: 27-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.00963	+/-0.0155	0.0276	0.030	pCi/L		KXM4 11/20/09	1604	923093	1
Thorium-230	U	0.0123	+/-0.0103	0.0134	0.030	pCi/L					
Thorium-232	U	-0.00175	+/-0.00769	0.0194	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		18.2	+/-0.433	0.0384	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		0.702	+/-0.0956	0.0365	0.030	pCi/L					
Uranium-238		12.2	+/-0.355	0.0408	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228		3.05	+/-1.81	2.85	3.00	pCi/L		JXC5 11/23/09	1726	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226	U	0.334	+/-0.243	0.360	1.00	pCi/L		KSD1 12/01/09	1840	920697	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"			82.6	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			86.6	(15%-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: December 2, 2009

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

Client Sample ID: M-139B
Sample ID: 239753005
Matrix: WG
Collect Date: 26-OCT-09 12:55
Receive Date: 27-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Th, Liquid "As Received"												
Thorium-228	U	0.0191	+/-0.0282	0.0485	0.030	pCi/L		KXM4	11/20/09	1604	923093	1
Thorium-230		0.0232	+/-0.0145	0.0183	0.030	pCi/L						
Thorium-232	U	-0.00166	+/-0.00975	0.0222	0.030	pCi/L						
Alphaspec U, Liquid "As Received"												
Uranium-233/234		5.77	+/-0.222	0.0533	0.030	pCi/L		KXM4	11/21/09	1552	923094	2
Uranium-235/236		0.209	+/-0.0472	0.0207	0.030	pCi/L						
Uranium-238		3.81	+/-0.179	0.0242	0.030	pCi/L						
Rad Gas Flow Proportional Counting												
GFPC, Ra228, Liquid "As Received"												
Radium-228	U	0.00759	+/-1.31	2.48	3.00	pCi/L		JXC5	11/23/09	1726	922859	3
Rad Radium-226												
Lucas Cell, Ra226, liquid "As Received"												
Radium-226		0.490	+/-0.269	0.360	1.00	pCi/L		KSD1	12/01/09	1840	920697	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"			109	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			99.4	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			88.4	(15%-125%)

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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: December 2, 2009

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

Client Sample ID: M-146B
Sample ID: 239753006
Matrix: WG
Collect Date: 27-OCT-09 09:30
Receive Date: 28-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.0426	+/-0.0284	0.0436	0.030	pCi/L		KXM4 11/20/09	1604	923093	1
Thorium-230		0.0599	+/-0.0225	0.0229	0.030	pCi/L					
Thorium-232		0.0428	+/-0.0187	0.0189	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		11.2	+/-0.341	0.0512	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		0.444	+/-0.0768	0.0366	0.030	pCi/L					
Uranium-238		7.62	+/-0.281	0.0359	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	0.391	+/-1.38	2.56	3.00	pCi/L		JXC5 11/23/09	1726	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.880	+/-0.318	0.347	1.00	pCi/L		KSD1 12/01/09	1840	920697	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"			102	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			86.3	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			72.0	(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: December 2, 2009

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

Client Sample ID: M-144B
Sample ID: 239753007
Matrix: WG
Collect Date: 27-OCT-09 12:25
Receive Date: 28-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.013	+/-0.019	0.0329	0.030	pCi/L		KXM4 11/20/09	1605	923093	1
Thorium-230		0.0157	+/-0.0115	0.0151	0.030	pCi/L					
Thorium-232	U	-1.87E-10	+/-0.00436	0.012	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		20.9	+/-0.466	0.0414	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		0.929	+/-0.112	0.0481	0.030	pCi/L					
Uranium-238		14.5	+/-0.388	0.0299	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	-0.654	+/-1.48	2.83	3.00	pCi/L		JXC5 11/23/09	1726	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.414	+/-0.215	0.271	1.00	pCi/L		KSD1 12/01/09	1840	920697	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"			104	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			83.0	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			88.1	(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: December 2, 2009

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

Client Sample ID: M-138B
Sample ID: 239753008
Matrix: WG
Collect Date: 28-OCT-09 11:15
Receive Date: 29-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.0253	+/-0.0184	0.027	0.030	pCi/L		KXM4 11/20/09	1605	923093	1
Thorium-230		0.0327	+/-0.0162	0.0165	0.030	pCi/L					
Thorium-232		0.019	+/-0.0131	0.0165	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		40.9	+/-0.688	0.0434	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		1.20	+/-0.131	0.0285	0.030	pCi/L					
Uranium-238		20.7	+/-0.490	0.0231	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	1.16	+/-1.62	2.76	3.00	pCi/L		JXC5 11/23/09	1727	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.671	+/-0.304	0.374	1.00	pCi/L		KSD1 12/01/09	1910	920697	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"			106	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			74.7	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			86.6	(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: December 2, 2009

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

Client Sample ID: M-138009B
Sample ID: 239753009
Matrix: WG
Collect Date: 28-OCT-09 11:15
Receive Date: 29-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.00697	+/-0.0161	0.0297	0.030	pCi/L		KXM4 11/20/09	1605	923093	1
Thorium-230	U	0.00817	+/-0.0147	0.0264	0.030	pCi/L					
Thorium-232	U	0.0131	+/-0.012	0.0181	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		41.6	+/-0.794	0.0436	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		1.53	+/-0.170	0.0467	0.030	pCi/L					
Uranium-238		20.9	+/-0.562	0.0377	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	-0.616	+/-1.53	2.83	3.00	pCi/L		JXC5 11/23/09	1727	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.540	+/-0.257	0.323	1.00	pCi/L		KSD1 12/01/09	1910	920697	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"			114	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			56.7	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			94.9	(15%-125%)

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Company : Northgate Environmental Management, Inc.
Address : 1100 Quail St., Suite 102
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Report Date: December 2, 2009

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

Client Sample ID: M-138BDISS
Sample ID: 239753010
Matrix: WG
Collect Date: 28-OCT-09 11:15
Receive Date: 29-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Th, Liquid "As Received"												
Thorium-228	U	0.0194	+/-0.0163	0.0248	0.030	pCi/L		KXM4	11/20/09	1605	923093	1
Thorium-230	U	0.00336	+/-0.00932	0.0186	0.030	pCi/L						
Thorium-232	U	0.00336	+/-0.00466	0.00504	0.030	pCi/L						
Alphaspec U, Liquid "As Received"												
Uranium-233/234		39.1	+/-0.687	0.0507	0.030	pCi/L		KXM4	11/21/09	1552	923094	2
Uranium-235/236		1.03	+/-0.124	0.0116	0.030	pCi/L						
Uranium-238		19.5	+/-0.485	0.0507	0.030	pCi/L						
Rad Gas Flow Proportional Counting												
GFPC, Ra228, Liquid "As Received"												
Radium-228	U	0.394	+/-1.42	2.60	3.00	pCi/L		JXC5	11/23/09	1727	922859	3
Rad Radium-226												
Lucas Cell, Ra226, liquid "As Received"												
Radium-226	U	0.252	+/-0.195	0.282	1.00	pCi/L		KSD1	12/01/09	1910	920697	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"			103	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			73.1	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			77.3	(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: December 2, 2009

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

Client Sample ID:	M-138009BDISS	Project:	KERRHenderson
Sample ID:	239753011	Client ID:	KERR003
Matrix:	WG		
Collect Date:	28-OCT-09 11:15		
Receive Date:	29-OCT-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.0346	+/-0.0251	0.039	0.030	pCi/L		KXM4 11/20/09	1605	923093	1
Thorium-230	U	-0.0032	+/-0.00887	0.0214	0.030	pCi/L					
Thorium-232	U	-0.0032	+/-0.0117	0.0259	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		38.5	+/-0.765	0.0728	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		1.10	+/-0.145	0.0468	0.030	pCi/L					
Uranium-238		19.2	+/-0.539	0.0302	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	2.19	+/-1.65	2.60	3.00	pCi/L		JXC5 11/23/09	1723	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.276	+/-0.173	0.227	1.00	pCi/L		KSD1 12/01/09	1910	920697	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"			98.3	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			57.3	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			81.4	(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: December 2, 2009

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

Client Sample ID: M-137B
Sample ID: 239753012
Matrix: WG
Collect Date: 29-OCT-09 13:30
Receive Date: 30-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228		0.0733	+/-0.0301	0.0394	0.030	pCi/L		KXM4 11/20/09	1605	923093	1
Thorium-230		0.103	+/-0.0276	0.0208	0.030	pCi/L					
Thorium-232		0.0711	+/-0.023	0.0187	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		34.0	+/-0.618	0.0359	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		1.01	+/-0.118	0.0108	0.030	pCi/L					
Uranium-238		19.0	+/-0.461	0.0323	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	0.624	+/-1.61	2.85	3.00	pCi/L		JXC5 11/23/09	1723	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226	U	0.177	+/-0.159	0.242	1.00	pCi/L		KSD1 12/01/09	1910	920697	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"			97.2	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			77.7	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			94.7	(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: December 2, 2009

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

Client Sample ID: M-137BDISS
Sample ID: 239753013
Matrix: WG
Collect Date: 29-OCT-09 13:30
Receive Date: 30-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.0314	+/-0.0218	0.033	0.030	pCi/L		KXM4 11/20/09	1605	923093	1
Thorium-230	U	0.00461	+/-0.00998	0.0189	0.030	pCi/L					
Thorium-232	U	-0.00768	+/-0.00903	0.0235	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		37.1	+/-0.676	0.0246	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		1.16	+/-0.134	0.038	0.030	pCi/L					
Uranium-238		19.9	+/-0.496	0.0462	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	2.47	+/-1.81	2.85	3.00	pCi/L		JXC5 11/23/09	1727	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.580	+/-0.283	0.360	1.00	pCi/L		KSD1 12/01/09	2000	920697	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"			101	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			71.0	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			81.1	(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: December 2, 2009

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

Client Sample ID: M-148B
Sample ID: 239753014
Matrix: WG
Collect Date: 29-OCT-09 09:10
Receive Date: 30-OCT-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228		0.0268	+/-0.0173	0.0229	0.030	pCi/L		KXM4 11/20/09	1605	923093	1
Thorium-230	U	0.00545	+/-0.00796	0.0139	0.030	pCi/L					
Thorium-232	U	0.00182	+/-0.00941	0.0201	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		32.3	+/-0.593	0.00852	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		1.19	+/-0.127	0.0269	0.030	pCi/L					
Uranium-238		21.9	+/-0.489	0.0217	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	1.55	+/-1.53	2.51	3.00	pCi/L		JXC5 11/23/09	1727	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.592	+/-0.234	0.235	1.00	pCi/L		KSD1 12/01/09	2000	920697	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"			96.0	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			80.8	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			84.2	(15%-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: December 2, 2009

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

Client Sample ID:	EB103009-GWA4	Project:	KERRHenderson
Sample ID:	239753015	Client ID:	KERR003
Matrix:	WG		
Collect Date:	30-OCT-09 11:10		
Receive Date:	31-OCT-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Th, Liquid "As Received"												
Thorium-228	U	0.00853	+/-0.0157	0.0282	0.030	pCi/L		KXM4	11/20/09	1605	923093	1
Thorium-230	U	-0.00162	+/-0.00842	0.020	0.030	pCi/L						
Thorium-232	U	-0.00162	+/-0.00842	0.020	0.030	pCi/L						
Alphaspec U, Liquid "As Received"												
Uranium-233/234		0.0272	+/-0.0176	0.0192	0.030	pCi/L		KXM4	11/21/09	1552	923094	2
Uranium-235/236	U	0.00	+/-0.0122	0.0298	0.030	pCi/L						
Uranium-238	U	0.0176	+/-0.0148	0.0192	0.030	pCi/L						
Rad Gas Flow Proportional Counting												
GFPC, Ra228, Liquid "As Received"												
Radium-228	U	-1.49	+/-1.09	2.50	3.00	pCi/L		JXC5	11/23/09	1727	922859	3
Rad Radium-226												
Lucas Cell, Ra226, liquid "As Received"												
Radium-226	U	0.244	+/-0.196	0.293	1.00	pCi/L		KSD1	12/01/09	2000	920697	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"			104	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			91.7	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			85.9	(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: December 2, 2009

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

Client Sample ID: M-147B
Sample ID: 239753016
Matrix: WG
Collect Date: 02-NOV-09 10:00
Receive Date: 03-NOV-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228		0.017	+/-0.0119	0.00647	0.030	pCi/L		KXM4 11/20/09	1416	923093	1
Thorium-230	U	0.00846	+/-0.0102	0.0162	0.030	pCi/L					
Thorium-232	U	-0.00212	+/-0.00587	0.0162	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		26.1	+/-0.527	0.0398	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236		1.09	+/-0.120	0.0261	0.030	pCi/L					
Uranium-238		19.6	+/-0.456	0.0265	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	1.35	+/-1.69	2.87	3.00	pCi/L		JXC5 11/23/09	1727	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226		0.784	+/-0.297	0.333	1.00	pCi/L		KSD1 12/01/09	2000	920697	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"			103	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			80.7	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			75.3	(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: December 2, 2009

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

Client Sample ID: M-147009B
Sample ID: 239753017
Matrix: WG
Collect Date: 02-NOV-09 10:00
Receive Date: 03-NOV-09
Collector: Client

Project: KERRHenderson
Client ID: KERR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Th, Liquid "As Received"												
Thorium-228	U	0.00564	+/-0.0124	0.0244	0.030	pCi/L		KXM4	11/20/09	1416	923093	1
Thorium-230	U	0.00499	+/-0.00978	0.0191	0.030	pCi/L						
Thorium-232	U	-0.00249	+/-0.00691	0.0191	0.030	pCi/L						
Alphaspec U, Liquid "As Received"												
Uranium-233/234		26.2	+/-0.575	0.044	0.030	pCi/L		KXM4	11/21/09	1552	923094	2
Uranium-235/236		1.07	+/-0.130	0.0311	0.030	pCi/L						
Uranium-238		19.6	+/-0.497	0.0251	0.030	pCi/L						
Rad Gas Flow Proportional Counting												
GFPC, Ra228, Liquid "As Received"												
Radium-228	U	0.949	+/-1.33	2.29	3.00	pCi/L		JXC5	11/23/09	1727	922859	3
Rad Radium-226												
Lucas Cell, Ra226, liquid "As Received"												
Radium-226		0.303	+/-0.182	0.233	1.00	pCi/L		KSD1	12/01/09	2000	920697	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"			84.4	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			67.3	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			79.6	(15%-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: December 2, 2009

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

Client Sample ID:	EB110209-GWA3	Project:	KERRHenderson
Sample ID:	239753018	Client ID:	KERR003
Matrix:	WG		
Collect Date:	02-NOV-09 12:40		
Receive Date:	03-NOV-09		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Alpha Spec Analysis											
Alphaspec Th, Liquid "As Received"											
Thorium-228	U	0.00543	+/-0.00998	0.0191	0.030	pCi/L		KXM4 11/20/09	1416	923093	1
Thorium-230	U	0.00244	+/-0.0107	0.0234	0.030	pCi/L					
Thorium-232	U	-0.00244	+/-0.00677	0.0187	0.030	pCi/L					
Alphaspec U, Liquid "As Received"											
Uranium-233/234		0.067	+/-0.028	0.0276	0.030	pCi/L		KXM4 11/21/09	1552	923094	2
Uranium-235/236	U	0.00309	+/-0.00605	0.00926	0.030	pCi/L					
Uranium-238		0.035	+/-0.023	0.0307	0.030	pCi/L					
Rad Gas Flow Proportional Counting											
GFPC, Ra228, Liquid "As Received"											
Radium-228	U	1.14	+/-1.54	2.63	3.00	pCi/L		JXC5 11/23/09	1723	922859	3
Rad Radium-226											
Lucas Cell, Ra226, liquid "As Received"											
Radium-226	U	0.108	+/-0.194	0.349	1.00	pCi/L		KSD1 12/01/09	2035	920697	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"			90.2	(15%-125%)
Uranium-232 Tracer	Alphaspec U, Liquid "As Received"			87.2	(15%-125%)
Barium-133 Tracer	GFPC, Ra228, Liquid "As Received"			79.8	(15%-125%)

QUALITY CONTROL DATA

QC Summary

Report Date: December 2, 2009

Northgate Environmental Management, Inc.
1100 Quail St., Suite 102
Newport Beach, California

Contact: **Mr. Frank Hagar**

Workorder: **239753**

Parmname	NOM		Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Alpha Spec											
Batch 923093											
QC1201973224 239753003 DUP											
Thorium-228		U	0.00702 +/-0.0175	U	0.00499 +/-0.00948	pCi/L	0.00		N/A	KXM4	11/20/09 14:16
Thorium-230		U	0.00819 +/-0.0106	U	0.00232 +/-0.00455	pCi/L	0.00		N/A		
Thorium-232		U	0.00164 +/-0.00718	U	0.00232 +/-0.00455	pCi/L	0.00		N/A		
QC1201973226 LCS											
Thorium-228				U	0.0016 +/-0.0134	pCi/L					11/20/09 16:05
Thorium-230	2.68				2.11 +/-0.112	pCi/L		78.7	(75%-125%)		
Thorium-232				U	0.00936 +/-0.00967	pCi/L			(75%-125%)		
QC1201973223 MB											
Thorium-228				U	0.00468 +/-0.0168	pCi/L					11/20/09 14:16
Thorium-230				U	-0.00684 +/-0.00999	pCi/L					
Thorium-232				U	-0.0205 +/-0.0141	pCi/L					
QC1201973225 239753003 MS											
Thorium-228		U	0.00702 +/-0.0175	U	0.00191 +/-0.0152	pCi/L					11/20/09 14:16
Thorium-230	2.68	U	0.00819 +/-0.0106		2.22 +/-0.134	pCi/L		82.9	(75%-125%)		
Thorium-232		U	0.00164 +/-0.00718	U	0.00 +/-0.00582	pCi/L			(75%-125%)		
Batch 923094											
QC1201973228 239753004 DUP											
Uranium-233/234			18.2 +/-0.433		18.6 +/-0.422	pCi/L	2.10		(0% - 20%)	KXM4	11/20/09 14:25
Uranium-235/236			0.702 +/-0.0956		0.635 +/-0.0878	pCi/L	9.99		(0% - 20%)		
Uranium-238			12.2 +/-0.355		12.6 +/-0.346	pCi/L	2.52		(0% - 20%)		
QC1201973230 LCS											
Uranium-233/234					3.12 +/-0.167	pCi/L					11/20/09 14:25
Uranium-235/236					0.178 +/-0.0443	pCi/L					
Uranium-238	3.15				3.25	pCi/L		103	(75%-125%)		

QC Summary

Workorder: 239753

Parmname	NOM		Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Rad Alpha Spec											
Batch 923094											
					+/-0.171						
QC1201973227 MB											
Uranium-233/234				U	0.0139	pCi/L				KXM4	11/20/09 14:25
					+/-0.0132						
Uranium-235/236					0.00895	pCi/L					
					+/-0.0101						
Uranium-238				U	0.00	pCi/L					
					+/-0.0134						
QC1201973229 239753004 MS											
Uranium-233/234			18.2		21.4	pCi/L					11/20/09 14:25
			+/-0.433		+/-0.472						
Uranium-235/236			0.702		0.702	pCi/L					
			+/-0.0956		+/-0.0959						
Uranium-238	3.15		12.2		15.3	pCi/L		98.4	(75%-125%)		
			+/-0.355		+/-0.399						
Rad Gas Flow											
Batch 922859											
QC1201972469 239753001 DUP											
Radium-228		U	2.40	U	0.755	pCi/L	0.00		N/A	JXC5	11/23/09 17:26
			+/-1.63		+/-1.26						
QC1201972471 LCS											
Radium-228	39.2				41.8	pCi/L		106	(75%-125%)		11/23/09 17:26
					+/-4.30						
QC1201972468 MB											
Radium-228				U	0.876	pCi/L					11/23/09 17:27
					+/-1.63						
QC1201972470 239753001 MS											
Radium-228	79.1	U	2.40		93.4	pCi/L		118	(75%-125%)		11/23/09 17:26
			+/-1.63		+/-9.04						
Rad Ra-226											
Batch 920697											
QC1201967364 239753012 DUP											
Radium-226		U	0.177	U	0.187	pCi/L	5.52		N/A	KSD1	12/01/09 20:35
			+/-0.159		+/-0.216						
QC1201967366 LCS											
Radium-226	24.2				19.4	pCi/L		80.4	(75%-125%)		12/01/09 21:25
					+/-1.24						
QC1201967363 MB											
Radium-226				U	0.320	pCi/L					12/01/09 20:35
					+/-0.260						
QC1201967365 239753012 MS											
Radium-226	121	U	0.177		102	pCi/L		84.4	(75%-125%)		12/01/09 20:35
			+/-0.159		+/-6.18						

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

QC Summary

Workorder: 239753

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time

**	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
^	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# 923093 Product: Th Date: 11/25/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to100 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.		✓	NCR 762500
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.		✓	NCR 762500
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 statused.	✓		
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 762500
Batch non-conformances second reviewed and disposition verified to be completed.	✓		NCR 762500
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: Joel M I 11/25/09

Secondary Review Performed By: [illegible] 11/25/09

11/26 12/7

KSRR

Thorium (Ac-227 Tracer) Que Sheet

16-NOV-09

Batch #: 923093 Analyst: KXM4 First Client Due Date:07-DEC-09 Internal Due Date26-NOV-09

Tracer Isotope: Ac-227 Tracer Code: 0387-B-102 Expiration Date: 7-23-10 Vol: 0.1ml Ac-227 Separation Date/Time: 11-19-09 /09:55

LCS Isotope: Th-230 LCS Code: A2796-5 Expiration Date: 4-13-10 Vol: 0.1ml

Spike Isotope: Th-230 Spike Code: A2796-5 Expiration Date: 4-13-10 Vol: 0.1ml

Prep Date: 11-18-09 Initials: KM Pipet ID: 7971058 Balance ID: 1675262 07 Witness: MDA 11/18/09

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Aliquot	Pos.	Label #	Wet/Dry Aliquot (g / l)	Th Det #
239753001-1	M-141B	SAMPLE		.03 pCi/L	WATER	KERR003	23-OCT-09	0.800	1	1	800.0	25
239753002-1	M-141009B	SAMPLE		.03 pCi/L	WATER	KERR003	23-OCT-09	0.800	2	2	800.0	26
239753003-1	PB102309-A3	SAMPLE		.03 pCi/L	WATER	KERR003	23-OCT-09	0.800	3	3	800.0	27
239753004-1	M-145B	SAMPLE		.03 pCi/L	WATER	KERR003	26-OCT-09	0.800	4	4	800.0	28
239753005-1	M-139B	SAMPLE		.03 pCi/L	WATER	KERR003	26-OCT-09	0.800	5	5	800.0	29
239753006-1	M-146B	SAMPLE		.03 pCi/L	WATER	KERR003	27-OCT-09	0.800	6	6	800.0	30
239753007-1	M-144B	SAMPLE		.03 pCi/L	WATER	KERR003	27-OCT-09	0.800	7	7	800.0	31
239753008-1	M-138B	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	0.800	8	8	800.0	33
239753009-1	M-138009B	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	0.800	9	9	800.0	35
239753010-1	M-138BDISS	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	0.800	10	10	800.0	36
239753011-1	M-138009BDISS	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	0.800	11	11	800.0	37
239753012-1	M-137B	SAMPLE		.03 pCi/L	WATER	KERR003	29-OCT-09	0.800	12	12	800.0	38
239753013-1	M-137BDISS	SAMPLE		.03 pCi/L	WATER	KERR003	29-OCT-09	0.800	13	13	800.0	39
239753014-1	M-148B	SAMPLE		.03 pCi/L	WATER	KERR003	29-OCT-09	0.800	14	14	800.0	40
239753015-1	EB103009-GWA4	SAMPLE		.03 pCi/L	WATER	KERR003	30-OCT-09	0.800	15	15	800.0	41
239753016-1	M-147B	SAMPLE		.03 pCi/L	WATER	KERR003	02-NOV-09	0.800	16	16	800.0	201
239753017-1	M-147009B	SAMPLE		.03 pCi/L	WATER	KERR003	02-NOV-09	0.800	17	17	800.0	202
239753018-1	EB110209-GWA3	SAMPLE		.03 pCi/L	WATER	KERR003	02-NOV-09	0.800	18	18	800.0	203
1201973223-1	MB for batch 923093	MB		.03 pCi/L	WATER	QC ACCOUNT		0.800	19	19	800.0	204
1201973224-1	PB102309-A3(239753003DUP)	DUP		.03 pCi/L	WATER	QC ACCOUNT	23-OCT-09	0.800	20	20	800.0	205
1201973225-1	PB102309-A3(239753003MS)	MS		.03 pCi/L	WATER	QC ACCOUNT	23-OCT-09	0.800	21	21	800.0	206
1201973226-1	LCS for batch 923093	LCS		.03 pCi/L	WATER	QC ACCOUNT		0.800	22	22	800.0	42

11/25/09

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~~ MKM 11-17-09
Circle One

Data Reviewed By: J. L. M. 11/25/09

GEL Laboratories LLC, Radiochemistry Division

GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

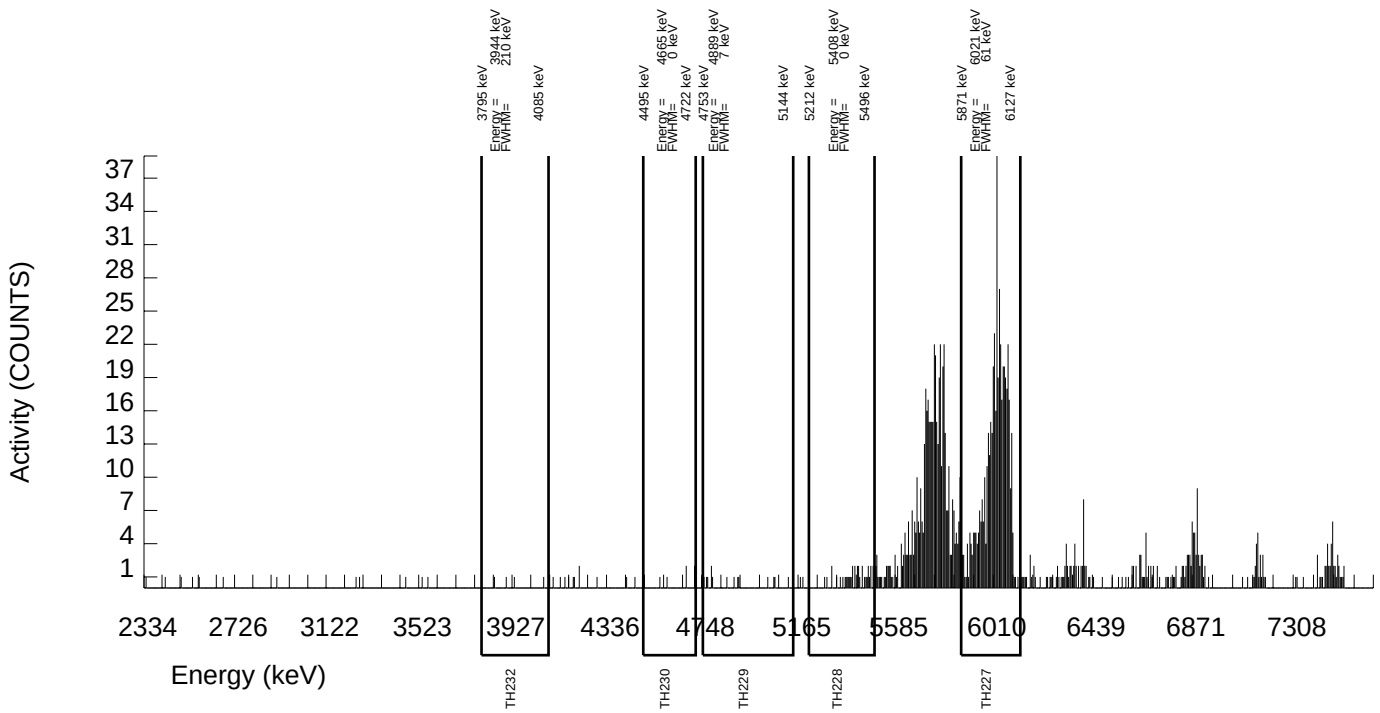
BATCH NUMBER: 923093 SAMPLE DATE : 23-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753001_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :45-149AA5 AVERAGE %EFFICIENCY :32.8418 % YIELD : 70.102	COUNT DATE:20-NOV-2009 16:04:59 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 2.72263 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B025.CNF;1082 BKG DATE : 15-NOV-2009 EFF FILE : W025.CNF;322 CAL DATE : 4-NOV-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	500.000	484.000	16.000	4.0000	57.44000	2.19E+00	2.33E-01	9.76E-02	4.20E-02	2.01E-01
TH-228	5363.000	35.000	10.100	23.000	4.7958	99.94000	2.54E-02	3.70E-02	6.38E-02	2.81E-02	3.70E-02
TH229	4900.000	15.000	12.000	3.000	1.7321	99.52000	2.95E-02	2.05E-02	2.72E-02	9.90E-03	2.04E-02
TH-230	4625.000	6.000	4.000	2.000	1.4142	100.0000	9.78E-03	1.36E-02	2.34E-02	8.05E-03	1.36E-02
TH-232	3972.000	4.000	3.000	1.000	1.0000	100.0000	7.34E-03	1.07E-02	1.87E-02	5.69E-03	1.07E-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

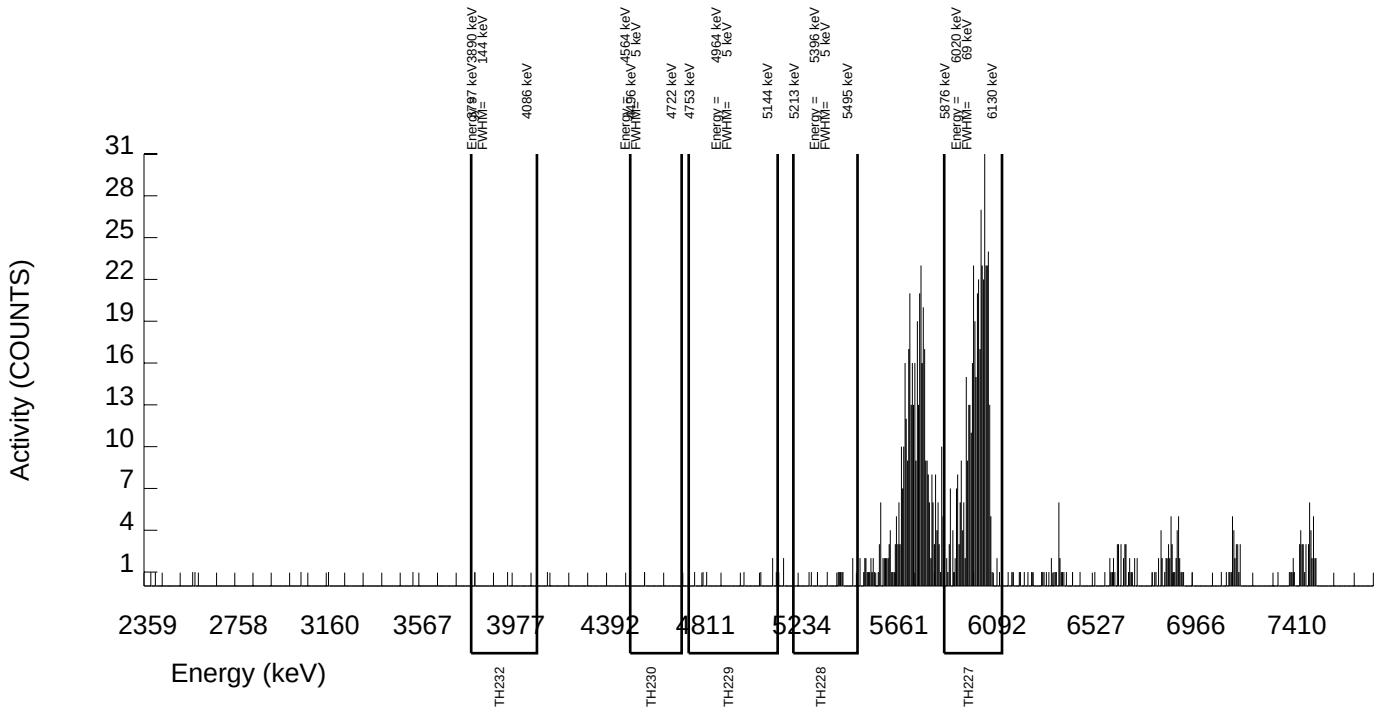
BATCH NUMBER: 923093 SAMPLE DATE : 23-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753002_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78204 AVERAGE %EFFICIENCY :31.8739 % YIELD : 67.455	COUNT DATE:20-NOV-2009 16:04:59 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 2.61982 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B026.CNF;1083 BKG DATE : 15-NOV-2009 EFF FILE : W026.CNF;296 CAL DATE : 4-NOV-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	465.000	452.000	13.000	3.6056	57.44000	2.19E+00	2.42E-01	9.57E-02	4.06E-02	2.07E-01
TH-228	5363.000	11.000	1.225	8.000	2.8284	99.94000	3.31E-03	2.19E-02	4.36E-02	1.77E-02	2.19E-02
TH229	4900.000	9.000	0.000	9.000	3.0000	99.52000	2.51E-09	2.19E-02	4.46E-02	1.84E-02	2.19E-02
TH-230	4625.000	1.000	-3.000	4.000	2.0000	100.0000	-7.86E-03	1.15E-02	3.22E-02	1.22E-02	1.15E-02
TH-232	3972.000	2.000	-2.000	4.000	2.0000	100.0000	-5.24E-03	1.26E-02	3.22E-02	1.22E-02	1.26E-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

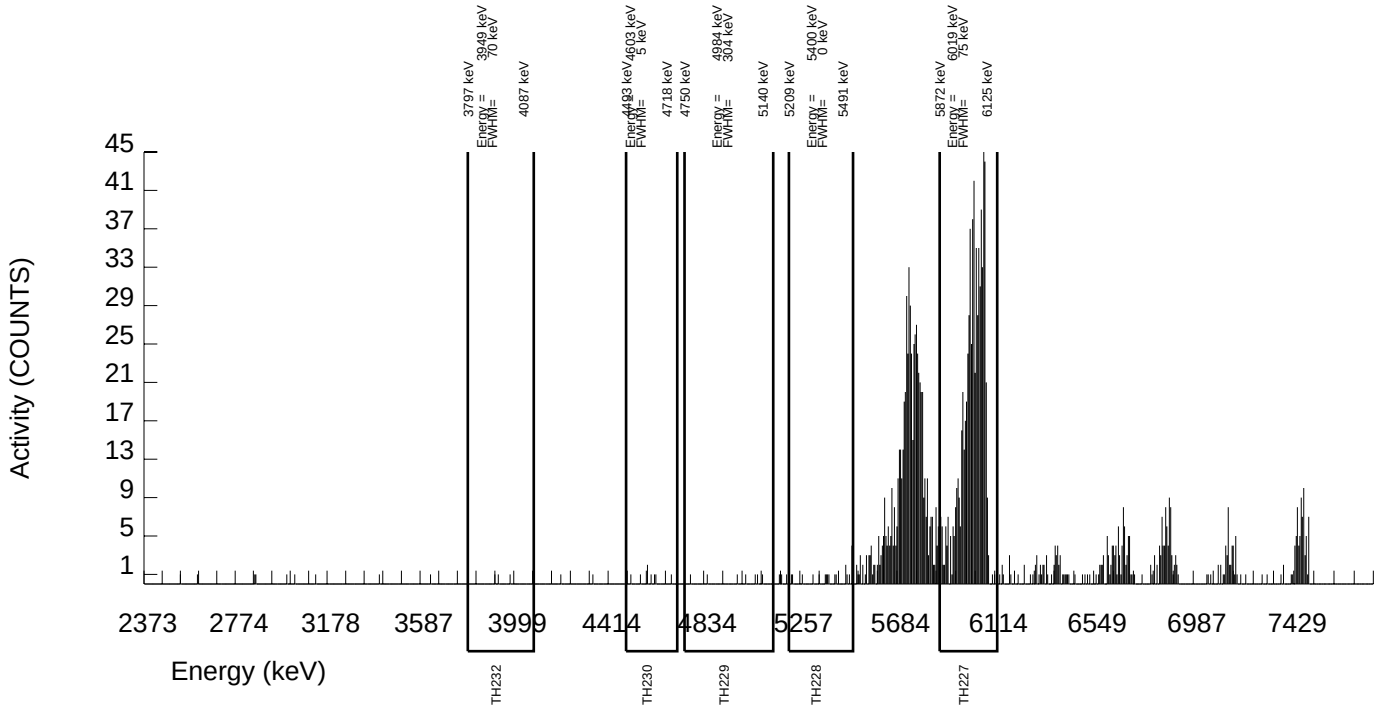
BATCH NUMBER: 923093 SAMPLE DATE : 23-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753003_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :42484 AVERAGE %EFFICIENCY :34.1663 % YIELD : 100.659	COUNT DATE:20-NOV-2009 16:04:59 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.90940 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B027.CNF;1089 BKG DATE : 15-NOV-2009 EFF FILE : W027.CNF;323 CAL DATE : 4-NOV-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	738.000	723.000	15.000	3.8730	57.44000	2.19E+00	2.06E-01	6.36E-02	2.73E-02	1.63E-01
TH-228	5363.000	19.000	4.162	12.000	3.4641	99.94000	7.02E-03	1.75E-02	3.22E-02	1.36E-02	1.75E-02
TH229	4900.000	7.000	2.000	5.000	2.2361	99.52000	3.29E-03	1.12E-02	2.21E-02	8.56E-03	1.12E-02
TH-230	4625.000	8.000	5.000	3.000	1.7321	100.0000	8.19E-03	1.07E-02	1.81E-02	6.60E-03	1.06E-02
TH-232	3972.000	3.000	1.000	2.000	1.4142	100.0000	1.64E-03	7.18E-03	1.57E-02	5.39E-03	7.18E-03

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

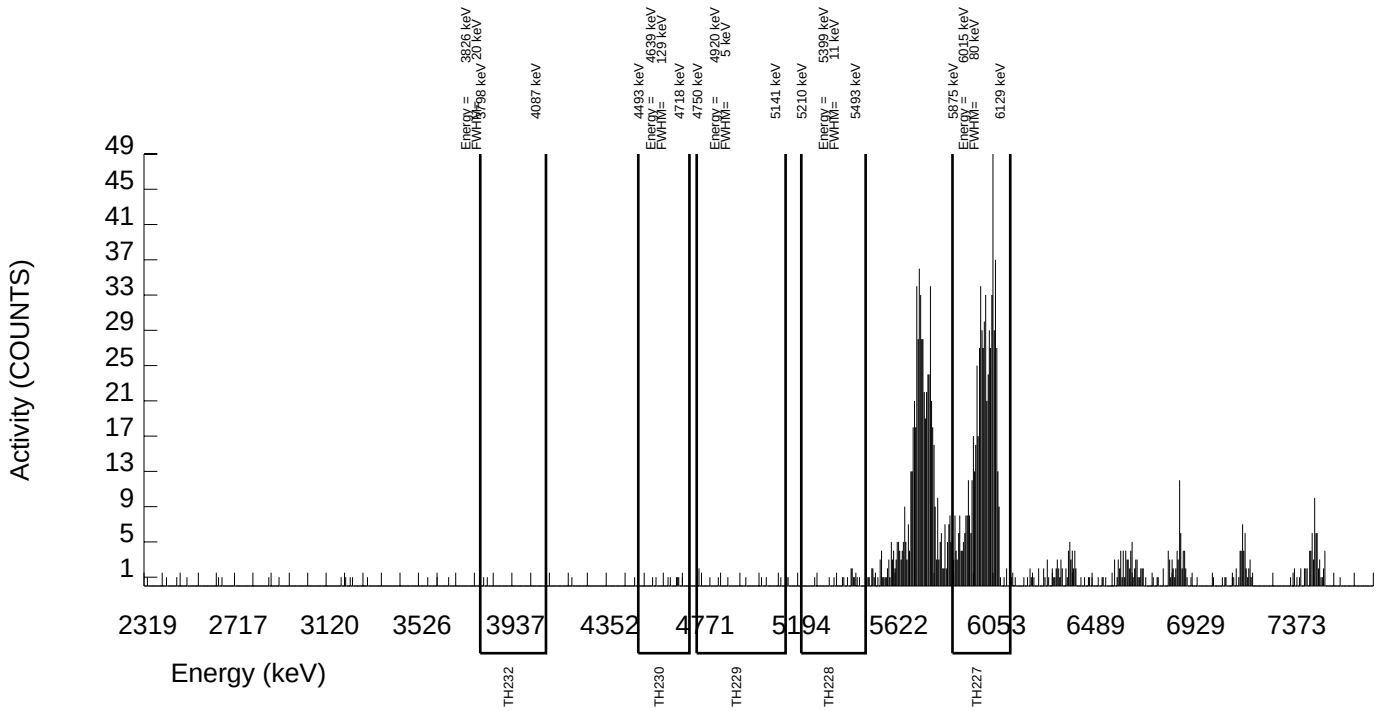
BATCH NUMBER: 923093 SAMPLE DATE : 26-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753004_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78792 AVERAGE %EFFICIENCY :30.5052 % YIELD : 105.255	COUNT DATE:20-NOV-2009 16:04:59 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.08789 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B028.CNF;1093 BKG DATE : 15-NOV-2009 EFF FILE : W028.CNF;315 CAL DATE : 4-NOV-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	685.000	675.000	10.000	3.1623	57.44000	2.19E+00	2.09E-01	5.74E-02	2.38E-02	1.67E-01
TH-228	5363.000	15.000	5.350	7.000	2.6458	99.94000	9.63E-03	1.55E-02	2.76E-02	1.11E-02	1.55E-02
TH229	4900.000	9.000	5.000	4.000	2.0000	99.52000	8.81E-03	1.25E-02	2.17E-02	8.20E-03	1.25E-02
TH-230	4625.000	8.000	7.000	1.000	1.0000	100.0000	1.23E-02	1.03E-02	1.34E-02	4.08E-03	1.03E-02
TH-232	3972.000	2.000	-1.000	3.000	1.7321	100.0000	-1.75E-03	7.69E-03	1.94E-02	7.07E-03	7.69E-03

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

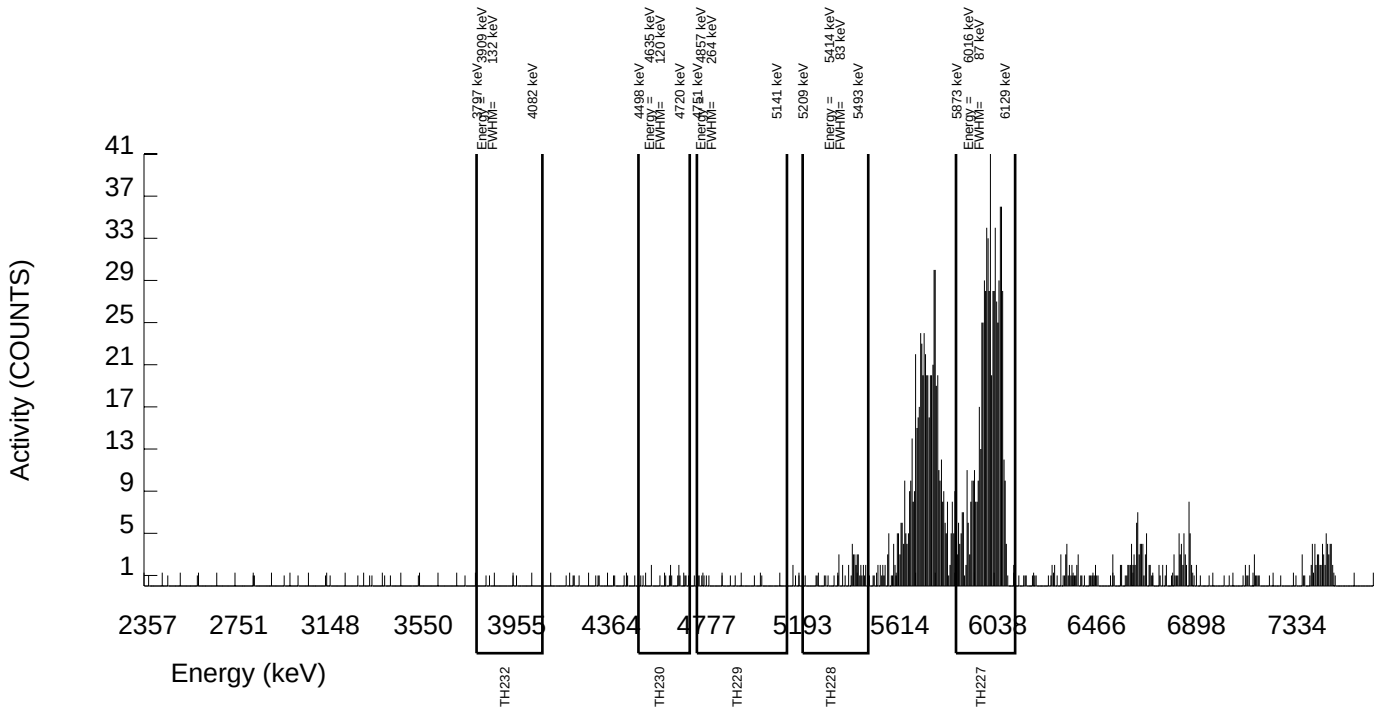
BATCH NUMBER: 923093 SAMPLE DATE : 26-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753005_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :33454 AVERAGE %EFFICIENCY :31.2344 % YIELD : 108.737	COUNT DATE:20-NOV-2009 16:04:59 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.22313 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B029.CNF;1084 BKG DATE : 15-NOV-2009 EFF FILE : W029.CNF;314 CAL DATE : 4-NOV-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	729.000	714.000	15.000	3.8730	57.44000	2.19E+00	2.06E-01	6.44E-02	2.76E-02	1.64E-01
TH-228	5363.000	44.000	11.197	30.000	5.4772	99.94000	1.91E-02	2.82E-02	4.85E-02	2.17E-02	2.82E-02
TH229	4900.000	11.000	2.000	9.000	3.0000	99.52000	3.33E-03	1.46E-02	2.83E-02	1.16E-02	1.46E-02
TH-230	4625.000	17.000	14.000	3.000	1.7321	100.0000	2.32E-02	1.46E-02	1.83E-02	6.68E-03	1.45E-02
TH-232	3972.000	4.000	-1.000	5.000	2.2361	100.0000	-1.66E-03	9.75E-03	2.22E-02	8.62E-03	9.75E-03

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

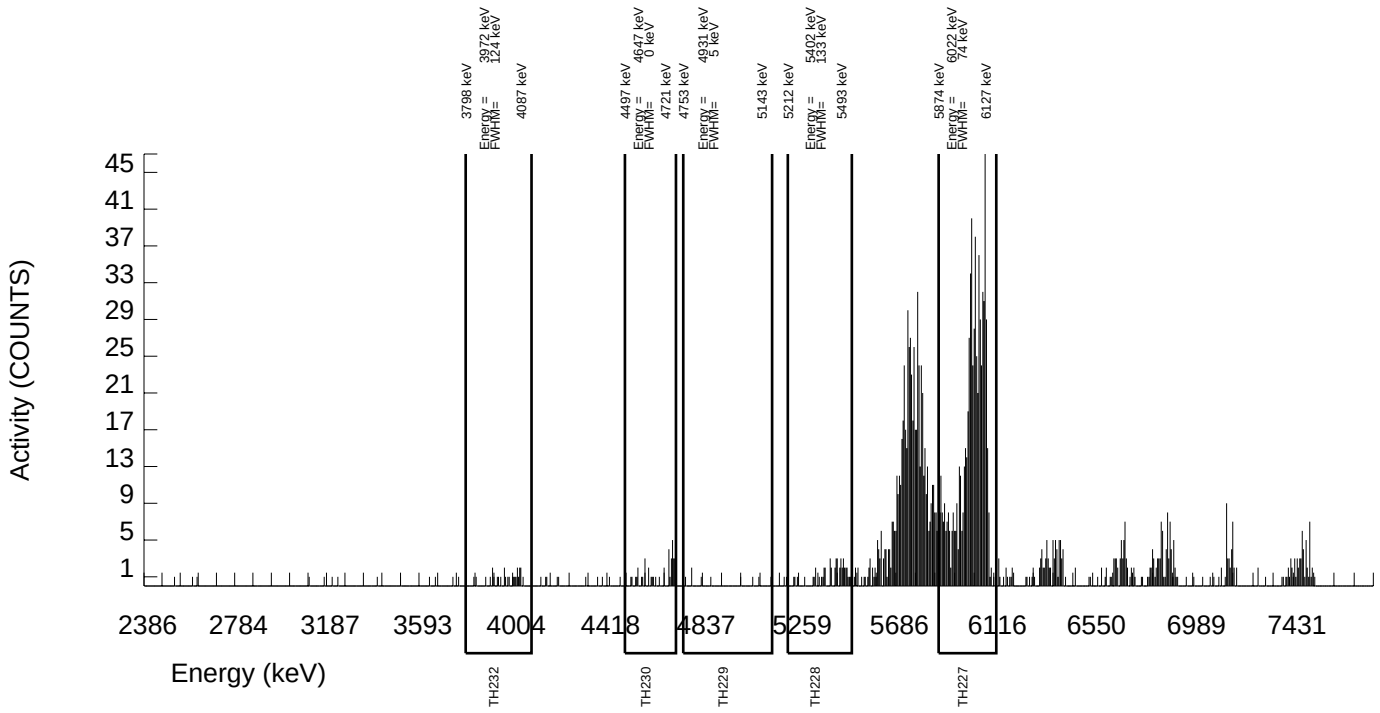
BATCH NUMBER: 923093 SAMPLE DATE : 27-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753006_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :33447 AVERAGE %EFFICIENCY :32.3788 % YIELD : 101.662	COUNT DATE:20-NOV-2009 16:04:59 ELAPSED LIVE TIME(SEC): 59999.99 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.94835 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B030.CNF;1081 BKG DATE : 15-NOV-2009 EFF FILE : W030.CNF;299 CAL DATE : 4-NOV-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	713.000	692.000	21.000	4.5826	57.44000	2.19E+00	2.10E-01	7.69E-02	3.37E-02	1.68E-01
TH-228	5363.000	49.000	24.283	22.000	4.6904	99.94000	4.26E-02	2.85E-02	4.36E-02	1.91E-02	2.84E-02
TH229	4900.000	9.000	-3.000	12.000	3.4641	99.52000	-5.16E-03	1.54E-02	3.29E-02	1.39E-02	1.54E-02
TH-230	4625.000	40.000	35.000	5.000	2.2361	100.0000	5.99E-02	2.28E-02	2.29E-02	8.90E-03	2.25E-02
TH-232	3972.000	28.000	25.000	3.000	1.7321	100.0000	4.28E-02	1.88E-02	1.89E-02	6.89E-03	1.87E-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

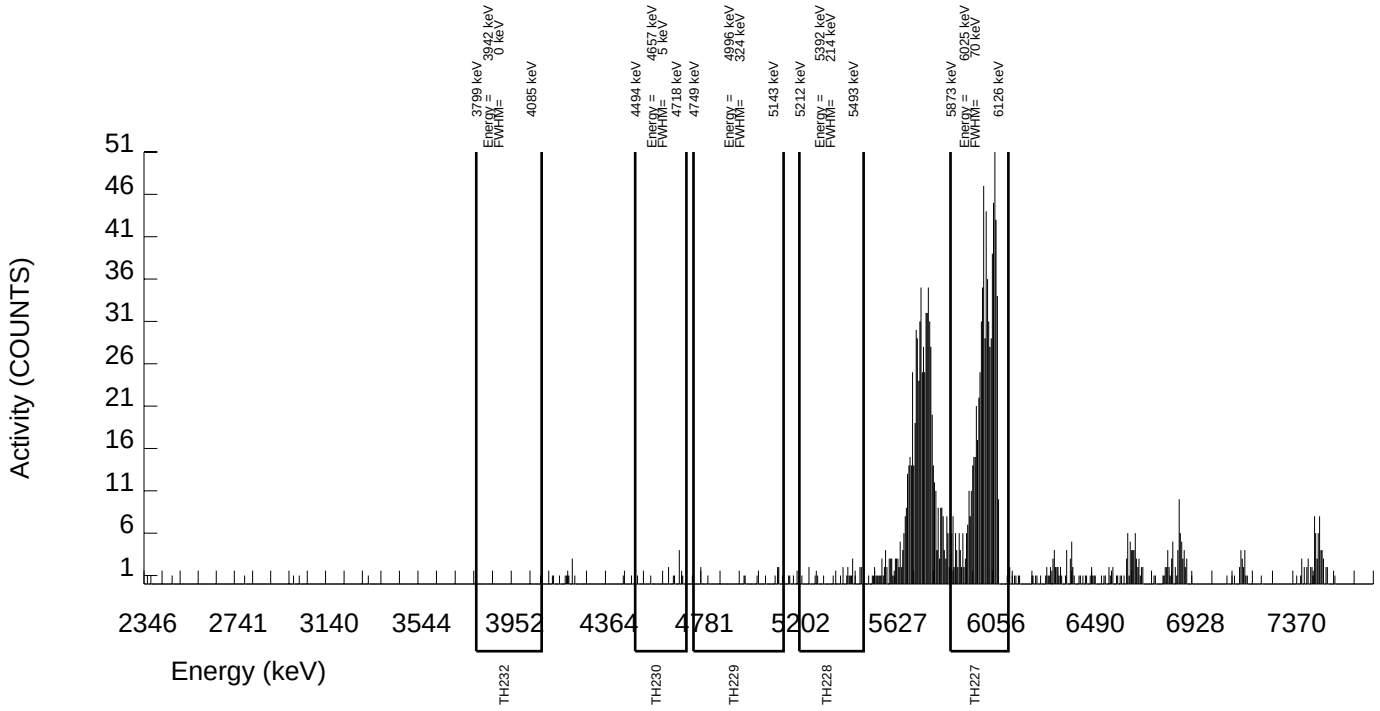
BATCH NUMBER: 923093 SAMPLE DATE : 27-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753007_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :79988 AVERAGE %EFFICIENCY :34.3928 % YIELD : 104.145	COUNT DATE:20-NOV-2009 16:05:00 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.04479 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B031.CNF;1079 BKG DATE : 15-NOV-2009 EFF FILE : W031.CNF;338 CAL DATE : 4-NOV-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	762.000	753.000	9.000	3.0000	57.44000	2.19E+00	1.97E-01	4.92E-02	2.03E-02	1.58E-01
TH-228	5363.000	25.000	8.044	14.000	3.7417	99.94000	1.30E-02	1.90E-02	3.29E-02	1.40E-02	1.90E-02
TH229	4900.000	14.000	-3.000	17.000	4.1231	99.52000	-4.74E-03	1.72E-02	3.50E-02	1.52E-02	1.72E-02
TH-230	4625.000	12.000	10.000	2.000	1.4142	100.0000	1.57E-02	1.16E-02	1.51E-02	5.17E-03	1.15E-02
TH-232	3972.000	1.000	0.000	1.000	1.0000	100.0000	-1.87E-10	4.36E-03	1.20E-02	3.66E-03	4.36E-03

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

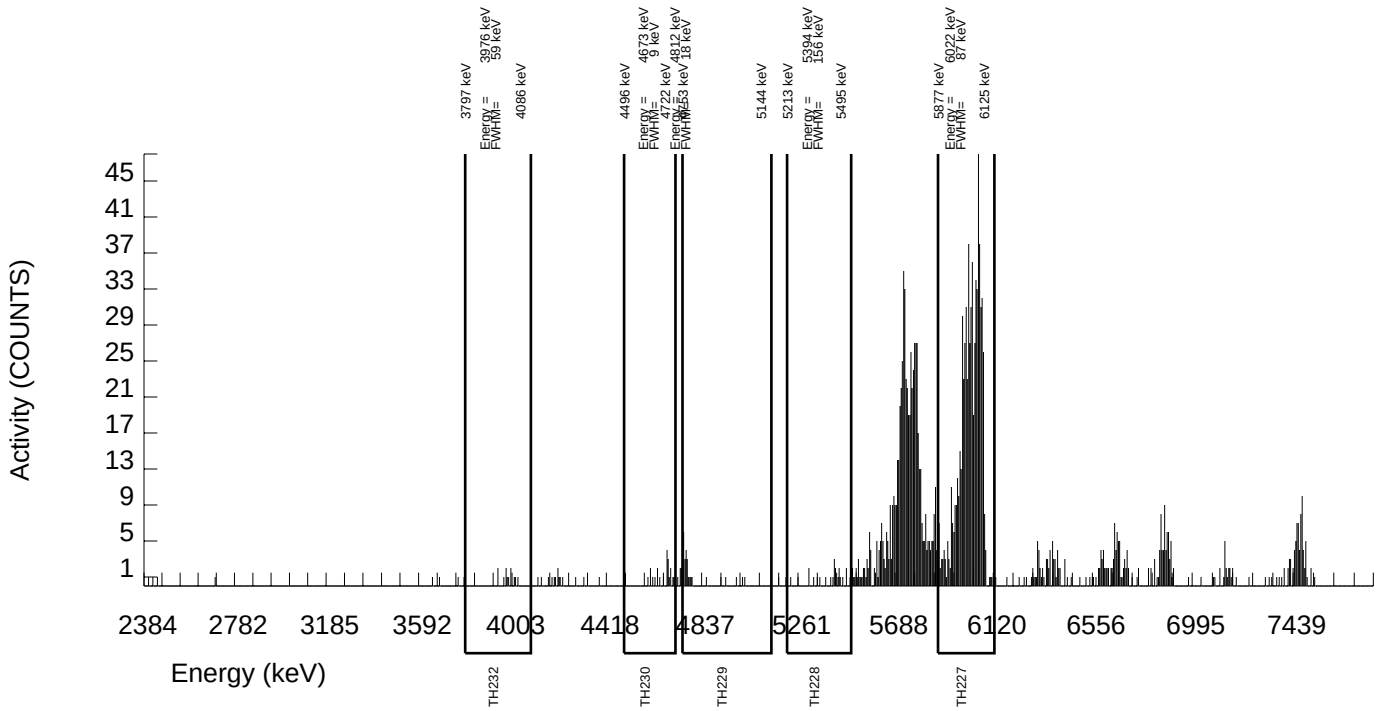
BATCH NUMBER: 923093 SAMPLE DATE : 28-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753008_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78785 AVERAGE %EFFICIENCY :30.9759 % YIELD : 105.498	COUNT DATE:20-NOV-2009 16:05:00 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.09734 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B033.CNF;1078 BKG DATE : 15-NOV-2009 EFF FILE : W033.CNF;324 CAL DATE : 4-NOV-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	701.000	687.000	14.000	3.7417	57.44000	2.19E+00	2.05E-01	6.50E-02	2.77E-02	1.67E-01
TH-228	5363.000	24.000	14.303	7.000	2.6458	99.94000	2.53E-02	1.85E-02	2.70E-02	1.09E-02	1.84E-02
TH229	4900.000	29.000	24.000	5.000	2.2361	99.52000	4.16E-02	1.99E-02	2.32E-02	9.01E-03	1.98E-02
TH-230	4625.000	21.000	19.000	2.000	1.4142	100.0000	3.27E-02	1.63E-02	1.65E-02	5.67E-03	1.62E-02
TH-232	3972.000	13.000	11.000	2.000	1.4142	100.0000	1.90E-02	1.31E-02	1.65E-02	5.67E-03	1.31E-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

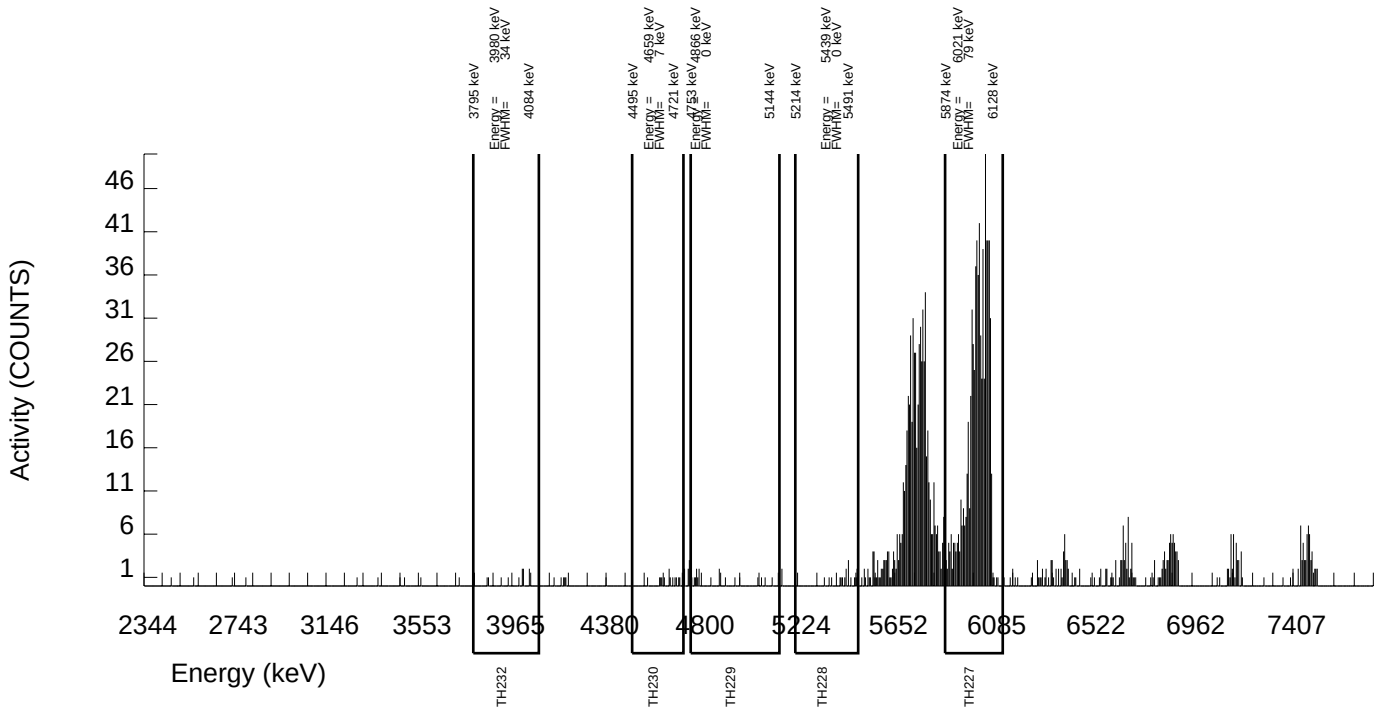
BATCH NUMBER: 923093 SAMPLE DATE : 28-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753009_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78202 AVERAGE %EFFICIENCY :30.1182 % YIELD : 114.346	COUNT DATE:20-NOV-2009 16:05:00 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.44098 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B035.CNF;1076 BKG DATE : 15-NOV-2009 EFF FILE : W035.CNF;313 CAL DATE : 4-NOV-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	743.000	724.000	19.000	4.3589	57.44000	2.19E+00	2.02E-01	7.03E-02	3.06E-02	1.63E-01
TH-228	5363.000	17.000	4.158	10.000	3.1623	99.94000	6.97E-03	1.61E-02	2.97E-02	1.23E-02	1.61E-02
TH229	4900.000	22.000	2.000	20.000	4.4721	99.52000	3.29E-03	2.09E-02	3.91E-02	1.71E-02	2.09E-02
TH-230	4625.000	13.000	5.000	8.000	2.8284	100.0000	8.17E-03	1.47E-02	2.64E-02	1.08E-02	1.47E-02
TH-232	3972.000	11.000	8.000	3.000	1.7321	100.0000	1.31E-02	1.20E-02	1.81E-02	6.59E-03	1.20E-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

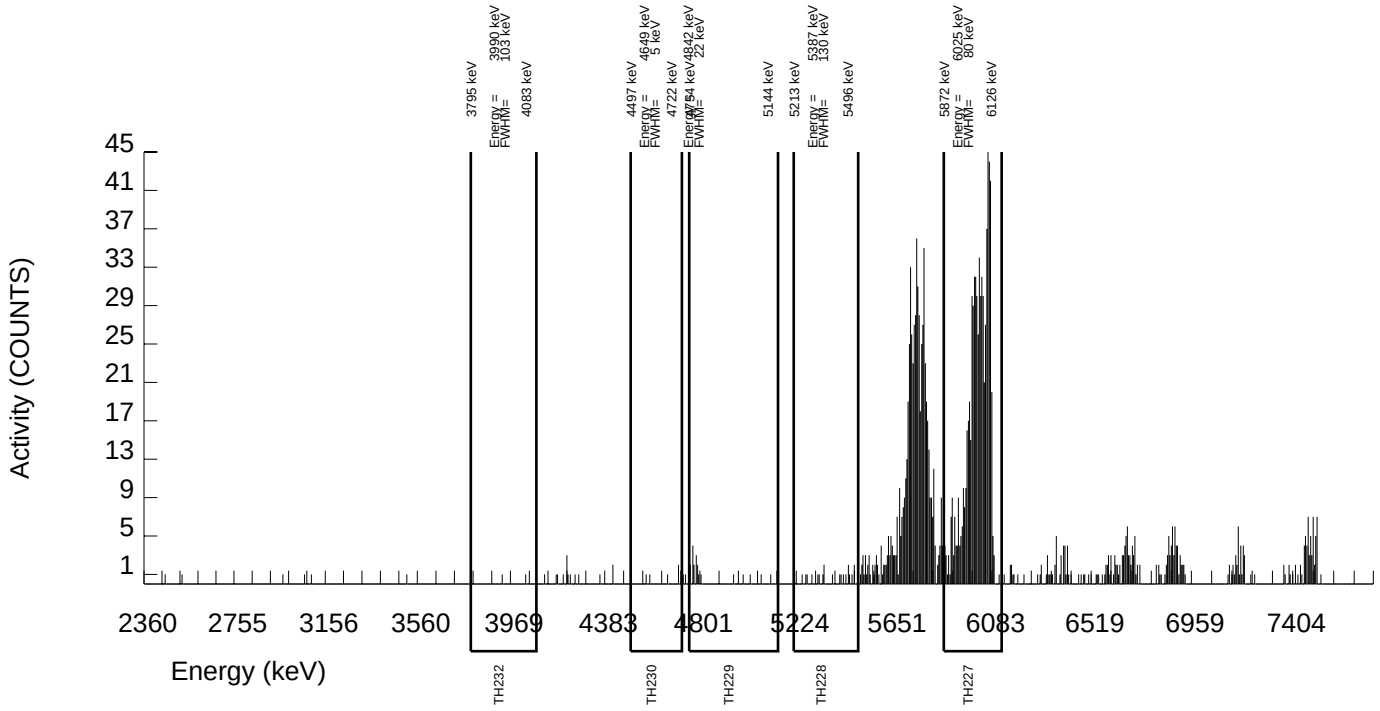
BATCH NUMBER: 923093 SAMPLE DATE : 28-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753010_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78203 AVERAGE %EFFICIENCY :32.5831 % YIELD : 102.776	COUNT DATE:20-NOV-2009 16:05:00 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.99163 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B036.CNF;1074 BKG DATE : 15-NOV-2009 EFF FILE : W036.CNF;325 CAL DATE : 4-NOV-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	723.000	704.000	19.000	4.3589	57.44000	2.19E+00	2.04E-01	7.23E-02	3.15E-02	1.66E-01
TH-228	5363.000	20.000	11.236	6.000	2.4495	99.94000	1.94E-02	1.63E-02	2.48E-02	9.82E-03	1.63E-02
TH229	4900.000	21.000	16.000	5.000	2.2361	99.52000	2.70E-02	1.69E-02	2.26E-02	8.79E-03	1.69E-02
TH-230	4625.000	5.000	2.000	3.000	1.7321	100.0000	3.36E-03	9.32E-03	1.86E-02	6.78E-03	9.32E-03
TH-232	3972.000	2.000	2.000	0.000	0.0000	100.0000	3.36E-03	4.66E-03	5.04E-03	0.00E+00	4.66E-03

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

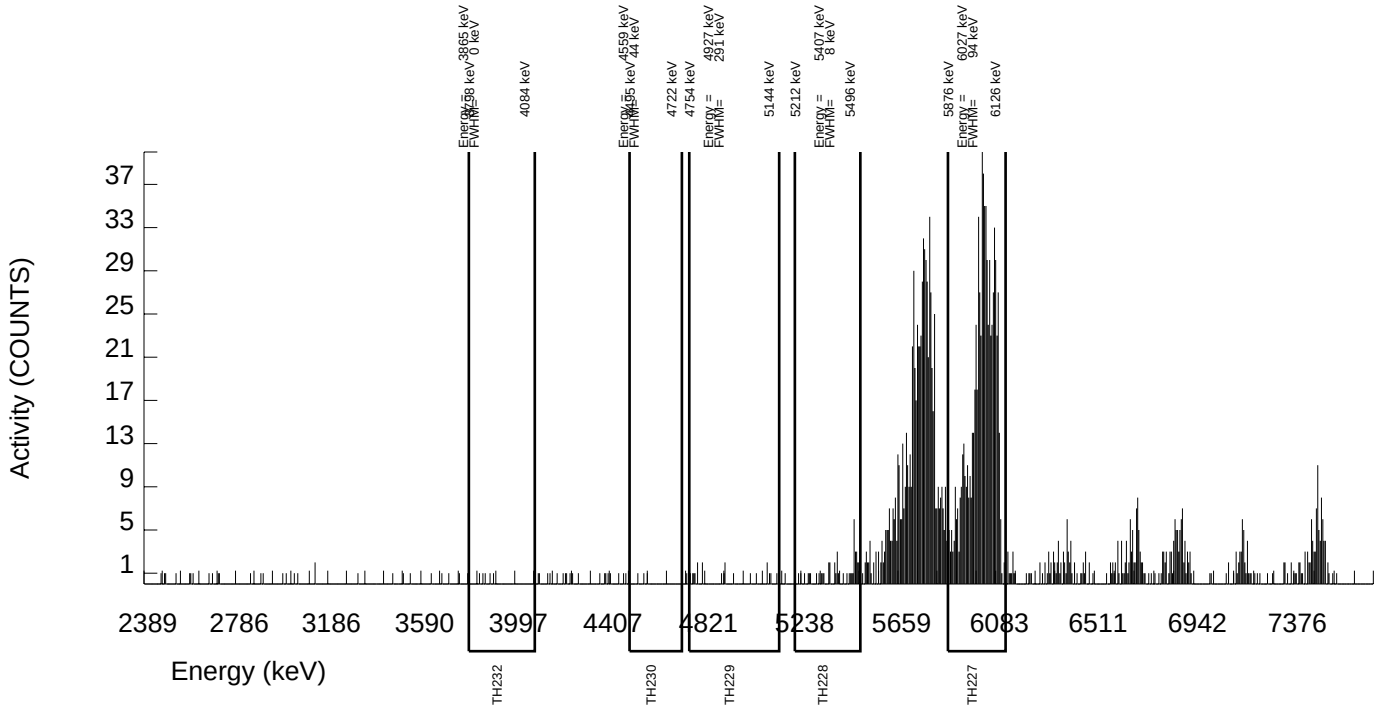
BATCH NUMBER: 923093 SAMPLE DATE : 28-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753011_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :45-149BB5 AVERAGE %EFFICIENCY :35.8039 % YIELD : 98.313	COUNT DATE:20-NOV-2009 16:05:01 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.81831 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B037.CNF;1086 BKG DATE : 15-NOV-2009 EFF FILE : W037.CNF;301 CAL DATE : 4-NOV-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	767.000	740.000	27.000	5.1962	57.44000	2.19E+00	2.01E-01	8.03E-02	3.57E-02	1.63E-01
TH-228	5363.000	44.000	21.095	20.000	4.4721	99.94000	3.46E-02	2.52E-02	3.90E-02	1.71E-02	2.51E-02
TH229	4900.000	20.000	14.000	6.000	2.4495	99.52000	2.25E-02	1.61E-02	2.31E-02	9.16E-03	1.61E-02
TH-230	4625.000	3.000	-2.000	5.000	2.2361	100.0000	-3.20E-03	8.87E-03	2.14E-02	8.32E-03	8.87E-03
TH-232	3972.000	6.000	-2.000	8.000	2.8284	100.0000	-3.20E-03	1.17E-02	2.58E-02	1.05E-02	1.17E-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

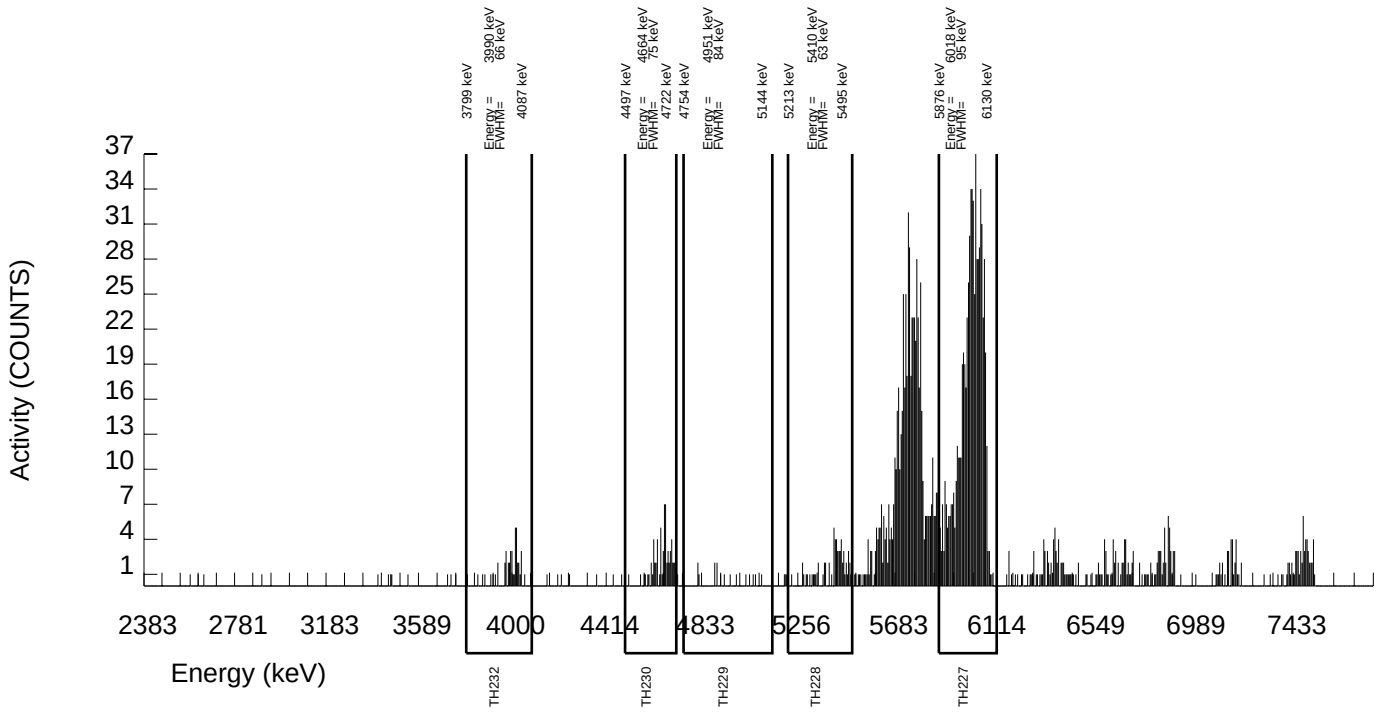
BATCH NUMBER: 923093 SAMPLE DATE : 29-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753012_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :72532 AVERAGE %EFFICIENCY :34.2033 % YIELD : 97.212	COUNT DATE:20-NOV-2009 16:05:01 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.77554 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B038.CNF;1083 BKG DATE : 15-NOV-2009 EFF FILE : W038.CNF;315 CAL DATE : 4-NOV-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	707.000	699.000	8.000	2.8284	57.44000	2.19E+00	2.02E-01	5.06E-02	2.06E-02	1.64E-01
TH-228	5363.000	63.000	42.256	18.000	4.2426	99.94000	7.33E-02	3.03E-02	3.94E-02	1.71E-02	3.01E-02
TH229	4900.000	16.000	8.000	8.000	2.8284	99.52000	1.36E-02	1.64E-02	2.75E-02	1.12E-02	1.63E-02
TH-230	4625.000	65.000	61.000	4.000	2.0000	100.0000	1.03E-01	2.81E-02	2.08E-02	7.88E-03	2.76E-02
TH-232	3972.000	45.000	42.000	3.000	1.7321	100.0000	7.11E-02	2.33E-02	1.87E-02	6.82E-03	2.30E-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

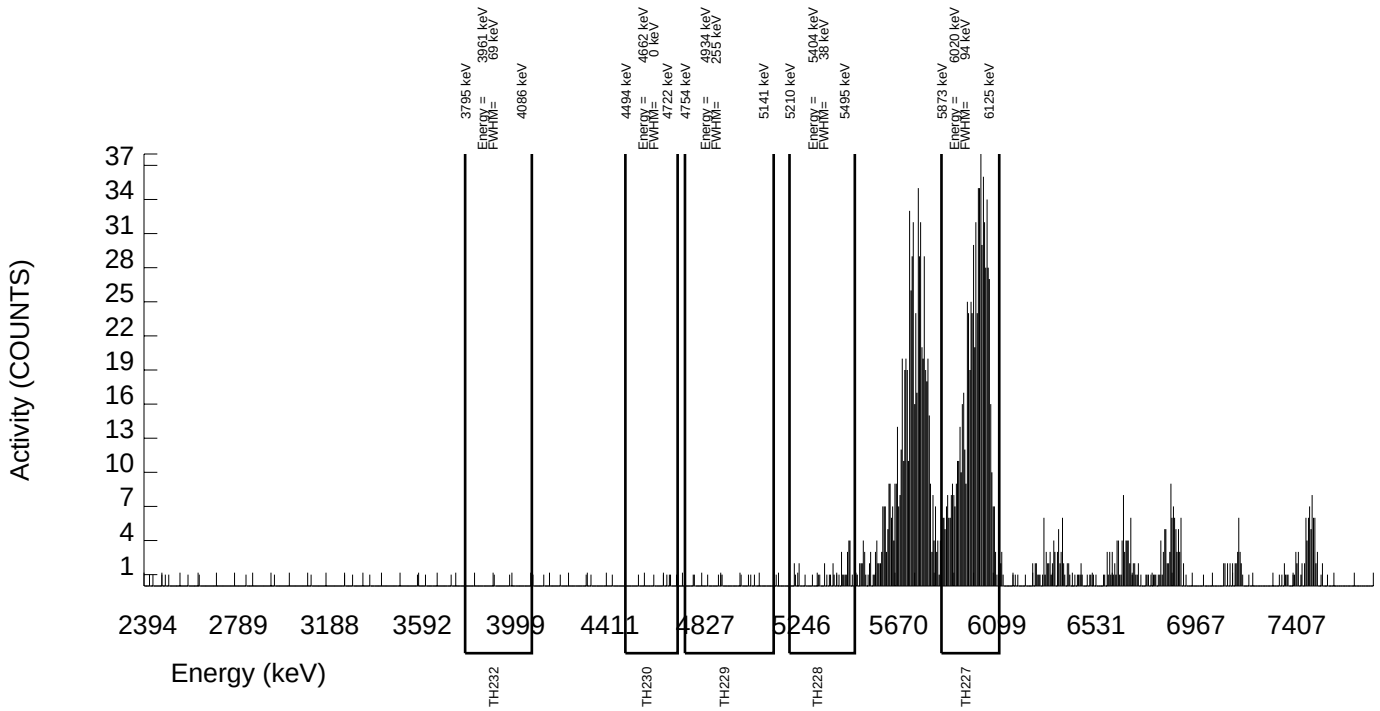
BATCH NUMBER: 923093 SAMPLE DATE : 29-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753013_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :45-149BB2 AVERAGE %EFFICIENCY :36.4893 % YIELD : 100.508	COUNT DATE:20-NOV-2009 16:05:01 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.90354 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B039.CNF;1083 BKG DATE : 15-NOV-2009 EFF FILE : W039.CNF;292 CAL DATE : 4-NOV-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	789.000	771.000	18.000	4.2426	57.44000	2.19E+00	1.97E-01	6.45E-02	2.80E-02	1.58E-01
TH-228	5363.000	38.000	19.973	15.000	3.8730	99.94000	3.14E-02	2.18E-02	3.30E-02	1.42E-02	2.18E-02
TH229	4900.000	10.000	2.000	8.000	2.8284	99.52000	3.09E-03	1.28E-02	2.49E-02	1.02E-02	1.28E-02
TH-230	4625.000	7.000	3.000	4.000	2.0000	100.0000	4.61E-03	9.98E-03	1.89E-02	7.14E-03	9.98E-03
TH-232	3972.000	2.000	-5.000	7.000	2.6458	100.0000	-7.68E-03	9.03E-03	2.35E-02	9.45E-03	9.03E-03

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

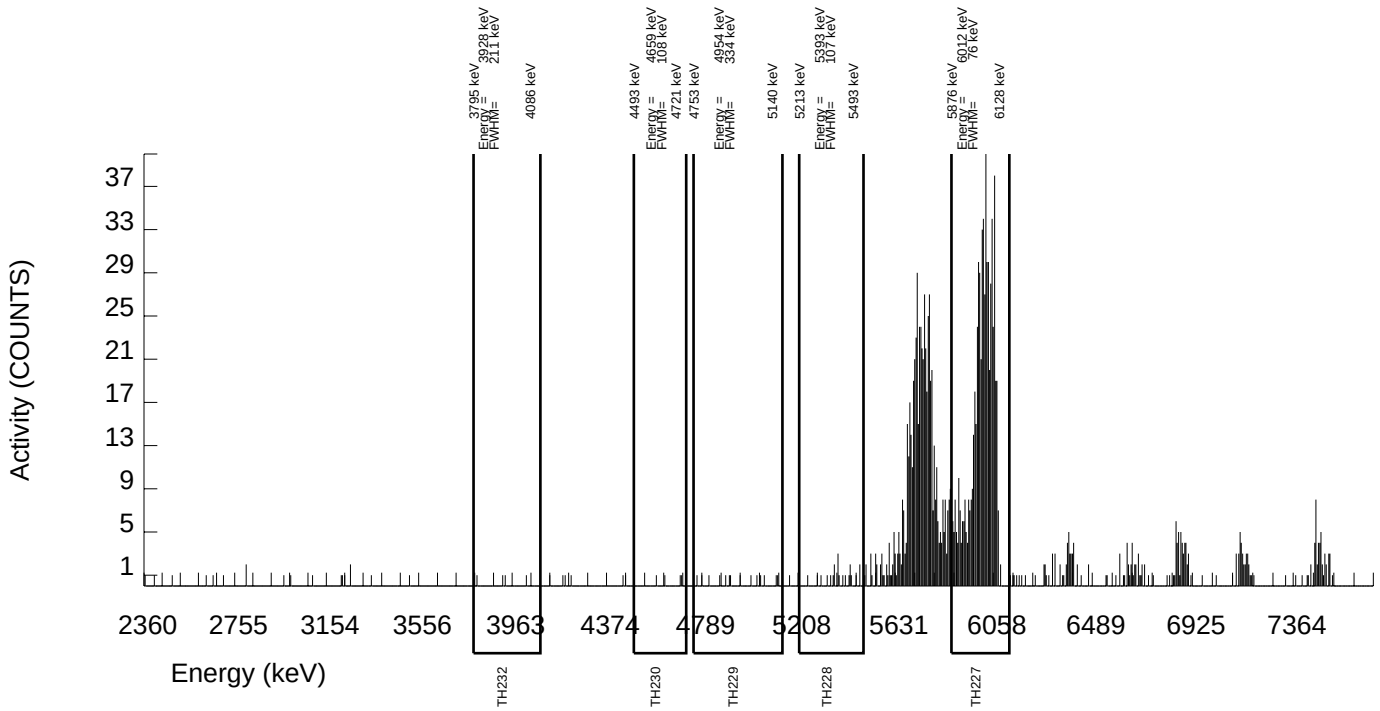
BATCH NUMBER: 923093 SAMPLE DATE : 29-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753014_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78773 AVERAGE %EFFICIENCY :32.3093 % YIELD : 95.991	COUNT DATE:20-NOV-2009 16:05:01 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.72812 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B040.CNF;1086 BKG DATE : 15-NOV-2009 EFF FILE : W040.CNF;311 CAL DATE : 4-NOV-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	661.000	652.000	9.000	3.0000	57.44000	2.19E+00	2.07E-01	5.69E-02	2.34E-02	1.70E-01
TH-228	5363.000	21.000	14.440	4.000	2.0000	99.94000	2.68E-02	1.73E-02	2.29E-02	8.65E-03	1.73E-02
TH229	4900.000	14.000	9.000	5.000	2.2361	99.52000	1.64E-02	1.56E-02	2.45E-02	9.49E-03	1.56E-02
TH-230	4625.000	4.000	3.000	1.000	1.0000	100.0000	5.45E-03	7.96E-03	1.39E-02	4.22E-03	7.96E-03
TH-232	3972.000	4.000	1.000	3.000	1.7321	100.0000	1.82E-03	9.42E-03	2.01E-02	7.32E-03	9.41E-03

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

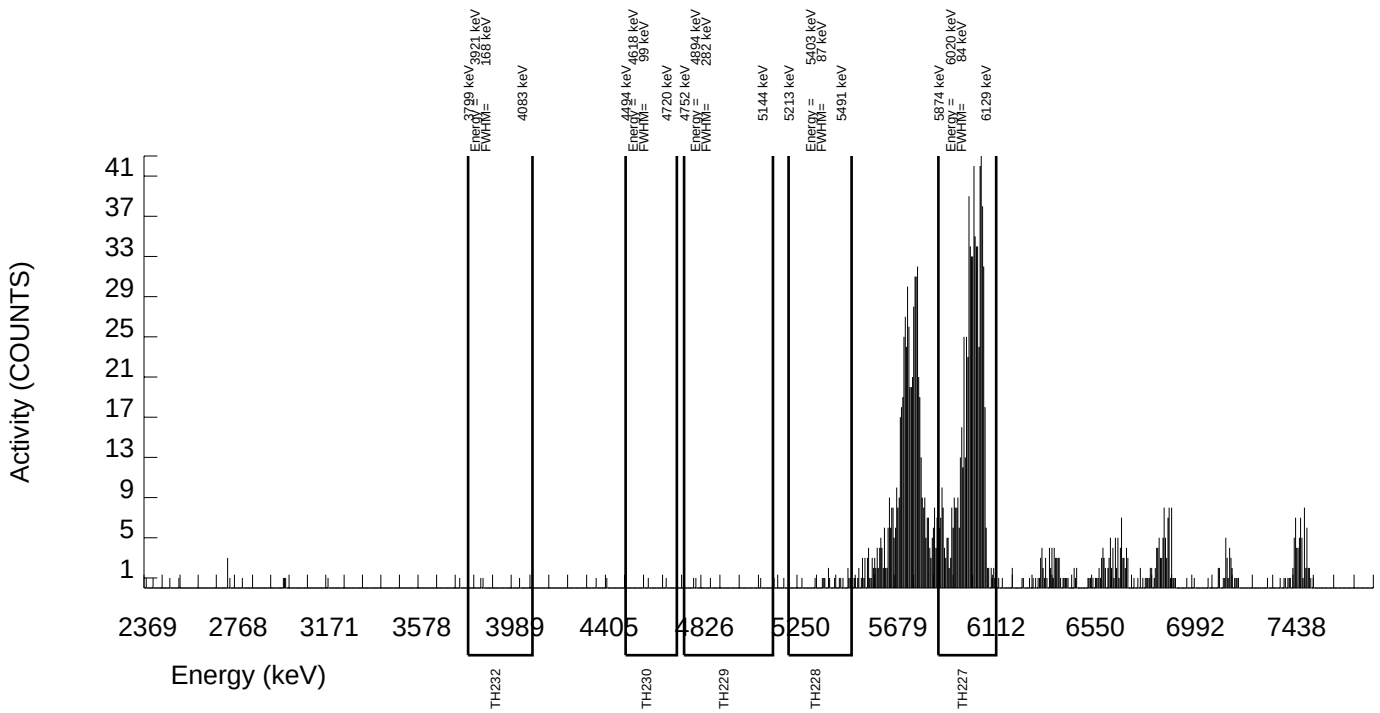
BATCH NUMBER: 923093 SAMPLE DATE : 30-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753015_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78205 AVERAGE %EFFICIENCY :33.2779 % YIELD : 104.204	COUNT DATE:20-NOV-2009 16:05:01 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.04708 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B041.CNF;1079 BKG DATE : 15-NOV-2009 EFF FILE : W041.CNF;315 CAL DATE : 4-NOV-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	745.000	729.000	16.000	4.0000	57.44000	2.19E+00	2.01E-01	6.48E-02	2.79E-02	1.62E-01
TH-228	5363.000	17.000	5.138	9.000	3.0000	99.94000	8.53E-03	1.57E-02	2.82E-02	1.16E-02	1.57E-02
TH229	4900.000	4.000	-8.000	12.000	3.4641	99.52000	-1.31E-02	1.28E-02	3.12E-02	1.31E-02	1.28E-02
TH-230	4625.000	3.000	-1.000	4.000	2.0000	100.0000	-1.62E-03	8.42E-03	2.00E-02	7.55E-03	8.42E-03
TH-232	3972.000	3.000	-1.000	4.000	2.0000	100.0000	-1.62E-03	8.42E-03	2.00E-02	7.55E-03	8.42E-03

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

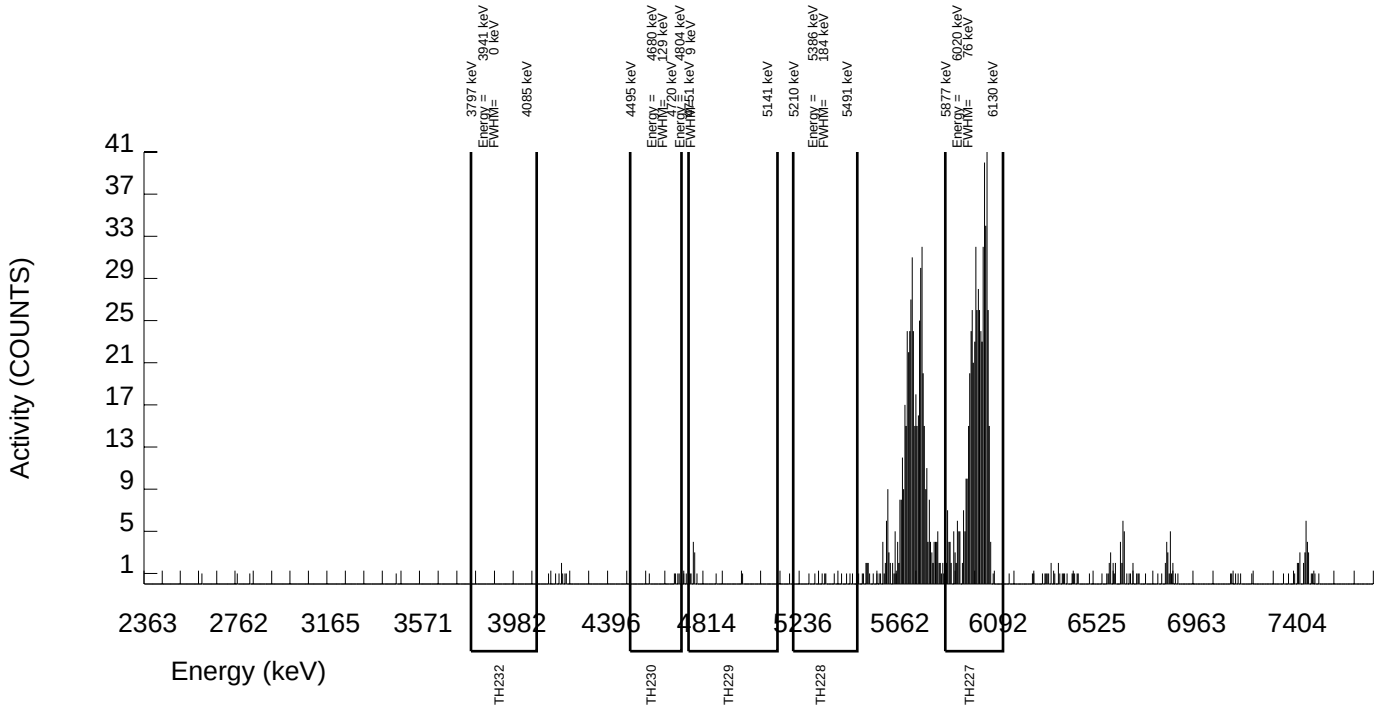
BATCH NUMBER: 923093 SAMPLE DATE : 2-NOV-2009 00:00:00. AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753016_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78902 AVERAGE %EFFICIENCY :25.8533 % YIELD : 102.931	COUNT DATE:20-NOV-2009 14:16:26 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.99764 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B201.CNF;72 BKG DATE : 15-NOV-2009 EFF FILE : W201.CNF;41 CAL DATE : 23-OCT-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	563.000	561.000	2.000	1.4142	57.44000	2.19E+00	2.17E-01	3.73E-02	1.28E-02	1.82E-01
TH-228	5363.000	10.000	7.899	0.000	0.0000	99.94000	1.70E-02	1.19E-02	6.47E-03	0.00E+00	1.19E-02
TH229	4900.000	12.000	9.000	3.000	1.7321	99.52000	1.91E-02	1.62E-02	2.35E-02	8.57E-03	1.61E-02
TH-230	4625.000	5.000	4.000	1.000	1.0000	100.0000	8.46E-03	1.02E-02	1.62E-02	4.92E-03	1.02E-02
TH-232	3972.000	0.000	-1.000	1.000	1.0000	100.0000	-2.12E-03	5.87E-03	1.62E-02	4.92E-03	5.86E-03

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

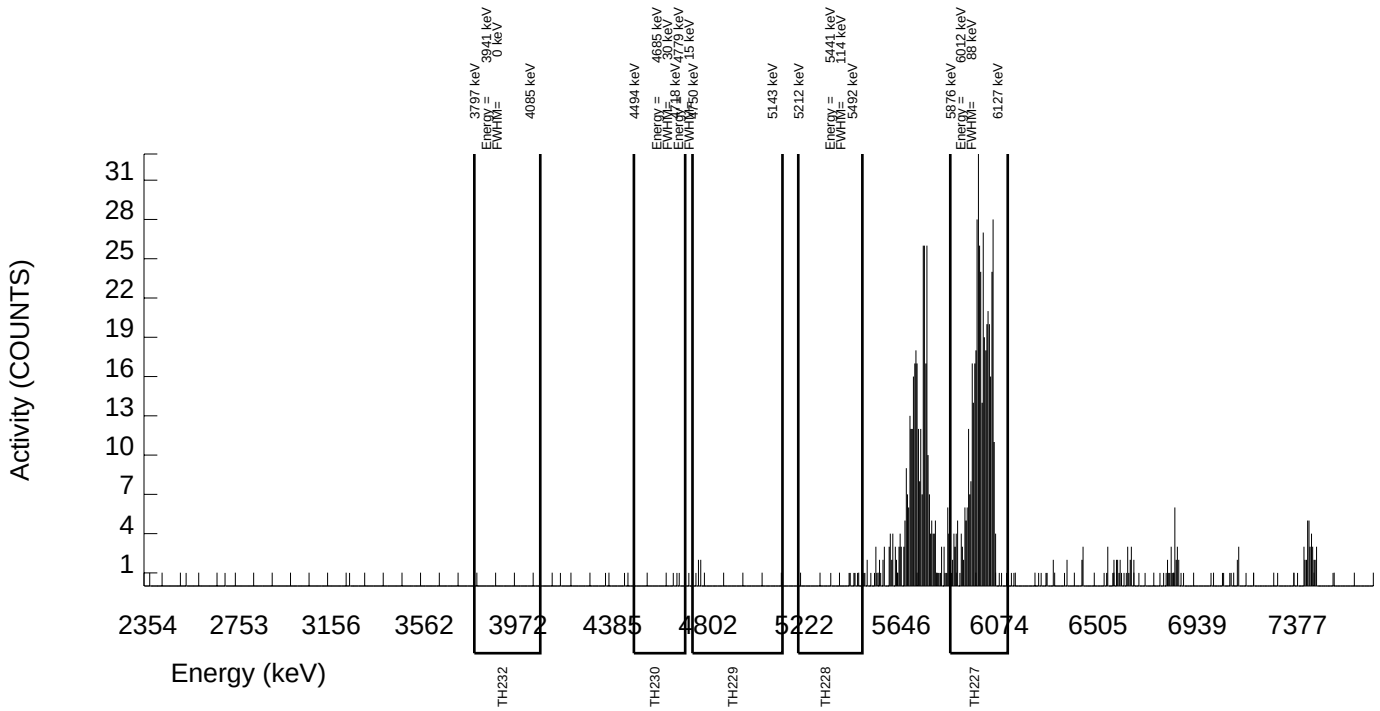
BATCH NUMBER: 923093 SAMPLE DATE : 2-NOV-2009 00:00:00. AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753017_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78903 AVERAGE %EFFICIENCY :26.7432 % YIELD : 84.429	COUNT DATE:20-NOV-2009 14:16:28 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.27907 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B202.CNF;72 BKG DATE : 15-NOV-2009 EFF FILE : W202.CNF;41 CAL DATE : 23-OCT-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	479.000	476.000	3.000	1.7321	57.44000	2.19E+00	2.30E-01	5.08E-02	1.85E-02	1.98E-01
TH-228	5363.000	6.000	2.218	2.000	1.4142	99.94000	5.64E-03	1.24E-02	2.44E-02	8.37E-03	1.24E-02
TH229	4900.000	6.000	6.000	0.000	0.0000	99.52000	1.50E-02	1.21E-02	7.52E-03	0.00E+00	1.20E-02
TH-230	4625.000	3.000	2.000	1.000	1.0000	100.0000	4.99E-03	9.78E-03	1.91E-02	5.80E-03	9.78E-03
TH-232	3972.000	0.000	-1.000	1.000	1.0000	100.0000	-2.49E-03	6.91E-03	1.91E-02	5.80E-03	6.91E-03

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

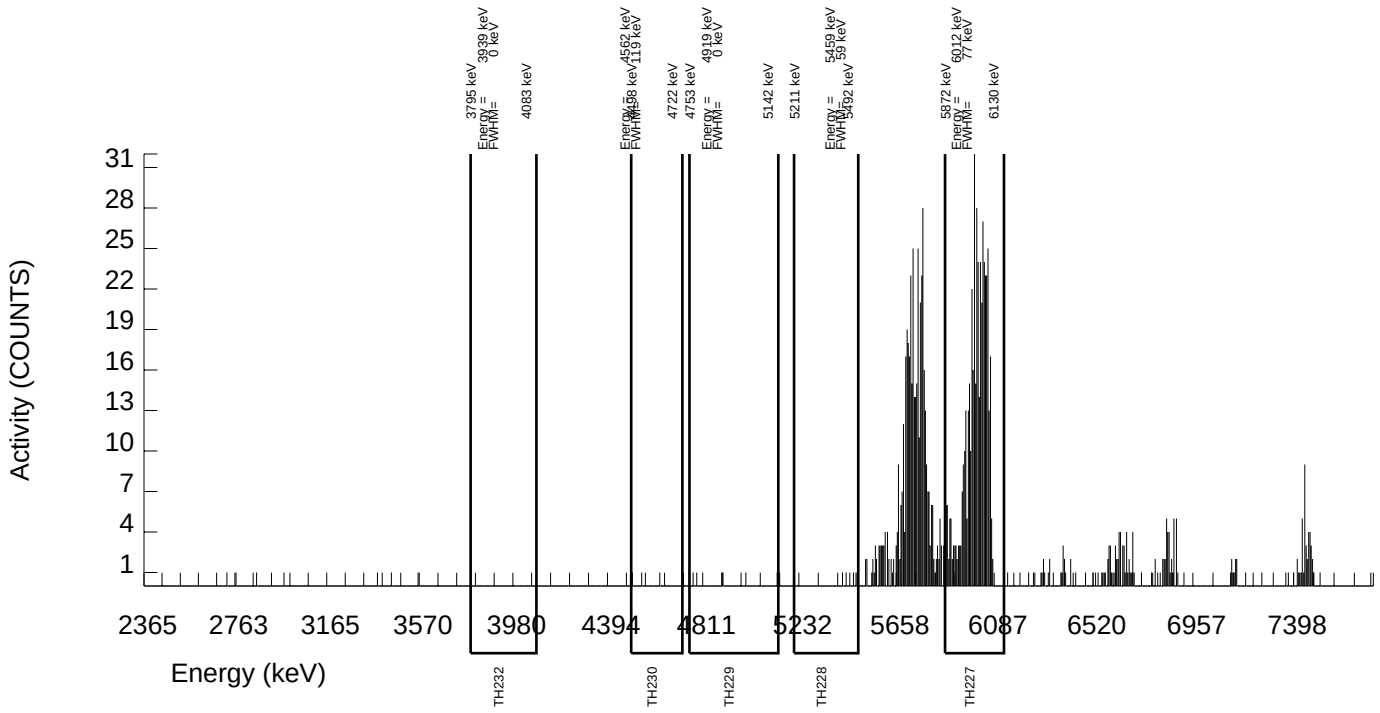
BATCH NUMBER: 923093 SAMPLE DATE : 2-NOV-2009 00:00:00. AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S0239753018_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78905 AVERAGE %EFFICIENCY :25.5537 % YIELD : 90.216	COUNT DATE:20-NOV-2009 14:16:31 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.50380 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B203.CNF;72 BKG DATE : 15-NOV-2009 EFF FILE : W203.CNF;42 CAL DATE : 23-OCT-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	487.000	486.000	1.000	1.0000	57.44000	2.19E+00	2.28E-01	3.44E-02	1.05E-02	1.95E-01
TH-228	5363.000	5.000	2.180	1.000	1.0000	99.94000	5.43E-03	9.98E-03	1.91E-02	5.79E-03	9.98E-03
TH229	4900.000	6.000	-2.000	8.000	2.8284	99.52000	-4.91E-03	1.80E-02	3.97E-02	1.61E-02	1.80E-02
TH-230	4625.000	3.000	1.000	2.000	1.4142	100.0000	2.44E-03	1.07E-02	2.34E-02	8.04E-03	1.07E-02
TH-232	3972.000	0.000	-1.000	1.000	1.0000	100.0000	-2.44E-03	6.77E-03	1.87E-02	5.68E-03	6.77E-03

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

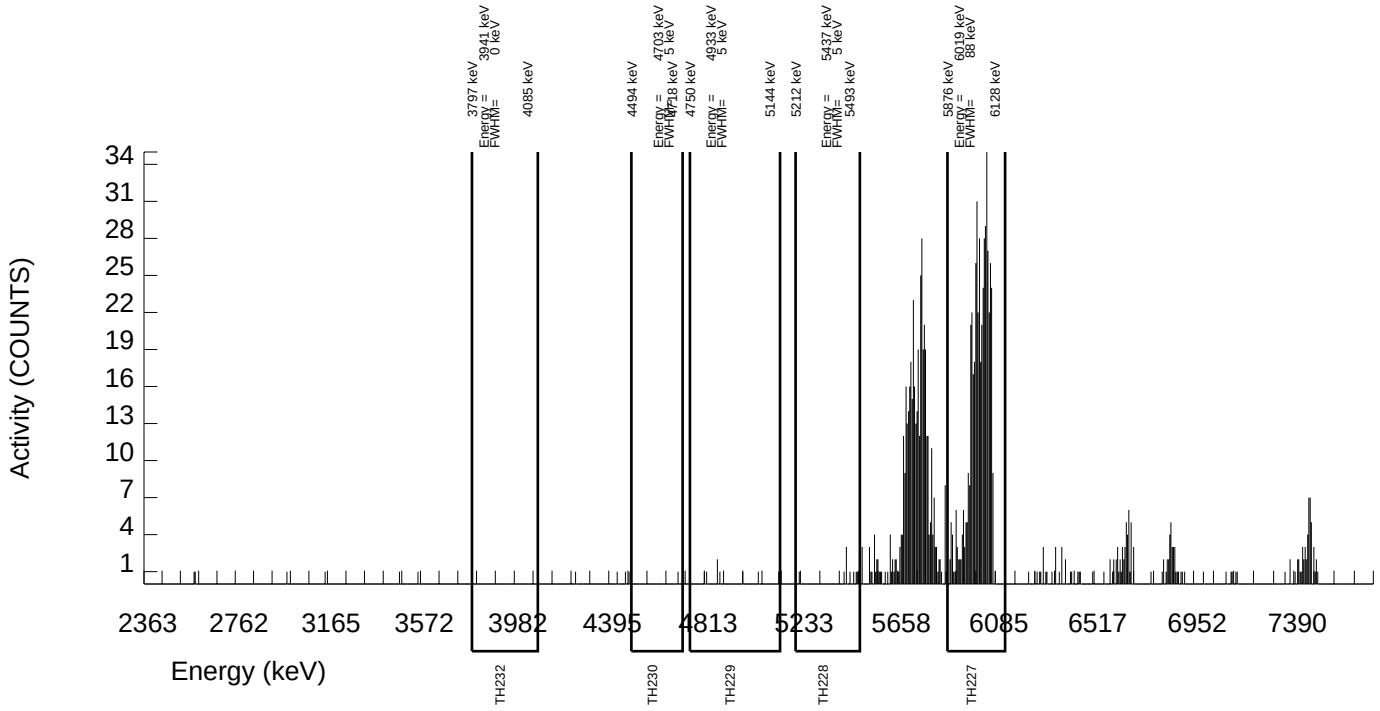
BATCH NUMBER: 923093 SAMPLE DATE : 18-NOV-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S1201973223_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78907 AVERAGE %EFFICIENCY :25.2254 % YIELD : 97.972	COUNT DATE:20-NOV-2009 14:16:33 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.80503 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B204.CNF;72 BKG DATE : 15-NOV-2009 EFF FILE : W204.CNF;41 CAL DATE : 23-OCT-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	524.000	521.000	3.000	1.7321	57.44000	2.19E+00	2.23E-01	4.64E-02	1.69E-02	1.89E-01
TH-228	5363.000	10.000	2.049	6.000	2.4495	99.94000	4.68E-03	1.68E-02	3.29E-02	1.30E-02	1.68E-02
TH229	4900.000	8.000	-2.000	10.000	3.1623	99.52000	-4.58E-03	1.90E-02	4.06E-02	1.68E-02	1.90E-02
TH-230	4625.000	1.000	-3.000	4.000	2.0000	100.0000	-6.84E-03	9.99E-03	2.80E-02	1.06E-02	9.99E-03
TH-232	3972.000	0.000	-9.000	9.000	3.0000	100.0000	-2.05E-02	1.41E-02	3.86E-02	1.59E-02	1.41E-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

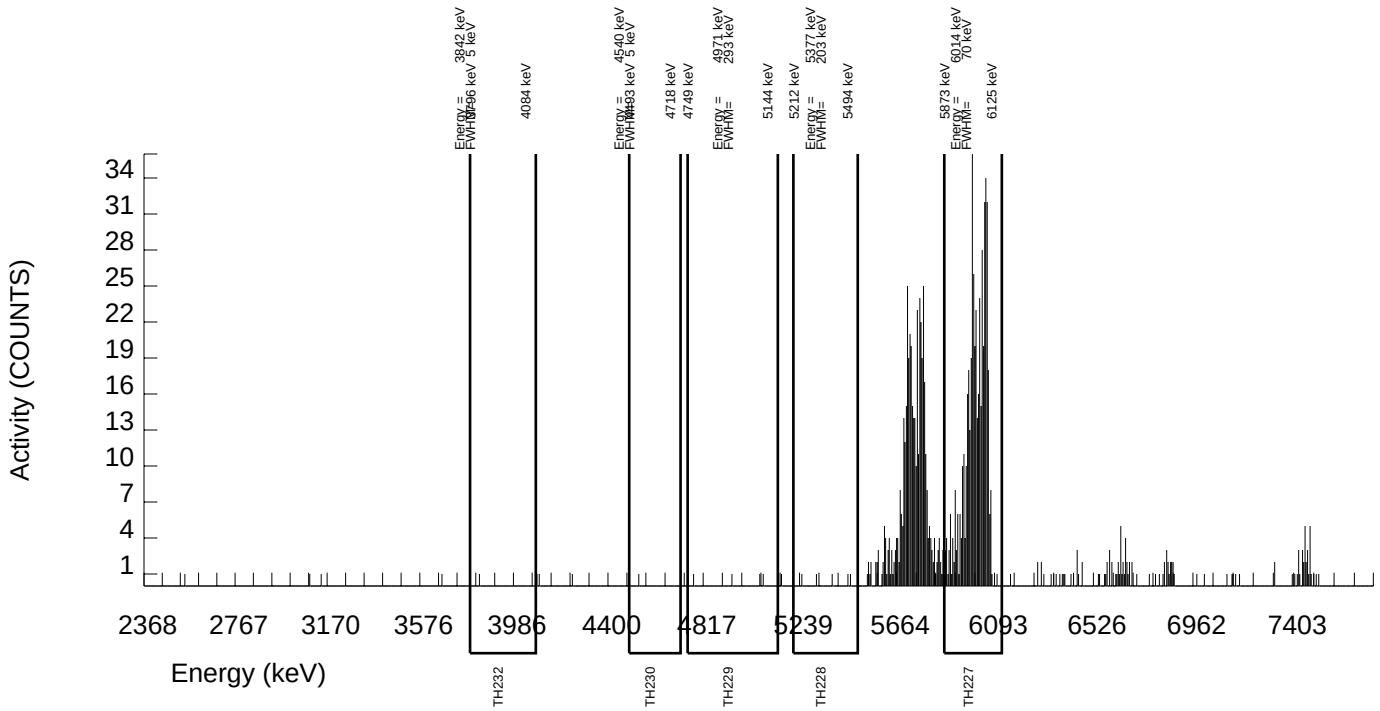
BATCH NUMBER: 923093 SAMPLE DATE : 23-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S1201973224_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78908 AVERAGE %EFFICIENCY :25.3700 % YIELD : 95.543	COUNT DATE:20-NOV-2009 14:16:36 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 3.71072 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B205.CNF;72 BKG DATE : 15-NOV-2009 EFF FILE : W205.CNF;41 CAL DATE : 23-OCT-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	513.000	511.000	2.000	1.4142	57.44000	2.19E+00	2.24E-01	4.10E-02	1.41E-02	1.90E-01
TH-228	5363.000	5.000	2.086	1.000	1.0000	99.94000	4.99E-03	9.48E-03	1.83E-02	5.56E-03	9.48E-03
TH229	4900.000	4.000	4.000	0.000	0.0000	99.52000	9.34E-03	9.16E-03	7.00E-03	0.00E+00	9.15E-03
TH-230	4625.000	1.000	1.000	0.000	0.0000	100.0000	2.32E-03	4.55E-03	6.97E-03	0.00E+00	4.55E-03
TH-232	3972.000	1.000	1.000	0.000	0.0000	100.0000	2.32E-03	4.55E-03	6.97E-03	0.00E+00	4.55E-03

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

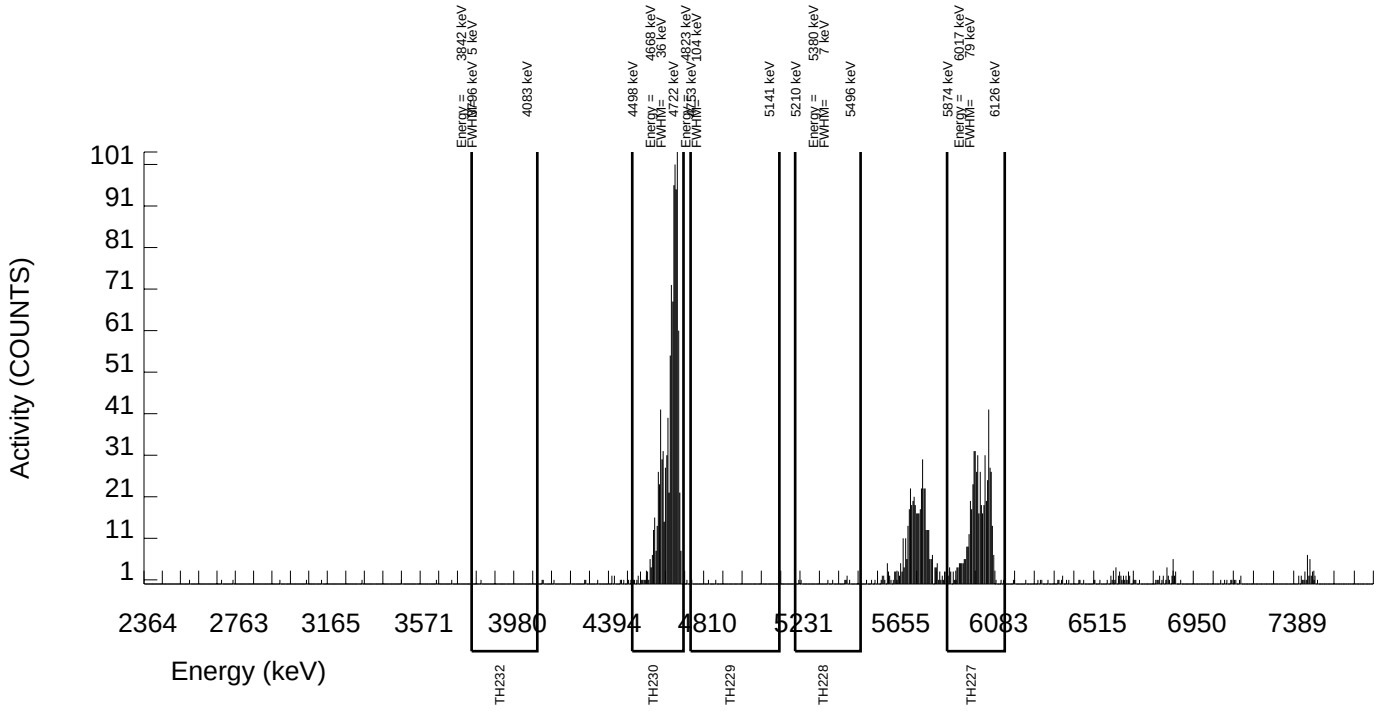
BATCH NUMBER: 923093 SAMPLE DATE : 23-OCT-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S1201973225_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78909 AVERAGE %EFFICIENCY :25.5419 % YIELD : 104.929	COUNT DATE:20-NOV-2009 14:16:37 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.07524 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B206.CNF;72 BKG DATE : 15-NOV-2009 EFF FILE : W206.CNF;41 CAL DATE : 23-OCT-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	570.000	565.000	5.000	2.2361	57.44000	2.19E+00	2.17E-01	5.19E-02	2.01E-02	1.82E-01
TH-228	5363.000	9.000	0.884	6.000	2.4495	99.94000	1.91E-03	1.52E-02	3.11E-02	1.23E-02	1.52E-02
TH229	4900.000	3.000	0.000	3.000	1.7321	99.52000	0.00E+00	1.01E-02	2.33E-02	8.51E-03	1.01E-02
TH-230	4625.000	1060.000	1059.000	1.000	1.0000	100.0000	2.22E+00	1.80E-01	1.61E-02	4.89E-03	1.34E-01
TH-232	3972.000	1.000	0.000	1.000	1.0000	100.0000	0.00E+00	5.82E-03	1.61E-02	4.89E-03	5.82E-03

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

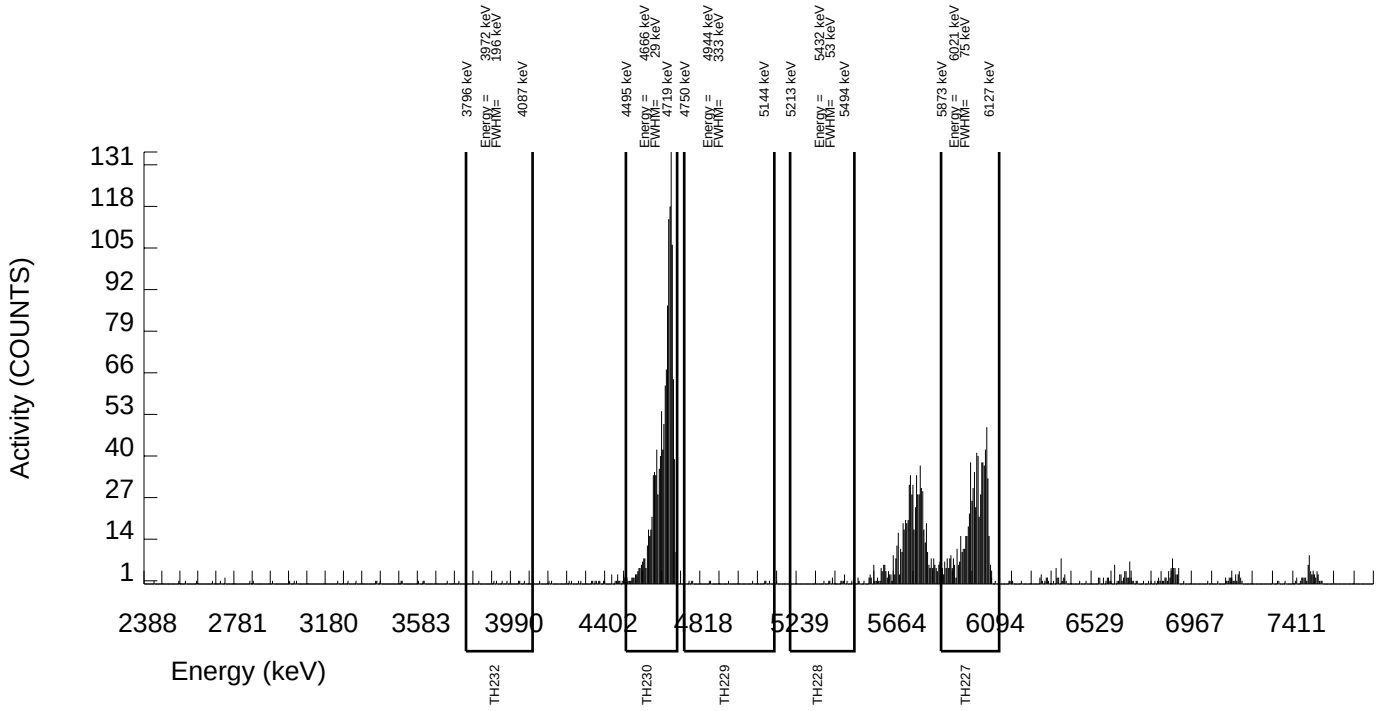
BATCH NUMBER: 923093 SAMPLE DATE : 18-NOV-2009 00:00:00 AC-227 SEPARATION : 19-NOV-2009 09:55:00	SAMPLE ID : S1201973226_TH SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78793 AVERAGE %EFFICIENCY :33.4222 % YIELD : 108.024	COUNT DATE:20-NOV-2009 16:05:01 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : A2796-J ISOTOPE : TH-230 PCI/L : 2.675E+00	ID : 0387-B-102 ISOTOPE : AC-227 NOMINAL : 3.88381 dpm RESULTS : 4.19543 dpm	LIB FILE : ENV_ALPHA_TH.N BKG FILE : B042.CNF;1078 BKG DATE : 15-NOV-2009 EFF FILE : W042.CNF;288 CAL DATE : 4-NOV-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	772.000	759.000	13.000	3.6056	57.44000	2.19E+00	1.97E-01	5.70E-02	2.42E-02	1.58E-01
TH-228	5363.000	13.000	1.020	9.000	3.0000	99.94000	1.60E-03	1.34E-02	2.65E-02	1.09E-02	1.34E-02
TH229	4900.000	10.000	2.000	8.000	2.8284	99.52000	3.13E-03	1.30E-02	2.53E-02	1.03E-02	1.30E-02
TH-230	4625.000	1350.000	1350.000	0.000	0.0000	100.0000	2.11E+00	1.60E-01	4.68E-03	0.00E+00	1.12E-01
TH-232	3972.000	8.000	6.000	2.000	1.4142	100.0000	9.36E-03	9.68E-03	1.49E-02	5.13E-03	9.67E-03

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.



URANIUM

Radiochemistry Batch Checklist, Rev 9

Batch# 923094 Product: d Date: 11/28/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to100 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.		✓	NCM# 762546
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.		✓	NCM# 762546
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 statused.	✓		
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.	✓		NCM# 762546
Batch non-conformances second reviewed and disposition verified to be completed.	✓		NCM# 762546
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: 11/28/09

Secondary Review Performed By: 11/30/09

11/26-12/7

Uranium Que Sheet

16-NOV-09

Batch #: 923094 Analyst: KXM4 First Client Due Date:07-DEC-09 Internal Due Date26-NOV-09

Tracer Isotope: U-232/U-236 Tracer Code: 1283-E Expiration Date: 1-15-10 Vol: 0.1ml

LCS Isotope: U-238 LCS Code: 1163-G Expiration Date: 4-16-10 Vol: 0.1ml

Spike Isotope: U-238 Spike Code: 1163-G Expiration Date: 4-16-10 Vol: 0.1ml

Prep Date: 11-17-09 Initials: KM Pipet ID: 2971058 Balance ID: 1675820 Witness: KM 11/17/09

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collection Date	Pos.	Label #	Wet/Dry Aliquot (g) (ml)	U Det #
239753001-1	M-141B	SAMPLE		.03 pCi/L	WATER	KERR003	23-OCT-09	1	1	800.0	138
239753002-1	M-141009B	SAMPLE		.03 pCi/L	WATER	KERR003	23-OCT-09	2	2	800.0	139
239753003-1	PB102309-A3	SAMPLE		.03 pCi/L	WATER	KERR003	23-OCT-09	3	3	800.0	140
239753004-1	M-145B	SAMPLE		.03 pCi/L	WATER	KERR003	26-OCT-09	4	4	800.0	141
239753005-1	M-139B	SAMPLE		.03 pCi/L	WATER	KERR003	26-OCT-09	5	5	800.0	142
239753006-1	M-146B	SAMPLE		.03 pCi/L	WATER	KERR003	27-OCT-09	6	6	800.0	143
239753007-1	M-144B	SAMPLE		.03 pCi/L	WATER	KERR003	27-OCT-09	7	7	800.0	144
239753008-1	M-138B	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	8	8	800.0	145
239753009-1	M-138009B	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	9	9	800.0	146
239753010-1	M-138BDISS	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	10	10	800.0	147
239753011-1	M-138009BDISS	SAMPLE		.03 pCi/L	WATER	KERR003	28-OCT-09	11	11	800.0	148
239753012-1	M-137B	SAMPLE		.03 pCi/L	WATER	KERR003	29-OCT-09	12	12	800.0	149
239753013-1	M-137BDISS	SAMPLE		.03 pCi/L	WATER	KERR003	29-OCT-09	13	13	800.0	150
239753014-1	M-148B	SAMPLE		.03 pCi/L	WATER	KERR003	29-OCT-09	14	14	800.0	151
239753015-1	EB103009-GWA4	SAMPLE		.03 pCi/L	WATER	KERR003	30-OCT-09	15	15	800.0	152
239753016-1	M-147B	SAMPLE		.03 pCi/L	WATER	KERR003	02-NOV-09	16	16	800.0	153
239753017-1	M-147009B	SAMPLE		.03 pCi/L	WATER	KERR003	02-NOV-09	17	17	800.0	154
239753018-1	EB110209-GWA3	SAMPLE		.03 pCi/L	WATER	KERR003	02-NOV-09	18	18	800.0	155
1201973227-1	MB for batch 923094	MB		.03 pCi/L	WATER	QC ACCOUNT		19	19	~~800~~ 800	121
1201973228-1	M-145B(239753004DUP)	DUP		.03 pCi/L	WATER	QC ACCOUNT	26-OCT-09	20	20	800.0	122
1201973229-1	M-145B(239753004MS)	MS		.03 pCi/L	WATER	QC ACCOUNT	26-OCT-09	21	21	800.0	123
1201973230-1	LCS for batch 923094	LCS		.03 pCi/L	WATER	QC ACCOUNT		22	22	~~800~~ 800	124

11/20/09

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~~ NA KM 11-17-09
Circle One

Data Reviewed By: 11/28/09
11/20/09

GEL Laboratories LLC, Radiochemistry Division

GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

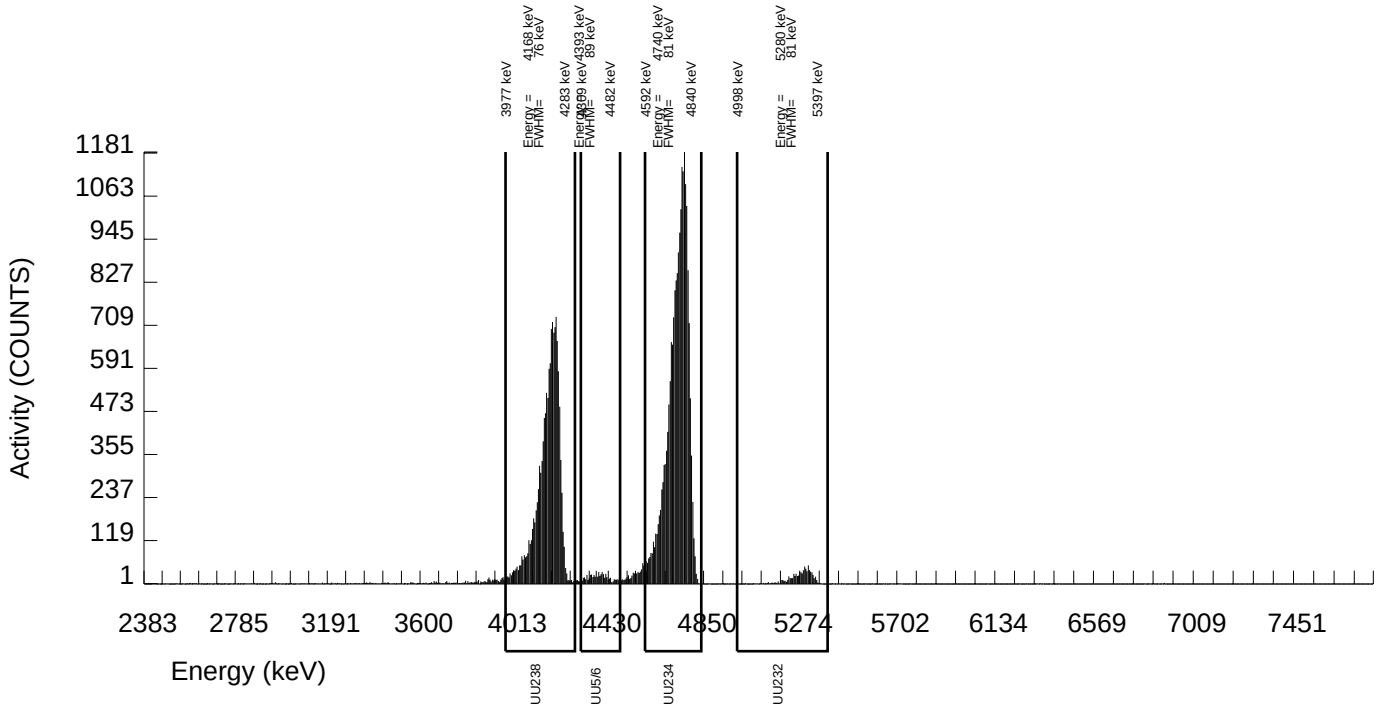
BATCH NUMBER: 923094 SAMPLE DATE : 23-OCT-2009 00:00:00	SAMPLE ID : S0239753001_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :65877 AVERAGE %EFFICIENCY :25.4206 % YIELD : 59.440	COUNT DATE:21-NOV-2009 15:52:09 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25236 dpm RESULTS : 3.12198 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B138.CNF;370 BKG DATE : 15-NOV-2009 EFF FILE : W138.CNF;98 CAL DATE : 18-NOV-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	20548.000	20527.199	20.000	4.4721	100.0000	7.65E+01	1.10E+01	8.87E-02	3.88E-02	1.05E+00
U232	5302.100	803.000	793.000	10.000	3.1623	100.0000	2.96E+00	4.71E-01	6.61E-02	2.74E-02	2.08E-01
U-235	4391.000	623.000	619.000	4.000	2.0000	80.90000	2.85E+00	4.66E-01	5.67E-02	2.14E-02	2.26E-01
U-238	4184.730	13219.000	13212.000	7.000	2.6458	100.0000	4.92E+01	7.09E+00	5.71E-02	2.29E-02	8.40E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

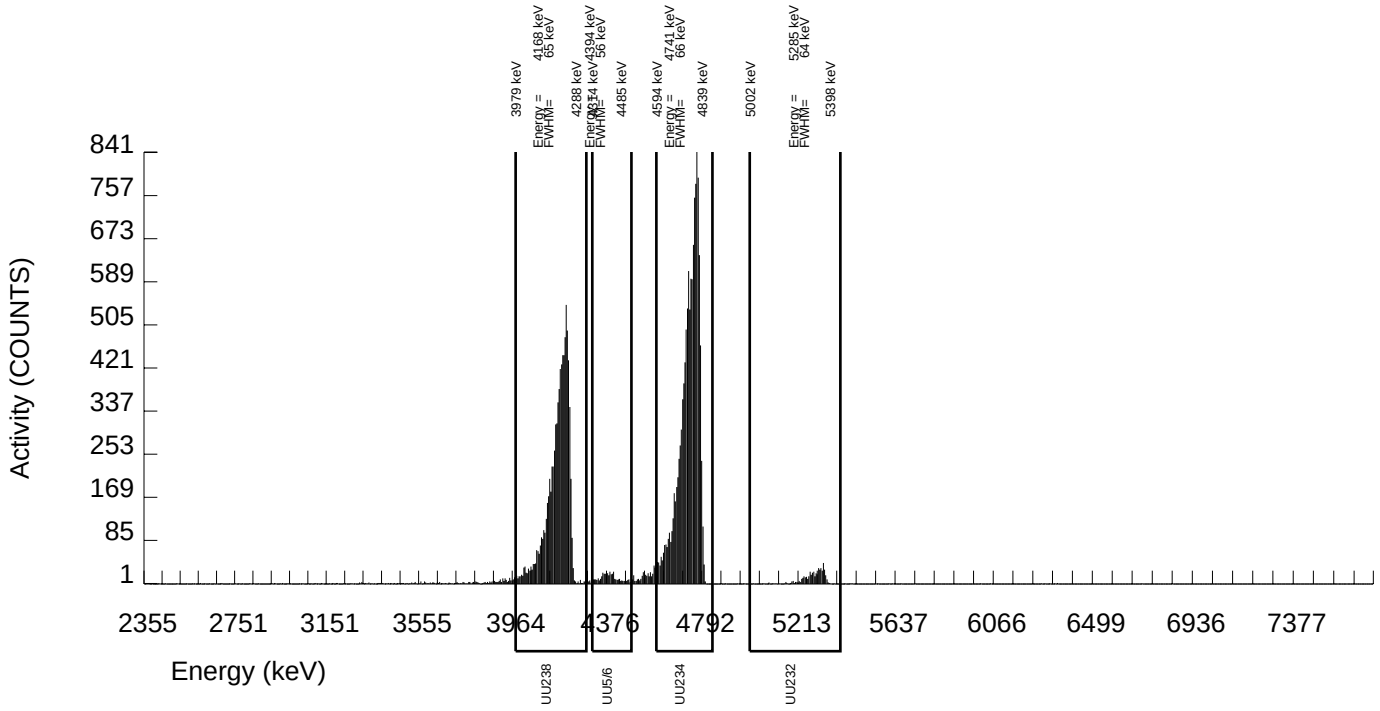
BATCH NUMBER: 923094 SAMPLE DATE : 23-OCT-2009 00:00:00	SAMPLE ID : S0239753002_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :76231 AVERAGE %EFFICIENCY :24.9134 % YIELD : 37.552	COUNT DATE:21-NOV-2009 15:52:12 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25236 dpm RESULTS : 1.97238 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B139.CNF;367 BKG DATE : 15-NOV-2009 EFF FILE : W139.CNF;98 CAL DATE : 18-NOV-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	12500.000	12480.505	19.000	4.3589	100.0000	7.51E+01	1.18E+01	1.40E-01	6.10E-02	1.32E+00
U232	5302.100	505.000	491.000	14.000	3.7417	100.0000	2.96E+00	5.35E-01	1.23E-01	5.24E-02	2.69E-01
U-235	4391.000	397.000	396.000	1.000	1.0000	80.90000	2.95E+00	5.45E-01	5.69E-02	1.73E-02	2.91E-01
U-238	4184.730	8431.000	8423.000	8.000	2.8284	100.0000	5.07E+01	8.01E+00	9.73E-02	3.96E-02	1.08E+00

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

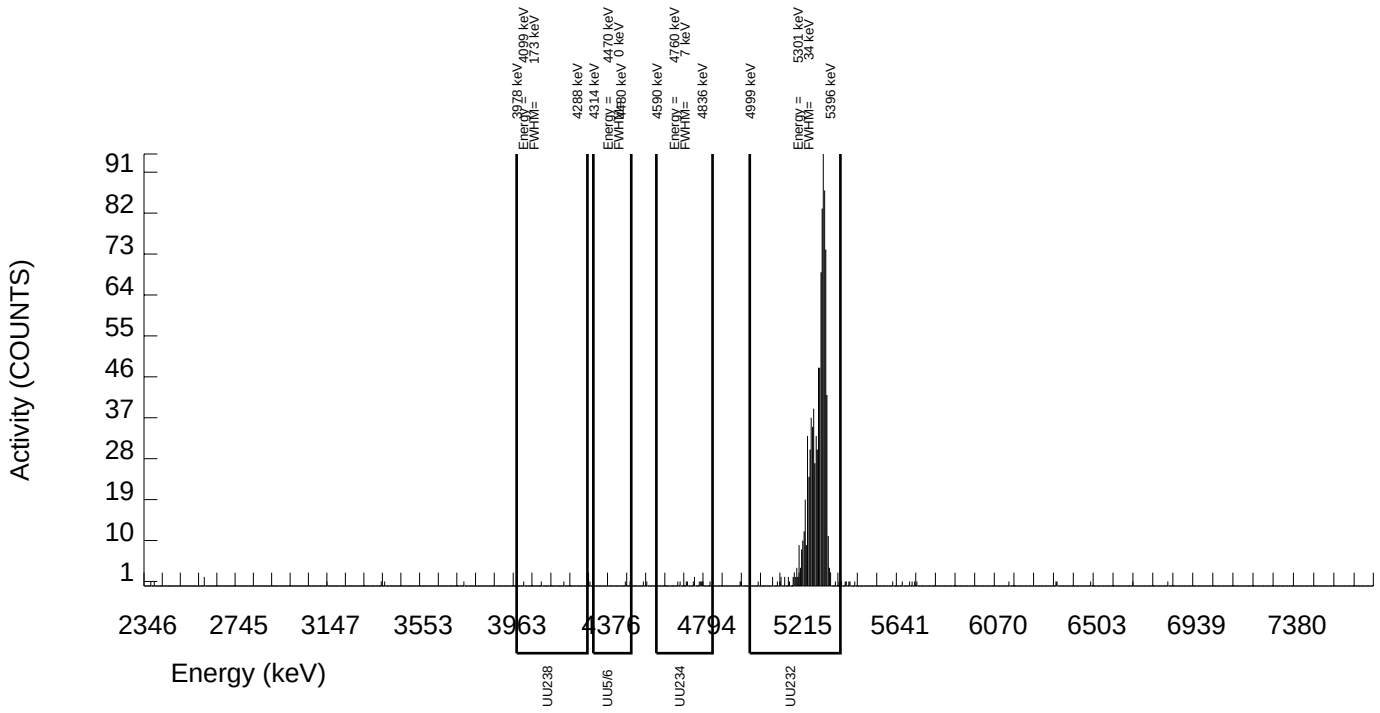
BATCH NUMBER: 923094 SAMPLE DATE : 23-OCT-2009 00:00:00	SAMPLE ID : S0239753003_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :78771 AVERAGE %EFFICIENCY :25.5118 % YIELD : 70.430	COUNT DATE:21-NOV-2009 15:52:14 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25236 dpm RESULTS : 3.69925 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B140.CNF;367 BKG DATE : 15-NOV-2009 EFF FILE : W140.CNF;103 CAL DATE : 18-NOV-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	12.000	-0.952	12.000	3.4641	100.0000	-2.98E-03	2.95E-02	5.99E-02	2.53E-02	2.95E-02
U232	5302.100	950.000	943.000	7.000	2.6458	100.0000	2.96E+00	4.56E-01	4.80E-02	1.93E-02	1.90E-01
U-235	4391.000	2.000	0.000	2.000	1.4142	80.90000	0.00E+00	1.52E-02	3.71E-02	1.27E-02	1.52E-02
U-238	4184.730	3.000	-2.000	5.000	2.2361	100.0000	-6.27E-03	1.74E-02	4.20E-02	1.63E-02	1.74E-02

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

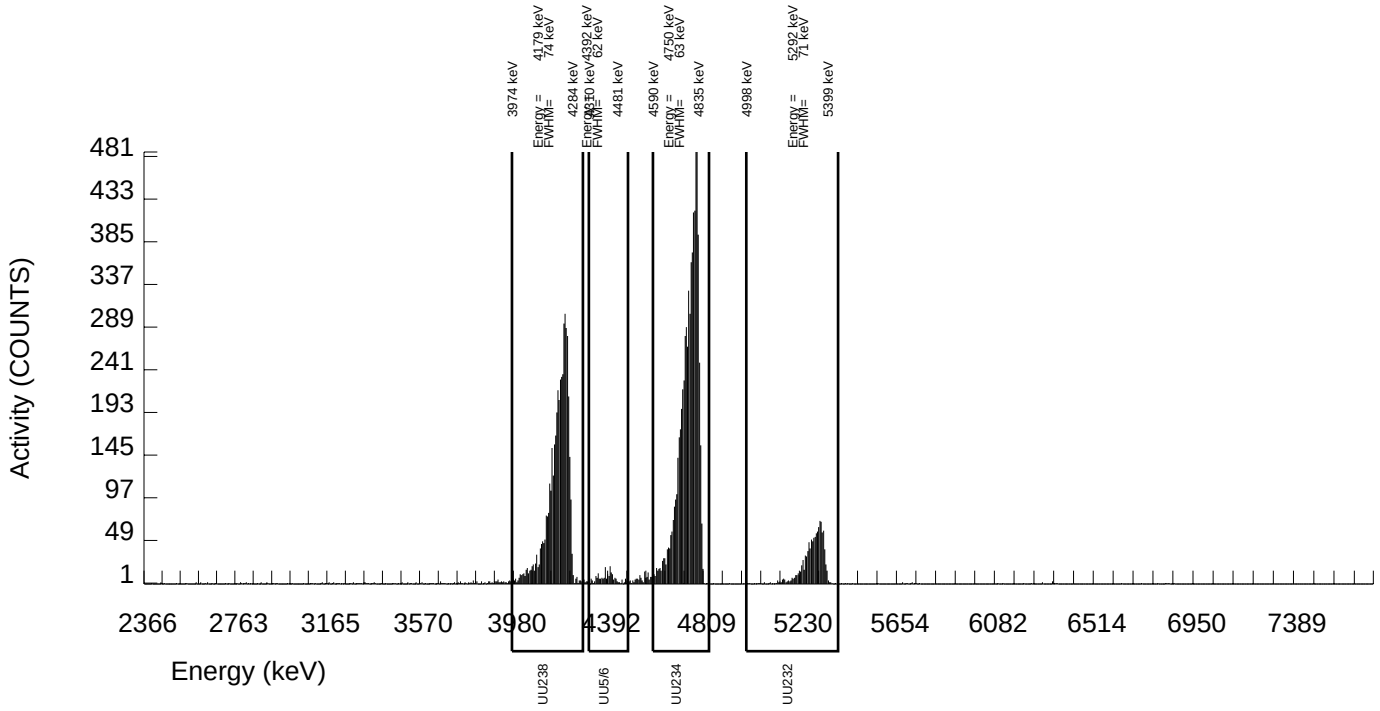
BATCH NUMBER: 923094 SAMPLE DATE : 26-OCT-2009 00:00:00	SAMPLE ID : S0239753004_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :76232 AVERAGE %EFFICIENCY :25.5443 % YIELD : 82.649	COUNT DATE:21-NOV-2009 15:52:17 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25193 dpm RESULTS : 4.34065 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B141.CNF;370 BKG DATE : 15-NOV-2009 EFF FILE : W141.CNF;101 CAL DATE : 18-NOV-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	6843.000	6835.882	6.000	2.4495	100.0000	1.82E+01	2.60E+00	3.84E-02	1.52E-02	4.33E-01
U232	5302.100	1114.000	1108.000	6.000	2.4495	100.0000	2.96E+00	4.51E-01	3.84E-02	1.52E-02	1.75E-01
U-235	4391.000	216.000	213.000	3.000	1.7321	80.90000	7.02E-01	1.37E-01	3.65E-02	1.33E-02	9.56E-02
U-238	4184.730	4598.000	4591.000	7.000	2.6458	100.0000	1.22E+01	1.76E+00	4.08E-02	1.64E-02	3.55E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

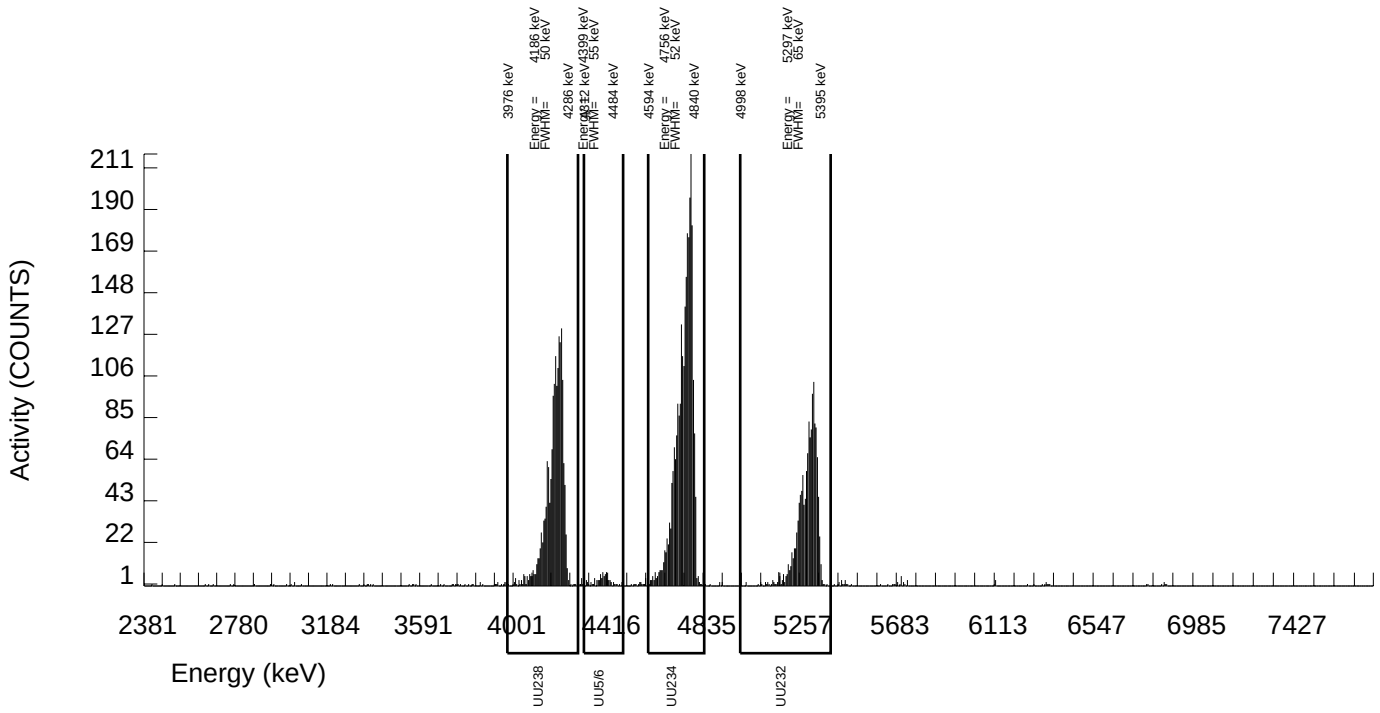
BATCH NUMBER: 923094 SAMPLE DATE : 26-OCT-2009 00:00:00	SAMPLE ID : S0239753005_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :64261 AVERAGE %EFFICIENCY :25.8306 % YIELD : 99.436	COUNT DATE:21-NOV-2009 15:52:19 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25193 dpm RESULTS : 5.22232 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B142.CNF;364 BKG DATE : 15-NOV-2009 EFF FILE : W142.CNF;105 CAL DATE : 18-NOV-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	2656.000	2633.640	21.000	4.5826	100.0000	5.77E+00	8.14E-01	5.33E-02	2.34E-02	2.22E-01
U232	5302.100	1368.000	1348.000	20.000	4.4721	100.0000	2.96E+00	4.32E-01	5.22E-02	2.28E-02	1.60E-01
U-235	4391.000	78.000	77.000	1.000	1.0000	80.90000	2.09E-01	5.50E-02	2.07E-02	6.30E-03	4.72E-02
U-238	4184.730	1742.000	1739.000	3.000	1.7321	100.0000	3.81E+00	5.47E-01	2.42E-02	8.83E-03	1.79E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

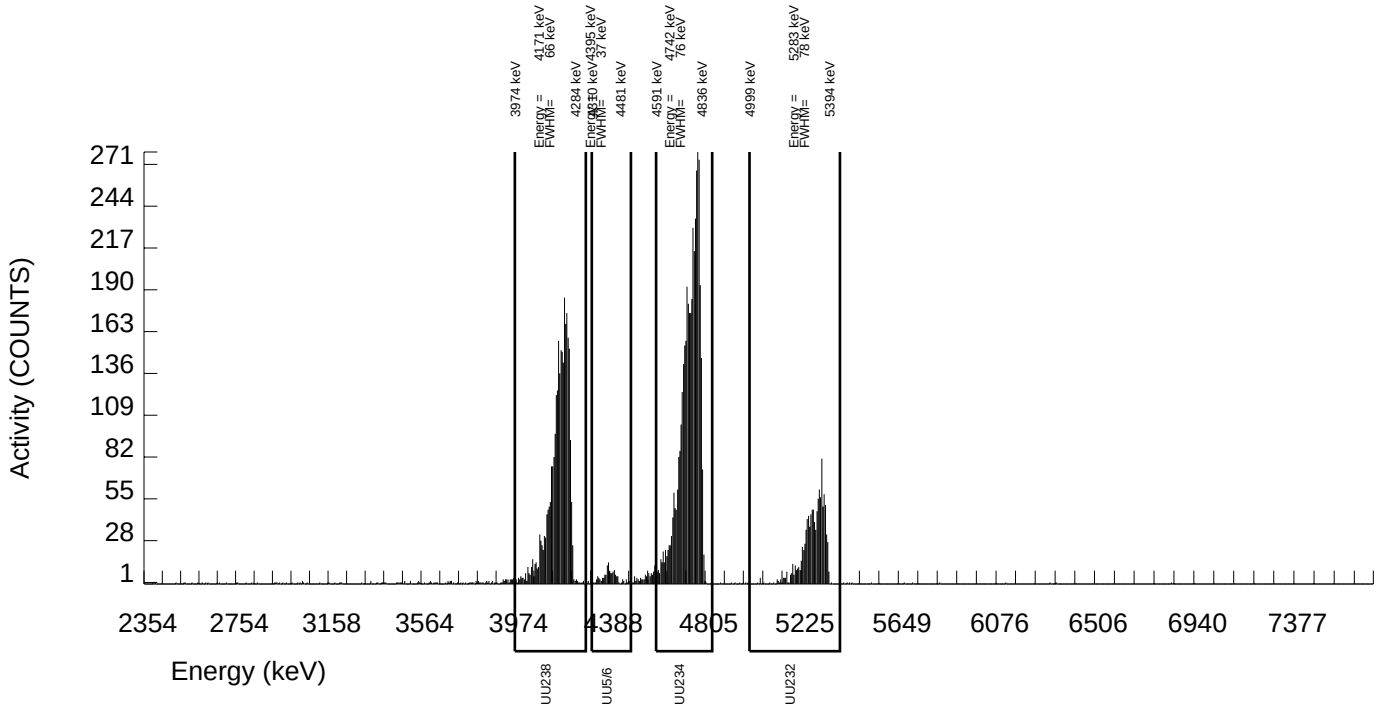
BATCH NUMBER: 923094 SAMPLE DATE : 27-OCT-2009 00:00:00	SAMPLE ID : S0239753006_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :65882 AVERAGE %EFFICIENCY :24.3577 % YIELD : 86.284	COUNT DATE:21-NOV-2009 15:52:22 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25179 dpm RESULTS : 4.53145 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B143.CNF;367 BKG DATE : 15-NOV-2009 EFF FILE : W143.CNF;108 CAL DATE : 18-NOV-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	4202.000	4188.887	12.000	3.4641	100.0000	1.12E+01	1.61E+00	5.12E-02	2.16E-02	3.41E-01
U232	5302.100	1113.000	1103.000	10.000	3.1623	100.0000	2.96E+00	4.52E-01	4.75E-02	1.97E-02	1.76E-01
U-235	4391.000	137.000	134.000	3.000	1.7321	80.90000	4.44E-01	9.90E-02	3.66E-02	1.33E-02	7.68E-02
U-238	4184.730	2850.000	2845.000	5.000	2.2361	100.0000	7.62E+00	1.11E+00	3.59E-02	1.39E-02	2.81E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

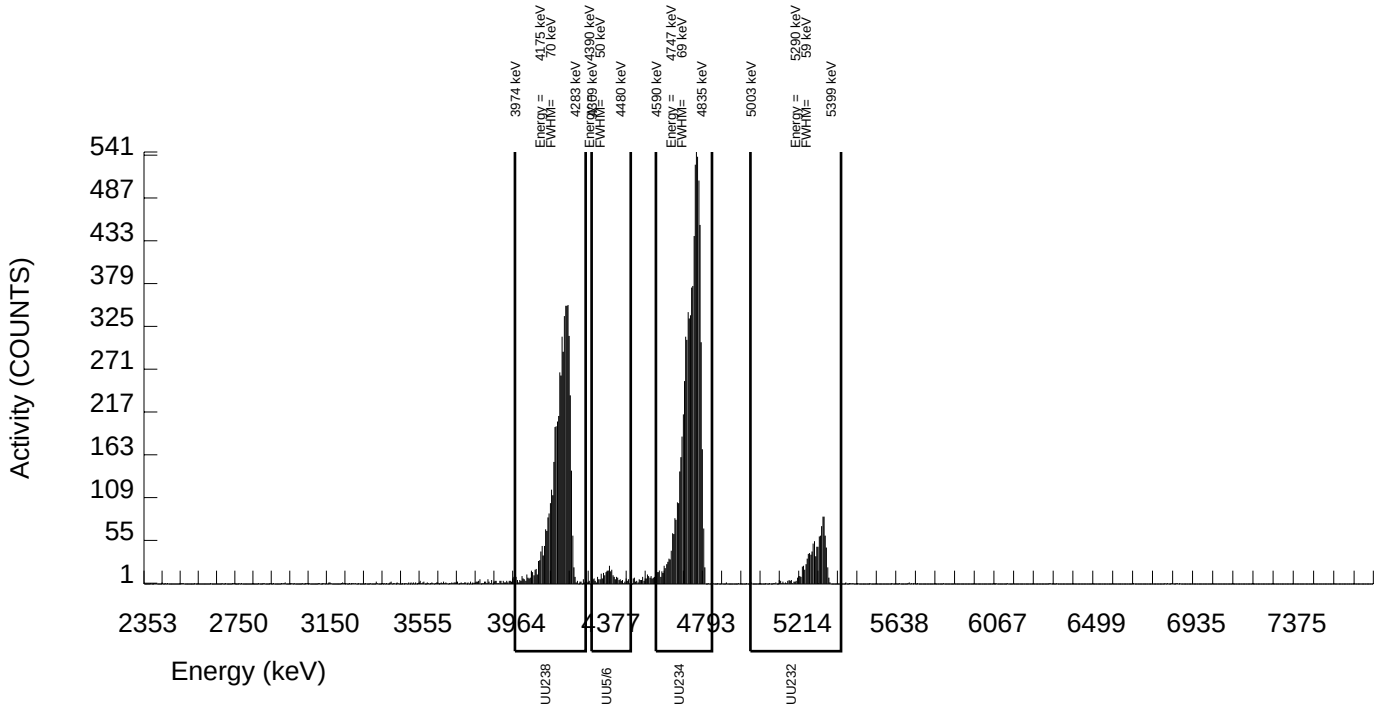
BATCH NUMBER: 923094 SAMPLE DATE : 27-OCT-2009 00:00:00	SAMPLE ID : S0239753007_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :75551 AVERAGE %EFFICIENCY :25.0940 % YIELD : 82.993	COUNT DATE:21-NOV-2009 15:52:24 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25180 dpm RESULTS : 4.35860 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B144.CNF;366 BKG DATE : 15-NOV-2009 EFF FILE : W144.CNF;102 CAL DATE : 18-NOV-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	7729.000	7720.897	7.000	2.6458	100.0000	2.09E+01	2.92E+00	4.14E-02	1.66E-02	4.66E-01
U232	5302.100	1103.000	1093.000	10.000	3.1623	100.0000	2.96E+00	4.45E-01	4.79E-02	1.99E-02	1.77E-01
U-235	4391.000	284.000	278.000	6.000	2.4495	80.90000	9.29E-01	1.70E-01	4.81E-02	1.90E-02	1.12E-01
U-238	4184.730	5363.000	5360.000	3.000	1.7321	100.0000	1.45E+01	2.04E+00	2.99E-02	1.09E-02	3.88E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

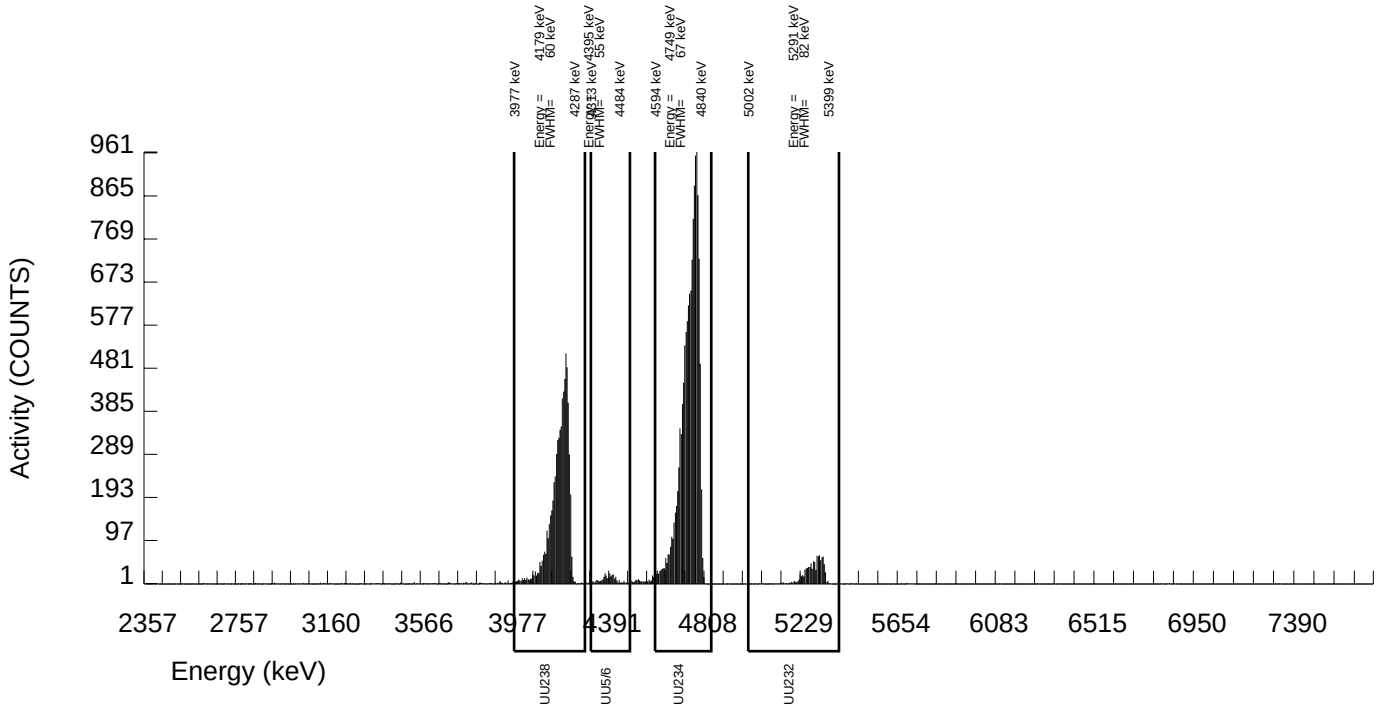
BATCH NUMBER: 923094 SAMPLE DATE : 28-OCT-2009 00:00:00	SAMPLE ID : S0239753008_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :72526 AVERAGE %EFFICIENCY :25.0221 % YIELD : 74.702	COUNT DATE:21-NOV-2009 15:52:27 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25166 dpm RESULTS : 3.92312 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B145.CNF;364 BKG DATE : 15-NOV-2009 EFF FILE : W145.CNF;107 CAL DATE : 18-NOV-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	13587.000	13580.010	6.000	2.4495	100.0000	4.09E+01	5.85E+00	4.34E-02	1.72E-02	6.88E-01
U232	5302.100	986.000	981.000	5.000	2.2361	100.0000	2.96E+00	4.59E-01	4.04E-02	1.57E-02	1.86E-01
U-235	4391.000	323.000	322.000	1.000	1.0000	80.90000	1.20E+00	2.15E-01	2.85E-02	8.66E-03	1.31E-01
U-238	4184.730	6888.000	6887.000	1.000	1.0000	100.0000	2.07E+01	2.99E+00	2.31E-02	7.01E-03	4.90E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

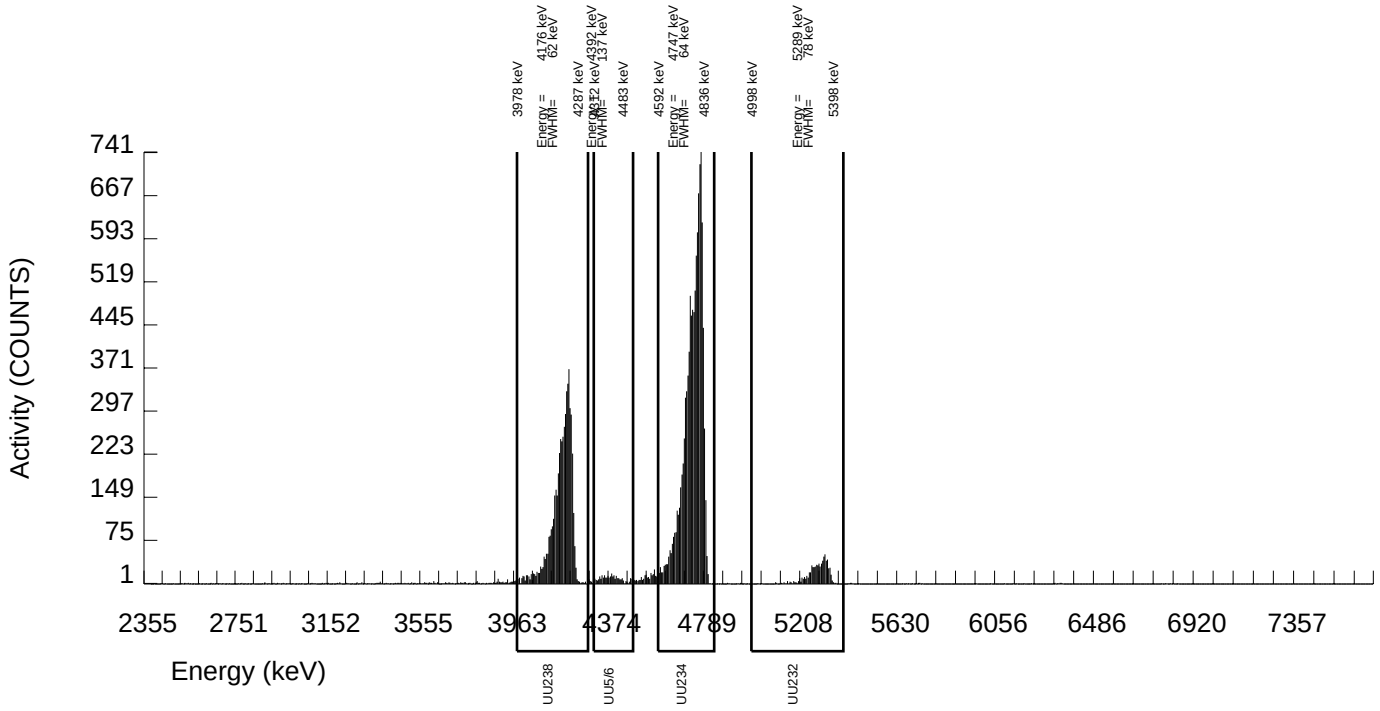
BATCH NUMBER: 923094 SAMPLE DATE : 28-OCT-2009 00:00:00	SAMPLE ID : S0239753009_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :72527 AVERAGE %EFFICIENCY :25.2174 % YIELD : 56.669	COUNT DATE:21-NOV-2009 15:52:29 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25167 dpm RESULTS : 2.97609 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B146.CNF;369 BKG DATE : 15-NOV-2009 EFF FILE : W146.CNF;109 CAL DATE : 18-NOV-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	10571.000	10567.243	3.000	1.7321	100.0000	4.16E+01	6.04E+00	4.36E-02	1.59E-02	7.94E-01
U232	5302.100	759.000	750.000	9.000	3.0000	100.0000	2.96E+00	4.76E-01	6.69E-02	2.75E-02	2.14E-01
U-235	4391.000	316.000	314.000	2.000	1.4142	80.90000	1.53E+00	2.78E-01	4.67E-02	1.60E-02	1.70E-01
U-238	4184.730	5301.000	5299.000	2.000	1.4142	100.0000	2.09E+01	3.06E+00	3.77E-02	1.30E-02	5.62E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

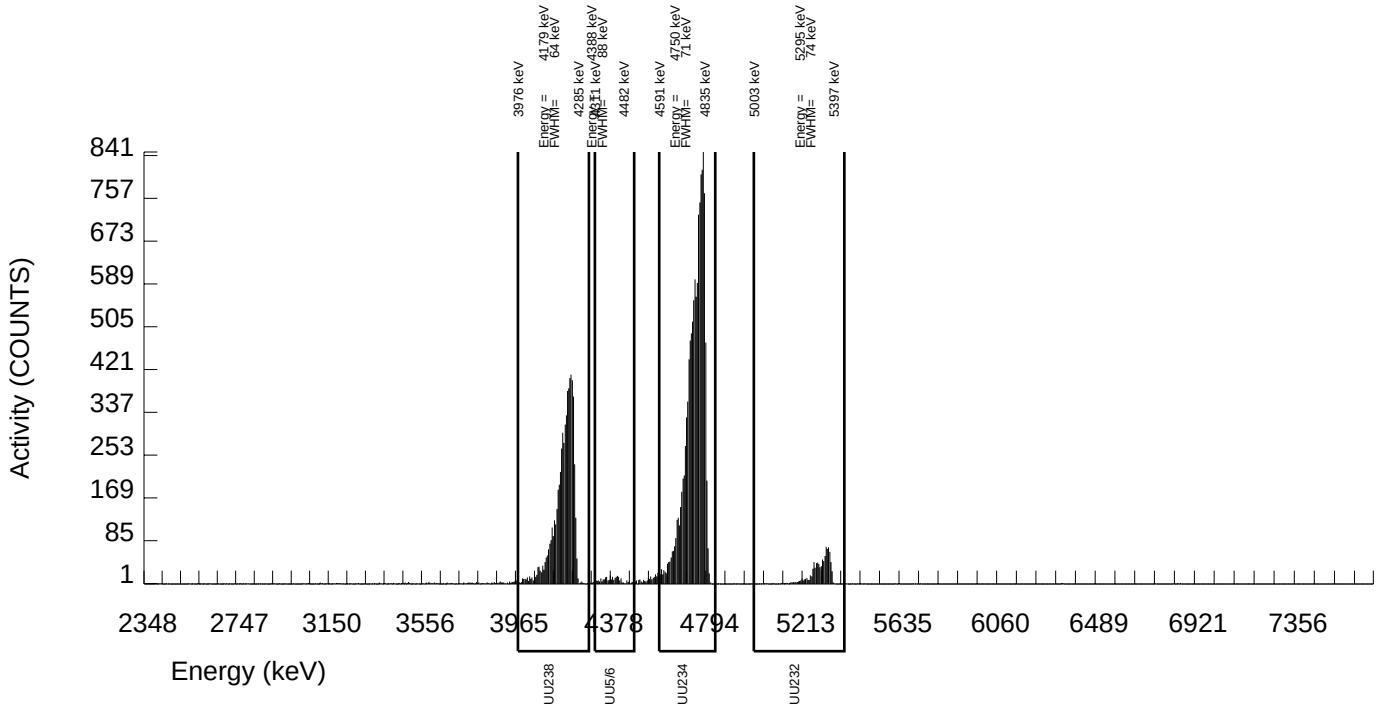
BATCH NUMBER: 923094 SAMPLE DATE : 28-OCT-2009 00:00:00	SAMPLE ID : S0239753010_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :75550 AVERAGE %EFFICIENCY :24.5119 % YIELD : 73.148	COUNT DATE:21-NOV-2009 15:52:32 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25166 dpm RESULTS : 3.84149 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B147.CNF;369 BKG DATE : 15-NOV-2009 EFF FILE : W147.CNF;108 CAL DATE : 18-NOV-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	12452.000	12443.051	8.000	2.8284	100.0000	3.91E+01	5.62E+00	5.07E-02	2.07E-02	6.87E-01
U232	5302.100	951.000	941.000	10.000	3.1623	100.0000	2.96E+00	4.63E-01	5.57E-02	2.31E-02	1.91E-01
U-235	4391.000	265.000	265.000	0.000	0.0000	80.90000	1.03E+00	1.92E-01	1.16E-02	0.00E+00	1.24E-01
U-238	4184.730	6205.000	6197.000	8.000	2.8284	100.0000	1.95E+01	2.82E+00	5.07E-02	2.07E-02	4.85E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

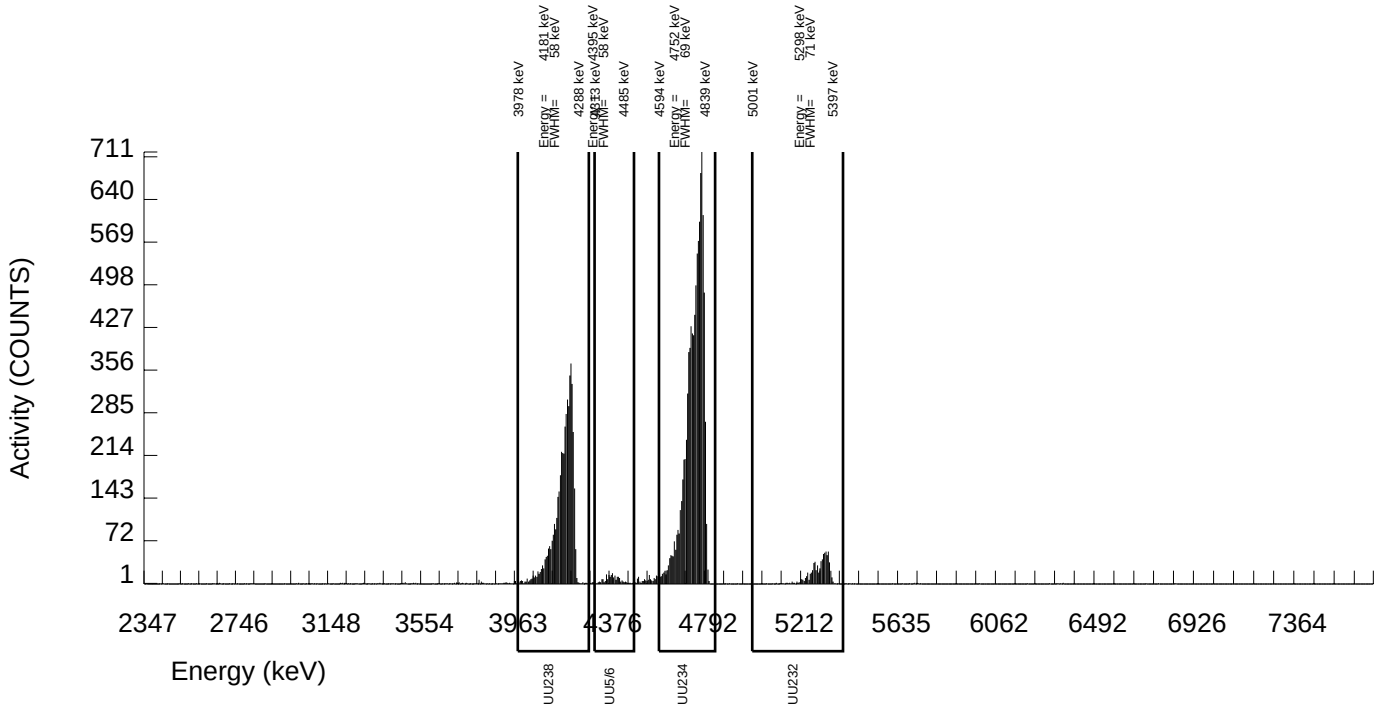
BATCH NUMBER: 923094 SAMPLE DATE : 28-OCT-2009 00:00:00	SAMPLE ID : S0239753011_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :74429 AVERAGE %EFFICIENCY :24.8842 % YIELD : 57.275	COUNT DATE:21-NOV-2009 15:52:34 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25166 dpm RESULTS : 3.00790 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B148.CNF;368 BKG DATE : 15-NOV-2009 EFF FILE : W148.CNF;123 CAL DATE : 18-NOV-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	9760.000	9748.245	11.000	3.3166	100.0000	3.85E+01	5.59E+00	7.28E-02	3.05E-02	7.65E-01
U232	5302.100	753.000	748.000	5.000	2.2361	100.0000	2.96E+00	4.76E-01	5.30E-02	2.06E-02	2.13E-01
U-235	4391.000	227.000	225.000	2.000	1.4142	80.90000	1.10E+00	2.14E-01	4.68E-02	1.61E-02	1.45E-01
U-238	4184.730	4853.000	4852.000	1.000	1.0000	100.0000	1.92E+01	2.81E+00	3.02E-02	9.19E-03	5.39E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

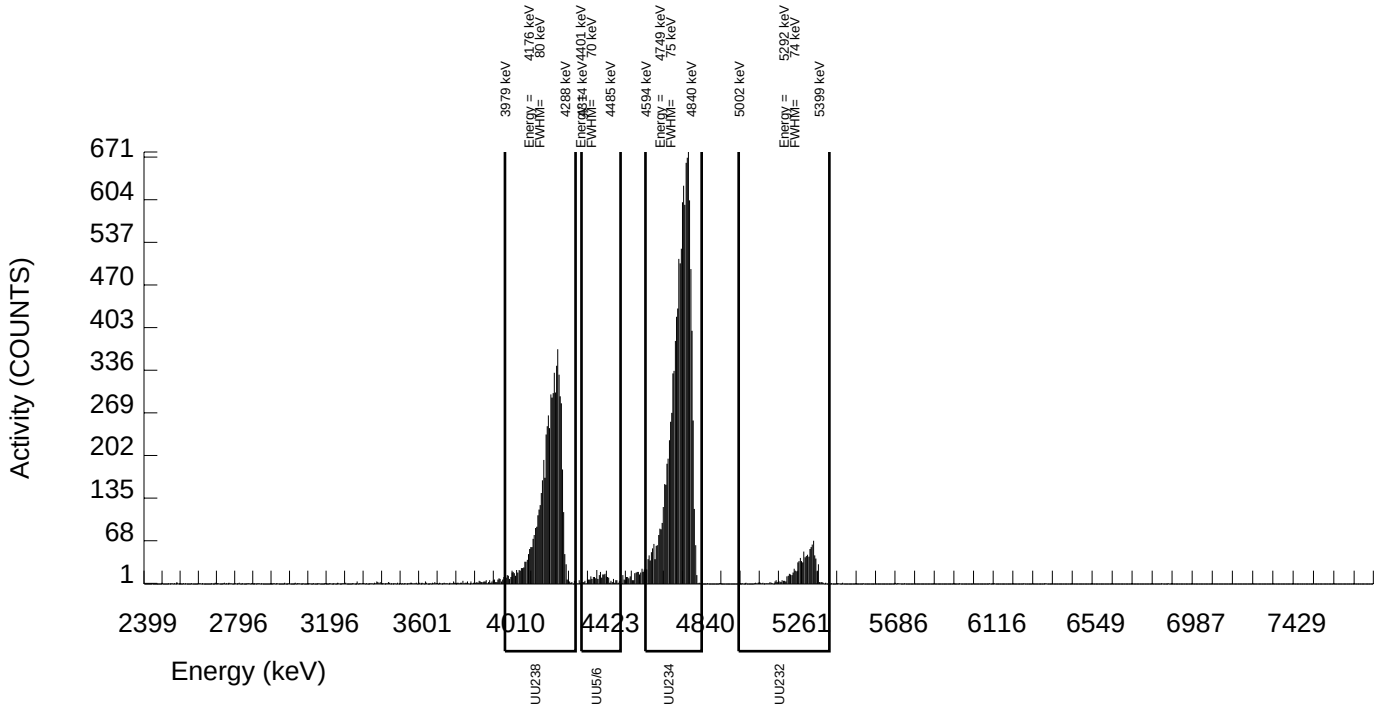
BATCH NUMBER: 923094 SAMPLE DATE : 29-OCT-2009 00:00:00	SAMPLE ID : S0239753012_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :33449 AVERAGE %EFFICIENCY :24.8326 % YIELD : 77.728	COUNT DATE:21-NOV-2009 15:52:37 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25152 dpm RESULTS : 4.08191 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B149.CNF;372 BKG DATE : 15-NOV-2009 EFF FILE : W149.CNF;108 CAL DATE : 18-NOV-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	11662.000	11656.978	4.000	2.0000	100.0000	3.40E+01	4.77E+00	3.59E-02	1.36E-02	6.18E-01
U232	5302.100	1024.000	1013.000	11.000	3.3166	100.0000	2.96E+00	4.51E-01	5.38E-02	2.25E-02	1.84E-01
U-235	4391.000	280.000	280.000	0.000	0.0000	80.90000	1.01E+00	1.84E-01	1.08E-02	0.00E+00	1.18E-01
U-238	4184.730	6505.000	6502.000	3.000	1.7321	100.0000	1.90E+01	2.68E+00	3.23E-02	1.18E-02	4.61E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

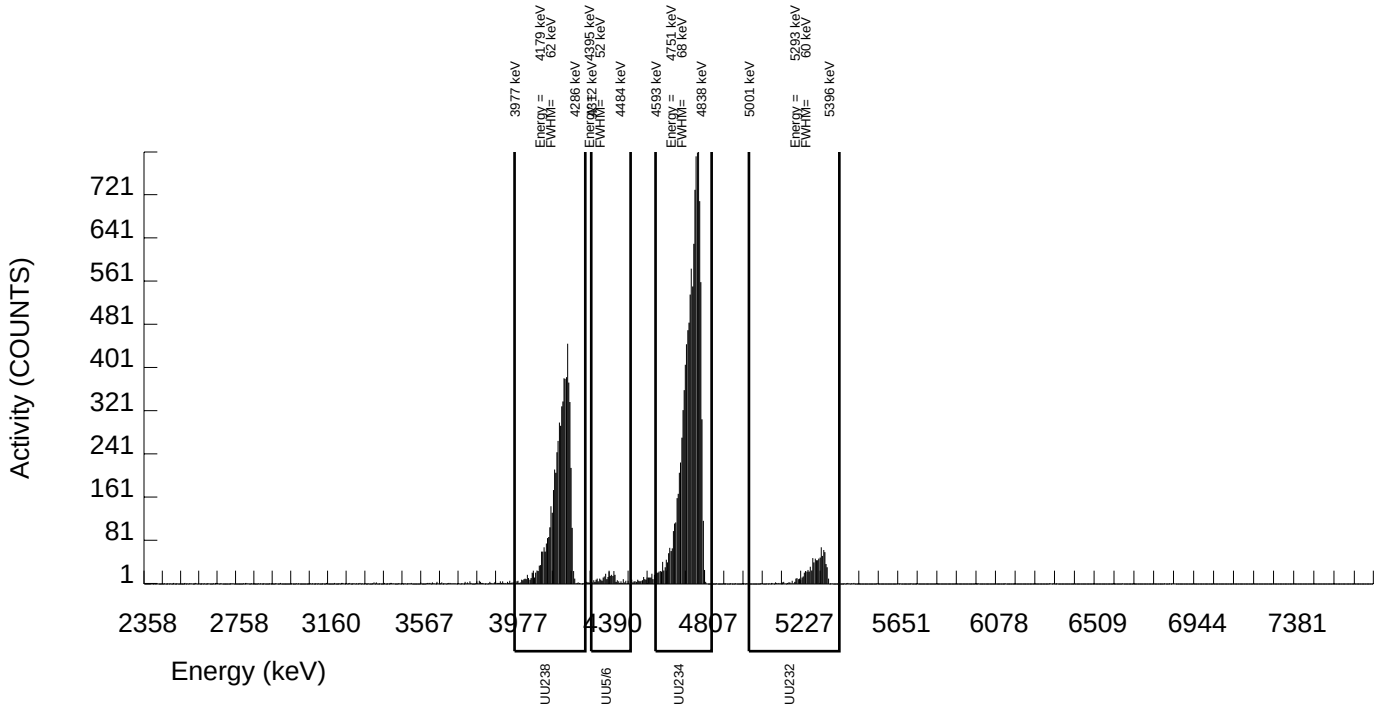
BATCH NUMBER: 923094 SAMPLE DATE : 29-OCT-2009 00:00:00	SAMPLE ID : S0239753013_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :75552 AVERAGE %EFFICIENCY :24.7216 % YIELD : 70.986	COUNT DATE:21-NOV-2009 15:52:38 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25152 dpm RESULTS : 3.72784 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B150.CNF;373 BKG DATE : 15-NOV-2009 EFF FILE : W150.CNF;116 CAL DATE : 18-NOV-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	11562.000	11560.070	1.000	1.0000	100.0000	3.71E+01	5.26E+00	2.46E-02	7.46E-03	6.76E-01
U232	5302.100	934.000	921.000	13.000	3.6056	100.0000	2.96E+00	4.59E-01	6.35E-02	2.69E-02	1.94E-01
U-235	4391.000	295.000	293.000	2.000	1.4142	80.90000	1.16E+00	2.11E-01	3.80E-02	1.30E-02	1.34E-01
U-238	4184.730	6210.000	6204.000	6.000	2.4495	100.0000	1.99E+01	2.84E+00	4.62E-02	1.83E-02	4.96E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

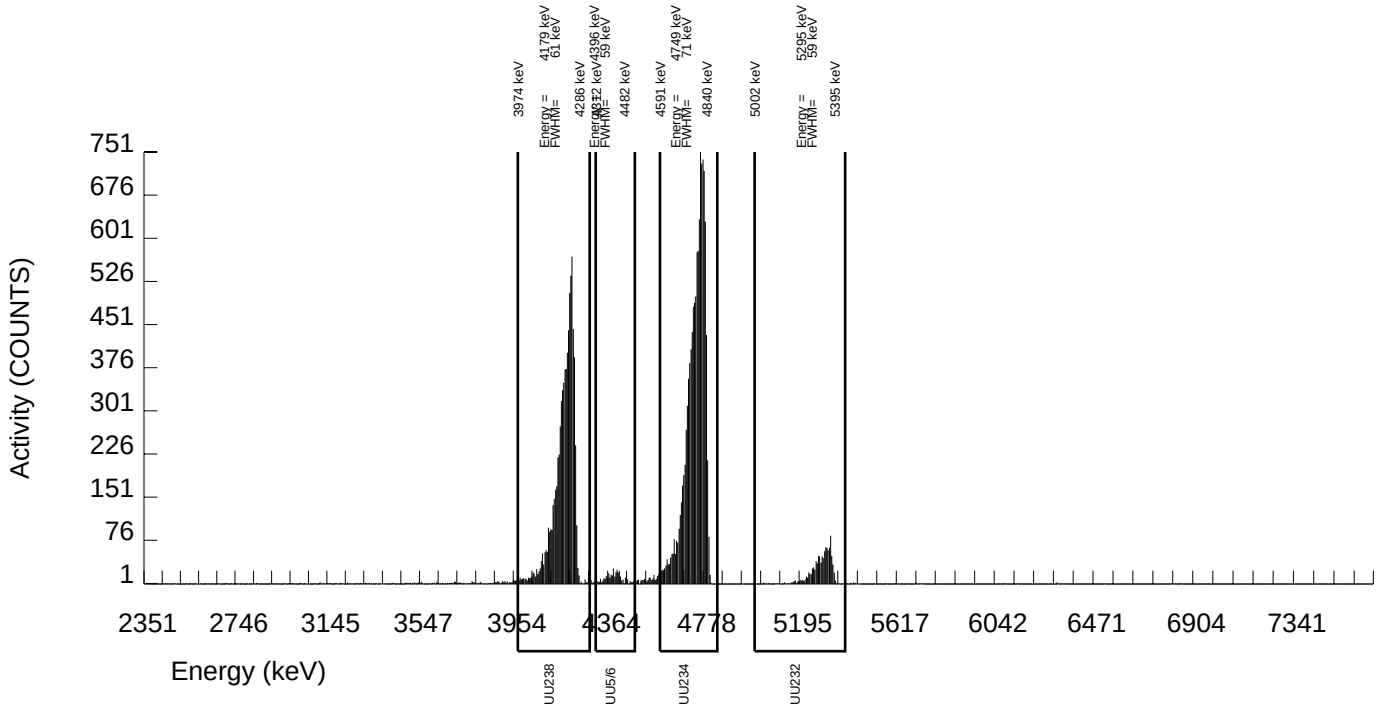
BATCH NUMBER: 923094 SAMPLE DATE : 29-OCT-2009 00:00:00	SAMPLE ID : S0239753014_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :75556 AVERAGE %EFFICIENCY :24.5337 % YIELD : 80.849	COUNT DATE:21-NOV-2009 15:52:40 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25152 dpm RESULTS : 4.24582 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B151.CNF;368 BKG DATE : 15-NOV-2009 EFF FILE : W151.CNF;114 CAL DATE : 18-NOV-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	11370.000	11368.949	0.000	0.0000	100.0000	3.23E+01	4.51E+00	8.52E-03	0.00E+00	5.93E-01
U232	5302.100	1047.000	1041.000	6.000	2.4495	100.0000	2.96E+00	4.48E-01	4.09E-02	1.62E-02	1.81E-01
U-235	4391.000	339.000	338.000	1.000	1.0000	80.90000	1.19E+00	2.08E-01	2.69E-02	8.16E-03	1.27E-01
U-238	4184.730	7732.000	7731.000	1.000	1.0000	100.0000	2.19E+01	3.08E+00	2.17E-02	6.60E-03	4.89E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

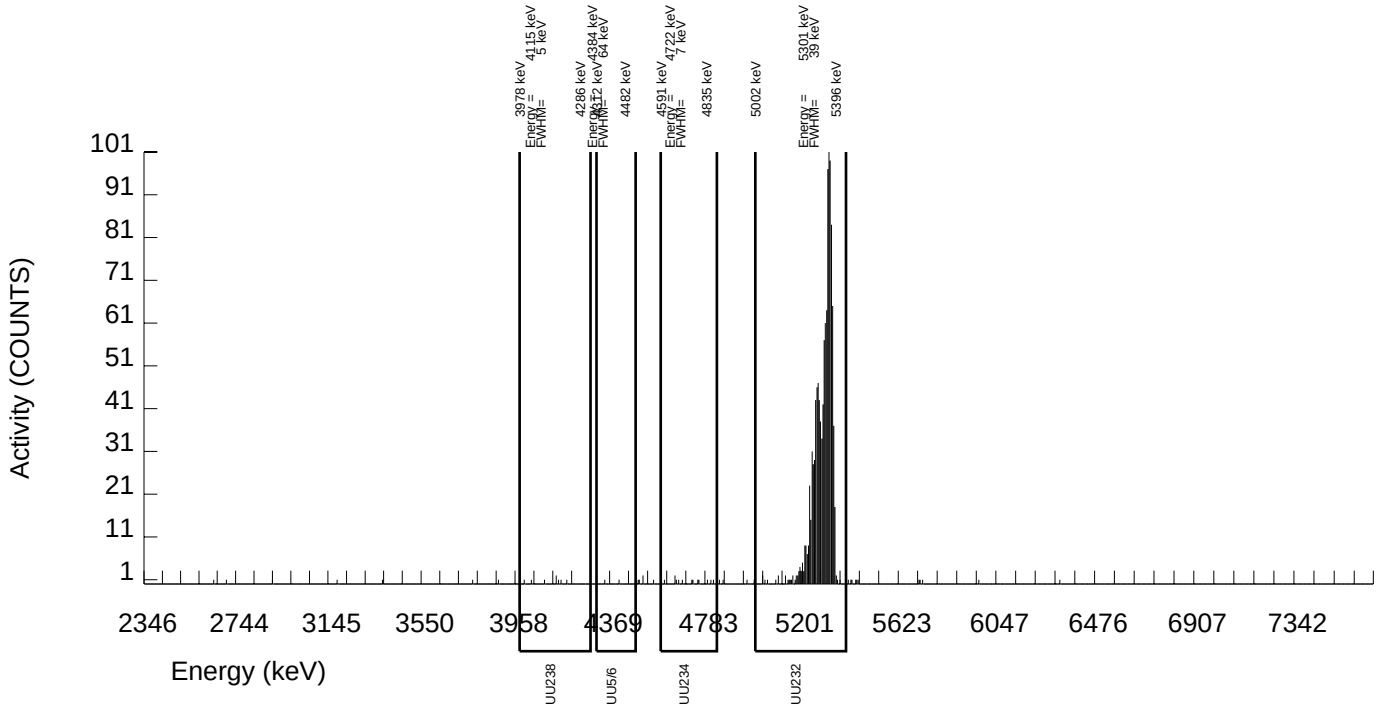
BATCH NUMBER: 923094 SAMPLE DATE : 30-OCT-2009 00:00:00	SAMPLE ID : S0239753015_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :76222 AVERAGE %EFFICIENCY :24.4246 % YIELD : 91.742	COUNT DATE:21-NOV-2009 15:52:43 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25138 dpm RESULTS : 4.81774 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B152.CNF;365 BKG DATE : 15-NOV-2009 EFF FILE : W152.CNF;101 CAL DATE : 18-NOV-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	13.000	10.813	1.000	1.0000	100.0000	2.72E-02	1.80E-02	1.92E-02	5.85E-03	1.76E-02
U232	5302.100	1179.000	1176.000	3.000	1.7321	100.0000	2.96E+00	4.39E-01	2.78E-02	1.01E-02	1.69E-01
U-235	4391.000	2.000	0.000	2.000	1.4142	80.90000	0.00E+00	1.22E-02	2.98E-02	1.02E-02	1.22E-02
U-238	4184.730	8.000	7.000	1.000	1.0000	100.0000	1.76E-02	1.50E-02	1.92E-02	5.85E-03	1.48E-02

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

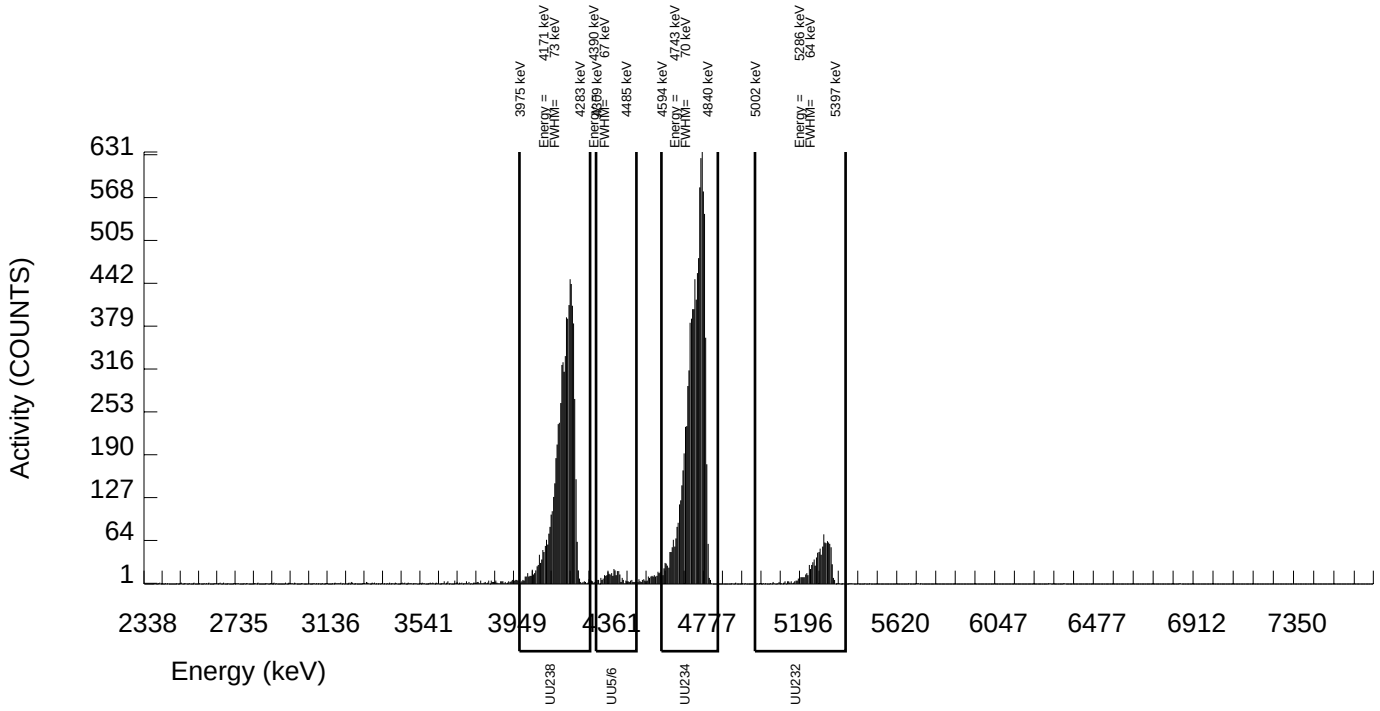
BATCH NUMBER: 923094 SAMPLE DATE : 2-NOV-2009 00:00:00.	SAMPLE ID : S0239753016_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :76223 AVERAGE %EFFICIENCY :25.2320 % YIELD : 80.726	COUNT DATE:21-NOV-2009 15:52:46 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25097 dpm RESULTS : 4.23892 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B153.CNF;360 BKG DATE : 15-NOV-2009 EFF FILE : W153.CNF;104 CAL DATE : 18-NOV-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	9460.000	9452.921	6.000	2.4495	100.0000	2.61E+01	3.66E+00	3.98E-02	1.58E-02	5.27E-01
U232	5302.100	1088.000	1069.000	19.000	4.3589	100.0000	2.96E+00	4.48E-01	6.44E-02	2.80E-02	1.80E-01
U-235	4391.000	319.000	318.000	1.000	1.0000	80.90000	1.09E+00	1.92E-01	2.61E-02	7.95E-03	1.20E-01
U-238	4184.730	7090.000	7088.000	2.000	1.4142	100.0000	1.96E+01	2.75E+00	2.65E-02	9.09E-03	4.56E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

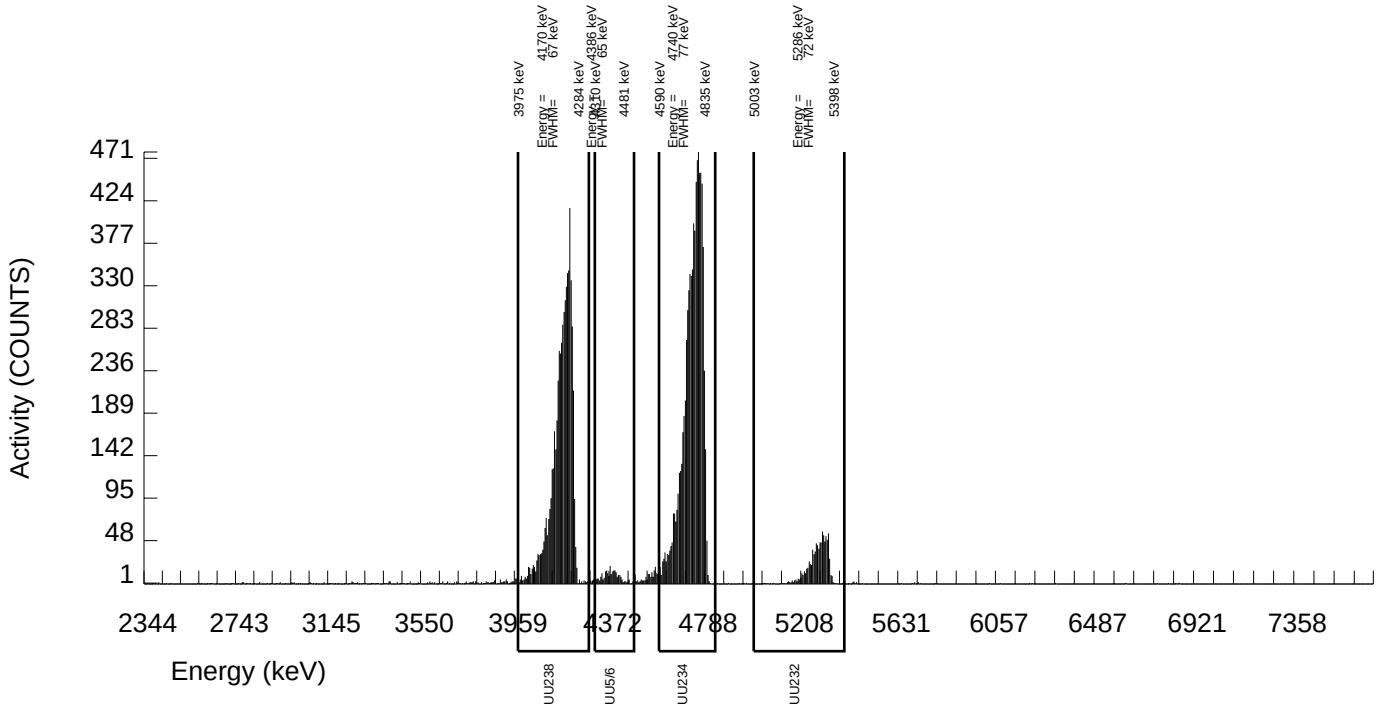
BATCH NUMBER: 923094 SAMPLE DATE : 2-NOV-2009 00:00:00.	SAMPLE ID : S0239753017_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :76224 AVERAGE %EFFICIENCY :25.4981 % YIELD : 67.255	COUNT DATE:21-NOV-2009 15:52:49 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25096 dpm RESULTS : 3.53154 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B154.CNF;362 BKG DATE : 15-NOV-2009 EFF FILE : W154.CNF;102 CAL DATE : 18-NOV-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	7989.000	7983.092	5.000	2.2361	100.0000	2.62E+01	3.73E+00	4.40E-02	1.71E-02	5.75E-01
U232	5302.100	908.000	900.000	8.000	2.8284	100.0000	2.96E+00	4.60E-01	5.31E-02	2.16E-02	1.95E-01
U-235	4391.000	264.000	263.000	1.000	1.0000	80.90000	1.07E+00	1.98E-01	3.11E-02	9.44E-03	1.29E-01
U-238	4184.730	5971.000	5970.000	1.000	1.0000	100.0000	1.96E+01	2.80E+00	2.51E-02	7.64E-03	4.97E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

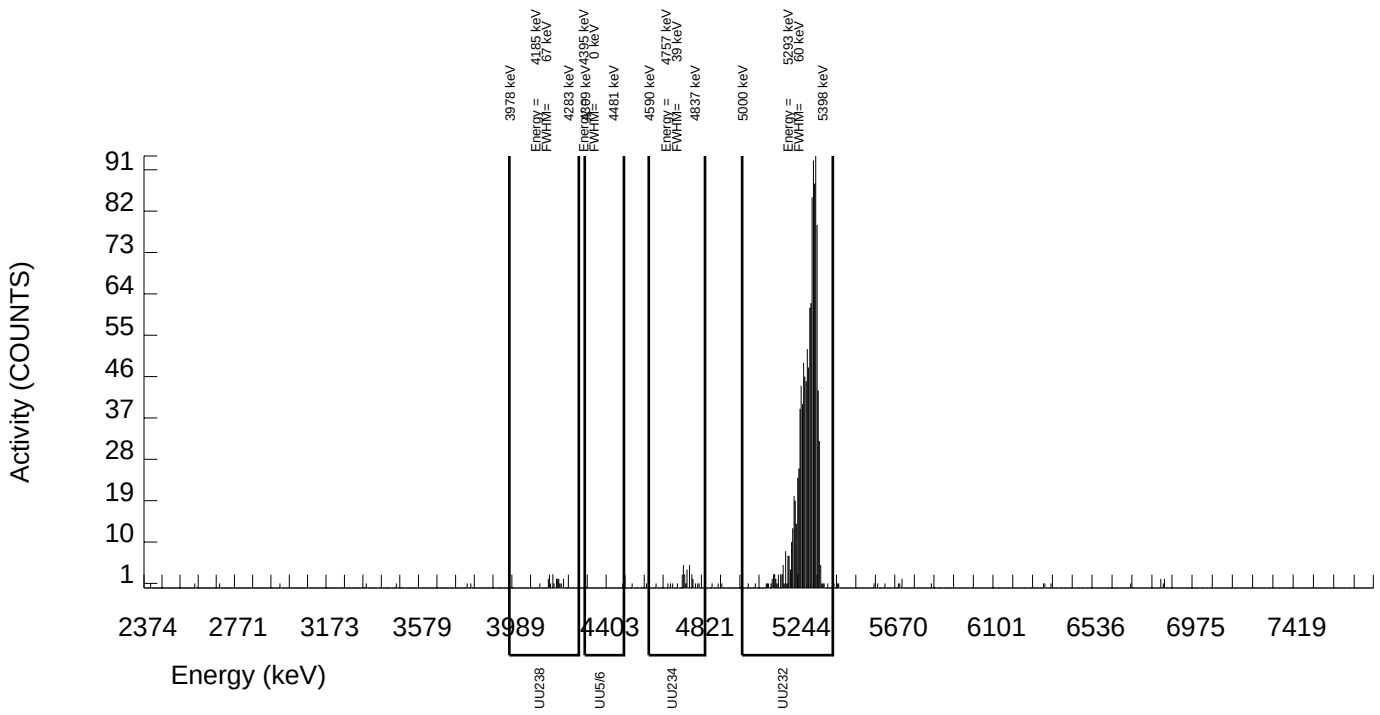
BATCH NUMBER: 923094 SAMPLE DATE : 2-NOV-2009 00:00:00.	SAMPLE ID : S0239753018_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :75553 AVERAGE %EFFICIENCY :25.8503 % YIELD : 87.199	COUNT DATE:21-NOV-2009 15:52:52 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25096 dpm RESULTS : 4.57877 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B155.CNF;369 BKG DATE : 15-NOV-2009 EFF FILE : W155.CNF;111 CAL DATE : 18-NOV-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	31.000	26.806	3.000	1.7321	100.0000	6.70E-02	2.95E-02	2.76E-02	1.01E-02	2.80E-02
U232	5302.100	1192.000	1183.000	9.000	3.0000	100.0000	2.96E+00	4.39E-01	4.24E-02	1.74E-02	1.70E-01
U-235	4391.000	1.000	1.000	0.000	0.0000	80.90000	3.09E-03	6.07E-03	9.26E-03	0.00E+00	6.05E-03
U-238	4184.730	18.000	14.000	4.000	2.0000	100.0000	3.50E-02	2.35E-02	3.07E-02	1.16E-02	2.30E-02

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

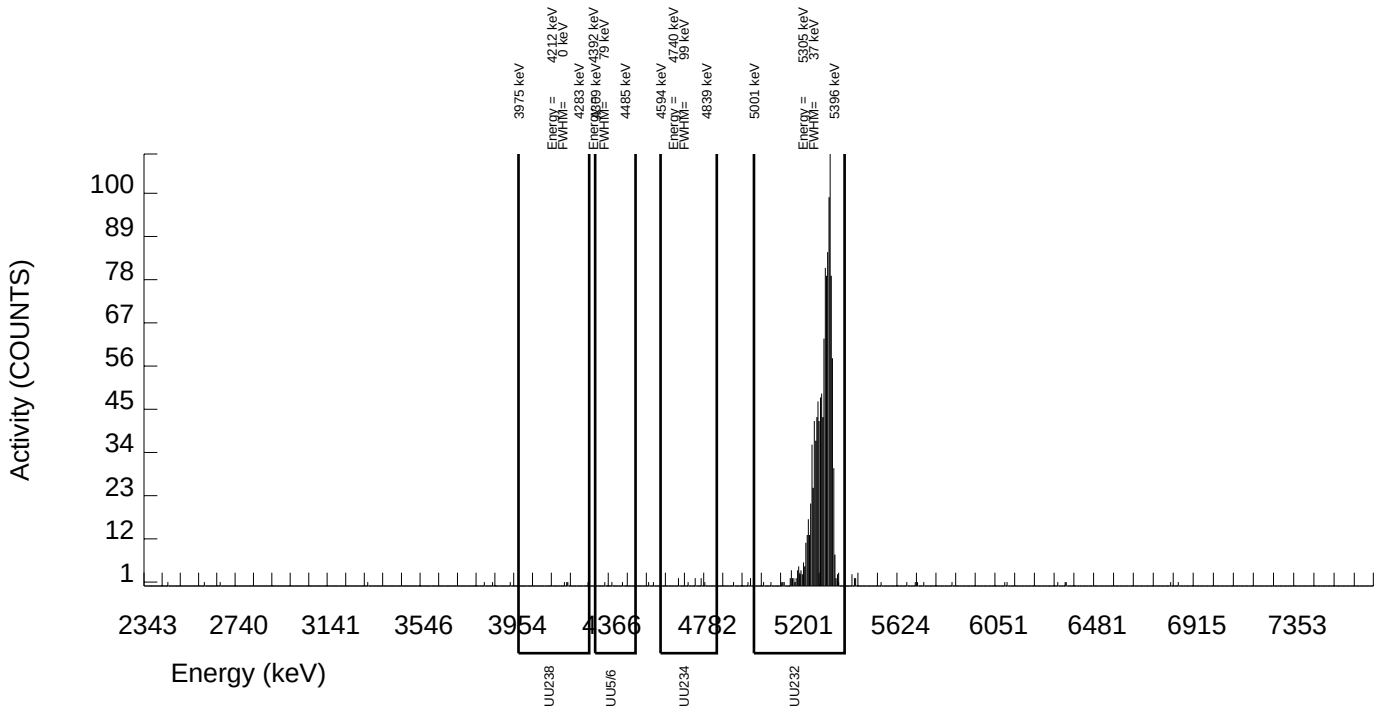
BATCH NUMBER: 923094 SAMPLE DATE : 17-NOV-2009 00:00:00	SAMPLE ID : S1201973227_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :75545 AVERAGE %EFFICIENCY :24.7357 % YIELD : 94.360	COUNT DATE:20-NOV-2009 14:25:28 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.24889 dpm RESULTS : 4.95286 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B121.CNF;412 BKG DATE : 15-NOV-2009 EFF FILE : W121.CNF;113 CAL DATE : 18-NOV-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	8.000	5.764	1.000	1.0000	100.0000	1.39E-02	1.33E-02	1.85E-02	5.61E-03	1.32E-02
U232	5302.100	1233.000	1225.000	8.000	2.8284	100.0000	2.96E+00	4.36E-01	3.90E-02	1.59E-02	1.67E-01
U-235	4391.000	3.000	3.000	0.000	0.0000	80.90000	8.95E-03	1.02E-02	8.95E-03	0.00E+00	1.01E-02
U-238	4184.730	4.000	0.000	4.000	2.0000	100.0000	0.00E+00	1.34E-02	2.97E-02	1.12E-02	1.34E-02

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

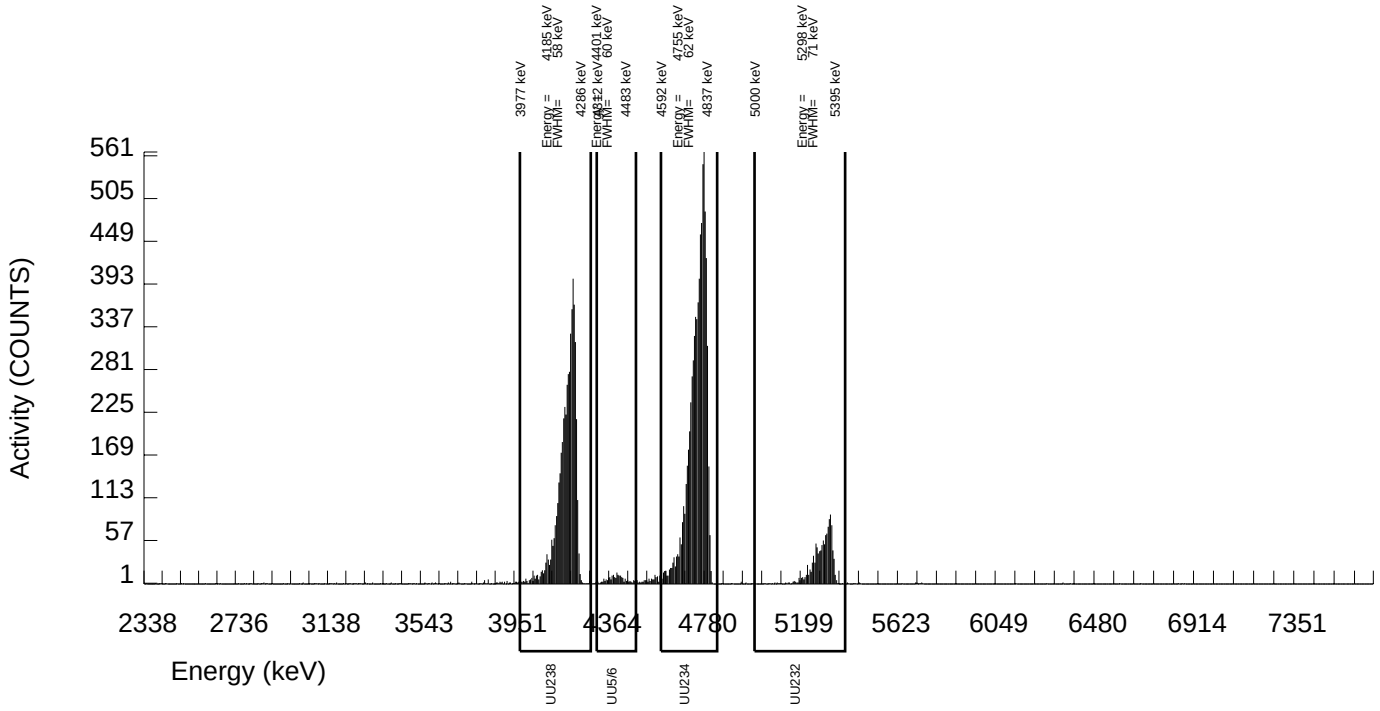
BATCH NUMBER: 923094 SAMPLE DATE : 26-OCT-2009 00:00:00	SAMPLE ID : S1201973228_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :75546 AVERAGE %EFFICIENCY :25.2661 % YIELD : 89.740	COUNT DATE:20-NOV-2009 14:25:29 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25193 dpm RESULTS : 4.71309 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B122.CNF;414 BKG DATE : 15-NOV-2009 EFF FILE : W122.CNF;116 CAL DATE : 18-NOV-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	7510.000	7496.799	12.000	3.4641	100.0000	1.86E+01	2.58E+00	4.75E-02	2.00E-02	4.22E-01
U232	5302.100	1200.000	1190.000	10.000	3.1623	100.0000	2.96E+00	4.39E-01	4.40E-02	1.83E-02	1.69E-01
U-235	4391.000	210.000	207.000	3.000	1.7321	80.90000	6.35E-01	1.24E-01	3.39E-02	1.24E-02	8.78E-02
U-238	4184.730	5060.000	5056.000	4.000	2.0000	100.0000	1.26E+01	1.75E+00	3.06E-02	1.16E-02	3.46E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

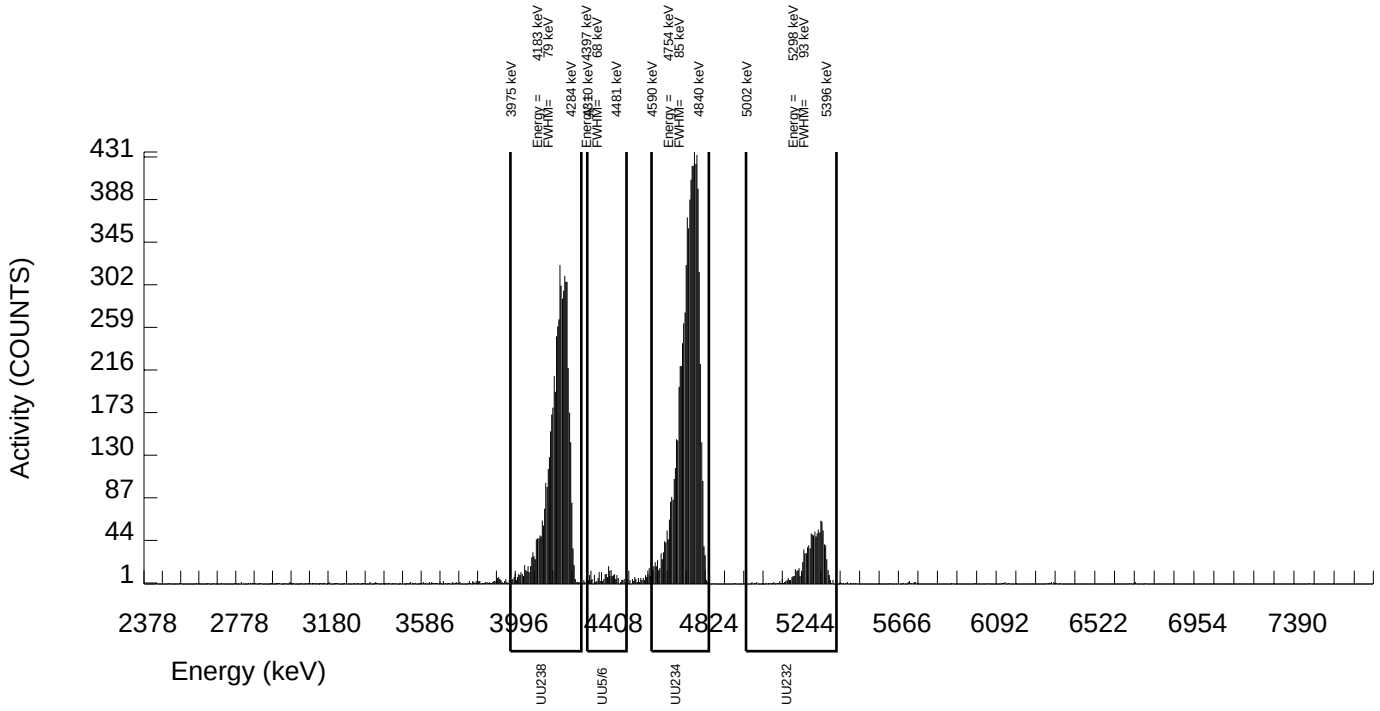
BATCH NUMBER: 923094 SAMPLE DATE : 26-OCT-2009 00:00:00	SAMPLE ID : S1201973229_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :45-142V3 AVERAGE %EFFICIENCY :26.0328 % YIELD : 79.924	COUNT DATE:20-NOV-2009 14:25:33 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.25193 dpm RESULTS : 4.19758 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B123.CNF;412 BKG DATE : 15-NOV-2009 EFF FILE : W123.CNF;112 CAL DATE : 18-NOV-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	7913.000	7910.898	1.000	1.0000	100.0000	2.14E+01	2.99E+00	2.07E-02	6.30E-03	4.72E-01
U232	5302.100	1105.000	1092.000	13.000	3.6056	100.0000	2.96E+00	4.45E-01	5.36E-02	2.27E-02	1.77E-01
U-235	4391.000	212.000	210.000	2.000	1.4142	80.90000	7.02E-01	1.36E-01	3.20E-02	1.10E-02	9.59E-02
U-238	4184.730	5670.000	5669.000	1.000	1.0000	100.0000	1.53E+01	2.15E+00	2.07E-02	6.30E-03	3.99E-01

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



GEL Laboratories LLC
ALPHA SPECTROSCOPY REPORT

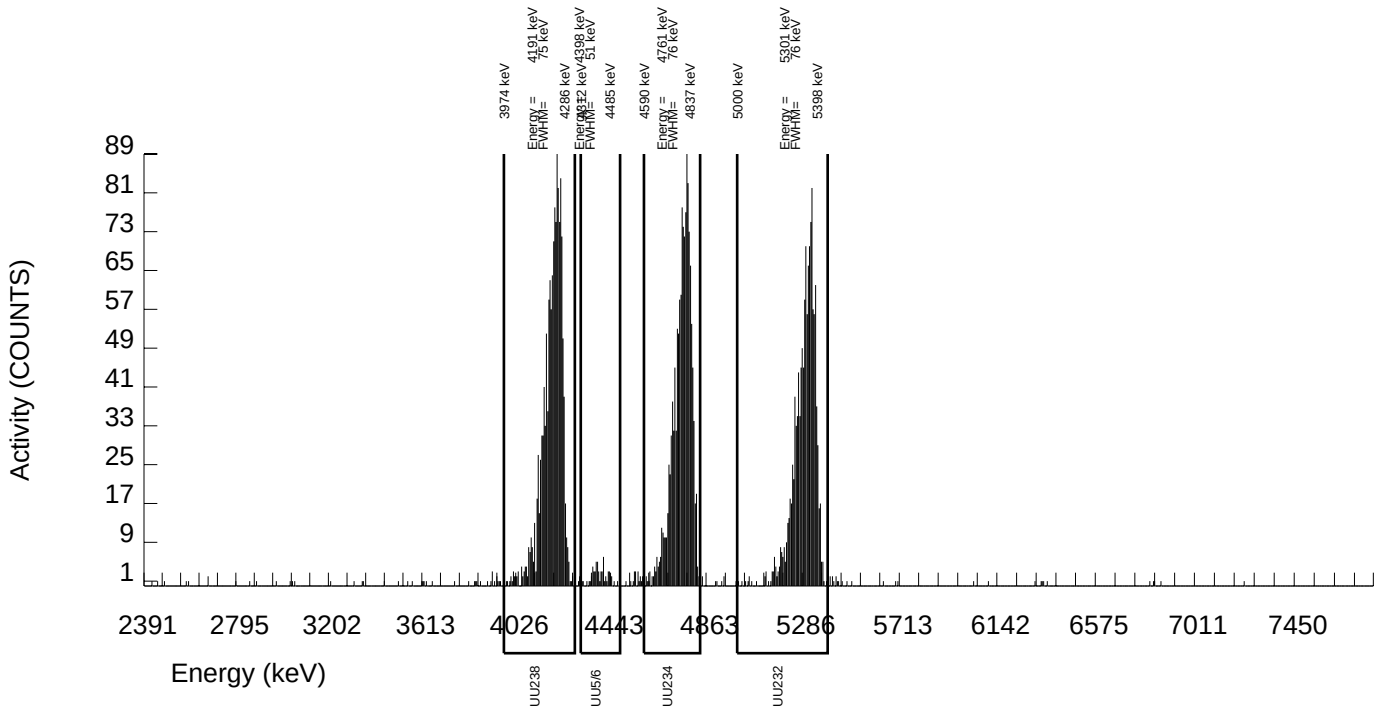
BATCH NUMBER: 923094 SAMPLE DATE : 17-NOV-2009 00:00:00	SAMPLE ID : S1201973230_UU SAMPLE QTY: 0.800 L
DETECTOR NUMBER :45-142V2 AVERAGE %EFFICIENCY :25.9543 % YIELD : 93.527	COUNT DATE:20-NOV-2009 14:25:35 ELAPSED LIVE TIME(SEC): 60000.00 ANALYST :KXM4

MS/MSD	LCS/LCSD	TRACER	
ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1163-G ISOTOPE : U-238 PCI/L : 3.149E+00	ID : 1283-E ISOTOPE : U232 NOMINAL : 5.24889 dpm RESULTS : 4.90913 dpm	LIB FILE : ENV_ALPHA_UU.N BKG FILE : B124.CNF;408 BKG DATE : 15-NOV-2009 EFF FILE : W124.CNF;108 CAL DATE : 18-NOV-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	1350.000	1343.714	5.000	2.2361	100.0000	3.12E+00	4.56E-01	3.11E-02	1.21E-02	1.67E-01
U232	5302.100	1282.000	1274.000	8.000	2.8284	100.0000	2.96E+00	4.34E-01	3.75E-02	1.53E-02	1.63E-01
U-235	4391.000	62.000	62.000	0.000	0.0000	80.90000	1.78E-01	5.04E-02	8.60E-03	0.00E+00	4.43E-02
U-238	4184.730	1404.000	1401.000	3.000	1.7321	100.0000	3.25E+00	4.74E-01	2.57E-02	9.35E-03	1.71E-01

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



RADIUM 228

Radiochemistry Batch Checklist, Rev 9

Batch# 922859 **Product:** RA-228 **Date:** 11.25

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to100 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 statused.	✓		
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
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: Rhyan Brantley

Secondary Review Performed By:

KERR

Radium-228 Que Sheet

11/16/2009

Batch #: 922859 Analyst:JXC5 First Client Due Date:12/07/2009 Internal Due Date11/26/2009

Spike Isotope: Radium-228 Spike Code: 0503-B Expiration Date: 9-11-10 Vol: 0.1 mL Ac-228 Ingrow: 11-19-09 / 1320

LCS Isotope: Radium-228 LCS Code: 0503-B Expiration Date: 9-11-10 Vol: 0.1 mL

Tracer Isotope: Barium-133 Tracer Code: 0112-J Expiration Date: 2-17-10 Vol: 0.1 mL Ac-228 Separation Date/Time: 11-23-09 / 1510

Prep Date: 11-18-09 Initials: MS Pipet ID: 17955419 Balance ID: 512048163 Witness: BF 11-18-09

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collect Date & Time	Pos. #	Vol (mL)	Det #	Ba Yield (%)	Gamma Det. #
239753001-1	M-141B	SAMPLE		3 pCi/L	WATER	KERR003	23-OCT-09 10:00 AM	1	200	1A	75.86	
239753002-1	M-141009B	SAMPLE		3 pCi/L	WATER	KERR003	23-OCT-09 10:00 AM	2	200	13A	90.77	
239753003-1	PB102309-A3	SAMPLE		3 pCi/L	WATER	KERR003	23-OCT-09 12:15 PM	3	200	8A	87.36	
239753004-1	M-145B	SAMPLE		3 pCi/L	WATER	KERR003	26-OCT-09 10:15 AM	4	200	1C	86.63	
239753005-1	M-139B	SAMPLE		3 pCi/L	WATER	KERR003	26-OCT-09 12:55 PM	5	200	2A	88.41	
239753006-1	M-146B	SAMPLE		3 pCi/L	WATER	KERR003	27-OCT-09 09:30 AM	6	200	7C	71.99	
239753007-1	M-144B	SAMPLE		3 pCi/L	WATER	KERR003	27-OCT-09 12:25 PM	7	200	6B	88.11	
239753008-1	M-138B	SAMPLE		3 pCi/L	WATER	KERR003	28-OCT-09 11:15 AM	8	200	5C	86.60	
239753009-1	M-138009B	SAMPLE		3 pCi/L	WATER	KERR003	28-OCT-09 11:15 AM	9	200	9D	94.88	
239753010-1	M-138BDISS	SAMPLE		3 pCi/L	WATER	KERR003	28-OCT-09 11:15 AM	10	200	7D	77.31	
239753011-1	M-138009BDISS	SAMPLE		3 pCi/L	WATER	KERR003	28-OCT-09 11:15 AM	11	200	4A	81.38	
239753012-1	M-137B	SAMPLE		3 pCi/L	WATER	KERR003	29-OCT-09 01:30 PM	12	200	12C	94.71	
239753013-1	M-137BDISS	SAMPLE		3 pCi/L	WATER	KERR003	29-OCT-09 01:30 PM	13	200	10D	81.12	
239753014-1	M-148B	SAMPLE		3 pCi/L	WATER	KERR003	29-OCT-09 09:10 AM	14	200	1D	84.24	
239753015-1	EB103009-GWA4	SAMPLE		3 pCi/L	WATER	KERR003	30-OCT-09 11:10 AM	15	200	8C	85.91	
239753016-1	M-147B	SAMPLE		3 pCi/L	WATER	KERR003	02-NOV-09 10:00 AM	16	200	7A	75.30	
239753017-1	M-147009B	SAMPLE		3 pCi/L	WATER	KERR003	02-NOV-09 10:00 AM	17	200	10C	79.64	
239753018-1	EB110209-GWA3	SAMPLE		3 pCi/L	WATER	KERR003	02-NOV-09 12:40 PM	18	200	12D	79.80	
1201972468-1	MB for batch 922859	MB		3 pCi/L	WATER	QC ACCOUNT		19	200	6D	88.08	
1201972469-1	M-141B(239753001DUP)	DUP		3 pCi/L	WATER	QC ACCOUNT	23-OCT-09 10:00 AM	20	200	9A	87.82	
1201972470-1	M-141B(239753001MS)	MS		3 pCi/L	WATER	QC ACCOUNT	23-OCT-09 10:00 AM	21	100	9B	88.74	
1201972471-1	LCS for batch 922859	LCS		3 pCi/L	WATER	QC ACCOUNT		22	200	3A	95.24	

SLB 11.25.09

Data Reviewed By: R Ryan Brantley

1950

Radium-228 Liquid

Filename : RA228.XLS
File type : Excel
Version # : 1.2.6

Batch : 922859
Analyst : JXC5
Prep Date : 11/18/2009

Ra-228 Abundance : 1
Ra-228 Method Uncertainty : 0.1268

Geometry: CeF on 25mm Filter

Spike S/N : 0503-B
Spike Exp Date : 9/11/2010
Spike Activity (dpm/ml): 174.18
Spike Volume Added: 0.10

LCS S/N : 0503-B
LCS Exp Date : 9/11/2010
LCS Activity (dpm/ml): 174.18
LCS Volume Added: 0.10

Tracer S/N : 0112-J
Tracer Exp Date : 2/17/2010
Tracer 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
Procedure Code :	GFC28RAL	
Parmname :	Radium-228	
Required MDA :	3	pCi/L
Halflife of Ra-228 :	5.75	years
Halflife of Ac-228 :	6.15	hours

Sample Characteristics					**Tracer Calculations**					
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Tracer Concentration (cpm) (Ba-133 Ref.)	Tracer Ref. Count Uncertainty (cpm)	Tracer Concentration (cpm) (Ba-133 Samp.)	Tracer Samp. Count Uncertainty (cpm)	Tracer Aliquot (mL)	Tracer Aliquot StDev. (mL)
1	239753001.1	0.2000	1.6007E-05	10/23/2009 10:00	304.5	3.52%	231.0	4.11%	0.1	0.000701
2	239753002.1	0.2000	1.6007E-05	10/23/2009 10:00	304.5	3.52%	276.4	3.71%	0.1	0.000701
3	239753003.1	0.2000	1.6007E-05	10/23/2009 12:15	304.5	3.52%	266.0	3.79%	0.1	0.000701
4	239753004.1	0.2000	1.6007E-05	10/26/2009 10:15	304.5	3.52%	263.8	3.81%	0.1	0.000701
5	239753005.1	0.2000	1.6007E-05	10/26/2009 12:55	304.5	3.52%	269.2	3.77%	0.1	0.000701
6	239753006.1	0.2000	1.6007E-05	10/27/2009 9:30	304.5	3.52%	219.2	4.24%	0.1	0.000701
7	239753007.1	0.2000	1.6007E-05	10/27/2009 12:25	304.5	3.52%	268.3	3.78%	0.1	0.000701
8	239753008.1	0.2000	1.6007E-05	10/28/2009 11:15	304.5	3.52%	263.7	3.81%	0.1	0.000701
9	239753009.1	0.2000	1.6007E-05	10/28/2009 11:15	304.5	3.52%	288.9	3.62%	0.1	0.000701
10	239753010.1	0.2000	1.6007E-05	10/28/2009 11:15	304.5	3.52%	235.4	4.07%	0.1	0.000701
11	239753011.1	0.2000	1.6007E-05	10/28/2009 11:15	304.5	3.52%	247.8	3.95%	0.1	0.000701
12	239753012.1	0.2000	1.6007E-05	10/29/2009 13:30	304.5	3.52%	288.4	3.63%	0.1	0.000701
13	239753013.1	0.2000	1.6007E-05	10/29/2009 13:30	304.5	3.52%	247.0	3.96%	0.1	0.000701
14	239753014.1	0.2000	1.6007E-05	10/29/2009 9:10	304.5	3.52%	256.5	3.87%	0.1	0.000701
15	239753015.1	0.2000	1.6007E-05	10/30/2009 11:10	304.5	3.52%	261.6	3.83%	0.1	0.000701
16	239753016.1	0.2000	1.6007E-05	11/2/2009 10:00	304.5	3.52%	229.3	4.13%	0.1	0.000701
17	239753017.1	0.2000	1.6007E-05	11/2/2009 10:00	304.5	3.52%	242.5	4.00%	0.1	0.000701
18	239753018.1	0.2000	1.6007E-05	11/2/2009 12:40	304.5	3.52%	243.0	3.99%	0.1	0.000701
19	1201972468.1	0.2000	1.6007E-05	11/18/2009 0:00	304.5	3.52%	268.2	3.78%	0.1	0.000701
20	1201972469.1	0.2000	1.6007E-05	10/23/2009 10:00	304.5	3.52%	267.4	3.78%	0.1	0.000701
21	1201972470.1	0.1000	1.1370E-05	10/23/2009 10:00	304.5	3.52%	270.2	3.76%	0.1	0.000701
22	1201972471.1	0.2000	1.6007E-05	11/18/2009 0:00	304.5	3.52%	290.0	3.61%	0.1	0.000701

Count raw Data													Calibration Data					Weekly Bkg	
Pos.	Detector ID	Counting Time (min.)	Gross Counts Alpha	Gross Counts 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)	cpm	Count Time (min.)
1	1A	60	6	55	0.917	11/23/2009 17:26	11/23/2009 15:10	0.990	0.774	1.057	75.86%	2.88%	PIC	7/2/2009	7/31/2010	0.6303	0.00600	0.548	500
2	13A	60	12	70	1.167	11/23/2009 17:23	11/23/2009 15:10	0.990	0.778	1.057	90.77%	2.74%	PIC	7/2/2009	7/31/2010	0.6410	0.00816	0.718	500
3	8A	75	8	116	1.547	11/23/2009 17:26	11/23/2009 15:10	0.990	0.774	1.072	87.36%	2.77%	PIC	7/2/2009	7/31/2010	0.6247	0.00816	1.280	500
4	1C	85	9	156	1.835	11/23/2009 17:26	11/23/2009 15:10	0.991	0.774	1.082	86.63%	2.78%	PIC	7/2/2009	7/31/2010	0.6176	0.00344	1.322	500
5	2A	60	10	44	0.733	11/23/2009 17:26	11/23/2009 15:10	0.991	0.773	1.057	88.41%	2.76%	PIC	7/2/2009	7/31/2010	0.6172	0.00349	0.732	500
6	7C	60	3	33	0.550	11/23/2009 17:26	11/23/2009 15:10	0.991	0.773	1.057	71.99%	2.93%	PIC	7/2/2009	7/31/2010	0.6178	0.00816	0.494	500
7	6B	75	22	82	1.093	11/23/2009 17:26	11/23/2009 15:10	0.991	0.773	1.072	88.11%	2.77%	PIC	7/2/2009	7/31/2010	0.6163	0.00816	1.206	500
8	5C	75	11	104	1.387	11/23/2009 17:27	11/23/2009 15:10	0.991	0.773	1.072	86.60%	2.78%	PIC	7/2/2009	7/31/2010	0.6368	0.00816	1.184	500
9	9D	85	3	137	1.612	11/23/2009 17:27	11/23/2009 15:10	0.991	0.773	1.082	94.88%	2.71%	PIC	7/2/2009	7/31/2010	0.6433	0.00816	1.730	500
10	7D	60	4	41	0.683	11/23/2009 17:27	11/23/2009 15:10	0.991	0.773	1.057	77.31%	2.87%	PIC	7/2/2009	7/31/2010	0.6257	0.00816	0.622	500
11	14A	60	9	67	1.117	11/23/2009 17:23	11/23/2009 15:10	0.991	0.778	1.057	81.38%	2.83%	PIC	7/2/2009	7/31/2010	0.6393	0.00816	0.748	500
12	12C	60	6	82	1.367	11/23/2009 17:23	11/23/2009 15:10	0.992	0.778	1.057	94.71%	2.72%	PIC	7/2/2009	7/31/2010	0.6304	0.00816	1.246	500
13	10D	60	20	77	1.283	11/23/2009 17:27	11/23/2009 15:10	0.992	0.773	1.057	81.12%	2.83%	PIC	7/2/2009	7/31/2010	0.6320	0.00816	0.876	500
14	1D	60	4	54	0.900	11/23/2009 17:27	11/23/2009 15:10	0.992	0.772	1.057	84.24%	2.80%	PIC	7/2/2009	7/31/2010	0.6043	0.00511	0.646	500
15	8C	60	4	29	0.483	11/23/2009 17:27	11/23/2009 15:10	0.992	0.772	1.057	85.91%	2.78%	PIC	7/2/2009	7/31/2010	0.6339	0.00816	0.744	500
16	7A	60	4	55	0.917	11/23/2009 17:27	11/23/2009 15:10	0.993	0.772	1.057	75.30%	2.89%	PIC	7/2/2009	7/31/2010	0.6180	0.00816	0.714	500
17	10C	60	4	39	0.650	11/23/2009 17:27	11/23/2009 15:10	0.993	0.772	1.057	79.64%	2.84%	PIC	7/2/2009	7/31/2010	0.6250	0.00816	0.498	500
18	12D	60	5	54	0.900	11/23/2009 17:23	11/23/2009 15:10	0.993	0.778	1.057	79.80%	2.84%	PIC	7/2/2009	7/31/2010	0.6320	0.00816	0.714	500
19	6D	75	7	101	1.347	11/23/2009 17:27	11/23/2009 15:10	0.998	0.772	1.072	88.08%	2.77%	PIC	7/2/2009	7/31/2010	0.6120	0.00816	1.196	500
20	9A	60	8	46	0.767	11/23/2009 17:26	11/23/2009 15:10	0.990	0.774	1.057	87.82%	2.77%	PIC	7/2/2009	7/31/2010	0.6496	0.00816	0.628	500
21	9B	60	5	617	10.283	11/23/2009 17:26	11/23/2009 15:10	0.990	0.774	1.057	88.74%	2.76%	PIC	7/2/2009	7/31/2010	0.6356	0.00816	1.806	500
22	3A	60	83	523	8.717	11/23/2009 17:26	11/23/2009 15:10	0.998	0.774	1.057	95.24%	2.71%	PIC	7/2/2009	7/31/2010	0.5682	0.00943	1.386	500

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

* - RPD changed to 0% due to activity below MDA for 1201972469.1

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 Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	1.5325	1.0820	3	2.4891	**2.3975**	0.3483	0.3687	0.1280	1.6310	1.7419		SAMPLE				
2	1.4340	1.0124	3	2.2907	**2.3852**	0.3233	0.4487	0.1445	1.5057	1.6237		SAMPLE				
3	1.8860	1.3315	3	2.8941	**1.5407**	0.5717	0.2667	0.1523	1.7242	1.7684		SAMPLE				
4	1.8679	1.3187	3	2.8472	**3.0504**	0.3046	0.5133	0.1557	1.8133	1.9725		SAMPLE				
5	1.5513	1.0953	3	2.4753	**7.595E-03**	87.7411	0.0013	0.1170	1.3061	1.3063		SAMPLE				
6	1.5635	1.1038	3	2.5571	**0.3913**	1.7997	0.0560	0.1008	1.3802	1.3838		SAMPLE				
7	1.8387	1.2981	3	2.8284	**-0.6538**	1.1573	-0.1127	0.1303	1.4826	1.4827		SAMPLE				
8	1.7938	1.2664	3	2.7614	**1.1580**	0.7132	0.2027	0.1444	1.6174	1.6441		SAMPLE				
9	1.8737	1.3229	3	2.8296	**-0.6161**	1.2668	-0.1182	0.1497	1.5294	1.5295		SAMPLE				
10	1.6133	1.1390	3	2.5993	**0.3941**	1.8328	0.0613	0.1124	1.4156	1.4192		SAMPLE				
11	1.6345	1.1540	3	2.6048	**2.1886**	0.3858	0.3687	0.1418	1.6500	1.7419		SAMPLE				
12	1.8377	1.2975	3	2.8535	**0.6241**	1.3177	0.1207	0.1590	1.6114	1.6192		SAMPLE				
13	1.8067	1.2755	3	2.8542	**2.4699**	0.3746	0.4073	0.1521	1.8079	1.9146		SAMPLE				
14	1.5629	1.1034	3	2.5122	**1.5515**	0.5033	0.2540	0.1276	1.5281	1.5784		SAMPLE				
15	1.5674	1.1066	3	2.4986	**-1.4880**	0.3759	-0.2607	0.0977	1.0930	1.0933		SAMPLE				
16	1.7953	1.2675	3	2.8688	**1.3527**	0.6385	0.2027	0.1293	1.6908	1.7258		SAMPLE				
17	1.4021	0.9899	3	2.2918	**0.9487**	0.7162	0.1520	0.1088	1.3305	1.3523		SAMPLE				
18	1.6451	1.1614	3	2.6287	**1.1375**	0.6897	0.1860	0.1282	1.5364	1.5635		SAMPLE				
19	1.8349	1.2955	3	2.8235	**0.8762**	0.9472	0.1507	0.1426	1.6259	1.6411		MB				
20	1.3742	0.9702	3	2.2128	**0.7554**	0.8548	0.1387	0.1185	1.2648	1.2794	239753001.1	DUP	0.0%			
21	4.7147	3.3286	3	7.2082	**93.4250**	0.0571	8.4773	0.4183	9.0361	25.4661	239753001.1	MS			79.1254	118.1%
22	2.1348	1.5072	3	3.2992	**41.7577**	0.0598	7.3307	0.3848	4.2959	11.4747		LCS			39.2300	106.4%

922859.xls

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine
239753001	1A	60	6	55	11/23/2009 17:26	11/23/2009 18:26	PIC
239753002	13A	60	12	70	11/23/2009 17:23	11/23/2009 18:23	PIC
239753003	8A	75	8	116	11/23/2009 17:26	11/23/2009 18:41	PIC
239753004	1C	85	9	156	11/23/2009 17:26	11/23/2009 18:51	PIC
239753005	2A	60	10	44	11/23/2009 17:26	11/23/2009 18:26	PIC
239753006	7C	60	3	33	11/23/2009 17:26	11/23/2009 18:26	PIC
239753007	6B	75	22	82	11/23/2009 17:26	11/23/2009 18:41	PIC
239753008	5C	75	11	104	11/23/2009 17:27	11/23/2009 18:42	PIC
239753009	9D	85	3	137	11/23/2009 17:27	11/23/2009 18:52	PIC
239753010	7D	60	4	41	11/23/2009 17:27	11/23/2009 18:27	PIC
239753011	14A	60	9	67	11/23/2009 17:23	11/23/2009 18:23	PIC
239753012	12C	60	6	82	11/23/2009 17:23	11/23/2009 18:23	PIC
239753013	10D	60	20	77	11/23/2009 17:27	11/23/2009 18:27	PIC
239753014	1D	60	4	54	11/23/2009 17:27	11/23/2009 18:27	PIC
239753015	8C	60	4	29	11/23/2009 17:27	11/23/2009 18:27	PIC
239753016	7A	60	4	55	11/23/2009 17:27	11/23/2009 18:27	PIC
239753017	10C	60	4	39	11/23/2009 17:27	11/23/2009 18:27	PIC
239753018	12D	60	5	54	11/23/2009 17:23	11/23/2009 18:23	PIC
1201972468	6D	75	7	101	11/23/2009 17:27	11/23/2009 18:42	PIC
1201972469	9A	60	8	46	11/23/2009 17:26	11/23/2009 18:26	PIC
1201972470	9B	60	5	617	11/23/2009 17:26	11/23/2009 18:26	PIC
1201972471	3A	60	83	523	11/23/2009 17:26	11/23/2009 18:26	PIC

ASSAY 20-Nov-09 4:25:11

Protocol	id	8	228_REC
Time	limit	180	
Count	limit	50000	
Isotope	Ba-133		
Protocol	date	9-Apr-07	10:03:07
Run	id.	41	

POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
1	98	1	180	1005	304.5	3.52		04:25:19
2	98	2	180	784	231	4.11	75.86	04:28:30
3	98	3	180	920	276.4	3.71	90.77	04:31:41
4	98	4	180	889	266	3.79	87.36	04:34:53
5	98	5	180	883	263.8	3.81	86.63	04:38:04
6	77	6	180	899	269.2	3.77	88.41	04:41:29
7	77	7	180	749	219.2	4.24	71.99	04:44:40
8	77	8	180	896	268.3	3.78	88.11	04:47:52
9	77	9	180	882	263.7	3.81	86.60	04:51:03
10	77	10	180	958	288.9	3.62	94.88	04:54:14
11	66	11	180	797	235.4	4.07	77.31	04:57:44
12	66	12	180	835	247.8	3.95	81.38	05:00:56
13	66	13	180	956	288.4	3.63	94.71	05:04:07
14	66	14	180	832	247	3.96	81.12	05:07:18
15	66	15	180	861	256.5	3.87	84.24	05:10:30
16	91	16	180	876	261.6	3.83	85.91	05:13:48
17	91	17	180	779	229.3	4.13	75.30	05:17:00
18	91	18	180	819	242.5	4	79.64	05:20:11
19	91	19	180	820	243	3.99	79.80	05:23:23
20	91	20	180	896	268.2	3.78	88.08	05:26:34
21	88	21	180	893	267.4	3.78	87.82	05:29:59
22	88	22	180	902	270.2	3.76	88.74	05:33:10
23	88	23	180	961	290	3.61	95.24	05:36:21

END OF ASSAY

RADIUM 226

Radiochemistry Batch Checklist, Rev 9

Batch# 920697 Product: Ra-226 Date: 12/2/09

Criteria:	Yes	No	Comments
Sample Solids are less than or equal to100 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.			NA
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 statused.	✓		
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 764411
Batch non-conformances second reviewed and disposition verified to be completed.	✓		NCR 764411
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: Lyndsey Pace KHETR 12/7/09

Secondary Review Performed By: L Linch 12/2/09

Radium-226 Que Sheet

09-NOV-09

GEL Laboratories, Radiochemistry Division

Batch #: 920697 Analyst: KSD1 First Client Due Date: 12/07/2009 Internal Due Date: 11/26/2009

Spike Isotope: Radium-226 Spike Code: 0638 I Expiration Date: 9/28/10 Vol: 0.1 End Initial/Degas Date/Time: 11/24/09 1515

LCS Isotope: Radium-226 LCS Code: 0638 I Expiration Date: 9/28/10 Vol: 0.1 End LN De-em Date: 12/1/09

Bkg Count Time: 30 (Min) Sample Count Time: 30 (Min) Start Count Date: 12/1/09

Prep Date: 11/24/09 Pipet ID: 1429303 Balance ID: 51204863 Initials: KD Witness: DL 11-24-09

Sample I	Client Description	Type	Hazard Code	Matrix	Min CRDL	Client	Position (Label)	Aliquot (mL or g)	End LN De-em Time	Start Count Time	Cell #	Det #	Bkg counts	Total Counts
239753001-1	M-141B	SAMPLE		WATER	1 pCi/L	KERR003	1	500	1425	1805	712	7	4	15
239753002-1	M-141009B	SAMPLE		WATER	1 pCi/L	KERR003	2	500	1445	1840	104	1	3	24
239753003-1	PB102309-A3	SAMPLE		WATER	1 pCi/L	KERR003	3	500	1445	1840	204	2	8	22
239753004-1	M-145B	SAMPLE		WATER	1 pCi/L	KERR003	4	500	1445	1840	307	3	8	23
239753005-1	M-139B	SAMPLE		WATER	1 pCi/L	KERR003	5	500	1445	1840	404	4	8	30
239753006-1	M-146B	SAMPLE		WATER	1 pCi/L	KERR003	6	500	1445	1840	506	5	8	49
239753007-1	M-144B	SAMPLE		WATER	1 pCi/L	KERR003	7	500	1445	1840	709	7	6	28
239753008-1	M-138B	SAMPLE		WATER	1 pCi/L	KERR003	8	500	1515	1910	102	1	8	37
239753009-1	M-138009B	SAMPLE		WATER	1 pCi/L	KERR003	9	500	1515	1910	207	2	8	35
239753010-1	M-138BDISS	SAMPLE		WATER	1 pCi/L	KERR003	10	500	1515	1910	309	3	4	15
239753011-1	M-138009BDISS	SAMPLE		WATER	1 pCi/L	KERR003	11	500	1515	1910	505	5	4	19
239753012-1	M-137B	SAMPLE		WATER	1 pCi/L	KERR003	12	500	1515	1910	708	7	4	13
239753013-1	M-137BDISS	SAMPLE		WATER	1 pCi/L	KERR003	13	500	1535	2000	112	1	8	34
239753014-1	M-148B	SAMPLE		WATER	1 pCi/L	KERR003	14	500	1535	2000	203	2	4	35
239753015-1	EB103009-GWA4	SAMPLE		WATER	1 pCi/L	KERR003	15	500	1535	2000	311	3	6	18
239753016-1	M-147B	SAMPLE		WATER	1 pCi/L	KERR003	16	500	1535	2000	501	5	8	46
239753017-1	M-147009B	SAMPLE		WATER	1 pCi/L	KERR003	17	500	1535	2000	707	7	4	20
239753018-1	EB110209-GWA3	SAMPLE		WATER	1 pCi/L	KERR003	18	500	1600	2035	201	2	8	13
1201967363-1	MB for batch 920697	MB		WATER	1 pCi/L	QC ACCOUNT	19	500	1600	2035	306	3	8	21
1201967364-1	M-137B(239753012DUP)	DUP		WATER	1 pCi/L	QC ACCOUNT	20	500	1600	2035	504	5	5	12
1201967365-1	M-137B(239753012MS)	MS		WATER	1 pCi/L	QC ACCOUNT	21	100	1600	2035	711	7	8	1071
1201967366-1	LCS for batch 920697	LCS		WATER	1 pCi/L	QC ACCOUNT	22	500	1615	2125	706	7	8	971

Comments:

Data Reviewed By: Lyndsey Pace 12/2/09

RA920697

Radium-226 Liquid

Filename : RA226.XLS
File type : Excel
Version # : 1.2.5

Batch : 920697
Analyst : KSD1
Prep Date : 11/24/2009
Ra-226 Abundance : 1
Ra-226 Method Uncertainty : 0.0918

Spike S/N : 0638-I
Spike Exp Date : 9/28/2010
Spike Activity (dpm/ml): 268.43
Spike Volume Added: 0.10

LCS S/N : 0638-I
LCS Exp Date : 9/28/2010
LCS Activity (dpm/ml): 268.43
LCS 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

Procedure Code : LUC26RAL
Parmname : Radium-226
Required MDA : 1 pCi/L
Halflife of Ra-226 : 1600 years
Halflife of Rn-222: 3.8235 days
Batch counted on : LUCAS CELL DETECTOR
BKG Count time : 30 min

Sample Characteristics					Count Raw Data				Weekly Background			
Pos.	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.)	Detector Efficiency (cpm/dpm)
1	239753001.1	0.5000	2.0256E-05	10/23/2009 10:00	712	30	15	0.500	4	0.133	30	2.0690
2	239753002.1	0.5000	2.0256E-05	10/23/2009 10:00	104	30	24	0.800	3	0.100	30	1.9720
3	239753003.1	0.5000	2.0256E-05	10/23/2009 12:15	204	30	22	0.733	8	0.267	30	2.1930
4	239753004.1	0.5000	2.0256E-05	10/26/2009 10:15	307	30	23	0.767	8	0.267	30	1.9310
5	239753005.1	0.5000	2.0256E-05	10/26/2009 12:55	404	30	30	1.000	8	0.267	30	1.9310
6	239753006.1	0.5000	2.0256E-05	10/27/2009 9:30	506	30	49	1.633	8	0.267	30	2.0040
7	239753007.1	0.5000	2.0256E-05	10/27/2009 12:25	709	30	28	0.933	6	0.200	30	2.2850
8	239753008.1	0.5000	2.0256E-05	10/28/2009 11:15	102	30	37	1.233	8	0.267	30	1.8550
9	239753009.1	0.5000	2.0256E-05	10/28/2009 11:15	207	30	35	1.167	8	0.267	30	2.1460
10	239753010.1	0.5000	2.0256E-05	10/28/2009 11:15	309	30	15	0.500	4	0.133	30	1.8770
11	239753011.1	0.5000	2.0256E-05	10/28/2009 11:15	505	30	19	0.633	4	0.133	30	2.3310
12	239753012.1	0.5000	2.0256E-05	10/29/2009 13:30	708	30	13	0.433	4	0.133	30	2.1880
13	239753013.1	0.5000	2.0256E-05	10/29/2009 13:30	112	30	34	1.133	8	0.267	30	1.9310
14	239753014.1	0.5000	2.0256E-05	10/29/2009 9:10	203	30	35	1.167	4	0.133	30	2.2540
15	239753015.1	0.5000	2.0256E-05	10/30/2009 11:10	311	30	18	0.600	6	0.200	30	2.1140
16	239753016.1	0.5000	2.0256E-05	11/2/2009 10:00	501	30	46	1.533	8	0.267	30	2.0870
17	239753017.1	0.5000	2.0256E-05	11/2/2009 10:00	707	30	20	0.667	4	0.133	30	2.2750
18	239753018.1	0.5000	2.0256E-05	11/2/2009 12:40	201	30	13	0.433	8	0.267	30	1.9930
19	1201967363.1	0.5000	2.0256E-05	11/24/2009 0:00	306	30	21	0.700	8	0.267	30	1.7470
20	1201967364.1	0.5000	2.0256E-05	10/29/2009 13:30	504	30	12	0.400	5	0.167	30	1.6150
21	1201967365.1	0.1000	1.1370E-05	10/29/2009 13:30	711	30	1071	35.700	8	0.267	30	2.2420
22	1201967366.1	0.5000	2.0256E-05	11/24/2009 0:00	706	30	971	32.367	8	0.267	30	2.1420

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	Rn-222 Corrections			
						De-Gas to Ingrowth	Ingrowth to Count	During Count	Ra-226 Decay
0.06519	9/30/2009	9/30/2010	11/24/2009 15:15	12/1/2009 14:25	12/1/2009 18:05	0.717	0.973	1.002	1.000
0.05303	8/31/2009	8/31/2010	11/24/2009 15:15	12/1/2009 14:45	12/1/2009 18:40	0.718	0.971	1.002	1.000
0.07722	12/19/2008	12/19/2009	11/24/2009 15:15	12/1/2009 14:45	12/1/2009 18:40	0.718	0.971	1.002	1.000
0.06082	2/4/2009	2/4/2010	11/24/2009 15:15	12/1/2009 14:45	12/1/2009 18:40	0.718	0.971	1.002	1.000
0.12371	3/2/2009	3/2/2010	11/24/2009 15:15	12/1/2009 14:45	12/1/2009 18:40	0.718	0.971	1.002	1.000
0.14377	3/25/2009	3/25/2010	11/24/2009 15:15	12/1/2009 14:45	12/1/2009 18:40	0.718	0.971	1.002	1.000
0.06519	9/30/2009	9/30/2010	11/24/2009 15:15	12/1/2009 14:45	12/1/2009 18:40	0.718	0.971	1.002	1.000
0.05303	8/31/2009	8/31/2010	11/24/2009 15:15	12/1/2009 15:15	12/1/2009 19:10	0.719	0.971	1.002	1.000
0.07722	12/19/2008	12/19/2009	11/24/2009 15:15	12/1/2009 15:15	12/1/2009 19:10	0.719	0.971	1.002	1.000
0.06082	2/4/2009	2/4/2010	11/24/2009 15:15	12/1/2009 15:15	12/1/2009 19:10	0.719	0.971	1.002	1.000
0.14377	3/25/2009	3/25/2010	11/24/2009 15:15	12/1/2009 15:15	12/1/2009 19:10	0.719	0.971	1.002	1.000
0.06519	9/30/2009	9/30/2010	11/24/2009 15:15	12/1/2009 15:15	12/1/2009 19:10	0.719	0.971	1.002	1.000
0.05303	8/31/2009	8/31/2010	11/24/2009 15:15	12/1/2009 15:35	12/1/2009 20:00	0.720	0.967	1.002	1.000
0.07722	12/19/2008	12/19/2009	11/24/2009 15:15	12/1/2009 15:35	12/1/2009 20:00	0.720	0.967	1.002	1.000
0.06082	2/4/2009	2/4/2010	11/24/2009 15:15	12/1/2009 15:35	12/1/2009 20:00	0.720	0.967	1.002	1.000
0.14377	3/25/2009	3/25/2010	11/24/2009 15:15	12/1/2009 15:35	12/1/2009 20:00	0.720	0.967	1.002	1.000
0.06519	9/30/2009	9/30/2010	11/24/2009 15:15	12/1/2009 15:35	12/1/2009 20:00	0.720	0.967	1.002	1.000
0.07722	12/19/2008	12/19/2009	11/24/2009 15:15	12/1/2009 16:00	12/1/2009 20:35	0.720	0.966	1.002	1.000
0.06082	2/4/2009	2/4/2010	11/24/2009 15:15	12/1/2009 16:00	12/1/2009 20:35	0.720	0.966	1.002	1.000
0.14377	3/25/2009	3/25/2010	11/24/2009 15:15	12/1/2009 16:00	12/1/2009 20:35	0.720	0.966	1.002	1.000
0.06519	9/30/2009	9/30/2010	11/24/2009 15:15	12/1/2009 16:00	12/1/2009 20:35	0.720	0.966	1.002	1.000
0.06519	9/30/2009	9/30/2010	11/24/2009 15:15	12/1/2009 16:15	12/1/2009 21:25	0.721	0.962	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

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 Error CPM	**2 SIGMA** Counting Uncertainty pCi/L	**2 SIGMA** Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	0.1369	0.0966	1	0.2556	**0.2285**	0.4016	0.3667	0.1453	0.1774	0.1845		SAMPLE				
2	0.1245	0.0879	1	0.2412	**0.4580**	0.2531	0.7000	0.1732	0.2221	0.2417		SAMPLE				
3	0.1828	0.1291	1	0.3169	**0.2746**	0.3988	0.4667	0.1826	0.2106	0.2202		SAMPLE				
4	0.2076	0.1466	1	0.3599	**0.3341**	0.3761	0.5000	0.1856	0.2431	0.2535		SAMPLE				
5	0.2076	0.1466	1	0.3599	**0.4900**	0.3063	0.7333	0.2055	0.2691	0.3071		SAMPLE				
6	0.2000	0.1412	1	0.3468	**0.8800**	0.2336	1.3667	0.2517	0.3176	0.4329		SAMPLE				
7	0.1519	0.1073	1	0.2710	**0.4141**	0.2729	0.7333	0.1944	0.2151	0.2337		SAMPLE				
8	0.2158	0.1523	1	0.3741	**0.6714**	0.2373	0.9667	0.2236	0.3044	0.3349		SAMPLE				
9	0.1865	0.1317	1	0.3234	**0.5403**	0.2548	0.9000	0.2186	0.2572	0.2869		SAMPLE				
10	0.1508	0.1065	1	0.2816	**0.2517**	0.4009	0.3667	0.1453	0.1955	0.2029		SAMPLE				
11	0.1214	0.0857	1	0.2267	**0.2764**	0.3506	0.5000	0.1599	0.1732	0.1963		SAMPLE				
12	0.1294	0.0913	1	0.2415	**0.1767**	0.4627	0.3000	0.1374	0.1586	0.1633		SAMPLE				
13	0.2079	0.1468	1	0.3604	**0.5799**	0.2548	0.8667	0.2160	0.2833	0.3079		SAMPLE				
14	0.1259	0.0889	1	0.2351	**0.5923**	0.2157	1.0333	0.2082	0.2339	0.2722		SAMPLE				
15	0.1644	0.1161	1	0.2933	**0.2445**	0.4128	0.4000	0.1633	0.1956	0.2026		SAMPLE				
16	0.1923	0.1358	1	0.3335	**0.7842**	0.2410	1.2667	0.2449	0.2972	0.3963		SAMPLE				
17	0.1248	0.0881	1	0.2330	**0.3029**	0.3130	0.5333	0.1633	0.1818	0.1937		SAMPLE				
18	0.2014	0.1422	1	0.3492	**0.1081**	0.9198	0.1667	0.1528	0.1941	0.1958		SAMPLE				
19	0.2298	0.1622	1	0.3984	**0.3205**	0.4187	0.4333	0.1795	0.2602	0.2692		MB				
20	0.1965	0.1387	1	0.3575	**0.1867**	0.6063	0.2333	0.1374	0.2155	0.2244	239753012.1	DUP	5.5%			
21	0.8952	0.6320	1	1.5522	**102.1017**	0.0721	35.4333	1.0949	6.1840	23.3646	239753012.1	MS			120.9196	84.4%
22	0.1881	0.1328	1	0.3261	**19.4337**	0.0728	32.1000	1.0430	1.2376	4.4635		LCS			24.1832	80.4%

METHOD CALIBRATION DATA

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-proplyene 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.

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	Pass
Two sigma =	0	
10 % of Mean =	10.6	
Rule 2 (Pass/Fail)	Pass	

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	Pass	Pass
Two sigma =	6.306610289		
10 % of Mean =	9.026666667		
Rule 2 (Pass/Fail)	Pass		

Gadolinium-148

Isotope	Value pCi/g		
SSTOCK2002A2_AM	96.080		
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	Pass	Pass
Two sigma =	3.006149253		
10 % of Mean =	9.546333333		
Rule 2 (Pass/Fail)	Pass		

① PASS ~~Fail~~ 02/12/03

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 std dev was zero. The intent of this rule is to ensure an appropriate amount of counts are achieved for proper determinations. ~~Force~~ 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.

Robert Tian 02/12/03

Attachment II

Mixed alpha	Reference date =	2/7/2003					
Isotope	Source	Stock Dpm/g	Reference date	Half-life (years)	amount used for mixed	Dpm/g mixed	Decay corr dpm/g
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

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 (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

*Notes and references are on pages 5 and 6

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]*.

*Notes and references are on pages 5 and 6.

RC-S-035-0051

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 Wall Thickness Barium content Lead-oxide content Other heavy elements	(16.5 ± 0.5) mm (0.60 ± 0.04) mm Less than 2.5% Less than 0.02% Trace quantities	
Solution density	**(1.030 ± 0.002) $g \cdot mL^{-1}$ at 22.8 °C** [b]*		
Solution mass	Approximately 5.15 g		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration ($mol \cdot L^{-1}$)	Mass Fraction ($g \cdot g^{-1}$)
	H_2O HNO_3 HCl $^{244}Cm^{+3}$	54 1.0 <0.001 5×10^{-11}	0.94 0.06 $<4 \times 10^{-5}$ 1×10^{-11}
Radiological Properties:			
Radionuclide	**Curium-244**		
Reference time	**1200 EST, 1 February 1996** [c]		
Massic activity of the solution [d]	**37.06 $Bq \cdot g^{-1}$** 74.12 Bq·g⁻¹		
Relative expanded uncertainty (k=2)	**0.68%** [e] [f]		
Alpha-particle-emitting daughters Alpha-particle-emitting impurities	Plutonium-240: (0.22 ± 0.11) $Bq \cdot g^{-1}$ [b] [c] Curium-243: (0.005 ± 0.004) $Bq \cdot g^{-1}$ [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 4πα liquid-scintillation counting systems		

37.06 x 2

2004

6

*Notes and references are on pages 5 and 6.

RC-S-035-005c

[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 $u_i(y)/y \equiv |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. 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 λ (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. $|\partial y/\partial x_i| \cdot (x_i/y)$ = {(response per Bq of impurity)/(response per Bq of Cm-244)}·{(Bq of impurity)/(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%. $|\partial y/\partial x_i| \cdot (x_i/y)$ = {(response per Bq of impurity)/(response per Bq of Cm-244)}·{(Bq of impurity)/(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.

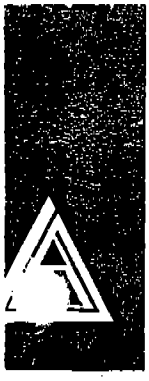
[2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide 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.

RC-5-035-005



ANALYTICS

0502

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

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

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):	3.759 E3
HALF-LIFE:	74.6 years
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: 9-6-02

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 (1)*
Solution mass	Approximately 5 grams
Solution composition	Neptunium-237 in 2 $mol \cdot L^{-1}$ nitric acid
Reference time	March 1992
Radioactivity concentration	97.0 $Bq \cdot g^{-1}$
Overall uncertainty	1.28 percent (2)
Photon-emitting impurities	None detected (3)
Alpha-particle-emitting impurities	None detected (4)
Half life	$(2.14 \pm 0.11) \times 10^6$ years (5)
Measuring instrument	NIST "$0.8\pi\alpha$ 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 ± 0.5 mm
wall thickness	0.60 ± 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 $\gamma \cdot s^{-1} \cdot g^{-1}$ for energies between 30 and 307 keV and
0.01 $\gamma \cdot s^{-1} \cdot g^{-1}$ 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 $\alpha \cdot s^{-1} \cdot g^{-1}$ for energies between 1.0 and 4.3 MeV and
0.05 $\alpha \cdot s^{-1} \cdot g^{-1}$ for energies between 4.9 and 10 MeV.

(5) Evaluated Nuclear Structure Data File (ENSDF), February 1990.

For further information please contact Dr. J.M. Robin Hutchinson at NIST.
Telephone: (301) 975-5532
FAX: (301) 926-7416

Instrument : CHAMBER 025

Detector : 45-149AA5
Standard ID : AESS-025
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 4-NOV-2009 08:33:11
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:11:20

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3182.535
NP-237	0807-B	28-FEB-2010	4768.800	4768.330
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.308

Energy Calibration Zero : 2328.778
Energy Calibration Slope : 4.877499
Energy Calibration Quadratic : 3.1643920E-04
Energy Calibration Range : 2334 to 7655 KeV

The Energy Calibration : energy = 2328.778+(4.877499*Channel)+(3.1643920E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:30
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.044	3301.926	2.000000	0.4799997	70.71068	95.00000
NP-237	4433.147	4903.809	8.000000	1.919999	35.35534	95.00000
CM-244	5532.473	5887.442	103.0000	24.71998	9.853293	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:11:20
Average Efficiency : 0.3284177
Average Efficiency Error : 9.0522086E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	195.5670	28-FEB-2010	2988.044	3301.926	15199.00	0.3290007	1.4139536E-02	59.97539
NP-237	167.9916	28-FEB-2010	4433.147	4903.809	13268.00	0.3290368	1.6698070E-02	66.06133
CM-244	157.2432	28-FEB-2010	5532.473	5887.442	11579.00	0.3269968	1.6631199E-02	60.85799

Instrument : CHAMBER 026

Detector : 78204
Standard ID : AESS-026
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 4-NOV-2009 08:33:11
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:11:30

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.801
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2354.369
Energy Calibration Slope : 4.953624
Energy Calibration Quadratic : 3.1949743E-04
Energy Calibration Range : 2359 to 7762 KeV

The Energy Calibration : energy = 2354.369+(4.953624*Channel)+(3.1949743E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:30
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.632	3302.017	1.000000	0.2399998	100.0000	95.00000
NP-237	4433.847	4905.782	9.000000	2.159998	33.33334	95.00000
CM-244	5532.384	5886.736	72.00000	17.27999	11.78511	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:11:30
Average Efficiency : 0.3187393
Average Efficiency Error : 9.3433373E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	199.5072	28-FEB-2010	2988.632	3302.017	15068.00	0.3197283	1.6198499E-02	48.77509
NP-237	168.0294	28-FEB-2010	4433.847	4905.782	13060.00	0.3237990	1.6436102E-02	68.84023
CM-244	160.5822	28-FEB-2010	5532.384	5886.736	11313.00	0.3130322	1.5926857E-02	52.34050

Instrument : CHAMBER 027

Detector : 42484
Standard ID : AESS-027
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 4-NOV-2009 08:33:11
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:11:40

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3182.724
NP-237	0807-B	28-FEB-2010	4768.800	4768.644
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.730

Energy Calibration Zero : 2368.047
Energy Calibration Slope : 4.986534
Energy Calibration Quadratic : 2.9072489E-04
Energy Calibration Range : 2373 to 7779 KeV

The Energy Calibration : energy = 2368.047+(4.986534*Channel)+(2.9072489E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:30
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.848	3300.506	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4435.280	4902.342	7.000000	1.679999	37.79645	95.00000
CM-244	5534.038	5882.559	88.00000	21.11999	10.66004	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:11:40
Average Efficiency : 0.3416629
Average Efficiency Error : 1.0012131E-02
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	193.4238	28-FEB-2010	2990.848	3300.506	15371.00	0.3364211	1.7039858E-02	49.61097
NP-237	161.6154	28-FEB-2010	4435.280	4902.342	13349.00	0.3441128	1.7461589E-02	67.07381
CM-244	148.1754	28-FEB-2010	5534.038	5882.559	11500.00	0.3447433	1.7535616E-02	54.61600

Instrument : CHAMBER 028

Detector : 78792
Standard ID : AESS-028
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 4-NOV-2009 08:33:11
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:11:50

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3182.824
NP-237	0807-B	28-FEB-2010	4768.800	4768.798
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.948

Energy Calibration Zero : 2314.256
Energy Calibration Slope : 4.950538
Energy Calibration Quadratic : 3.2644827E-04
Energy Calibration Range : 2319 to 7726 KeV

The Energy Calibration : energy = 2314.256+(4.950538*Channel)+(3.2644827E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:30
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.528	3302.181	2.000000	0.4799997	70.71068	95.00000
NP-237	4435.396	4902.811	8.000000	1.919999	35.35534	95.00000
CM-244	5530.503	5885.549	76.00000	18.23999	11.47079	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:11:50
Average Efficiency : 0.3050518
Average Efficiency Error : 8.9486167E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	199.6542	28-FEB-2010	2988.528	3302.181	14354.00	0.3043484	1.5429220E-02	44.19452
NP-237	168.1992	28-FEB-2010	4435.396	4902.811	12198.00	0.3021244	1.5351990E-02	59.07529
CM-244	156.7614	28-FEB-2010	5530.503	5885.549	10898.00	0.3088536	1.5724592E-02	43.16341

Instrument : CHAMBER 029

Detector : 33454
Standard ID : AESS-029
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 4-NOV-2009 08:33:11
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:12:00

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3182.660
NP-237	0807-B	28-FEB-2010	4768.800	4768.540
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.916

Energy Calibration Zero : 2352.222
Energy Calibration Slope : 4.897179
Energy Calibration Quadratic : 2.9826825E-04
Energy Calibration Range : 2357 to 7680 KeV

The Energy Calibration : energy = 2352.222+(4.897179*Channel)+(2.9826825E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:30
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.921	3298.464	2.000000	0.4799997	70.71068	95.00000
NP-237	4435.920	4906.562	8.000000	1.919999	35.35534	95.00000
CM-244	5534.740	5883.900	86.00000	20.63999	10.78328	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:12:00
Average Efficiency : 0.3123440
Average Efficiency Error : 9.1590546E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	201.5742	28-FEB-2010	2988.921	3298.464	14665.00	0.3079810	1.5608890E-02	58.07315
NP-237	169.7700	28-FEB-2010	4435.920	4906.562	12802.00	0.3141530	1.5951235E-02	72.72359
CM-244	154.8234	28-FEB-2010	5534.740	5883.900	10984.00	0.3151226	1.6041664E-02	56.41142

Instrument : CHAMBER 030

Detector : 33447
Standard ID : AESS-030
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 4-NOV-2009 08:33:11
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:12:11

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3182.992
NP-237	0807-B	28-FEB-2010	4768.800	4768.798
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2380.611
Energy Calibration Slope : 4.957869
Energy Calibration Quadratic : 3.0952605E-04
Energy Calibration Range : 2386 to 7782 KeV

The Energy Calibration : energy = 2380.611+(4.957869*Channel)+(3.0952605E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:30
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.078	3298.267	1.000000	0.2399998	100.0000	95.00000
NP-237	4434.110	4905.334	11.00000	2.639998	30.15113	95.00000
CM-244	5530.758	5884.331	76.00000	18.23999	11.47079	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:12:11
Average Efficiency : 0.3237875
Average Efficiency Error : 9.4913049E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	198.9792	28-FEB-2010	2990.078	3298.267	14918.00	0.3173854	1.6081888E-02	56.46090
NP-237	166.3758	28-FEB-2010	4434.110	4905.334	13266.00	0.3321642	1.6856849E-02	66.08606
CM-244	157.1856	28-FEB-2010	5530.758	5884.331	11410.00	0.3225155	1.6407013E-02	58.34272

Instrument : CHAMBER 031

Detector : 79988
Standard ID : AESS-031
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 4-NOV-2009 08:33:12
Calibration Count Time : 240.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:12:20

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.800
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.862

Energy Calibration Zero : 2341.273
Energy Calibration Slope : 4.909827
Energy Calibration Quadratic : 3.3634368E-04
Energy Calibration Range : 2346 to 7722 KeV

The Energy Calibration : energy = 2341.273+(4.909827*Channel)+(3.3634368E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.232	3301.398	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4436.778	4906.511	11.00000	2.640001	30.15113	95.00000
CM-244	5530.640	5883.813	45.00000	10.80000	14.90712	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:12:20
Average Efficiency : 0.3439283
Average Efficiency Error : 9.4762286E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	193.6650	28-FEB-2010	2990.232	3301.398	15614.00	0.3412869	1.4660587E-02	55.13291
NP-237	162.9186	28-FEB-2010	4436.778	4906.511	13684.00	0.3499030	1.7749120E-02	69.00159
CM-244	153.1968	28-FEB-2010	5530.640	5883.813	11785.00	0.3419108	1.7383847E-02	51.83997

Instrument : CHAMBER 033

Detector : 78785
Standard ID : AESS-033
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 4-NOV-2009 08:33:12
Calibration Count Time : 240.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:12:35

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.801
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2378.839
Energy Calibration Slope : 4.956201
Energy Calibration Quadratic : 3.2238252E-04
Energy Calibration Range : 2384 to 7792 KeV

The Energy Calibration : energy = 2378.839+(4.956201*Channel)+(3.2238252E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.294	3301.695	2.000000	0.4800001	70.71068	95.00000
NP-237	4433.763	4905.875	9.000000	2.160001	33.33334	95.00000
CM-244	5532.781	5887.338	79.00000	18.96000	11.25088	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:12:35
Average Efficiency : 0.3097593
Average Efficiency Error : 8.5533001E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	192.4158	28-FEB-2010	2988.294	3301.695	13801.00	0.3036067	1.3071683E-02	47.79169
NP-237	161.7816	28-FEB-2010	4433.763	4905.875	12172.00	0.3134331	1.5927175E-02	58.02074
CM-244	147.2670	28-FEB-2010	5532.781	5887.338	10457.00	0.3153150	1.6065678E-02	52.63453

Instrument : CHAMBER 035

Detector : 78202
Standard ID : AESS-035
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 4-NOV-2009 08:33:12
Calibration Count Time : 240.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:12:49

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.811
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.071

Energy Calibration Zero : 2339.498
Energy Calibration Slope : 4.957463
Energy Calibration Quadratic : 3.2899898E-04
Energy Calibration Range : 2344 to 7761 KeV

The Energy Calibration : energy = 2339.498+(4.957463*Channel)+(3.2899898E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2989.528	3298.375	4.000000	0.9600002	50.00000	95.00000
NP-237	4432.590	4905.766	17.00000	4.080001	24.25356	95.00000
CM-244	5534.227	5884.327	82.00000	19.68000	11.04315	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:12:49
Average Efficiency : 0.3011819
Average Efficiency Error : 8.3130784E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	198.6666	28-FEB-2010	2989.528	3298.375	14249.00	0.3035896	1.3062931E-02	46.51835
NP-237	168.2934	28-FEB-2010	4432.590	4905.766	12293.00	0.3042536	1.5458381E-02	64.58060
CM-244	158.8128	28-FEB-2010	5534.227	5884.327	10554.00	0.2950884	1.5032584E-02	50.29810

Instrument : CHAMBER 036

Detector : 78203
Standard ID : AESS-036
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 4-NOV-2009 08:33:12
Calibration Count Time : 240.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:12:59

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.275
NP-237	0807-B	28-FEB-2010	4768.800	4768.954
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.157

Energy Calibration Zero : 2354.929
Energy Calibration Slope : 4.916327
Energy Calibration Quadratic : 3.5188830E-04
Energy Calibration Range : 2360 to 7758 KeV

The Energy Calibration : energy = 2354.929+(4.916327*Channel)+(3.5188830E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2989.984	3301.734	3.000000	0.7200001	57.73503	95.00000
NP-237	4434.980	4906.333	10.00000	2.400001	31.62278	95.00000
CM-244	5532.965	5882.330	79.00000	18.96000	11.25088	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:12:59
Average Efficiency : 0.3258305
Average Efficiency Error : 8.9820670E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	201.3204	28-FEB-2010	2989.984	3301.734	15169.00	0.3189372	1.3707514E-02	56.87218
NP-237	167.4312	28-FEB-2010	4434.980	4906.333	13321.00	0.3314448	1.6819313E-02	67.32282
CM-244	156.4188	28-FEB-2010	5532.965	5882.330	11643.00	0.3305905	1.6812116E-02	56.23889

Instrument : CHAMBER 037

Detector : 45-149BB5
Standard ID : AESS-037
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 4-NOV-2009 08:33:13
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:13:10

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.661
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2384.221
Energy Calibration Slope : 4.937421
Energy Calibration Quadratic : 2.6759913E-04
Energy Calibration Range : 2389 to 7721 KeV

The Energy Calibration : energy = 2384.221+(4.937421*Channel)+(2.6759913E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.569	3301.766	6.000000	1.439999	40.82483	95.00000
NP-237	4432.923	4904.219	17.00000	4.079998	24.25356	95.00000
CM-244	5532.481	5886.614	107.0000	25.67998	9.667364	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:13:10
Average Efficiency : 0.3580391
Average Efficiency Error : 9.8568676E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	197.7372	28-FEB-2010	2990.569	3301.766	16393.00	0.3509030	1.5061274E-02	69.74401
NP-237	167.1294	28-FEB-2010	4432.923	4904.219	14632.00	0.3646860	1.8482015E-02	78.18130
CM-244	154.7664	28-FEB-2010	5532.481	5886.614	12623.00	0.3620973	1.8390791E-02	72.24805

Instrument : CHAMBER 038

Detector : 72532
Standard ID : AESS-038
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 4-NOV-2009 08:33:13
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:13:20

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.800
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.935

Energy Calibration Zero : 2378.027
Energy Calibration Slope : 4.946940
Energy Calibration Quadratic : 3.2543507E-04
Energy Calibration Range : 2383 to 7785 KeV

The Energy Calibration : energy = 2378.027+(4.946940*Channel)+(3.2543507E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2991.424	3299.282	2.000000	0.4799997	70.71068	95.00000
NP-237	4434.917	4906.502	10.00000	2.399998	31.62278	95.00000
CM-244	5532.790	5887.039	104.0000	24.95998	9.805807	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:13:20
Average Efficiency : 0.3420325
Average Efficiency Error : 9.4205979E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	200.1408	28-FEB-2010	2991.424	3299.282	15846.00	0.3351398	1.4392883E-02	55.53449
NP-237	170.0886	28-FEB-2010	4434.917	4906.502	14205.00	0.3479221	1.7639427E-02	64.95515
CM-244	157.7460	28-FEB-2010	5532.790	5887.039	12310.00	0.3464782	1.7604353E-02	59.85936

Instrument : CHAMBER 039

Detector : 45-149BB2
Standard ID : AESS-039
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 4-NOV-2009 08:33:13
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:13:31

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.799
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2388.746
Energy Calibration Slope : 4.914010
Energy Calibration Quadratic : 3.2089511E-04
Energy Calibration Range : 2394 to 7757 KeV

The Energy Calibration : energy = 2388.746+(4.914010*Channel)+(3.2089511E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.039	3298.756	6.000000	1.439999	40.82483	95.00000
NP-237	4436.729	4905.040	12.00000	2.879998	28.86751	95.00000
CM-244	5532.232	5884.005	110.0000	26.39998	9.534626	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:13:31
Average Efficiency : 0.3648929
Average Efficiency Error : 1.0049243E-02
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	192.2418	28-FEB-2010	2988.039	3298.756	16118.00	0.3548785	1.5236211E-02	63.08267
NP-237	159.1506	28-FEB-2010	4436.729	4905.040	14402.00	0.3769790	1.9109026E-02	85.58052
CM-244	151.7142	28-FEB-2010	5532.232	5884.005	12591.00	0.3684085	1.8712135E-02	67.12554

Instrument : CHAMBER 040

Detector : 78773
Standard ID : AESS-040
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 4-NOV-2009 08:33:13
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:13:54

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3183.000
NP-237	0807-B	28-FEB-2010	4768.800	4768.799
CM-244	0910/0911-A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2355.549
Energy Calibration Slope : 4.906727
Energy Calibration Quadratic : 3.1722613E-04
Energy Calibration Range : 2360 to 7713 KeV

The Energy Calibration : energy = 2355.549+(4.906727*Channel)+(3.1722613E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.808	3299.279	3.000000	0.7199996	57.73503	95.00000
NP-237	4436.136	4903.894	6.000000	1.439999	40.82483	95.00000
CM-244	5535.565	5886.878	96.00000	23.03999	10.20621	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:13:54
Average Efficiency : 0.3230931
Average Efficiency Error : 8.9092702E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	194.4828	28-FEB-2010	2988.808	3299.279	14753.00	0.3210947	1.3807181E-02	48.34544
NP-237	166.8174	28-FEB-2010	4436.136	4903.894	12953.00	0.3234969	1.6422754E-02	64.00413
CM-244	155.0100	28-FEB-2010	5535.565	5886.878	11367.00	0.3255583	1.6563144E-02	53.88326

Instrument : CHAMBER 041

Detector : 78205
Standard ID : AESS-041
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 4-NOV-2009 08:33:13
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:14:05

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3182.715
NP-237	0807-B	28-FEB-2010	4768.800	4768.680
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.847

Energy Calibration Zero : 2364.283
Energy Calibration Slope : 4.953596
Energy Calibration Quadratic : 3.3976510E-04
Energy Calibration Range : 2369 to 7793 KeV

The Energy Calibration : energy = 2364.283+(4.953596*Channel)+(3.3976510E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.791	3302.487	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4436.678	4904.854	10.00000	2.399998	31.62278	95.00000
CM-244	5533.881	5884.420	95.00000	22.79999	10.25978	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:14:05
Average Efficiency : 0.3327790
Average Efficiency Error : 9.1675343E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	203.9034	28-FEB-2010	2988.791	3302.487	15730.00	0.3265573	1.4026052E-02	49.55199
NP-237	171.2268	28-FEB-2010	4436.678	4904.854	13823.00	0.3363137	1.7057342E-02	66.69939
CM-244	159.5796	28-FEB-2010	5533.881	5884.420	12167.00	0.3385442	1.7204376E-02	53.56832

Instrument : CHAMBER 042

Detector : 78793
Standard ID : AESS-042
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 4-NOV-2009 08:33:13
Calibration Count Time : 239.9998 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 4-NOV-2009 14:14:15

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	0810-B	28-FEB-2010	3183.000	3182.598
NP-237	0807-B	28-FEB-2010	4768.800	4768.622
CM-244	0910/0911-A	28-FEB-2010	5795.020	5794.973

Energy Calibration Zero : 2382.684
Energy Calibration Slope : 4.893946
Energy Calibration Quadratic : 3.5197593E-04
Energy Calibration Range : 2388 to 7763 KeV

The Energy Calibration : energy = 2382.684+(4.893946*Channel)+(3.5197593E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 1-NOV-2009 19:30:31
Background Count Time : 59999.99 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2989.964	3300.110	4.000000	0.9599994	50.00000	95.00000
NP-237	4432.825	4901.917	9.000000	2.159999	33.33334	95.00000
CM-244	5530.914	5884.067	116.0000	27.83998	9.284767	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 4-NOV-2009 14:14:15
Average Efficiency : 0.3342218
Average Efficiency Error : 9.2160990E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	188.7090	28-FEB-2010	2989.964	3300.110	14924.00	0.3347494	1.4391325E-02	47.46222
NP-237	159.6558	28-FEB-2010	4432.825	4901.917	12885.00	0.3362144	1.7069759E-02	62.70876
CM-244	150.5208	28-FEB-2010	5530.914	5884.067	11246.00	0.3315499	1.6871363E-02	52.78824

Instrument : CHAMBER 121

Detector : 75545
Standard ID : AESS-005
Standard Reference Date : 14-FEB-2008 09:35:18
Calibration Analysis Date/Time : 18-NOV-2009 08:14:13
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:33:22

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.765
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2337.936
Energy Calibration Slope : 4.942307
Energy Calibration Quadratic : 2.8753869E-04
Energy Calibration Range : 2343 to 7700 KeV

The Energy Calibration : energy = 2337.936+(4.942307*Channel)+(2.8753869E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:14:17
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.313	3302.511	1.000000	0.3000000	100.0000	95.00000
NP-237	4433.334	4901.898	2.000000	0.6000000	70.71068	95.00000
CM-244	5533.896	5885.024	6.000000	1.800000	40.82483	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:33:22
Average Efficiency : 0.2473573
Average Efficiency Error : 6.8073976E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	210.7452	28-FEB-2010	2990.313	3302.511	15217.00	0.2446291	1.0513312E-02	50.02479
NP-237	209.5938	28-FEB-2010	4433.334	4901.898	15770.00	0.2507932	1.2697713E-02	58.78762
CM-244	202.7478	28-FEB-2010	5533.896	5885.024	14097.00	0.2478902	1.2569192E-02	51.04265

Instrument : CHAMBER 122

Detector : 75546
Standard ID : AESS-011
Standard Reference Date : 14-FEB-2008 13:39:25
Calibration Analysis Date/Time : 18-NOV-2009 08:14:17
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:33:39

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2333.121
Energy Calibration Slope : 4.951138
Energy Calibration Quadratic : 2.8171830E-04
Energy Calibration Range : 2338 to 7698 KeV

The Energy Calibration : energy = 2333.121+(4.951138*Channel)+(2.8171830E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:14:23
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2991.580	3299.185	2.000000	0.6000000	70.71068	95.00000
NP-237	4436.363	4905.292	18.00000	5.400000	23.57022	95.00000
CM-244	5532.326	5883.533	5.000000	1.500000	44.72136	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:33:39
Average Efficiency : 0.2526607
Average Efficiency Error : 6.9489521E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	212.8284	28-FEB-2010	2991.580	3299.185	15866.00	0.2525603	1.0846268E-02	50.15437
NP-237	214.4868	28-FEB-2010	4436.363	4905.292	16139.00	0.2507320	1.2691127E-02	56.76629
CM-244	208.4184	28-FEB-2010	5532.326	5883.533	14895.00	0.2547987	1.2909920E-02	50.74705

Instrument : CHAMBER 123

Detector : 45-142V3
Standard ID : AESS-006
Standard Reference Date : 14-FEB-2008 09:35:18
Calibration Analysis Date/Time : 18-NOV-2009 08:14:22
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:33:53

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.801
CM-244	4320A	28-FEB-2010	5795.020	5795.129

Energy Calibration Zero : 2373.252
Energy Calibration Slope : 4.970928
Energy Calibration Quadratic : 2.5967354E-04
Energy Calibration Range : 2378 to 7736 KeV

The Energy Calibration : energy = 2373.252+(4.970928*Channel)+(2.5967354E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:14:28
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.604	3301.760	1.000000	0.3000000	100.0000	95.00000
NP-237	4434.252	4902.716	3.000000	0.9000000	57.73503	95.00000
CM-244	5533.878	5884.205	17.00000	5.100000	24.25356	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:33:53
Average Efficiency : 0.2603278
Average Efficiency Error : 7.1630413E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	203.6952	28-FEB-2010	2988.604	3301.760	15566.00	0.2589007	1.1122215E-02	66.44209
NP-237	204.7038	28-FEB-2010	4434.252	4902.716	15697.00	0.2555905	1.2941348E-02	72.51353
CM-244	195.0060	28-FEB-2010	5533.878	5884.205	14643.00	0.2676548	1.3564456E-02	65.26345

Instrument : CHAMBER 124

Detector : 45-142V2
Standard ID : AESS-012
Standard Reference Date : 14-FEB-2008 13:39:25
Calibration Analysis Date/Time : 18-NOV-2009 08:14:27
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:34:11

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2385.700
Energy Calibration Slope : 5.030823
Energy Calibration Quadratic : 2.4897119E-04
Energy Calibration Range : 2391 to 7798 KeV

The Energy Calibration : energy = 2385.700+(5.030823*Channel)+(2.4897119E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:14:33
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2987.893	3299.314	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4432.634	4905.307	6.000000	1.800000	40.82483	95.00000
CM-244	5531.143	5884.210	7.000000	2.100000	37.79645	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:34:11
Average Efficiency : 0.2595429
Average Efficiency Error : 7.1389978E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	206.2200	28-FEB-2010	2987.893	3299.314	15727.00	0.2583798	1.1097851E-02	66.33055
NP-237	205.8930	28-FEB-2010	4432.634	4905.307	16250.00	0.2630527	1.3313570E-02	74.78283
CM-244	203.1954	28-FEB-2010	5531.143	5884.210	14692.00	0.2577755	1.3063119E-02	69.52264

Instrument : CHAMBER 138

Detector : 65877
Standard ID : AESS-031
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 18-NOV-2009 08:15:30
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:40:59

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.299
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.037

Energy Calibration Zero : 2378.122
Energy Calibration Slope : 4.999195
Energy Calibration Quadratic : 2.9128915E-04
Energy Calibration Range : 2383 to 7803 KeV

The Energy Calibration : energy = 2378.122+(4.999195*Channel)+(2.9128915E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:15:45
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2992.359	3297.624	4.000000	1.200000	50.00000	95.00000
NP-237	4434.872	4902.951	26.00000	7.800000	19.61161	95.00000
CM-244	5530.666	5885.297	9.000000	2.700000	33.33334	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:40:59
Average Efficiency : 0.2542060
Average Efficiency Error : 7.0132604E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	193.6650	28-FEB-2010	2992.359	3297.624	14409.00	0.2520270	1.0842061E-02	57.19797
NP-237	162.9186	28-FEB-2010	4434.872	4902.951	12538.00	0.2563694	1.3021626E-02	60.08981
CM-244	153.1968	28-FEB-2010	5530.666	5885.297	10971.00	0.2551810	1.2989706E-02	57.60730

Instrument : CHAMBER 139

Detector : 76231
Standard ID : AESS-026
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 18-NOV-2009 08:15:35
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:41:12

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.801
CM-244	4320A	28-FEB-2010	5795.020	5795.019

Energy Calibration Zero : 2350.269
Energy Calibration Slope : 4.923247
Energy Calibration Quadratic : 3.1972880E-04
Energy Calibration Range : 2355 to 7727 KeV

The Energy Calibration : energy = 2350.269+(4.923247*Channel)+(3.1972880E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:15:50
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.688	3302.273	2.000000	0.6000000	70.71068	95.00000
NP-237	4432.919	4902.312	25.00000	7.500000	20.00000	95.00000
CM-244	5530.906	5883.442	8.000000	2.400000	35.35534	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:41:12
Average Efficiency : 0.2491344
Average Efficiency Error : 7.3053949E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	199.5072	28-FEB-2010	2990.688	3302.273	14592.00	0.2477839	1.2558901E-02	54.20703
NP-237	168.0294	28-FEB-2010	4432.919	4902.312	12793.00	0.2536362	1.2878811E-02	52.46771
CM-244	160.5822	28-FEB-2010	5530.906	5883.442	11092.00	0.2462171	1.2530987E-02	49.40826

Instrument : CHAMBER 140

Detector : 78771
Standard ID : AESS-032
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 18-NOV-2009 08:15:39
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:41:26

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2341.379
Energy Calibration Slope : 4.954690
Energy Calibration Quadratic : 3.0003360E-04
Energy Calibration Range : 2346 to 7730 KeV

The Energy Calibration : energy = 2341.379+(4.954690*Channel)+(3.0003360E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:15:55
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.559	3298.670	1.000000	0.3000000	100.0000	95.00000
NP-237	4433.640	4904.243	16.00000	4.800000	25.00000	95.00000
CM-244	5533.946	5886.857	2.000000	0.6000000	70.71068	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:41:26
Average Efficiency : 0.2551176
Average Efficiency Error : 7.0365276E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	195.2364	28-FEB-2010	2990.559	3298.670	14738.00	0.2557228	1.0996417E-02	45.42550
NP-237	165.9822	28-FEB-2010	4433.640	4904.243	12678.00	0.2545095	1.2924836E-02	53.64622
CM-244	153.7938	28-FEB-2010	5533.946	5886.857	10999.00	0.2548880	1.2974110E-02	52.32060

Instrument : CHAMBER 141

Detector : 76232
Standard ID : AESS-027
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 18-NOV-2009 08:15:43
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:41:39

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3182.673
NP-237	4341	28-FEB-2010	4768.800	4768.653
CM-244	4320A	28-FEB-2010	5795.020	5794.897

Energy Calibration Zero : 2360.567
Energy Calibration Slope : 4.948405
Energy Calibration Quadratic : 2.9607967E-04
Energy Calibration Range : 2366 to 7738 KeV

The Energy Calibration : energy = 2360.567+(4.948405*Channel)+(2.9607967E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:15:59
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.766	3301.332	2.000000	0.6000000	70.71068	95.00000
NP-237	4433.993	4903.545	10.00000	3.000000	31.62278	95.00000
CM-244	5531.761	5883.798	6.000000	1.800000	40.82483	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:41:39
Average Efficiency : 0.2554431
Average Efficiency Error : 7.4935821E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	193.4238	28-FEB-2010	2988.766	3301.332	14292.00	0.2503223	1.2691112E-02	57.52324
NP-237	161.6154	28-FEB-2010	4433.993	4903.545	12568.00	0.2591544	1.3162418E-02	56.32706
CM-244	148.1754	28-FEB-2010	5531.761	5883.798	10692.00	0.2572228	1.3099612E-02	54.26664

Instrument : CHAMBER 142

Detector : 64261
Standard ID : AESS-033
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 18-NOV-2009 08:15:47
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:41:56

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2376.230
Energy Calibration Slope : 4.966580
Energy Calibration Quadratic : 3.0060238E-04
Energy Calibration Range : 2381 to 7777 KeV

The Energy Calibration : energy = 2376.230+(4.966580*Channel)+(3.0060238E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:04
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2991.667	3300.258	1.000000	0.3000000	100.0000	95.00000
NP-237	4437.001	4903.079	26.00000	7.800000	19.61161	95.00000
CM-244	5533.701	5887.128	22.00000	6.600000	21.32007	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:41:56
Average Efficiency : 0.2583063
Average Efficiency Error : 7.1268436E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	192.4158	28-FEB-2010	2991.667	3300.258	14459.00	0.2545594	1.0950263E-02	56.98912
NP-237	161.7816	28-FEB-2010	4437.001	4903.079	12611.00	0.2596752	1.3188355E-02	65.52209
CM-244	147.2670	28-FEB-2010	5533.701	5887.128	10852.00	0.2624816	1.3364112E-02	55.63273

Instrument : CHAMBER 143

Detector : 65882
Standard ID : AESS-028
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 18-NOV-2009 08:15:51
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:42:11

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.801
CM-244	4320A	28-FEB-2010	5795.020	5795.019

Energy Calibration Zero : 2349.458
Energy Calibration Slope : 4.977223
Energy Calibration Quadratic : 2.6478578E-04
Energy Calibration Range : 2354 to 7724 KeV

The Energy Calibration : energy = 2349.458+(4.977223*Channel)+(2.6478578E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:10
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.881	3299.612	10.00000	3.000000	31.62278	95.00000
NP-237	4434.630	4904.266	18.00000	5.400000	23.57022	95.00000
CM-244	5531.815	5883.100	11.00000	3.300000	30.15113	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:42:11
Average Efficiency : 0.2435768
Average Efficiency Error : 7.1454709E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	199.6542	28-FEB-2010	2990.881	3299.612	14261.00	0.2419440	1.2266767E-02	49.88798
NP-237	168.1992	28-FEB-2010	4434.630	4904.266	12424.00	0.2461090	1.2502169E-02	57.93009
CM-244	156.7614	28-FEB-2010	5531.815	5883.100	10677.00	0.2427591	1.2363405E-02	51.17299

Instrument : CHAMBER 144

Detector : 75551
Standard ID : AESS-034
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 18-NOV-2009 08:15:55
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:42:32

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2347.599
Energy Calibration Slope : 4.937171
Energy Calibration Quadratic : 3.0647003E-04
Energy Calibration Range : 2353 to 7725 KeV

The Energy Calibration : energy = 2347.599+(4.937171*Channel)+(3.0647003E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:14
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2989.594	3301.779	4.000000	1.200000	50.00000	95.00000
NP-237	4433.735	4903.290	11.00000	3.300000	30.15113	95.00000
CM-244	5531.770	5884.080	9.000000	2.700000	33.33334	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:42:32
Average Efficiency : 0.2509402
Average Efficiency Error : 6.9225174E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	200.5488	28-FEB-2010	2989.594	3301.779	14579.00	0.2462479	1.0591129E-02	46.81347
NP-237	167.2962	28-FEB-2010	4433.735	4903.290	12833.00	0.2556286	1.2979213E-02	58.06931
CM-244	154.4388	28-FEB-2010	5531.770	5884.080	10977.00	0.2532673	1.2892167E-02	48.64608

Instrument : CHAMBER 145

Detector : 72526
Standard ID : AESS-029
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 18-NOV-2009 08:15:59
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:42:45

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2352.373
Energy Calibration Slope : 4.969179
Energy Calibration Quadratic : 2.8356104E-04
Energy Calibration Range : 2357 to 7738 KeV

The Energy Calibration : energy = 2352.373+(4.969179*Channel)+(2.8356104E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:19
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.032	3301.677	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4437.403	4902.601	7.000000	2.100000	37.79645	95.00000
CM-244	5531.625	5883.957	4.000000	1.200000	50.00000	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:42:45
Average Efficiency : 0.2502206
Average Efficiency Error : 7.3377313E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	201.5742	28-FEB-2010	2988.032	3301.677	14603.00	0.2454380	1.2439859E-02	54.61472
NP-237	169.7700	28-FEB-2010	4437.403	4902.601	12733.00	0.2499637	1.2693054E-02	54.42122
CM-244	154.8234	28-FEB-2010	5531.625	5883.957	11106.00	0.2557254	1.3014561E-02	53.58852

Instrument : CHAMBER 146

Detector : 72527
Standard ID : AESS-035
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 18-NOV-2009 08:16:04
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:43:01

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3182.984
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2350.006
Energy Calibration Slope : 4.931883
Energy Calibration Quadratic : 2.8951556E-04
Energy Calibration Range : 2355 to 7704 KeV

The Energy Calibration : energy = 2350.006+(4.931883*Channel)+(2.8951556E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:23
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2991.037	3297.515	2.000000	0.6000000	70.71068	95.00000
NP-237	4436.256	4903.993	3.000000	0.9000000	57.73503	95.00000
CM-244	5534.939	5885.513	10.00000	3.000000	31.62278	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:43:01
Average Efficiency : 0.2521740
Average Efficiency Error : 6.9548828E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	198.6666	28-FEB-2010	2991.037	3297.515	15016.00	0.2560428	1.1006447E-02	52.29327
NP-237	168.2934	28-FEB-2010	4436.256	4903.993	12722.00	0.2519628	1.2794692E-02	59.50724
CM-244	158.8128	28-FEB-2010	5534.939	5885.513	11023.00	0.2473175	1.2588392E-02	55.02975

Instrument : CHAMBER 147

Detector : 75550
Standard ID : AESS-030
Standard Reference Date : 15-FEB-2008 09:06:52
Calibration Analysis Date/Time : 18-NOV-2009 08:16:08
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:43:19

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.143

Energy Calibration Zero : 2342.758
Energy Calibration Slope : 4.974234
Energy Calibration Quadratic : 2.5187916E-04
Energy Calibration Range : 2348 to 7700 KeV

The Energy Calibration : energy = 2342.758+(4.974234*Channel)+(2.5187916E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:28
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.625	3302.025	2.000000	0.6000000	70.71068	95.00000
NP-237	4434.897	4903.298	14.00000	4.200000	26.72612	95.00000
CM-244	5534.180	5884.256	5.000000	1.500000	44.72136	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:43:19
Average Efficiency : 0.2451187
Average Efficiency Error : 7.1902573E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	198.9792	28-FEB-2010	2988.625	3302.025	14282.00	0.2431632	1.2328269E-02	48.34250
NP-237	166.3758	28-FEB-2010	4434.897	4903.298	12254.00	0.2454244	1.2470047E-02	57.47663
CM-244	157.1856	28-FEB-2010	5534.180	5884.256	10884.00	0.2468401	1.2566833E-02	47.78167

Instrument : CHAMBER 148

Detector : 74429
Standard ID : AESS-036
Standard Reference Date : 18-FEB-2008 11:28:15
Calibration Analysis Date/Time : 18-NOV-2009 08:16:12
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:43:37

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.134
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2342.267
Energy Calibration Slope : 4.959772
Energy Calibration Quadratic : 2.7652038E-04
Energy Calibration Range : 2347 to 7711 KeV

The Energy Calibration : energy = 2342.267+(4.959772*Channel)+(2.7652038E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:33
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2991.710	3299.671	3.000000	0.9000000	57.73503	95.00000
NP-237	4432.630	4901.757	17.00000	5.100000	24.25356	95.00000
CM-244	5534.227	5885.479	11.00000	3.300000	30.15113	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:43:37
Average Efficiency : 0.2488421
Average Efficiency Error : 6.8639922E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	201.3204	28-FEB-2010	2991.710	3299.671	14736.00	0.2479510	1.0662264E-02	49.91240
NP-237	167.4312	28-FEB-2010	4432.630	4901.757	12530.00	0.2493544	1.2665348E-02	49.84171
CM-244	156.4188	28-FEB-2010	5534.227	5885.479	10957.00	0.2495920	1.2705517E-02	53.03390

Instrument : CHAMBER 149

Detector : 33449
Standard ID : AESS-037
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 18-NOV-2009 08:16:16
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:43:50

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.207
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2394.373
Energy Calibration Slope : 4.928394
Energy Calibration Quadratic : 3.2330301E-04
Energy Calibration Range : 2399 to 7780 KeV

The Energy Calibration : energy = 2394.373+(4.928394*Channel)+(3.2330301E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:38
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.436	3302.050	4.000000	1.200000	50.00000	95.00000
NP-237	4433.023	4902.650	6.000000	1.800000	40.82483	95.00000
CM-244	5531.642	5884.441	6.000000	1.800000	40.82483	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:43:50
Average Efficiency : 0.2483255
Average Efficiency Error : 6.8516782E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	197.7372	28-FEB-2010	2990.436	3302.050	14366.00	0.2460991	1.0587637E-02	68.92946
NP-237	167.1294	28-FEB-2010	4433.023	4902.650	12626.00	0.2517851	1.2787181E-02	66.29462
CM-244	154.7664	28-FEB-2010	5531.642	5884.441	10776.00	0.2481186	1.2634184E-02	65.00041

Instrument : CHAMBER 150

Detector : 75552
Standard ID : AESS-043
Standard Reference Date : 19-FEB-2008 00:32:27
Calibration Analysis Date/Time : 18-NOV-2009 08:16:20
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:44:03

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.870
CM-244	4320A	28-FEB-2010	5795.020	5795.095

Energy Calibration Zero : 2353.210
Energy Calibration Slope : 4.970113
Energy Calibration Quadratic : 2.7265481E-04
Energy Calibration Range : 2358 to 7729 KeV

The Energy Calibration : energy = 2353.210+(4.970113*Channel)+(2.7265481E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:43
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.812	3302.301	1.000000	0.3000000	100.0000	95.00000
NP-237	4436.790	4906.431	6.000000	1.800000	40.82483	95.00000
CM-244	5534.181	5885.674	5.000000	1.500000	44.72136	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:44:03
Average Efficiency : 0.2472161
Average Efficiency Error : 6.8205683E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	197.7708	28-FEB-2010	2988.812	3302.301	14459.00	0.2476633	1.0653616E-02	51.90544
NP-237	168.7422	28-FEB-2010	4436.790	4906.431	12530.00	0.2474881	1.2570423E-02	58.37593
CM-244	156.3252	28-FEB-2010	5534.181	5885.674	10806.00	0.2463256	1.2542248E-02	51.11081

Instrument : CHAMBER 151

Detector : 75556
Standard ID : AESS-038
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 18-NOV-2009 08:16:24
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:44:18

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2346.500
Energy Calibration Slope : 4.910573
Energy Calibration Quadratic : 2.9834322E-04
Energy Calibration Range : 2351 to 7688 KeV

The Energy Calibration : energy = 2346.500+(4.910573*Channel)+(2.9834322E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:48
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2989.916	3300.328	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4435.770	4902.424	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
CM-244	5532.149	5887.482	4.000000	1.200000	50.00000	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:44:18
Average Efficiency : 0.2453373
Average Efficiency Error : 6.7687407E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	200.1408	28-FEB-2010	2989.916	3300.328	14345.00	0.2428084	1.0446316E-02	54.48222
NP-237	170.0886	28-FEB-2010	4435.770	4902.424	12621.00	0.2473418	1.2561537E-02	57.49018
CM-244	157.7460	28-FEB-2010	5532.149	5887.482	10933.00	0.2469928	1.2573596E-02	57.42320

Instrument : CHAMBER 152

Detector : 76222
Standard ID : AESS-044
Standard Reference Date : 19-FEB-2008 00:32:27
Calibration Analysis Date/Time : 18-NOV-2009 08:16:28
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:44:34

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2341.313
Energy Calibration Slope : 4.950351
Energy Calibration Quadratic : 2.6349045E-04
Energy Calibration Range : 2346 to 7687 KeV

The Energy Calibration : energy = 2341.313+(4.950351*Channel)+(2.6349045E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:53
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2989.311	3301.494	1.000000	0.3000000	100.0000	95.00000
NP-237	4435.919	4903.221	1.000000	0.3000000	100.0000	95.00000
CM-244	5532.929	5882.503	8.000000	2.400000	35.35534	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:44:34
Average Efficiency : 0.2442460
Average Efficiency Error : 6.7417030E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	194.4510	28-FEB-2010	2989.311	3301.494	14186.00	0.2471355	1.0634735E-02	48.77798
NP-237	166.6248	28-FEB-2010	4435.919	4903.221	12052.00	0.2410947	1.2253158E-02	55.60851
CM-244	155.8290	28-FEB-2010	5532.929	5882.503	10651.00	0.2435444	1.2403901E-02	54.29796

Instrument : CHAMBER 153

Detector : 76223
Standard ID : AESS-039
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 18-NOV-2009 08:16:32
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:44:49

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.801
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2333.060
Energy Calibration Slope : 4.940231
Energy Calibration Quadratic : 2.9184026E-04
Energy Calibration Range : 2338 to 7698 KeV

The Energy Calibration : energy = 2333.060+(4.940231*Channel)+(2.9184026E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:16:57
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2990.256	3302.449	4.000000	1.200000	50.00000	95.00000
NP-237	4433.519	4902.304	10.00000	3.000000	31.62278	95.00000
CM-244	5534.705	5886.108	7.000000	2.100000	37.79645	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:44:49
Average Efficiency : 0.2523201
Average Efficiency Error : 6.9638924E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	192.2418	28-FEB-2010	2990.256	3302.449	14256.00	0.2511956	1.0808469E-02	45.93060
NP-237	159.1506	28-FEB-2010	4433.519	4902.304	12260.00	0.2567171	1.3043687E-02	53.80658
CM-244	151.7142	28-FEB-2010	5534.705	5886.108	10631.00	0.2496969	1.2717671E-02	49.20813

Instrument : CHAMBER 154

Detector : 76224
Standard ID : AESS-045
Standard Reference Date : 19-FEB-2008 00:32:27
Calibration Analysis Date/Time : 18-NOV-2009 08:16:36
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:45:05

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.801
CM-244	4320A	28-FEB-2010	5795.020	5795.070

Energy Calibration Zero : 2339.159
Energy Calibration Slope : 4.959938
Energy Calibration Quadratic : 2.7331465E-04
Energy Calibration Range : 2344 to 7705 KeV

The Energy Calibration : energy = 2339.159+(4.959938*Channel)+(2.7331465E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:17:02
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.570	3301.543	4.000000	1.200000	50.00000	95.00000
NP-237	4434.233	4903.159	8.000000	2.400000	35.35534	95.00000
CM-244	5535.283	5886.305	8.000000	2.400000	35.35534	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:45:05
Average Efficiency : 0.2549808
Average Efficiency Error : 7.0385467E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	186.9936	28-FEB-2010	2988.570	3301.543	14056.00	0.2546200	1.0958767E-02	48.42456
NP-237	160.8066	28-FEB-2010	4434.233	4903.159	12136.00	0.2515155	1.2781434E-02	55.84683
CM-244	145.8384	28-FEB-2010	5535.283	5886.305	10609.00	0.2592019	1.3202298E-02	48.53014

Instrument : CHAMBER 155

Detector : 75553
Standard ID : AESS-040
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 18-NOV-2009 08:16:40
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 18-NOV-2009 13:45:22

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.199
NP-237	4341	28-FEB-2010	4768.800	4768.862
CM-244	4320A	28-FEB-2010	5795.020	5795.045

Energy Calibration Zero : 2368.783
Energy Calibration Slope : 4.941553
Energy Calibration Quadratic : 3.2590213E-04
Energy Calibration Range : 2374 to 7771 KeV

The Energy Calibration : energy = 2368.783+(4.941553*Channel)+(3.2590213E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 15-NOV-2009 17:17:06
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2991.569	3299.187	5.000000	1.500000	44.72136	95.00000
NP-237	4433.980	4905.235	4.000000	1.200000	50.00000	95.00000
CM-244	5531.102	5885.121	11.00000	3.300000	30.15113	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 18-NOV-2009 13:45:22
Average Efficiency : 0.2585027
Average Efficiency Error : 7.1280575E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	194.4828	28-FEB-2010	2991.569	3299.187	14883.00	0.2592175	1.1144735E-02	52.61243
NP-237	166.8174	28-FEB-2010	4433.980	4905.235	12881.00	0.2573634	1.3066485E-02	59.47372
CM-244	155.0100	28-FEB-2010	5531.102	5885.121	11253.00	0.2586618	1.3161110E-02	51.99247

Instrument : CHAMBER 201

Detector : 78902
Standard ID : AESS-039
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 23-OCT-2009 07:44:38
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 23-OCT-2009 13:32:21

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3182.826
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2358.063
Energy Calibration Slope : 4.962597
Energy Calibration Quadratic : 2.9971759E-04
Energy Calibration Range : 2363 to 7754 KeV

The Energy Calibration : energy = 2358.063+(4.962597*Channel)+(2.9971759E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 18-OCT-2009 17:41:20
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.109	3301.625	1.000000	0.3000000	100.0000	95.00000
NP-237	4432.695	4903.768	2.000000	0.6000000	70.71068	95.00000
CM-244	5534.085	5887.332	18.00000	5.400000	23.57022	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 23-OCT-2009 13:32:21
Average Efficiency : 0.2585327
Average Efficiency Error : 7.1318159E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	192.2418	28-FEB-2010	2988.109	3301.625	14633.00	0.2576852	1.1082157E-02	44.32004
NP-237	159.1506	28-FEB-2010	4432.695	4903.768	12467.00	0.2610968	1.3262650E-02	56.19632
CM-244	151.7142	28-FEB-2010	5534.085	5887.332	10984.00	0.2572168	1.3093179E-02	45.13528

Instrument : CHAMBER 202

Detector : 78903
Standard ID : AESS-045
Standard Reference Date : 19-FEB-2008 00:32:27
Calibration Analysis Date/Time : 23-OCT-2009 07:44:42
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 23-OCT-2009 13:23:05

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2348.852
Energy Calibration Slope : 4.968003
Energy Calibration Quadratic : 2.7484546E-04
Energy Calibration Range : 2354 to 7724 KeV

The Energy Calibration : energy = 2348.852+(4.968003*Channel)+(2.7484546E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 18-OCT-2009 17:41:24
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2989.259	3297.622	0.0000000E+00	0.0000000E+00	0.0000000E+00	95.00000
NP-237	4437.128	4901.565	1.000000	0.3000000	100.0000	95.00000
CM-244	5534.664	5886.243	21.00000	6.300000	21.82179	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 23-OCT-2009 13:23:05
Average Efficiency : 0.2674317
Average Efficiency Error : 7.3762531E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	186.9936	28-FEB-2010	2989.259	3297.622	14760.00	0.2672196	1.1490363E-02	44.90806
NP-237	160.8066	28-FEB-2010	4437.128	4901.565	12659.00	0.2624004	1.3325701E-02	51.42311
CM-244	145.8384	28-FEB-2010	5534.664	5886.243	11217.00	0.2732188	1.3902702E-02	48.56720

Instrument : CHAMBER 203

Detector : 78905
Standard ID : AESS-040
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 23-OCT-2009 07:44:47
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 23-OCT-2009 13:23:13

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.801
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2360.050
Energy Calibration Slope : 4.948787
Energy Calibration Quadratic : 3.0506149E-04
Energy Calibration Range : 2365 to 7747 KeV

The Energy Calibration : energy = 2360.050+(4.948787*Channel)+(3.0506149E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 18-OCT-2009 17:41:28
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.440	3301.203	8.000000	2.400000	35.35534	95.00000
NP-237	4435.134	4905.455	8.000000	2.400000	35.35534	95.00000
CM-244	5534.910	5882.378	26.00000	7.800000	19.61161	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 23-OCT-2009 13:23:13
Average Efficiency : 0.2555374
Average Efficiency Error : 7.0476462E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	194.4828	28-FEB-2010	2988.440	3301.203	14732.00	0.2564026	1.1025699E-02	49.14829
NP-237	166.8174	28-FEB-2010	4435.134	4905.455	12659.00	0.2529034	1.2843485E-02	57.22518
CM-244	155.0100	28-FEB-2010	5534.910	5882.378	11218.00	0.2570517	1.3080092E-02	55.29720

Instrument : CHAMBER 204

Detector : 78907
Standard ID : AESS-046
Standard Reference Date : 19-FEB-2008 19:35:48
Calibration Analysis Date/Time : 23-OCT-2009 07:44:51
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 23-OCT-2009 13:23:21

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2357.577
Energy Calibration Slope : 4.971226
Energy Calibration Quadratic : 2.7621095E-04
Energy Calibration Range : 2363 to 7738 KeV

The Energy Calibration : energy = 2357.577+(4.971226*Channel)+(2.7621095E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 18-OCT-2009 17:41:33
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.337	3301.930	11.00000	3.300000	30.15113	95.00000
NP-237	4437.014	4901.750	13.00000	3.900000	27.73501	95.00000
CM-244	5535.287	5887.123	32.00000	9.600000	17.67767	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 23-OCT-2009 13:23:21
Average Efficiency : 0.2522539
Average Efficiency Error : 6.9599389E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	194.7474	28-FEB-2010	2988.337	3301.930	14610.00	0.2539103	1.0920225E-02	51.81709
NP-237	164.6658	28-FEB-2010	4437.014	4901.750	12297.00	0.2488496	1.2643373E-02	55.31627
CM-244	151.3824	28-FEB-2010	5535.287	5887.123	10807.00	0.2534880	1.2907310E-02	54.27145

Instrument : CHAMBER 205

Detector : 78908
Standard ID : AESS-041
Standard Reference Date : 18-FEB-2008 15:31:47
Calibration Analysis Date/Time : 23-OCT-2009 07:44:55
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 23-OCT-2009 13:23:29

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.799
CM-244	4320A	28-FEB-2010	5795.020	5795.021

Energy Calibration Zero : 2363.378
Energy Calibration Slope : 4.959655
Energy Calibration Quadratic : 2.9583176E-04
Energy Calibration Range : 2368 to 7752 KeV

The Energy Calibration : energy = 2363.378+(4.959655*Channel)+(2.9583176E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 18-OCT-2009 17:41:36
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2987.957	3301.178	2.000000	0.6000000	70.71068	95.00000
NP-237	4436.162	4901.400	3.000000	0.9000000	57.73503	95.00000
CM-244	5530.781	5883.461	11.00000	3.300000	30.15113	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 23-OCT-2009 13:23:29
Average Efficiency : 0.2537003
Average Efficiency Error : 6.9936696E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	203.9034	28-FEB-2010	2987.957	3301.178	15153.00	0.2515763	1.0812583E-02	48.70498
NP-237	171.2268	28-FEB-2010	4436.162	4901.400	13162.00	0.2562121	1.3003838E-02	57.91314
CM-244	159.5796	28-FEB-2010	5530.781	5883.461	11419.00	0.2542548	1.2933665E-02	55.11108

Instrument : CHAMBER 206

Detector : 78909
Standard ID : AESS-047
Standard Reference Date : 19-FEB-2008 00:32:27
Calibration Analysis Date/Time : 23-OCT-2009 07:44:59
Calibration Count Time : 300.0000 min.

Subsection 1: Energy Calibration

Energy/Channel Equation
energy = Cal_Zero+(e1*C)+(e2*C^2)

where : Cal_Zero = Energy Calibration Zero
e1 = Energy Calibration Slope
e2 = Energy Calibration Quadratic
C = Channel

Energy Calibration Date/Time : 23-OCT-2009 13:23:40

Cal. Isotopes	Source Id	Expiration Date	Standard Energy (KeV)	Actual Energy (KeV)
GD-148	6445-278	28-FEB-2010	3183.000	3183.000
NP-237	4341	28-FEB-2010	4768.800	4768.800
CM-244	4320A	28-FEB-2010	5795.020	5795.020

Energy Calibration Zero : 2359.196
Energy Calibration Slope : 4.958711
Energy Calibration Quadratic : 2.8597465E-04
Energy Calibration Range : 2364 to 7737 KeV

The Energy Calibration : energy = 2359.196+(4.958711*Channel)+(2.8597465E-04*Channel^2)

Subsection 2: Background Calibration

Background Analysis Date/Time : 18-OCT-2009 17:41:40
Background Count Time : 60000.00 sec.

Cal. Isotopes	Start Energy (KeV)	End Energy (KeV)	Counts in 1000 min	Counts during Cal	% Error	% Confidence
GD-148	2988.534	3301.541	2.000000	0.6000000	70.71068	95.00000
NP-237	4435.146	4904.801	2.000000	0.6000000	70.71068	95.00000
CM-244	5532.900	5884.749	16.00000	4.800000	25.00000	95.00000

Subsection 3: Efficiency Calibration

Efficiency Calibration Date/Time : 23-OCT-2009 13:23:40
Average Efficiency : 0.2554192
Average Efficiency Error : 7.0435088E-03
% Confidence : 95.00000

Cal. Isotopes	DPM	Exp. Date	Start Engy (KeV)	End Engy (KeV)	Counts	EFF.	EFF Err	Resolution
GD-148	197.4804	28-FEB-2010	2988.534	3301.541	15042.00	0.2578534	1.1083830E-02	50.51255
NP-237	168.3948	28-FEB-2010	4435.146	4904.801	12737.00	0.2521141	1.2802137E-02	55.90126
CM-244	154.6032	28-FEB-2010	5532.900	5884.749	11117.00	0.2554787	1.3001921E-02	55.72073

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 (PIC)

	YES	NO	Comments
1) Is all calibration standard information enclosed for:			
primary standard certificate?	✓		
secondard standard(s) documentation?	✓		
standard preparation information?	✓		
standard < 1 Year old or verified?	✓		
2) Are the detector graphs included?			
beta absorption curves?			Average Efficiency
beta plateau?	✓		
3) Is the raw count data included for:			
the plateau generation?	✓		
the absorption curve generation?	✓		
the calibration verification?	✓		
the crosstalk calculations?	✓		
4) Are the calibration verification calculations included?			
are verification recoveries 100% +/- 25%	✓		
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

Ra-228 Calibration PROTEAN Detectors

Detector #	Source #	Seperation date	Count date	Ac-228 decay (dec)	Spike Vol. Ra-228 (mL)	Seperation time Decay Corrected Std. Act. Ra-228 dpm/mL	Volume corrected Standard Nominal dpm	raw beta counts	ct. time (min)	Beta cpm	corrected* cpm	Ra-228 eff (cpm/dpm)	
1A	1	7/1/09 10:45	7/1/2009 13:36	0.7249	1.5	6363.2	9544.8	13564	3	4521.3	6237.434348	0.6535	
1A	2	7/1/09 10:45	7/1/2009 13:52	0.7032	1.5	6363.2	9544.8	12775	3	4258.3	6055.521583	0.6344	
1A	3	7/1/09 10:45	7/1/2009 13:48	0.7083	1.5	6363.2	9544.8	12750	3	4250.0	6000.085083	0.6286	Average EFF
1A	4	7/1/09 10:45	7/1/2009 13:41	0.7170	1.5	6363.2	9544.8	12410	3	4136.7	5769.693602	0.6045	0.6303
1B	1	7/1/09 10:45	7/1/2009 13:41	0.7174	1.5	6363.2	9544.8	13292	3	4430.7	6176.07771	0.6471	
1B	2	7/1/09 10:45	7/1/2009 13:36	0.7246	1.5	6363.2	9544.8	13274	3	4424.7	6106.181463	0.6397	
1B	3	7/1/09 10:45	7/1/2009 13:52	0.7031	1.5	6363.2	9544.8	12699	3	4233.0	6020.43969	0.6308	Average EFF
1B	4	7/1/09 10:45	7/1/2009 13:48	0.7082	1.5	6363.2	9544.8	12072	3	4024.0	5682.267909	0.5953	0.6282
1C	1	7/1/09 10:45	7/1/2009 13:48	0.7085	1.5	6363.2	9544.8	12813	3	4271.0	6028.410186	0.6316	
1C	2	7/1/09 10:45	7/1/2009 13:41	0.7172	1.5	6363.2	9544.8	12979	3	4326.3	6032.15531	0.6320	
1C	3	7/1/09 10:45	7/1/2009 13:36	0.7245	1.5	6363.2	9544.8	12755	3	4251.7	5868.722998	0.6149	Average EFF
1C	4	7/1/09 10:45	7/1/2009 13:52	0.7030	1.5	6363.2	9544.8	11917	3	3972.3	5650.765354	0.5920	0.6176
1D	1	7/1/09 10:45	7/1/2009 13:52	0.7033	1.5	6363.2	9544.8	12473	3	4157.7	5911.258105	0.6193	
1D	2	7/1/09 10:45	7/1/2009 13:48	0.7084	1.5	6363.2	9544.8	12484	3	4161.3	5874.170562	0.6154	
1D	3	7/1/09 10:45	7/1/2009 13:41	0.7171	1.5	6363.2	9544.8	12289	3	4096.3	5712.363902	0.5985	Average EFF
1D	4	7/1/09 10:45	7/1/2009 13:36	0.7243	1.5	6363.2	9544.8	12115	3	4038.3	5575.47435	0.5841	0.6043
2A	1	7/1/09 10:45	7/1/2009 13:57	0.6960	1.5	6363.2	9544.8	12499	3	4166.3	5986.085459	0.6272	
2A	2	7/1/09 10:45	7/1/2009 14:15	0.6728	1.5	6363.2	9544.8	12103	3	4034.3	5996.6905	0.6283	
2A	3	7/1/09 10:45	7/1/2009 14:09	0.6815	1.5	6363.2	9544.8	11968	3	3989.3	5854.110901	0.6133	Average EFF
2A	4	7/1/09 10:45	7/1/2009 14:02	0.6899	1.5	6363.2	9544.8	11855	3	3951.7	5728.227222	0.6001	0.6172
2B	1	7/1/09 10:45	7/1/2009 14:02	0.6903	1.5	6363.2	9544.8	12471	3	4157.0	6022.286434	0.6309	
2B	2	7/1/09 10:45	7/1/2009 13:57	0.6958	1.5	6363.2	9544.8	12492	3	4164.0	5984.232843	0.6270	
2B	3	7/1/09 10:45	7/1/2009 14:15	0.6727	1.5	6363.2	9544.8	11892	3	3964.0	5892.884561	0.6174	Average EFF
2B	4	7/1/09 10:45	7/1/2009 14:09	0.6814	1.5	6363.2	9544.8	11539	3	3846.3	5644.974311	0.5914	0.6167
2C	1	7/1/09 10:45	7/1/2009 14:08	0.6817	1.5	6363.2	9544.8	12050	3	4016.7	5892.005142	0.6173	
2C	2	7/1/09 10:45	7/1/2009 14:02	0.6901	1.5	6363.2	9544.8	11914	3	3971.3	5754.571355	0.6029	
2C	3	7/1/09 10:45	7/1/2009 13:58	0.6957	1.5	6363.2	9544.8	11994	3	3998.0	5746.92868	0.6021	Average EFF
2C	4	7/1/09 10:45	7/1/2009 14:15	0.6726	1.5	6363.2	9544.8	10889	3	3629.7	5396.37168	0.5654	0.5969
2D	1	7/1/09 10:45	7/1/2009 14:15	0.6729	1.5	6363.2	9544.8	12010	3	4003.3	5949.493049	0.6233	
2D	2	7/1/09 10:45	7/1/2009 14:08	0.6816	1.5	6363.2	9544.8	12124	3	4041.3	5929.303014	0.6212	
2D	3	7/1/09 10:45	7/1/2009 14:02	0.6900	1.5	6363.2	9544.8	12168	3	4056.0	5878.360714	0.6159	Average EFF
2D	4	7/1/09 10:45	7/1/2009 13:58	0.6954	1.5	6363.2	9544.8	11692	3	3897.3	5604.156523	0.5871	0.6119
3A	1	7/1/09 10:45	7/1/2009 14:19	0.6675	1.5	6363.2	9544.8	11194	3	3731.3	5589.748519	0.5856	
3A	2	7/1/09 10:45	7/1/2009 14:35	0.6482	1.5	6363.2	9544.8	14227	4	3556.8	5486.792678	0.5748	
3A	3	7/1/09 10:45	7/1/2009 14:30	0.6548	1.5	6363.2	9544.8	14180	4	3545.0	5414.108112	0.5672	Average EFF
3A	4	7/1/09 10:45	7/1/2009 14:25	0.6608	1.5	6363.2	9544.8	13754	4	3438.5	5203.464549	0.5452	0.5682
3B	1	7/1/09 10:45	7/1/2009 14:25	0.6612	1.5	6363.2	9544.8	15370	4	3842.5	5811.010789	0.6088	
3B	2	7/1/09 10:45	7/1/2009 14:20	0.6673	1.5	6363.2	9544.8	11695	3	3898.3	5842.303251	0.6121	
3B	3	7/1/09 10:45	7/1/2009 14:35	0.6481	1.5	6363.2	9544.8	14905	4	3726.3	5749.171166	0.6023	Average EFF
3B	4	7/1/09 10:45	7/1/2009 14:30	0.6547	1.5	6363.2	9544.8	14220	4	3555.0	5430.231301	0.5689	0.5980
3C	1	7/1/09 10:45	7/1/2009 14:29	0.6552	1.5	6363.2	9544.8	15644	4	3911.0	5969.527404	0.6254	
3C	2	7/1/09 10:45	7/1/2009 14:25	0.6611	1.5	6363.2	9544.8	15964	4	3991.0	6036.911214	0.6325	
3C	3	7/1/09 10:45	7/1/2009 14:20	0.6672	1.5	6363.2	9544.8	11701	3	3900.3	5846.033242	0.6125	Average EFF
3C	4	7/1/09 10:45	7/1/2009 14:35	0.6480	1.5	6363.2	9544.8	14729	4	3682.3	5682.352456	0.5953	0.6164
3D	1	7/1/09 10:45	7/1/2009 14:35	0.6484	1.5	6363.2	9544.8	15152	4	3788.0	5842.430209	0.6121	
3D	2	7/1/09 10:45	7/1/2009 14:30	0.6550	1.5	6363.2	9544.8	15168	4	3792.0	5789.343603	0.6065	
3D	3	7/1/09 10:45	7/1/2009 14:25	0.6610	1.5	6363.2	9544.8	15295	4	3823.8	5785.011122	0.6061	Average EFF
3D	4	7/1/09 10:45	7/1/2009 14:20	0.6670	1.5	6363.2	9544.8	10942	3	3647.3	5468.022172	0.5729	0.5994
4A	1	7/1/09 10:45	7/1/2009 14:40	0.6418	1.5	6363.2	9544.8	15298	4	3824.5	5959.288371	0.6243	
4A	2	7/1/09 10:45	7/1/2009 15:00	0.6187	1.5	6363.2	9544.8	14897	4	3724.3	6019.957238	0.6307	
4A	3	7/1/09 10:45	7/1/2009 14:53	0.6266	1.5	6363.2	9544.8	15050	4	3762.5	6005.095127	0.6291	Average EFF
4A	4	7/1/09 10:45	7/1/2009 14:48	0.6325	1.5	6363.2	9544.8	14462	4	3615.5	5715.951787	0.5989	0.6208
4B	1	7/1/09 10:45	7/1/2009 14:48	0.6329	1.5	6363.2	9544.8	15335	4	3833.8	6057.768128	0.6347	
4B	2	7/1/09 10:45	7/1/2009 14:41	0.6416	1.5	6363.2	9544.8	15513	4	3878.3	6044.745331	0.6333	
4B	3	7/1/09 10:45	7/1/2009 15:00	0.6186	1.5	6363.2	9544.8	14521	4	3630.3	5868.56525	0.6148	Average EFF
4B	4	7/1/09 10:45	7/1/2009 14:53	0.6265	1.5	6363.2	9544.8	14328	4	3582.0	5717.547589	0.5990	0.6205
4C	1	7/1/09 10:45	7/1/2009 14:53	0.6268	1.5	6363.2	9544.8	14733	4	3683.3	5876.583259	0.6157	
4C	2	7/1/09 10:45	7/1/2009 14:48	0.6327	1.5	6363.2	9544.8	14902	4	3725.5	5888.011911	0.6169	
4C	3	7/1/09 10:45	7/1/2009 14:41	0.6414	1.5	6363.2	9544.8	14856	4	3714.0	5790.010642	0.6066	Average EFF
4C	4	7/1/09 10:45	7/1/2009 15:00	0.6185	1.5	6363.2	9544.8	13733	4	3433.3	5550.795964	0.5816	0.6052
4D	1	7/1/09 10:45	7/1/2009 15:00	0.6188	1.5	6363.2	9544.8	14167	4	3541.8	5723.884149	0.5997	
4D	2	7/1/09 10:45	7/1/2009 14:53	0.6267	1.5	6363.2	9544.8	14204	4	3551.0	5666.467573	0.5937	
4D	3	7/1/09 10:45	7/1/2009 14:48	0.6326	1.5	6363.2	9544.8	14131	4	3532.8	5584.07765	0.5850	Average EFF
4D	4	7/1/09 10:45	7/1/2009 14:41	0.6413	1.5	6363.2	9544.8	13978	4	3494.5	5449.182717	0.5709	0.5873
5A	1	7/1/09 10:45	7/1/2009 15:06	0.6112	1.5	6363.2	9544.8	14870	4	3717.5	6082.165089	0.6372	
5A	2	7/1/09 10:45	7/1/2009 15:21	0.5943	1.5	6363.2	9544.8	14487	4	3621.8	6094.223373	0.6385	
5A	3	7/1/09 10:45	7/1/2009 15:17	0.5996	1.5	6363.2	9544.8	14259	4	3564.8	5945.170793	0.6229	Average EFF
5A	4	7/1/09 10:45	7/1/2009 15:12	0.6047	1.5	6363.2	9544.8	13957	4	3489.3	5770.592799	0.6046	0.6258
5B	1	7/1/09 10:45	7/1/2009 15:12	0.6050	1.5	6363.2	9544.8	14869	4	3717.3	6144.005028	0.6437	
5B	2	7/1/09 10:45	7/1/2009 15:06	0.6111	1.5	6363.2	9544.8	14821	4	3705.3	6063.072791	0.6352	
5B	3	7/1/09 10:45	7/1/2009 15:21	0.5942	1.5	6363.2	9544.8	14289	4	3572.3	6011.872812	0.6299	Average EFF
5B	4	7/1/09 10:45	7/1/2009 15:17	0.5995	1.5	6363.2	9544.8	13809	4	3452.3	5758.629577	0.6033	0.6280
5C	1	7/1/09 10:45	7/1/2009 15:17	0.5994	1.5	6363.2	9544.8	14676	4	3669.0	6120.953053	0.6413	
5C	2	7/1/09 10:45	7/1/2009 15:12	0.6049	1.5	6363.2	9544.8	15122	4	3780.5	6249.917577	0.6548	
5C	3	7/1/09 10:45	7/1/2009 15:07	0.6108	1.5	6363.2	9544.8	14958	4	3739.5	6121.8025	0.6414	Average EFF

7/2/09

5C	4	7/1/09 10:45	7/1/2009 15:21	0.5941	1.5	6363.2	9544.8	13831	4	3457.8	5819.905873	0.6097	0.6368
5D	1	7/1/09 10:45	7/1/2009 15:21	0.5943	1.5	6363.2	9544.8	14321	4	3580.3	6024.014899	0.6311	
5D	2	7/1/09 10:45	7/1/2009 15:17	0.5993	1.5	6363.2	9544.8	14642	4	3660.5	6107.538025	0.6399	
5D	3	7/1/09 10:45	7/1/2009 15:12	0.6048	1.5	6363.2	9544.8	14443	4	3610.8	5970.409434	0.6255	Average EFF
5D	4	7/1/09 10:45	7/1/2009 15:07	0.6107	1.5	6363.2	9544.8	13954	4	3488.5	5711.973074	0.5984	0.6237
6A	1	7/1/09 10:45	7/1/2009 15:27	0.5885	1.5	6363.2	9544.8	14018	4	3504.5	5955.42076	0.6239	
6A	2	7/1/09 10:45	7/1/2009 15:40	0.5735	1.5	6363.2	9544.8	12283	3.5	3509.4	6118.819734	0.6411	
6A	3	7/1/09 10:45	7/1/2009 15:36	0.5779	1.5	6363.2	9544.8	12111	3.5	3460.3	5987.187856	0.6273	Average EFF
6A	4	7/1/09 10:45	7/1/2009 15:32	0.5826	1.5	6363.2	9544.8	11598	3.5	3313.7	5687.952648	0.5959	0.6221
6B	1	7/1/09 10:45	7/1/2009 15:32	0.5824	1.5	6363.2	9544.8	12151	3.5	3471.7	5961.398905	0.6246	
6B	2	7/1/09 10:45	7/1/2009 15:27	0.5885	1.5	6363.2	9544.8	14371	4	3592.8	6105.389624	0.6397	
6B	3	7/1/09 10:45	7/1/2009 15:40	0.5734	1.5	6363.2	9544.8	11705	3.5	3344.3	5831.983307	0.6110	Average EFF
6B	4	7/1/09 10:45	7/1/2009 15:36	0.5779	1.5	6363.2	9544.8	11388	3.5	3253.7	5630.295163	0.5899	0.6163
6C	1	7/1/09 10:45	7/1/2009 15:36	0.5778	1.5	6363.2	9544.8	12161	3.5	3474.6	6013.224586	0.6300	
6C	2	7/1/09 10:45	7/1/2009 15:32	0.5821	1.5	6363.2	9544.8	12083	3.5	3452.3	5930.638446	0.6213	
6C	3	7/1/09 10:45	7/1/2009 15:27	0.5883	1.5	6363.2	9544.8	13638	4	3409.5	5795.433731	0.6072	Average EFF
6C	4	7/1/09 10:45	7/1/2009 15:40	0.5733	1.5	6363.2	9544.8	11218	3.5	3205.1	5590.212659	0.5857	0.6111
6D	1	7/1/09 10:45	7/1/2009 15:40	0.5732	1.5	6363.2	9544.8	11987	3.5	3424.9	5974.547886	0.6259	
6D	2	7/1/09 10:45	7/1/2009 15:36	0.5777	1.5	6363.2	9544.8	12183	3.5	3480.9	6025.235519	0.6313	
6D	3	7/1/09 10:45	7/1/2009 15:32	0.5819	1.5	6363.2	9544.8	11882	3.5	3394.9	5833.810262	0.6112	Average EFF
6D	4	7/1/09 10:45	7/1/2009 15:27	0.5881	1.5	6363.2	9544.8	13018	4	3254.5	5533.699914	0.5798	0.6120
7A	1	7/1/09 10:45	7/1/2009 15:46	0.5673	1.5	6363.2	9544.8	12007	3.5	3430.6	6047.285606	0.6336	
7A	2	7/1/09 10:45	7/1/2009 16:00	0.5525	1.5	6363.2	9544.8	11655	3.5	3330.0	6027.30696	0.6315	
7A	3	7/1/09 10:45	7/1/2009 15:56	0.5569	1.5	6363.2	9544.8	11445	3.5	3270.0	5871.972756	0.6152	Average EFF
7A	4	7/1/09 10:45	7/1/2009 15:50	0.5627	1.5	6363.2	9544.8	11121	3.5	3177.4	5646.694018	0.5916	0.6180
7B	1	7/1/09 10:45	7/1/2009 15:51	0.5622	1.5	6363.2	9544.8	11968	3.5	3419.4	6082.664171	0.6373	
7B	2	7/1/09 10:45	7/1/2009 15:46	0.5673	1.5	6363.2	9544.8	12050	3.5	3442.9	6069.322745	0.6359	
7B	3	7/1/09 10:45	7/1/2009 16:00	0.5524	1.5	6363.2	9544.8	11675	3.5	3335.7	6038.785014	0.6327	Average EFF
7B	4	7/1/09 10:45	7/1/2009 15:56	0.5567	1.5	6363.2	9544.8	11271	3.5	3220.3	5784.331251	0.6060	0.6280
7C	1	7/1/09 10:45	7/1/2009 15:56	0.5566	1.5	6363.2	9544.8	11781	3.5	3366.0	6047.202464	0.6336	
7C	2	7/1/09 10:45	7/1/2009 15:51	0.5621	1.5	6363.2	9544.8	11760	3.5	3360.0	5978.073192	0.6263	
7C	3	7/1/09 10:45	7/1/2009 15:46	0.5670	1.5	6363.2	9544.8	11766	3.5	3361.7	5928.878357	0.6212	Average EFF
7C	4	7/1/09 10:45	7/1/2009 16:00	0.5523	1.5	6363.2	9544.8	10888	3.5	3110.9	5632.598965	0.5901	0.6178
7D	1	7/1/09 10:45	7/1/2009 16:00	0.5522	1.5	6363.2	9544.8	11605	3.5	3315.7	6004.271132	0.6291	
7D	2	7/1/09 10:45	7/1/2009 15:56	0.5565	1.5	6363.2	9544.8	11920	3.5	3405.7	6119.509991	0.6411	
7D	3	7/1/09 10:45	7/1/2009 15:51	0.5619	1.5	6363.2	9544.8	11933	3.5	3409.4	6067.346561	0.6357	Average EFF
7D	4	7/1/09 10:45	7/1/2009 15:46	0.5668	1.5	6363.2	9544.8	11305	3.5	3230.0	5698.36602	0.5970	0.6257
8A	1	7/1/09 10:45	7/1/2009 16:06	0.5466	1.5	6363.2	9544.8	11673	3.5	3335.1	6101.651756	0.6393	
8A	2	7/1/09 10:45	7/1/2009 16:19	0.5333	1.5	6363.2	9544.8	11172	3.5	3192.0	5985.379105	0.6271	
8A	3	7/1/09 10:45	7/1/2009 16:15	0.5377	1.5	6363.2	9544.8	11258	3.5	3216.6	5982.329368	0.6268	Average EFF
8A	4	7/1/09 10:45	7/1/2009 16:10	0.5424	1.5	6363.2	9544.8	10977	3.5	3136.3	5782.059146	0.6058	0.6247
8B	1	7/1/09 10:45	7/1/2009 16:10	0.5423	1.5	6363.2	9544.8	11583	3.5	3309.4	6102.412618	0.6393	
8B	2	7/1/09 10:45	7/1/2009 16:06	0.5466	1.5	6363.2	9544.8	11758	3.5	3359.4	6146.082528	0.6439	
8B	3	7/1/09 10:45	7/1/2009 16:19	0.5332	1.5	6363.2	9544.8	11499	3.5	3285.4	6161.727069	0.6456	Average EFF
8B	4	7/1/09 10:45	7/1/2009 16:15	0.5376	1.5	6363.2	9544.8	10844	3.5	3098.3	5763.600098	0.6038	0.6332
8C	1	7/1/09 10:45	7/1/2009 16:15	0.5375	1.5	6363.2	9544.8	11539	3.5	3296.9	6133.762218	0.6426	
8C	2	7/1/09 10:45	7/1/2009 16:10	0.5422	1.5	6363.2	9544.8	11774	3.5	3364.0	6204.011354	0.6500	
8C	3	7/1/09 10:45	7/1/2009 16:06	0.5465	1.5	6363.2	9544.8	11611	3.5	3317.4	6070.574762	0.6360	Average EFF
8C	4	7/1/09 10:45	7/1/2009 16:19	0.5331	1.5	6363.2	9544.8	10809	3.5	3088.3	5793.080291	0.6069	0.6339
8D	1	7/1/09 10:45	7/1/2009 16:19	0.5330	1.5	6363.2	9544.8	11301	3.5	3228.9	6057.336905	0.6346	
8D	2	7/1/09 10:45	7/1/2009 16:15	0.5374	1.5	6363.2	9544.8	11412	3.5	3260.6	6067.58377	0.6357	
8D	3	7/1/09 10:45	7/1/2009 16:10	0.5421	1.5	6363.2	9544.8	11660	3.5	3331.4	6145.674775	0.6439	Average EFF
8D	4	7/1/09 10:45	7/1/2009 16:06	0.5464	1.5	6363.2	9544.8	10918	3.5	3119.4	5709.327085	0.5982	0.6281
9A	1	7/1/09 10:45	7/1/2009 16:24	0.5280	1.5	6363.2	9544.8	11605	3.5	3315.7	6280.207813	0.6580	
9A	2	7/1/09 10:45	7/1/2009 16:42	0.5106	1.5	6363.2	9544.8	11281	3.5	3223.1	6313.016372	0.6614	
9A	3	7/1/09 10:45	7/1/2009 16:33	0.5196	1.5	6363.2	9544.8	11301	3.5	3228.9	6214.402502	0.6511	Average EFF
9A	4	7/1/09 10:45	7/1/2009 16:29	0.5236	1.5	6363.2	9544.8	10987	3.5	3139.1	5995.155865	0.6281	0.6496
9B	1	7/1/09 10:45	7/1/2009 16:29	0.5235	1.5	6363.2	9544.8	11151	3.5	3186.0	6085.406603	0.6376	
9B	2	7/1/09 10:45	7/1/2009 16:24	0.5280	1.5	6363.2	9544.8	11462	3.5	3274.9	6202.821366	0.6499	
9B	3	7/1/09 10:45	7/1/2009 16:42	0.5104	1.5	6363.2	9544.8	11004	3.5	3144.0	6160.125852	0.6454	Average EFF
9B	4	7/1/09 10:45	7/1/2009 16:33	0.5195	1.5	6363.2	9544.8	10581	3.5	3023.1	5819.569586	0.6097	0.6356
9C	1	7/1/09 10:45	7/1/2009 16:33	0.5194	1.5	6363.2	9544.8	11026	3.5	3150.3	6064.890483	0.6354	
9C	2	7/1/09 10:45	7/1/2009 16:29	0.5235	1.5	6363.2	9544.8	11281	3.5	3223.1	6157.122814	0.6451	
9C	3	7/1/09 10:45	7/1/2009 16:24	0.5279	1.5	6363.2	9544.8	11016	3.5	3147.4	5962.583098	0.6247	Average EFF
9C	4	7/1/09 10:45	7/1/2009 16:42	0.5103	1.5	6363.2	9544.8	10297	3.5	2942.0	5765.244836	0.6040	0.6273
9D	1	7/1/09 10:45	7/1/2009 16:38	0.5146	1.5	6363.2	9544.8	11135	3.5	3181.4	6182.4976	0.6477	
9D	2	7/1/09 10:45	7/1/2009 16:33	0.5193	1.5	6363.2	9544.8	11412	3.5	3260.6	6276.391381	0.6578	
9D	3	7/1/09 10:45	7/1/2009 16:29	0.5234	1.5	6363.2	9544.8	11340	3.5	3240.0	6190.682442	0.6486	Average EFF
9D	4	7/1/09 10:45	7/1/2009 16:24	0.5278	1.5	6363.2	9544.8	10912	3.5	3117.7	5907.401951	0.6189	0.6433
10A	1	7/1/09 10:45	7/1/2009 16:47	0.5057	1.5	6363.2	9544.8	10991	3.5	3140.3	6209.984837	0.6506	
10A	2	7/1/09 10:45	7/1/2009 17:12	0.4824	1.5	6363.2	9544.8	11959	4	2989.8	6198.168046	0.6494	
10A	3	7/1/09 10:45	7/1/2009 16:58	0.4958	1.5	6363.2	9544.8	10553	3.5	3015.1	6081.381423	0.6371	Average EFF
10A	4	7/1/09 10:45	7/1/2009 16:53	0.5003	1.5	6363.2	9544.8	10338	3.5	2953.7	5903.409852	0.6185	0.6389
10B	1	7/1/09 10:45	7/1/2009 17:03	0.4910	1.5	6363.2	9544.8	11110	4	2777.5	5656.748417	0.5927	
10B	2	7/1/09 10:45	7/1/2009 16:47	0.5057	1.5	6363.2	9544.8	10812	3.5	3089.1	6109.231533	0.6401	
10B	3	7/1/09 10:45	7/1/2009 17:12	0.4822	1.5	6363.2	9544.8	11422	4	2855.5	5921.333197	0.6204	Average EFF
10B	4	7/1/09 10:45	7/1/2009 16:58	0.4957	1.5	6363.2	9544.8	9967	3.5	2847.7	5744.946895	0.6019	0.6137
10C	1	7/1/09 10:45	7/1/2009 16:58	0.4956	1.5	6363.2	9544.8	10482	3.5	2994.9	6042.548531	0.6331	
10C	2	7/1/09 10:45	7/1/2009 16:53	0.5001	1.5	6363.2	9544.8	10535	3.5	3010.0	6018.73284	0.6306	
10C	3	7/1/09 10:45	7/1/2009 16:47	0.5054	1.5	6363.2	9544.8	10723	3.5	3063.7	6061.601256	0.6351	Average EFF
10C	4	7/1/09 10:45	7/1/2009 17:13	0.4820	1.5	6363.2	9544.8	11066	4	2766.5	5739.114805	0.6013	0.6250
10D	1	7/1/09 10:45	7/1/2009 17:13	0.4819	1.5	6363.2	9544.8	12021	4	3005.3	6236.356344	0.6534	
10D	2	7/1/09 10:45	7/1/2009 16:58	0.4955	1.5	6363.2	9544.8	10614	3.5	3032.6	6119.984615	0.6412	

10D	3	7/1/09 10:45	7/1/2009 16:53	0.5000	1.5	6363.2	9544.8	10643	3.5	3040.9	6081.577364	0.6372	Average EFF
10D	4	7/1/09 10:45	7/1/2009 16:48	0.5053	1.5	6363.2	9544.8	10064	3.5	2875.4	5690.501596	0.5962	0.6320
11A	1	7/1/09 10:45	7/1/2009 11:56	0.8745	1.5	6363.2	9544.8	14773	3	4924.3	5631.22443	0.5900	
11A	2	7/1/09 10:45	7/1/2009 12:08	0.8547	1.5	6363.2	9544.8	14429	3	4809.7	5627.17636	0.5896	
11A	3	7/1/09 10:45	7/1/2009 12:04	0.8607	1.5	6363.2	9544.8	14454	3	4818.0	5597.851728	0.5865	Average EFF
11A	4	7/1/09 10:45	7/1/2009 12:00	0.8677	1.5	6363.2	9544.8	14013	3	4671.0	5383.193838	0.5640	0.5825
11B	1	7/1/09 10:45	7/1/2009 12:00	0.8681	1.5	6363.2	9544.8	16203	3	5401.0	6221.768068	0.6518	
11B	2	7/1/09 10:45	7/1/2009 11:56	0.8742	1.5	6363.2	9544.8	16106	3	5368.7	6141.073627	0.6434	
11B	3	7/1/09 10:45	7/1/2009 12:08	0.8545	1.5	6363.2	9544.8	15643	3	5214.3	6102.154531	0.6393	Average EFF
11B	4	7/1/09 10:45	7/1/2009 12:04	0.8606	1.5	6363.2	9544.8	15133	3	5044.3	5861.738123	0.6141	0.6372
11C	1	7/1/09 10:45	7/1/2009 12:04	0.8609	1.5	6363.2	9544.8	15637	3	5212.3	6054.305139	0.6343	
11C	2	7/1/09 10:45	7/1/2009 12:00	0.8680	1.5	6363.2	9544.8	15919	3	5306.3	6113.481467	0.6405	
11C	3	7/1/09 10:45	7/1/2009 11:56	0.8740	1.5	6363.2	9544.8	16452	3	5484.0	6274.376359	0.6574	Average EFF
11C	4	7/1/09 10:45	7/1/2009 12:08	0.8544	1.5	6363.2	9544.8	14887	3	4962.3	5808.157492	0.6085	0.6352
11D	1	7/1/09 10:45	7/1/2009 12:08	0.8548	1.5	6363.2	9544.8	15607	3	5202.3	6085.822645	0.6376	
11D	2	7/1/09 10:45	7/1/2009 12:04	0.8608	1.5	6363.2	9544.8	15944	3	5314.7	6174.136045	0.6469	
11D	3	7/1/09 10:45	7/1/2009 12:00	0.8679	1.5	6363.2	9544.8	16098	3	5366.0	6182.998937	0.6478	Average EFF
11D	4	7/1/09 10:45	7/1/2009 11:56	0.8738	1.5	6363.2	9544.8	15191	3	5063.7	5794.733717	0.6071	0.6348
12A	1	7/1/09 10:45	7/1/2009 12:15	0.8437	1.5	6363.2	9544.8	15450	3	5150.0	6104.026984	0.6395	
12A	2	7/1/09 10:45	7/1/2009 12:28	0.8234	1.5	6363.2	9544.8	15016	3	5005.3	6078.958269	0.6369	
12A	3	7/1/09 10:45	7/1/2009 12:24	0.8296	1.5	6363.2	9544.8	14984	3	4994.7	6020.558384	0.6308	Average EFF
12A	4	7/1/09 10:45	7/1/2009 12:20	0.8358	1.5	6363.2	9544.8	14530	3	4843.3	5794.58497	0.6071	0.6286
12B	1	7/1/09 10:45	7/1/2009 12:20	0.8362	1.5	6363.2	9544.8	15404	3	5134.7	6140.635636	0.6433	
12B	2	7/1/09 10:45	7/1/2009 12:15	0.8437	1.5	6363.2	9544.8	15607	3	5202.3	6166.05496	0.6460	
12B	3	7/1/09 10:45	7/1/2009 12:28	0.8232	1.5	6363.2	9544.8	15060	3	5020.0	6097.91718	0.6389	Average EFF
12B	4	7/1/09 10:45	7/1/2009 12:24	0.8295	1.5	6363.2	9544.8	14553	3	4851.0	5848.11587	0.6127	0.6352
12C	1	7/1/09 10:45	7/1/2009 12:24	0.8300	1.5	6363.2	9544.8	15183	3	5061.0	6097.649845	0.6388	
12C	2	7/1/09 10:45	7/1/2009 12:20	0.8361	1.5	6363.2	9544.8	15651	3	5217.0	6239.881493	0.6537	
12C	3	7/1/09 10:45	7/1/2009 12:15	0.8436	1.5	6363.2	9544.8	15216	3	5072.0	6012.519531	0.6299	Average EFF
12C	4	7/1/09 10:45	7/1/2009 12:28	0.8231	1.5	6363.2	9544.8	14117	3	4705.7	5716.805229	0.5989	0.6304
12D	1	7/1/09 10:45	7/1/2009 12:28	0.8235	1.5	6363.2	9544.8	15174	3	5058.0	6141.959419	0.6435	
12D	2	7/1/09 10:45	7/1/2009 12:24	0.8298	1.5	6363.2	9544.8	15137	3	5045.7	6080.699807	0.6371	
12D	3	7/1/09 10:45	7/1/2009 12:20	0.8359	1.5	6363.2	9544.8	15418	3	5139.3	6148.142699	0.6441	Average EFF
12D	4	7/1/09 10:45	7/1/2009 12:15	0.8434	1.5	6363.2	9544.8	14566	3	4855.3	5756.75774	0.6031	0.6320
13A	1	7/1/09 10:45	7/1/2009 12:33	0.8153	1.5	6363.2	9544.8	15230	3	5076.7	6226.552932	0.6524	
13A	2	7/1/09 10:45	7/1/2009 12:50	0.7902	1.5	6363.2	9544.8	14784	3	4928.0	6236.596242	0.6534	
13A	3	7/1/09 10:45	7/1/2009 12:41	0.8031	1.5	6363.2	9544.8	14851	3	4950.3	6164.384216	0.6458	Average EFF
13A	4	7/1/09 10:45	7/1/2009 12:37	0.8090	1.5	6363.2	9544.8	14183	3	4727.7	5843.553624	0.6122	0.6410
13B	1	7/1/09 10:45	7/1/2009 12:37	0.8094	1.5	6363.2	9544.8	15625	3	5208.3	6434.850276	0.6742	
13B	2	7/1/09 10:45	7/1/2009 12:33	0.8153	1.5	6363.2	9544.8	15450	3	5150.0	6316.496573	0.6618	
13B	3	7/1/09 10:45	7/1/2009 12:50	0.7901	1.5	6363.2	9544.8	14689	3	4896.3	6197.297391	0.6493	Average EFF
13B	4	7/1/09 10:45	7/1/2009 12:41	0.8029	1.5	6363.2	9544.8	14377	3	4792.3	5968.757323	0.6253	0.6526
13C	1	7/1/09 10:45	7/1/2009 12:41	0.8033	1.5	6363.2	9544.8	15426	3	5142.0	6401.251014	0.6707	
13C	2	7/1/09 10:45	7/1/2009 12:37	0.8093	1.5	6363.2	9544.8	15315	3	5105.0	6307.973396	0.6609	
13C	3	7/1/09 10:45	7/1/2009 12:33	0.8152	1.5	6363.2	9544.8	15288	3	5096.0	6251.048762	0.6549	Average EFF
13C	4	7/1/09 10:45	7/1/2009 12:50	0.7900	1.5	6363.2	9544.8	14222	3	4740.7	6001.209943	0.6287	0.6538
13D	1	7/1/09 10:45	7/1/2009 12:50	0.7903	1.5	6363.2	9544.8	14492	3	4830.7	6112.65055	0.6404	
13D	2	7/1/09 10:45	7/1/2009 12:46	0.7958	1.5	6363.2	9544.8	14858	3	4952.7	6223.19528	0.6520	
13D	3	7/1/09 10:45	7/1/2009 12:37	0.8092	1.5	6363.2	9544.8	14873	3	4957.7	6126.881339	0.6419	Average EFF
13D	4	7/1/09 10:45	7/1/2009 12:33	0.8151	1.5	6363.2	9544.8	14389	3	4796.3	5884.197712	0.6165	0.6377
14A	1	7/1/09 10:45	7/1/2009 12:54	0.7834	1.5	6363.2	9544.8	14463	3	4821.0	6153.596507	0.6447	
14A	2	7/1/09 10:45	7/1/2009 13:17	0.7507	1.5	6363.2	9544.8	14137	3	4712.3	6277.53373	0.6577	
14A	3	7/1/09 10:45	7/1/2009 13:13	0.7571	1.5	6363.2	9544.8	14022	3	4674.0	6173.627369	0.6468	Average EFF
14A	4	7/1/09 10:45	7/1/2009 13:02	0.7727	1.5	6363.2	9544.8	13451	3	4483.7	5802.830587	0.6080	0.6393
14B	1	7/1/09 10:45	7/1/2009 13:01	0.7730	1.5	6363.2	9544.8	14039	3	4679.7	6054.030301	0.6343	
14B	2	7/1/09 10:45	7/1/2009 12:54	0.7834	1.5	6363.2	9544.8	14398	3	4799.3	6126.324754	0.6418	
14B	3	7/1/09 10:45	7/1/2009 13:17	0.7505	1.5	6363.2	9544.8	13475	3	4491.7	5984.510182	0.6270	Average EFF
14B	4	7/1/09 10:45	7/1/2009 13:13	0.7569	1.5	6363.2	9544.8	13077	3	4359.0	5758.643863	0.6033	0.6266
14C	1	7/1/09 10:45	7/1/2009 13:12	0.7573	1.5	6363.2	9544.8	14116	3	4705.3	6213.261445	0.6510	
14C	2	7/1/09 10:45	7/1/2009 13:02	0.7729	1.5	6363.2	9544.8	14187	3	4729.0	6118.427365	0.6410	
14C	3	7/1/09 10:45	7/1/2009 12:55	0.7832	1.5	6363.2	9544.8	14409	3	4803.0	6132.734423	0.6425	Average EFF
14C	4	7/1/09 10:45	7/1/2009 13:17	0.7505	1.5	6363.2	9544.8	13229	3	4409.7	5875.993199	0.6156	0.6375
14D	1	7/1/09 10:45	7/1/2009 13:17	0.7508	1.5	6363.2	9544.8	13927	3	4642.3	6183.314452	0.6478	
14D	2	7/1/09 10:45	7/1/2009 13:12	0.7572	1.5	6363.2	9544.8	14089	3	4696.3	6202.348821	0.6498	
14D	3	7/1/09 10:45	7/1/2009 13:02	0.7728	1.5	6363.2	9544.8	13912	3	4637.3	6000.768164	0.6287	Average EFF
14D	4	7/1/09 10:45	7/1/2009 12:55	0.7830	1.5	.6363.2	9544.8	13545	3	4515.0	5766.084113	0.6041	0.6326

*Background is considered negligible

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

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

Radium-228 Liquid

Filename : RA228.XLS
File type : Excel
Version # : 1.2.3

Batch : 595514
Analyst : AF1
Prep Date : 7/1/2009

Ra-228 Abundance : 1
Ra-228 Method Uncertainty : 0.0784

Calibration Date : 6/2/2008
Calibration Due Date : 6/30/2009

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

LCS S/N : 0503-B
LCS Exp Date : 9/13/2009
LCS Activity (dpm/ml): 182.42
LCS Volume Added: 2.00

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

Procedure Code : GFC90SRL
Parmname : Radium-228
Required MDA : 1 pCi/L
Halflife of Ra-228 : 5.75 years
Halflife of Ac-228 : 6.13 hours
Batch counted on : PIC
BKG Count time : 500 min

Sample Characteristics					Count raw Data																Results
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Pos.	Detector ID	Counting Time (min.)	Gross Counts Alpha	Gross Counts Beta	Beta cpm	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Weekly Bkg cpm	Count Time (min.)	Separation Date/Time	Count Start Date/Time	Ra-228 Decay	Ac-228 Decay	Ac-228 Count Correction	Calculated Sample Recovery %	Sample Recovery Error %	Pos.
1	1201245712.1	1.0000	2.0399E-05	7/1/2009 0:00	1	1A	15	36	1980	132.000	0.6303	0.00600	0.312	500	7/2/2009 5:40	7/2/2009 8:39	1.000	0.713	1.014	100.83%	1.00%	1 *
2	1201245713.1	1.0000	2.0399E-05	7/1/2009 0:00	2	1B	15	27	1959	130.600	0.6282	0.00409	0.342	500	7/2/2009 5:40	7/2/2009 8:40	1.000	0.712	1.014	108.20%	1.00%	2 *
3	1201245714.1	1.0000	2.0399E-05	7/1/2009 0:00	3	1C	15	44	2108	140.533	0.6176	0.00344	0.716	500	7/2/2009 5:40	7/2/2009 8:40	1.000	0.712	1.014	114.22%	1.00%	3 *
4	1201245715.1	1.0000	2.0399E-05	7/1/2009 0:00	4	1D	15	108	2265	151.000	0.6043	0.00511	0.524	500	7/2/2009 5:40	7/2/2009 8:40	1.000	0.712	1.014	120.58%	1.00%	4 *
5	1201245716.1	1.0000	2.0399E-05	7/1/2009 0:00	5	2A	15	69	1838	122.533	0.6172	0.00349	0.450	500	7/2/2009 5:40	7/2/2009 8:40	1.000	0.712	1.014	105.84%	1.00%	5 *
6	1201245717.1	1.0000	2.0399E-05	7/1/2009 0:00	6	2B	15	8	2053	136.867	0.6167	0.00383	1.428	500	7/2/2009 5:40	7/2/2009 8:40	1.000	0.712	1.014	102.70%	1.00%	6 *
7	1201245718.1	1.0000	2.0399E-05	7/1/2009 0:00	7	2C	15	96	1982	132.133	0.5969	0.00575	0.334	500	7/2/2009 5:40	7/2/2009 8:40	1.000	0.711	1.014	112.82%	1.00%	7 *
8	1201245719.1	1.0000	2.0399E-05	7/1/2009 0:00	8	2D	15	93	1984	132.267	0.6119	0.00479	0.378	500	7/2/2009 5:40	7/2/2009 9:08	1.000	0.676	1.014	111.91%	1.00%	8 *
9	1201245720.1	1.0000	2.0399E-05	7/1/2009 0:00	9	3A	15	233	1645	109.667	0.5682	0.00943	0.762	500	7/2/2009 5:40	7/2/2009 9:08	1.000	0.675	1.014	100.83%	1.00%	9 *
10	1201245721.1	1.0000	2.0399E-05	7/1/2009 0:00	10	3B	15	99	1821	121.400	0.5980	0.00655	1.710	500	7/2/2009 5:40	7/2/2009 9:08	1.000	0.675	1.014	108.20%	1.00%	10 *
11	1201245722.1	1.0000	2.0399E-05	7/1/2009 0:00	11	3C	15	96	1942	129.467	0.6164	0.00535	0.822	500	7/2/2009 5:40	7/2/2009 9:08	1.000	0.675	1.014	114.22%	1.00%	11 *
12	1201245723.1	1.0000	2.0399E-05	7/1/2009 0:00	12	3D	15	90	2076	138.400	0.5994	0.00464	0.630	500	7/2/2009 5:40	7/2/2009 9:08	1.000	0.675	1.014	120.58%	1.00%	12 *
13	1201245724.1	1.0000	2.0399E-05	7/1/2009 0:00	13	4A	15	79	1877	125.133	0.6208	0.00744	0.890	500	7/2/2009 5:40	7/2/2009 9:08	1.000	0.675	1.014	105.84%	1.00%	13 *
14	1201245725.1	1.0000	2.0399E-05	7/1/2009 0:00	14	4B	15	13	1909	127.267	0.6205	0.00196	1.838	500	7/2/2009 5:40	7/2/2009 9:08	1.000	0.675	1.014	102.70%	1.00%	14 *
15	1201245726.1	1.0000	2.0399E-05	7/1/2009 0:00	15	4C	15	97	1974	131.600	0.6052	0.00426	1.260	500	7/2/2009 5:40	7/2/2009 9:09	1.000	0.674	1.014	112.82%	1.00%	15 *
16	1201245727.1	1.0000	2.0399E-05	7/1/2009 0:00	16	4D	15	181	1880	125.333	0.5873	0.00816	1.070	500	7/2/2009 5:40	7/2/2009 9:25	1.000	0.654	1.014	111.91%	1.00%	16 *
17	1201245728.1	1.0000	2.0399E-05	7/1/2009 0:00	17	5A	15	53	1818	121.200	0.6258	0.00816	0.496	500	7/2/2009 5:40	7/2/2009 9:26	1.000	0.653	1.014	100.83%	1.00%	17 *
18	1201245729.1	1.0000	2.0399E-05	7/1/2009 0:00	18	5B	15	59	1785	119.000	0.6280	0.00816	1.050	500	7/2/2009 5:40	7/2/2009 9:26	1.000	0.653	1.014	108.20%	1.00%	18 *
19	1201245730.1	1.0000	2.0399E-05	7/1/2009 0:00	19	5C	15	43	2009	133.933	0.6368	0.00816	0.946	500	7/2/2009 5:40	7/2/2009 9:26	1.000	0.653	1.014	114.22%	1.00%	19 *
20	1201245731.1	1.0000	2.0399E-05	7/1/2009 0:00	20	5D	15	59	2107	140.467	0.6237	0.00816	1.248	500	7/2/2009 5:40	7/2/2009 9:26	1.000	0.652	1.014	120.58%	1.00%	20 *
21	1201245732.1	1.0000	2.0399E-05	7/1/2009 0:00	21	6A	15	35	1800	120.000	0.6221	0.00816	1.004	500	7/2/2009 5:40	7/2/2009 9:27	1.000	0.652	1.014	105.84%	1.00%	21 *
22	1201245733.1	1.0000	2.0399E-05	7/1/2009 0:00	22	6B	15	71	1816	121.067	0.6163	0.00816	0.764	500	7/2/2009 5:40	7/2/2009 9:27	1.000	0.651	1.014	102.70%	1.00%	22 *
23	1201245734.1	1.0000	2.0399E-05	7/1/2009 0:00	23	6C	15	81	1933	128.867	0.6111	0.00816	1.836	500	7/2/2009 5:40	7/2/2009 9:27	1.000	0.651	1.014	112.82%	1.00%	23 *
24	1201245735.1	1.0000	2.0399E-05	7/1/2009 0:00	24	6D	15	81	1826	121.733	0.6120	0.00816	0.362	500	7/2/2009 5:40	7/2/2009 9:47	1.000	0.627	1.014	111.91%	1.00%	24 *
25	1201245736.1	1.0000	2.0399E-05	7/1/2009 0:00	25	7A	15	75	1711	114.067	0.6180	0.00816	0.344	500	7/2/2009 5:40	7/2/2009 9:48	1.000	0.627	1.014	100.83%	1.00%	25 *
26	1201245737.1	1.0000	2.0399E-05	7/1/2009 0:00	26	7B	15	59	1783	118.867	0.6280	0.00816	0.378	500	7/2/2009 5:40	7/2/2009 9:48	1.000	0.627	1.014	108.20%	1.00%	26 *
27	1201245738.1	1.0000	2.0399E-05	7/1/2009 0:00	27	7C	15	74	1934	128.933	0.6178	0.00816	0.302	500	7/2/2009 5:40	7/2/2009 9:48	1.000	0.627	1.014	114.22%	1.00%	27 *
28	1201245739.1	1.0000	2.0399E-05	7/1/2009 0:00	28	7D	15	83	1963	130.867	0.6257	0.00816	0.396	500	7/2/2009 5:40	7/2/2009 9:48	1.000	0.627	1.014	120.58%	1.00%	28 *
29	1201245740.1	1.0000	2.0399E-05	7/1/2009 0:00	29	8A	15	49	1653	110.200	0.6247	0.00816	0.788	500	7/2/2009 5:40	7/2/2009 9:48	1.000	0.626	1.014	105.84%	1.00%	29 *
30	1201245741.1	1.0000	2.0399E-05	7/1/2009 0:00	30	8B	15	20	1788	119.200	0.6332	0.00816	1.946	500	7/2/2009 5:40	7/2/2009 9:48	1.000	0.626	1.014	102.70%	1.00%	30 *
31	1201245742.1	1.0000	2.0399E-05	7/1/2009 0:00	31	8C	15	34	1920	128.000	0.6339	0.00816	0.676	500	7/2/2009 5:40	7/2/2009 9:48	1.000	0.626	1.014	112.82%	1.00%	31 *
32	1201245743.1	1.0000	2.0399E-05	7/1/2009 0:00	32	8D	15	45	1782	118.800	0.6281	0.00816	1.312	500	7/2/2009 5:40	7/2/2009 10:07	1.000	0.604	1.014	111.91%	1.00%	32 *
33	1201490021.1	1.0000	2.0399E-05	7/1/2009 0:00	33	9A	15	17	1689	112.600	0.6496	0.00816	0.380	500	7/2/2009 5:40	7/2/2009 10:06	1.000	0.605	1.014	100.83%	1.00%	33 *
34	1201490022.1	1.0000	2.0399E-05	7/1/2009 0:00	34	9B	15	13	1706	113.733	0.6356	0.00816	1.206	500	7/2/2009 5:40	7/2/2009 10:06	1.000	0.605	1.014	108.20%	1.00%	34 *
35	1201490023.1	1.0000	2.0399E-05	7/1/2009 0:00	35	9C	15	13	1802	120.133	0.6273	0.00816	0.370	500	7/2/2009 5:40	7/2/2009 10:06	1.000	0.605	1.014	114.22%	1.00%	35 *
36	1201490024.1	1.0000	2.0399E-05	7/1/2009 0:00	36	9D	15	15	1945	129.667	0.6433	0.00816	1.292	500	7/2/2009 5:40	7/2/2009 10:06	1.000	0.605	1.014	120.58%	1.00%	36 *
37	1201490025.1	1.0000	2.0399E-05	7/1/2009 0:00	37	10A	15	10	1708	113.867	0.6389	0.00816	0.316	500	7/2/2009 5:40	7/2/2009 10:07	1.000	0.604	1.014	105.84%	1.00%	37 *
38	1201490026.1	1.0000	2.0399E-05	7/1/2009 0:00	38	10B	15	19	1743	116.200	0.6137	0.00816	6.596	500	7/2/2009 5:40	7/2/2009 10:07	1.000	0.604	1.014	102.70%	1.00%	38 *
39	1201490027.1	1.0000	2.0399E-05	7/1/2009 0:00	39	10C	15	15	1826	121.733	0.6250	0.00816	0.324	500	7/2/2009 5:40	7/2/2009 10:07	1.000	0.604	1.014	112.82%	1.00%	39 *
40	1201490028.1	1.0000	2.0399E-05	7/1/2009 0:00	40	10D	15	14	1769	117.933	0.6320	0.00816	0.348	500	7/2/2009 5:40	7/2/2009 10:22	1.000	0.587	1.014	111.91%	1.00%	40 *
41	1201245736.1	1.0000	2.0399E-05	7/1/2009 0:00	41	11A	15	19	2125	141.667	0.5825	0.00816	0.344	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.819	1.014	100.83%	1.00%	41 *
42	1201245737.1	1.0000	2.0399E-05	7/1/2009 0:00	42	11B	15	22	2260	150.667	0.6372	0.00816	0.378	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.819	1.014	108.20%	1.00%	42 *
43	1201245738.1	1.0000	2.0399E-05	7/1/2009 0:00	43	11C	15	13	2544	169.600	0.6352	0.00816	0.302	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.819	1.014	114.22%	1.00%	43 *
44	1201245739.1	1.0000	2.0399E-05	7/1/2009 0:00	44	11D	15	14	2596	173.067	0.6348	0.00816	0.396	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.819	1.014	120.58%	1.00%	44 *
45	1201245740.1	1.0000	2.0399E-05	7/1/2009 0:00	45	12A	15	17	2235	149.000	0.6286	0.00816	0.788	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.818	1.014	105.84%	1.00%	45 *
46	1201245741.1	1.0000	2.0399E-05	7/1/2009 0:00	46	12B	15	10	2330	155.333	0.6352	0.00816	1.946	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.818	1.014	102.70%	1.00%	46 *
47	1201245742.1	1.0000	2.0399E-05	7/1/2009 0:00	47	12C	15	16	2530	168.667	0.6304	0.00816	0.676	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.818	1.014	112.82%	1.00%	47 *
48	1201245743.1	1.0000	2.0399E-05	7/1/2009 0:00	48	12D	15	10	2463	164.200	0.6320	0.00816	1.312	500	7/2/2009 5:40	7/2/2009 7:26	1.000	0.818	1.014	111.91%	1.00%	48 *
49	1201490021.1	1.0000	2.0399E-05	7/1/2009 0:00	49	13A	15	11	2231	148.733	0.6410	0.00816	0.380	500	7/2/2009 5:40	7/2/2009 7:49	1.000	0.783	1.014	100.83%	1.00%	49 *
50	1201490022.1	1.0000	2.0399E-05	7/1/2009 0:00	50	13B	15	13	2190	146.000	0.6526	0.00816	1.206	500	7/2/2009 5:40	7/2/2009 7:49	1.000	0.783	1.014	108.20%	1.00%	50 *
51	1201490023.1	1.0000	2.0399E-05	7/1/2009 0:00	51	13C	15	11	2458	163.867	0.6538	0.00816	0.370	500	7/2/2009 5:40	7/2/2009 7:49	1.000	0.783	1.014	114.22%	1.00%	51 *
52	1201490024.1	1.0000	2.0399E-05	7/1/2009 0:00	52	13D	15	12	2635	175.667	0.6377	0.00816	1.292	500	7/2/2009 5:40	7/2/2009 7:50	1.000	0.783	1.014	120.58%	1.00%	52 *
53	1201490025.1	1.0000	2.0399E-05	7/1/2009 0:00	53	14A	15	11	2173	144.867	0.6393	0.00816	0.316	500	7/2/2009 5:40	7/2/2009 7:50	1.000	0.783	1.014	105.84%	1.00%	53 *
54	1201490026.1	1.0000	2.0399E-05	7/1/2009 0:00	54	14B	15	11	2281	152.067	0.6266	0.00816	6.596	500	7/2/2009 5:40	7/2/2009 7:50	1.000	0.782	1.014	102.70%	1.00%	54 *
55	1201490027.1	1.0000	2.0399E-05	7/1/2009 0:00	55	14C	15	14	2323	154.867	0.6375	0.00816	0.324	500	7/2/2009 5:40	7/2/2009 7:50	1.000	0.782	1.014	112.82%	1.00%	55 *
56	1201490028.1	1.0000	2.0399E-05	7/1/2009 0:00	56	14D	15	14	2388	159.200	0.6326	0.00816	0.348	500	7/2/2009 5:40	7/2/2009 7:50	1.000	0.782	1.014	111.91%	1.00%	56 *

7/21/09

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

* indicates results calculated at 100% recovery

s 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 Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample Type	Nominal pCi/L	Recovery
0.3471	0.2451	1	0.6937	**134.0279**	0.0254	131.6880	2.9666	5.9178	21.6466	LCS	164.3409	81.6%
0.3647	0.2575	1	0.7192	**133.0399**	0.0251	130.2580	2.9508	5.9071	21.4655	LCS	164.3409	81.0%
0.5369	0.3790	1	0.9659	**145.2921**	0.0243	139.8173	3.0611	6.2347	23.3752	LCS	164.3409	88.4%
0.4695	0.3314	1	0.8753	**159.8328**	0.0239	150.4760	3.1730	6.6057	25.6756	LCS	164.3409	97.3%
0.4261	0.3008	1	0.8097	**127.0000**	0.0257	122.0833	2.8583	5.8279	20.5368	LCS	164.3409	77.3%
0.7599	0.5365	1	1.2813	**141.0616**	0.0247	135.4387	3.0211	6.1673	22.7300	LCS	164.3409	85.8%
0.3798	0.2681	1	0.7515	**141.8559**	0.0253	131.7993	2.9681	6.2613	22.9053	LCS	164.3409	86.3%
0.4150	0.2930	1	0.8072	**145.8192**	0.0251	131.8887	2.9696	6.4352	23.5274	LCS	164.3409	88.7%
0.6347	0.4481	1	1.1343	**129.6854**	0.0284	108.9047	2.7042	6.3116	21.1935	LCS	164.3409	78.9%
0.9035	0.6379	1	1.5022	**135.4510**	0.0266	119.6900	2.8455	6.3115	21.9803	LCS	164.3409	82.4%
0.6078	0.4291	1	1.0779	**141.2594**	0.0255	128.6447	2.9382	6.3235	22.8259	LCS	164.3409	86.0%
0.5473	0.3864	1	0.9987	**155.5960**	0.0247	137.7700	3.0378	6.7244	25.0636	LCS	164.3409	94.7%
0.6283	0.4436	1	1.1054	**135.5336**	0.0264	124.2433	2.8886	6.1761	21.9739	LCS	164.3409	82.5%
0.9036	0.6379	1	1.4942	**136.9155**	0.0254	125.4287	2.9134	6.2333	22.1127	LCS	164.3409	83.3%
0.7676	0.5419	1	1.3079	**145.9626**	0.0252	130.3400	2.9624	6.5032	23.5621	LCS	164.3409	88.8%
0.7520	0.5309	1	1.3000	**147.9661**	0.0266	124.2633	2.8910	6.7471	24.0105	LCS	164.3409	90.0%
0.4809	0.3395	1	0.9027	**134.9911**	0.0269	120.7040	2.8427	6.2312	21.9265	LCS	164.3409	82.1%
0.6974	0.4924	1	1.2076	**131.4742**	0.0271	117.9500	2.8170	6.1544	21.3797	LCS	164.3409	80.0%
0.6530	0.4610	1	1.1419	**148.2299**	0.0259	132.9873	2.9884	6.4406	23.6659	LCS	164.3409	89.0%
0.7661	0.5409	1	1.3064	**156.3706**	0.0255	139.2187	3.0605	6.7377	25.2668	LCS	164.3409	95.2%
0.6899	0.4871	1	1.1997	**134.1883**	0.0270	118.9960	2.8288	6.2523	21.8127	LCS	164.3409	81.7%
0.6079	0.4292	1	1.0862	**137.0396**	0.0269	120.3027	2.8412	6.3436	22.2643	LCS	164.3409	83.4%
0.9509	0.6713	1	1.5725	**146.0056**	0.0264	127.0307	2.9317	6.6044	23.6775	LCS	164.3409	88.8%
0.4376	0.3090	1	0.8562	**144.5849**	0.0268	121.3713	2.8489	6.6518	23.4785	LCS	164.3409	88.0%
0.4227	0.2984	1	0.8330	**134.2390**	0.0275	113.7227	2.7577	6.3803	21.8573	LCS	164.3409	81.7%
0.4360	0.3079	1	0.8480	**137.6373**	0.0270	118.4887	2.8152	6.4094	22.3723	LCS	164.3409	83.8%
0.3962	0.2797	1	0.7956	**151.8935**	0.0262	128.6313	2.9319	6.7858	24.6088	LCS	164.3409	92.4%
0.4480	0.3163	1	0.8657	**152.1131**	0.0261	130.4707	2.9539	6.7499	24.6318	LCS	164.3409	92.6%
0.6332	0.4470	1	1.1278	**127.8251**	0.0279	109.4120	2.7108	6.2072	20.8518	LCS	164.3409	77.8%
0.9817	0.6931	1	1.6167	**135.1471**	0.0273	117.2540	2.8197	6.3699	21.9896	LCS	164.3409	82.2%
0.5779	0.4080	1	1.0463	**146.5864**	0.0263	127.3240	2.9214	6.5922	23.7610	LCS	164.3409	89.2%
0.8422	0.5946	1	1.4301	**141.4935**	0.0272	117.4880	2.8147	6.6441	23.0149	LCS	164.3409	86.1%
0.4379	0.3091	1	0.8509	**130.5505**	0.0276	112.2200	2.7400	6.2476	21.2692	LCS	164.3409	79.4%
0.7972	0.5629	1	1.3635	**133.7974**	0.0277	112.5273	2.7540	6.4182	21.8026	LCS	164.3409	81.4%
0.4475	0.3159	1	0.8728	**144.2924**	0.0269	119.7633	2.8301	6.6832	23.4437	LCS	164.3409	87.8%
0.8154	0.5757	1	1.3863	**150.8313**	0.0263	128.3747	2.9406	6.7718	24.4459	LCS	164.3409	91.8%
0.4063	0.2868	1	0.8104	**134.4151**	0.0275	113.5507	2.7553	6.3927	21.8871	LCS	164.3409	81.8%
1.9322	1.3641	1	2.9747	**135.0540**	0.0285	109.6040	2.7857	6.7277	22.0820	LCS	164.3409	82.2%
0.4205	0.2969	1	0.8358	**146.9063**	0.0268	121.4093	2.8489	6.7565	23.8548	LCS	164.3409	89.4%
0.4437	0.3132	1	0.8728	**144.8386**	0.0271	117.5853	2.8041	6.7699	23.5500	LCS	164.3409	88.1%
0.3432	0.2423	1	0.6763	**135.4549**	0.0253	141.3227	3.0733	5.7736	21.8705	LCS	164.3409	82.4%
0.3289	0.2322	1	0.6397	**131.6931**	0.0247	150.2887	3.1694	5.4434	21.2189	LCS	164.3409	80.1%
0.2949	0.2082	1	0.5922	**148.8038**	0.0237	169.2980	3.3626	5.7929	23.8866	LCS	164.3409	90.5%
0.3379	0.2385	1	0.6530	**151.8473**	0.0235	172.6707	3.3968	5.8549	24.3615	LCS	164.3409	92.4%
0.4816	0.3400	1	0.8577	**131.6889**	0.0249	148.2120	3.1520	5.4891	21.2301	LCS	164.3409	80.1%
0.7488	0.5287	1	1.2332	**134.8566**	0.0246	153.3873	3.2186	5.5463	21.7215	LCS	164.3409	82.1%
0.4447	0.3140	1	0.8052	**148.8317**	0.0238	167.9907	3.3535	5.8232	23.8982	LCS	164.3409	90.6%
0.6180	0.4363	1	1.0494	**143.9479**	0.0241	162.8880	3.3090	5.7315	23.1384	LCS	164.3409	87.6%
0.3427	0.2420	1	0.6660	**135.0873**	0.0248	148.3533	3.1490	5.6202	21.7752	LCS	164.3409	82.2%
0.5997	0.4234	1	1.0256	**129.5009**	0.0251	144.7940	3.1202	5.4697	20.8960	LCS	164.3409	78.8%
0.3316	0.2341	1	0.6469	**146.0021**	0.0240	163.4967	3.3053	5.7852	23.4616	LCS	164.3409	88.8%
0.6355	0.4487	1	1.0805	**159.6717**	0.0235	174.3747	3.4225	6.1425	25.6134	LCS	164.3409	97.2%
0.3136	0.2214	1	0.6255	**132.0625**	0.0251	144.5507	3.1078	5.5650	21.3060	LCS	164.3409	80.4%
1.4618	1.0321	1	2.2506	**135.6135**	0.0254	145.4707	3.1861	5.8215	21.9070	LCS	164.3409	82.5%
0.3185	0.2249	1	0.6330	**141.6298**	0.0245	154.5427	3.2133	5.7718	22.7990	LCS	164.3409	86.2%
0.3327	0.2349	1	0.6546	**146.7439**	0.0242	158.8520	3.2579	5.8988	23.6017	LCS	164.3409	89.3%

7/2/09

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

7/21/09

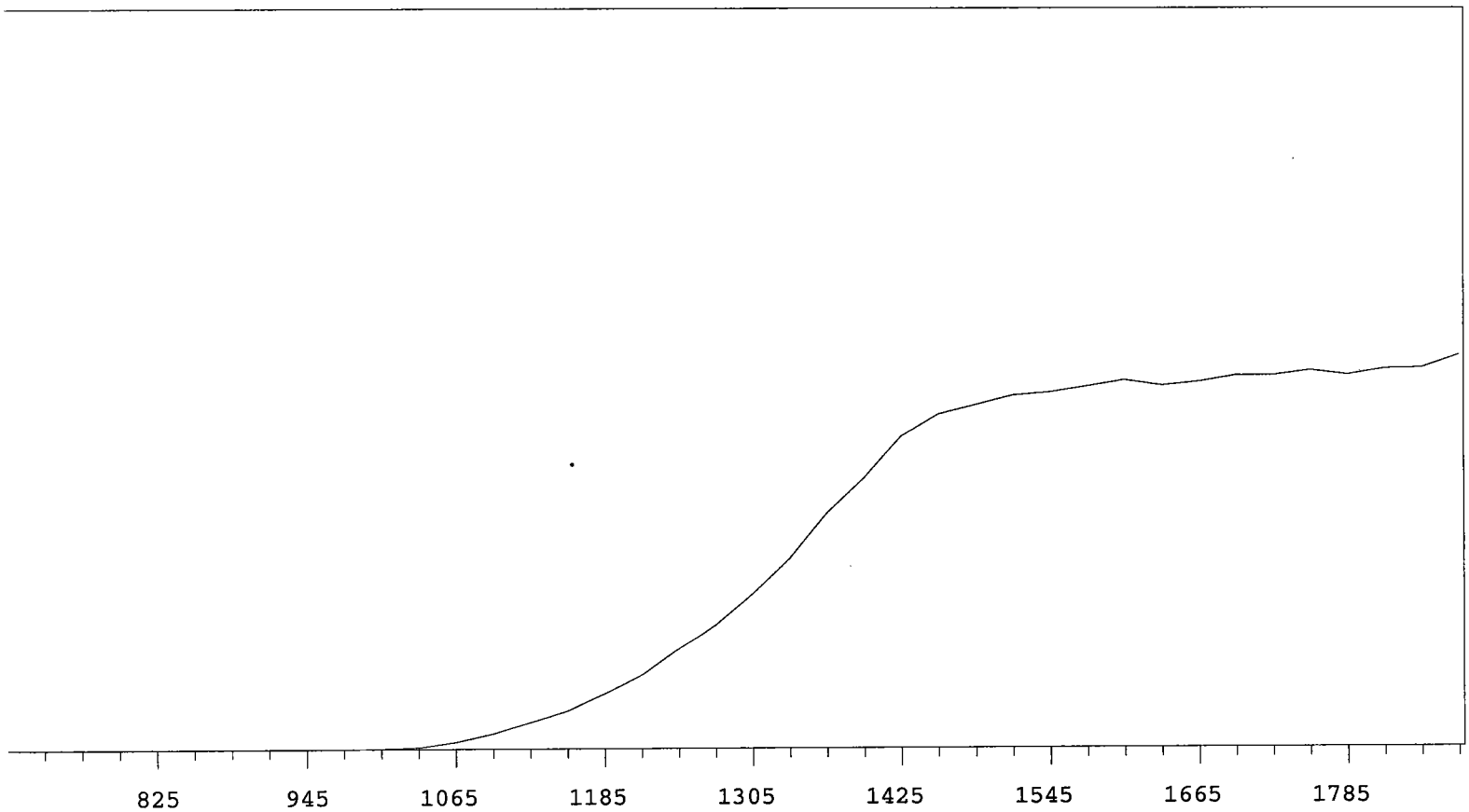
4	13D	15	12	2635	7/2/2009 7:50	7/2/2009 8:05	Protean
5	14A	15	11	2173	7/2/2009 7:50	7/2/2009 8:05	Protean
6	14B	15	11	2281	7/2/2009 7:50	7/2/2009 8:05	Protean
7	14C	15	14	2323	7/2/2009 7:50	7/2/2009 8:05	Protean
8	14D	15	14	2388	7/2/2009 7:50	7/2/2009 8:05	Protean

Ra-228	Cal Date	7/2/2009	Exp Date	7/31/2009	
Protean	A0	A1	A2	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				

13B	6.52643E-01
13C	6.53798E-01
13D	6.37701E-01
14A	6.39290E-01
14B	6.26611E-01
14C	6.37531E-01
14D	6.32609E-01

MPC 9600 Plateau Instrument 1 MPC 9604 Detector A 7/1/2009

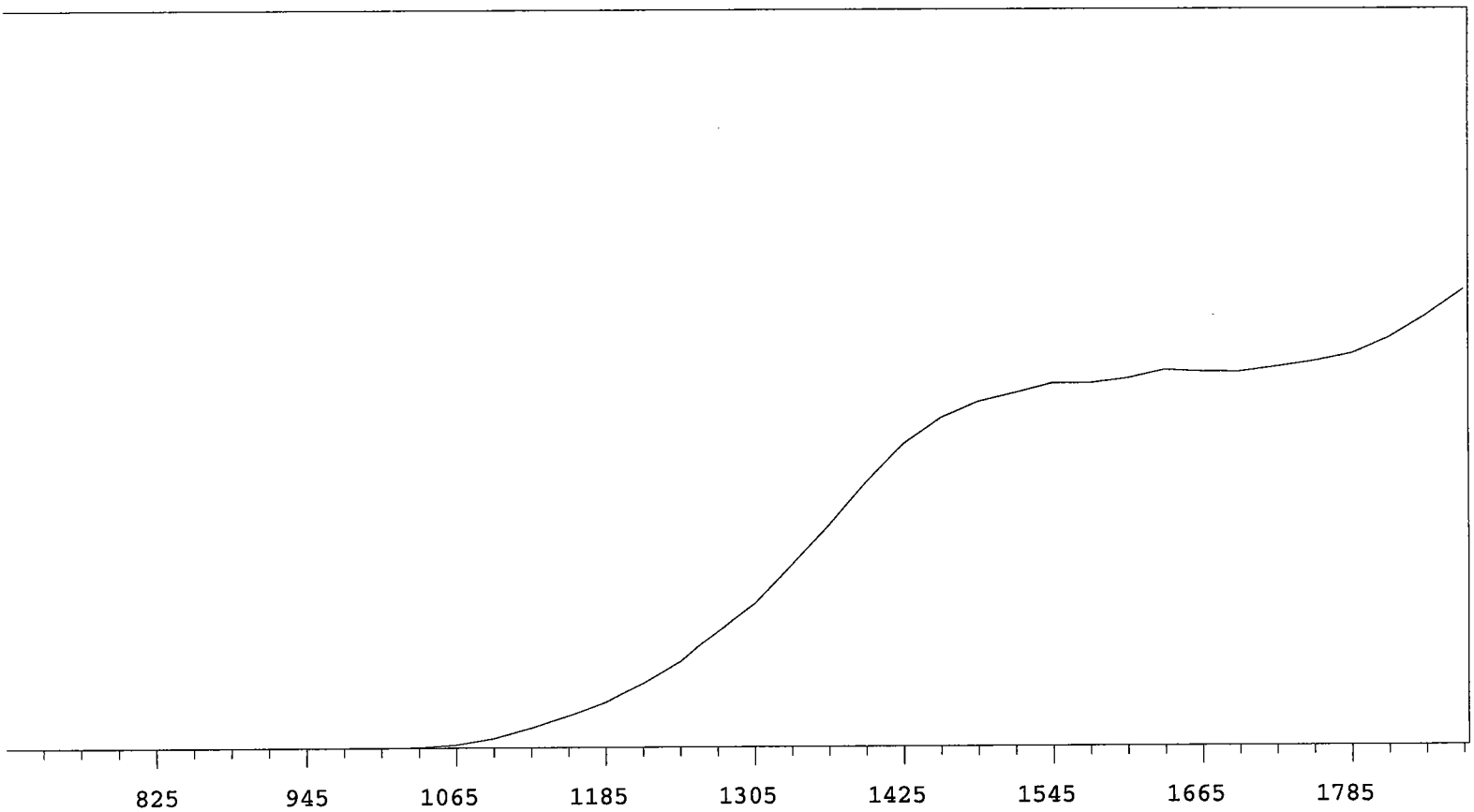
Alpha Volts: 1575 Beta Volts: 1575



VOLTS	COUNTS	%/100 Volts
705	1	
735	1	
765	0	
795	0	+0.00
825	0	>100
855	1	>100
885	0	+55.56
915	2	+66.67
945	0	>100
975	2	>100
1005	42	>100
1035	145	>100
1065	544	>100
1095	1136	>100
1125	1967	>100
1155	2845	>100
1185	4078	>100
1215	5483	+93.18
1245	7400	+83.35
1275	9328	+75.40
1305	11640	+69.78
1335	14241	+62.88
1365	17534	+55.91
1395	20127	+45.04
1425	23254	+31.29
1455	24902	+20.41
1485	25605	+10.49
1515	26310	+6.44
1545	26535	+5.31
1575	26953	+2.79
1605	27399	+1.83
1635	27000	+1.71
1665	27255	+1.62
1695	27723	+3.14
1725	27705	+1.56
1755	28072	+1.15
1785	27729	+1.43
1815	28194	+3.24
1845	28243	
1875	29191	

MPC 9600 Plateau Instrument 1 MPC 9604 Detector B 7/1/2009

Alpha Volts: 1575 Beta Volts: 1575

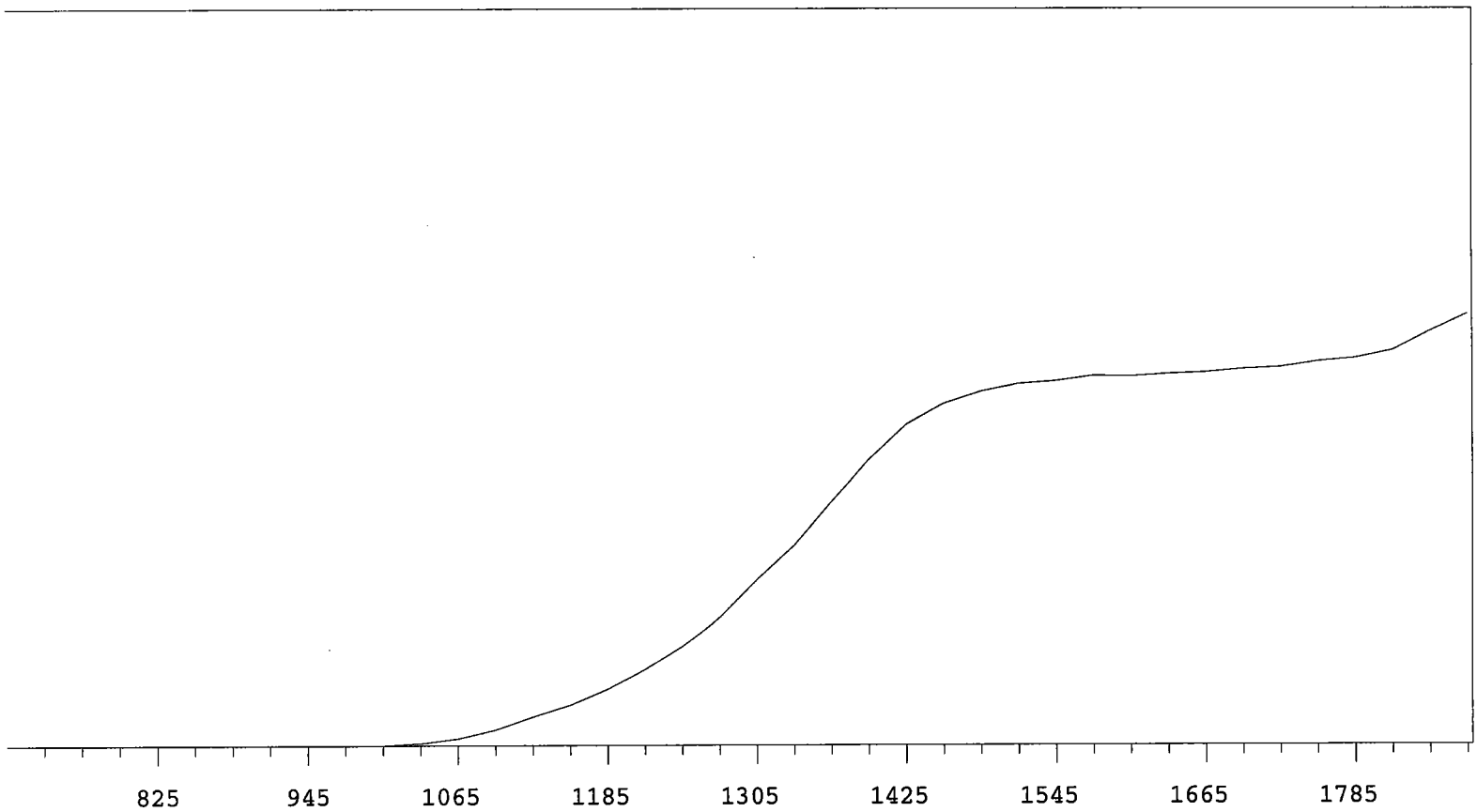


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	+55.56
795	1	+83.33
825	1	+55.56
855	0	>100
885	1	+0.00
915	0	+0.00
945	1	>100
975	0	>100
1005	4	>100
1035	56	>100
1065	292	>100
1095	890	>100
1125	1841	>100
1155	2936	>100
1185	4179	>100
1215	5837	>100
1245	7821	+91.28
1275	10638	+83.88

VOLTS	COUNTS	%/100 Volts
1305	13188	+75.92
1335	16818	+67.60
1365	20420	+59.86
1395	24341	+47.85
1425	27854	+35.51
1455	30288	+23.26
1485	31798	+14.54
1515	32622	+8.32
1545	33496	+5.11
1575	33475	+4.43
1605	33903	+3.09
1635	34654	+2.46
1665	34485	+1.74
1695	34445	+1.84
1725	34908	+3.91
1755	35401	+6.80
1785	36062	+10.27
1815	37505	+14.30
1845	39508	
1875	41843	

MPC 9600 Plateau Instrument 1 MPC 9604 Detector C 7/1/2009

Alpha Volts: 1575 Beta Volts: 1575

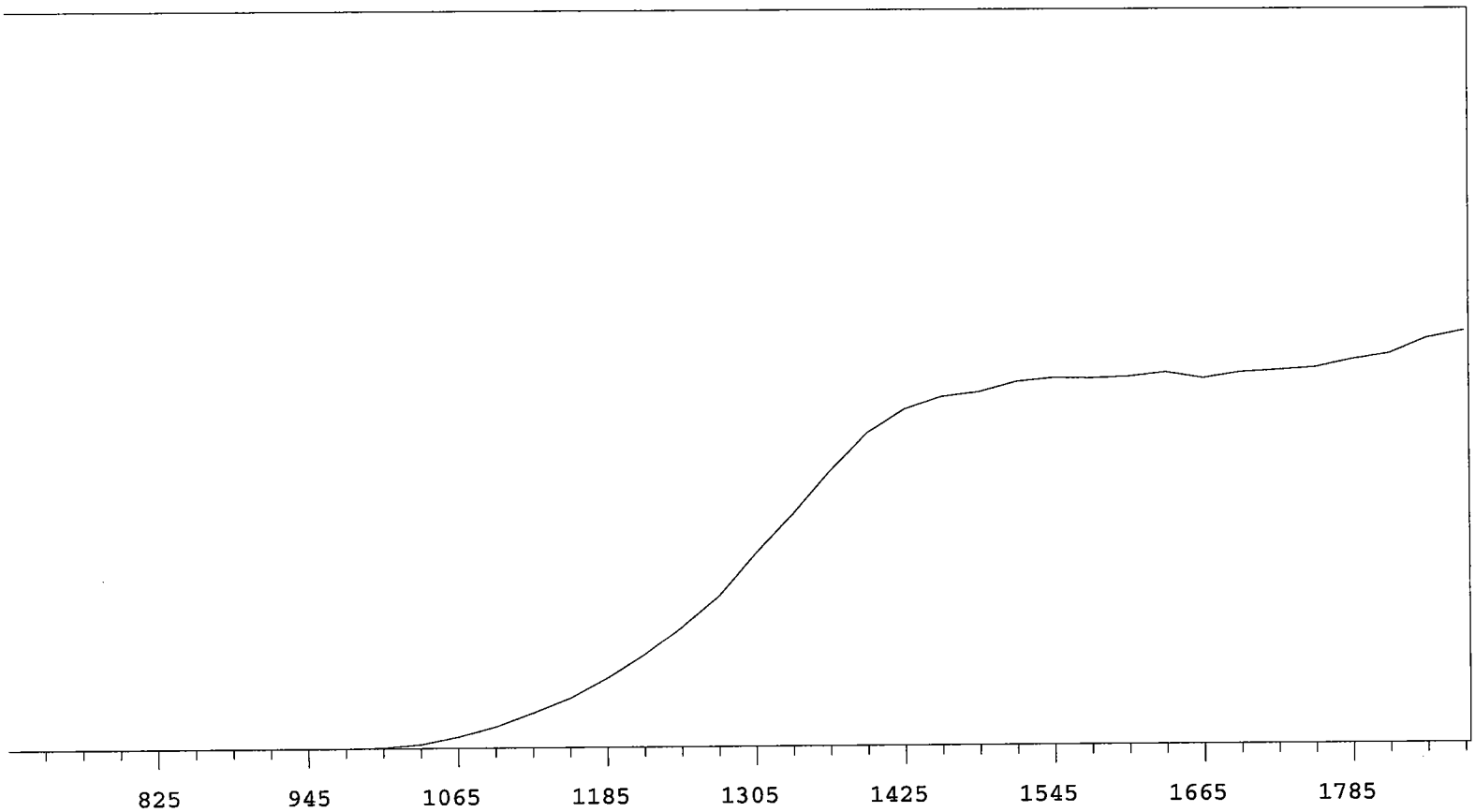


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	1	+0.00
795	0	>100
825	1	-55.56
855	1	+55.56
885	0	>100
915	1	>100
945	0	>100
975	4	>100
1005	32	>100
1035	206	>100
1065	639	>100
1095	1416	>100
1125	2551	>100
1155	3619	>100
1185	5037	+98.68
1215	6875	+91.19
1245	8915	+85.53
1275	11519	+77.28

VOLTS	COUNTS	%/100 Volts
1305	14817	+71.06
1335	17823	+63.34
1365	21704	+53.63
1395	25422	+42.55
1425	28424	+29.21
1455	30244	+18.11
1485	31305	+10.10
1515	31989	+6.07
1545	32223	+3.43
1575	32671	+2.15
1605	32621	+1.68
1635	32837	+1.52
1665	32961	+2.01
1695	33249	+2.64
1725	33409	+3.21
1755	33931	+4.07
1785	34234	+7.20
1815	34909	+10.28
1845	36660	
1875	38205	

MPC 9600 Plateau Instrument 1 MPC 9604 Detector D 7/1/2009

Alpha Volts: 1575 Beta Volts: 1575

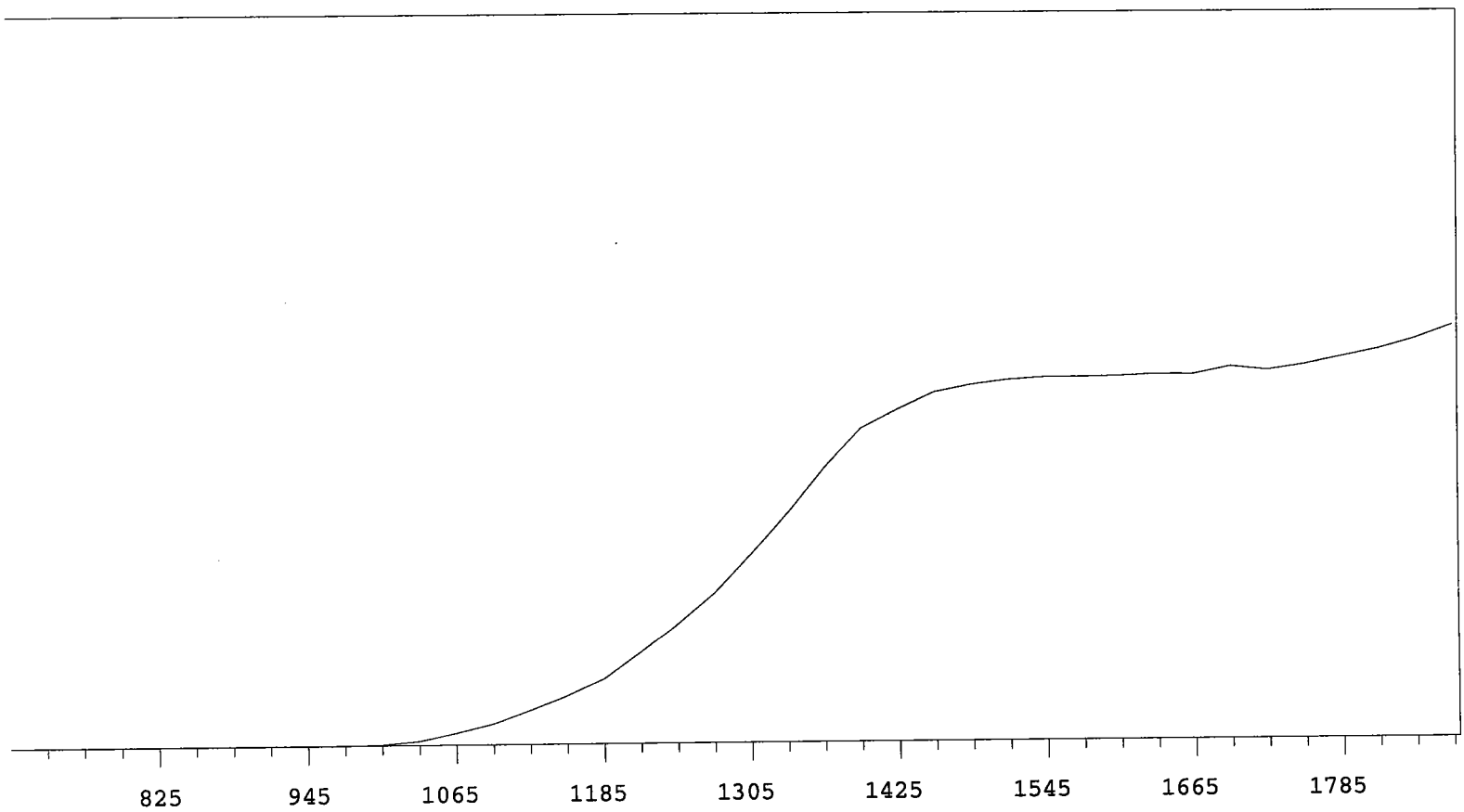


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	+0.00
795	1	+0.00
825	0	+0.00
855	1	>100
885	0	>100
915	0	>100
945	0	>100
975	8	>100
1005	75	>100
1035	303	>100
1065	872	>100
1095	1656	>100
1125	2729	>100
1155	3862	>100
1185	5425	+98.19
1215	7256	+88.82
1245	9510	+81.89
1275	11944	+74.07

VOLTS	COUNTS	%/100 Volts
1305	15202	+66.36
1335	18216	+57.86
1365	21597	+45.58
1395	24648	+32.96
1425	26505	+19.92
1455	27475	+11.42
1485	27836	+7.08
1515	28609	+4.51
1545	28896	+2.93
1575	28862	+1.66
1605	28969	+0.36
1635	29292	+0.80
1665	28836	+1.06
1695	29279	+1.48
1725	29439	+3.59
1755	29642	+4.07
1785	30243	+6.51
1815	30699	+7.79
1845	31876	
1875	32444	

MPC 9600 Plateau Instrument 2 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

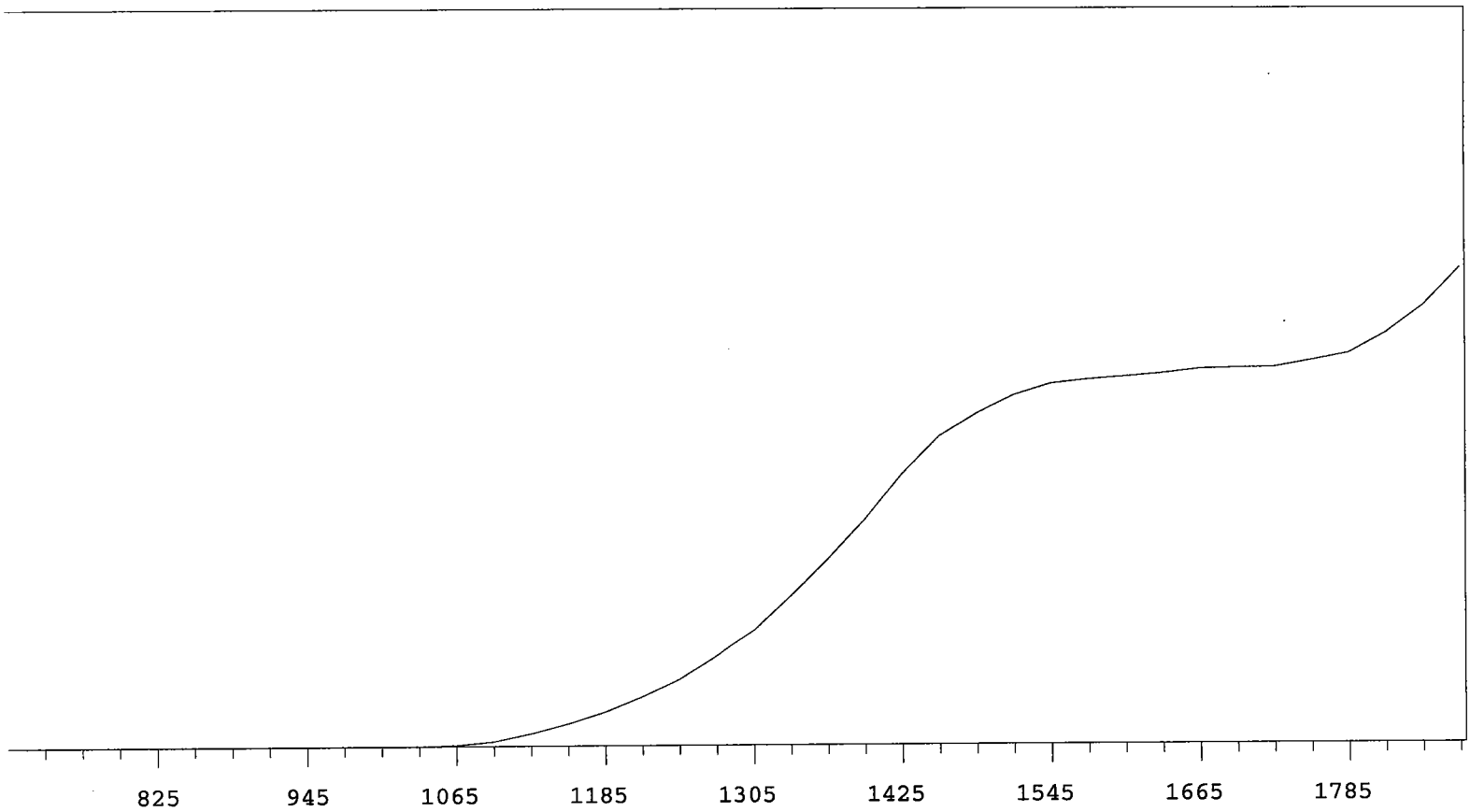


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	+83.33
795	0	-83.33
825	1	>100
855	0	>100
885	1	+100.00
915	1	>100
945	2	>100
975	12	>100
1005	91	>100
1035	421	>100
1065	1239	>100
1095	2155	>100
1125	3527	>100
1155	4974	>100
1185	6647	+97.44
1215	9250	+89.00
1245	12041	+82.15
1275	15094	+73.81

VOLTS	COUNTS	%/100 Volts
1305	19017	+67.45
1335	23157	+59.23
1365	27625	+45.78
1395	31465	+32.72
1425	33352	+20.41
1455	35084	+11.74
1485	35819	+7.11
1515	36292	+3.35
1545	36527	+1.63
1575	36540	+0.87
1605	36585	+0.48
1635	36742	+1.76
1665	36691	+1.53
1695	37461	+1.89
1725	37073	+3.07
1755	37603	+4.02
1785	38346	+6.58
1815	39111	+7.95
1845	40115	
1875	41409	

MPC 9600 Plateau Instrument 2 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

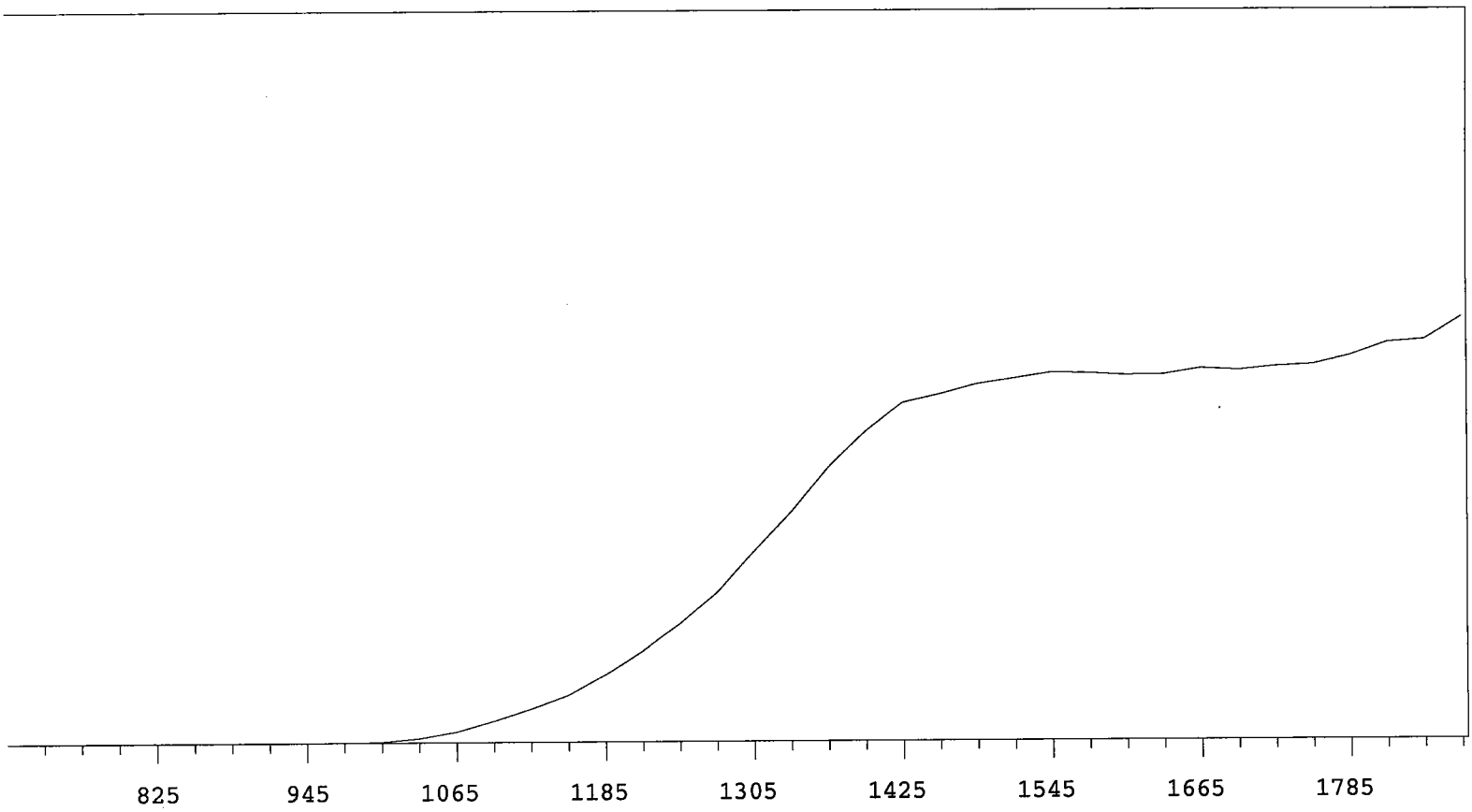


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	1	>100
975	2	>100
1005	3	>100
1035	14	>100
1065	127	>100
1095	500	>100
1125	1332	>100
1155	2373	>100
1185	3614	>100
1215	5227	>100
1245	7060	+97.33
1275	9574	+90.30

VOLTS	COUNTS	%/100 Volts
1305	12541	+83.18
1335	16192	+74.48
1365	20083	+67.17
1395	24273	+58.43
1425	29090	+46.86
1455	33223	+34.56
1485	35608	+22.67
1515	37581	+13.63
1545	38762	+8.18
1575	39185	+4.42
1605	39484	+3.06
1635	39806	+2.61
1665	40264	+2.03
1695	40353	+2.32
1725	40431	+3.28
1755	41127	+7.09
1785	41882	+12.40
1815	44049	+18.52
1845	46950	
1875	51097	

MPC 9600 Plateau Instrument 2 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

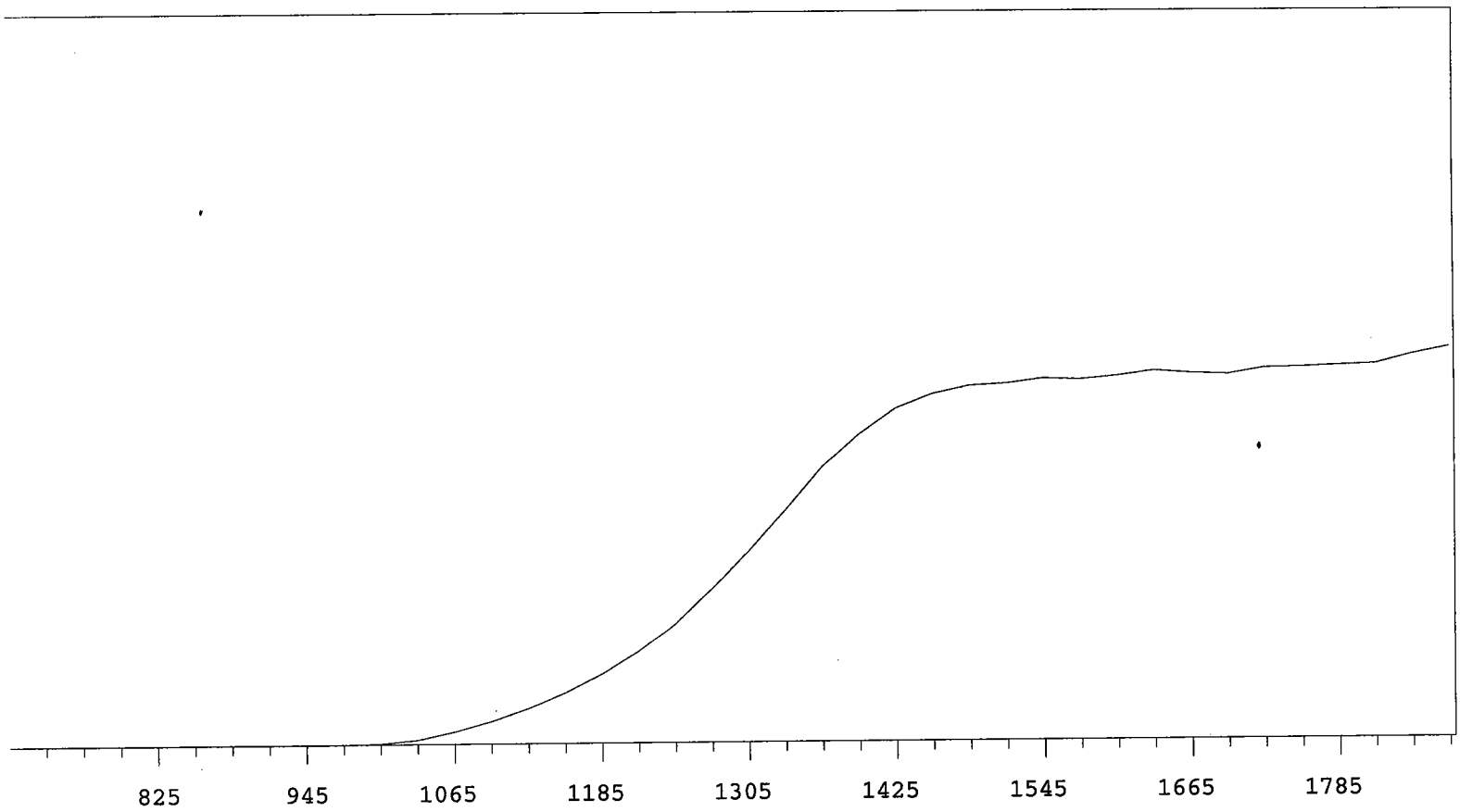


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	1	>100
945	0	>100
975	17	>100
1005	87	>100
1035	438	>100
1065	1055	>100
1095	2114	>100
1125	3282	>100
1155	4625	>100
1185	6554	+97.66
1215	8743	+88.09
1245	11345	+81.31
1275	14261	+74.60

VOLTS	COUNTS	%/100 Volts
1305	18216	+67.74
1335	21995	+58.11
1365	26173	+46.11
1395	29479	+32.75
1425	32186	+20.62
1455	33022	+12.13
1485	33981	+7.22
1515	34520	+4.95
1545	35095	+2.07
1575	35014	+0.38
1605	34812	+0.55
1635	34859	+1.11
1665	35460	+1.94
1695	35273	+1.95
1725	35629	+2.73
1755	35811	+5.77
1785	36656	+6.44
1815	37896	+9.21
1845	38145	
1875	40283	

MPC 9600 Plateau Instrument 2 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

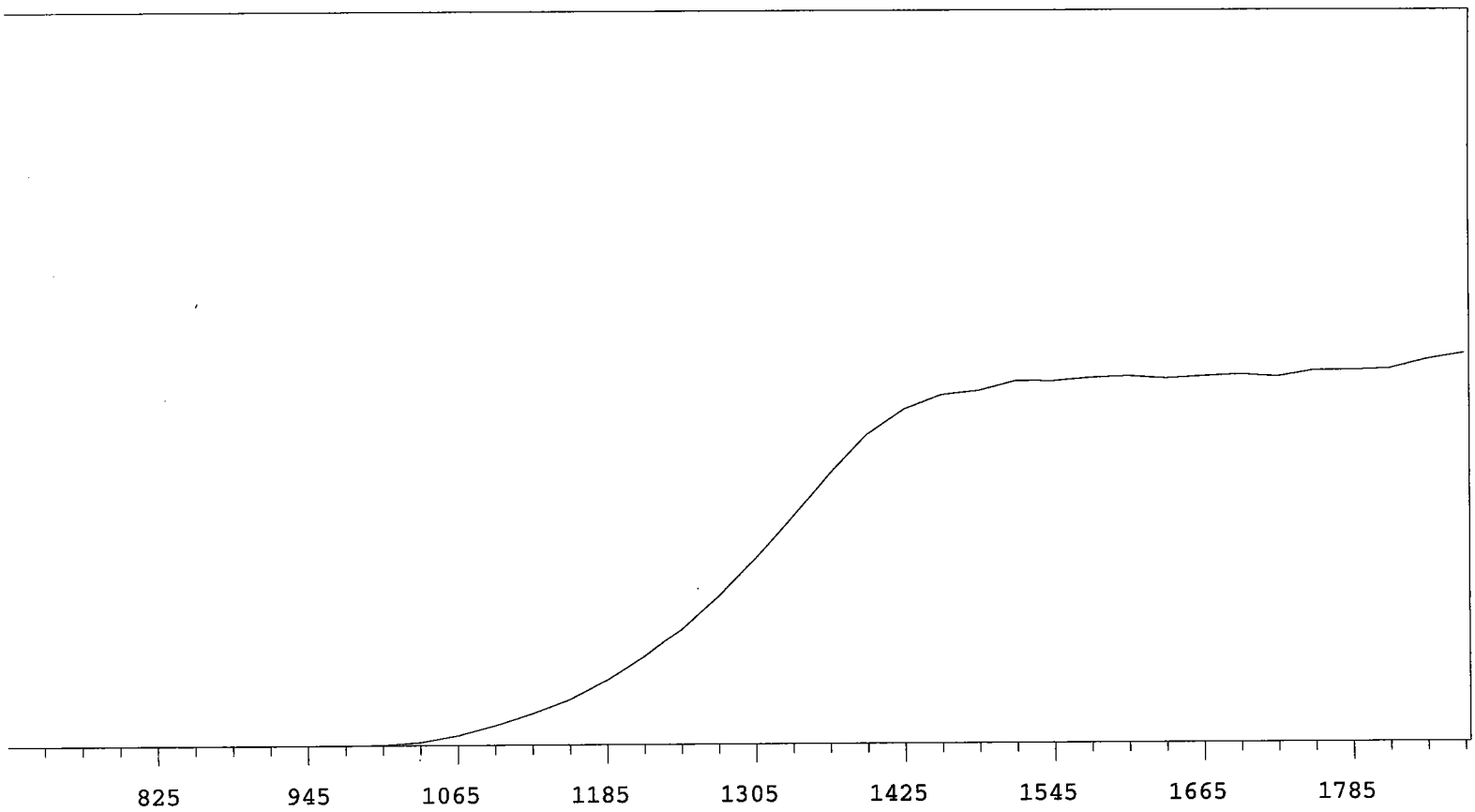


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	+83.33
795	2	+55.56
825	1	>100
855	0	>100
885	0	>100
915	0	>100
945	2	>100
975	9	>100
1005	89	>100
1035	439	>100
1065	1198	>100
1095	2164	>100
1125	3436	>100
1155	4917	>100
1185	6762	+96.59
1215	9006	+89.14
1245	11800	+81.34
1275	15132	+73.59

VOLTS	COUNTS	%/100 Volts
1305	18675	+65.94
1335	22620	+55.69
1365	26869	+44.63
1395	29957	+32.08
1425	32494	+20.49
1455	33836	+11.98
1485	34627	+6.45
1515	34849	+3.22
1545	35298	+1.98
1575	35180	+2.37
1605	35503	+1.57
1635	36006	+0.99
1665	35722	+0.89
1695	35597	+0.93
1725	36188	+1.86
1755	36272	+1.90
1785	36389	+2.55
1815	36529	+4.39
1845	37459	
1875	38170	

MPC 9600 Plateau Instrument 3 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

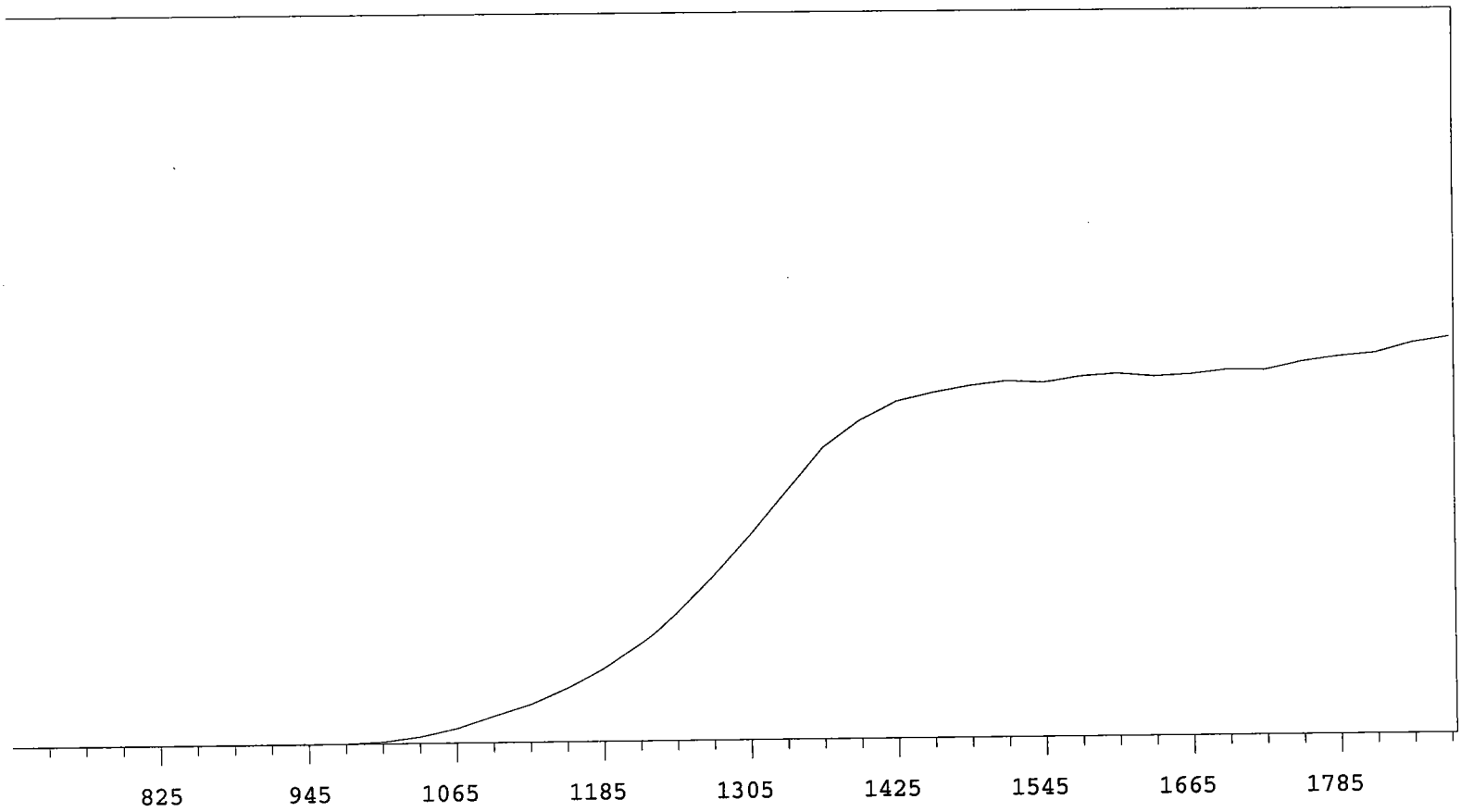


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	+55.56
795	1	>100
825	1	+0.00
855	1	>100
885	0	>100
915	0	>100
945	0	>100
975	9	>100
1005	53	>100
1035	302	>100
1065	878	>100
1095	1805	>100
1125	2887	>100
1155	4163	>100
1185	5842	+99.81
1215	7959	+90.90
1245	10323	+83.03
1275	13250	+75.91

VOLTS	COUNTS	%/100 Volts
1305	16654	+68.57
1335	20416	+59.26
1365	24191	+47.28
1395	27643	+34.04
1425	29891	+21.08
1455	31183	+12.30
1485	31558	+6.67
1515	32444	+4.05
1545	32413	+2.90
1575	32704	+0.81
1605	32837	+0.71
1635	32629	+0.49
1665	32797	+0.16
1695	32964	+1.32
1725	32746	+1.40
1755	33308	+1.56
1785	33318	+3.21
1815	33456	+3.92
1845	34283	
1875	34815	

MPC 9600 Plateau Instrument 3 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

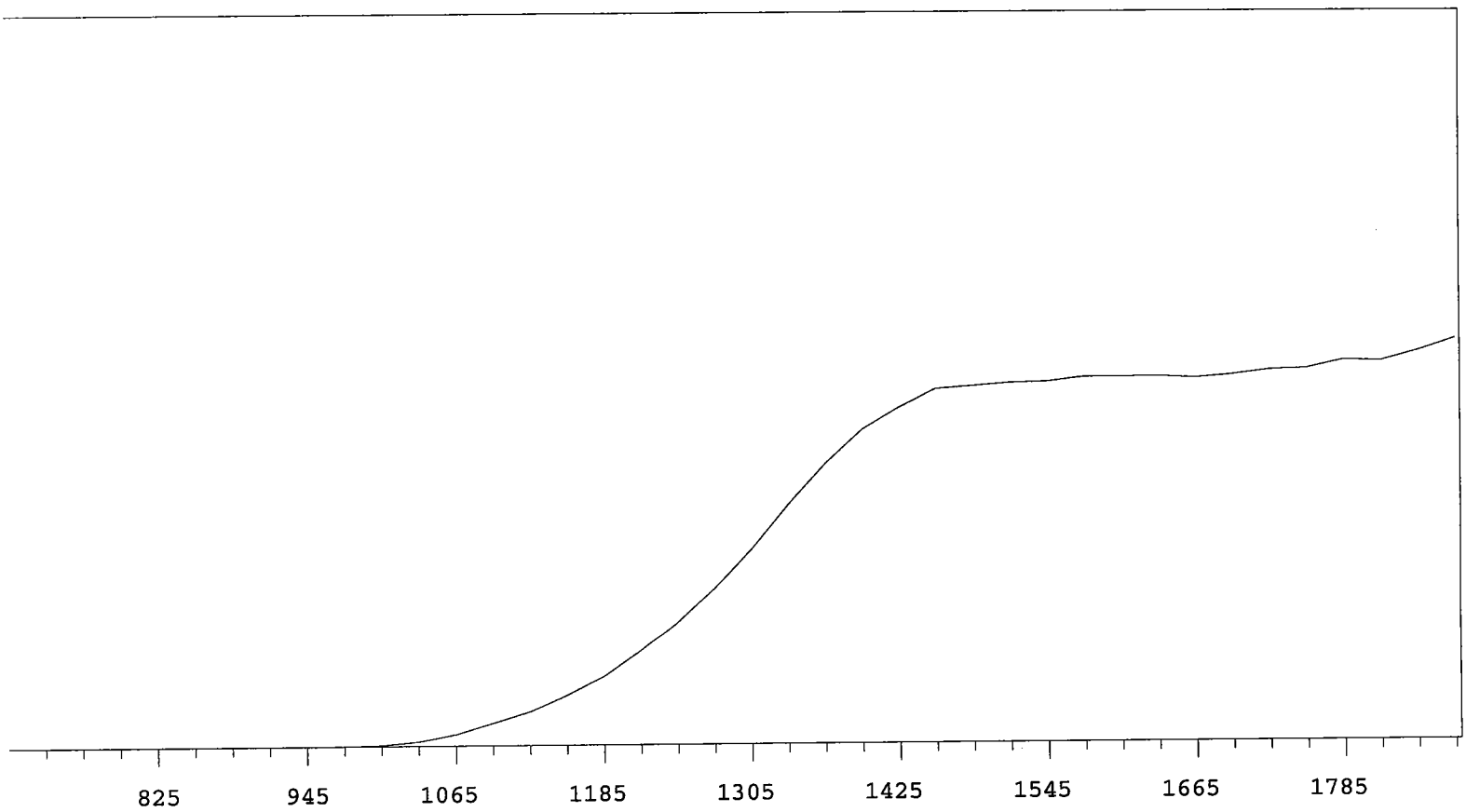


VOLTS	COUNTS	%/100 Volts
705	1	
735	1	
765	0	-55.56
795	0	>100
825	1	>100
855	3	+33.33
885	0	+0.00
915	1	>100
945	2	>100
975	29	>100
1005	165	>100
1035	613	>100
1065	1394	>100
1095	2558	>100
1125	3702	>100
1155	5222	>100
1185	7161	+96.06
1215	9507	+89.18
1245	12552	+81.52
1275	16030	+73.64

VOLTS	COUNTS	%/100 Volts
1305	19810	+64.73
1335	23962	+52.62
1365	28091	+39.27
1395	30594	+25.61
1425	32381	+14.86
1455	33206	+8.91
1485	33832	+4.41
1515	34260	+3.01
1545	34071	+2.33
1575	34623	+1.34
1605	34848	+1.22
1635	34564	+0.89
1665	34733	+1.01
1695	35144	+2.76
1725	35084	+3.66
1755	35839	+3.97
1785	36332	+5.39
1815	36654	+5.35
1845	37609	
1875	38164	

MPC 9600 Plateau Instrument 3 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

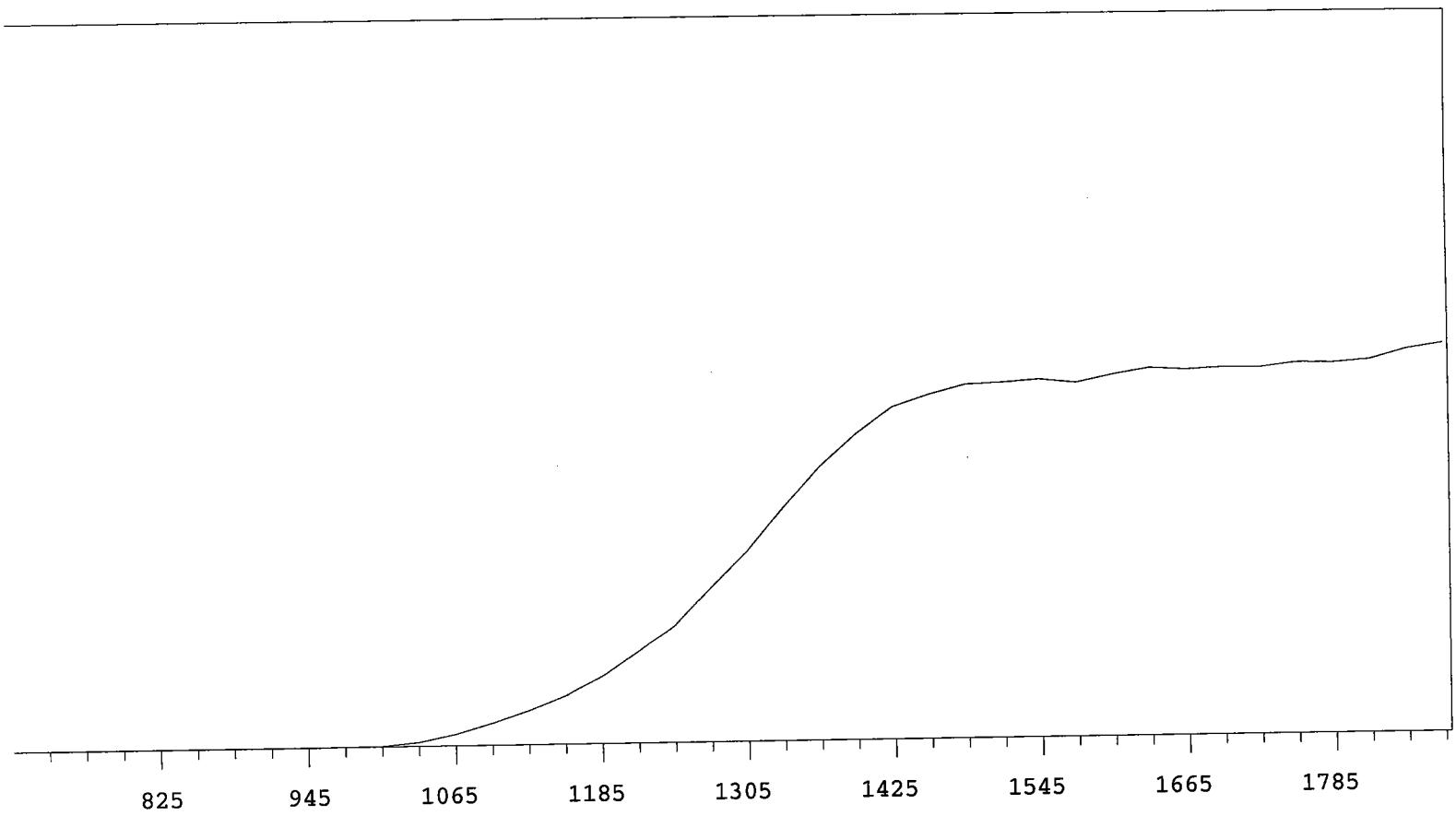


VOLTS	COUNTS	%/100 Volts
705	1	
735	1	
765	1	
795	0	>100
825	0	+0.00
855	0	>100
885	1	>100
915	1	>100
945	1	>100
975	17	>100
1005	122	>100
1035	533	>100
1065	1287	>100
1095	2493	>100
1125	3753	>100
1155	5482	>100
1185	7538	+99.39
1215	10305	+90.31
1245	13415	+82.57
1275	17141	+75.13

VOLTS	COUNTS	%/100 Volts
1305	21412	+66.80
1335	26262	+56.32
1365	30679	+43.71
1395	34466	+31.61
1425	36949	+20.14
1455	38998	+11.16
1485	39313	+5.34
1515	39625	+2.44
1545	39751	+2.04
1575	40227	+1.45
1605	40228	+0.56
1635	40255	+0.13
1665	40075	+1.22
1695	40384	+1.95
1725	40900	+3.50
1755	41028	+3.05
1785	41899	+3.71
1815	41767	+5.64
1845	42852	
1875	44132	

MPC 9600 Plateau Instrument 3 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

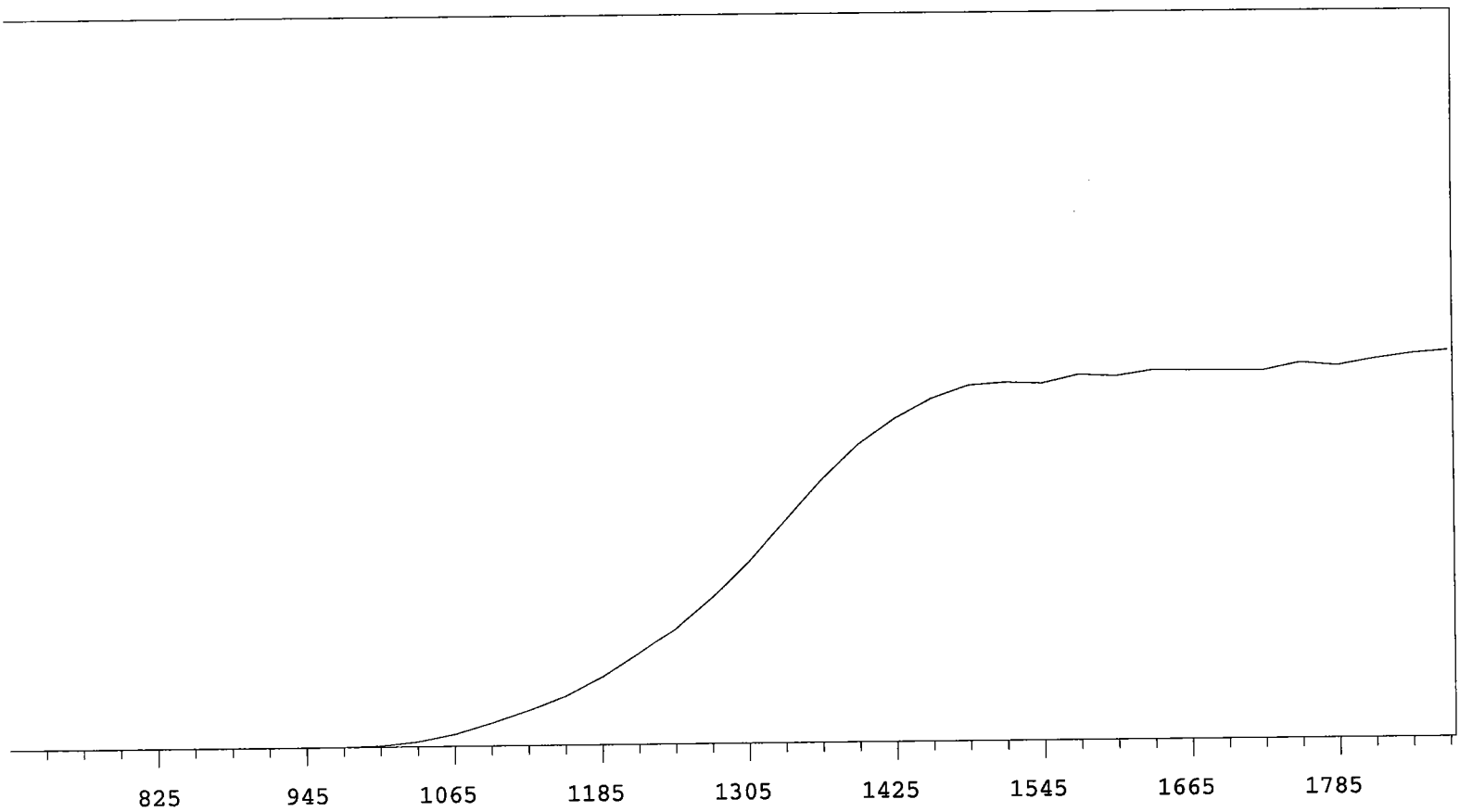


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	+0.00
795	1	>100
825	0	+83.33
855	0	-83.33
885	1	>100
915	0	>100
945	1	>100
975	12	>100
1005	51	>100
1035	298	>100
1065	848	>100
1095	1649	>100
1125	2535	>100
1155	3602	>100
1185	5036	+98.31
1215	6880	+91.37
1245	8822	+82.29
1275	11546	+74.61

VOLTS	COUNTS	%/100 Volts
1305	14171	+66.45
1335	17362	+54.90
1365	20310	+43.83
1395	22647	+30.82
1425	24551	+20.19
1455	25440	+11.69
1485	26124	+5.90
1515	26245	+2.21
1545	26428	+1.39
1575	26151	+2.69
1605	26721	+2.72
1635	27168	+2.80
1665	27007	+0.87
1695	27135	+0.70
1725	27089	+1.24
1755	27414	+1.43
1785	27373	+3.21
1815	27581	+4.34
1845	28332	
1875	28750	

MPC 9600 Plateau Instrument 4 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

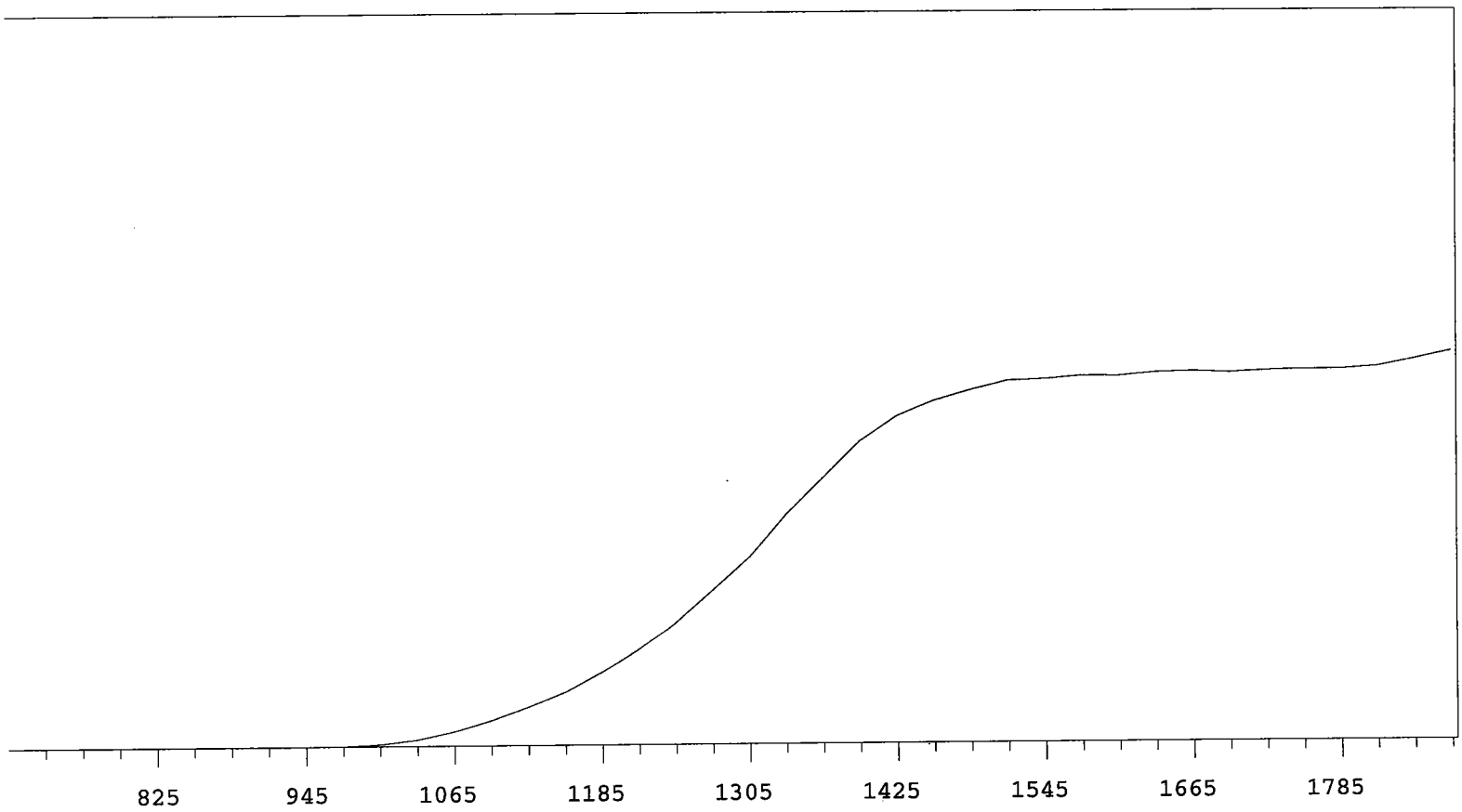


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	2	+55.56
855	1	>100
885	0	-55.56
915	3	>100
945	0	>100
975	16	>100
1005	114	>100
1035	451	>100
1065	1100	>100
1095	2068	>100
1125	3189	>100
1155	4386	>100
1185	6094	+94.81
1215	8184	+87.09
1245	10489	+78.88
1275	13273	+72.66

VOLTS	COUNTS	%/100 Volts
1305	16442	+66.24
1335	20146	+57.40
1365	23769	+46.40
1395	26926	+34.68
1425	29276	+24.40
1455	31037	+15.28
1485	32197	+7.91
1515	32425	+4.33
1545	32314	+2.14
1575	33071	+2.66
1605	32918	+2.52
1635	33435	+1.02
1665	33382	+0.73
1695	33349	+1.07
1725	33324	+1.28
1755	34001	+2.26
1785	33701	+3.08
1815	34304	+2.97
1845	34744	
1875	35012	

MPC 9600 Plateau Instrument 4 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

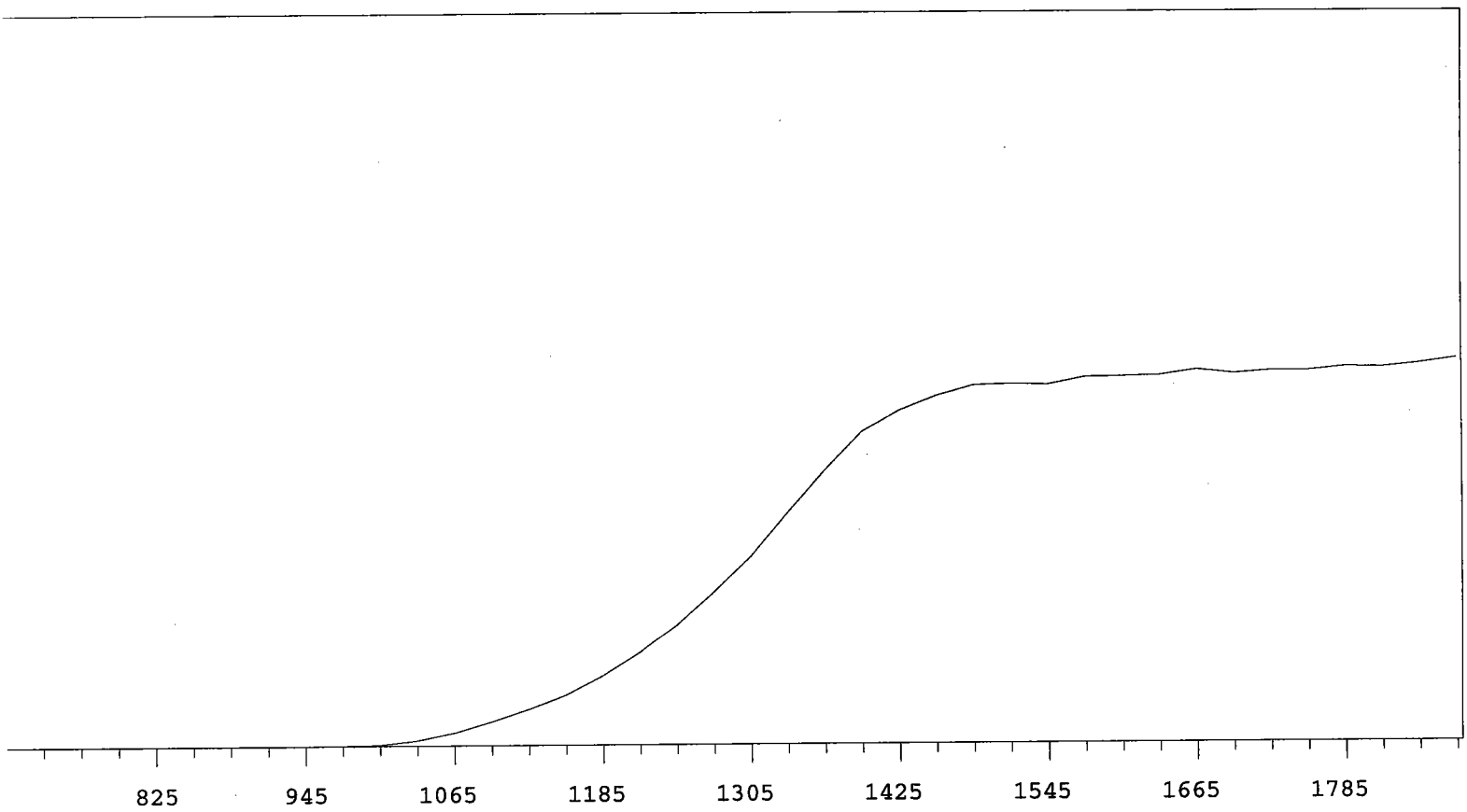


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	+0.00
795	1	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	2	>100
975	31	>100
1005	176	>100
1035	550	>100
1065	1218	>100
1095	2114	>100
1125	3212	>100
1155	4416	>100
1185	6066	+92.28
1215	7936	+85.60
1245	10288	+76.79
1275	13020	+70.59

VOLTS	COUNTS	%/100 Volts
1305	15747	+62.38
1335	19230	+54.19
1365	22255	+44.46
1395	25299	+32.45
1425	27370	+22.24
1455	28625	+14.10
1485	29467	+8.56
1515	30213	+5.29
1545	30326	+2.77
1575	30564	+1.57
1605	30548	+1.52
1635	30820	+0.85
1665	30898	+0.79
1695	30779	+0.44
1725	30934	+0.45
1755	31008	+0.96
1785	30991	+2.01
1815	31196	+3.80
1845	31781	
1875	32406	

MPC 9600 Plateau Instrument 4 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

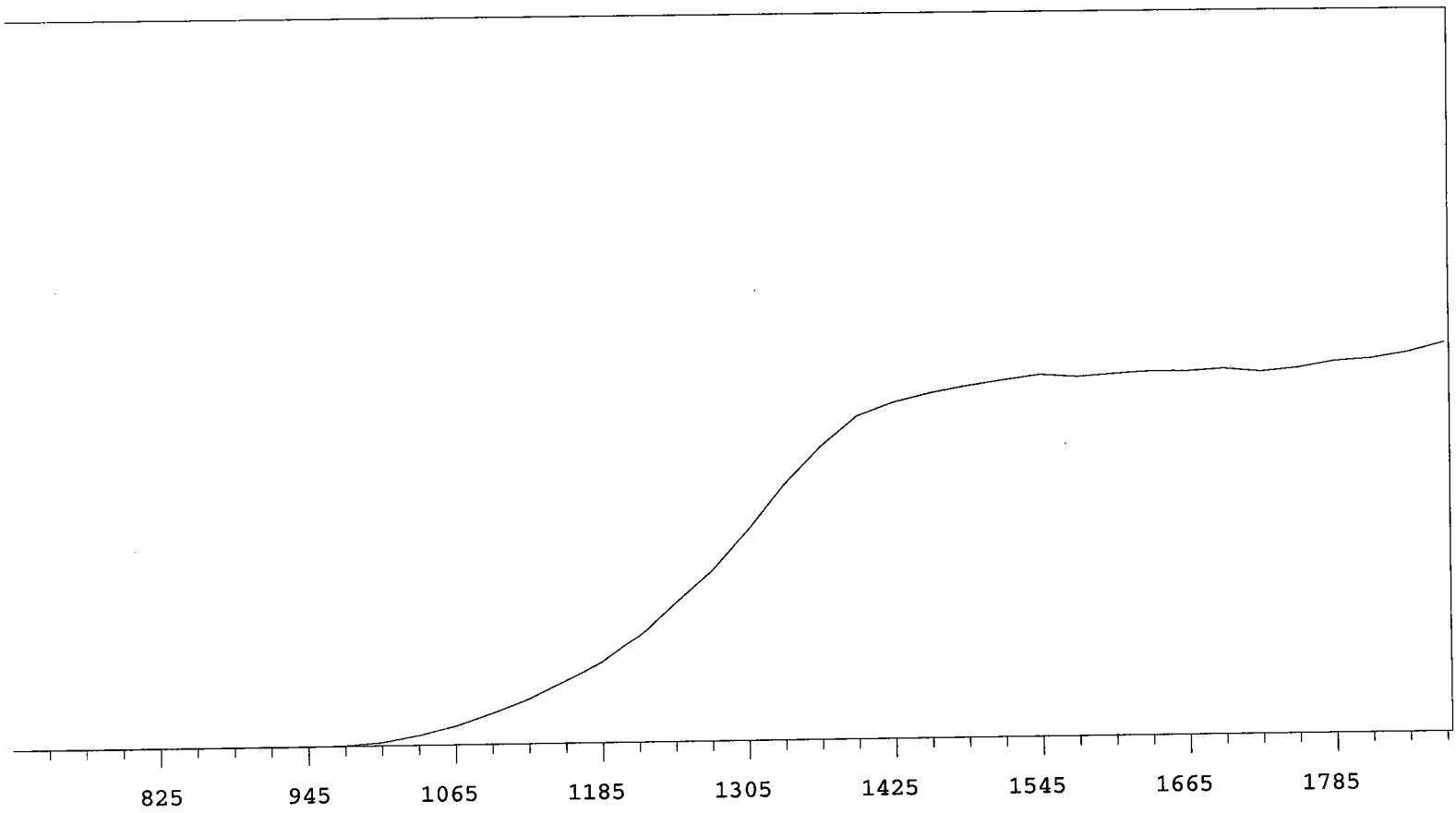


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	+55.56
795	2	+0.00
825	0	-55.56
855	1	>100
885	0	>100
915	0	>100
945	2	>100
975	24	>100
1005	134	>100
1035	558	>100
1065	1361	>100
1095	2511	>100
1125	3762	>100
1155	5246	>100
1185	7268	+96.29
1215	9733	+88.98
1245	12701	+79.94
1275	16176	+73.13

VOLTS	COUNTS	%/100 Volts
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 Instrument 4 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

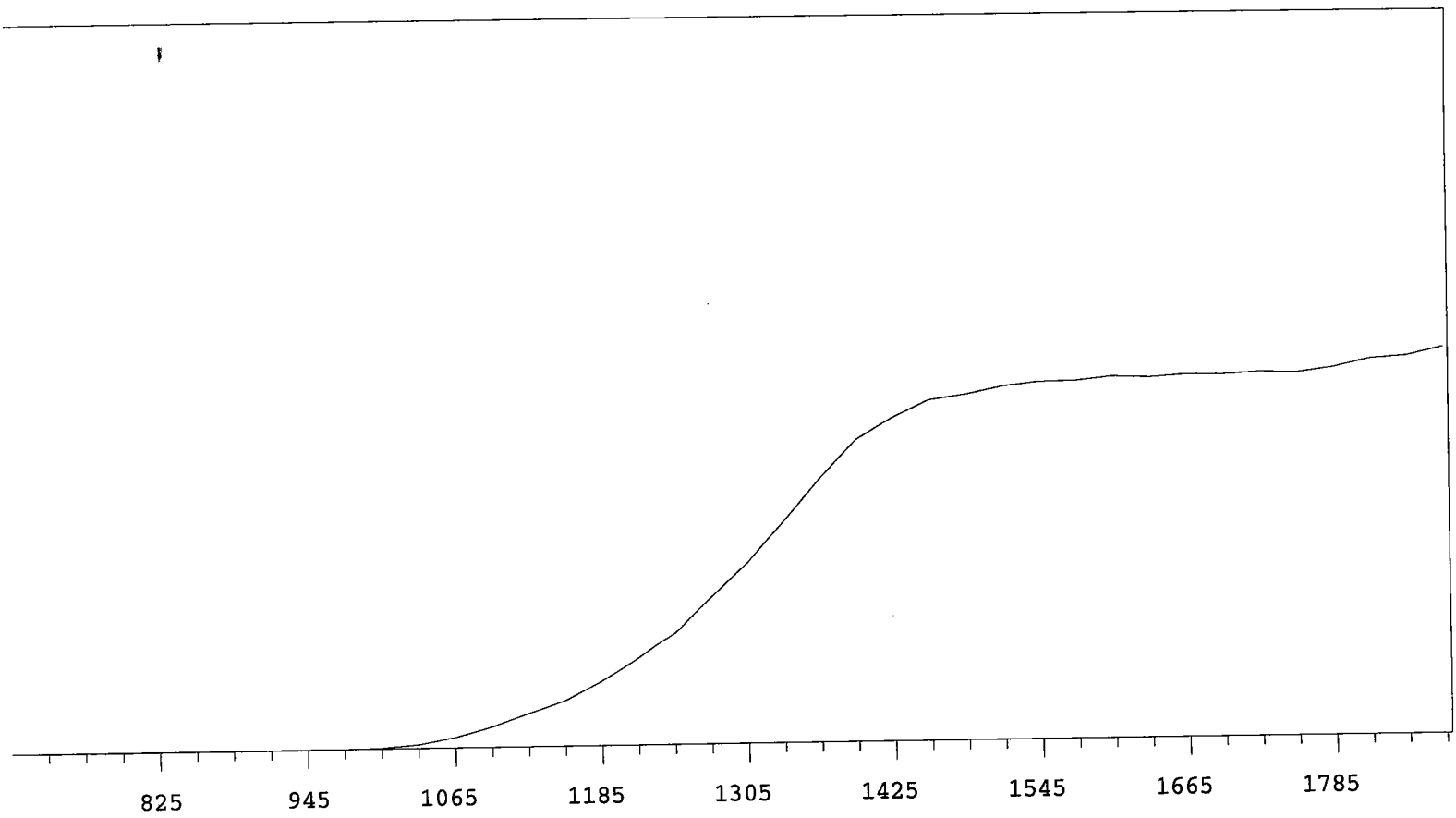


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	+0.00
795	0	>100
825	1	+83.33
855	1	+55.56
885	0	+0.00
915	1	>100
945	1	>100
975	60	>100
1005	297	>100
1035	855	>100
1065	1647	>100
1095	2700	>100
1125	3921	>100
1155	5471	+96.54
1185	7042	+90.21
1215	9405	+82.23
1245	12266	+76.33
1275	14989	+69.38

VOLTS	COUNTS	%/100 Volts
1305	18491	+61.09
1335	22444	+51.56
1365	25756	+37.44
1395	28379	+23.82
1425	29517	+14.00
1455	30309	+8.08
1485	30874	+6.03
1515	31345	+3.66
1545	31782	+2.17
1575	31567	+1.31
1605	31789	+0.78
1635	31963	+1.34
1665	31956	+0.29
1695	32123	+0.20
1725	31850	+1.46
1755	32114	+2.39
1785	32665	+3.95
1815	32876	+4.96
1845	33399	
1875	34206	

MPC 9600 Plateau Instrument 5 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

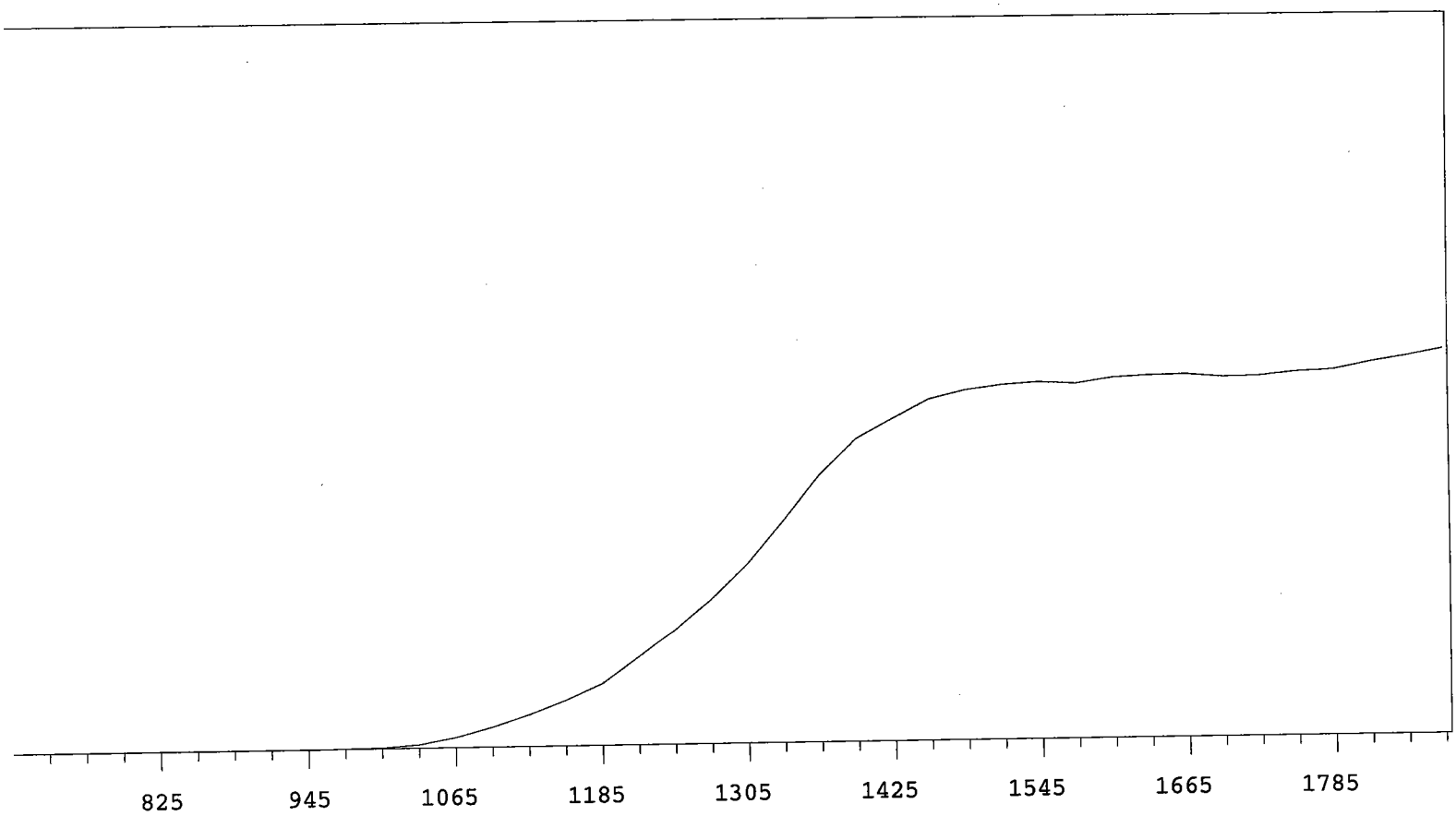


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	1	
795	1	+83.33
825	1	-83.33
855	1	>100
885	0	-55.56
915	0	>100
945	1	>100
975	9	>100
1005	76	>100
1035	308	>100
1065	814	>100
1095	1600	>100
1125	2598	>100
1155	3596	>100
1185	5065	+96.05
1215	6773	+90.23
1245	8717	+81.43
1275	11391	+74.83

VOLTS	COUNTS	%/100 Volts
1305	13974	+68.00
1335	17170	+58.62
1365	20456	+47.04
1395	23332	+33.83
1425	24996	+21.10
1455	26290	+12.40
1485	26683	+7.74
1515	27270	+4.43
1545	27590	+3.48
1575	27635	+1.71
1605	27932	+1.20
1635	27807	+0.88
1665	28006	+0.62
1695	27964	+0.63
1725	28112	+0.98
1755	28020	+2.84
1785	28392	+3.76
1815	29028	+5.17
1845	29220	
1875	29849	

MPC 9600 Plateau Instrument 5 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

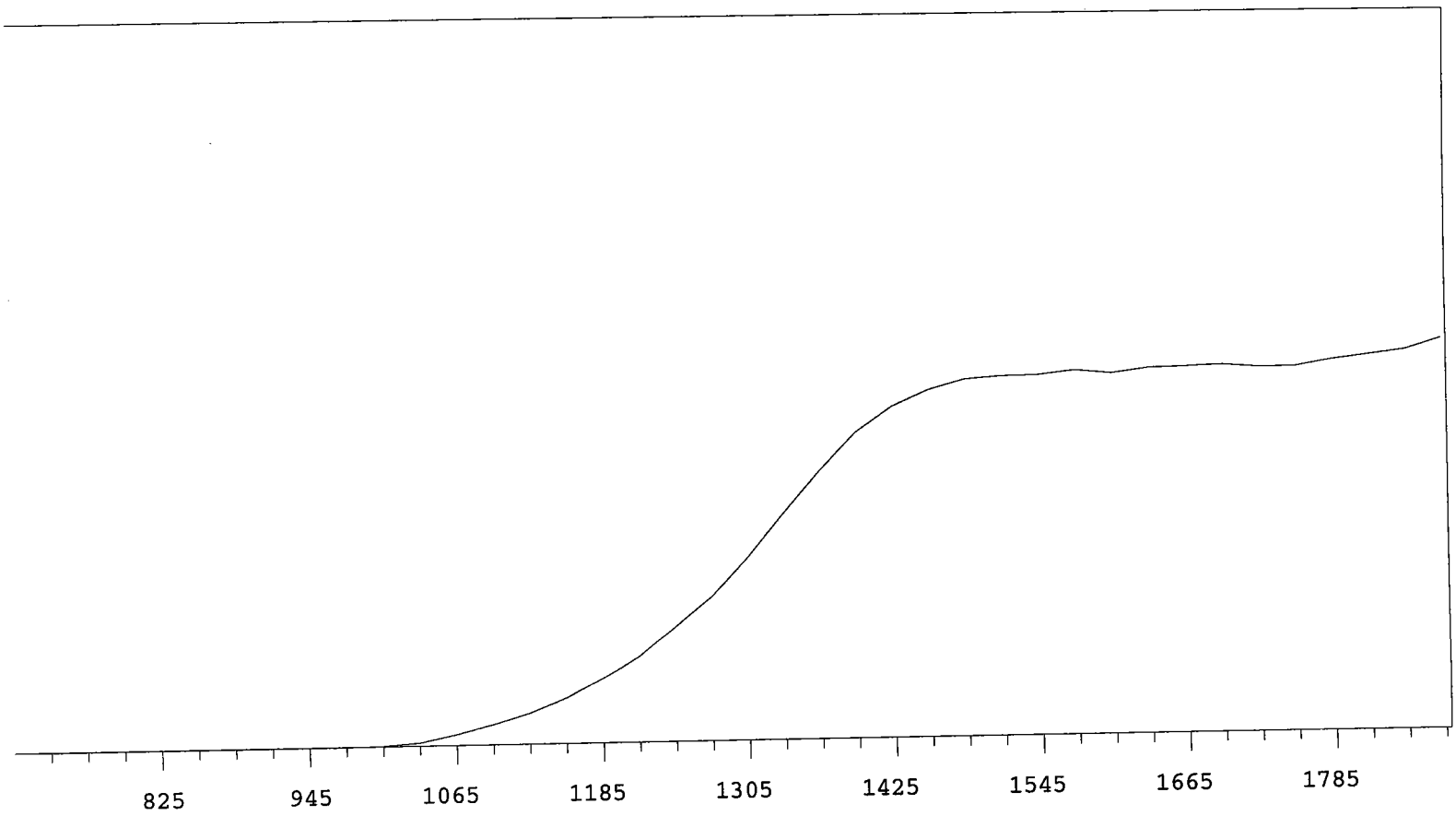


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	1	>100
855	1	+41.67
885	2	-33.33
915	0	>100
945	1	>100
975	17	>100
1005	87	>100
1035	336	>100
1065	1010	>100
1095	1955	>100
1125	3124	>100
1155	4486	>100
1185	6017	>100
1215	8507	+91.20
1245	11148	+82.59
1275	14003	+74.21

VOLTS	COUNTS	%/100 Volts
1305	17414	+68.46
1335	21540	+59.98
1365	25854	+46.75
1395	29222	+33.38
1425	31128	+21.52
1455	32995	+13.26
1485	33846	+8.09
1515	34289	+3.25
1545	34528	+2.00
1575	34311	+1.78
1605	34866	+1.78
1635	35046	+1.14
1665	35087	-0.26
1695	34795	+0.11
1725	34857	+0.93
1755	35220	+2.81
1785	35363	+3.98
1815	36028	+4.79
1845	36577	
1875	37207	

MPC 9600 Plateau Instrument 5 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

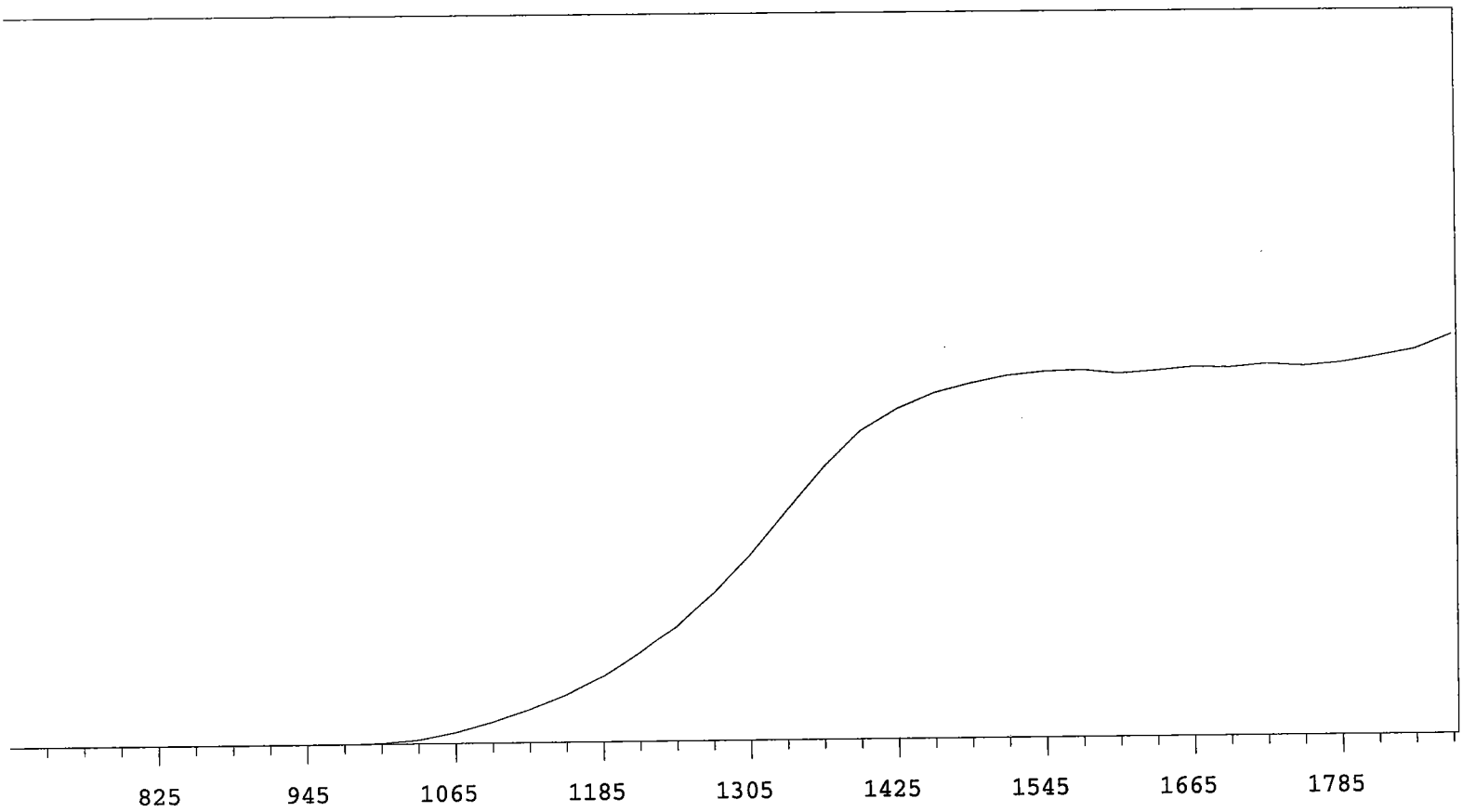


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	1	>100
885	0	>100
915	1	>100
945	2	>100
975	7	>100
1005	56	>100
1035	305	>100
1065	982	>100
1095	1874	>100
1125	2890	>100
1155	4260	>100
1185	6001	>100
1215	8050	+91.54
1245	10895	+82.98
1275	13556	+76.26

VOLTS	COUNTS	%/100 Volts
1305	17085	+68.24
1335	21135	+59.99
1365	25066	+47.39
1395	28530	+33.93
1425	30823	+22.30
1455	32287	+12.93
1485	33217	+6.71
1515	33474	+3.57
1545	33517	+1.17
1575	33921	+1.13
1605	33584	+1.27
1635	34014	+1.12
1665	34116	+0.98
1695	34225	-0.22
1725	33980	+0.58
1755	33971	+1.96
1785	34541	+3.64
1815	34954	+5.38
1845	35375	
1875	36384	

MPC 9600 Plateau Instrument 5 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

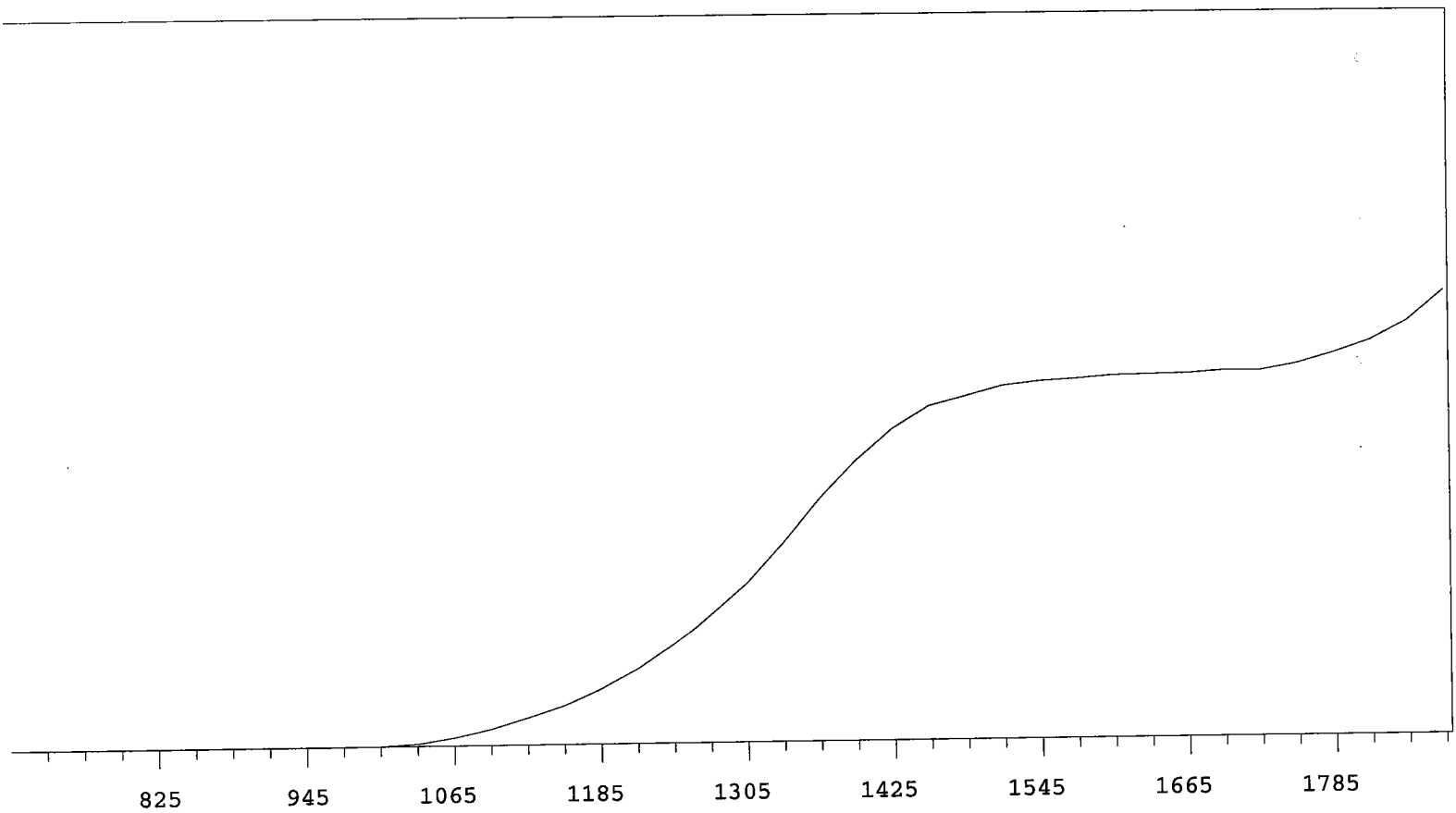


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	6	>100
1005	81	>100
1035	318	>100
1065	897	>100
1095	1710	>100
1125	2714	>100
1155	3925	>100
1185	5395	+97.31
1215	7282	+88.49
1245	9426	+81.36
1275	12007	+75.65

VOLTS	COUNTS	%/100 Volts
1305	15025	+68.87
1335	18640	+58.97
1365	22048	+45.84
1395	24877	+32.08
1425	26653	+20.83
1455	27899	+13.08
1485	28670	+8.43
1515	29257	+5.13
1545	29568	+2.06
1575	29683	+0.52
1605	29362	+0.57
1635	29589	+0.80
1665	29870	+1.82
1695	29783	+0.90
1725	30077	+0.75
1755	29889	+2.02
1785	30152	+3.33
1815	30656	+6.54
1845	31211	
1875	32389	

MPC 9600 Plateau Instrument 6 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

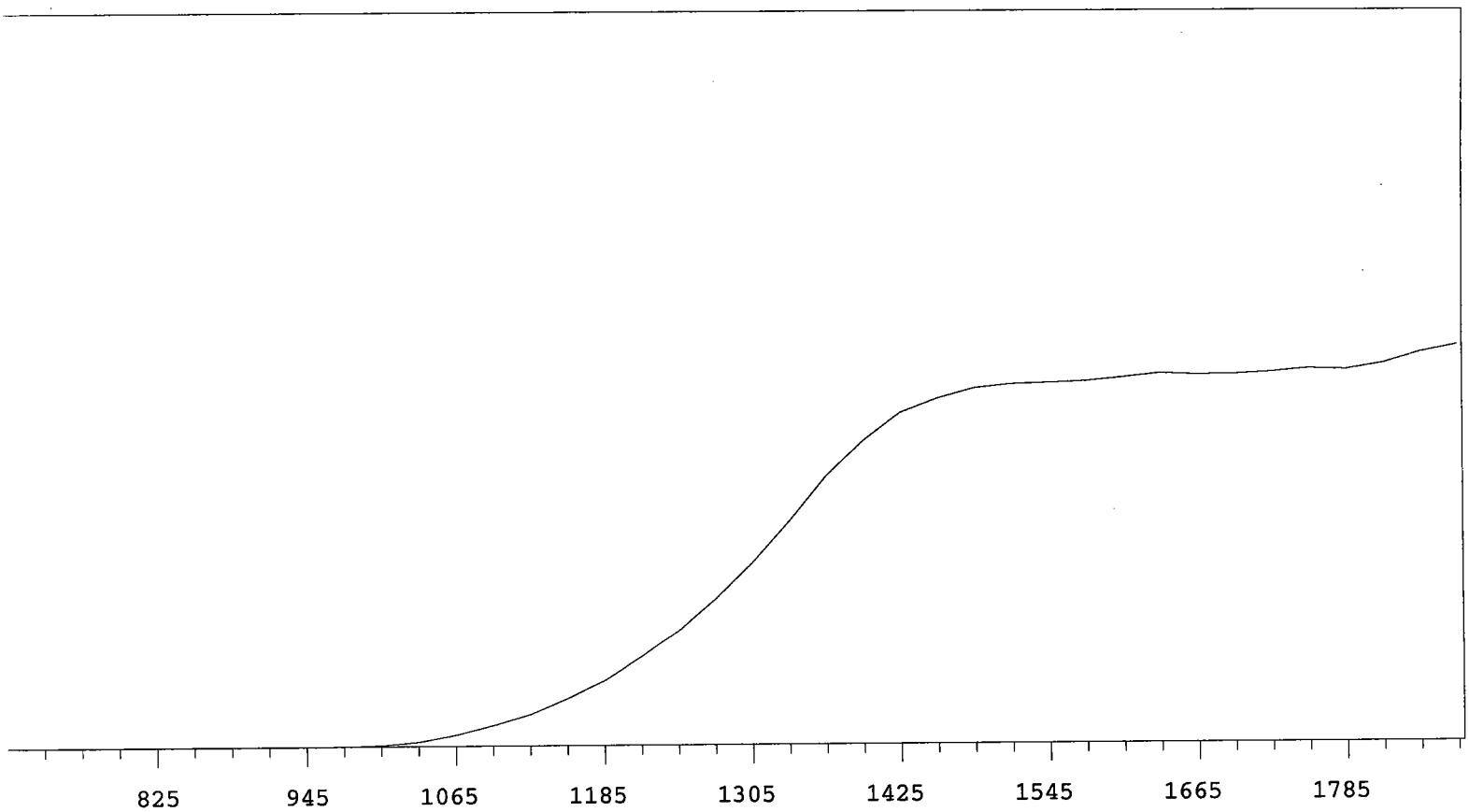


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	7	>100
1005	31	>100
1035	238	>100
1065	810	>100
1095	1637	>100
1125	2743	>100
1155	3932	>100
1185	5579	>100
1215	7602	+94.41
1245	10078	+84.86
1275	13091	+77.67

VOLTS	COUNTS	%/100 Volts
1305	16217	+71.57
1335	20184	+63.76
1365	24605	+53.98
1395	28528	+41.40
1425	31675	+28.02
1455	33899	+17.93
1485	34826	+10.65
1515	35815	+6.13
1545	36225	+4.15
1575	36456	+2.28
1605	36747	+1.47
1635	36801	+1.26
1665	36859	+0.85
1695	37095	+1.85
1725	37072	+4.01
1755	37724	+6.65
1785	38802	+10.33
1815	40036	+14.71
1845	41975	
1875	45123	

MPC 9600 Plateau Instrument 6 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

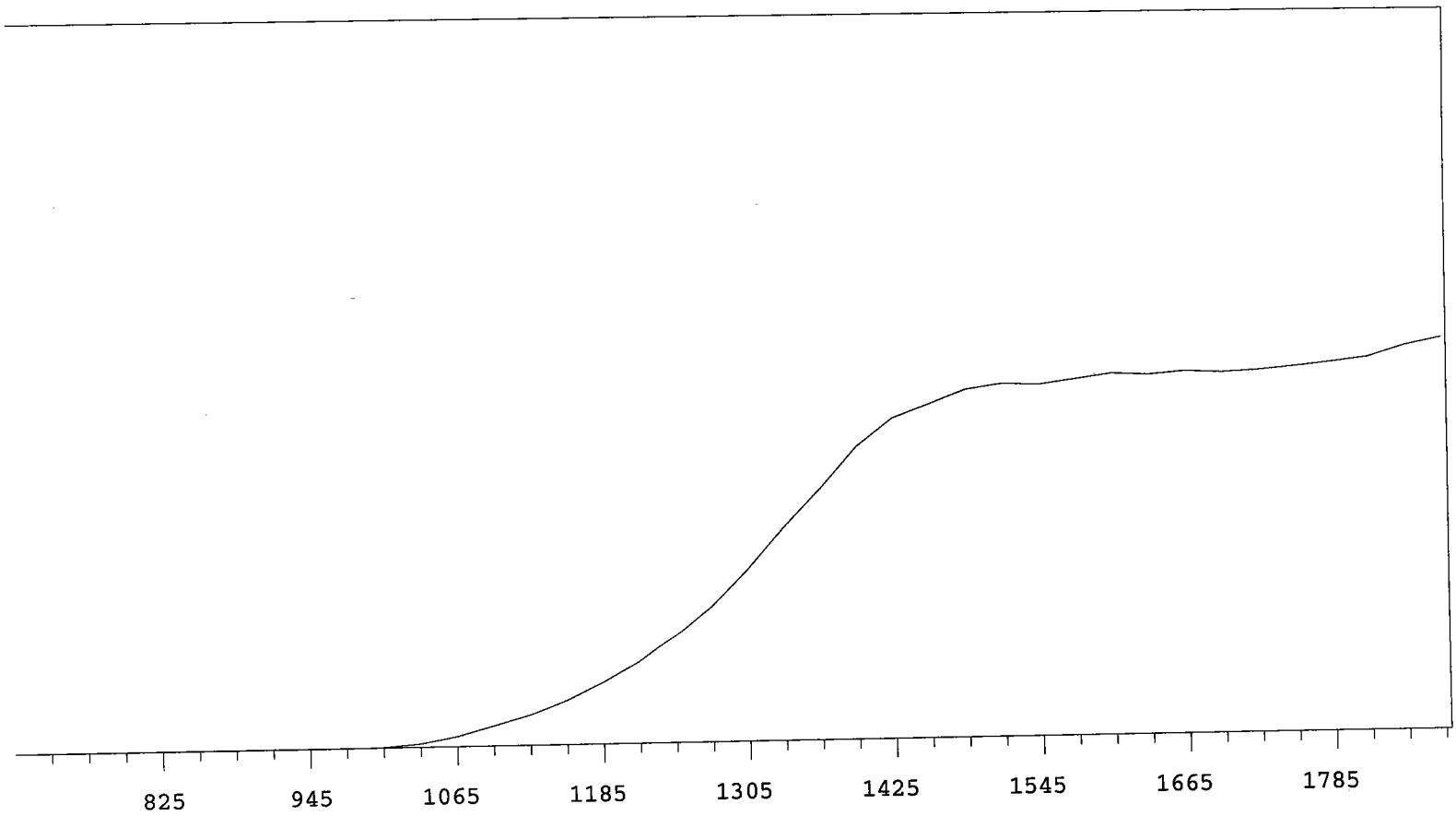


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	1	+83.33
855	1	-83.33
885	0	>100
915	0	>100
945	5	>100
975	18	>100
1005	125	>100
1035	482	>100
1065	1255	>100
1095	2318	>100
1125	3540	>100
1155	5288	>100
1185	7168	+98.51
1215	9760	+88.48
1245	12656	+81.52
1275	16065	+74.58

VOLTS	COUNTS	%/100 Volts
1305	20094	+68.67
1335	24665	+59.40
1365	29591	+47.86
1395	33376	+34.51
1425	36440	+22.50
1455	38024	+13.58
1485	39187	+7.04
1515	39608	+3.63
1545	39722	+2.10
1575	39894	+2.32
1605	40298	+2.09
1635	40711	+1.41
1665	40574	+0.80
1695	40608	+1.02
1725	40839	+1.28
1755	41201	+1.97
1785	41065	+3.74
1815	41711	+5.42
1845	42917	
1875	43699	

MPC 9600 Plateau Instrument 6 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

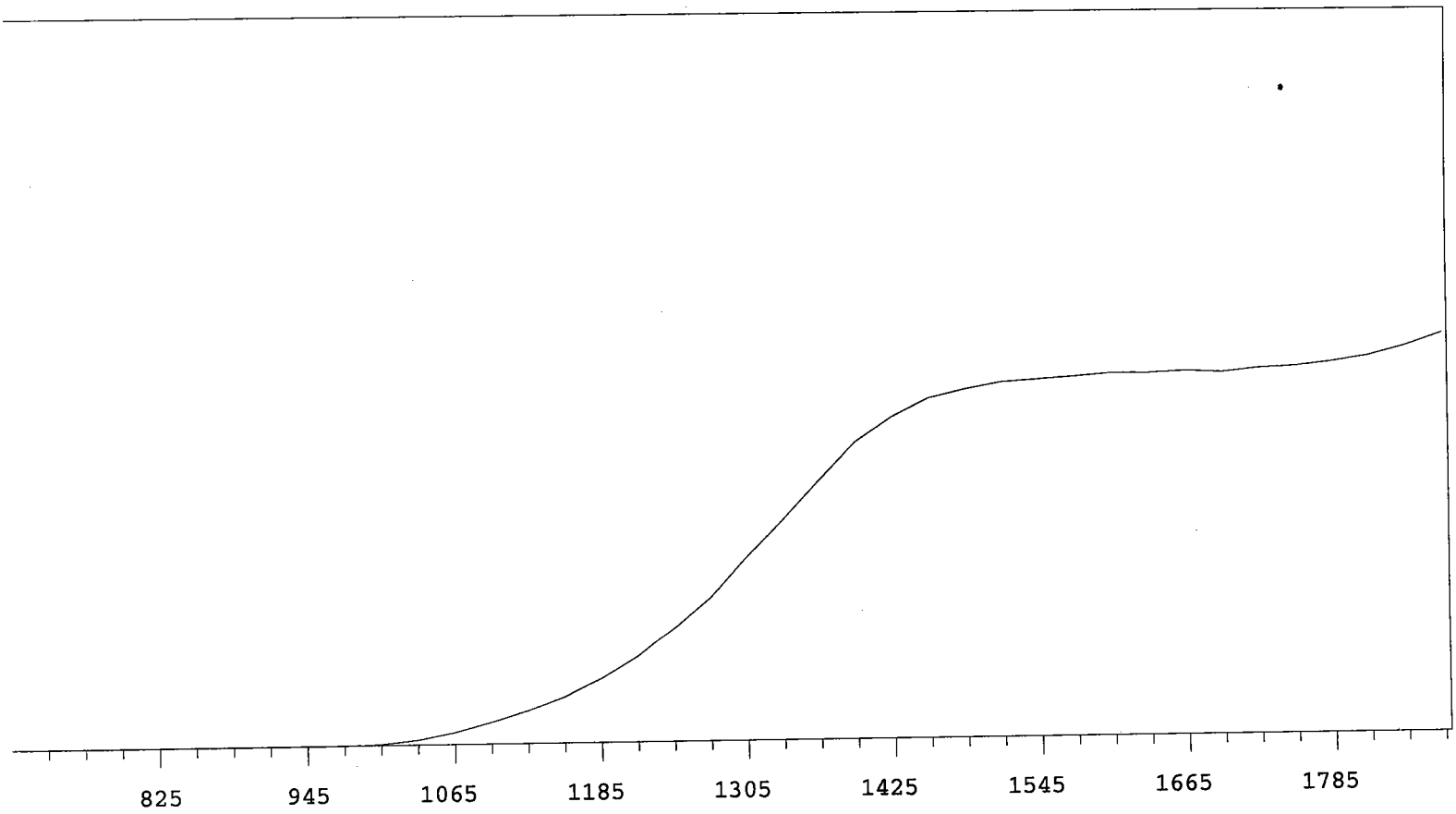


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	1	+0.00
795	0	>100
825	0	+0.00
855	0	>100
885	1	>100
915	1	>100
945	2	>100
975	8	>100
1005	70	>100
1035	353	>100
1065	990	>100
1095	1956	>100
1125	3024	>100
1155	4400	>100
1185	6173	+99.75
1215	8230	+89.85
1245	10904	+82.36
1275	13747	+76.18

VOLTS	COUNTS	%/100 Volts
1305	17350	+67.80
1335	21371	+60.27
1365	25084	+49.32
1395	29177	+36.15
1425	31927	+24.86
1455	33217	+14.70
1485	34545	+7.74
1515	35097	+4.64
1545	34927	+2.96
1575	35439	+2.21
1605	35939	+2.41
1635	35763	+0.94
1665	36053	+0.35
1695	35886	+1.15
1725	36066	+1.77
1755	36379	+3.03
1785	36768	+4.80
1815	37193	+6.14
1845	38320	
1875	39061	

MPC 9600 Plateau Instrument 6 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

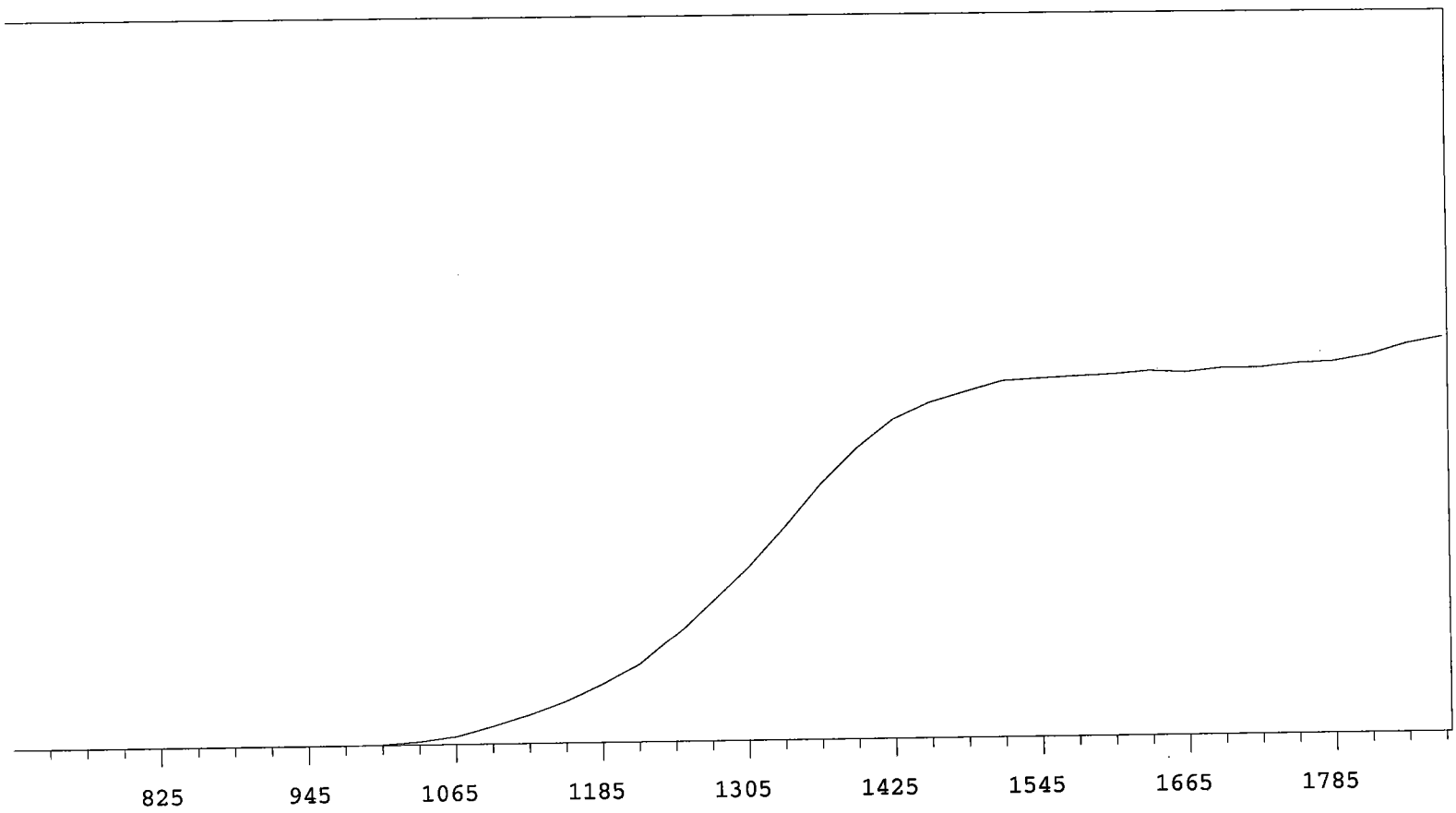


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	1	+0.00
825	0	>100
855	0	+0.00
885	0	>100
915	1	>100
945	0	>100
975	14	>100
1005	109	>100
1035	481	>100
1065	1177	>100
1095	2133	>100
1125	3243	>100
1155	4554	>100
1185	6285	+98.38
1215	8468	+89.75
1245	11266	+83.13
1275	14088	+74.43

VOLTS	COUNTS	%/100 Volts
1305	17954	+65.82
1335	21482	+57.64
1365	25373	+45.78
1395	29042	+34.80
1425	31373	+23.29
1455	33143	+14.25
1485	34006	+8.49
1515	34662	+4.71
1545	34892	+3.14
1575	35129	+1.86
1605	35411	+1.49
1635	35380	+0.62
1665	35554	+0.65
1695	35385	+1.18
1725	35755	+1.89
1755	35907	+3.26
1785	36305	+4.62
1815	36870	+6.98
1845	37807	
1875	39047	

MPC 9600 Plateau Instrument 7 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

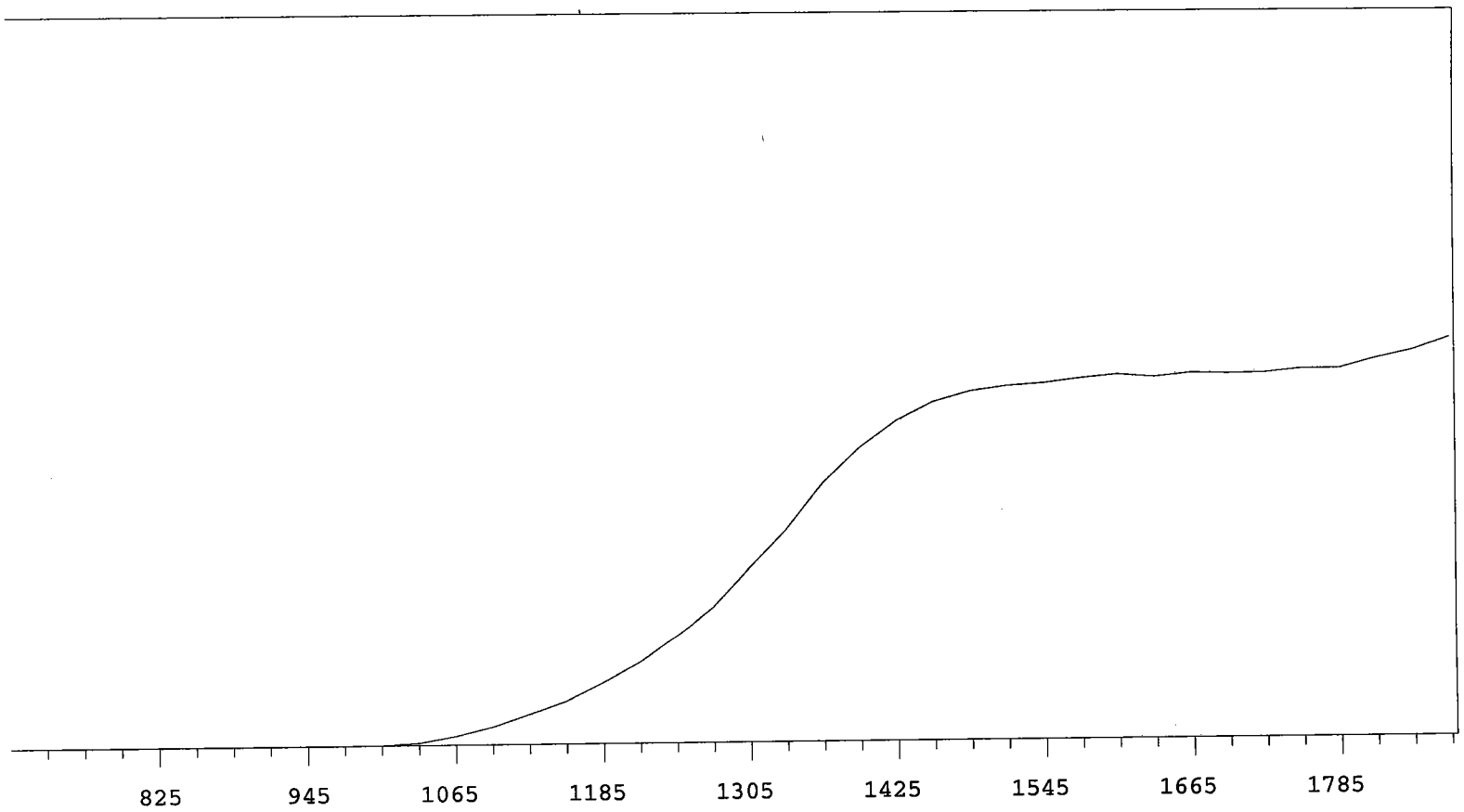


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	1	+83.33
855	1	-83.33
885	0	-55.56
915	0	>100
945	1	>100
975	3	>100
1005	42	>100
1035	242	>100
1065	613	>100
1095	1353	>100
1125	2213	>100
1155	3256	>100
1185	4474	>100
1215	5932	+94.10
1245	8072	+87.32
1275	10579	+79.61

VOLTS	COUNTS	%/100 Volts
1305	13228	+70.36
1335	16271	+60.12
1365	19506	+49.19
1395	22188	+36.46
1425	24373	+24.43
1455	25649	+15.99
1485	26433	+9.58
1515	27195	+5.74
1545	27367	+3.24
1575	27490	+1.86
1605	27608	+1.22
1635	27841	+1.33
1665	27695	+1.11
1695	27999	+1.42
1725	27992	+2.04
1755	28289	+2.52
1785	28408	+4.56
1815	28863	+5.70
1845	29664	
1875	30148	

MPC 9600 Plateau Instrument 7 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

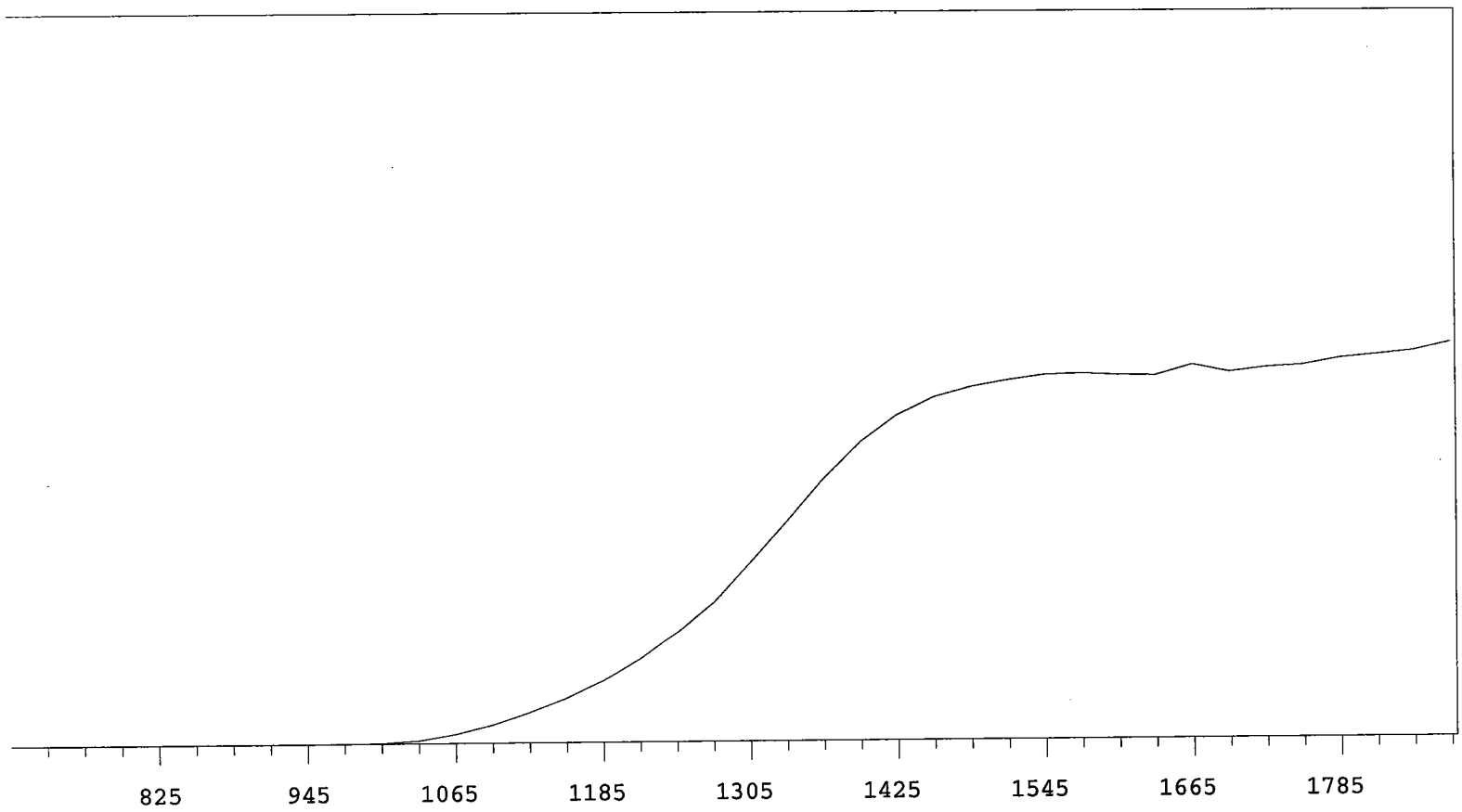


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	1	>100
945	1	>100
975	3	>100
1005	34	>100
1035	221	>100
1065	825	>100
1095	1709	>100
1125	2873	>100
1155	4078	>100
1185	5858	>100
1215	7809	+91.82
1245	10336	+85.02
1275	13215	+77.79

VOLTS	COUNTS	%/100 Volts
1305	16978	+70.97
1335	20569	+61.39
1365	24989	+48.97
1395	28389	+36.69
1425	30977	+24.05
1455	32727	+14.93
1485	33697	+8.42
1515	34195	+4.89
1545	34437	+3.49
1575	34850	+2.11
1605	35174	+1.62
1635	34923	+0.68
1665	35250	+0.35
1695	35171	+1.24
1725	35237	+1.02
1755	35584	+2.79
1785	35587	+4.59
1815	36485	+6.74
1845	37270	
1875	38453	

MPC 9600 Plateau Instrument 7 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

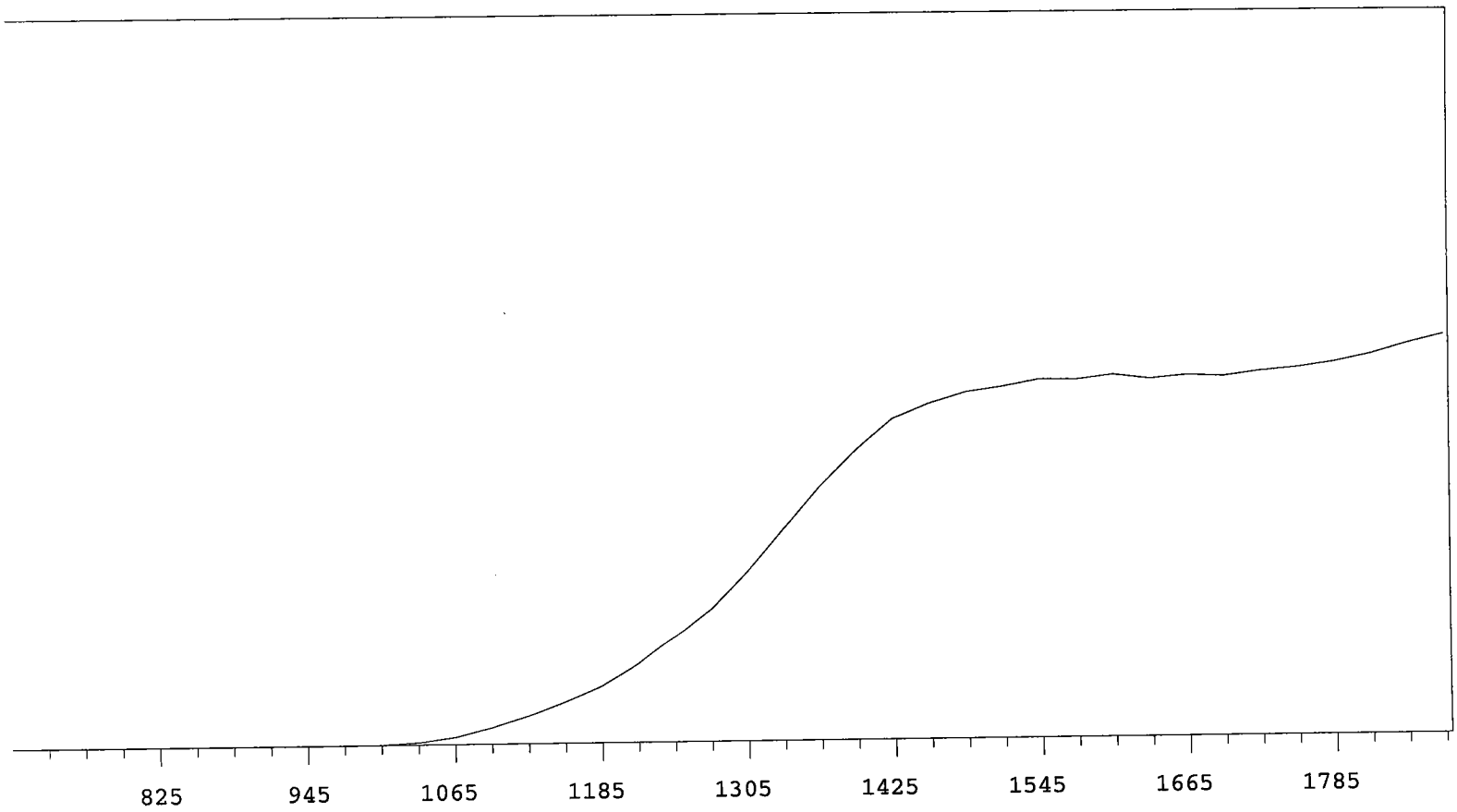


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	4	>100
1005	57	>100
1035	277	>100
1065	817	>100
1095	1666	>100
1125	2766	>100
1155	4077	>100
1185	5667	>100
1215	7694	+91.50
1245	10209	+84.83
1275	12950	+77.50

VOLTS	COUNTS	%/100 Volts
1305	16543	+70.03
1335	20257	+60.71
1365	24245	+48.17
1395	27602	+35.50
1425	30019	+23.48
1455	31614	+14.53
1485	32522	+8.91
1515	33103	+5.28
1545	33572	+2.60
1575	33695	+0.70
1605	33525	+1.48
1635	33477	+0.99
1665	34432	+1.49
1695	33745	+1.43
1725	34149	+1.60
1755	34350	+3.69
1785	34955	+3.62
1815	35251	+4.44
1845	35592	
1875	36382	

MPC 9600 Plateau Instrument 7 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

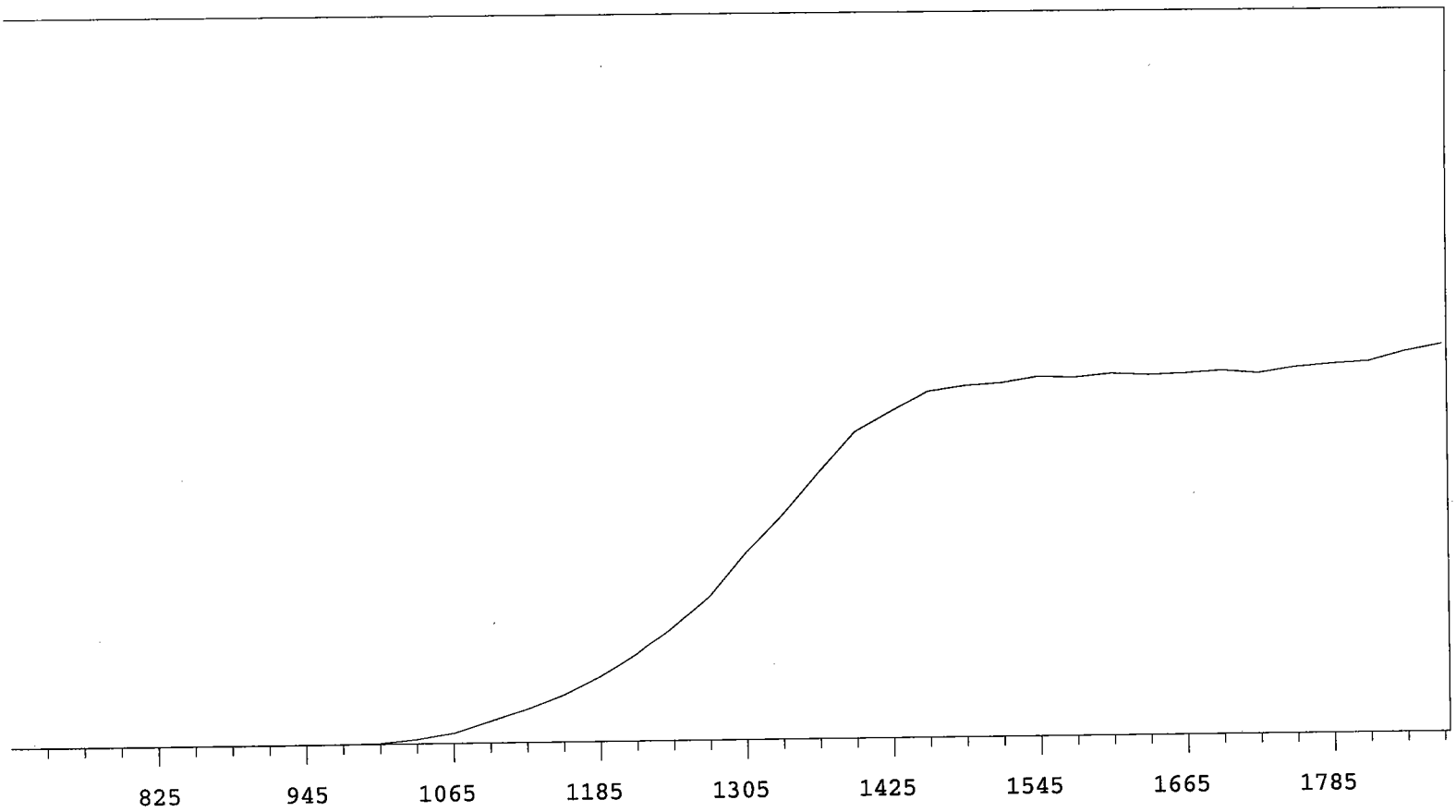


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	5	>100
1005	29	>100
1035	204	>100
1065	609	>100
1095	1354	>100
1125	2316	>100
1155	3418	>100
1185	4654	>100
1215	6455	+92.99
1245	8669	+86.45
1275	10931	+79.15

VOLTS	COUNTS	%/100 Volts
1305	14016	+71.42
1335	17436	+62.21
1365	20814	+50.32
1395	23760	+36.91
1425	26302	+24.91
1455	27519	+15.17
1485	28410	+8.91
1515	28843	+5.41
1545	29396	+3.58
1575	29357	+1.54
1605	29719	+0.51
1635	29358	+0.23
1665	29623	+0.57
1695	29509	+2.12
1725	29896	+2.84
1755	30165	+4.42
1785	30570	+5.65
1815	31180	+6.95
1845	31995	
1875	32717	

MPC 9600 Plateau Instrument 8 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

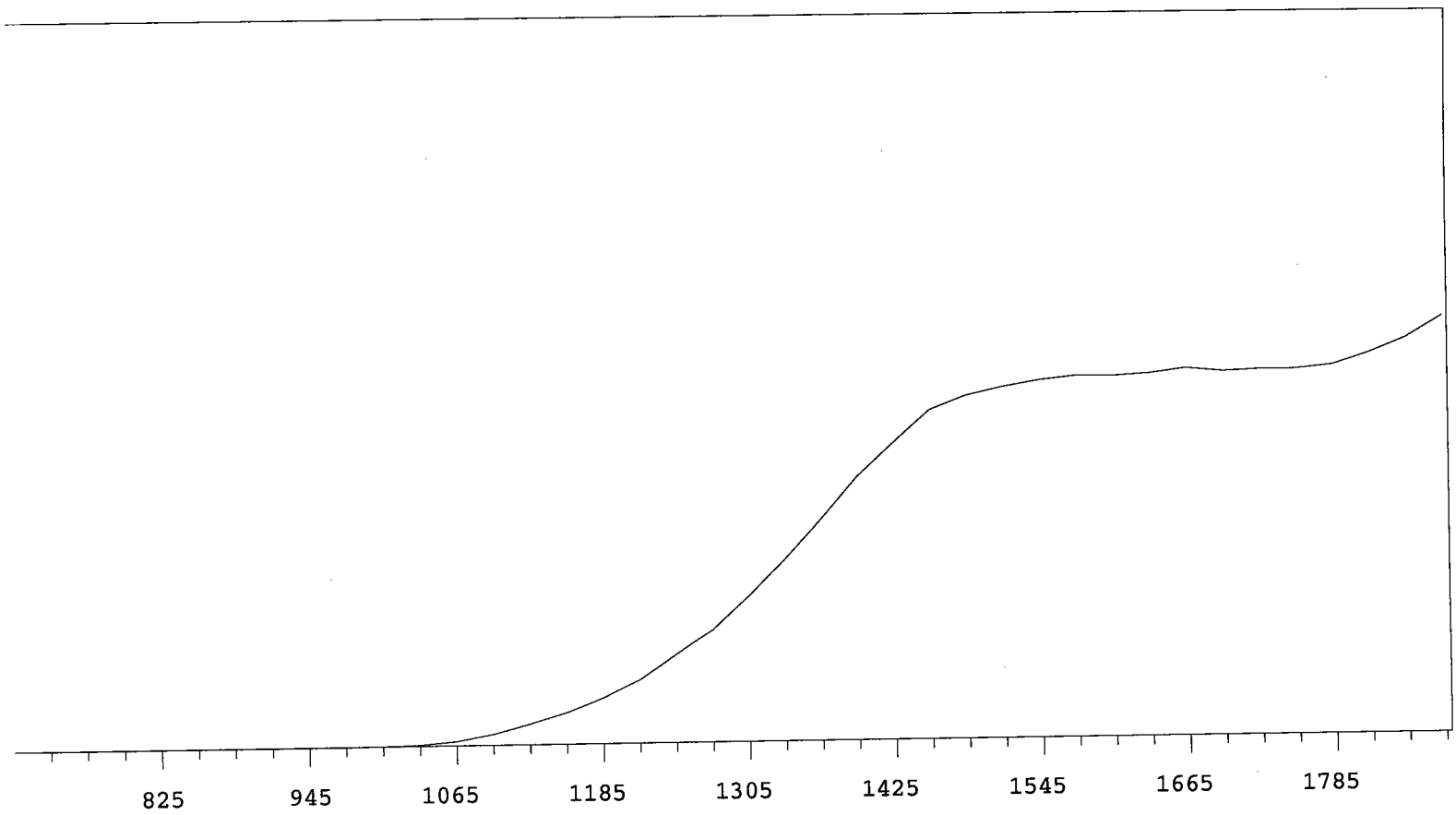


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	1	>100
975	9	>100
1005	96	>100
1035	468	>100
1065	1084	>100
1095	2286	>100
1125	3479	>100
1155	4912	>100
1185	6819	+98.23
1215	9153	+89.05
1245	12105	+83.21
1275	15122	+75.24

VOLTS	COUNTS	%/100 Volts
1305	19482	+67.45
1335	23344	+59.35
1365	27793	+45.86
1395	31916	+34.29
1425	33979	+21.61
1455	35993	+11.71
1485	36530	+7.04
1515	36796	+3.11
1545	37393	+2.44
1575	37279	+1.41
1605	37650	+0.49
1635	37458	+0.91
1665	37579	+0.12
1695	37828	+1.10
1725	37535	+1.72
1755	38104	+2.18
1785	38416	+4.12
1815	38633	+4.92
1845	39649	
1875	40366	

MPC 9600 Plateau Instrument 8 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

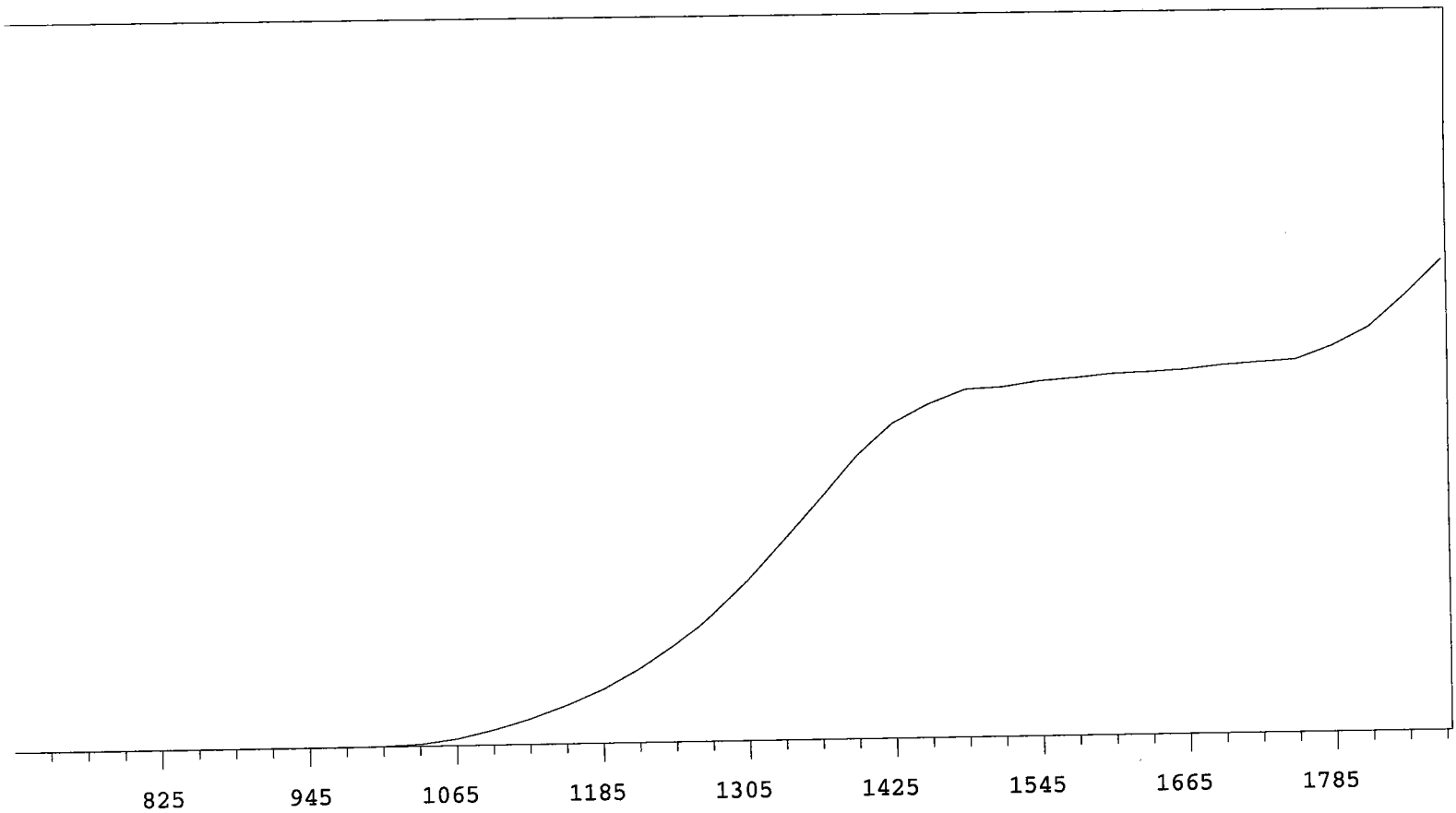


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	0	>100
1005	20	>100
1035	122	>100
1065	511	>100
1095	1263	>100
1125	2390	>100
1155	3641	>100
1185	5246	>100
1215	7212	+98.32
1245	9897	+89.80
1275	12742	+82.40

VOLTS	COUNTS	%/100 Volts
1305	16337	+74.91
1335	20471	+68.07
1365	25012	+57.86
1395	29694	+47.48
1425	33409	+35.17
1455	37013	+23.27
1485	38629	+14.35
1515	39529	+7.69
1545	40284	+4.34
1575	40711	+2.52
1605	40642	+1.97
1635	40879	+1.11
1665	41405	+0.98
1695	41011	+0.30
1725	41182	+0.41
1755	41178	+3.28
1785	41573	+6.47
1815	42858	+10.82
1845	44440	
1875	46780	

MPC 9600 Plateau Instrument 8 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

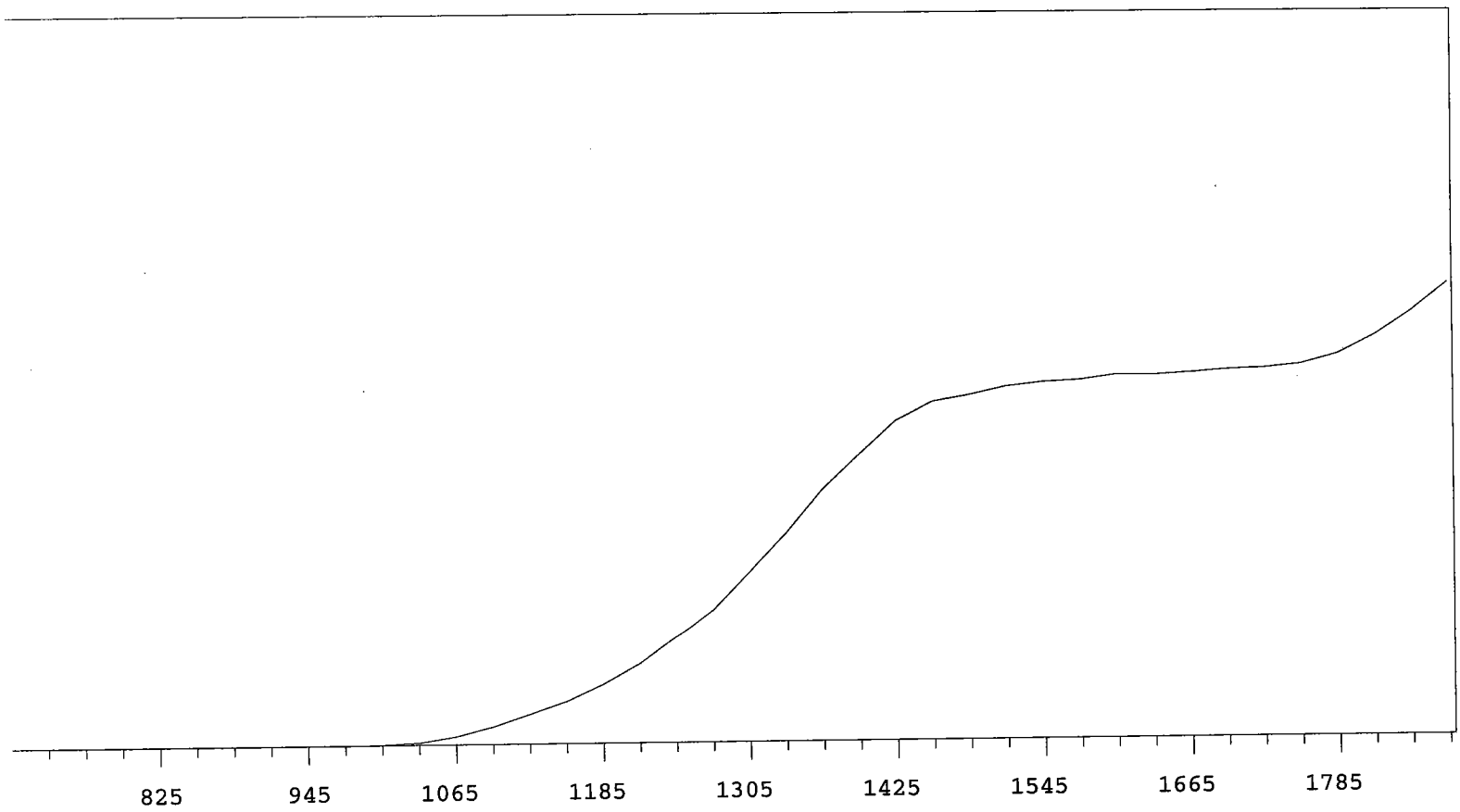


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	4	>100
1005	46	>100
1035	202	>100
1065	697	>100
1095	1532	>100
1125	2614	>100
1155	3953	>100
1185	5474	>100
1215	7466	+93.09
1245	9842	+86.73
1275	12814	+80.29

VOLTS	COUNTS	%/100 Volts
1305	16303	+72.82
1335	20309	+64.32
1365	24364	+53.82
1395	28527	+40.95
1425	31774	+28.74
1455	33631	+16.87
1485	35030	+9.25
1515	35208	+5.21
1545	35741	+3.27
1575	36019	+2.95
1605	36373	+2.21
1635	36484	+2.27
1665	36713	+2.28
1695	37093	+2.46
1725	37325	+4.17
1755	37543	+7.52
1785	38833	+13.43
1815	40656	+19.49
1845	43753	
1875	47246	

MPC 9600 Plateau Instrument 8 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1575

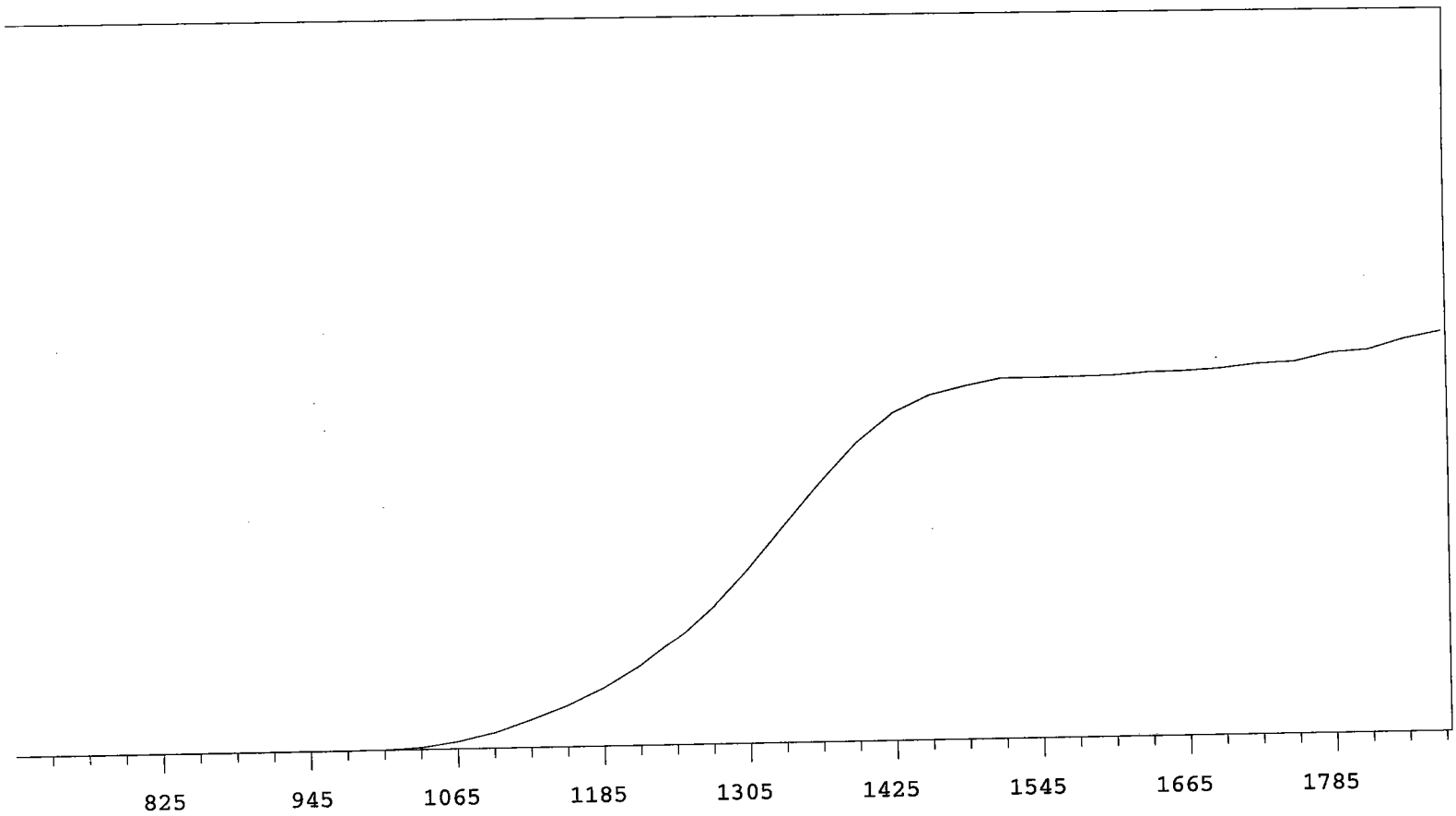


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	1	+0.00
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	5	>100
1005	47	>100
1035	243	>100
1065	792	>100
1095	1744	>100
1125	2933	>100
1155	4123	>100
1185	5780	>100
1215	7791	+91.58
1245	10478	+84.93
1275	13118	+77.50

VOLTS	COUNTS	%/100 Volts
1305	16889	+70.18
1335	20600	+61.29
1365	24824	+50.40
1395	28208	+38.85
1425	31539	+25.79
1455	33391	+16.06
1485	33991	+8.60
1515	34782	+5.01
1545	35201	+4.10
1575	35380	+2.50
1605	35849	+1.87
1635	35784	+1.79
1665	36000	+1.43
1695	36269	+2.10
1725	36381	+3.46
1755	36733	+6.86
1785	37669	+11.78
1815	39465	+16.64
1845	41803	
1875	44665	

MPC 9600 Plateau Instrument 9 MPC 9604 Detector A 7/1/2009

Alpha Volts: 870 Beta Volts: 1530

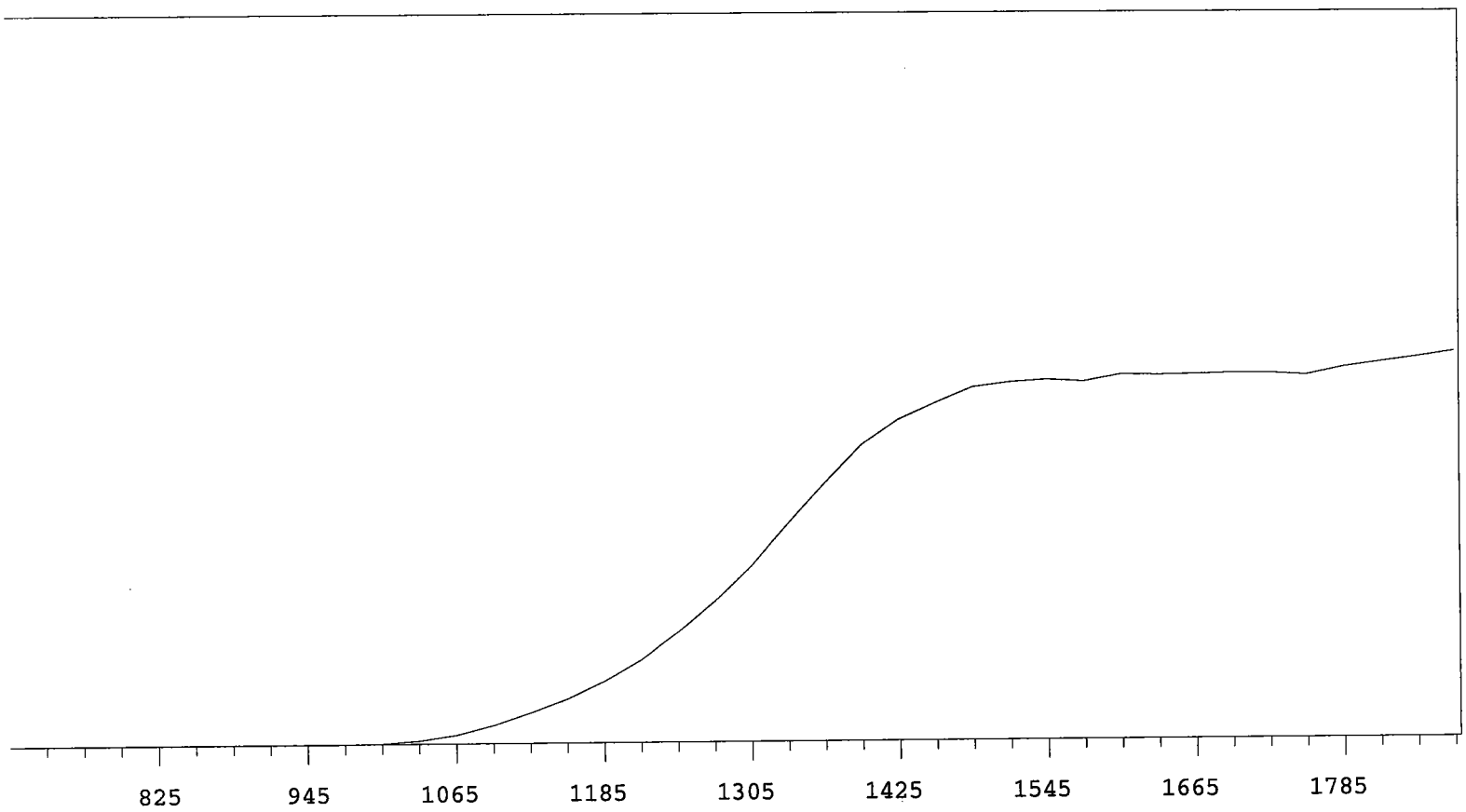


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	1	+0.00
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	2	>100
1005	33	>100
1035	203	>100
1065	668	>100
1095	1403	>100
1125	2545	>100
1155	3800	>100
1185	5363	>100
1215	7355	+95.00
1245	9807	+87.69
1275	12700	+80.28

VOLTS	COUNTS	%/100 Volts
1305	16226	+71.71
1335	20083	+61.95
1365	23913	+49.99
1395	27526	+36.97
1425	30193	+24.54
1455	31747	+14.71
1485	32544	+7.71
1515	33198	+3.66
1545	33188	+1.51
1575	33227	+0.73
1605	33278	+1.04
1635	33518	+1.38
1665	33565	+1.95
1695	33774	+1.99
1725	34135	+3.30
1755	34244	+3.67
1785	35022	+4.84
1815	35229	+5.93
1845	36179	
1875	36821	

MPC 9600 Plateau Instrument 9 MPC 9604 Detector B 7/1/2009

Alpha Volts: 870 Beta Volts: 1530

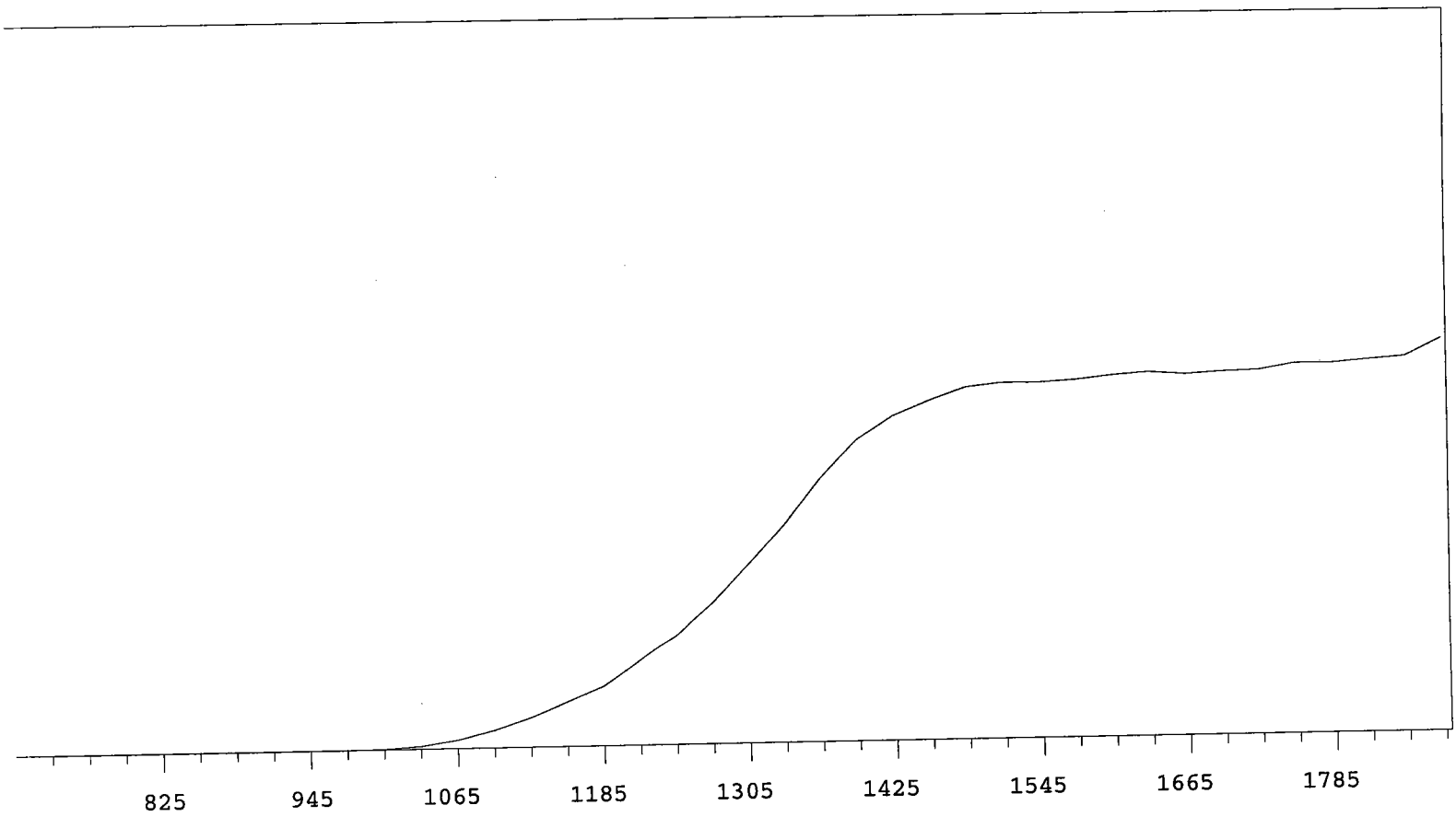


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	4	>100
1005	45	>100
1035	300	>100
1065	836	>100
1095	1742	>100
1125	2896	>100
1155	4198	>100
1185	5849	>100
1215	7887	+92.20
1245	10561	+83.55
1275	13442	+76.62

VOLTS	COUNTS	%/100 Volts
1305	16723	+68.78
1335	20749	+60.55
1365	24686	+48.78
1395	28343	+35.24
1425	30657	+24.31
1455	32208	+15.22
1485	33662	+9.32
1515	34098	+4.47
1545	34326	+2.17
1575	34133	+1.60
1605	34758	+1.41
1635	34706	+1.35
1665	34769	+0.30
1695	34830	-0.10
1725	34850	+0.90
1755	34613	+2.41
1785	35351	+3.87
1815	35849	+4.97
1845	36285	
1875	36814	

MPC 9600 Plateau Instrument 9 MPC 9604 Detector C 7/1/2009

Alpha Volts: 870 Beta Volts: 1530

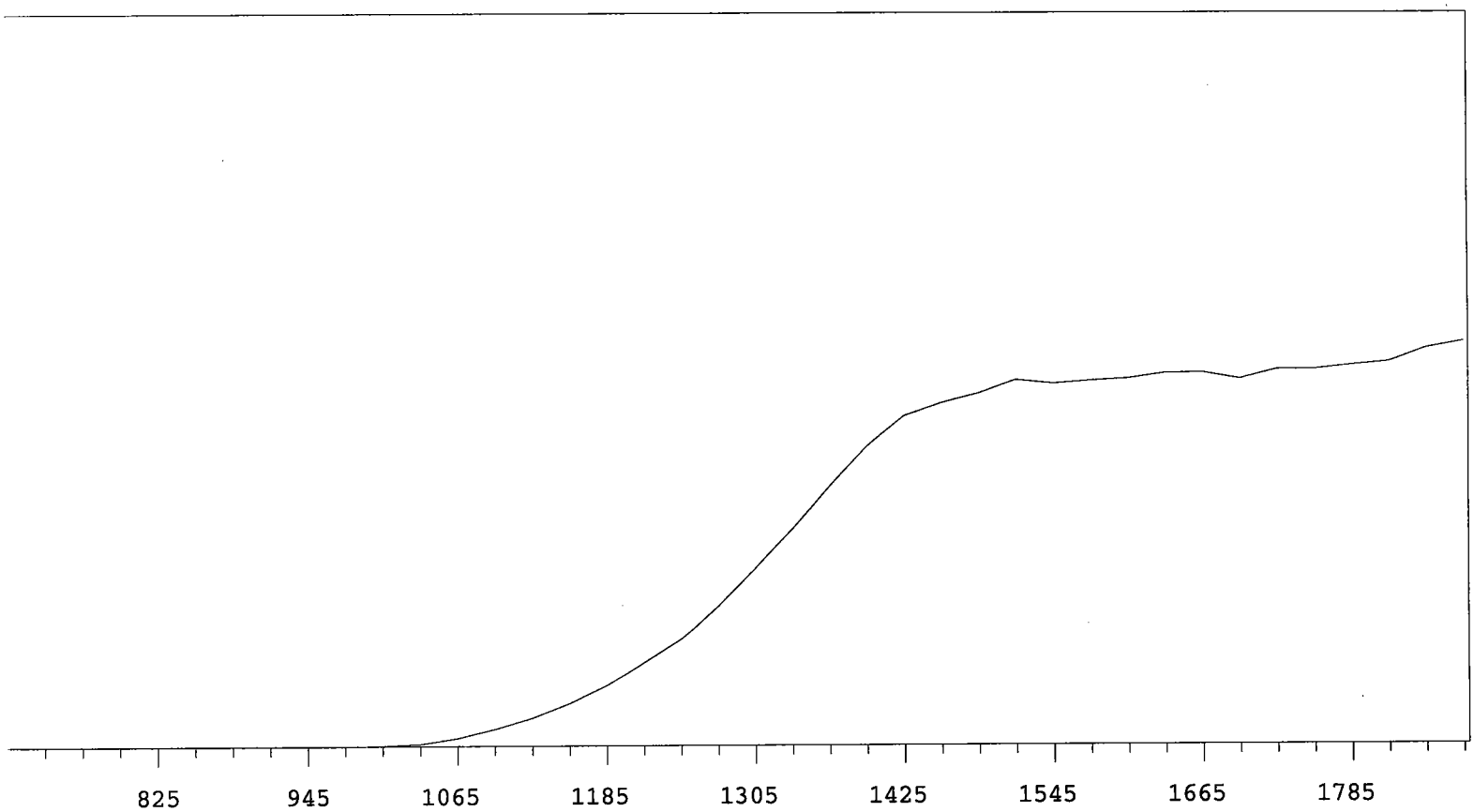


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	1	>100
915	1	>100
945	2	>100
975	3	>100
1005	64	>100
1035	349	>100
1065	970	>100
1095	1982	>100
1125	3328	>100
1155	5012	>100
1185	6669	>100
1215	9448	+92.67
1245	12293	+86.58
1275	15917	+76.99

VOLTS	COUNTS	%/100 Volts
1305	20192	+70.39
1335	24524	+60.97
1365	29650	+48.44
1395	33904	+35.09
1425	36549	+22.73
1455	38217	+13.58
1485	39628	+7.51
1515	40035	+3.73
1545	40020	+1.92
1575	40236	+2.06
1605	40680	+1.62
1635	40953	+1.03
1665	40643	+0.43
1695	40882	+1.41
1725	40979	+2.18
1755	41654	+2.20
1785	41602	+2.27
1815	41935	+4.50
1845	42259	
1875	44183	

MPC 9600 Plateau Instrument 9 MPC 9604 Detector D 7/1/2009

Alpha Volts: 870 Beta Volts: 1530

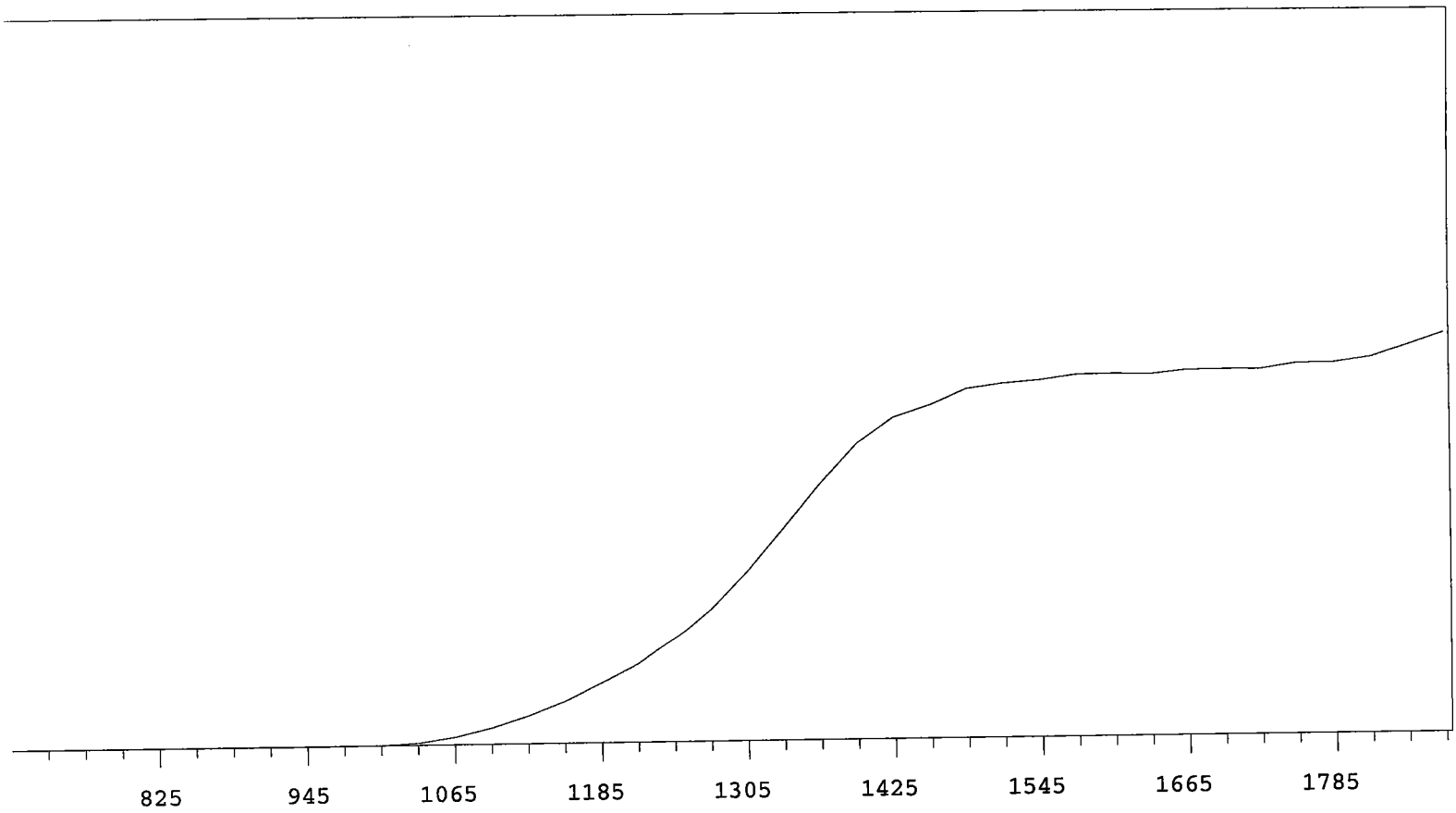


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	1	>100
945	0	>100
975	5	>100
1005	35	>100
1035	186	>100
1065	618	>100
1095	1280	>100
1125	2141	>100
1155	3268	>100
1185	4659	>100
1215	6343	+90.68
1245	8064	+83.46
1275	10497	+77.03

VOLTS	COUNTS	%/100 Volts
1305	13319	+70.94
1335	16319	+61.35
1365	19577	+50.27
1395	22498	+36.85
1425	24782	+23.90
1455	25761	+15.37
1485	26486	+8.38
1515	27503	+5.11
1545	27223	+2.67
1575	27453	+1.71
1605	27604	+2.70
1635	28021	+0.78
1665	28059	+1.05
1695	27548	+0.90
1725	28280	+2.16
1755	28290	+3.51
1785	28600	+4.46
1815	28879	+6.35
1845	29913	
1875	30417	

MPC 9600 Plateau Instrument 10 MPC 9604 Detector A 7/1/2009

Alpha Volts: 870 Beta Volts: 1552

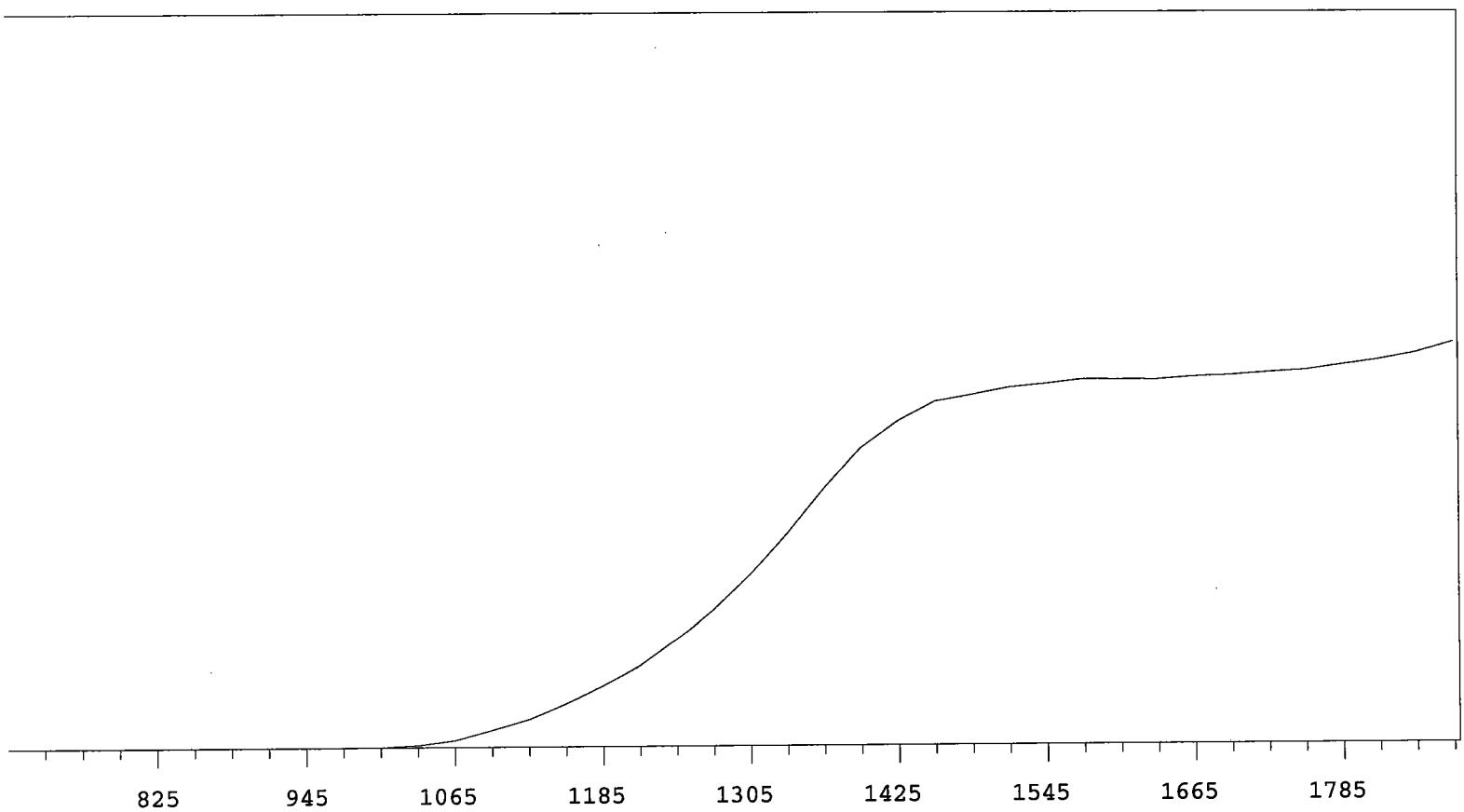


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	1	>100
1005	37	>100
1035	198	>100
1065	687	>100
1095	1491	>100
1125	2580	>100
1155	3920	>100
1185	5588	>100
1215	7384	+91.32
1245	9794	+84.81
1275	12572	+79.73

VOLTS	COUNTS	%/100 Volts
1305	16076	+72.76
1335	19985	+63.85
1365	24102	+50.95
1395	27819	+36.01
1425	30228	+23.86
1455	31343	+14.40
1485	32811	+8.77
1515	33243	+6.10
1545	33518	+3.25
1575	34010	+1.98
1605	34061	+1.59
1635	33973	+0.97
1665	34346	+0.93
1695	34366	+1.72
1725	34341	+1.54
1755	34860	+2.47
1785	34897	+4.50
1815	35377	+6.60
1845	36458	
1875	37630	

MPC 9600 Plateau Instrument 10 MPC 9604 Detector B 7/1/2009

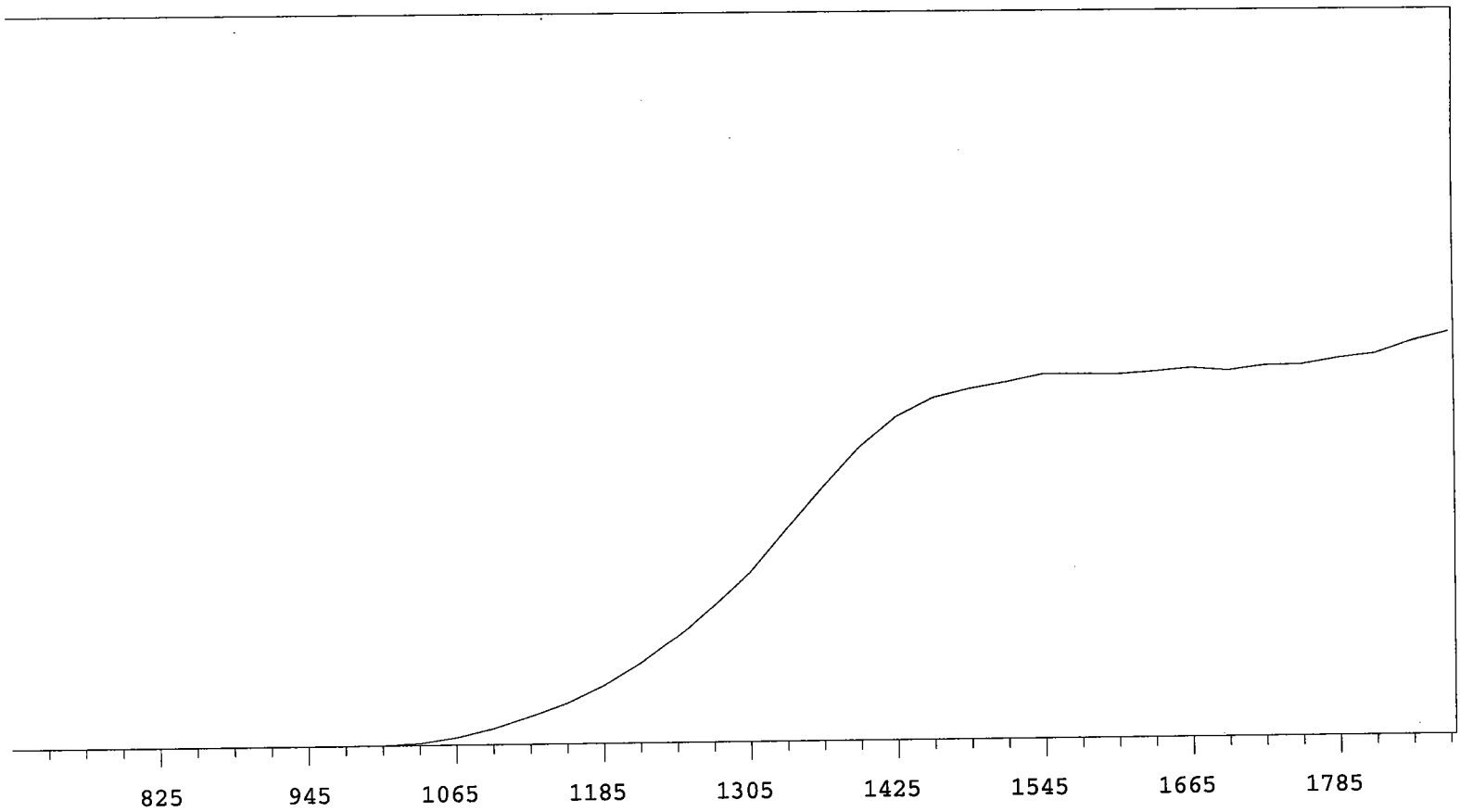
Alpha Volts: 870 Beta Volts: 1552



VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	1	>100
975	7	>100
1005	28	>100
1035	190	>100
1065	597	>100
1095	1474	>100
1125	2383	>100
1155	3680	>100
1185	5131	>100
1215	6808	+89.95
1245	8990	+83.03
1275	11493	+77.30
1305	14469	+71.08
1335	17904	+63.07
1365	21677	+51.20
1395	25027	+38.06
1425	27237	+24.55
1455	28914	+14.61
1485	29480	+8.48
1515	30075	+5.06
1545	30374	+3.42
1575	30738	+1.68
1605	30703	+1.08
1635	30679	+0.77
1665	30902	+1.46
1695	30992	+1.89
1725	31224	+2.40
1755	31397	+3.27
1785	31826	+4.13
1815	32236	+5.59
1845	32782	
1875	33632	

MPC 9600 Plateau Instrument 10 MPC 9604 Detector C 7/1/2009

Alpha Volts: 870 Beta Volts: 1552

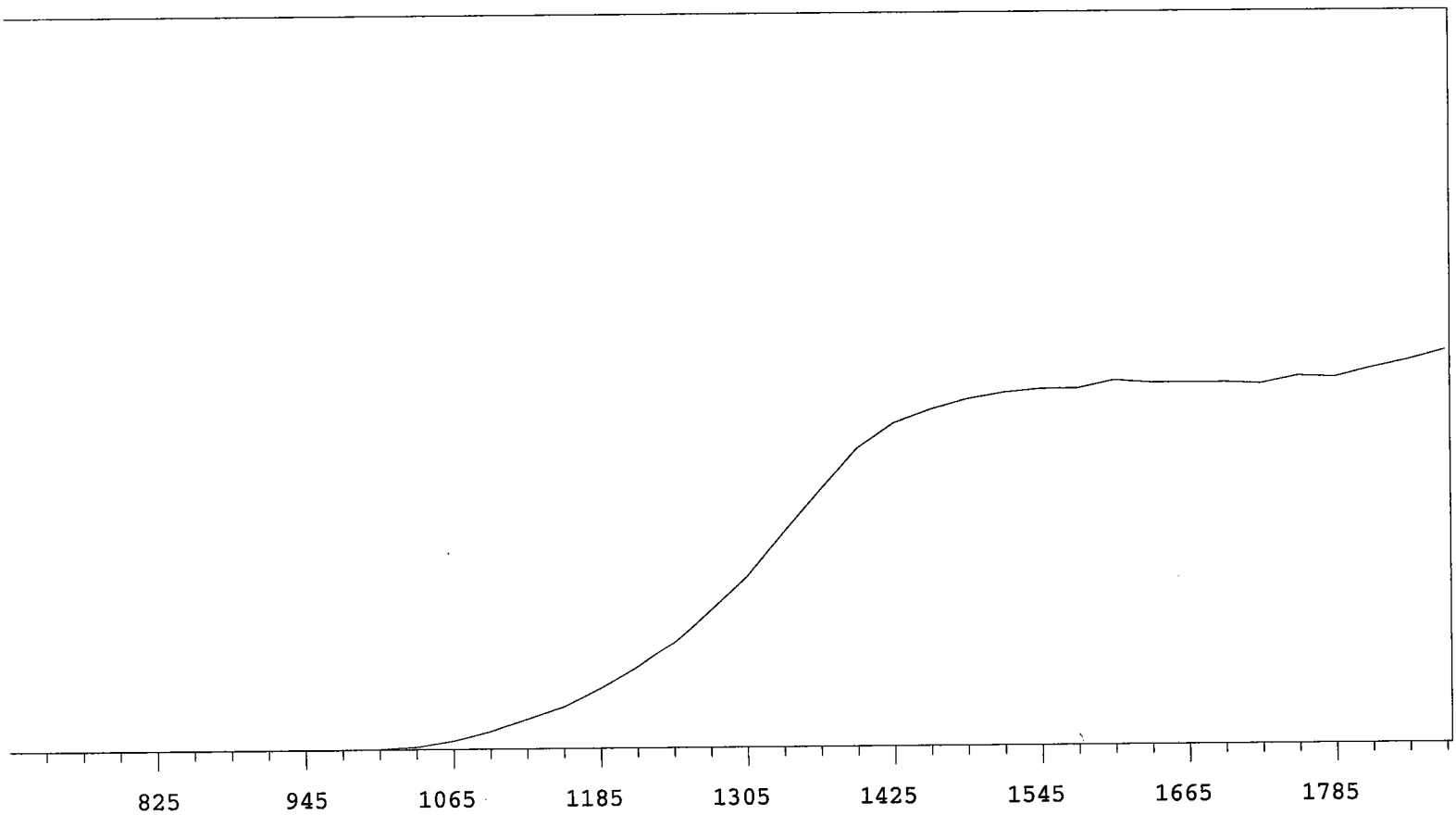


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	1	>100
915	0	>100
945	2	>100
975	2	>100
1005	36	>100
1035	220	>100
1065	780	>100
1095	1712	>100
1125	2926	>100
1155	4297	>100
1185	6097	>100
1215	8397	+95.11
1245	11155	+85.84
1275	14430	+78.79

VOLTS	COUNTS	%/100 Volts
1305	18051	+71.16
1335	22586	+62.34
1365	26973	+51.47
1395	31137	+38.24
1425	34321	+25.70
1455	36267	+15.37
1485	37197	+9.21
1515	37851	+5.38
1545	38622	+3.00
1575	38600	+1.55
1605	38538	+1.03
1635	38786	+0.91
1665	39129	+1.38
1695	38832	+1.20
1725	39323	+2.00
1755	39390	+3.35
1785	40031	+4.86
1815	40466	+6.64
1845	41713	
1875	42620	

MPC 9600 Plateau Instrument 10 MPC 9604 Detector D 7/1/2009

Alpha Volts: 870 Beta Volts: 1552

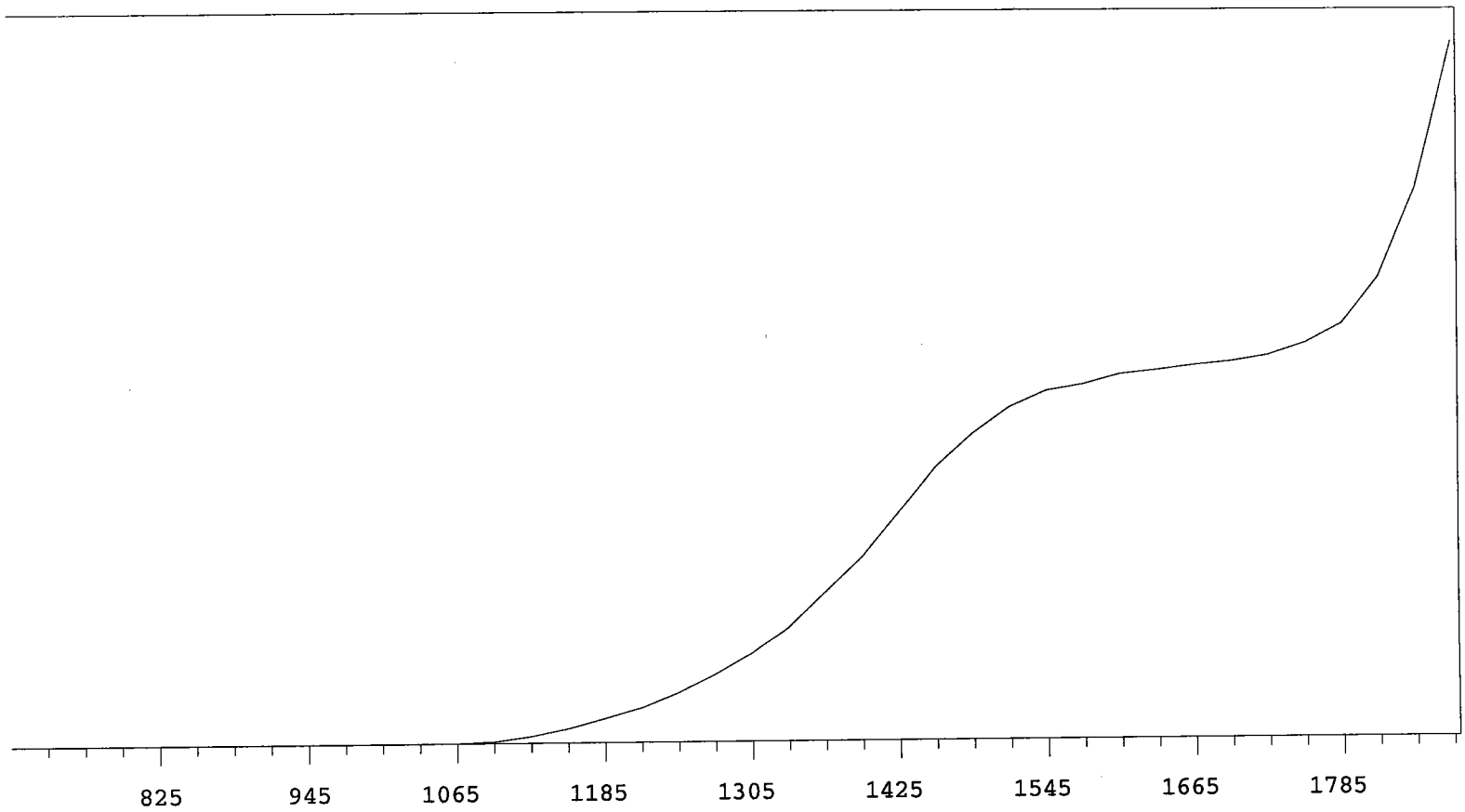


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	3	>100
1005	49	>100
1035	244	>100
1065	764	>100
1095	1584	>100
1125	2677	>100
1155	3763	>100
1185	5395	>100
1215	7350	+93.71
1245	9655	+83.52
1275	12504	+76.82

VOLTS	COUNTS	%/100 Volts
1305	15430	+69.87
1335	19258	+61.49
1365	23018	+50.06
1395	26562	+35.34
1425	28750	+22.67
1455	29911	+13.20
1485	30798	+8.01
1515	31375	+4.83
1545	31684	+3.74
1575	31721	+2.38
1605	32398	+1.44
1635	32154	+0.64
1665	32157	-0.77
1695	32152	+0.99
1725	32029	+1.41
1755	32699	+3.00
1785	32566	+4.71
1815	33351	+5.92
1845	34031	
1875	34941	

Plateau 7/1/09 Instrument 11 MPC 9604 Detector A 7/1/2009

Alpha Volts: 1515 Beta Volts: 1515

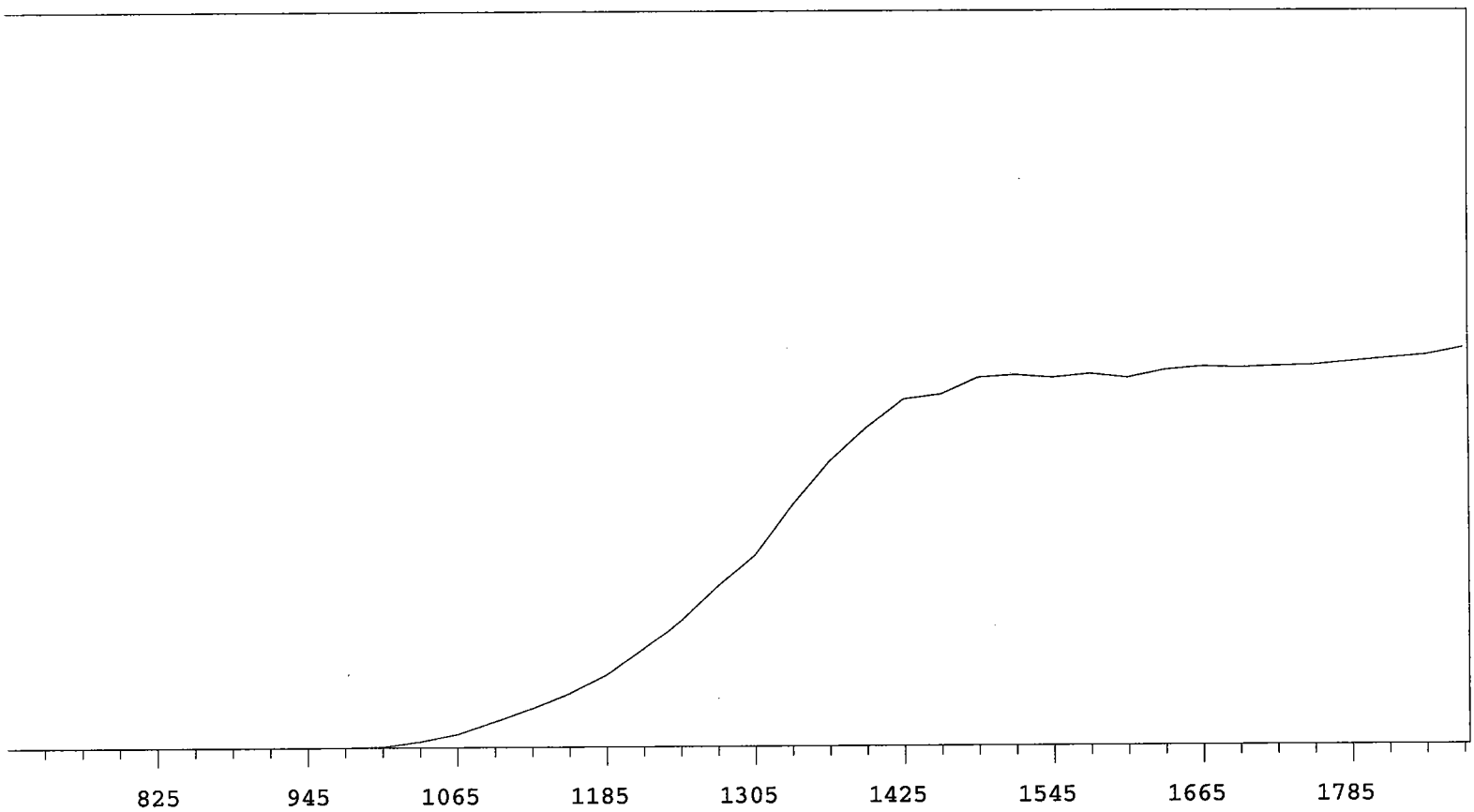


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	1	+0.00
975	0	>100
1005	0	>100
1035	2	>100
1065	9	>100
1095	61	>100
1125	248	>100
1155	528	>100
1185	882	>100
1215	1270	>100
1245	1786	>100
1275	2478	+93.67

VOLTS	COUNTS	%/100 Volts
1305	3225	+87.64
1335	4189	+80.15
1365	5428	+75.12
1395	6662	+68.60
1425	8241	+58.14
1455	9857	+46.65
1485	11018	+33.24
1515	11953	+21.01
1545	12538	+13.57
1575	12760	+8.35
1605	13114	+5.84
1635	13258	+4.78
1665	13430	+3.99
1695	13551	+5.46
1725	13771	+8.65
1755	14204	+16.44
1785	14916	+30.03
1815	16579	+48.74
1845	19717	
1875	25029	

Plateau 7/1/09 Instrument 11 MPC 9604 Detector B 7/1/2009

Alpha Volts: 1515 Beta Volts: 1515

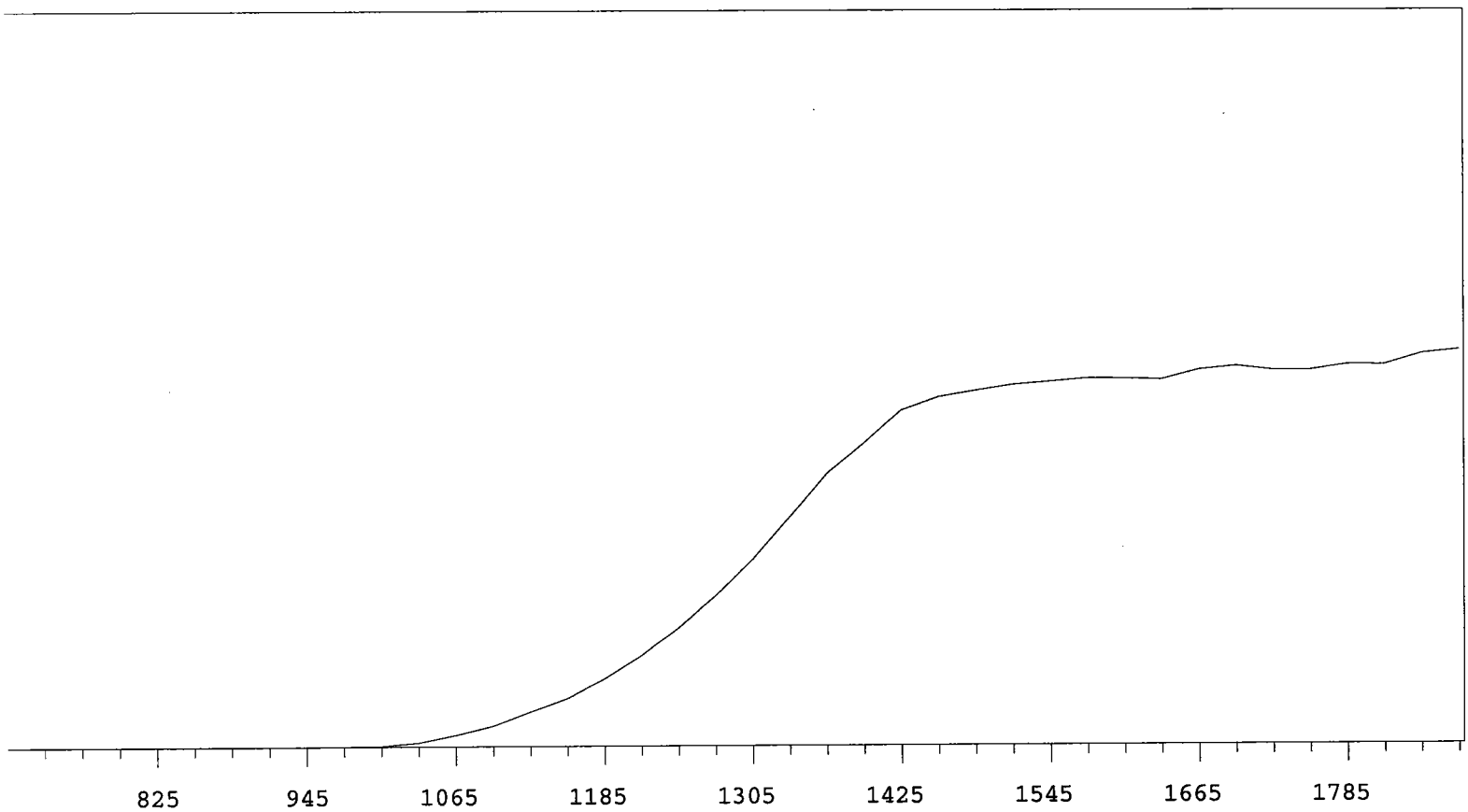


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	1	>100
945	0	>100
975	11	>100
1005	47	>100
1035	280	>100
1065	610	>100
1095	1192	>100
1125	1789	>100
1155	2466	>100
1185	3337	+94.91
1215	4526	+88.85
1245	5885	+78.40
1275	7518	+72.09

VOLTS	COUNTS	%/100 Volts
1305	8947	+65.63
1335	11238	+56.58
1365	13246	+46.66
1395	14838	+30.69
1425	16166	+20.11
1455	16396	+11.95
1485	17161	+5.61
1515	17274	+3.59
1545	17144	-0.00
1575	17323	+0.80
1605	17136	+2.21
1635	17484	+1.94
1665	17638	+2.16
1695	17580	+0.85
1725	17655	+1.05
1755	17700	+1.98
1785	17857	+2.38
1815	18006	+3.36
1845	18140	
1875	18468	

Plateau 7/1/09 Instrument 11 MPC 9604 Detector C 7/1/2009

Alpha Volts: 1515 Beta Volts: 1515

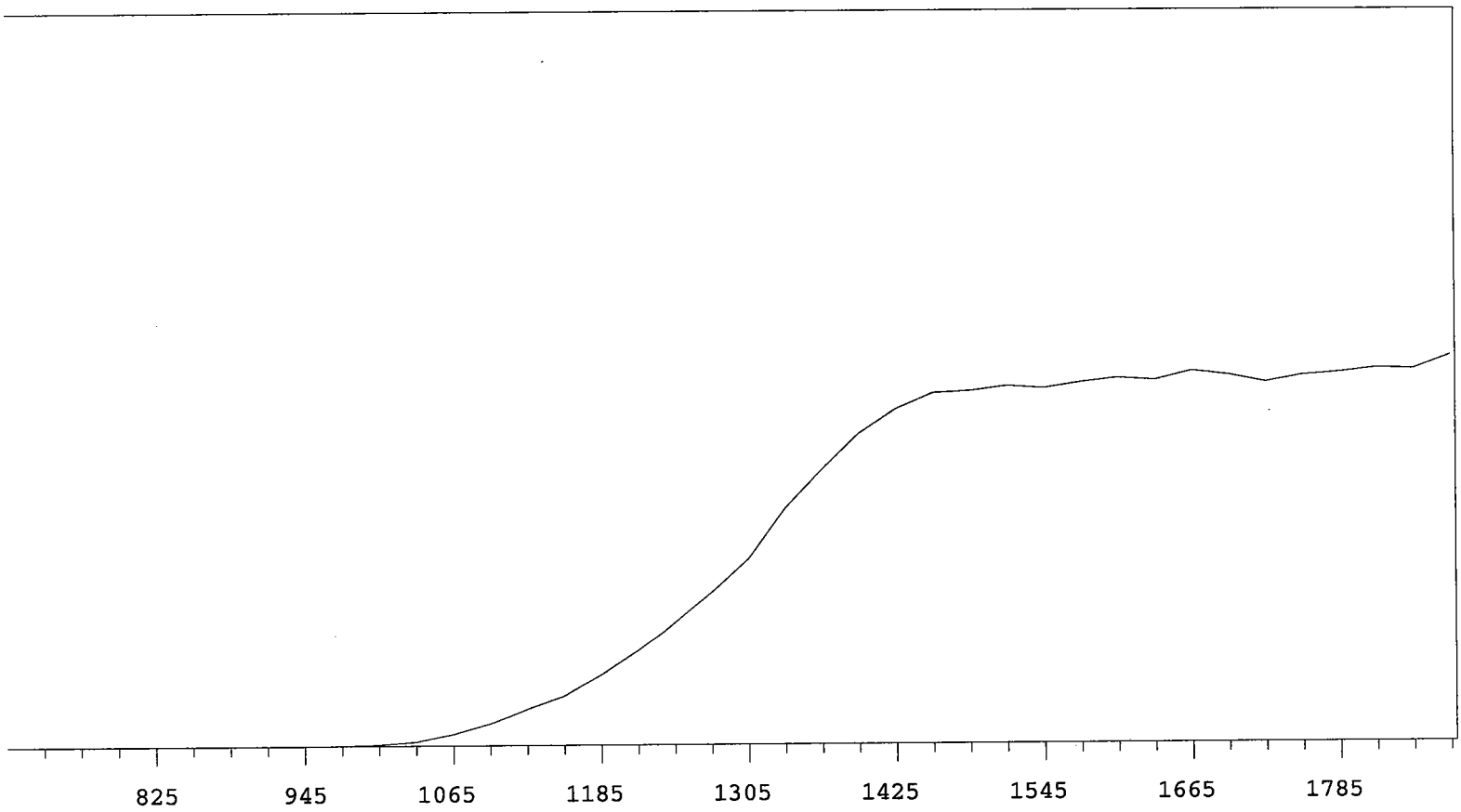


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	+0.00
795	0	>100
825	1	+0.00
855	0	>100
885	0	+0.00
915	0	>100
945	1	>100
975	7	>100
1005	46	>100
1035	191	>100
1065	540	>100
1095	957	>100
1125	1597	>100
1155	2217	>100
1185	3154	+98.74
1215	4239	+89.75
1245	5550	+79.98
1275	6980	+73.12

VOLTS	COUNTS	%/100 Volts
1305	8636	+66.44
1335	10593	+56.56
1365	12582	+46.23
1395	13957	+33.45
1425	15443	+21.49
1455	16048	+13.14
1485	16331	+6.45
1515	16603	+4.19
1545	16736	+2.73
1575	16884	+1.11
1605	16875	+1.91
1635	16813	+2.86
1665	17257	+2.60
1695	17425	+1.58
1725	17238	+0.49
1755	17230	+0.63
1785	17482	+3.27
1815	17468	+4.46
1845	17977	
1875	18163	

Plateau 7/1/09 Instrument 11 MPC 9604 Detector D 7/1/2009

Alpha Volts: 1515 Beta Volts: 1515

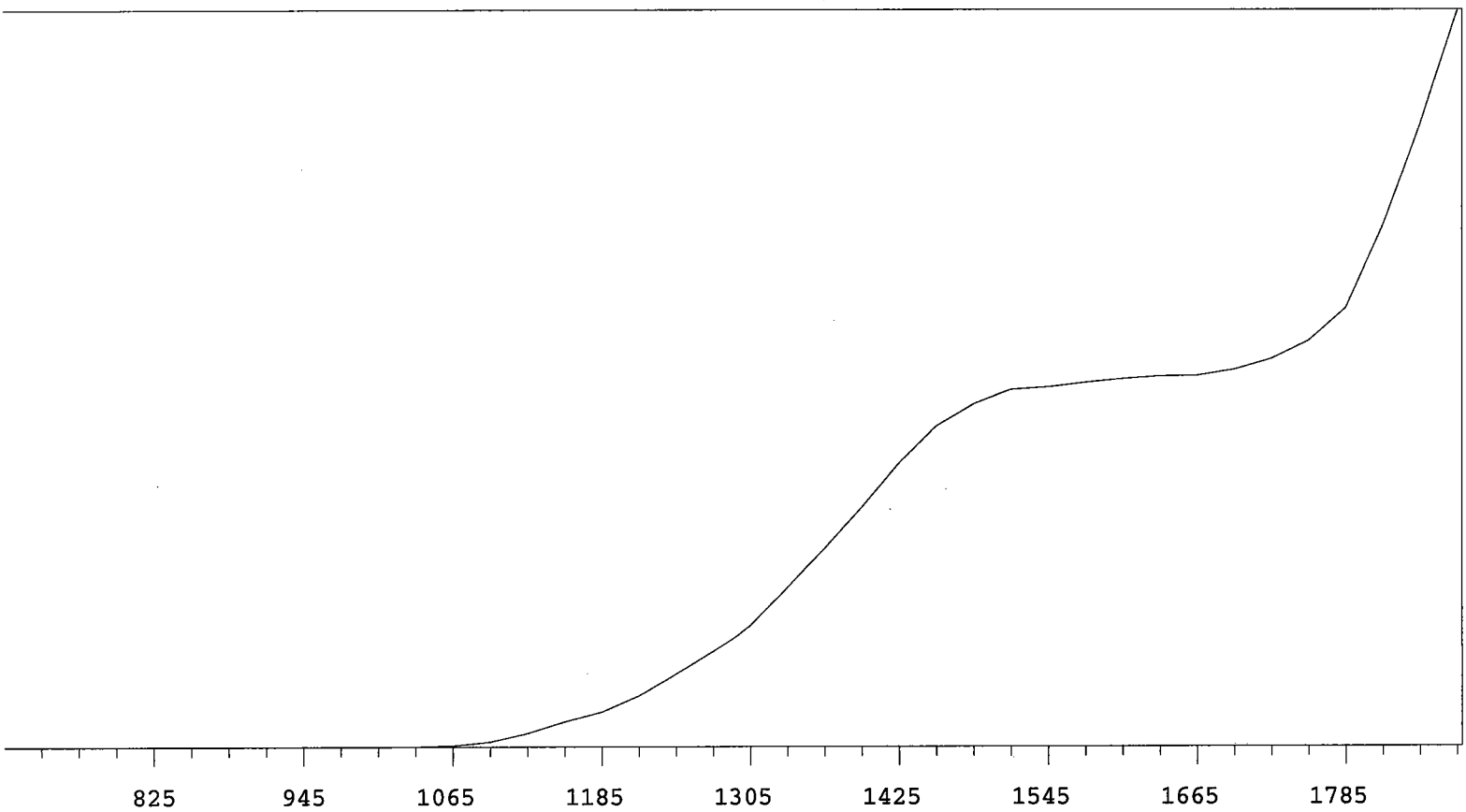


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	1	+83.33
885	1	+55.56
915	0	>100
945	1	>100
975	9	>100
1005	60	>100
1035	173	>100
1065	480	>100
1095	911	>100
1125	1508	>100
1155	2024	>100
1185	2872	+97.38
1215	3858	+89.30
1245	5070	+78.02
1275	6322	+73.30

VOLTS	COUNTS	%/100 Volts
1305	7679	+65.97
1335	9737	+57.57
1365	11301	+45.87
1395	12767	+31.71
1425	13767	+19.90
1455	14399	+10.72
1485	14467	+4.38
1515	14671	+2.12
1545	14576	+2.61
1575	14808	+1.80
1605	14974	+3.15
1635	14872	+1.76
1665	15248	-0.41
1695	15067	-0.27
1725	14784	-0.43
1755	15044	+2.01
1785	15163	+2.82
1815	15333	+3.61
1845	15278	
1875	15817	

Plateau 7/1/09 Instrument 12 MPC 9604 Detector A 7/1/2009

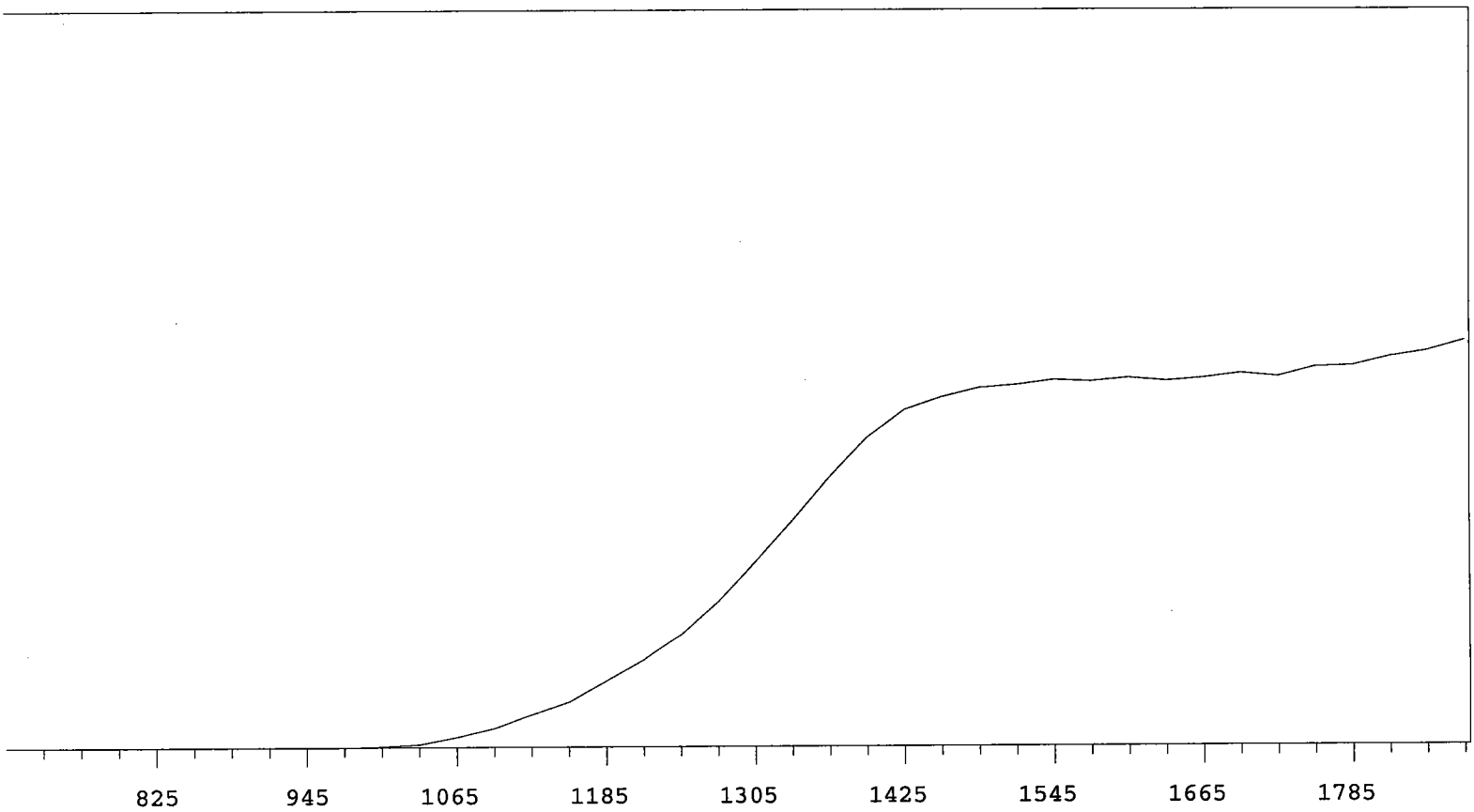
Alpha Volts: 705 Beta Volts: 1515



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	

Plateau 7/1/09 Instrument 12 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1515

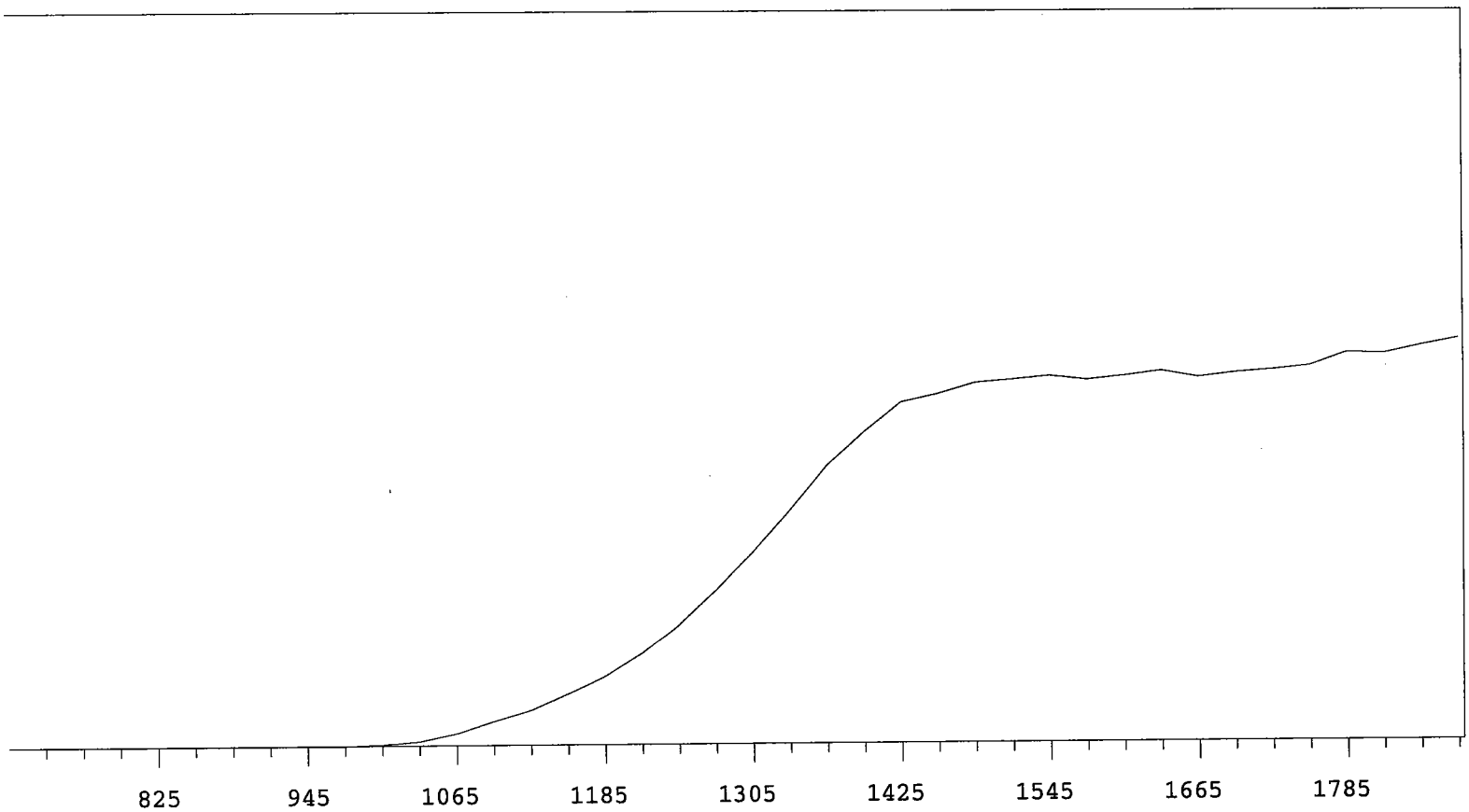


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	1	+83.33
885	1	-83.33
915	0	-55.56
945	0	>100
975	1	>100
1005	43	>100
1035	165	>100
1065	557	>100
1095	1055	>100
1125	1775	>100
1155	2470	>100
1185	3617	+98.46
1215	4757	+90.95
1245	6186	+83.59
1275	8021	+77.85

VOLTS	COUNTS	%/100 Volts
1305	10207	+70.42
1335	12473	+60.75
1365	14900	+48.87
1395	17101	+35.36
1425	18643	+22.53
1455	19350	+12.34
1485	19848	+6.68
1515	20014	+3.51
1545	20278	+2.03
1575	20186	+0.80
1605	20375	+0.32
1635	20209	+1.36
1665	20364	+0.83
1695	20607	+2.43
1725	20429	+2.51
1755	20924	+3.64
1785	20984	+5.11
1815	21470	+5.63
1845	21773	
1875	22346	

Plateau 7/1/09 Instrument 12 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1515

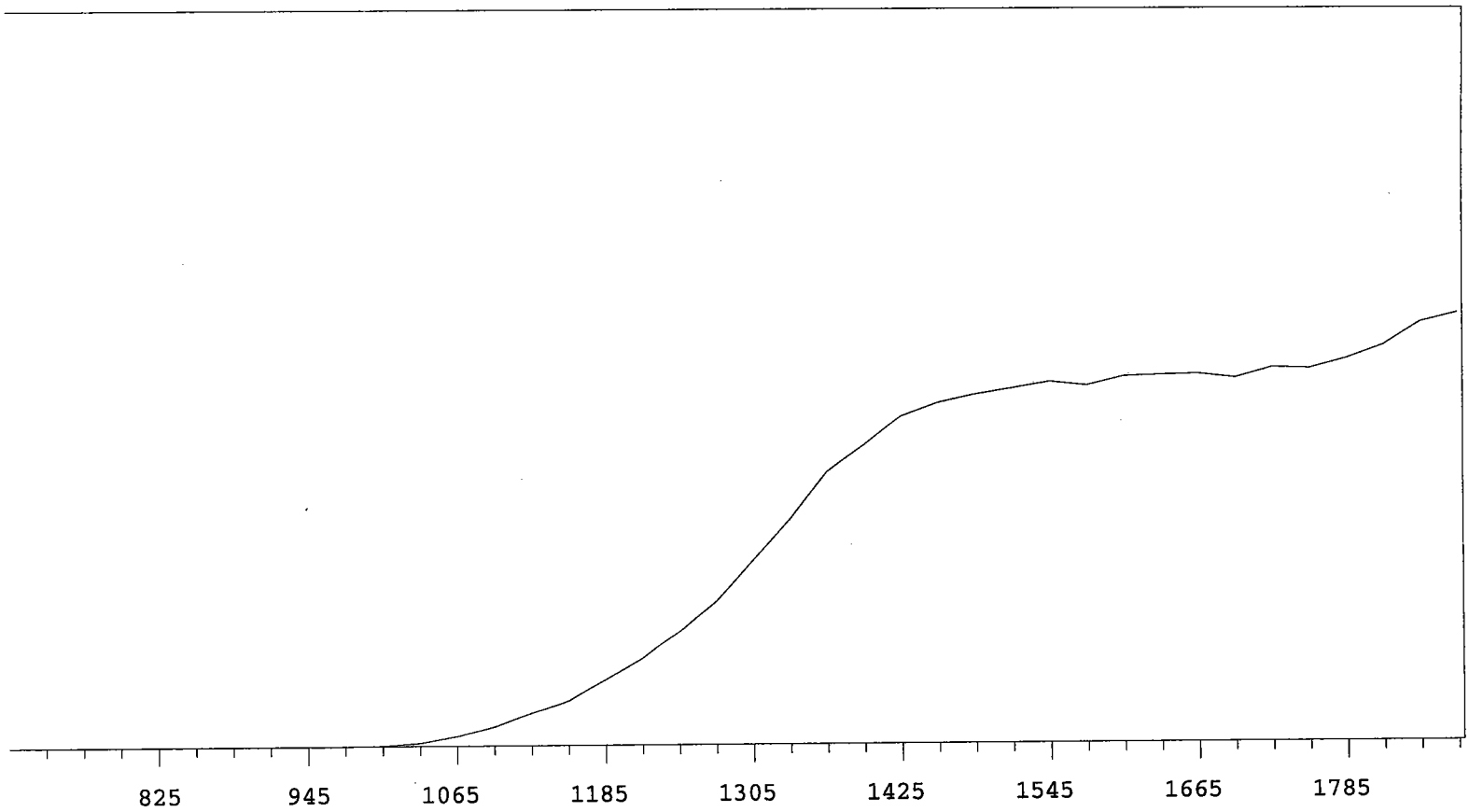


VOLTS	COUNTS	%/100 Volts
705	1	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	1	+0.00
915	0	>100
945	0	>100
975	7	>100
1005	52	>100
1035	214	>100
1065	590	>100
1095	1201	>100
1125	1759	>100
1155	2569	>100
1185	3440	+95.13
1215	4583	+87.74
1245	5985	+81.67
1275	7682	+74.54

VOLTS	COUNTS	%/100 Volts
1305	9543	+67.01
1335	11617	+56.47
1365	13791	+45.47
1395	15387	+31.66
1425	16819	+20.02
1455	17210	+11.63
1485	17742	+6.05
1515	17892	+3.04
1545	18070	+1.09
1575	17856	+1.43
1605	18054	+0.42
1635	18287	+1.06
1665	17969	+0.78
1695	18187	+1.48
1725	18317	+4.89
1755	18518	+4.76
1785	19156	+5.18
1815	19100	+5.18
1845	19496	
1875	19842	

Plateau 7/1/09 Instrument 12 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1515

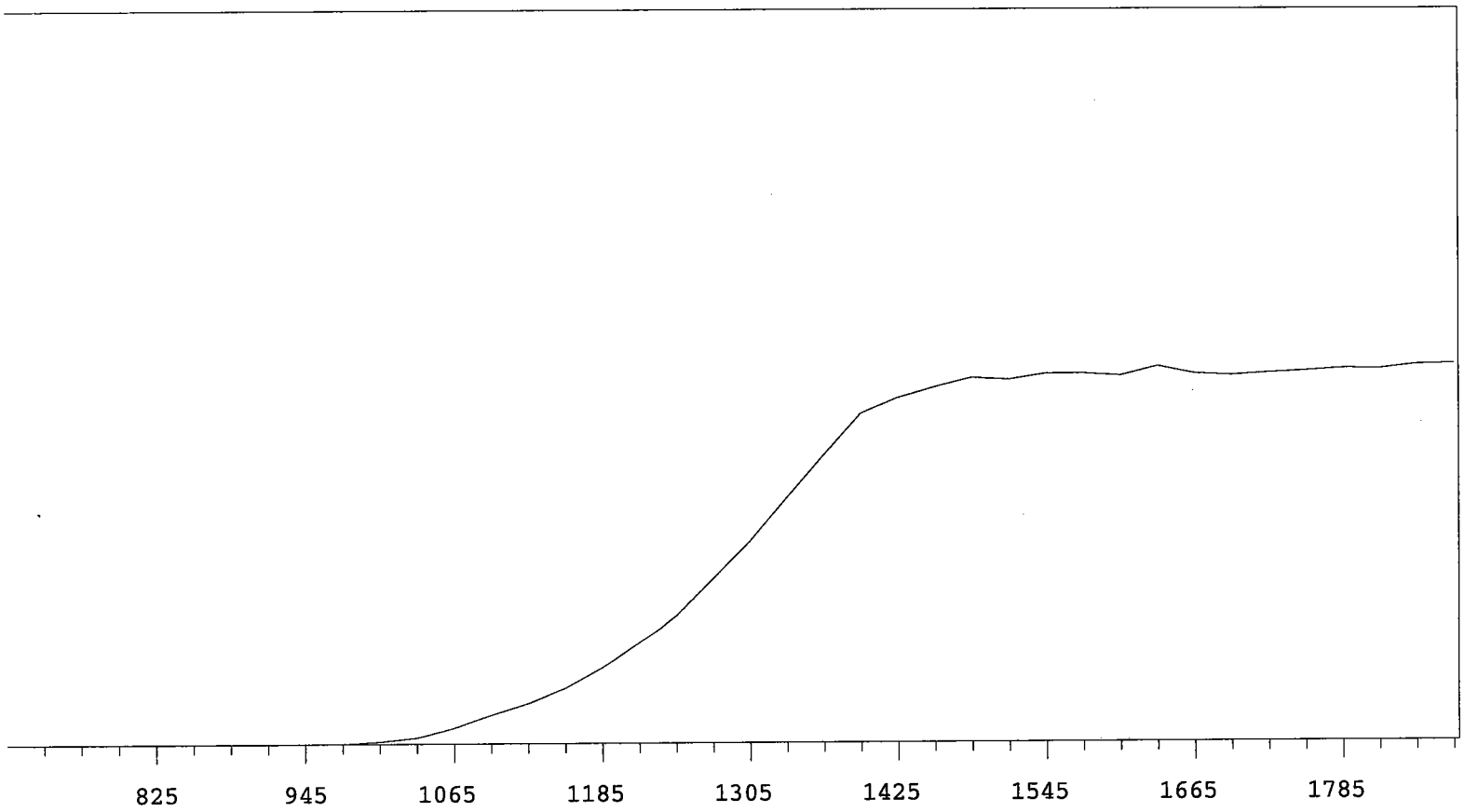


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	4	>100
1005	26	>100
1035	169	>100
1065	483	>100
1095	955	>100
1125	1639	>100
1155	2233	>100
1185	3262	+98.61
1215	4306	+89.77
1245	5662	+82.36
1275	7113	+76.36

VOLTS	COUNTS	%/100 Volts
1305	9144	+69.92
1335	11120	+58.43
1365	13399	+45.40
1395	14711	+32.57
1425	16134	+20.69
1455	16805	+13.46
1485	17209	+7.90
1515	17500	+4.31
1545	17812	+3.48
1575	17629	+2.80
1605	18066	+2.23
1635	18122	+1.44
1665	18166	+1.20
1695	17967	+1.60
1725	18469	+3.41
1755	18409	+6.35
1785	18884	+9.47
1815	19535	+11.98
1845	20630	
1875	21076	

Plateau 7/1/09 Instrument 13 MPC 9604 Detector A 7/1/2009

Alpha Volts: 705 Beta Volts: 1515

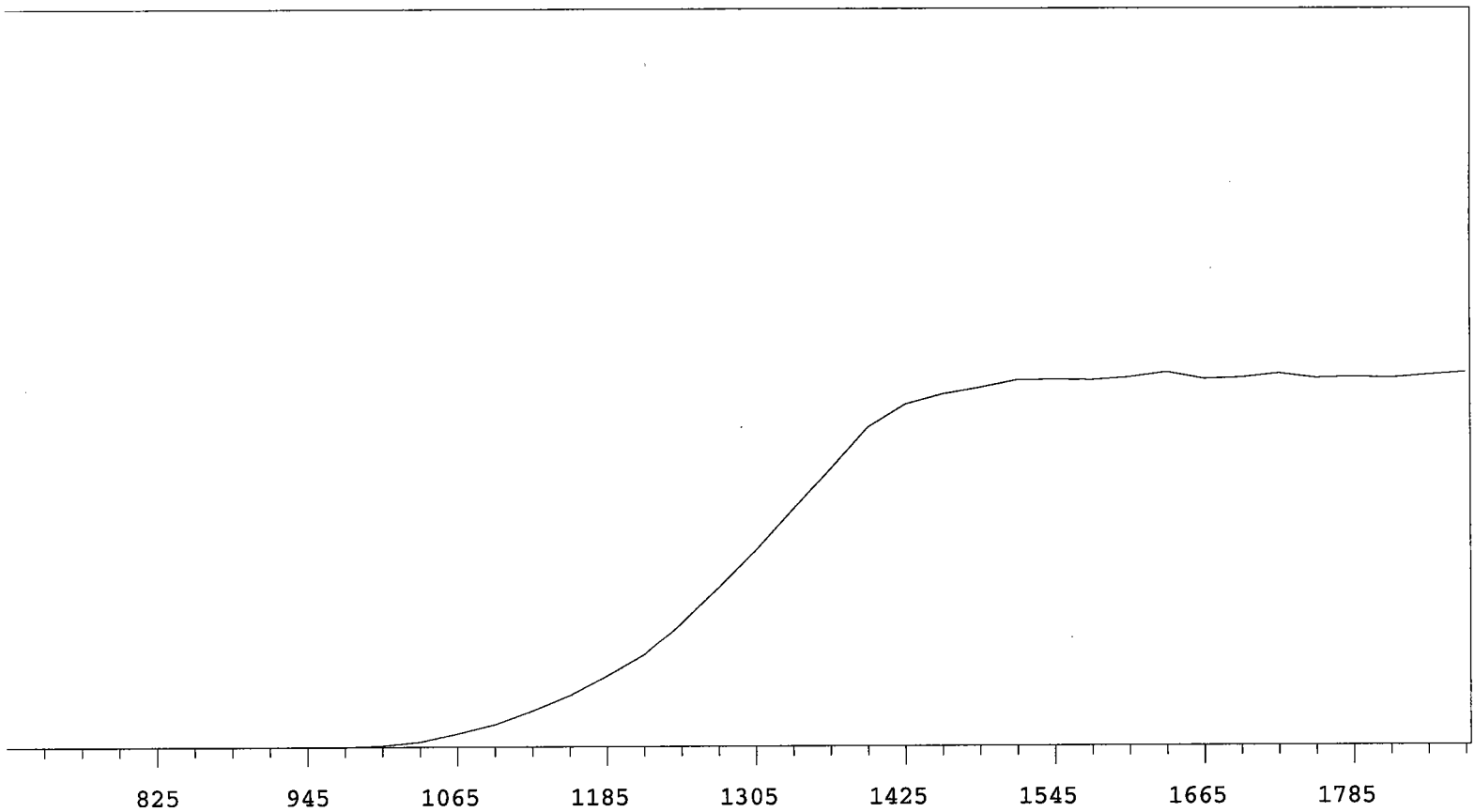


VOLTS	COUNTS	%/100 Volts
705	0	
735	1	
765	0	+55.56
795	2	>100
825	0	+0.00
855	0	>100
885	1	>100
915	0	>100
945	1	>100
975	14	>100
1005	104	>100
1035	281	>100
1065	720	>100
1095	1302	>100
1125	1834	>100
1155	2544	>100
1185	3485	+92.28
1215	4624	+85.50
1245	5878	+77.82
1275	7515	+71.49

VOLTS	COUNTS	%/100 Volts
1305	9209	+64.55
1335	11200	+55.94
1365	13123	+43.27
1395	14957	+29.04
1425	15658	+17.41
1455	16123	+8.01
1485	16530	+4.92
1515	16437	+2.71
1545	16704	+0.83
1575	16707	+2.14
1605	16602	+0.55
1635	17024	-0.28
1665	16684	-0.42
1695	16597	-0.85
1725	16711	+1.27
1755	16796	+1.51
1785	16903	+1.57
1815	16880	+1.46
1845	17066	
1875	17085	

Plateau 7/1/09 Instrument 13 MPC 9604 Detector B 7/1/2009

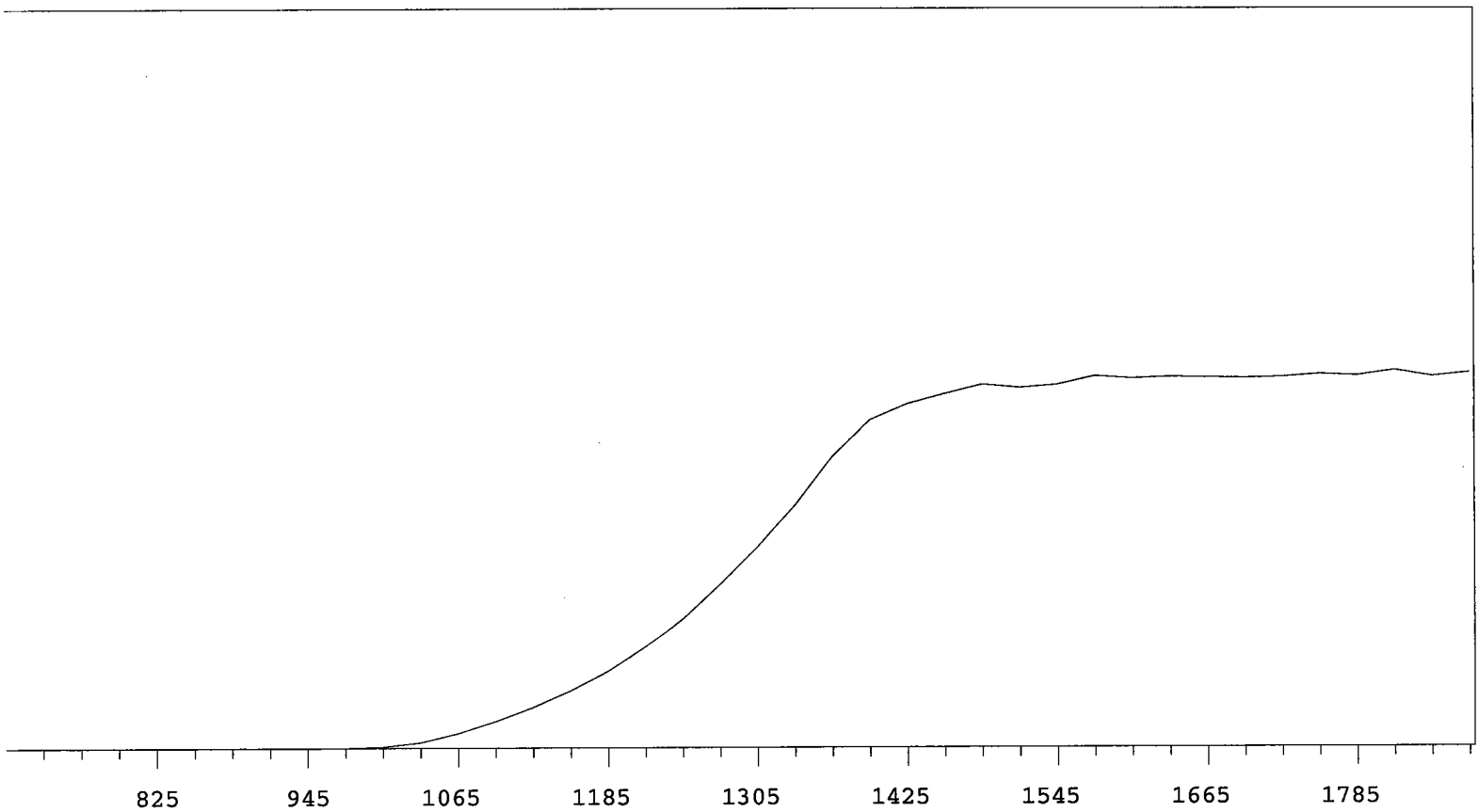
Alpha Volts: 705 Beta Volts: 1515



VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	1	>100
945	0	>100
975	4	>100
1005	70	>100
1035	257	>100
1065	648	>100
1095	1116	>100
1125	1784	>100
1155	2560	>100
1185	3531	+96.11
1215	4568	+89.22
1245	6137	+81.65
1275	7855	+74.42

VOLTS	COUNTS	%/100 Volts
1305	9666	+64.39
1335	11722	+55.91
1365	13680	+44.91
1395	15677	+31.56
1425	16786	+19.46
1455	17283	+10.57
1485	17608	+5.95
1515	17972	+3.32
1545	18006	+1.84
1575	17970	+1.58
1605	18104	+0.74
1635	18351	+0.24
1665	18016	+0.16
1695	18080	-0.63
1725	18283	+0.29
1755	18047	-0.47
1785	18110	-0.32
1815	18040	+1.17
1845	18200	
1875	18320	

Plateau 7/1/09 Instrument 13 MPC 9604 Detector C 7/1/2009
Alpha Volts: 705 Beta Volts: 1515

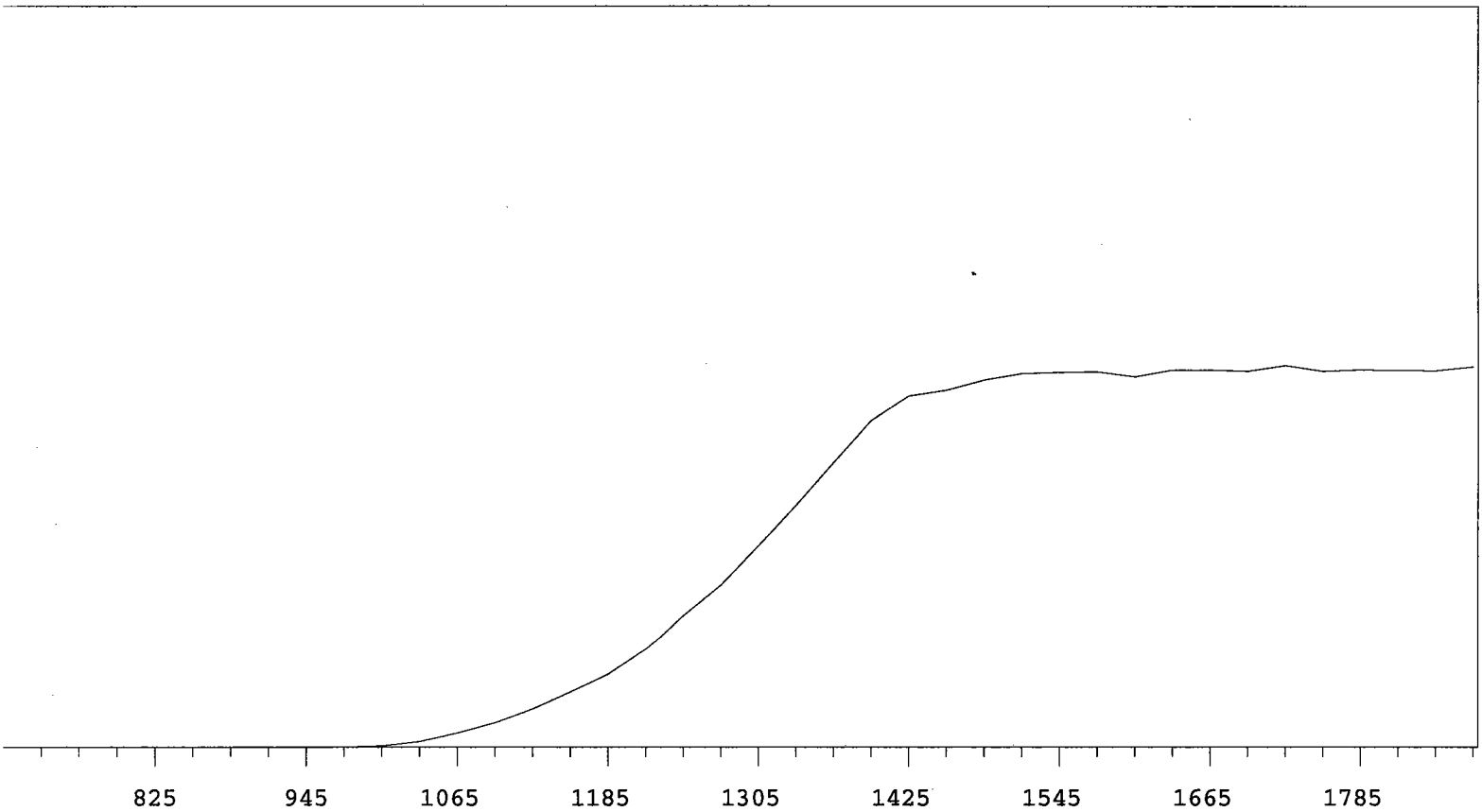


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	0	>100
915	0	>100
945	0	>100
975	9	>100
1005	93	>100
1035	325	>100
1065	834	>100
1095	1525	>100
1125	2318	>100
1155	3233	>100
1185	4357	+92.07
1215	5755	+85.64
1245	7438	+78.35
1275	9463	+70.89

VOLTS	COUNTS	%/100 Volts
1305	11573	+64.95
1335	13929	+56.47
1365	16726	+43.82
1395	18834	+29.38
1425	19743	+16.84
1455	20314	+7.95
1485	20860	+4.16
1515	20670	+3.23
1545	20844	+2.09
1575	21330	+2.48
1605	21188	+1.16
1635	21280	-0.32
1665	21237	+0.08
1695	21202	+0.42
1725	21254	+0.60
1755	21406	+1.41
1785	21326	+0.42
1815	21619	+0.16
1845	21282	
1875	21478	

Plateau 7/1/09 Instrument 13 MPC 9604 Detector D 7/1/2009

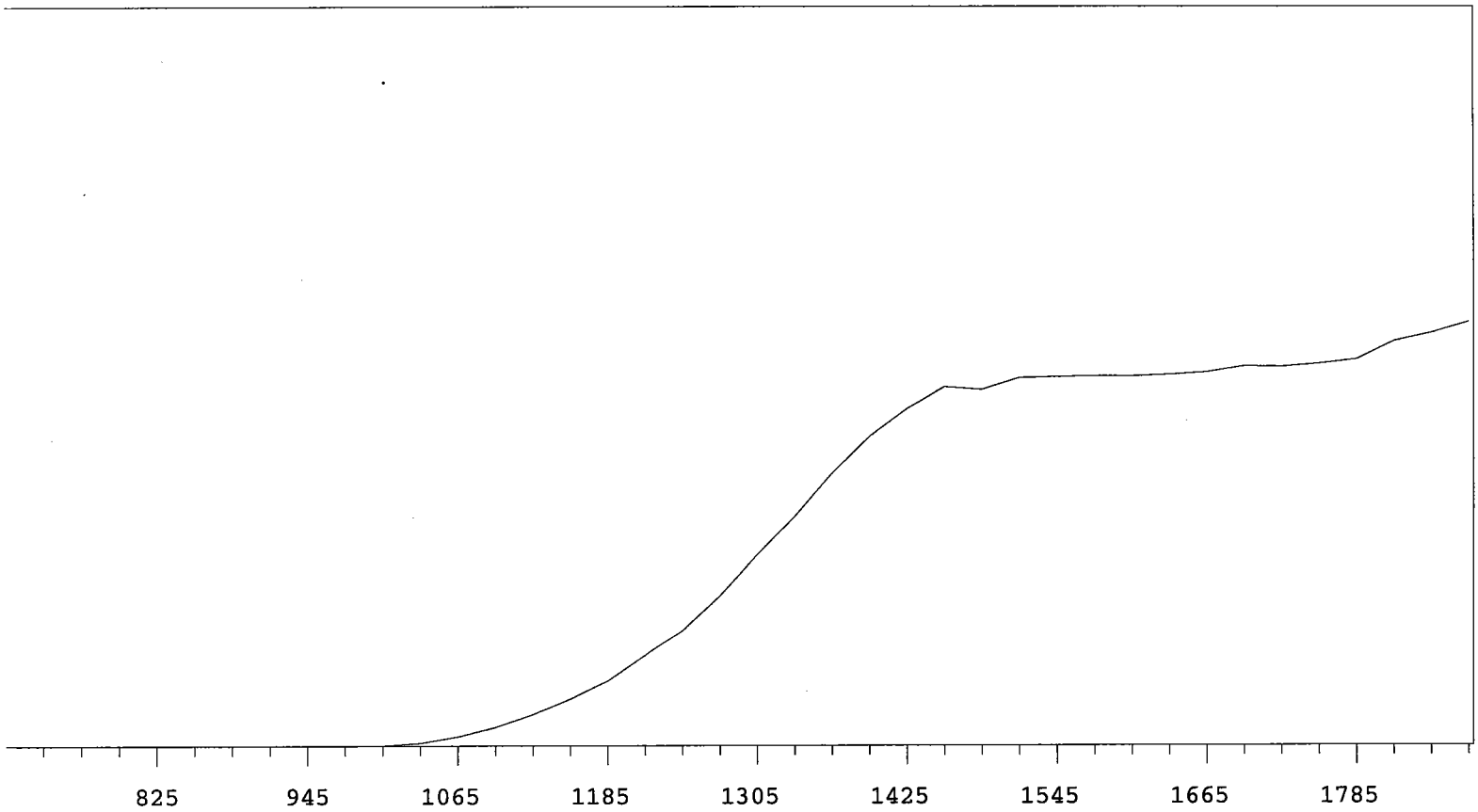
Alpha Volts: 705 Beta Volts: 1515



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	

Plateau 7/1/09 Instrument 14 MPC 9604 Detector A 7/1/2009

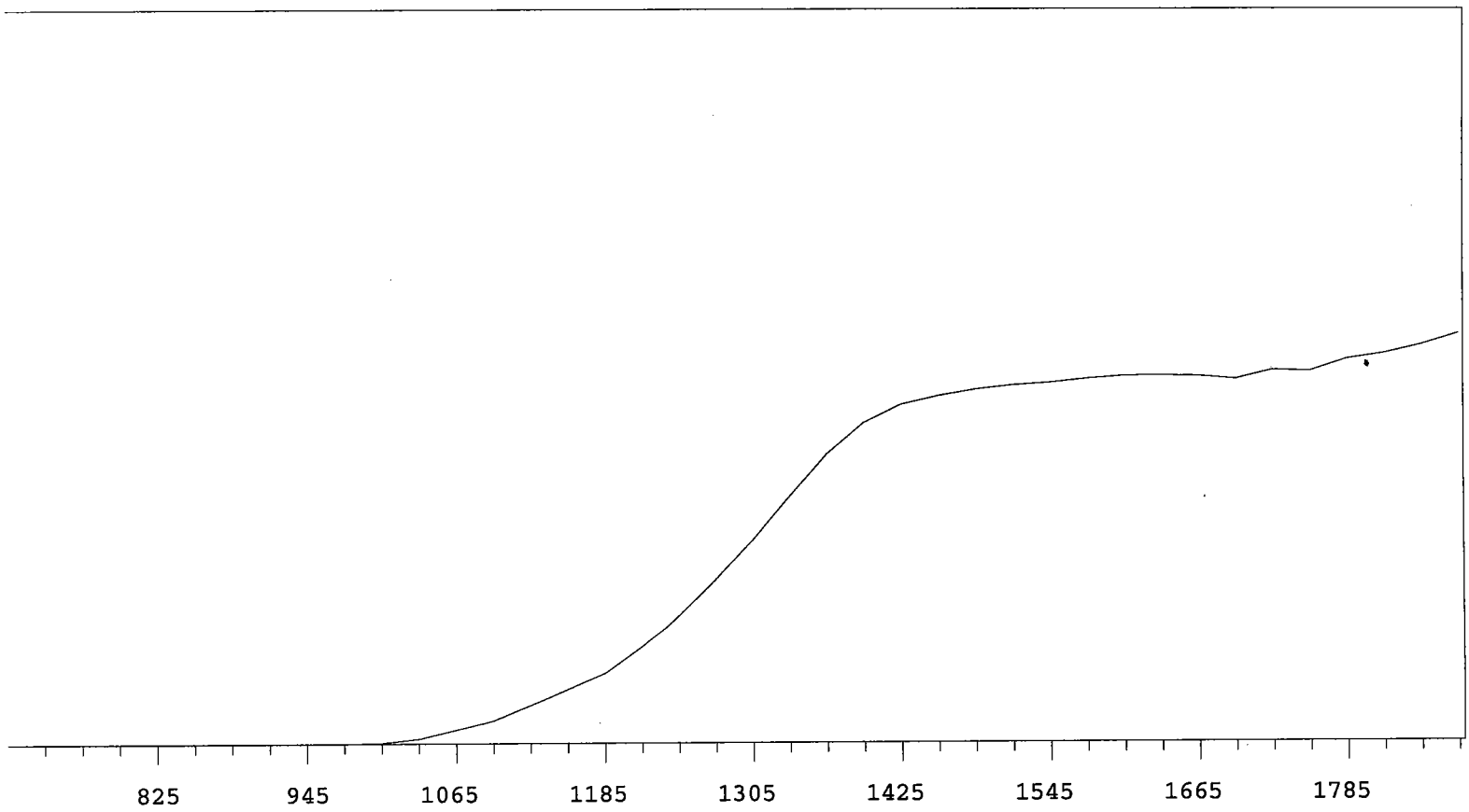
Alpha Volts: 705 Beta Volts: 1515



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	

Plateau 7/1/09 Instrument 14 MPC 9604 Detector B 7/1/2009

Alpha Volts: 705 Beta Volts: 1515

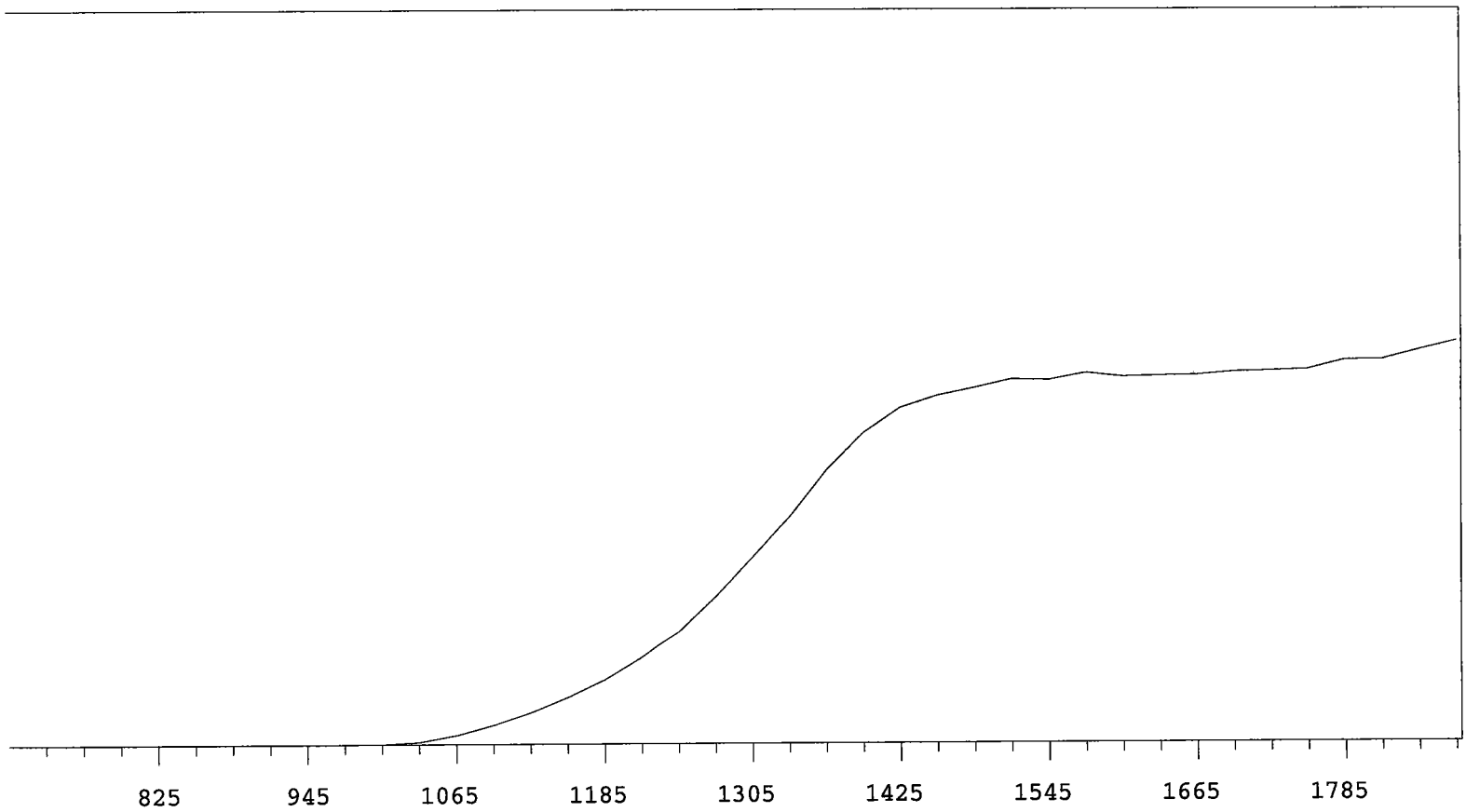


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	1	+0.00
885	0	>100
915	0	>100
945	0	>100
975	3	>100
1005	40	>100
1035	210	>100
1065	590	>100
1095	983	>100
1125	1645	>100
1155	2342	>100
1185	3045	+96.43
1215	4201	+90.42
1245	5579	+83.64
1275	7121	+74.44

VOLTS	COUNTS	%/100 Volts
1305	8797	+65.44
1335	10726	+54.47
1365	12570	+41.11
1395	13917	+26.79
1425	14687	+15.44
1455	15048	+8.47
1485	15318	+5.00
1515	15494	+3.76
1545	15606	+3.04
1575	15776	+2.35
1605	15889	+1.44
1635	15907	-0.16
1665	15881	+0.64
1695	15741	+1.21
1725	16124	+3.63
1755	16076	+5.41
1785	16588	+5.79
1815	16830	+7.53
1845	17185	
1875	17682	

Plateau 7/1/09 Instrument 14 MPC 9604 Detector C 7/1/2009

Alpha Volts: 705 Beta Volts: 1515

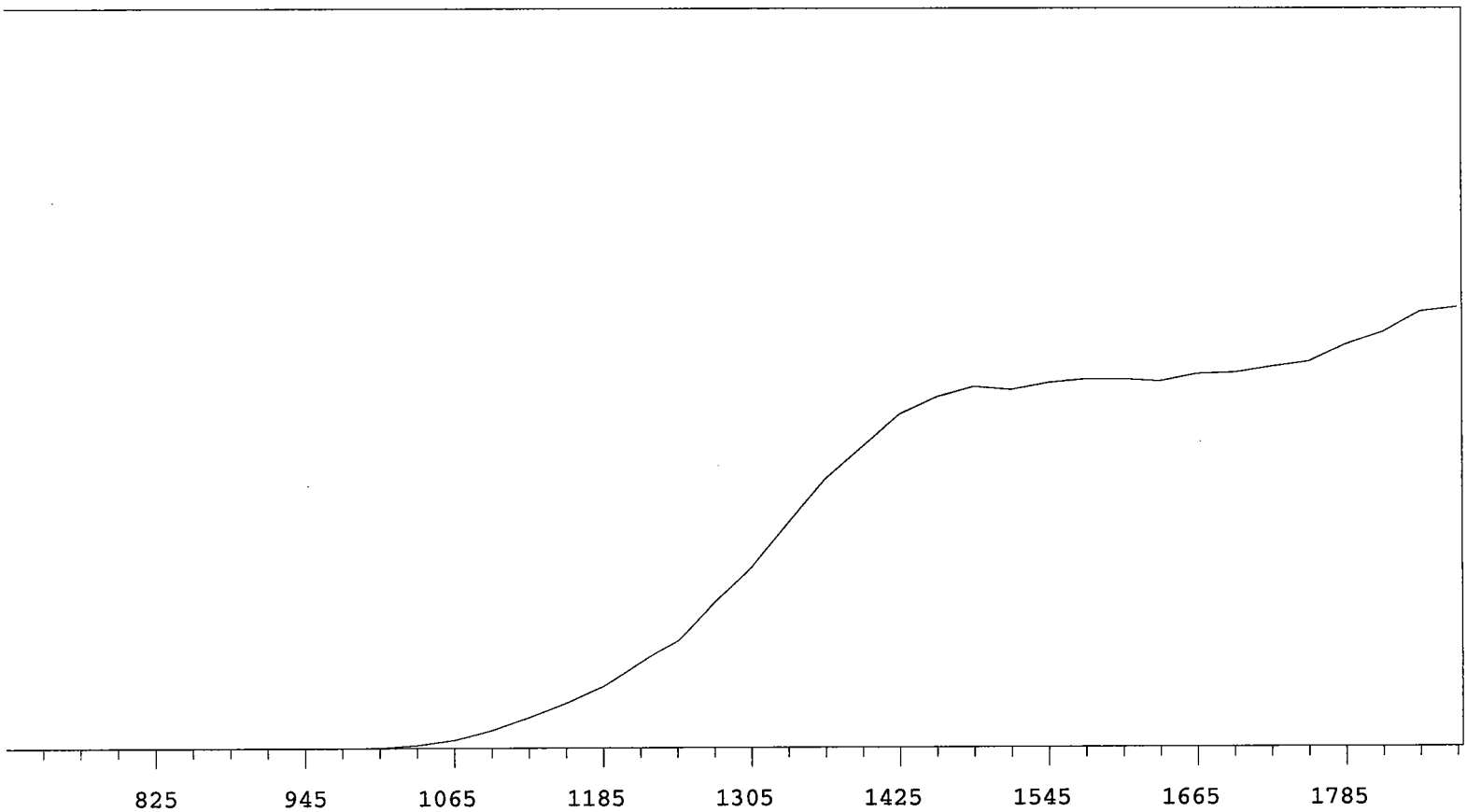


VOLTS	COUNTS	%/100 Volts
705	0	
735	0	
765	0	
795	0	>100
825	0	>100
855	0	>100
885	1	+0.00
915	0	>100
945	0	>100
975	2	>100
1005	21	>100
1035	132	>100
1065	491	>100
1095	1036	>100
1125	1698	>100
1155	2517	>100
1185	3468	>100
1215	4721	+91.83
1245	6175	+85.13
1275	8025	+76.82

VOLTS	COUNTS	%/100 Volts
1305	10118	+69.76
1335	12269	+59.65
1365	14810	+47.35
1395	16773	+33.46
1425	18104	+20.13
1455	18720	+11.98
1485	19122	+6.50
1515	19580	+4.77
1545	19527	+2.48
1575	19902	+0.81
1605	19690	+0.53
1635	19739	+0.23
1665	19765	+1.29
1695	19932	+1.40
1725	19976	+2.72
1755	20051	+2.92
1785	20523	+4.26
1815	20542	+5.57
1845	21035	
1875	21528	

Plateau 7/1/09 Instrument 14 MPC 9604 Detector D 7/1/2009

Alpha Volts: 705 Beta Volts: 1515



VOLTS	COUNTS	%/100 Volts
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

VOLTS	COUNTS	%/100 Volts
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	

0553

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

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: γ-impurities (other than decay products) <0.1%, Ra-226 <0.1%

5.31628 grams 4M HCl solution with 100 µg/g Ba carrier.

P O NUMBER 3219 RD, Item 1

SOURCE PREPARED BY: M Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: M. Monty 4-23-03

Standard Traceability Log Rad

Source Material Info	
Parent Code:	0553-A
Prepared By:	Lonnie Morris
Carrier Conc:	0.5M HCl
Reference Date:	04/23/2003
Ampoule Mass (g):	5.0235 g
Uncertainty:	+/-
LogBook No:	RC-S-035-068

A Solution Material Info	
Isotope:	Radium-228 SPIKE
Prepared By:	Lonnie Morris
Prep Date:	04/25/2003
Verification Date:	04/27/2005
Expiration Date:	04/27/2006
Primary Code:	0553-B
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

(Mass of parent(g)) * (Parm Activity (dpm/mL)) * (conversion dpm to dpm) / (Dilution Vol) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (dpm/mL)) * (conversion dpm to dpm) / Density (g/mL)/ (Dilution Vol) = Parent Activity (dpm/g)
(30.535 g) * (13419.8626 dpm/mL) * (1 dpm/dpm) / (1000 mL) = 409.7755 dpm/mL
(30.535 g) * (13419.8626 dpm/mL) * (1 dpm/dpm) / (g/mL) / (1000 mL) = 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

0503

ANALYTICS

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

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: γ-impurities <0.1%

5.02617 grams 0.1M HCl solution with 110 µg/g Ba carrier.

P O NUMBER 3208RD, Item 2

SOURCE PREPARED BY: M Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: M. Mtg 10-2-02

RC-S-035-018a

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

(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / (Ampoule Mass(g) *(Dilution Vol)) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / Density / (Ampoule Mass (g) * (Dilution Vol)) = Parent Activity (dpm/g)
(4.4737 g) * (19390 dps) * (60 dpm/dps) / (5.02617 g * 100 mL) = 10355.2060 dpm/mL
(4.4737 g) * (19390 dps) * (60 dpm/dps) / (0.9992 g/mL)/ (5.02617 g * 100 mL) = 10363.0820 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	Standard Mass. Used (mL)	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
							206.3740189

Mean Value (Counting) =	206.3740189	dpm/mL	**102.880426**	**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:

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 9/16/08

Douglas A Johnson 9/17/08

ID: TOTAL ACTIVITY 16 SEP 2008 16:24

USER:11 COMMENT:GOLD

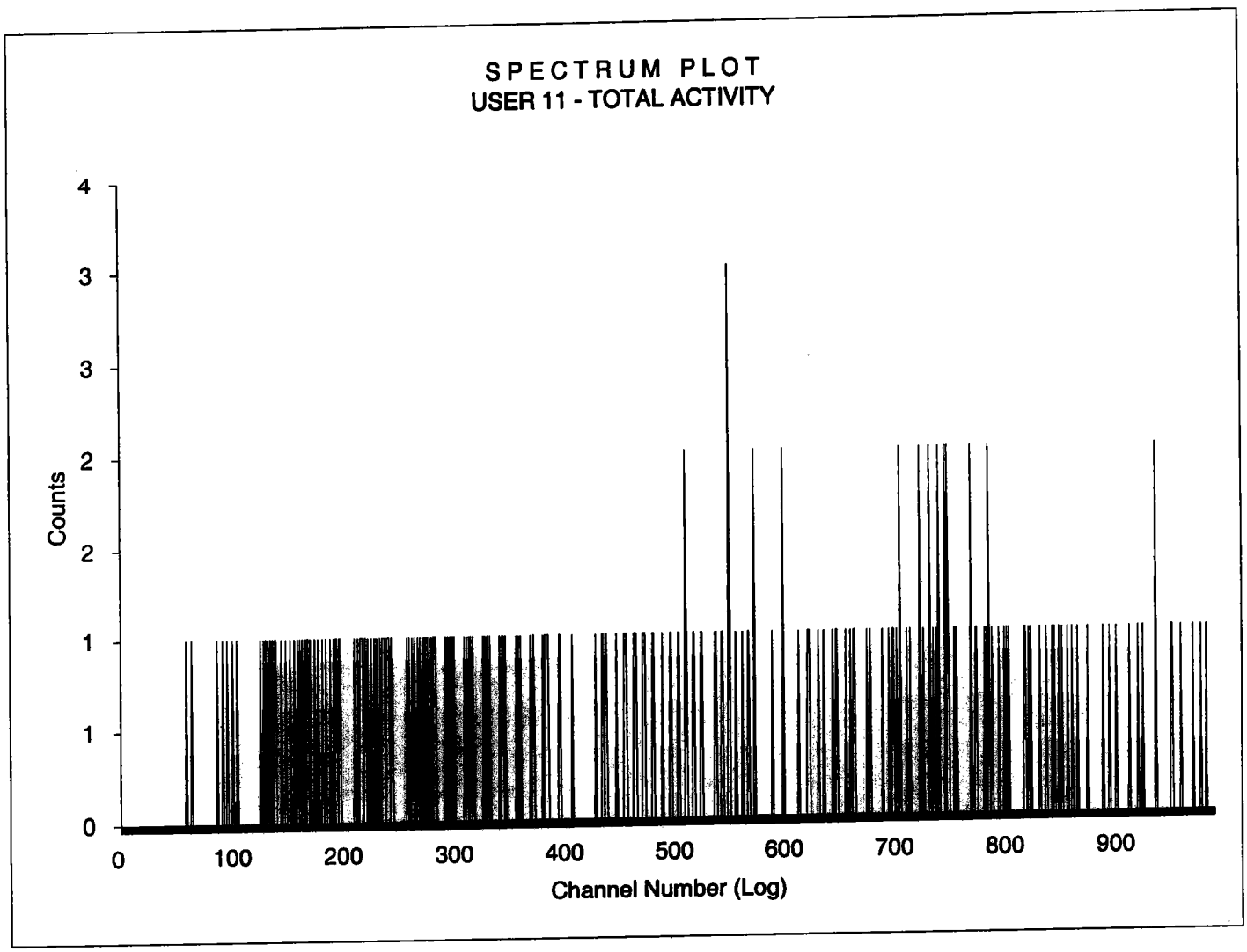
PRESET TIME :	5.00						
DATA CALC :	CPM	H# :YES	SAMPLE REPEATS:	1	PRINTER	: STD
COUNT BLANK :	NO	IC# : NO	REPLICATES :	1	RS232	:EDIT
TWO PHASE :	NO	AQC : NO	CYCLE REPEATS :	1	DISK	: OFF
SCINTILLATOR:	LIQUID	LUMEX:YES	LOW SAMPLE REJ:	0		
LOW LEVEL :	NO	HALF LIFE CORRECTION DATE:			none	

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

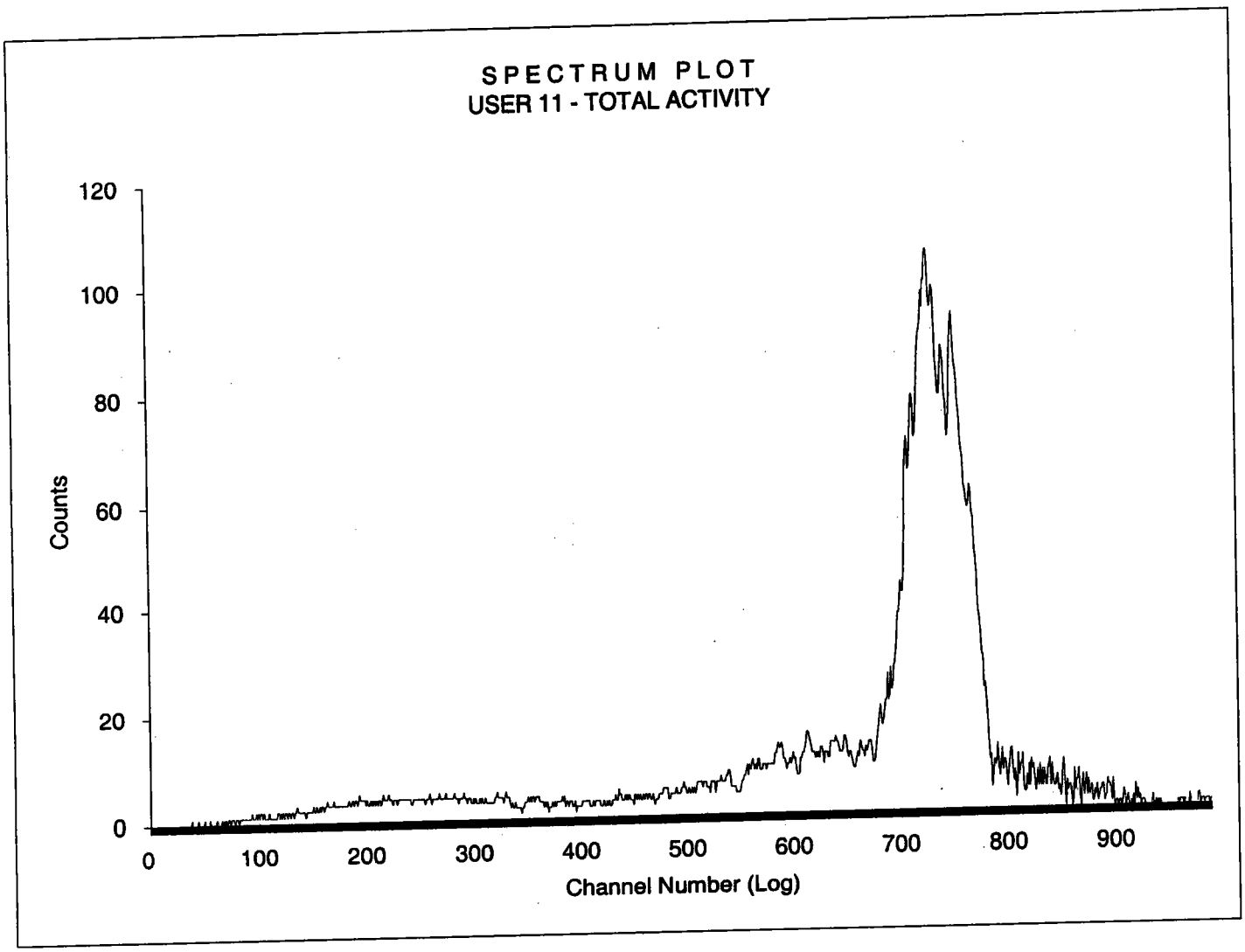
SAM NO	POS	TIME MIN	H#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
1	11-1	5.00	98.2	50.40	12.60	54.00	12.17	0.41	5.55
2	11-2	1.30	99.3	7802.31	1.99	7803.08	1.99	0.00	7.81
3	11-3	1.30	100.4	7782.31	1.99	7786.15	1.99	0.00	10.14
4	11-4	1.35	99.2	7581.48	1.98	7585.19	1.98	0.01	12.51
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

8/9/16

Sample Count Start Time:	16 Sep 2008 16:46:59		
Data Capture Date:	9/16/2008 16:52:01		
User Filename:	S11091611-5A.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:	5	11-5	5.00
H#, Total Counts:	97.9	69	
Start, End, X-Axis:	0	990	Channel Number

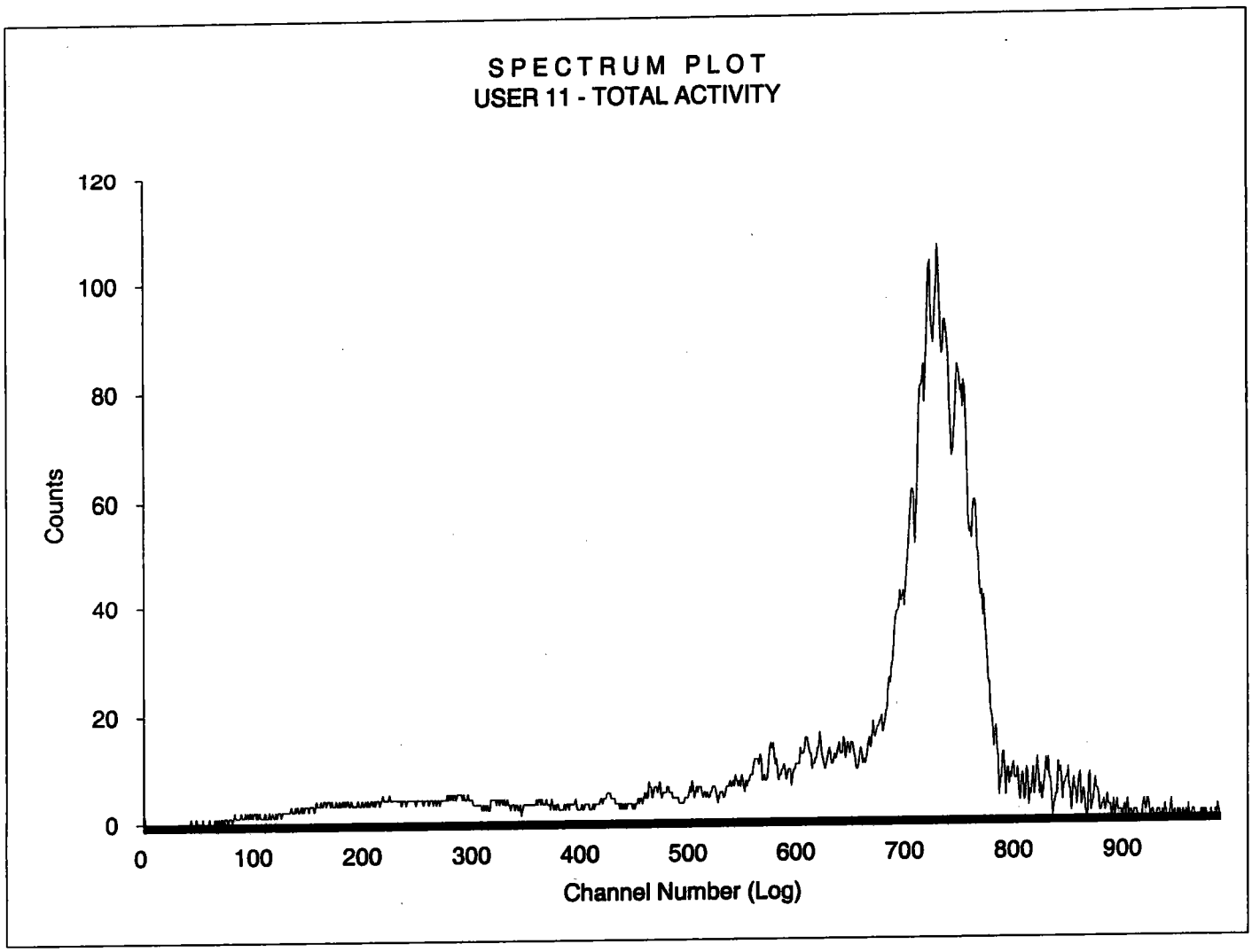


Sample Count Start Time:	16 Sep 2008 16:53:01		
Data Capture Date:	9/16/2008 16:58:06		
User Filename:	S11091611-6A.WK1		
	U11091611-1A.WK1		
Spectrum Type	Log Counts		
User Number:	11		
User Id:	TOTAL ACTIVITY		
User Comment:	GOLD		
Isotope Name:	14C		
Scintillator:	LIQUID		
Sample, Rack-Pos, Time:	6	11-6	5.00
H#, Total Counts:	110.7	7666	
Start, End, X-Axis:	0	990	Channel Number



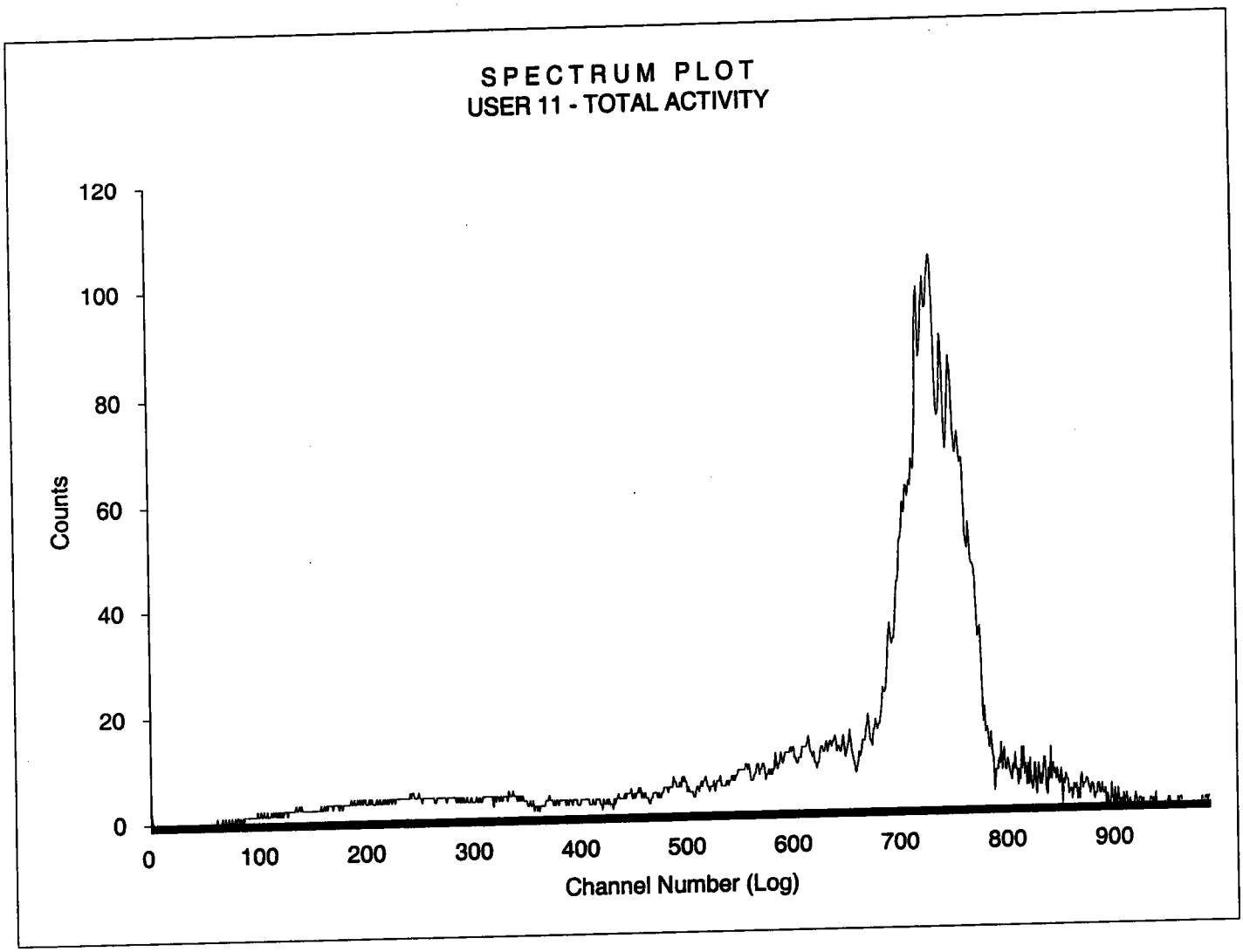
8/9/16

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



8/9/16

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



General Engineering Laboratories, Radiochemistry Division
06/30/2009

Radium-228 Que Sheet

JRS 6/30/09

Batch #: 881540 Analyst:DXM2 First Client Due Date: Internal Due Date07/03/2009 Ac-228 Ingrow: 2025 6/30/09

Spike Isotope: Radium-228 Spike Code: ~~0~~ NA Expiration Date: NA Vol: NA

LCS Isotope: Radium-228 LCS Code: 0503-B Expiration Date: 9/13/09 Vol: 2 Ac-228 Separation Date/Time: 7-2-09 0540

Tracer Isotope: Barium-133 Tracer Code: 0112-J Expiration Date: 2/17/10 Vol: 0.1 Witness: JRS 6/30/09

Prep Date: 6/30/09 Initials: JRS Pipet ID: 1734218 Balance ID: NA

Sample ID	Client Description	Type	Hazard Code	Min CRDL	Matrix	Client	Collect Date & Time	Pos. #	Vol (mL)	Det #	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	W2AL4
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		112.82	
1201872119-1	LCS for batch 881540	LCS		3 pCi/L	GROUND WATI	QC ACCOUNT	16-JUN-09 03:56 PM	8	20		111.91	

JR 7/2/09

Comments:

Data Reviewed By: 7/2/09

Instrument Used: (Circle One) PIC S/N: 10751-4

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

7/2/09

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: [signature] Date: 8/31/09

Reviewed By: [signature] 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	bkg 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
101	1.846	Average	1.956	cal 7	8/27/2009 16:35	8/27/2009 13:30	8/21/2009 11:30			4479	15	298.60	248.32	6.08333	0.12847	3544	0.9958
101	1.960	Stdev	0.107	cal 9	8/24/2009 14:20	8/24/2009 9:30	8/18/2009 13:40			4581	15	305.40	248.32	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	248.32	2.82639	0.22917	3538	0.9958
102	1.862	Average	1.855	cal 5	8/27/2009 15:50	8/27/2009 12:40	8/21/2009 10:50			4510	15	300.67	248.32	6.07639	0.13194	3544	0.9958
102	1.850	Stdev	0.006	cal 10	8/24/2009 14:45	8/24/2009 9:55	8/18/2009 13:40			4330	15	288.67	248.32	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	248.32	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	248.32	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	248.32	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	248.32	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	248.32	2.94444	0.20486	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	248.32	5.87500	0.20486	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	248.32	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	248.32	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	248.32	3.00694	0.20486	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	248.32	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	248.32	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	248.32	3.02083	0.21181	3541	0.9958
108	1.957			cla 6	8/21/2009 17:00	8/21/2009 11:15	8/18/2009 13:40			2846	15	189.73	248.32	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	248.32	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	248.32	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	248.32	2.90972	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	248.32	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	248.32	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	248.32	2.92708	0.23611	3538	0.9958

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

8/31/09

8/31/09

Voltage 1.10 = .900

* count time 15 min

Ra-226 Calibration Sheet

Standard ID: 0249-H
Volume Added (mL): 0.1
Expiration Date: 8/7/10

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 1	500	8/18/09 1340	8/21/09 0930	8/21/09 1500 ~~1230~~ 1410	101	1	~~3142~~ ~~0852~~ 2945
Cal 2	500	8/18/09 1340	8/21/09 0950	8/21/09 1520 ~~1305~~ 1425	102	1	~~2778~~ 2659
Cal 3	500	8/18/09 1340	8/21/09 1010	8/21/09 1550 1445	104	1	~~2182~~ 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	2546
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							

KD 8/31/09

KD 8/31/09

KD 8/31/09

Voltage - 0.9

Ra-226 Calibration Sheet

Standard ID: 0799-H
Volume Added (mL): 0.1
Expiration Date: 9/7/10

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 0930	8/24/09 ~~1735~~ 1420	101	1	~~4439~~ 4581
Cal 10	500	8/18/09 1340	8/24/09 0955	8/24/09 ~~1305~~ 1445	102	1	~~4477~~ 4330
Cal 11	500	8/18/09 1340	8/24/09 1015	8/24/09 ~~1405~~ 1515	104	1	4343
Cal 12	500	8/18/09 1340	8/24/09 1040	8/24/09 1535	106	1	4078
Cal 1	500	8/21/09 1050	8/24/09 1100	8/24/09 1555	107	1	3090
Cal 2	500	8/21/09 1050	8/24/09 1120	8/24/09 1625	108	1	2978
Cal 3	500	8/21/09 1050	8/24/09 1215	8/24/09 1700	111	1	3139
Cal 4	500	8/21/09 1050	8/24/09 1240	8/24/09 1715	112	1	3019
KP 8/31/09							

KP 8/31/09

KP 8/31/09

Voltage - 0.9

Ra-226 Calibration Sheet

Standard ID: D199-H
Volume Added (mL): 1.1
Expiration Date: 8/7/10

* 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 0935	8/27/09 1425	104	1	3070
Cal 2	500	8/24/09 1120	8/27/09 1000	8/27/09 1455	106	1	2940
Cal 3	500	8/24/09 1225	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	108	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

KD 8/27/09

KD 8/31/09

KD 8/31/09

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL-RAD-A-008

Date Standards Prepared: 4/5/05

Standard ID: 0299-H

Amount Used (g or ml): 0.1

Standard Activity (DPM/g or mL): 2483.2133

Reference Date: 12/15/99

Expiration Date: 8/1/10

Residue/Carrier Agent: 0.1M HCl

Isotope: RA-226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA / WA / NA

Type of Scintillation Vial: NA

Pipette ID Used: 1429303

Balance ID Used: B8081404

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			8/31/09	
7	cal 7		WA		
8	cal 8				
9	cal 9				
10	Cal 10				
11	Cal 11				
12	cal 12				
	WA 8/31/09				

Prepared By: [signature] Date: 8/31/09

Reviewed By: [signature] Date: 8/31/09

Rev 1 RLM 9/10/97

EEC 8-21-00

Nycomed Amersham plc
Amersham Laboratories

0299

[redacted]

CALIBRATION
No. 0148

[redacted]

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 Signatory

Date of issue 17th December 1999

VO 8130105

Nycomed

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

(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / (Dilution Vol) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / Density (g/mL)/ (Dilution Vol) = Parent Activity (dpm/g)
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (100 mL) = 122414.2500 dpm/mL
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (1.0012 g/mL) / (100 mL) = 122273.3377 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

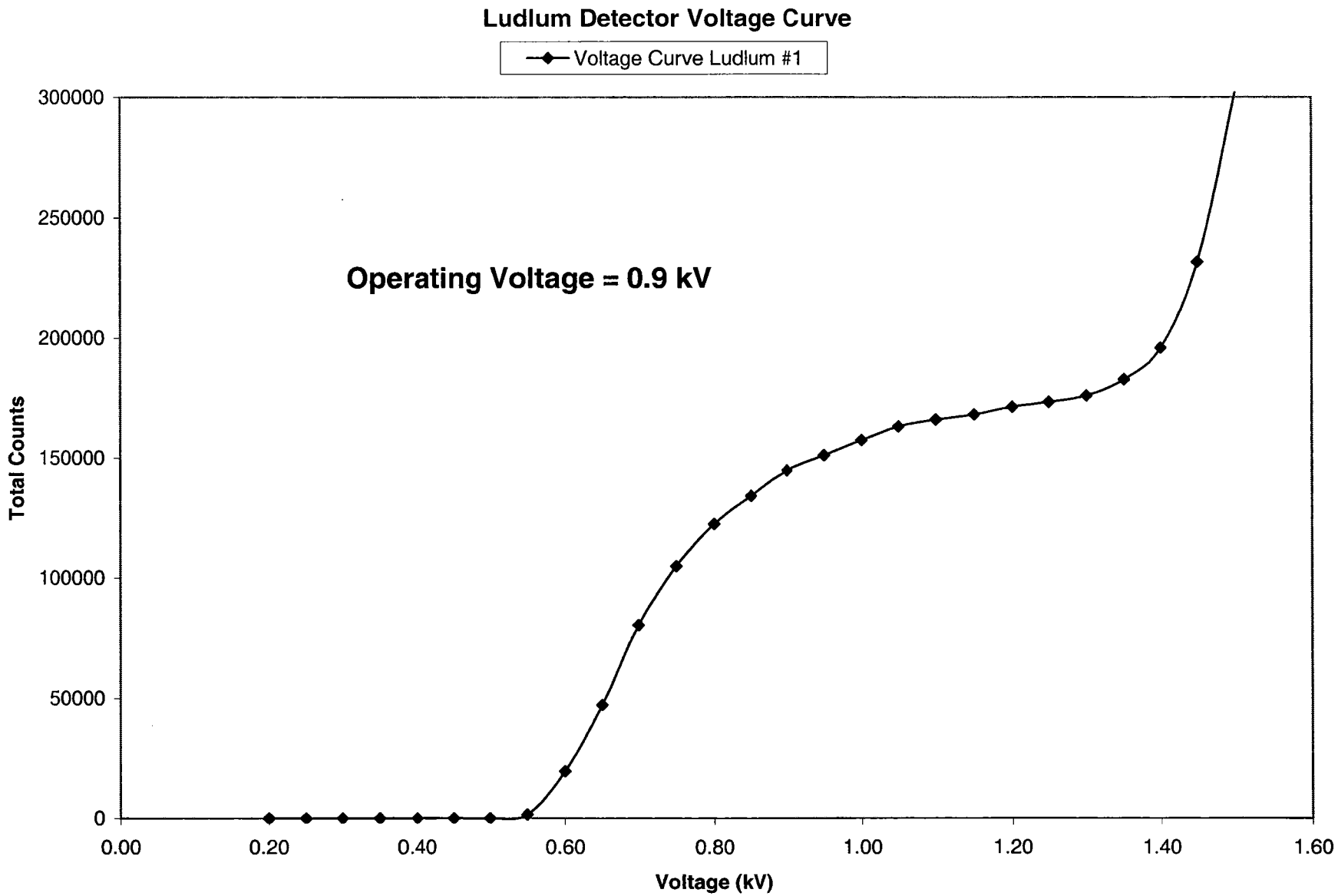
VO 8/13/09

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

8/31/09


Ludlum Detector Voltage Curve
Voltage Curve Ludlum #1
Operating Voltage = 0.9 kV
Total Counts
300000
250000
200000
150000
100000
50000
0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Voltage (kV)

8/31/09

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**
	Detector #1
Upper Limit	**143282**
Lower Limit	**132629**

* Operating Voltage changed to 0.9 kV

8/31/09

	Eff	Cal Date
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

Lucas	Ra-226	
Oldest Cal	01/23/2008	
Detector	**Eff Error**	**Cal Date**
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
Bkg Count Time: 30 min

Procedure Code : LUC26RAL
Parmname : Radium-226
MDA : 1 pCi/L
Instrument Used : LUCAS CELL DETECTOR

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

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 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

JH 8/31/09

063584 CAP: 7/17/10

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
~~Ver 1~~	~~500~~	~~8/25/09 1600~~	~~8/28/09 0955~~	~~8/28/09 1310~~	~~101~~	~~1~~	~~8~~	~~525~~
Ver 2	500	8/25/09 1600	8/28/09 1020	8/28/09 1400	104	1	8	656
Ver 3	500	8/25/09 1600	8/28/09 1040	8/28/09 1435	111	1	8	672
Ver 4	500	8/25/09 1600	8/28/09 1100	8/28/09 1510	112	1	8	631
~~Ver 5~~	~~500~~	~~8/25/09 1600~~	~~8/28/09 1120~~	~~8/28/09 1540~~	~~106~~	~~1~~	~~8~~	~~678~~
~~Ver 6~~	~~500~~	~~8/25/09 1600~~	~~8/28/09 1140~~	~~8/28/09 1610~~	~~102~~	~~1~~	~~4~~	~~654~~
Ver 7	500	8/25/09 1600	8/28/09 1200	8/28/09 ~~1650~~ 1750	8/28/09 107	1	8	629
~~Ver 8~~	~~500~~	~~8/25/09 1600~~	~~8/28/09 1305~~	~~8/28/09 1820~~	~~108~~	~~1~~	~~8~~	~~736~~
Ver 2	500	8/28/09 1020	8/31/09 1110	8/31/09 1435	101	1	8	689
Ver 3	500	8/28/09 1040	8/31/09 1130	8/31/09 1505	102	1	4	697
Ver 4	500	8/28/09 1100	8/31/09 1155	8/31/09 1540	106	1	8	638
Ver 5	500	8/28/09 1120	8/31/09 1215	8/31/09 1615	108	1	8	693

8/31/09

8/31/09

8/31/09

8/31/09

8/31/09

8/31/09

8/31/09

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL-RAD-A 008

Date Standards Prepared: 7/23/08

Standard ID: 0638-H

Amount Used (g or mL): 0.1

Standard Activity (DPM/g or mL): ~~66.4108~~ 268.8845 KD 8/31/09

Reference Date: 1/23/04

Expiration Date: 7/17/10

Residue/Carrier Agent: NA

Isotope: Ra-226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA

NA

NA

Type of Scintillation Vial: NA

Pipette ID Used: 1429303

Balance ID Used: 38080204

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				

KD 8/31/09

Prepared By: Kelli S Dawson Date: 8/31/09

Reviewed By: [signature] 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: γ-impurities (other than decay products) <0.1%

5.01065 grams 0.1M HCl solution with 50 µg/g Ba carrier.

P O NUMBER 3231RD, Item 5

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

Q A APPROVED: 1/26/04

WO 873105

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	
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

(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / (Ampoule Mass(g) *(Dilution Vol)) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / Density / (Ampoule Mass (g) * (Dilution Vol)) = Parent Activity (dpm/g)
(4.8398 g) * (23530 dps) * (60 dpm/dps) / (5.01065 g * 100 mL) = 13636.6133 dpm/mL
(4.8398 g) * (23530 dps) * (60 dpm/dps) / (1.0266 g/mL)/ (5.01065 g * 100 mL) = 13282.9676 dpm/g

8/31/09

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

KW 8/31/09

Verification for Ra-226 Standard 0638-H

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

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

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 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 Dowell Date: 12/19/08

Reviewed By: [signature] Date: 12/19/08

Effective Date: 12/19/08

Ra-226 Cell Constants

NLD 12/19/08

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	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
201	2.021	Average	1.993	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	Stdev	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	Stdev	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	10/13/2008 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	Stdev	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	0.44792	3208	0.9962
204	2.184	Average	2.193	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	Stdev	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	9/26/2008 9:45	0.133	7535	30	251.17	243.02	3.97569	0.20486	3213	0.9962
205	1.677	Average	1.799	Cal 13	10/21/2008 8:30	10/20/2008 14:05	10/13/2008 16:00	0.267	7584	30	252.80	243.02	6.92014	0.76736	3233	0.9962
205	1.730	Stdev	0.167	Cal 44	9/18/2008 16:00	9/18/2008 10:05	9/15/2008 10:55	0.167	4999	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	9/26/2008 9:45	0.167	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	0.40625	3198	0.9962
206	2.293	Stdev	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	9/26/2008 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	6094	30	203.13	243.02	2.93750	0.40972	3198	0.9962
207	2.141	Stdev	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	2.95139	0.30208	3201	0.9962
207	2.110			Cal 36	9/30/2008 16:00	9/30/2008 10:45	9/26/2008 9:45	0.233	7656	30	255.20	243.02	4.04167	0.21875	3213	0.9962
~~208~~	~~2.239~~	~~Average~~	~~2.283~~	~~Cal 30~~	~~9/15/2008 22:15~~	~~9/15/2008 12:15~~	~~9/12/2008 13:20~~	~~0.267~~	~~6258~~	~~30~~	~~208.60~~	~~243.02~~	~~3.95486~~	~~0.41667~~	~~3198~~	~~0.9962~~
~~208~~	~~2.243~~	~~Stdev~~	~~0.135~~	~~Cal 30~~	~~9/18/2008 18:30~~	~~9/18/2008 11:00~~	~~9/15/2008 10:15~~	~~0.133~~	~~6374~~	~~30~~	~~212.47~~	~~243.02~~	~~2.94792~~	~~0.81250~~	~~3201~~	~~0.9962~~
~~208~~	~~2.116~~			~~Cal 30~~	~~9/30/2008 18:35~~	~~9/30/2008 11:10~~	~~9/26/2008 9:45~~	~~0.333~~	~~7681~~	~~30~~	~~256.03~~	~~243.02~~	~~4.05990~~	~~0.99560~~	~~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	Stdev	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	9/26/2008 9:45	0.100	8795	30	293.17	243.02	4.07986	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	6665	30	222.17	243.02	3.03819	0.37500	3198	0.9962
210	2.210	Stdev	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	0.34375	3201	0.9962
210	2.230			Cal 47	9/30/2008 18:00	9/30/2008 12:05	9/26/2008 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	3.04861	0.38889	3198	0.9962
211	2.238	Stdev	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	0.40625	3201	0.9962
211	2.136			Cal 37	9/30/2008 18:30	9/30/2008 13:35	9/26/2008 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	9/16/2008 0:20	9/15/2008 14:50	9/12/2008 13:20	0.033	6926	30	230.87	243.02	3.06250	0.39583	3198	0.9962
212	2.315	Stdev	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	9/26/2008 9:45	0.267	8287	30	276.23	243.02	4.17708	0.24306	3213	0.9962

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	9/22/08 1000	9/25/08 0915	9/25/08 1935	201	2	0	5361
~~Cal 13~~	~~500~~	~~9/22/08 1000~~	~~9/25/08 0950~~	~~9/25/08 2010~~	~~202~~	~~2~~	~~0~~	~~5845~~
Cal 43	500	9/22/08 1000	9/25/08 1015	9/25/08 2100	203	2	0	6298
Cal 15	500	9/22/08 1000						
Cal 44	500	9/22/08 1000						
Cal 46	500	9/22/08 1000						
Cal 36	500	9/22/08 1000						
Cal 30	500	9/22/08 1000						
Cal 19	500	9/22/08 1000						
Cal 47	500	9/22/08 1000						
Cal 37	500	9/22/08 1000						
Cal 42	500	9/22/08 1000						

KCD 12/18/08

KCD 12/18/08

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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
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
~~Cal 44~~	~~500~~	~~9/12/08 1320~~	9/15/08 1055	9.15.08 1805	~~205~~	~~2~~	5	6132
Cal 46	500	9/12/08 1320	9/15/08 1125	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
~~Cal 30~~	500	9/12/08 1320	9/15/08 1215	9.15.08 2215	~~208~~	~~2~~	8	6258
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

KD 12/18/08

KD 12/19/08

KD 12/18/08

KD 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
15	500	9/26/08 0945	9/30/08 0910	9/30/08 1405	204	2	4	7535
44	500	9/26/08 0945	9/30/08 0940	9/30/08 1445	205	2	5	7170
46	500	9/26/08 0945	9/30/08 1015	9/30/08 1520	206	2	8	8125
36	500	9/26/08 0945	9/30/08 1015	9/30/08 1600	207	2	7	7656
~~30~~	~~500~~	~~9/26/08 0945~~	~~9/30/08 1110~~	~~9/30/08 1635~~	~~208~~	~~2~~	~~1~~	~~7681~~
19	500	9/26/08 0945	9/30/08 1140	9.30.08 1725	209	2	3	8795
47	500	9/26/08 0945	9/30/08 1205	9.30.08 1800	210	2	1	8116
37	500	9/26/08 0945	9/30/08 1335	9.30.08 1830	211	2	3	7917
42	500	9/26/08 0945	9/30/08 1400	9.30.08 1950	212	2	8	8287

KW 12/19/08

KW 12/18/08

KW 12/19/08

KW 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	9/15/08 0905	9/18/08 0810	9/18/08 1300	201	2	8	5949
cal 13	500	9/15/08 0935	9/18/08 0845	9/18/08 1350	202	2	8	6425
Cal 43	500	9/15/08 1000	9/18/08 0915	9/18/08 1425	203	2	8	6413
cal 15	500	9/15/08 1030	9/18/08 0935	9/18/08 1455	204	2	8	6671
cal 44	500	9/15/08 1055	9/18/08 1005	9/18/08 1600	205	2	5	4999
Cal 46	500	9/15/08 1125	9/18/08 1025	9/18/08 1635	206	2	8	6604
Ca136	500	9/15/08 1150	9/18/08 1040	9/18/08 1755	207	2	8	6105
~~Cal30~~	~~500~~	9/15/08 1215	9/18/08 1100	9/18/08 1830	208	2	4	6374
Cal 19	500	9/15/08 1350	9/18/08 1115	9/18/08 1915	209	2	2	6170
Cal 47	500	9/15/08 1415	9/18/08 1130	9/18/08 1945	210	2	3	6142
Cal 37	500	9/15/08 1430	9/18/08 1235	9/18/08 2220	211	2	4	6207
Ca142	500	9/15/08 1450	9/18/08 1250	9/18/08 2255	212	2	8	6405
				KD 12/18/08				

KD 12/19/08

KD 12/19/08

KD 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	10/13/08 1600	10/20/08 1345	10.21.08 ~~10/20/08~~ 13:50	202	2	8	9248
13	500	10/13/08 1600	10/20/08 1405	10/21/08 0830	205	2	8	1584
43								
44								
15								
36								
46								
30								
19								
47								
37				LCO 12/18/08				
42								

LCO 12/19/08
Reviewed 12/19/08

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		**104.944421**	**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	**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:

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

4/10/08

4/9/08

4/10/08

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:	

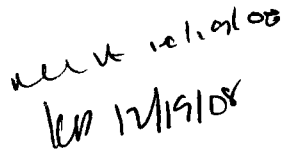
Calculations Converting parent activity to dpm/mL|dpm/g

(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / (Dilution Vol) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / Density (g/mL)/ (Dilution Vol) = Parent Activity (dpm/g)
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (100 mL) = 122414.2500 dpm/mL
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (1.0012 g/mL) / (100 mL) = 122273.3377 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



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: 0299-G

Matrix of Vial/Planchett: NA / NA / NA

Amount Used (g or (ml)): 0.1

Standard Activity (DPM/g or (mL)): 1446.347

Type of Scintillation Vial: NA

Reference Date: 4/15/99

Pipette ID Used: 1429303

Expiration Date: 4/2/09

Balance ID Used: 36040216

Residue/Carrier Agent: 0.5 M HCl

Quenching Agent: NA

	Standard Number	Quenching Vol (uL)/ Residue Volume(mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
14	Cal14				
13	Cal13				
43	Cal43				
15	Cal15				
44	Cal44				
46	Cal46				
36	Cal36				
19	Cal19				
47	Cal47				
37	Cal37				
42	Cal42				

Prepared By: Kelli S Dermody Date: 12/19/08

Reviewed By: [signature] Date: 12/19/08

Rev 1 RLM 9/10/97

0299

[redacted]

UKAS ACCREDITED CALIBRATION LABORATORY No. 0146

ement

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.

acy

Expanded uncertainty in the radioactive concentration quoted above: ± 2.5 %

Combined Type A uncertainty: ± 0.2 %
Combined Type B uncertainty: ± 1.3 %

onuclidic

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.

tical
position

Carrier free in 0.5M HCl

arks

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.

MCR 12/19/08
KD 12/19/08

ver 11-08

Ra-226 WATER

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

Procedure Code : LUC26RAL
Parmname : Radium-226
MDA : 1 pCi/L
Bkg Count Time: 30 min
Instrument Used : LUCAS CELL DETECTOR

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~~	~~533~~	~~**208**~~	~~**2.283**~~	~~0.267~~	~~0.5132~~	~~**16.9552**~~	~~1.4723~~	~~11/20/2008 16:40~~ KD
VER 9	0.500	30	630	**209**	**2.291**	0.133	0.4042	**21.0513**	1.6596	10/30/2008 23:40 12/19/08
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

LL CA 12/19/08
KD 12/19/08

ver 11-08

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%~~
209		2	10/30/2008 14:05	LCS	0638-F	24.10	pCi/L	87%
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%

KD 12/18/08

DEGASSING DATE/TIME	DE-EMAN. DATE/TIME	DEGASS-DE-EM	dE-EM-COUNT	constant	constant	constant	Net CPM 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~~	~~17.5000~~	~~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

KD 12/18/08

NVA 12/19/08
KD 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
VER 1	500	~~11/10/08 1535~~ ~~10/30/08 1430~~ 11/10/08	11/17/08 1020	11/17/08 1510	201	2	8	1014
2	500	11/10/08 1535	11/17/08 1045	11/17/08 1545	202	2	8	1056
3	500	11/10/08 1535	11/17/08 1110	11/17/08 1620	205	2	8	937
4	500	11/10/08 1535	11/17/08 1135	~~11.17.08 2050~~	~~208~~	~~2~~	~~8~~	~~786~~
5	500	11/10/08 1535	11/17/08 1150	11.17.08 2120	209	2	8	1200
6	500	11/10/08 1535	11/17/08 1220	11.17.08 2155	211	2	8	1067
~~7~~	~~500~~	~~11/10/08 1535~~	~~11/17/08 0845~~	~~11/17/08 1330~~	~~702~~	~~1~~	~~8~~	~~982~~
8	500	11/10/08 1535	11/17/08 0900	~~11/17/08 1405~~	~~708~~	~~7~~	~~8~~	~~1164~~
9	500	~~11/10/08 1535~~	11/17/08 0930	11/17/08 1435	705	7	8	1122
10								
11								
12			12/1/08					
~~VER 3~~	500	~~11/17/08 1110~~	~~11/20/08 1145~~	~~11/20/08 1640~~	~~208~~	~~2~~	~~8~~	~~533~~
							12/1/08	

12/18/08

12/18/08

12/18/08

12/18/08

11/21/08

12/19/08

12/19/08

12/19/08

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	
~~Ver 1~~	~~500~~	~~10/27/08 1420~~	~~10/30/08 0945~~	10/30/08 1500	201	2	6	~~752~~	KO 12/18/08
~~Ver 2~~	~~500~~	~~10/27/08 1420~~	10/30/08 1005	10/30/08 1535	202	2	8	~~789~~	KO 12/18/08
Ver 3	500	10/27/08 1420	10/30/08 1105	10/30/08 1605	203 ~~204~~	2	8	726	
Ver 4	500	10/27/08 1420	10/30/08 1230	10/30/08 1820	KO 10/31/08 ~~203~~ 204	2	8	737	
~~Ver 5~~	~~500~~	~~10/27/08 1420~~	~~10/30/08 1250~~	10/30/08 1900	205	2	6	~~663~~	KO 12/18/08
Ver 6	500	10/27/08 1420	10/30/08 1310	10/30/08 2020	206	2	8	780	
Ver 7	500	10/27/08 1420	10/30/08 1325	10/30/08 2200	207	2	8	711	
~~Ver 8~~	~~500~~	10/27/08 1420	10/30/08 1345	10/30/08 2300	208	2	4	~~497~~	KO 12/18/08
Ver 9	500	10/27/08 1420	10/30/08 1405	10/30/08 2340	209	2	4	630	
Ver 10	500	10/27/08 1420	10/30/08 1425	10/31/08 0115	210	2	1	691	
~~Ver 11~~	~~500~~	10/27/08 1420	10/30/08 1440	10/31/08 0835	211	2	3	~~723~~	KO 12/18/08
Ver 12	500	10/27/08 1420	10/30/08 1455	10/31/08 0915	212	2	4	648	

KO 12/19/08

KO 12/19/08

Verification for Ra-226 Standard 0638-F

D Roy
12/27/2007

	Isotope	Detector CPM	BKG CPM	NET CPM	Detector Eff	Standard Mass. Used (mL)	Source DPM/mL
	0638-F N1	1239.9000	31.5000	1208.4000	4.624018	1.0000	261.3311626
	0638-F N2	1222.8000	31.5000	1191.3000	4.624018	1.0000	257.6330801
	0638-F N3	1219.4000	31.5000	1187.9000	4.624018	1.0000	256.8977889
						Average =	258.6206772
Mean Value (Counting) =	258.6206772		**96.8384646**	**Pass**			
Stdev =	2.375965421		0.00918707	**Rule 3 (Pass/Fail)**			
Certificate Value =	267.1						
Lower Limit =	253.8687464						
Upper Limit =	263.3726081						
Rule 1 Pass/Fail	**Fail**	'exception taken due to full recovery of standard					
Two sigma =	4.751930843						
10 % of Mean =	25.86206772						
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 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:

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

LW 12/19/08

1/4/07

Amanda L. Tech 1/4/07

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL-RAD-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

Standard Activity (DPM/g or mL): 167.519

Type of Scintillation Vial: NA

Reference Date: 1/23/04

Pipette ID Used: 1425303

Expiration Date: 12/2008

Balance ID Used: 3604046

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	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

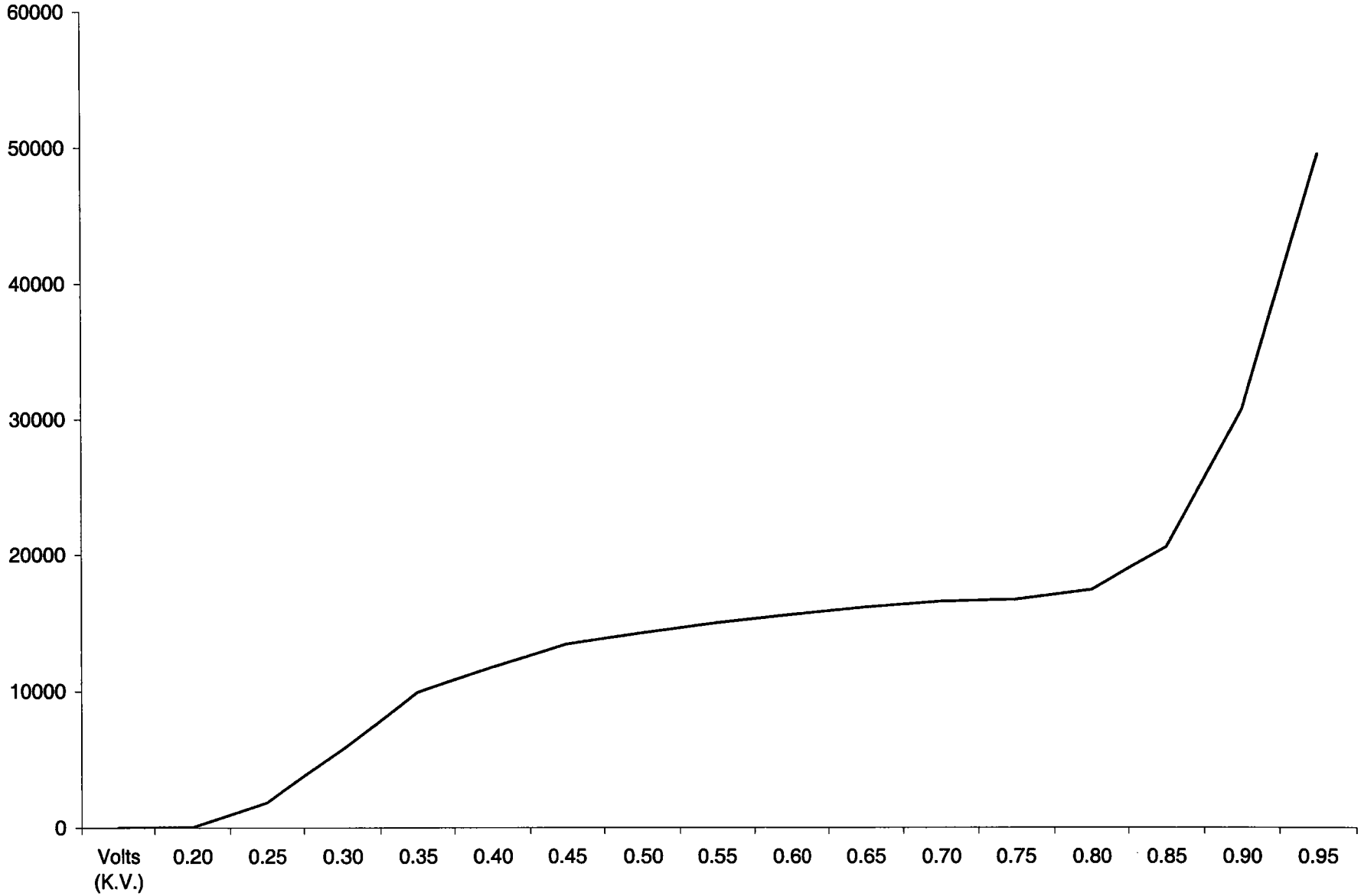
Prepared By: Kelli Dienel Date: 12/19/08

Reviewed By: Mary Griffiths Date: 12/19/08

Rev 1 RLM 9/10/97

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
12/19/08



12/19/08
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

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 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 Darnell Date: 2/3/09

Reviewed By: [signature] 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	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	1.867	Average	2.021	43	1/20/2009 11:05	1/19/2009 10:10	1/9/2009 15:45	0.267	9355	30	311.83	243.67	9.76736	1.03819	3324	0.9961
301	2.184	Stdev	0.159	43	1/29/2009 11:50	1/29/2009 8:50	1/26/2009 13:00	0.267	6239	30	207.97	243.67	2.82639	0.12500	3333	0.9961
301	2.011			43	1/26/2009 14:35	1/26/2009 9:25	1/22/2009 9:10	0.267	7282	30	242.73	243.67	4.01042	0.21528	3331	0.9961
302	2.082	Average	2.131	13	1/30/2009 11:30	1/30/2009 8:30	1/26/2009 13:00	0.267	7401	30	246.70	243.67	3.81250	0.12500	3334	0.9961
302	2.225	Stdev	0.082	47	1/29/2009 13:30	1/29/2009 9:20	1/26/2009 13:00	0.233	6335	30	211.17	243.67	2.84722	0.17361	3334	0.9961
302	2.086			47	1/26/2009 15:30	1/26/2009 9:55	1/22/2009 9:10	0.267	7555	30	251.83	243.67	4.03125	0.23264	3331	0.9961
303	1.958	Average	2.136	19	1/20/2009 13:40	1/19/2009 11:00	1/9/2009 15:45	0.267	9695	30	323.17	243.67	9.80208	1.11111	3325	0.9961
303	2.218	Stdev	0.154	19	1/22/2009 20:35	1/22/2009 10:05	1/19/2009 15:00	0.267	5938	30	197.93	243.67	2.79514	0.43750	3327	0.9961
303	2.231			19	1/26/2009 17:20	1/26/2009 10:25	1/22/2009 9:10	0.267	8028	30	267.60	243.67	4.05208	0.28819	3331	0.9961
305	1.897	Average	2.057	42	1/20/2009 14:50	1/19/2009 11:35	1/9/2009 15:45	0.200	9357	30	311.90	243.67	9.82639	1.13542	3325	0.9961
305	2.191	Stdev	0.149	42	1/22/2009 21:50	1/22/2009 11:05	1/19/2009 15:00	0.267	5921	30	197.37	243.67	2.83681	0.44792	3327	0.9961
305	2.083			42	1/26/2009 23:00	1/26/2009 11:20	1/22/2009 9:10	0.267	7280	30	242.67	243.67	4.09028	0.48611	3331	0.9961
306	1.730	Average	1.747	44	1/20/2009 15:20	1/19/2009 11:50	1/9/2009 15:45	0.167	8521	30	284.03	243.67	9.83681	1.14583	3325	0.9961
306	1.691	Stdev	0.067	30	1/29/2009 14:30	1/29/2009 10:20	1/26/2009 13:00	0.233	4869	30	162.30	243.67	2.88889	0.17361	3334	0.9961
306	1.821			44	1/26/2009 23:30	1/26/2009 11:50	1/22/2009 9:10	0.267	6387	30	212.90	243.67	4.11111	0.48611	3331	0.9961
307	1.818	Average	1.931	15	1/20/2009 15:50	1/19/2009 12:05	1/9/2009 15:45	0.267	8944	30	298.13	243.67	9.84722	1.15625	3325	0.9961
307	2.095	Stdev	0.145	36	1/30/2009 12:55	1/30/2009 9:10	1/26/2009 13:00	0.267	7442	30	248.07	243.67	3.84028	0.15625	3335	0.9961
307	1.881			15	1/27/2009 0:05	1/26/2009 12:10	1/22/2009 9:10	0.267	6598	30	219.93	243.67	4.12500	0.49653	3331	0.9961
308	2.129	Average	1.950	44	1/29/2009 15:50	1/29/2009 11:05	1/26/2009 13:00	0.133	6149	30	204.97	243.67	2.92014	0.19792	3334	0.9961
308	1.858	Stdev	0.155	14	1/23/2009 9:35	1/22/2009 13:45	1/19/2009 15:00	0.267	4829	30	160.97	243.67	2.94792	0.82639	3327	0.9961
308	1.862			14	1/27/2009 8:30	1/26/2009 13:15	1/22/2009 9:10	0.267	6226	30	207.53	243.67	4.17014	0.80208	3331	0.9961
309	1.857	Average	1.877	13	1/20/2009 17:20	1/19/2009 13:35	1/9/2009 15:45	0.033	9149	30	304.97	243.67	9.90972	1.15625	3325	0.9961
309	1.964	Stdev	0.079	13	1/23/2009 10:30	1/22/2009 14:05	1/19/2009 15:00	0.267	5100	30	170.00	243.67	2.96181	0.85069	3327	0.9961
309	1.810			13	1/27/2009 9:05	1/26/2009 13:30	1/22/2009 9:10	0.267	6046	30	201.53	243.67	4.18056	0.81597	3331	0.9961
311	2.140	Average	2.114	15	1/29/2009 16:40	1/29/2009 11:20	1/26/2009 13:00	0.267	6176	30	205.87	243.67	2.93056	0.22222	3334	0.9961
311	2.212	Stdev	0.114	28	1/23/2009 12:20	1/22/2009 14:25	1/19/2009 15:00	0.267	5698	30	189.93	243.67	2.97569	0.91319	3328	0.9961
311	1.988			28	1/27/2009 10:15	1/26/2009 13:45	1/22/2009 9:10	0.267	6607	30	220.23	243.67	4.19097	0.85417	3331	0.9961
312	1.871	Average	1.944	36	1/20/2009 19:16	1/19/2009 14:10	1/9/2009 15:45	0.100	9135	30	304.50	243.67	9.93403	1.21250	3325	0.9961
312	2.014	Stdev	0.071	14	1/29/2009 17:10	1/29/2009 11:35	1/26/2009 13:00	0.167	5814	30	193.80	243.67	2.94097	0.23264	3334	0.9961
312	1.946			36	1/27/2009 11:10	1/26/2009 14:00	1/22/2009 9:10	0.267	6446	30	214.87	243.67	4.20139	0.88194	3331	0.9961

KD 2/3/09

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	11/26/09 1300	11/30/09 0830	11/30/09 1130	302	3	8	7401
~~Cal 28~~	~~500~~	~~11/26/09 1300~~	~~11/30/09 0855~~	~~11/30/09 1200~~	~~304~~	~~3~~	~~8~~	~~7101~~
Cal 36	500	11/26/09 1300	11/30/09 0910	11/30/09 1255	307	3	8	7442

KD 2/3/09

1/3/09

KD 2/3/09

MCA 2/4/09

KD 2/3/09

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 43	500	1/26/09 1300	1/29/09 0850	1/29/09 1150	301	3	8	6239	
Cal 47	500	1/26/09 1300	1/29/09 0920	1/29/09 1330	302	3	7	6335	
~~Cal 19~~	~~500~~	~~1/26/09 1300~~	~~1/29/09 0950~~	~~1/29/09 1400~~	~~304~~	~~3~~	~~2~~	~~6472~~	
Cal 130	500	1/26/09 1300	1/29/09 1020	1/29/09 1430	306	3	7	4869	LW 2/3/09
~~Cal 42~~	~~500~~	~~1/26/09 1300~~	~~1/29/09 1045~~	~~1/29/09 1515~~	~~307~~	~~3~~	~~3~~	~~6668~~	LW 2/3/09
Cal 144	500	1/26/09 1300	1/29/09 1105	1/29/09 1550	308	3	4	6149	
Cal 15	500	1/26/09 1300	1/29/09 1120	1/29/09 1640	311	3	8	6176	
Cal 14	500	1/26/09 1300	1/29/09 1135	1/29/09 1710	312	3	5	5814	
Cal 13	500	1/26/09 1300							
Cal 28	500	1/26/09 1300							
Cal 36	500	1/26/09 1300							
Cal 37	500	1/26/09 1300							
				LW 2/3/09					

KD 2/3/09

M.A 2/4/09

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	1/9/09 1545	1/19/09 1010	1/20/09 1105	301	3	8	9355	
~~Cal 47~~	~~500~~	~~1/9/09 1545~~	~~1/19/09 1040~~	~~1/20/09 1150~~	~~302~~	~~3~~	~~8~~	~~8933~~	KD 2/3/09
Cal 19	500	1/9/09 1545	1/19/09 1100	1/20/09 1340	303	3	8	9695	
~~Cal 30~~	~~500~~	~~1/9/09 1545~~	~~1/19/09 1120~~	~~1/20/09 1420~~	~~304~~	~~3~~	~~8~~	~~7630~~	KD 2/3/09
Cal 42	500	1/9/09 1545	1/19/09 1135	1/20/09 1450	305	3	5	9357	
Cal 44	500	1/9/09 1545	1/19/09 1150	1/20/09 ~~1420~~ 1520 KD 1/20/09	306	3	7	8521	
Cal 15	500	1/9/09 1545	1/19/09 1205	1/20/09 1550	307	3	8	8944	
~~Cal 14~~	~~500~~	~~1/9/09 1545~~	~~1/19/09 1315~~	~~1/20/09 1645~~	~~308~~	~~3~~	~~3~~	~~6938~~	KD 2/3/09
Cal 13	500	1/9/09 1545	1/19/09 1335	1/20/09 1720	309	3	1	9149	
~~Cal 28~~	~~500~~	~~1/9/09 1545~~	~~1/19/09 1355~~	~~1/20/09 1840~~	~~311~~	~~3~~	~~8~~	~~8648~~	KD 2/3/09
Cal 36	500	1/9/09 1545	1/19/09 1410	1/20/09 1916	312	3	1	9135	
~~Cal 37~~	~~500~~	~~1/9/09 1545~~							

KD 2/3/09

KD 2/3/09 MLA 2/4/09

Cal for #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	
~~Cal 43~~	~~500~~	~~11/19/09 1500~~	~~11/22/09 0910~~	~~11/23/09 1525~~	~~301~~	~~3~~	~~8~~	~~6408~~	KD 2/3/09
~~Cal 44~~	~~500~~	~~11/19/09 1500~~	~~11/22/09 0935~~	11/22/09 1605	302	3	8	6493	KD 2/3/09
Cal 29	500	11/19/09 1500	11/22/09 1005	1.22.09 2035	303	3	8	5938	
Cal 30	500	11/19/09 1500	11/22/09 1035	1.22.09 2120	~~304~~	~~3~~	~~8~~	~~5240~~	KD 2/3/09
Cal 42	500	11/19/09 1500	11/22/09 1105	11/22/09 2150	305	3	8	5921	
~~Cal 44~~	500	~~11/19/09 1500~~	~~11/22/09 1135~~	~~11/23/09 0830~~	~~306~~	~~3~~	~~8~~	~~5393~~	KD 2/3/09
Cal 15	500	~~11/19/09 1500~~	~~11/22/09 1320~~	11/23/09 0950	~~307~~	~~3~~	~~8~~	~~5870~~	KD 2/3/09
Cal 14	500	11/19/09 1500	11/22/09 1345	11/23/09 0935	308	3	8	4826	
Cal 13	500	11/19/09 1500	11/22/09 1405	11/23/09 1030	309	3	8	5100	
Cal 28	500	11/19/09 1500	11/22/09 1425	11/23/09 1220	311	3	8	5698	
~~Cal 36~~	500	~~11/19/09 1500~~	11/22/09 1440	~~11/23/09 1315~~	~~312~~	~~3~~	~~8~~	5881	KD 2/3/09
~~Cal 27~~	500	11/19/09 1500	11/22/09						
					KD 2/3/09				KD 2/3/09 RLA 2/4/09

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
Cal 43	500	11/22/09 0910	11/26/09 0925	11/26/09 1455	301	3	0	7282
Cal 47	500	11/22/09 0910	11/26/09 0955	11/26/09 1530	302	3	0	1555
Cal 19	500	11/22/09 0910	11/26/09 1025	11/26/09 1610 1720	303	3	0	8028
~~Cal 30~~	~~500~~	~~11/22/09 0910~~	11/26/09 1050	~~1.26.09 1645~~	~~304~~	~~3~~		~~5162~~
Cal 42	500	11/22/09 0910	11/26/09 1120	1.26.09 2300	305	3	0	7280
Cal 44	500	11/22/09 0910	11/26/09 1150	1.26.09 2330	306	3	0	6387
Cal 15	500	11/22/09 0910	11/26/09 1210	1.27.09 0005	307	3	0	6598
Cal 14	500	11/22/09 0910	11/26/09 1315	11/27/09 0830	308	3	0	6726
Cal 13	500	11/22/09 0910	11/26/09 1330	11/27/09 0905	309	3	0	6046
Cal 28	500	11/22/09 0910	11/26/09 1345	11/27/09 1015	311	3	0	6607
Cal 36	500	11/22/09 1910	11/26/09 1400	11/27/09 1110	312	3	0	6446
Cal 37								

~~Cal 37~~ KD 2/3/09

~~Cal 30~~ KD 2/3/09

KD 2/4/09

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		**104.944421**	**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	**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:

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

JLO 2/3/09
μ_ut 2/4/09

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

(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / (Dilution Vol) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / Density (g/mL)/ (Dilution Vol) = Parent Activity (dpm/g)
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (100 mL) = 122414.2500 dpm/mL
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (1.0012 g/mL) / (100 mL) = 122273.3377 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

KD 2/3/09
ALLA 2/4/09

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL-RAD-A-008

Isotope: RA-226

Date Standards Prepared: 4/5/09

Cocktail Type Used: NA

Standard ID: 02996

Matrix of Vial/Planchett: NA / NA / NA

Amount Used (g or ml): 0.1

Standard Activity (DPM/g or mL): 246.347

Type of Scintillation Vial: NA

Reference Date: 12/15/99

Pipette ID Used: 1429303

Expiration Date: 4/2/09

Balance ID Used: 36040216

Residue/Carrier Agent: 0.5 M HCl

Quenching Agent: NA

	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				

LVD 2/31/09

Prepared By: Kelli S Power Date: 2/31/09

Reviewed By: [signature] Date: 2/4/09

Rev 1 RLM 9/10/97

0299

Certificate of calibration [illegible] radioactive reference solution

UKAS ACCREDITED CALIBRATION LABORATORY No. 0146

ement 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.

acy Expanded uncertainty in the radioactive concentration quoted above: ± 2.5 %
Combined Type A uncertainty: ± 0.2 %
Combined Type B uncertainty: ± 1.3 %

onuclidic y 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.

nical position Carrier free in 0.5M HCl.

arks 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.

KD 2/3/09
[illegible] 2/11/09

Vers 1-07

Ra-226 WATER

Batch : LCSVER
Date : 1/2/2009
Analyst : KSD1

Procedure Code : LUC26RAL
Parmname : Radium-226
MDA : 1 pCi/L
Bkg Count Time: 30 min
Instrument Used : LUCAS CELL DETECTOR

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

2/4/09

2/4/09

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%**
						24.10		
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%**
						24.10		
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	constant	Net CPM cpm	Ingrowth constant
1/26/2009 16:05	1/30/2009 10:40	90.58	4.42	0.4954	0.9672	1.0019	21.6000	0.4800
1/30/2009 10:00	2/2/2009 9:15	71.25	4.42	0.4160	0.9672	1.0019	21.5667	0.4032
1/26/2009 16:05	1/30/2009 11:05	91.00	4.58	0.4969	0.9660	1.0019	30.1997	0.4809
1/26/2009 16:05	1/30/2009 11:30	91.42	5.58	0.4985	0.9587	1.0019	26.1000	0.4788
1/26/2009 16:05	1/30/2009 11:45	91.67	5.87	0.4995	0.9567	1.0019	25.3330	0.4787
1/30/2009 10:00	2/2/2009 9:40	71.67	4.58	0.4179	0.9660	1.0019	23.7330	0.4044
1/26/2009 16:05	1/30/2009 12:00	91.92	7.08	0.5004	0.9479	1.0019	24.0667	0.4753
1/26/2009 16:05	1/30/2009 13:05	93.00	21.25	0.5045	0.8518	1.0019	25.1997	0.4305
1/26/2009 16:05	1/30/2009 13:20	93.25	28.00	0.5054	0.8095	1.0019	19.5330	0.4099
1/26/2009 16:05	1/30/2009 13:40	93.58	66.75	0.5067	0.6041	1.0019	17.7997	0.3067

LWA 2141.09

#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
Ver 1	500	11/26/09 1605	11/30/09 1040	11/30/09 1505	301	3	8	656
Ver 2	500	11/26/09 1605	11/30/09 1105	11/30/09 1540	303	3	8	914
Ver 3	500	11/26/09 1605	11/30/09 1130	11/30/09 1705	305	3	8	791
Ver 4	500	11/26/09 1605	11/30/09 1145	~~11/30/09~~ 1.30.09 1737	306	3	8	768
Ver 5	500	11/26/09 1605	11/30/09 1200	~~11/30/09~~ 1.30.09 1905	308	3	8	730
Ver 6	500	11/26/09 1605	11/30/09 1305	1.31.09 1020	309	3	8	764
Ver 7	500	11/26/09 1605	11/30/09 1320	1.31.09 1720	311	3	8	594
Ver 8	500	11/26/09 1605	11/30/09 1340	2/1/09 0825	312	3	8	542
~~Ver 9~~	500	11/26/09 1605						
Ver 10	500	11/26/09 1605						
Ver 11	500	11/26/09 1605						
Ver 12	500	11/26/09 1605						

KD 2/3/09

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
VW 1	500	1/30/09 1000	2/2/09 0915	2/2/09 1340	307	3	8	655
VW 2	500	1/30/09 1000	2/2/09 0940	2/2/09 1415	307	3	8	720
~~VW 3~~	~~500~~	~~1/30/09 1000~~	~~2/2/09 1115~~	2/2/09 1450	~~309~~	3	8	~~754~~

KD 2/3/09

KD 2/3/09

KD 2/3/09

Verification for Ra-226 Standard 0638-F

D. Roy 2/2/2009	Isotope	Value	Uncertainty
	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.

LCO 2/4/09
2/2/09
2/4/09

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL-RAD-008

Date Standards Prepared: ~~A~~ 12/18/2007 (NLA 2/4/09)

Standard ID: 0630-F

Amount Used (g or ml): 0.1 ml

Standard Activity (DPM/g or mL): 267.519 dpm/ml

Reference Date: 1/23/2004

Expiration Date: 2/~~4~~2/09 (NLA 2/4/09)

Residue/Carrier Agent: 0.1 ml HCl

Isotope: Ra-226

Cocktail Type Used: N/A

Matrix of Vial/Planchett: N/A, N/A, N/A

Type of Scintillation Vial: N/A

Pipette ID Used: 1429303

Balance ID Used: N/A

Quenching Agent: N/A

	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				

KD 2/3/09

Prepared By: Kelli Bonnell Date: 2/3/09

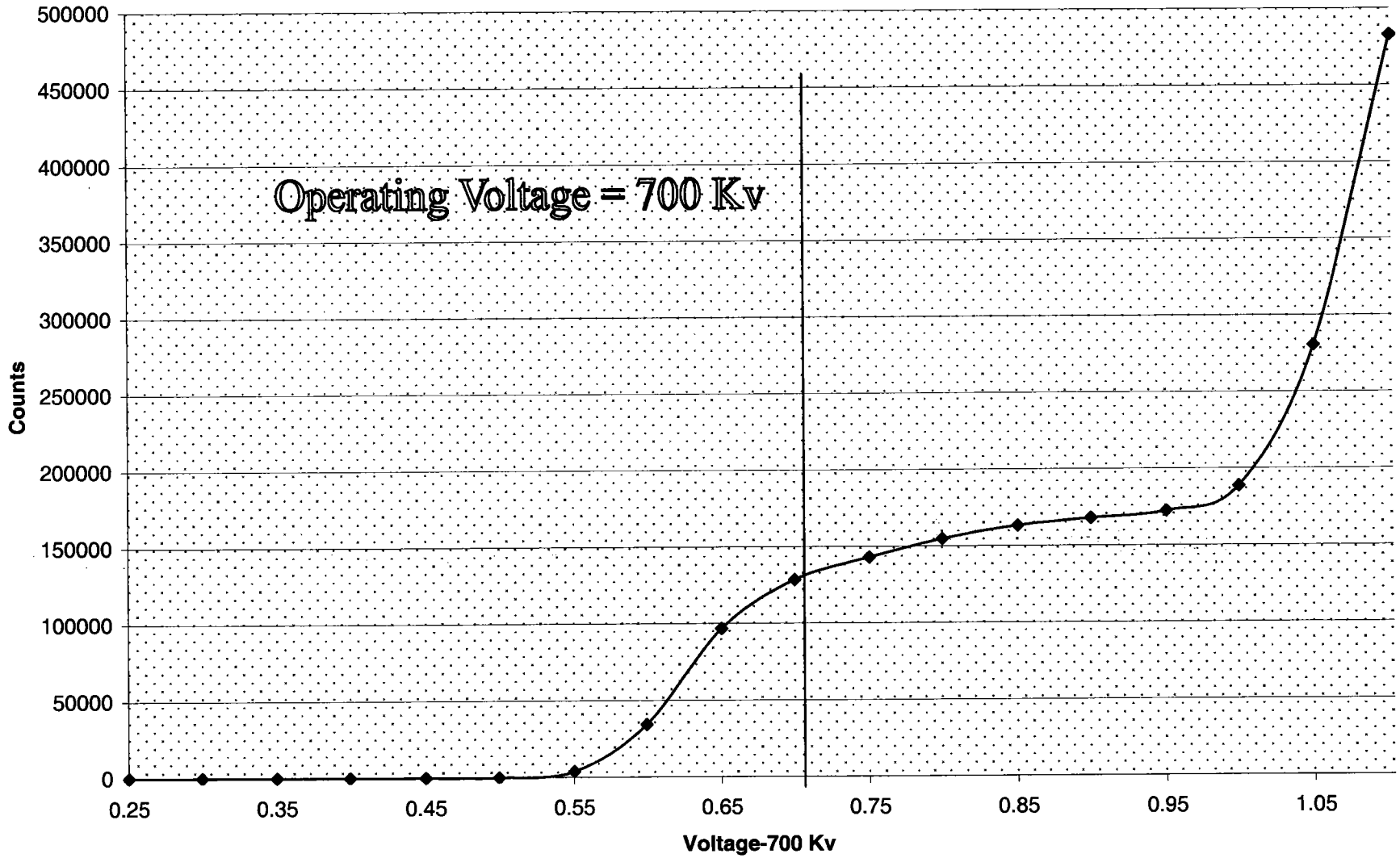
Reviewed By: [signature] Date: 2/4/09

Rev 1 RLM 9/10/97

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

ALA 2/4/09
KM 2/3/09

Ludlum 3 Voltage Curve



KO 213109

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

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 Worrell Date: 2/28/09

Reviewed By: [signature] Date: 3/2/09

Effective Date: 3/2/09

Ra-226 Cell Constants

Standard Reference date :	12/15/1999
standard ID :	0.299-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	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
401	1.689	Average	1.574	3	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	3	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			38	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	43	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	43	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			15	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	7	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	7	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			14	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	42	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	42	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			46	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	38	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	13	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			47	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	30	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	44	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			44	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	28	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	15	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			48	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	36	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	1.811	Stdev	0.013	30	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			9	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	34	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	48	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			35	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)

3/2/09

3/2/09

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

Date Standards Prepared: 4/5/05

Standard ID: 0299G

Amount Used (g or ml): 0.1

Standard Activity (DPM/g or mL): 2446.347

Reference Date: 12/15/99

Expiration Date: 4/2/09

Residue/Carrier Agent: 0.5 M HCl

Isotope: Ra-226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA / NA / NA

Type of Scintillation Vial: NA

Pipette ID Used: 1429303

Balance ID Used: 36040216

Quenching Agent: NA

	Standard Number	Quenching Vol (uL)/ Residue Volume(mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
3	Cal 3				
43	Cal 43				
7	Cal 7				
42	Cal 42				
13	Cal 43				
44	Cal 44				
30	Cal 30				
48	Cal 48				
36	Cal 36				
35	Cal 35				
38	Cal 38				
15	Cal 15				
14	Cal 14				
46	Cal 46				
47	Cal 47				

3/2/09

Prepared By: Kelli Dowell Date: 3/2/09

Reviewed By: [signature] Date: 3/2/09

Rev 1 RLM 9/10/97

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL-RAD-A-008

Date Standards Prepared: 4/5/05

Standard ID: 0299G

Amount Used (g or ml): ~~0.2~~ KD 3/2/09 0.1

Standard Activity (DPM/g or mL): 2,446,347

Reference Date: 12/15/99

Expiration Date: 4/2/09

Residue/Carrier Agent: 0.5M HCl

Isotope: RA-226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA
NA
NA

Type of Scintillation Vial: NA

Pipette ID Used: 1429305

Balance ID Used: 36040216

Quenching Agent: NA

	Standard Number	Quenching Vol (uL)/ Residue Volume(mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
16	CG116				
25	CG125				
23	CG123				
28	CG128				
9	CG19				
34	CG134				

KD 3/2/09

Prepared By: Kelli Dorrell Date: 3/2/09

Reviewed By: [signature] Date: 3/2/09

Rev 1 RLM 9/10/97

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

(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / (Dilution Vol) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / Density (g/mL)/ (Dilution Vol) = Parent Activity (dpm/g)
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (100 mL) = 122414.2500 dpm/mL
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (1.0012 g/mL) / (100 mL) = 122273.3377 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

[redacted]

NAMAS
CALIBRATION
No. 0146

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

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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 issue 17th December 1999

Nycomed Amersham

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		**104.944421**	**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	**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:

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

4/9/08

David Roy 4/10/08

4/10/08

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	
~~611 43~~		~~11/30/09 1050~~	~~2/3/09 1335~~	~~2.3.09 1710~~	~~401~~	~~4~~	~~8~~	~~6763~~	LM 3/2/09
47		11/30/09 1050	2/3/09 1310	2.3.09 1800	402	4	8	9067	
~~19~~		~~11/30/09 1050~~	2/3/09 1335	2.3.09 1840	403	4	8	~~7092~~	LM 3/2/09
~~30~~		11/30/09 1050	2/3/09 1400	2.3.09 1915	~~404~~	4	8	7877	LM 3/2/09
~~42~~		~~11/30/09 1050~~	~~2/3/09 1425~~	2.3.09 2035	405	4	8	8700	LM 3/2/09
44		11/30/09 1050	2/3/09 1500	2.3.09 2110	409	4	8	7949	
15		11/30/09 1050	2/3/09 1530	~~2/4/09~~ 2/4/09 0830	410	4	8	4108	
~~14~~		~~11/30/09 1050~~	~~2/3/09 1545~~	~~2/4/09 1015~~	~~411~~	4	8	~~7562~~	LM 3/2/09
~~13~~		11/30/09 1050	2/3/09 1600	2/4/09 1100	412	4	8	~~9523~~	LM 3/2/09
~~38~~									
36									
				LM 2/26/09					LM 3/2/09
									LM 3/2/09

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 3	500	2/20/09 1725	2/23/09 1030	2/23/09 1615	401	4	8	4580	
43	500	2/20/09 1725	2/23/09 1105	2/23/09 1655	402	4	8	~~4817~~ 5017	KD 2/23/09
7	500	2/20/09 1725	2/23/09 1130	2.23.09 1930	403	4	8	4011	
42	500	2/20/09 1725	2/23/09 1310	2.23.09 1905	404	4	8	5005	
~~13~~	~~500~~	2/20/09 1725	2/23/09 1340	2.23.09 1955	405	4	8	~~4224~~	KD 2/28/09
~~31~~	~~500~~	2/20/09 1725	~~2/23/09~~ 1405	2.23.09 2250	406	4		~~2355~~	KD 2/28/09
44	500	~~2/20/09 1725~~	~~2/23/09~~ 1435	2.23.09 2330	407	4		2359	2/28/09 KD
~~19~~	500	2/20/09 1725	2/23/09 1455	2.24.09 00:00	408	4		~~2598~~	KD 2/28/09
30	500	2/20/09 1725	2/23/09 1520	2.24.09 00:30	409	4	8	~~5000~~ 5035	KD 2/24/09
48	500	2/20/09 1725	2/23/09 1540	~~2/24/09 0850~~ 2/24/09 0800	40	4	8	4840	
36	500	2/20/09 1725	2/23/09 1555	2/24/09 0840	411	4	8	4839	
35	500	2/20/09 1725	2/23/09 1610	2/24/09 0940	412	4	8	4818	
				KD 2/28/09					

KD 3/2/09

KD 3/2/09

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
Cal 38	500	2/20/09 1725	2/25/09 0755	2/25/09 1440	401	4	8	5677
15	500	2/20/09 1725	2/25/09 0815	2/25/09 1525	402	4	8	8017
14	500	2/20/09 1725	2/25/09 0835	2/25/09 1555	403	4	8	5562
46	500	2/20/09 1725	2/25/09 0855	2.25.09 20:20	404	4	8	7075
47	500	2/20/09 1725	2/25/09 1010	2.25.09 2055	405	4	8	6721
~~16~~	~~500~~	~~2/20/09 1725~~	~~2/25/09 1040~~	2.26.09 20:22 ~~2.25.09 2135~~ ~~2.25.09~~	~~406~~	~~4~~	~~8~~	~~2091~~
~~25~~	~~500~~	~~2/20/09 1725~~	~~2/25/09 1110~~	~~2.25.09 2205~~	~~407~~	~~4~~	~~8~~	~~2827~~
~~23~~	~~500~~	~~2/20/09 1725~~	~~2/25/09 1145~~	~~2.25.09 22:45~~ ~~2.25.09~~ 2253	~~408~~	~~4~~	~~8~~	~~3137~~
~~39~~	500	2/20/09 1725	2/25/09 1210	2/26/09 0810	409	4	8	5169
28	500	2/20/09 1725	2/25/09 1305	2/26/09 0850	410	4	8	6838
9	500	2/20/09 1725	2/25/09 1340	2/26/09 0930	411	4	8	6734
34	500	2/20/09 1725	2/25/09 1405	2/26/09 1015	412	4	8	7137

KD 2/25/09

AH 3/2/09

AH 3/2/09

AH 3/2/09

KD 3/2/09

AH 3/2/09

KD 3/2/09

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 15~~ Cal 3	500	2/23/09 1605	2/27/09 0900	2/27/09 0915	401	4	8	5474
Cal 43	500	2/23/09 1605	2/27/09 0930	2/27/09 1416	402	4	8	7507
Cal 7	500	2/23/09 1605	2/27/09 1000	2/27/09 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 16:35	409	4	8	7516
~~Cal 9~~	~~500~~	~~2/23/09 1605~~	~~2/27/09 1150~~	~~2/27/09 17:15~~	~~410~~	~~4~~	~~8~~	~~7850~~
Cal 30	500	2/23/09 1605	2/27/09 1220	2/27/09 17:45	411	4	8	~~2357~~ 6357
Cal 48	500	2/23/09 1605	2/27/09 1245	2/27/09 18:20	412	4	8	7495

IWD 3/2/09

IWD 2/28/09

IWD 2/28/09

IWD 3/2/09

Ra-226 Verification Sheet

Cal #4

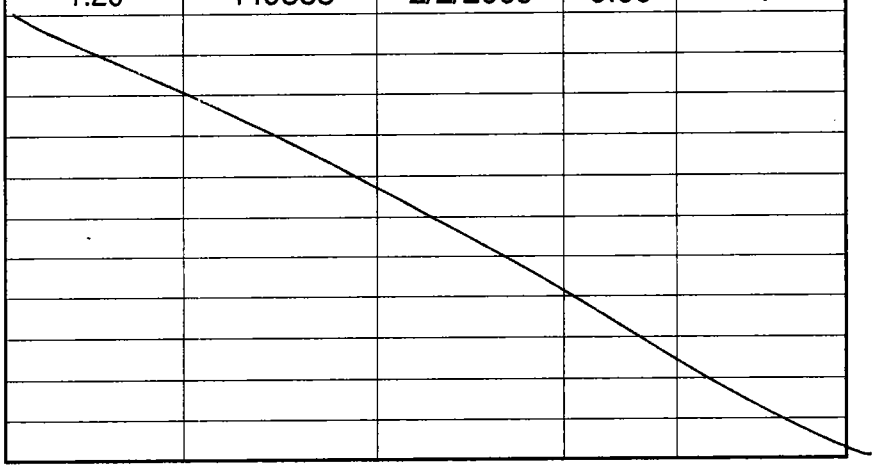
Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 38	500	2/25/09 1400	3/2/09 1030	3/2/09 1340	405	4	8	8602

KO 3/2/09

AH 3/2/09

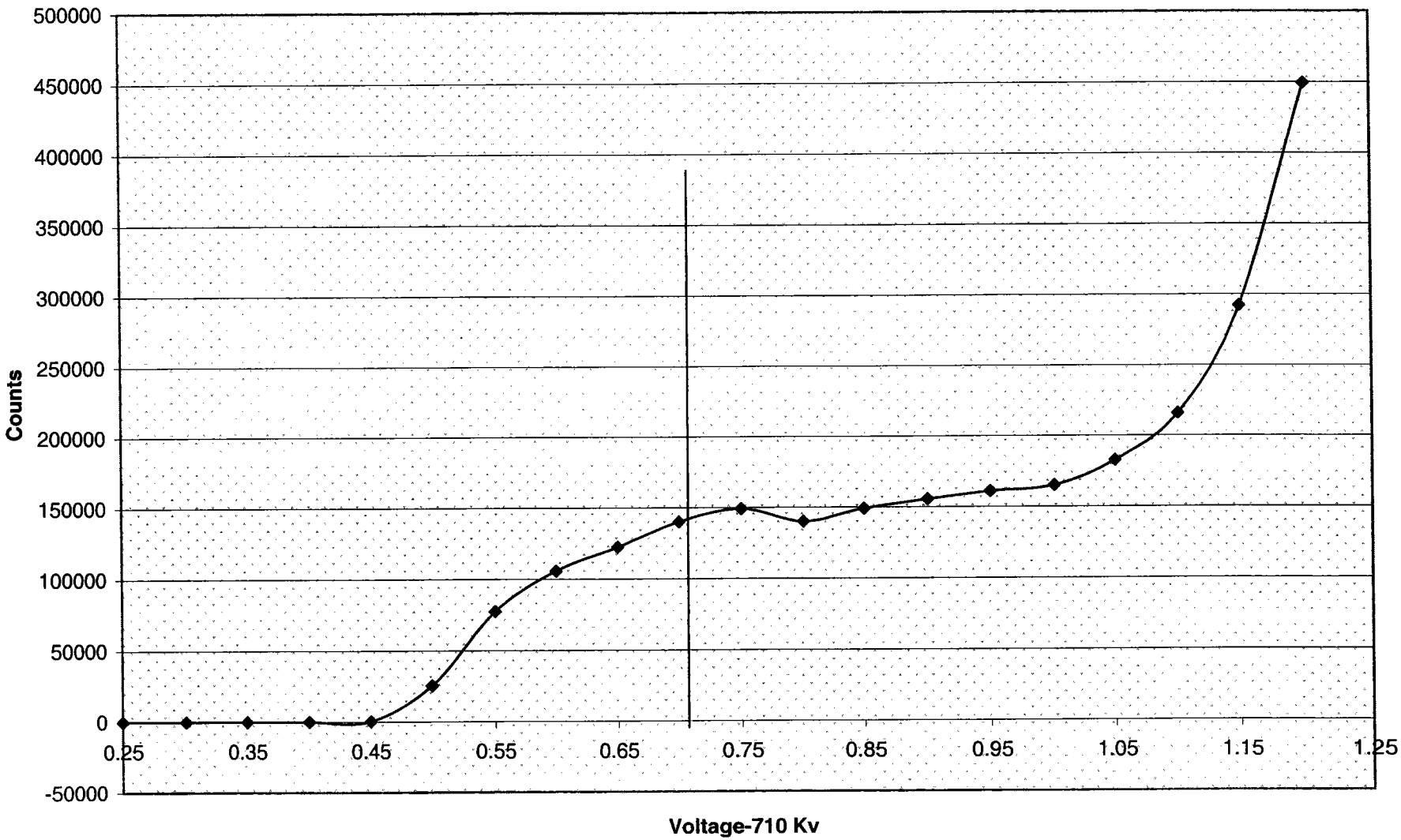
KO 3/2/09

Voltage Curve Ludlum # 4				
Volts (K.V.)	Counts	Date	Time	Detector
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



3/2/09

3/2/09


Ludlum 4 Voltage Curve
Counts
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
-50000
0.25
0.35
0.45
0.55
0.65
0.75
0.85
0.95
1.05
1.15
1.25
Voltage-710 Kv

KD 3/4/09

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 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: [signature] Date: 3/24/09

Reviewed By: [signature] 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	Average	2.087	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	Stdev	0.160	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	Average	1.878	16	3/18/2009 8:25	3/17/2009 12:50	3/10/2009 14:00	7951	30	265.03	243.03	6.95139	0.81597	3381	0.9960
502	2.045	Stdev	0.146	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	Average	1.601	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	Stdev	0.028	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	Average	1.615	47	3/6/2009 10:30	3/5/2009 9:40	2/25/2009 14:00	7262	30	242.07	243.03	7.81944	1.03472	3369	0.9960
504	1.611	Stdev	0.025	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	Average	2.331	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	Stdev	0.127	23	3/11/2009 13:00	3/10/2009 14:30	3/5/2009 14:00	8924	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	Average	2.004	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	Stdev	0.112	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	Average	1.701	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	Stdev	0.024	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	Average	1.534	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	Stdev	0.062	44	3/19/2009 21:30	3/19/2009 15:45	3/12/2009 12:10	7561	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	Average	1.798	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	Stdev	0.064	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	Average	1.458	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	Stdev	0.024	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	Average	1.959	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	Stdev	0.106	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	9068	30	302.27	243.03	5.90625	0.39583	3376	0.9960
512	1.796	Average	1.956	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	Stdev	0.152	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

EffErr 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).

Cal #5

Calibration

Ra-226 ~~Verification~~ Sheet

AJ 3/16/09

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	3/3/09 0815	3/6/09 0750	501	5	8	5281
~~Cal 14~~	~~500~~	~~2/25/09 1400~~	~~3/3/09 0845~~	~~3/6/09 0840~~	502	5	1	~~4368~~
		~~2/25/09~~ 1400	3/3/09		~~503~~	5	KO 3/3/09	~~6860~~
Cal 46	500	2/25/09 1400	3/5/09 0920	3/6/09 0920	503	5	3	7250
Cal 47	500	2/25/09 1400	3/5/09 0940	3/6/09 1030	504	5	1	7262
Cal 16	500	2/25/09 1400	3/5/09 1005	3/6/09 1240	505	5	3	10654
Cal 25	500	2/25/09 1400	3/5/09 1030	3/6/09 1310	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	502	2/25/09 1400	3/5/09 1320	3/6/09 1630	511	5	6	8316

KO 3/24/09

AJ 3/19/09

AJ 3/16/09

Calibration

Ra-226 ~~Verification~~ Sheet

JMS 3/16/09

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts	
Cal 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 1320	3/11/09 1115	502	5	5	7414	
~~Cal 15~~	~~500~~	~~3/5/09 1400~~	~~3/10/09 1345~~	~~3/11/09 1155~~	503	5	8	7352	KD 3/24/09
Cal 34	500	3/5/09 1400	3/10/09 1405	3/11/09 1230	504	5	4	5889	
Cal 23	500	3/5/09 1400	3/10/09 1430	3/11/09 1300	505	5	2	8924	
Cal 47	500	3/5/09 1400	3/10/09 1505	3/11/09 1330	506	5	8	7804	
~~Cal 45~~	~~500~~	~~3/5/09 1400~~	3/10/09 1527	3/11/09 1420	~~507~~	~~5~~	~~4~~	~~6315~~	KD 3/24/09
~~Cal 16~~	~~500~~	~~3/5/09 1400~~	3/10/09 1550	3/11/09 1455	~~508~~	~~5~~	~~4~~	~~6443~~	KD 3/24/09
Cal 39	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	7246	
Cal 46	500	3/5/09 1400	3/10/09 1635	3/11/09 1650	511	5	8	7283	
Cal 48	500	3/5/09 1400	3/10/09 1650	3/11/09 1735	512	5	8	6542	

JMS 3/16/09

Calibration

Ra-226 ~~Verification~~ Sheet

JH 3/11/09

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
Cal 42	500	3/6/09 1525	3/12/09 0910	3/12/09 1330	501	5	8	10210
Cal 19	500	3/6/09 1525	3/12/09 ~~0940~~ 0935 ~~to 3/11/09~~	3/12/09 1420	502	5	8	8243
Cal 44	500	3/6/09 1525	3/12/09 1000	3/12/09 1450	503	5	2	7214
~~Cal 40~~	500	3/6/09 1525	3/12/09 1025	3/12/09 1525	~~504~~	~~5~~	~~0~~	~~420~~
Cal 7	500	3/6/09 1525	3/12/09 1050	3/12/09 1701	505	5	5	9884
Cal 13	500	3/6/09 1525	3/12/09 1115	3/12/09 17:40	506	5	8	8954
Cal 43	500	3/6/09 1525	3/12/09 1135	3/12/09 18:30	507	5	6	7535
Cal 3	500	~~3/10~~ 3/6/09 1525 ~~to 3/12/09~~	3/12/09 1210	3/12/09 20:45	508	5	0	6640
Cal 36	500	3/6/09 1525	3/12/09 1235	3/12/09 21:20	509	5	8	8049
Cal 35	500	3/6/09 1525	3/12/09 1250	3/12/09 21:55	510	5	1	6589
Cal 37	500	3/6/09 1525	3/12/09 1310	3/12/09 22:40	511	5	8	9068
Cal 38	500	3/6/09 1525	3/12/09 1330	3/12/09 23:15	512	5	5	9322

LCD 3/24/09

JH 3/11/09

Calibration

Ra-226 ~~Verification~~ Sheet

Cal #5's

KD 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 14	500	3/10/09 1400	3/17/09 1250	3/18/09 0825	502	5	5	7951
~~Cal 39~~	~~500~~	~~3/10/09 1400~~	~~3/17/09 1325~~	~~3/18/09 0855~~	~~503~~	5		6855
~~Cal 28~~	~~500~~	~~3/10/09 1400~~	~~3/17/09 1345~~	~~3/18/09 1025~~	~~504~~	~~5~~		6804
Cal 40	500	3/10/09 1400	3/17/09 1400	3/18/09 1300	512	5	8	8653
Cal 25	500	3/5/09 1400	3/10/09 1527	3/11/09 1420	507	5	4	6315

KD 3/24/09

KD 3/24/09

KD 3/24/09

KD 3/25/09

Ra-226 Calibration Sheet

Standard ID: 0249-G
Volume Added (mL): 0.1
Expiration Date: 4/2/09

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det # VW 3/24/09	Total Counts
Cal 42	500	3/12/09 1210	3/19/09 1515	3/19/09 2015	503	5	8282
Cal 19	500	3/12/09 1210	3/19/09 1530	3/19/09 2030	504	5	8310
Cal 44	500	3/12/09 1210	3/19/09 1545	3/19/09 2130	508	5	7561
~~Cal 30~~	~~500~~	~~3/12/09 1210~~	~~3/19/09 1600~~	3/19/09 2200	509	5	9942

VW 3/24/09

VW 3/24/09

VW 3/25/09

8-21-00

Nycomed Amersham plc
Amersham Laboratories

0299

NAMAS
CALIBRATION
No. 0146

Certificate of calibration of a radionuclide reference solution

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

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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 17th December 1999

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

(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / (Dilution Vol) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / Density (g/mL)/ (Dilution Vol) = Parent Activity (dpm/g)
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (100 mL) = 122414.2500 dpm/mL
(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (1.0012 g/mL) / (100 mL) = 122273.3377 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 Darnell

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		**104.944421**	**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	**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:

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

3/24/08 4/9/08

David Roy 4/10/08

General Engineering Laboratories

~~Verification~~ Source Preparation Sheet

3/25/09 Calibration

Applicable SOP Number: GL-RAD-A-008

Date Standards Prepared: 4/15/05

Standard ID: 0249-G

Amount Used (g or ml): 0.1

Standard Activity (DPM/g or mL): 12446.347

Reference Date: 12/15/99

Expiration Date: 4/2/09

Residue/Carrier Agent: 0.5M HCl

Isotope: RA-226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA

NA

NA

Type of Scintillation Vial: NA

Pipette ID Used: 1425303

Balance ID Used: 3600402216

Quenching Agent: NA

	Standard Number	Quenching Vol (uL)/ Residue Volume(mL)	Initial Wt. (g)	Final Wt. (g)	Net Wt. (mg)
15	Cal 15				
46	Cal 46				
47	Cal 47				
16	Cal 16				
25	Cal 25				
23	Cal 23				
39	Cal 39				
28	Cal 28				
9	Cal 9				
34	Cal 34				
42	Cal 42				
19	Cal 19				
44	Cal 44				
7	Cal 7				
13	Cal 13				

3/24/09

Prepared By: Kelli Dixon Date: 3/24/09

Reviewed By: Date:

Rev 1 RLM 9/10/97

General Engineering Laboratories
~~Verification~~ Source Preparation Sheet

3/25/09 Calibration

Applicable SOP Number: GL-RAD-A-008

Date Standards Prepared: 4/5/09

Standard ID: 02996

Amount Used (g or ml): 0.1

Standard Activity (DPM/g or mL): 2446.347

Reference Date: 12/15/99

Expiration Date: 4/2/09

Residue/Carrier Agent: 0.5M HCl

Isotope: RA 226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA / NA / NA

Type of Scintillation Vial: NA

Pipette ID Used: 1429303

Balance ID Used: 36040216

Quenching Agent: NA

	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				

KD 3/24/09

Prepared By: Kelli Dance Date: 3/24/09

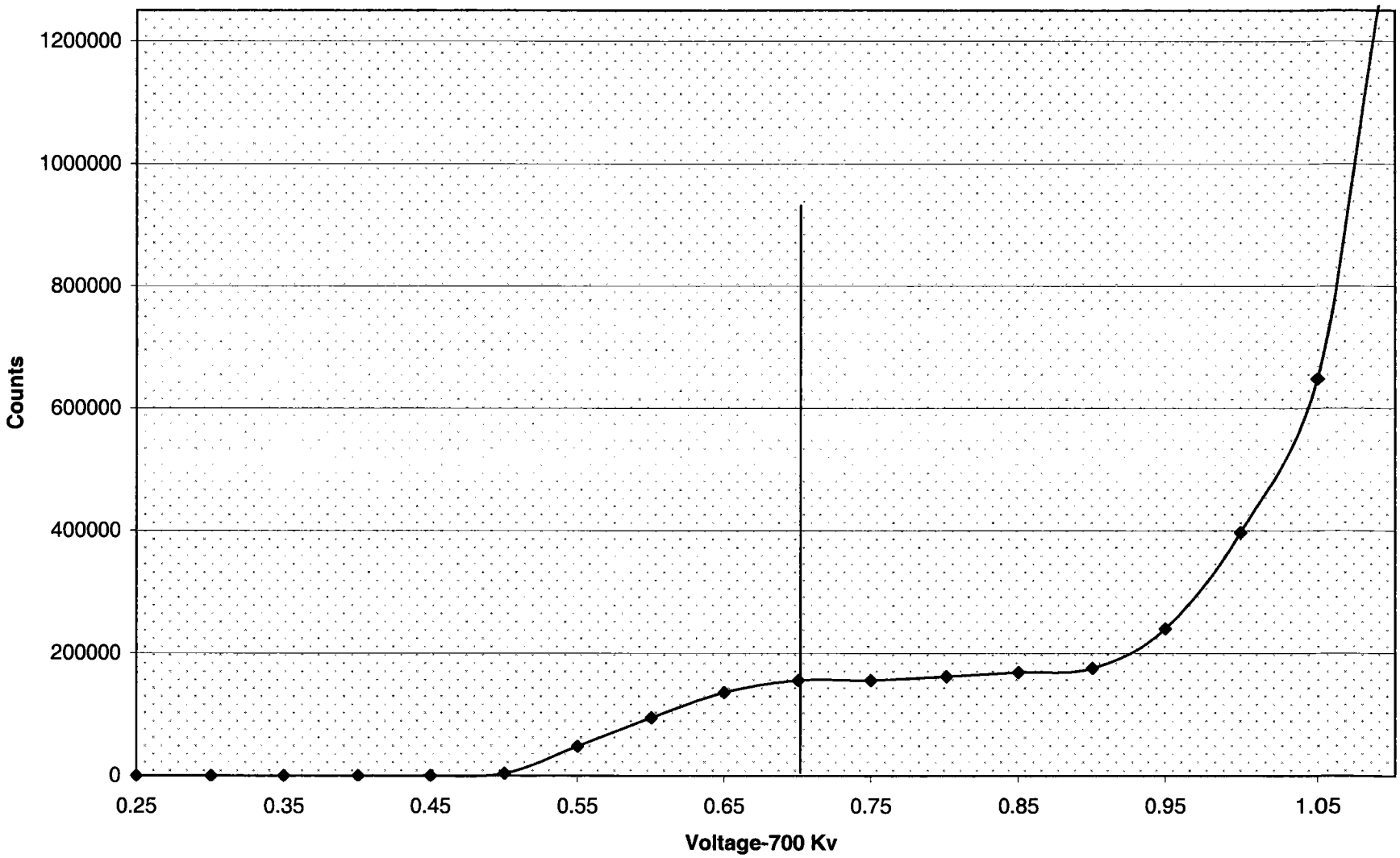
Reviewed By: Date:

Rev 1 RLM 9/10/97

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

VD 3/24/09

Ludlum 5 Voltage Curve



KAP 3/24/09

vers 3-09

Ra-226 WATER

Batch : LCSVER
Date : 2/20/2008
Analyst : DXM2
Bkg Count Time: 30 min

Procedure Code : LUC26RAL
Parmname : Radium-226
MDA : 1 pCi/L
Instrument Used : LUCAS CELL DETECTOR

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	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 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
VER 1	500	3/13/09 1530	3/16/09 0945	~~3/16/09 1510~~ 3.16.09 1510 ->SEA 3.17.09	501	5	8	766
VER 2	500	3/13/09 1530	3/16/09 1010	3.16.09 1925	502	5	~~8~~ 5 KD 3/25/09	537
VER 3	500	3/13/09 1530	3/16/09 1030	3/16/09 2020	503	5	8	518
~~VER 4~~	~~500~~	~~3/13/09 1530~~	~~3/16/09~~ 1100	~~3.16.09 2115~~	504	5	8	~~577~~ KD 3/24/09
VER 5	500	3/13/09 1530	3/16/09 1125	3.16.09 2200	505	5	~~8~~ 1 KD 3/25/09	680
~~VER 6~~	~~500~~	3/13/09 1530	3/16/09 1155	3.16.09 2230	506	5	8	~~707~~ KD 3/24/09
VER 7	500	3/13/09 1530	3/16/09 1320	3.16.09 2300	507	5	8	488
VER 8	500	3/13/09 1530	3/16/09 1350	3.16.09 2330	508	5	~~8~~ 1 KD 3/25/09	544
~~VER 9~~	~~500~~	~~3/13/09 1530~~	~~3/16/09 1410~~	~~3/17/09 0315~~ 0415 BB 3/17/09	509	5	8	640 KD 3/24/09
VER 10	500	3/13/09 1530	3/16/09 1425	3/17/09 0500	510	5	~~8~~ 1 KD 3/25/09	432
VER 11	500	3/13/09 1530	3/16/09 1445	3/17/09 0535	511	5	8	577
VER 12	500	3/13/09 1530	3/16/09 1500	3/17/09 0610	512	5	8	723
				KD 3/24/09				

KD 3/25/09

KW 3/24/09

Ra-226 Verification Sheet

Standard ID: 0638F
Volume Added (mL): D.I
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
~~VER 1~~	~~500~~	~~3/16/09 1400~~	3/20/09 1245	3/20/09 1820	501	5	~~8~~	~~10~~
VER 2	500	3/16/09 1400	3/20/09 1305	3/20/09 1900	504	5	8	701
VER 3	500	3/16/09 1400	3/20/09 1320	3/~~30~~20/09 1940	506	5	8	893
VER 4	500	3/16/09 1400	3/20/09 1345	3/~~30~~20/09 2050	509	5	8	768

KW 3/24/09

KW 3/24/09

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL-RAD-A-008

Date Standards Prepared: 11/16/09

Standard ID: 0638-F

Amount Used (g or ml): 0.1

Standard Activity (DPM/g or mL): 267.519

Reference Date: 1123104

Expiration Date: 2/2/10

Residue/Carrier Agent: NA

Isotope: RA-226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA / NA / NA

Type of Scintillation Vial: NA

Pipette ID Used: 1429303

Balance ID Used: 3808 0004

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		LD 3/24/09		
10	Ver 10				
11	Ver 11				
12	Ver 12				

Prepared By: Kelli Diesel Date: 3/24/09

Reviewed By: Angela A Quinn Date: 3/25/09

Rev 1 RLM 9/10/97

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:	03/04/2007
Expiration Date:	03/04/2008
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

(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / (Ampoule Mass(g) *(Dilution Vol)) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / Density / (Ampoule Mass (g) * (Dilution Vol)) = Parent Activity (dpm/g)
(4.8398 g) * (23530 dps) * (60 dpm/dps) / (5.01065 g * 100 mL) = 13636.6133 dpm/mL
(4.8398 g) * (23530 dps) * (60 dpm/dps) / (1.0266 g/mL)/ (5.01065 g * 100 mL) = 13282.9676 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	Isotope	Value	Uncertainty
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.

LW 3/24/09

2/2/09

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 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: [signature] Date: 9/30/09

Reviewed By: [signature] 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	bkg 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	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	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		3292	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	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	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	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	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	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	0.14931	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	0.14931	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	242.33	243.02	3.31250	0.15972	3566	0.9958
711	2.212	Average	2.242	Cal 11	9/18/2009 21:37	9/18/2009 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	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	3572	0.9958

EffErr 0.065186 <- Put in Machines.xls (Lucas Cell Tab)

9/30/09

#7

Ra-226 Calibration Sheet

Standard ID: 0209-H
Volume Added (mL): 0.1
Expiration Date: 8/7/10 * 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	9/1/09 1030	9/15/09 1345	9/15/09 1745	701	7	6595
Cal 2	500	9/1/09 1030	9/15/09 1410	9/15/09 1810	702	7	6583
~~Cal 3~~	500	~~9/1/09 1030~~	~~9/15/09 1435~~	9/15/09 1845	~~703~~	~~7~~	~~5672~~ * 9/30/09
~~Cal 4~~		~~9/1/09 1030~~	~~9/15/09 1515~~	9/15/09 1900	~~704~~	7	~~6039~~ LLD 9/30/09
~~Cal 5~~ LLD 9/30/09		~~9/1/09 1030~~	9/15/09 1540 ~~1605~~ LLD 9/15/09	9/15/09 1915	~~705~~	~~7~~	~~5579~~
~~Cal 6~~		~~9/1/09 1030~~	~~9/15/09 1605~~	9/15/09 1945	~~706~~	~~7~~	~~5347~~ LLD 9/30/09
~~Cal 7~~		~~9/1/09 1030~~	~~9/15/09 1630~~	9/15/09 2000	701	7	5376 LLD 9/30/09
~~Cal 8~~ LLD 9/30/09		~~9/1/09 1030~~	~~9/15/09 1645~~	~~9/15/09 2030~~	708	7	6203
~~Cal 9~~		~~9/1/09 1030~~	~~9/15/09 1705~~	9/15/09 2110	710	7	~~6458~~ LLD 9/30/09
~~Cal 10~~		~~9/1/09 1030~~	~~9/15/09 1720~~	9/15/09 2155	711	7	~~5935~~ ~~LLD~~ 9/30/09
Cal 11	500	9/1/09 1030	9/15/09 1735	9/15/09 2215	712	7	6263

* 9/30/09

LLD 9/30/09

Ra-226 Calibration Sheet

Standard ID: 0299-H
Volume Added (mL): 0.1
Expiration Date: 8/17/10

* 15min

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cal 1	500	~~9/15/10~~ 9/15/09 1000	9/18/09 1320	9/18/09 1815	701	7	3219
~~Cal 2~~ WD 9/30/09	~~500~~	~~9/15/09 1000~~	~~9/18/09 1435~~	~~9/18/09 1835~~	~~702~~	~~7~~	~~3426~~
Cal 3	500	9/15/09 1000	9/18/09 1455	9/18/09 1900	703	7	3364
Cal 4	500	9/15/09 1000	9/18/09 1520	9/18/09 1915	704	7	3356
Cal 5	500	9/15/09 1000	9/18/09 1545	9/18/09 1940	705	7	3187
Cal 6	500	9/15/09 1000	9/18/09 1610	9/18/09 1955	706	7	3505
Cal 7	500	9/15/09 1000	9/18/09 ~~1610~~ 1630 WD 9/15/09	9/18/09 2015	707	7	3406
Cal 8	500	9/15/09 1000	9/18/09 1650	9/18/09 2025	708	7	3055
Cal 9	500	9/15/09 1000	9/18/09 1715	9/18/09 2103	709	7	3324
Cal 10	500	9/15/09 1000	9/18/09 1730	9/18/09 2120	710	7	3635
Cal 11	500	9/15/09 1000	9/18/09 1745	9/18/09 2137 ~~2140~~ WD 9/18/09	711	7	3536
~~Cal 12~~	~~500~~	~~9/1/09 1000~~	~~9/18/09 1800~~	~~9/18/09 2218~~	712	~~7~~	~~5663~~

WD 9/30/09

9/30/09

WD 9/30/09

Ra-226 Calibration Sheet

Standard ID: 0249H
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 12	500	9/18/09 1700	9/21/09 1255	9/21/09 1700	701	7	6158
Cal 11	500	9/18/09 1700	9/21/09 1320	9/21/09 1725	702	7	5611
Cal 10	500	9/18/09 1700	9/21/09 1345	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
~~Cal 5~~	~~500~~	~~9/18/09 1700~~	~~9/21/09 1605~~	~~9/21/09 2112~~	~~708~~	~~7~~	~~7155~~
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

KMD 9/30/09

KMD 9/30/09

Ra-226 Calibration Sheet

Standard ID: 09119-11
Volume Added (mL): 0.1
Expiration Date: 9/7/10

* 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	9/21/09 1700	9/24/09 1340	9/24/09 1745	701	7	~~3125~~
Cal 2	500	9/21/09 1700	9/24/09 1405	9/24/09 1805	702	7	3014
Cal 3	500	9/21/09 1700	9/24/09 1435	9/24/09 1825	703	7	3292
Cal 4	500	9/21/09 1700	9/24/09 1500	9/24/09 1845	704	7	3274
Cal 5	500	9/21/09 1700	9/24/09 1525	9/24/09 1905	705	7	3050
Cal 6	500	9/21/09 1700	9/24/09 1545	9/24/09 1925	706	7	3089
Cal 7	500	9/21/09 1700	9/24/09 1605	9/24/09 1945	707	7	3506
Cal 8	500	9/21/09 1700	9/24/09 1630	9/24/09 2000	708	7	3330
Cal 9	500	9/21/09 1700	9/24/09 1645	9/24/09 2020	709	7	3554
Cal 10	500	9/21/09 1700	9/24/09 1700	9/24/09 2050	710	7	3611
Cal 11	500	9/21/09 1700	9/24/09 1715	9/24/09 2205	711	7	3395
Cal 12	500	9/21/09 1700	9/24/09 1730	9/24/09 2227	712	7	2938

9/30/09

9/30/09

Ra-226 Calibration Sheet

Standard ID: 092409-H
Volume Added (mL): 0.1
Expiration Date: 8/7/10

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Total Counts
Cell 1	500	9/24/09 1100	9/28/09 1505	9/28/09 1835	708	7	7591

KD 9/30/09

KD 9/30/09

KD 9/30/09

General Engineering Laboratories

~~Verification~~ Source Preparation Sheet

#19 9/30/09 Calibration

Applicable SOP Number: GL-RAD-A-008

Isotope: RA-226

Date Standards Prepared: 4/5/05

Cocktail Type Used: NA

Standard ID: 0799-H

Matrix of Vial/Planchett: NA / NA / NA

Amount Used (g or (ml)): 0.1

Standard Activity (DPM/g or (mL)): 2483.2133

Type of Scintillation Vial: NA

Reference Date: 12/15/99

Pipette ID Used: 14293D3

Expiration Date: 8/1/10

Balance ID Used: 38080204

Residue/Carrier Agent: 0.1 M 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	WO 41280105			

Prepared By: Kelli Dowell Date: 9/30/09

Reviewed By: Angela Johnson Date: 9/30/09

Rev 1 RLM 9/10/97

ec'd 8-21-00

Nycomed Amersham plc
Amersham Laboratories

0299

[redacted]

CALIBRATION
No. 0146

[redacted]

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 Signatory

Date of issue 17th December 1999

WD91380109

Nycomed

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

(Mass of parent(g)) * (Parm Activity (kBq/g)) * (conversion dpm to kBq) / (Dilution Vol) = Parent Activity (dpm/mL)

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

(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (100 mL) = 122414.2500 dpm/mL

(4.6634 g) * (43.75 kBq/g) * (60000 dpm/kBq) / (1.0012 g/mL) / (100 mL) = 122273.3377 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

KD 9/23/2009

Verification for Ra-226 Standard 0299-H

M. Aders	Isotope	Value	Uncertainty
8/7/2009	0299-H	111.440	2.5408
	0299-H	115.924	2.5878
	0299-H	111.780	2.5407
Mean Value (Counting) =	113.048	101.49	**Pass**
Stdev =	2.496414563		**Rule 3 (Pass/Fail)**
Target =	111.39		
Lower Limit =	108.0550709		
Upper Limit =	118.0407291		
Rule 1 Pass/Fail	**Pass**		
Two sigma =	4.992829126		
10 % of Mean =	11.30479		
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 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:

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

RN891920a

Radon-222 Liquid

Filename : RN222.XLS
File type : Excel
Version # : 1.2.4

Batch : 891920
Analyst : MLA
Prep Date : 8/7/2009

Rn-222 Abundance : 1
Rn-222 Method Uncertainty : 0.1111
Geometry : 10ML MINERAL OIL/10ML SAMPLE

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

Procedure Code : LSC22RNL
Parmname : Radon-222
Required MDA : 200 pCi/L
Halflife of Radon-222 : 3.823 days

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

Sample Characteristics					Count raw Data				Background			
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Rack Position #	Counting Time (min.)	Quench#	Gross cpm	cpm	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

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)	Backgrounds Rack Position #	Backgrounds Count Start Date/Time	Spike Date/Time	Rn-222 Ingrowth	Rn-222 Count Correction	
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	

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 Error CPM	**2 SIGMA** Counting Uncertainty pCi/L	**2 SIGMA** Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	0.5420	0.3827	200	0.8092	**111.4397**	0.0141	509.0600	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	2.5878	25.4391		LCS			111.3896	104.1%
3	0.5404	0.3816	200	0.8068	**111.7802**	0.0140	512.1300	5.9390	2.5407	24.5345		LCS			111.3896	100.4%

3/13/15

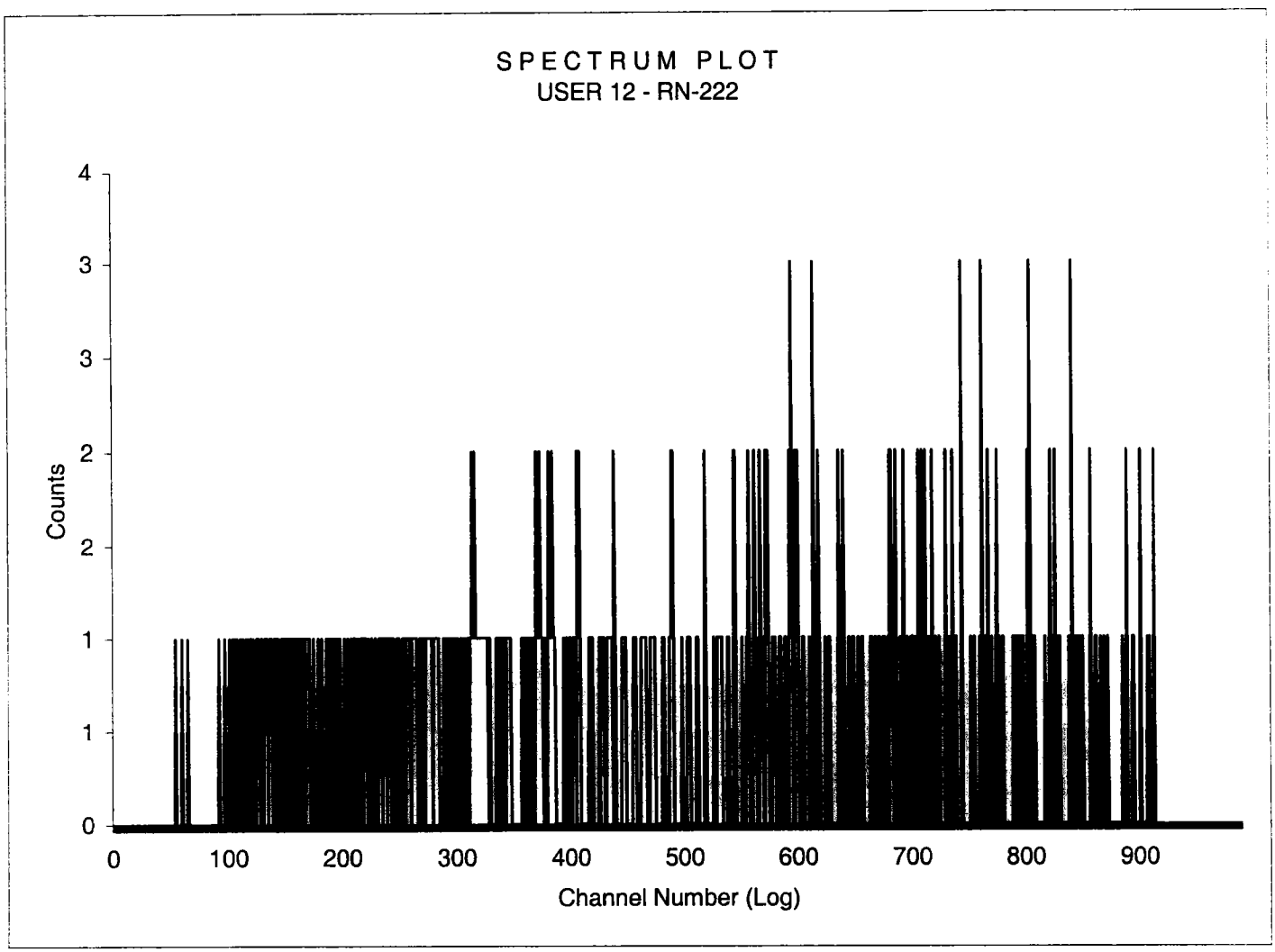
ID: R14-[illegible] 12 AUG 2009 07:42
USER:12 COMMENT:RED
PRESET TIME : 15.00
DATA CALC : CPM H# :YES SAMPLE REPEATS: 1 PRINTER :EDIT
COUNT BLANK : NO ID# : NO REPLICATES : 1 RS232 :EDIT
TWO PHASE : NO ADC : NO CYCLE REPEATS : 1 DISK : OFF
SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE REJ: 0
LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

CHAN: 600.0 - 375.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0
CHAN: 0.0 - 200.0 %ERROR: 2.00 FACTOR: 1.000000 BKG. SUB: 0

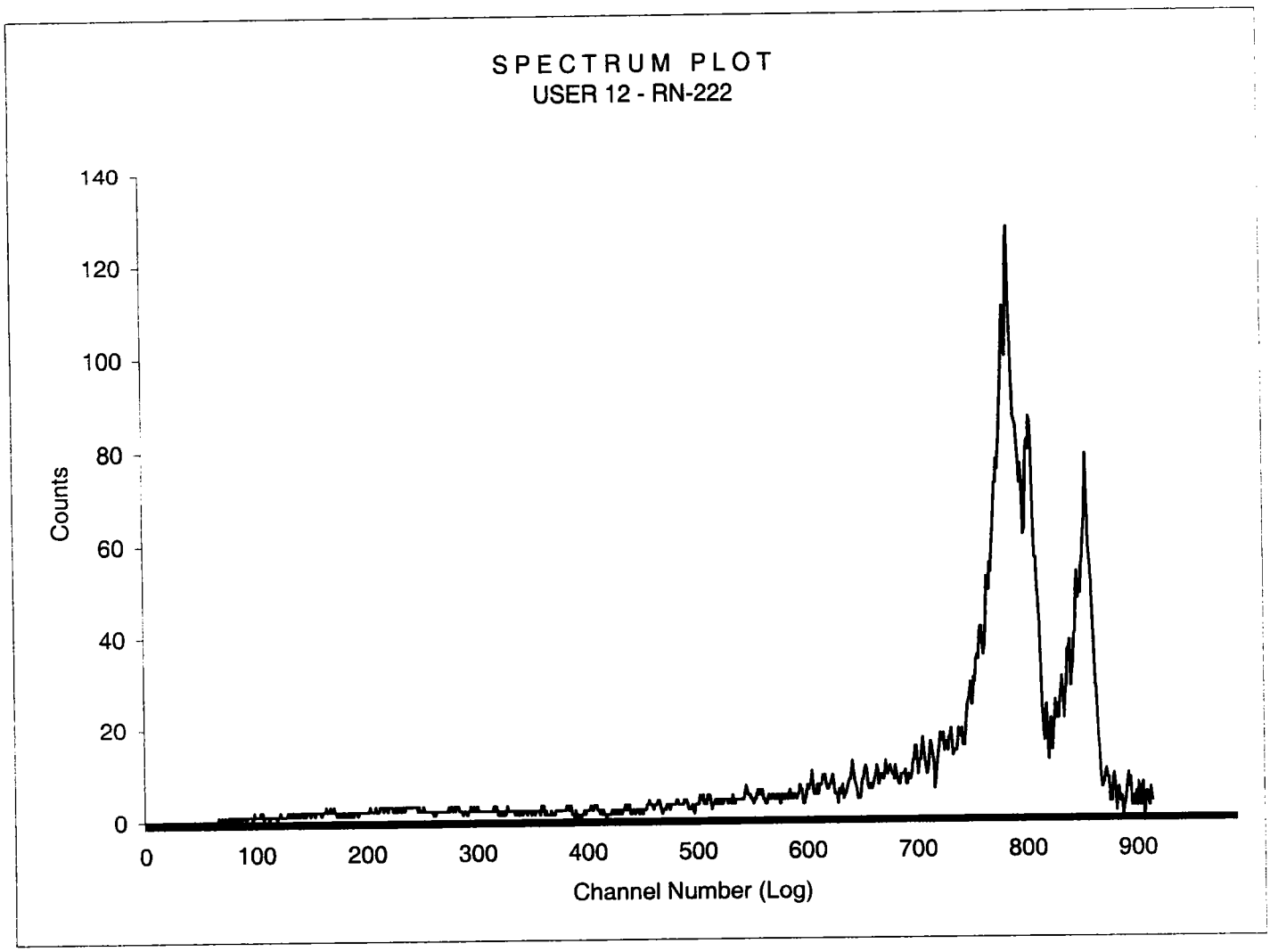
ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	H#	WIND1 RAW CPM	WIND2 RAW CPM	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
1	3-1	15.00	39.1	9.47	27.73	8.47	17.75	27.73	9.81	0.47	[illegible]
2	3-2	15.00	43.3	517.53	607.33	517.53	2.27	607.33	2.10	0.37	[illegible]
3	3-3	15.00	44.6	539.80	629.67	538.80	2.22	628.67	2.06	0.07	[illegible]
4	3-4	15.00	45.0	520.60	610.00	520.60	2.26	610.00	2.09	0.37	[illegible]

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

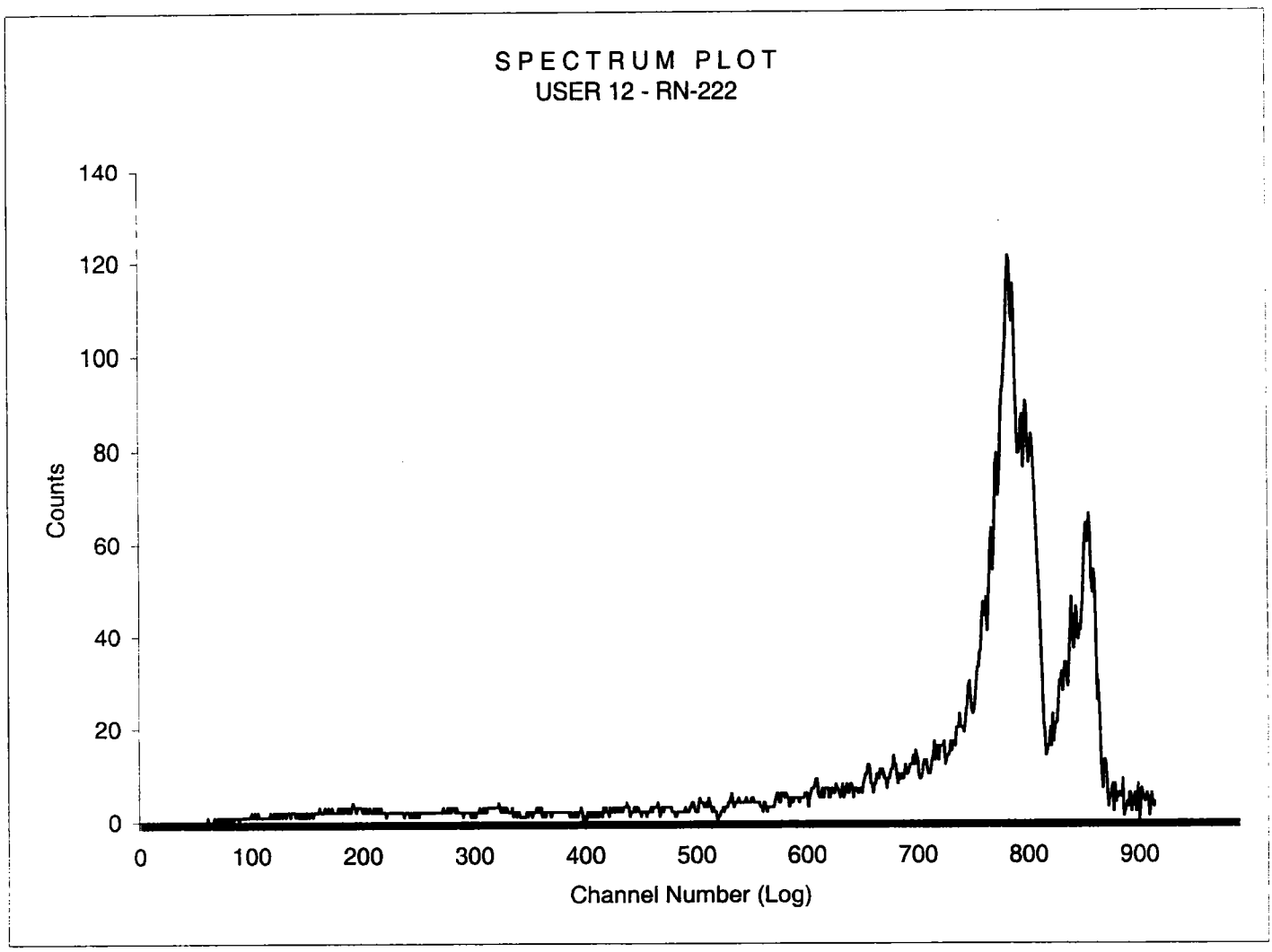


Sample Count Start Time:	12 Aug 2009 07:48:04		
Data Capture Date	12 Aug 2009 08:03:28		
User Filename	S12081208-2A.XLS		
	U12081208-1A.XLS		
Spectrum Type	Log Counts		
User Number	12		
User Id	RN-222		
User Comment	RED		
Isotope Name	14C		
Scintillator	LIQUID		
Sample, Rack-Pos, Time:	2	8-2	15.00
H#, Total Counts:	43.3	9166	
Start, End, X-Axis:	0	990	Channel Number

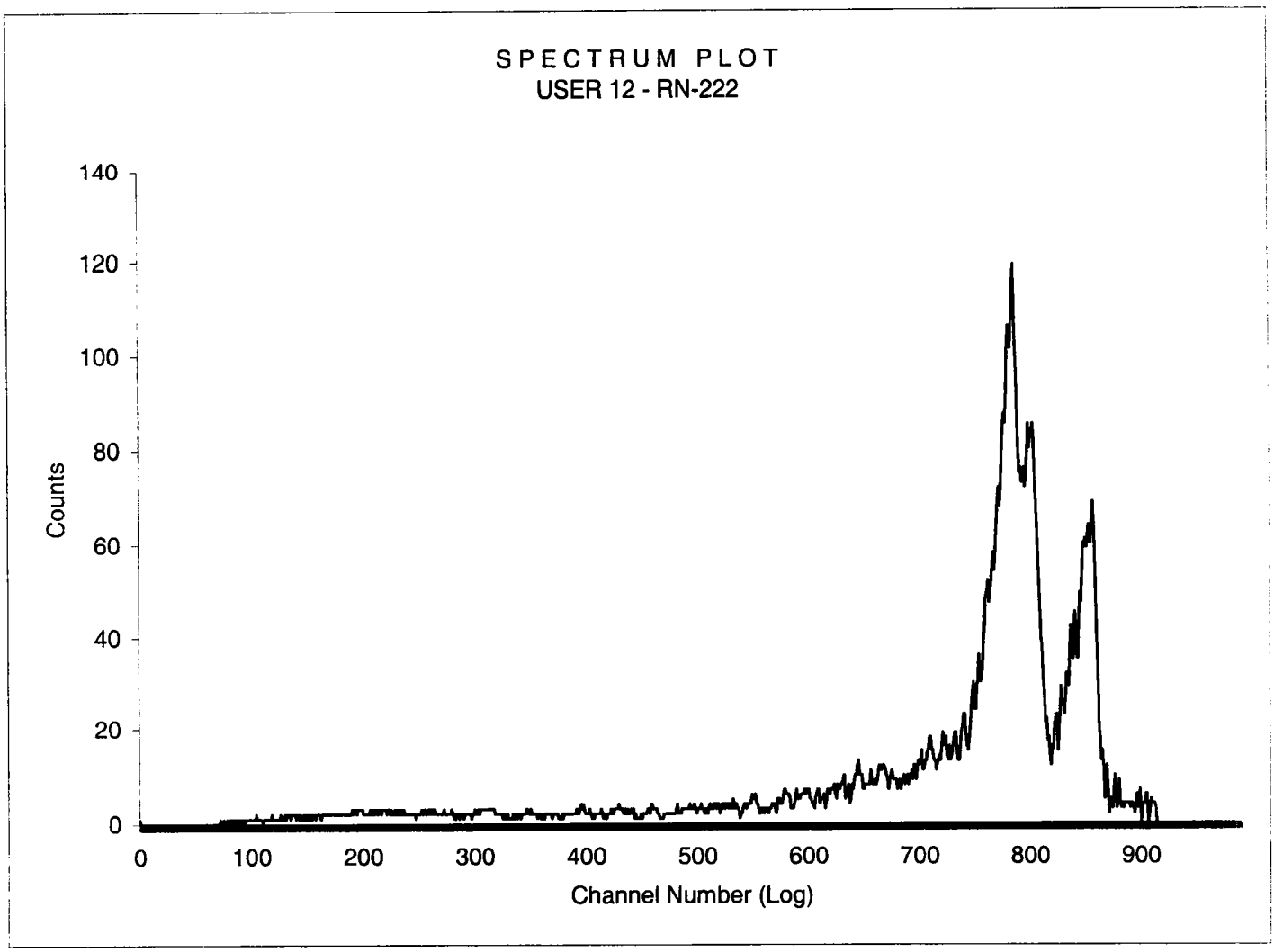


3/13/09

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	14C		
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



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	14C		
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



Radon 222 Que Sheet

08/07/2009

Batch #:891920 Analyst:MLA First Client Due Date: Internal Due Date:08/17/2009

Spike Isotope: Radium-226 Spike Code:0 Expiration Date:— Vol:— Nom Conc:_____

LCS Isotope: Radium-226 LCS Code:0709-H Expiration Date:8/17/09 Vol:0.1 ml Nom Conc:_____

Prep Date:8/7/09 Pipet ID:2070968 Initials:_____ 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
1201897268-1	LCS for batch 891920	LCS		.2 pCi/mL	DRINKING WATQC ACCOUNT		20-JUL-09 12:00 PM	1			1400
1201897269-1	LCS for batch 891920	LCS		.2 pCi/mL	DRINKING WATQC ACCOUNT		20-JUL-09 12:00 PM	2			1400
1201897270-1	LCS for batch 891920	LCS		.2 pCi/mL	DRINKING WATQC ACCOUNT		20-JUL-09 12:00 PM	3			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

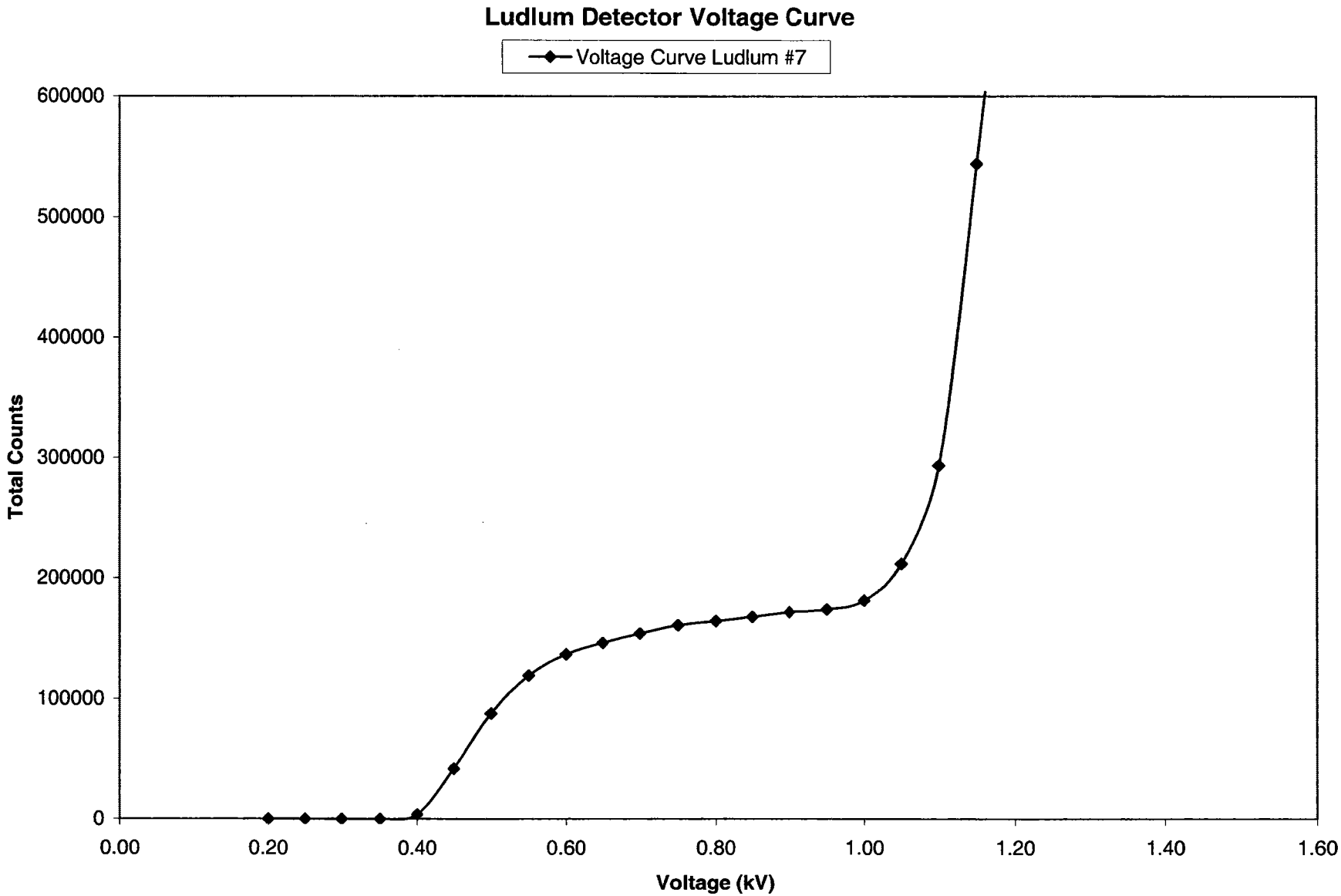
8/13/09

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
Total Counts
600000
500000
400000
300000
200000
100000
0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Voltage (kV)

JKQ
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
UPPER	**160934**
LOWER	**140489**

HA 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

9/30/09

Ra-226 WATER

Batch : LCSVER
Date : 9/22/2009
Analyst : KSD1
Bkg Count Time: 30 min

Procedure Code : LUC26RAL
Parmname : Radium-226
MDA : 1 pCi/L
Instrument Used : LUCAS CELL DETECTOR

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

KSD 9/30/09

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	constant	Net CPM cpm	Ingrowth constant
9/22/2009 14:30	9/30/2009 6:00	183.50	3.33	0.7498	0.9751	1.0009	42.1333	0.7318
9/22/2009 14:30	9/29/2009 10:00	163.50	6.17	0.7090	0.9545	1.0009	41.4000	0.6774
9/22/2009 14:30	9/29/2009 10:15	163.75	6.50	0.7095	0.9521	1.0009	41.4000	0.6762
9/22/2009 14:30	9/29/2009 10:30	164.00	6.75	0.7101	0.9503	1.0009	38.8667	0.6755
9/22/2009 14:30	9/29/2009 10:50	164.33	7.00	0.7108	0.9485	1.0009	33.8000	0.6749
9/22/2009 14:30	9/29/2009 11:15	164.75	7.17	0.7117	0.9473	1.0009	38.4000	0.6749
9/22/2009 14:30	9/29/2009 12:45	166.25	5.92	0.7150	0.9563	1.0009	35.6663	0.6844
9/22/2009 14:30	9/29/2009 13:10	166.67	5.83	0.7159	0.9569	1.0009	34.7333	0.6857
9/22/2009 14:30	9/29/2009 13:35	167.08	6.08	0.7168	0.9551	1.0009	37.0000	0.6852
9/22/2009 14:30	9/30/2009 6:30	184.00	3.33	0.7507	0.9751	1.0009	46.0000	0.7328
9/22/2009 14:30	9/29/2009 14:20	167.83	6.00	0.7184	0.9557	1.0009	35.5333	0.6872
9/22/2009 14:30	9/29/2009 14:40	168.17	6.50	0.7191	0.9521	1.0009	36.5333	0.6853

AHQ 9/30/09

Ra-226 Verification Sheet VERS #7 count time: 15 min

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts	
~~VER1~~	~~500~~	~~9/22/09 1430~~	~~9/24/09 0940~~	~~9/29/09 1535~~	~~701~~	~~7~~	~~8~~	~~488~~	~~#19 9/30/09~~
VER 2	500	9/22/09 1430	9/24/09 1000	9/29/09 1610	702	7	8	625	
VER 3	500	9/22/09 1430	9/24/09 1015	9/29/09 1645	703	7	1	625	
VER 4	500	9/22/09 1430	9/24/09 1030	9/29/09 1715	704	7	3	587	
VER 5	500	9/22/09 1430	9/24/09 1050	9/29/09 1750	705	7	1	511	
VER 6	500	9/22/09 1430	9/24/09 1115	9/29/09 1825	706	7	6	580	
VER 7	500	9/22/09 1430	9/24/09 1145	9/29/09 1840	707	7	1	539	
VER 8	500	9/22/09 1430	9/24/09 1310	9/29/09 1900	708	7	6	525	
VER 9	500	9/22/09 1430	9/24/09 1335	9/29/09 1940	709	7	5	559	
~~VER 10~~	~~500~~	~~9/22/09 1430~~	~~9/24/09 1400~~	~~9/29/09 2000~~	~~710~~	~~7~~	~~4~~	~~322~~	~~#19 9/30/09~~
VER 11	500	9/22/09 1430	9/24/09 1420	9/29/09 2020	711	7	7	537	
VER 12	500	9/22/09 1430	9/24/09 1440	9/29/09 2110	712	7	3	552	
									#19 9/30/09

Ra-226 Verification Sheet

*count is min

Sample ID	Volume (mL)	End Degas Date/Time	End De-em Date/Time	Start Count Date/Time	Cell #	Det #	Background CPM	Total Counts
VER16	500	9/22/09 1430	9/30/09 600	9/30/09 0920	701	7	3	636
VER17	500	9/22/09 1430	9/30/09 630	9/30/09 0950	710	7	8	694

JHQ 9/30/09

JHQ 9/30/09

General Engineering Laboratories
Verification Source Preparation Sheet

Applicable SOP Number: GL RAD-A 008

Date Standards Prepared: 7/23/08

Standard ID: 063874

Amount Used (g or ml): 0.1

Standard Activity (DPM/g or mL): 268.8845

Reference Date: 1/23/04

Expiration Date: 7/17/10

Residue/Carrier Agent: NA

Isotope: RA226

Cocktail Type Used: NA

Matrix of Vial/Planchett: NA / NA / NA

Type of Scintillation Vial: NA

Pipette ID Used: 1429303

Balance ID Used: 38080204

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				
13	Ver 16				
14	Ver 17				

HP 9/30/09

9/30/09

Prepared By: Kelli S Dowell Date: 9/30/09

Reviewed By: [signature] Date: 9/30/09

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

5.01065 grams 0.1M HCl solution with 50 µg/g Ba carrier.

P O NUMBER 3231RD, Item 5

SOURCE PREPARED BY: M. D. Currie

M. D. Currie, Radiochemist

Q A APPROVED: 1/26/04

WO 4730105

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	
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

(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / (Ampoule Mass(g) *(Dilution Vol)) = Parent Activity (dpm/mL)
(Mass of parent(g)) * (Parm Activity (dps)) * (conversion dpm to dps) / Density / (Ampoule Mass (g) * (Dilution Vol)) = Parent Activity (dpm/g)
(4.8398 g) * (23530 dps) * (60 dpm/dps) / (5.01065 g * 100 mL) = 13636.6133 dpm/mL
(4.8398 g) * (23530 dps) * (60 dpm/dps) / (1.0266 g/mL)/ (5.01065 g * 100 mL) = 13282.9676 dpm/g

VM 9/22/09

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

VM 9/30/09

Verification for Ra-226 Standard 0638-H

M. Aders	**Isotope**	**Value**	**Uncertainty**
7/17/2009	0638-H	12.025	1.2237
	0638-H	10.739	1.1752
	0638-H	12.348	1.2298
Mean Value (Counting) =	11.704	96.86	**Pass**
Stdev =	0.85081728		**Rule 3 (Pass/Fail)**
Target =	12.08		
Lower Limit =	10.00223211		
Upper Limit =	13.40550123		
Rule 1 Pass/Fail	**Pass**		
Two sigma =	1.701634559		
10 % of Mean =	1.170386667		
Rule 2 (Pass/Fail)	**Fail**	***Exception taken due to full reacovery of standard**	

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:

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

7/30/09
7/20/09
7/30/09

RN886194a

Radon-222 Liquid

Filename : RN222.XLS
File type : Excel
Version # : 1.2.4

Batch : 886194
Analyst : MLA
Prep Date : 7/17/2009

Rn-222 Abundance : 1
Rn-222 Method Uncertainty : 0.0556
Geometry : 10ML MINERAL OIL/10ML SAMPLE

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

Procedure Code : LSC99TCL
Parmname : Radon-222
Required MDA : 50 pCi/L
Halflife of Radon-222 : 3.823 days

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

Sample Characteristics					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 cpm	Background Count Time (min.)	Count Start Date/Time	Sample Decay
1	1201883284.1	1.0000	2.0399E-05	7/17/2009 15:00	22-2	15	50.3	43.73	8.20	15	7/20/2009 11:53	0.594
2	1201883285.1	1.0000	2.0399E-05	7/17/2009 15:00	22-3	15	50	38.2	8.20	15	7/20/2009 12:09	0.592
3	1201883286.1	1.0000	2.0399E-05	7/17/2009 15:00	22-4	15	49.1	45.4	8.20	15	7/20/2009 12:26	0.591

Calibration Data						Backgrounds		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 #	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

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 Error CPM	**2 SIGMA** Counting Uncertainty pCi/L	**2 SIGMA** Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
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 Date07/22/2009

Spike Isotope: Radium-226 Spike Code: C638 H Expiration Date: 7/23/09 Vol: [illegible] Nom Conc:

LCS Isotope: Radium-226 LCS Code: — Expiration Date: — Vol: — Nom Conc:

Comments

Prep Date: 7/17/09 Pipet ID: 2971058 Initials: [illegible] Witness: —

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

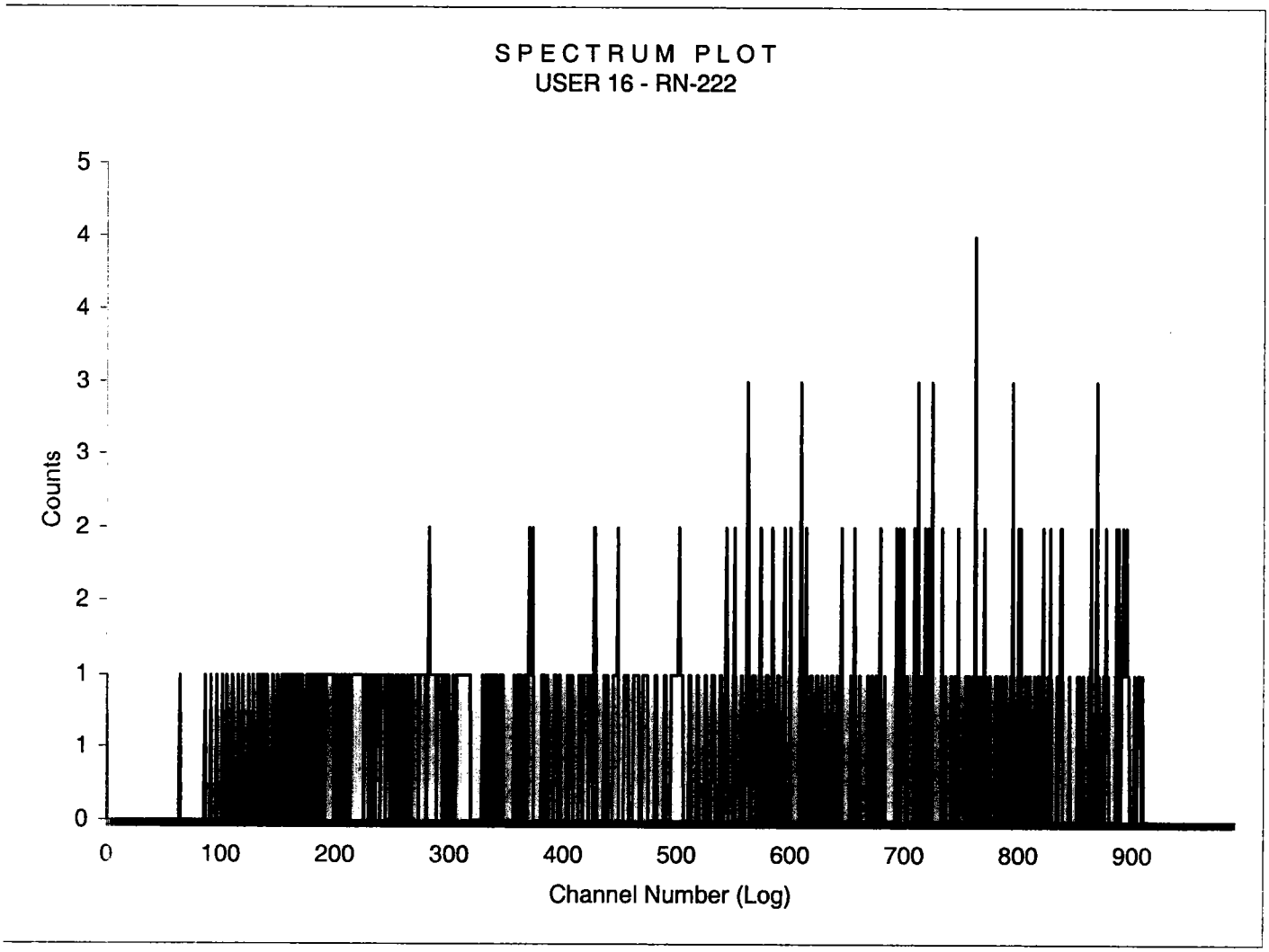
ID: RIN-2222 20 JUL 2009 11:16
USER: LA COMMENT: GREEN
PRESET TIME : 15.00
DATA CALC : CPM H# :YES SAMPLE REPEATS: 1 PRINTER :EDIT
COUNT SCAN : NO IC# : NO REPLICATES : 1 RS232 :EDIT
TWO PHASE : NO AQC : NO CYCLE REPEATS : 1 DISK : OFF
SCINTILLATOR: LIQUID LUMEX:YES LOW SAMPLE REJ: 0 RWM LIST : OFF
LOW 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

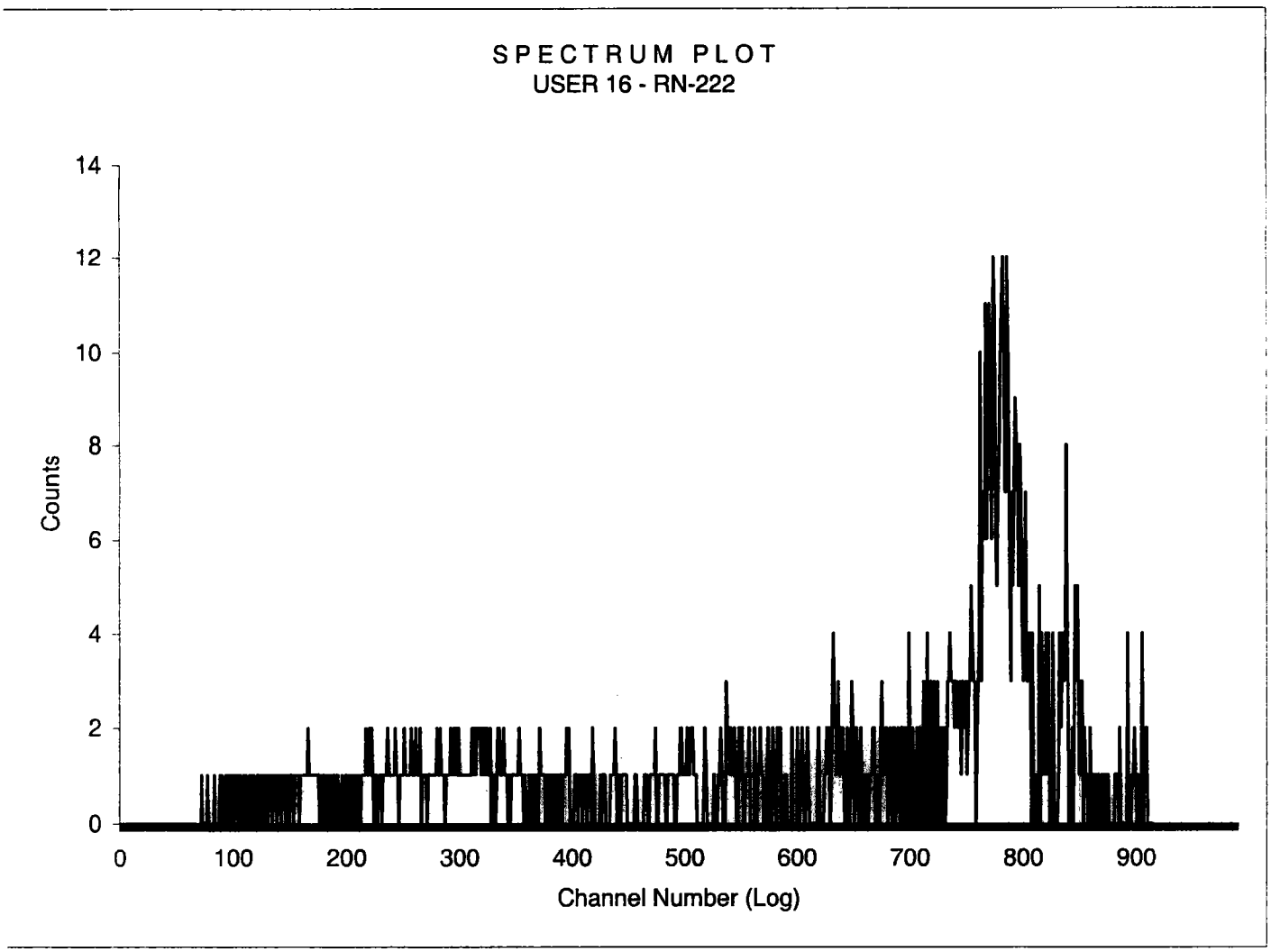
ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	H#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
1	2:1-1	15.00	47.9	8.20	18.03	19.13	11.81	0.38	15.92
2	2:1-2	15.00	50.3	43.73	7.81	60.67	6.63	0.16	32.28
3	2:1-3	15.00	50.0	38.20	8.36	52.27	7.14	0.17	48.66
4	2:1-4	15.00	49.1	45.40	7.66	62.93	6.51	0.15	65.03

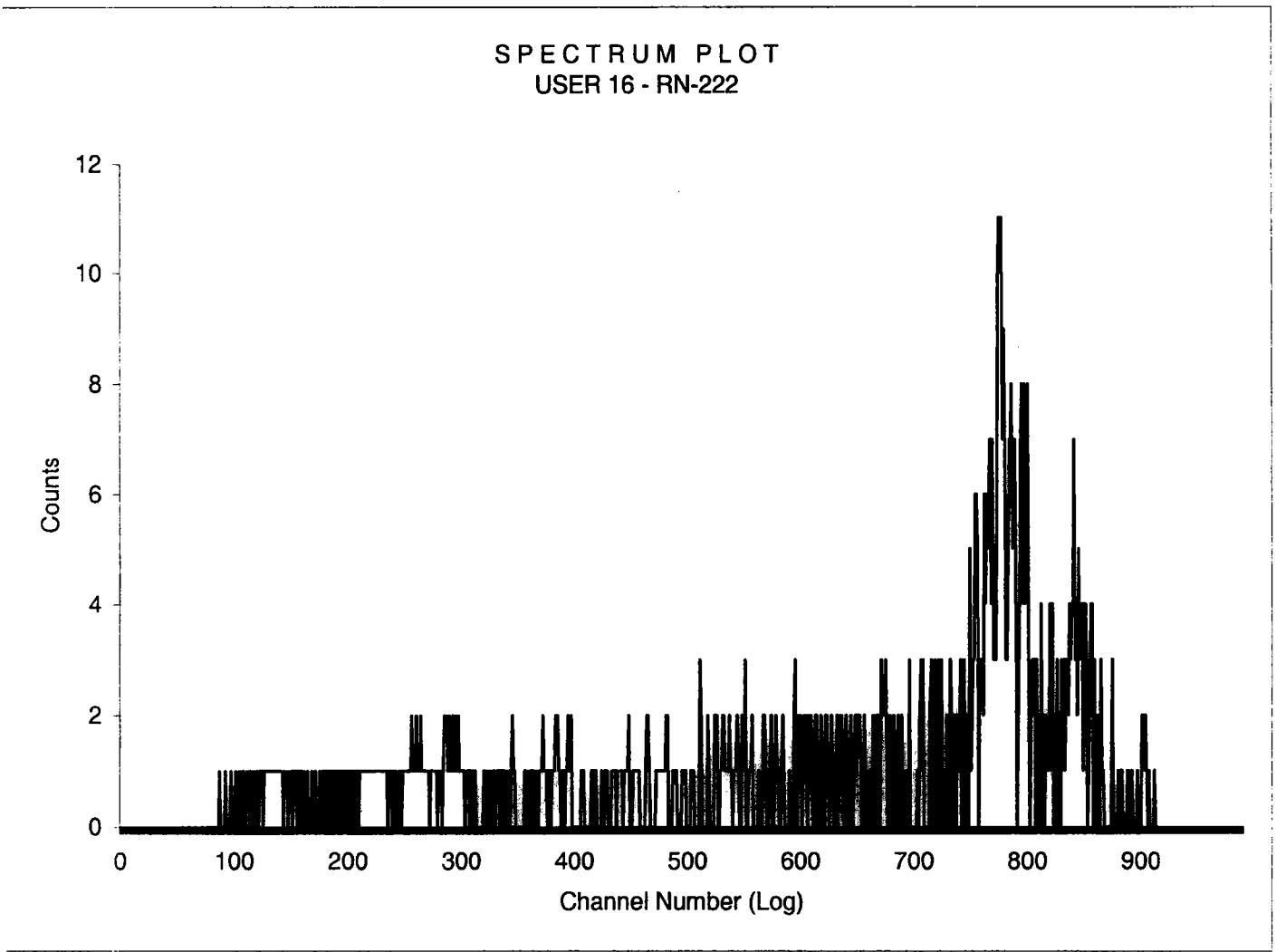
Sample Count Start Time:	20 Jul 2009 11:36:58		
Data Capture Date	20 Jul 2009 11:52:21		
User Filename	S16072022-1B.XLS		
	U16072022-1B.XLS		
Spectrum Type	Log Counts		
User Number	16		
User Id	RN-222		
User Comment	GREEN		
Isotope Name	14C		
Scintillator	LIQUID		
Sample, Rack-Pos, Time:	1	22-1	15.00
H#, Total Counts:	47.9	412	
Start, End, X-Axis:	0	990	Channel Number



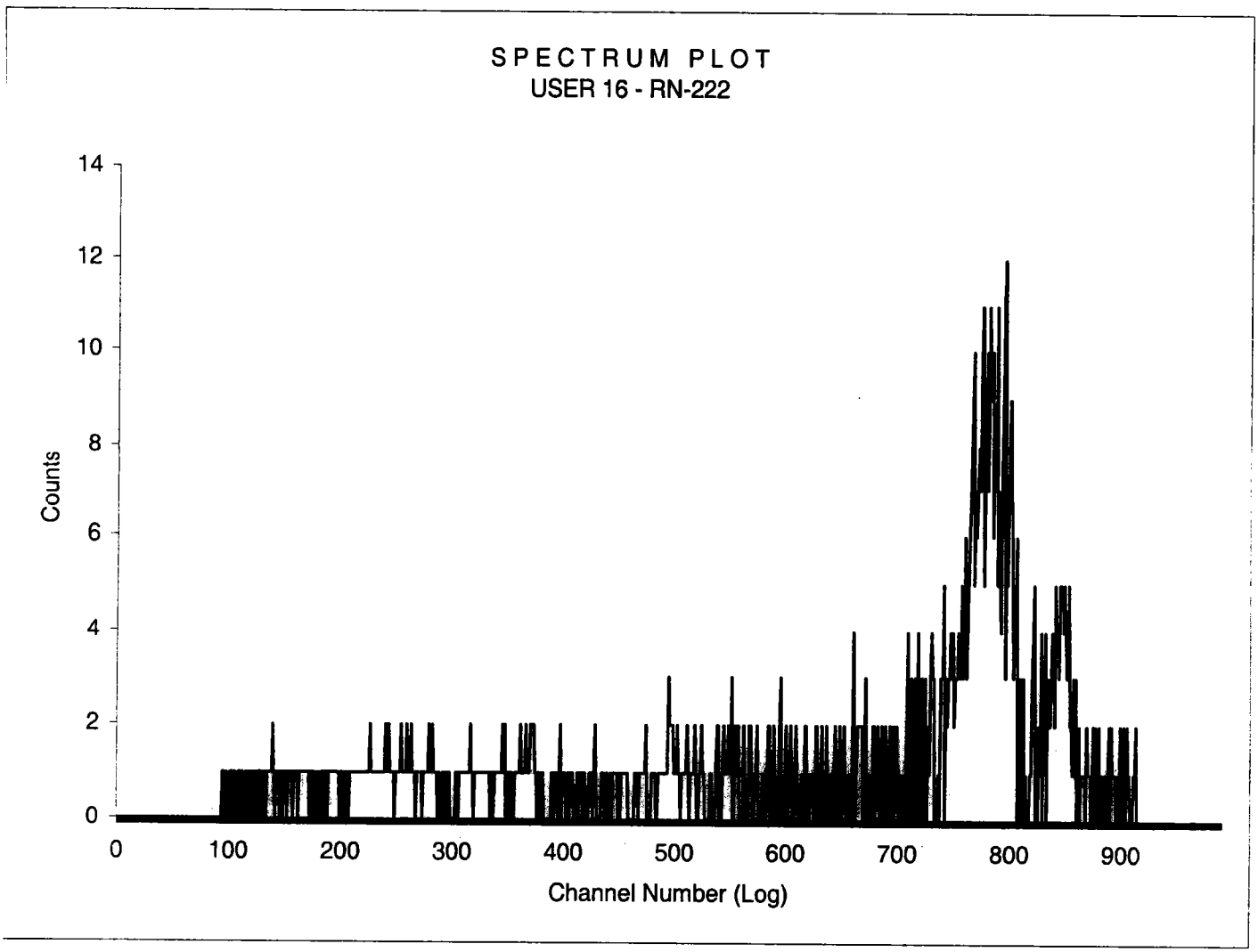
Sample Count Start Time:	20 Jul 2009 11:53:20		
Data Capture Date	20 Jul 2009 12:08:43		
User Filename	S16072022-2B.XLS		
	U16072022-1B.XLS		
Spectrum Type	Log Counts		
User Number	16		
User Id	RN-222		
User Comment	GREEN		
Isotope Name	14C		
Scintillator	LIQUID		
Sample, Rack-Pos, Time:	2	22-2	15.00
H#, Total Counts:	50.3	1100	
Start, End, X-Axis:	0	990	Channel Number



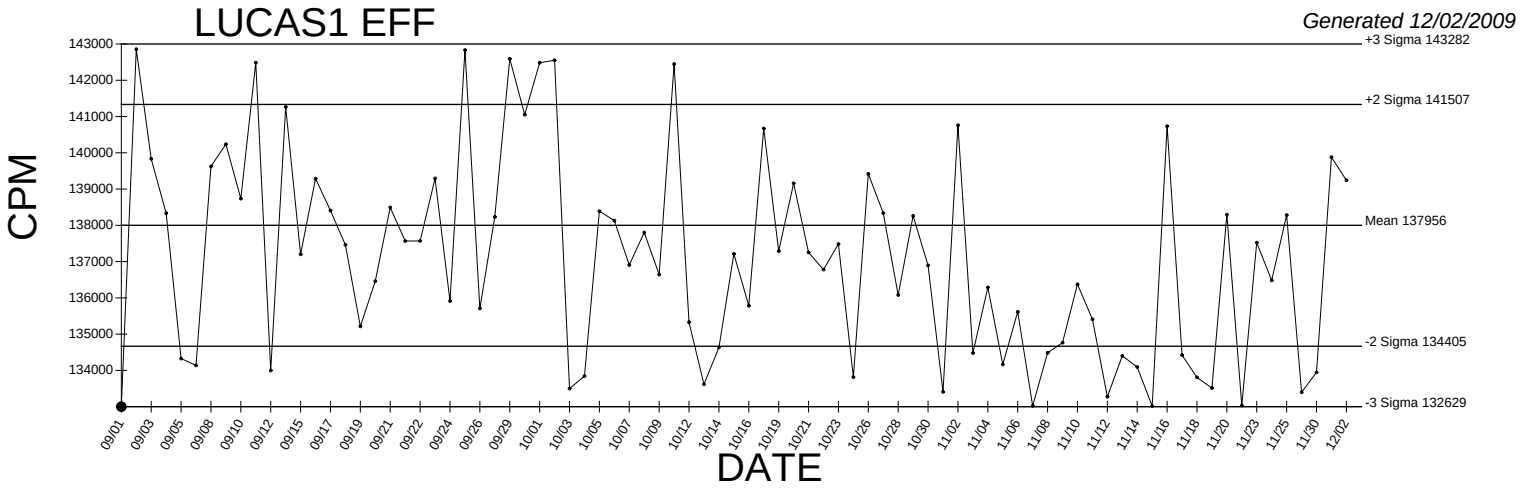
Sample Count Start Time:	20 Jul 2009 12:09:43		
Data Capture Date	20 Jul 2009 12:25:05		
User Filename	S16072022-3B.XLS		
	U16072022-1B.XLS		
Spectrum Type	Log Counts		
User Number	16		
User Id	RN-222		
User Comment	GREEN		
Isotope Name	14C		
Scintillator	LIQUID		
Sample, Rack-Pos, Time:	3	22-3	15.00
H#, Total Counts:	50.0	956	
Start, End, X-Axis:	0	990	Channel Number



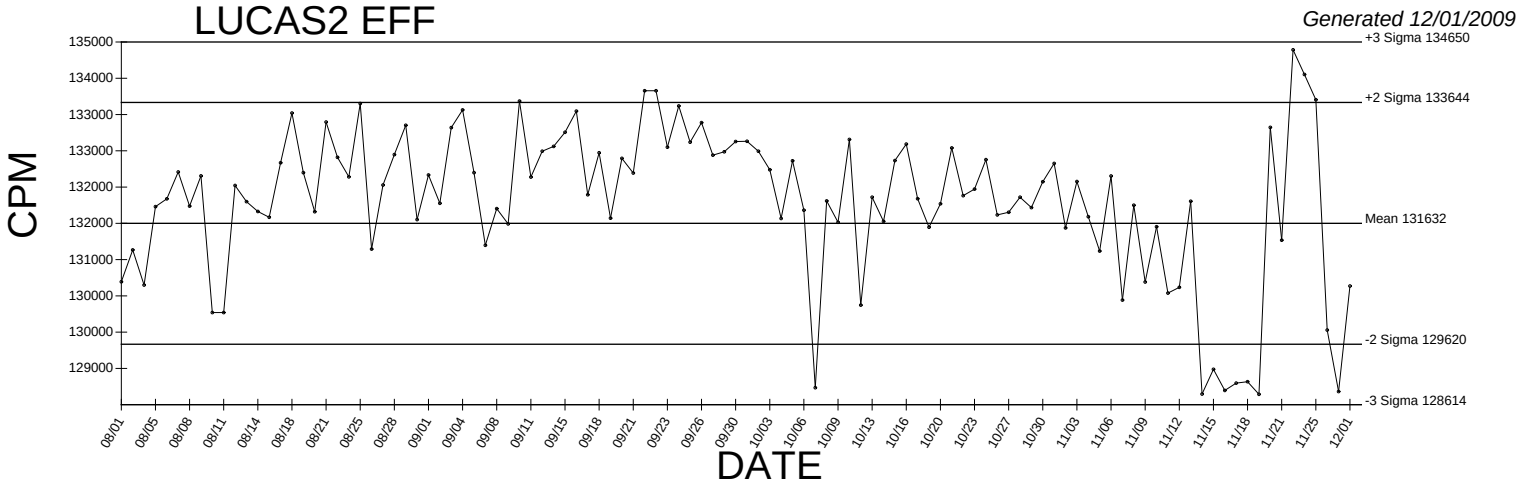
Sample Count Start Time:	20 Jul 2009 12:26:05		
Data Capture Date	20 Jul 2009 12:41:28		
User Filename	S16072022-4B.XLS		
	U16072022-1B.XLS		
Spectrum Type	Log Counts		
User Number	16		
User Id	RN-222		
User Comment	GREEN		
Isotope Name	14C		
Scintillator	LIQUID		
Sample, Rack-Pos, Time:	4	22-4	15.00
H#, Total Counts:	49.1	1123	
Start, End, X-Axis:	0	990	Channel Number



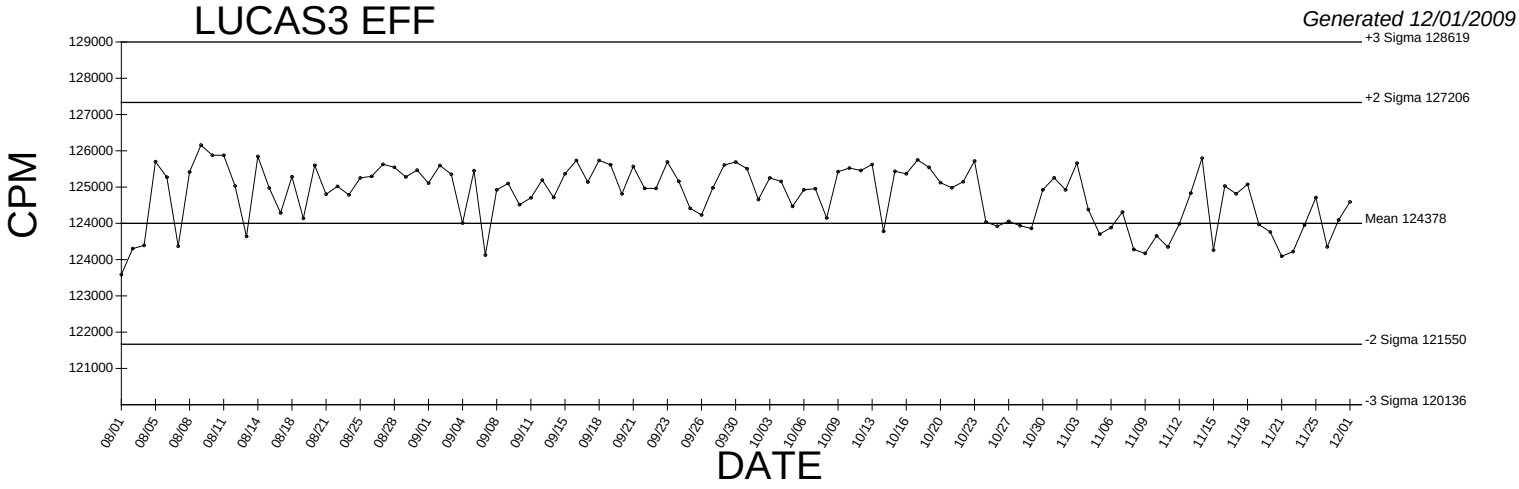
BACKGROUND AND EFFICIENCY DATA



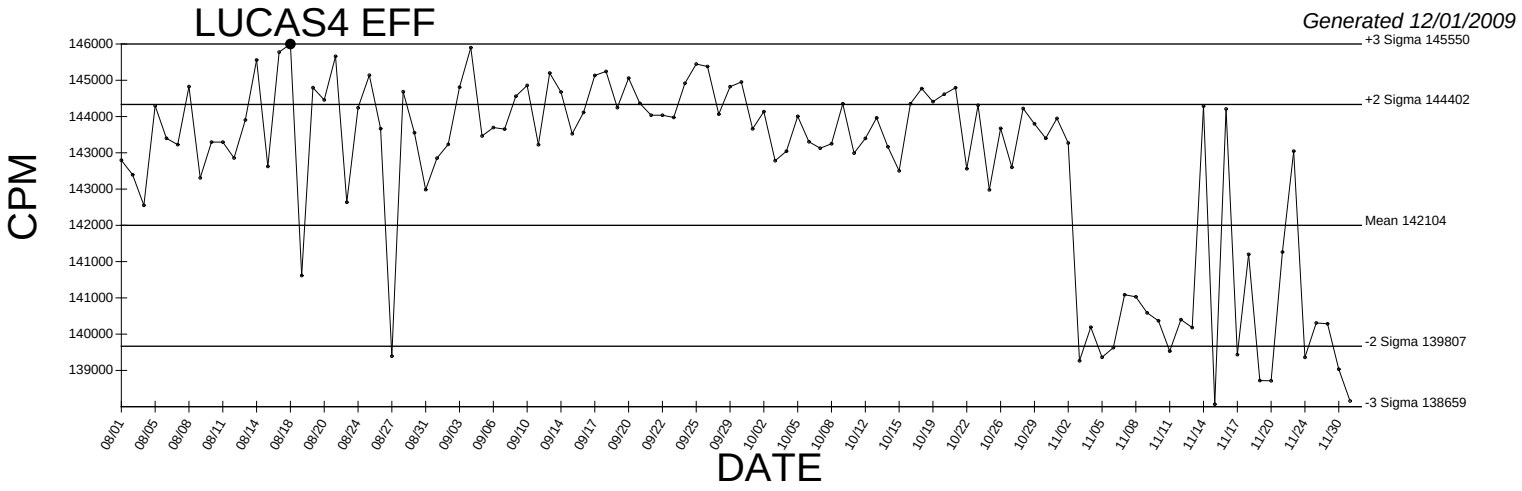
● Denotes Outlier



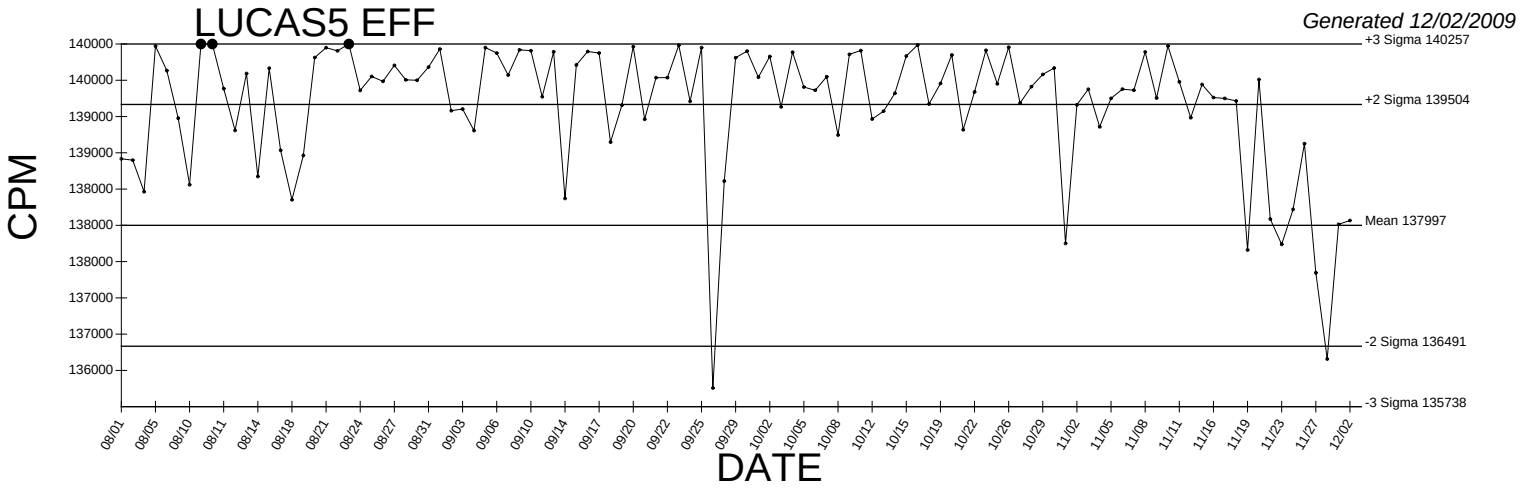
● Denotes Outlier



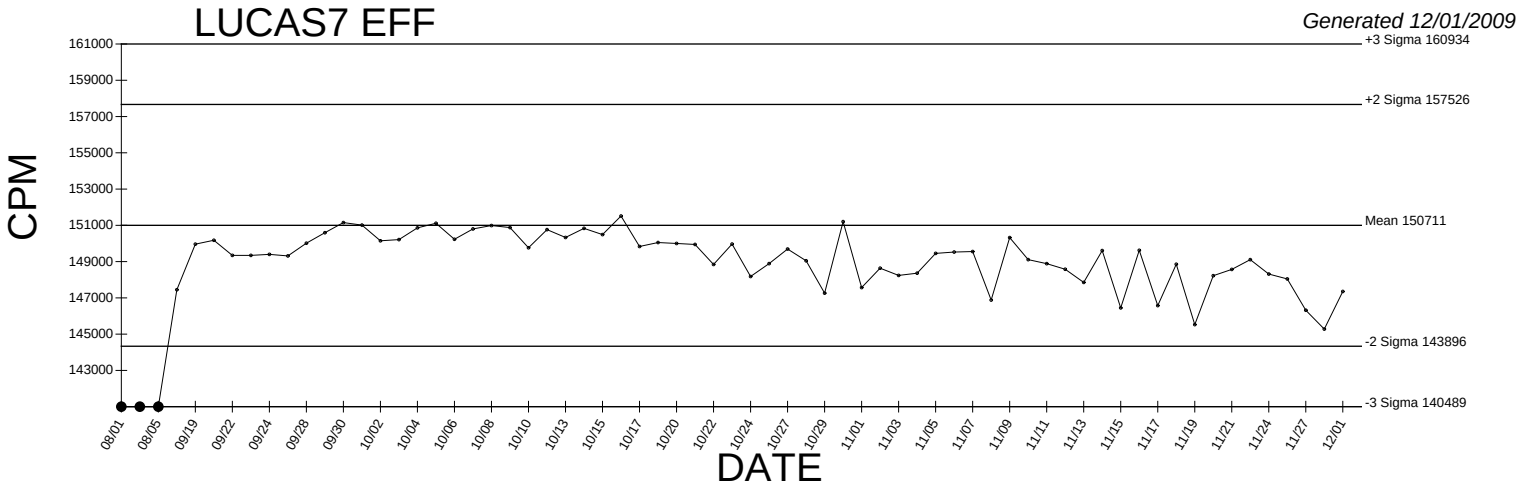
● Denotes Outlier



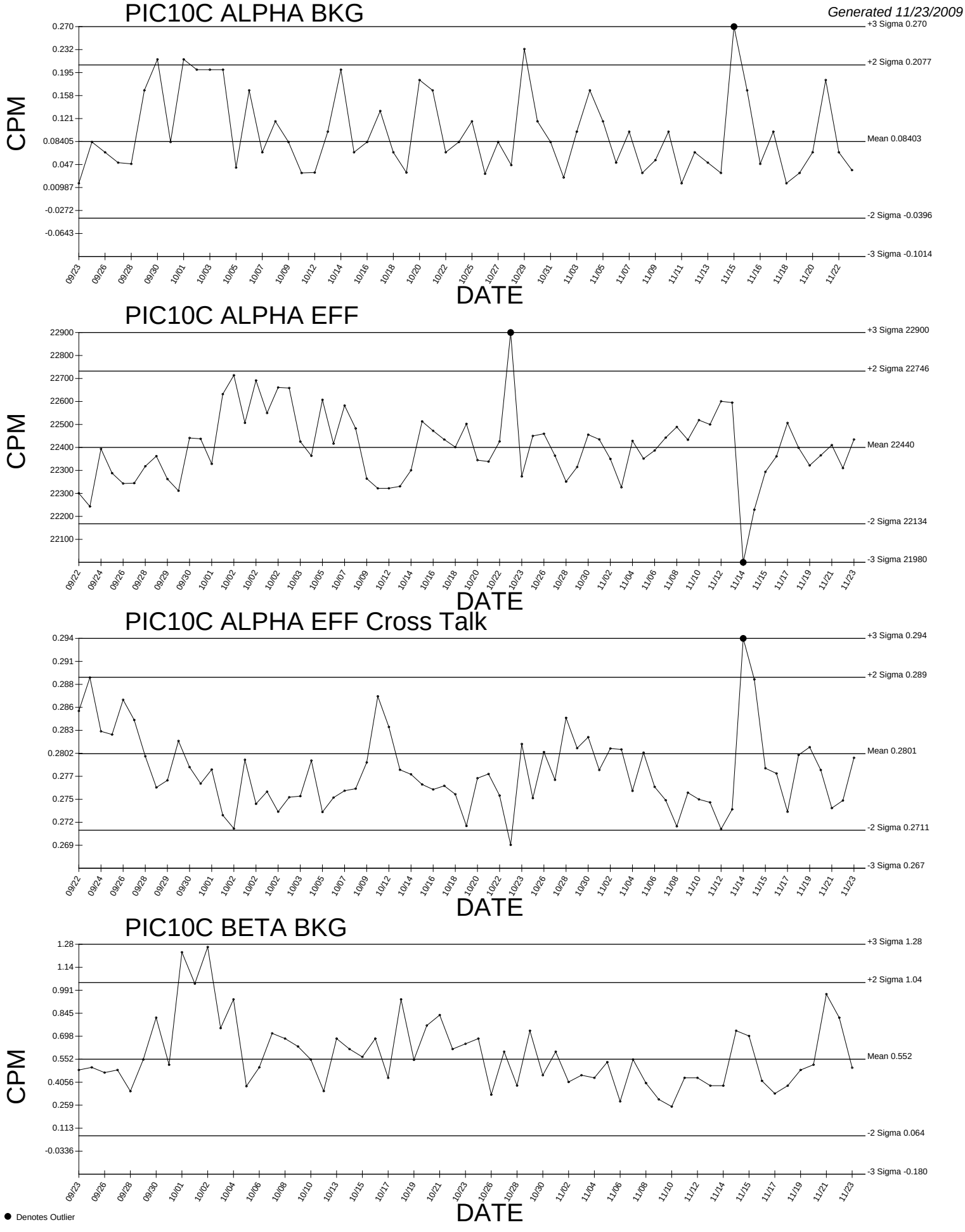
● Denotes Outlier

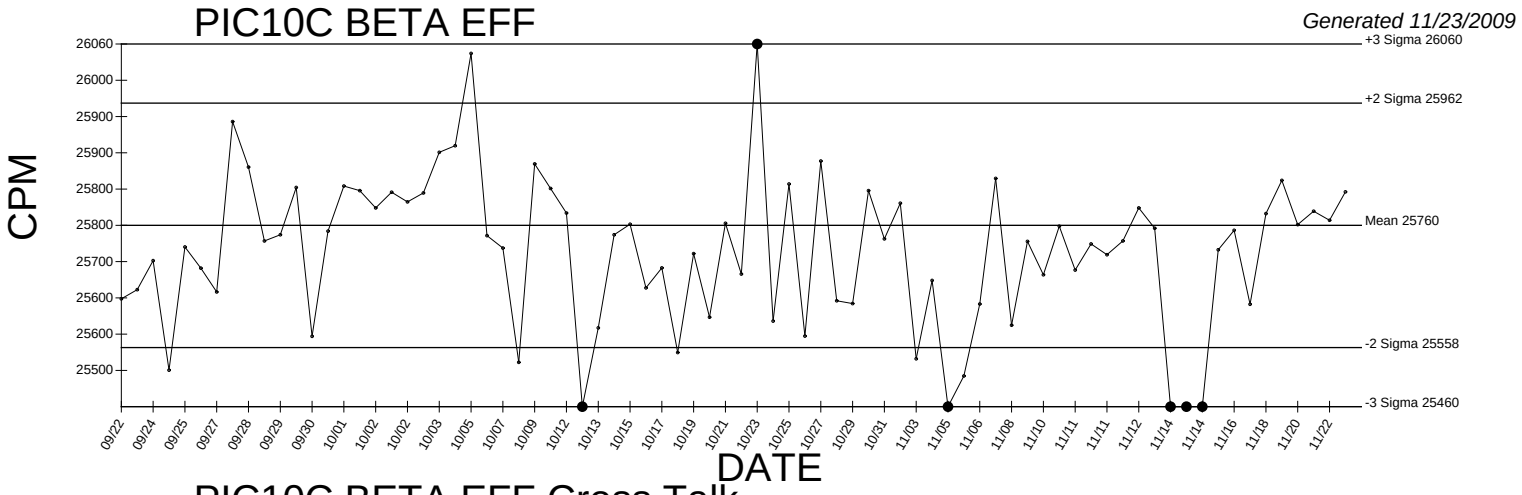


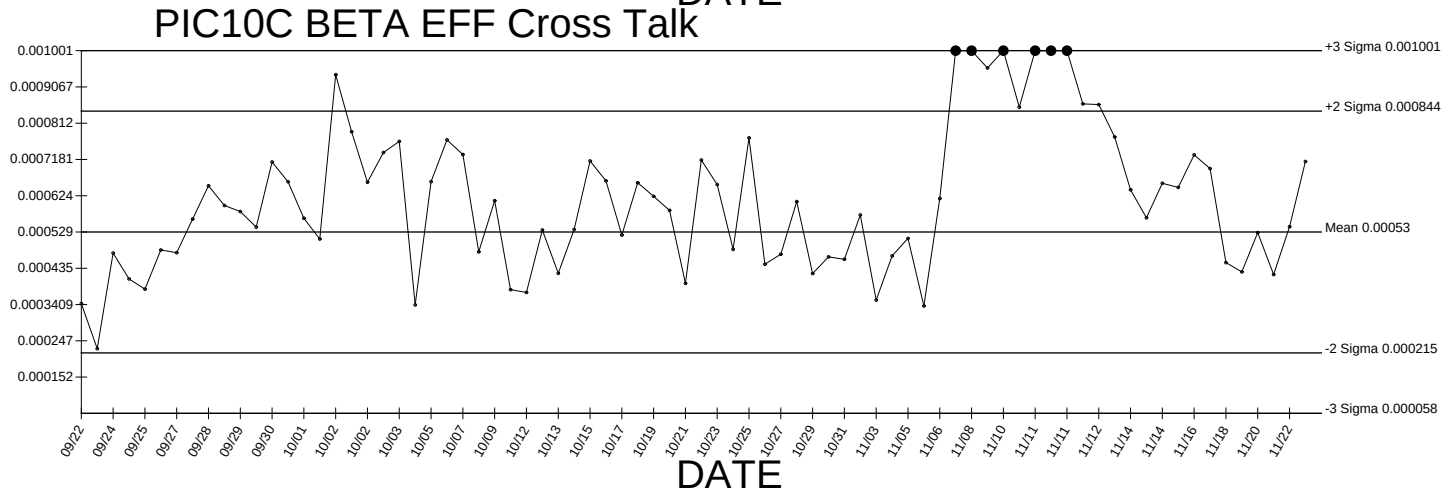
● Denotes Outlier



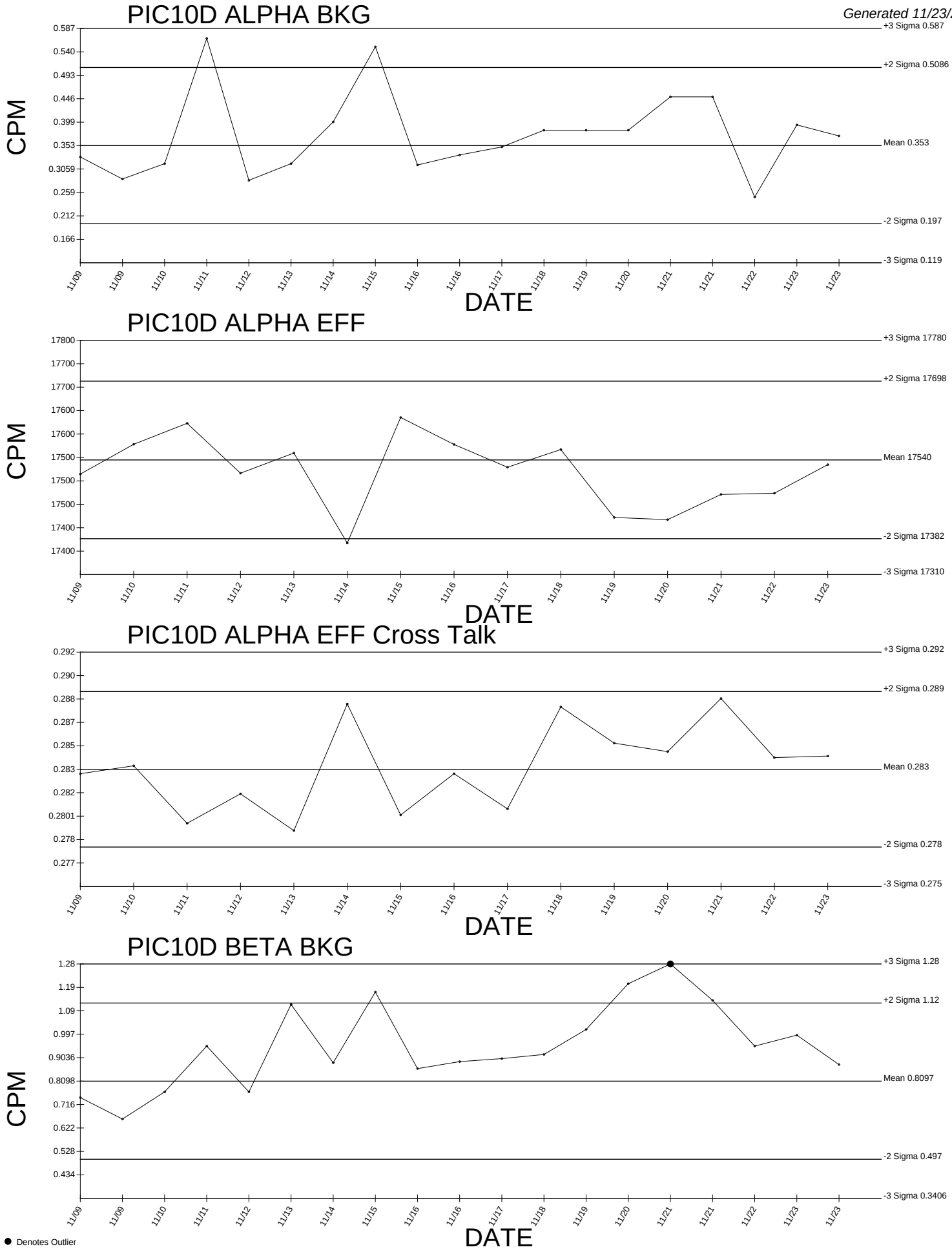
● Denotes Outlier

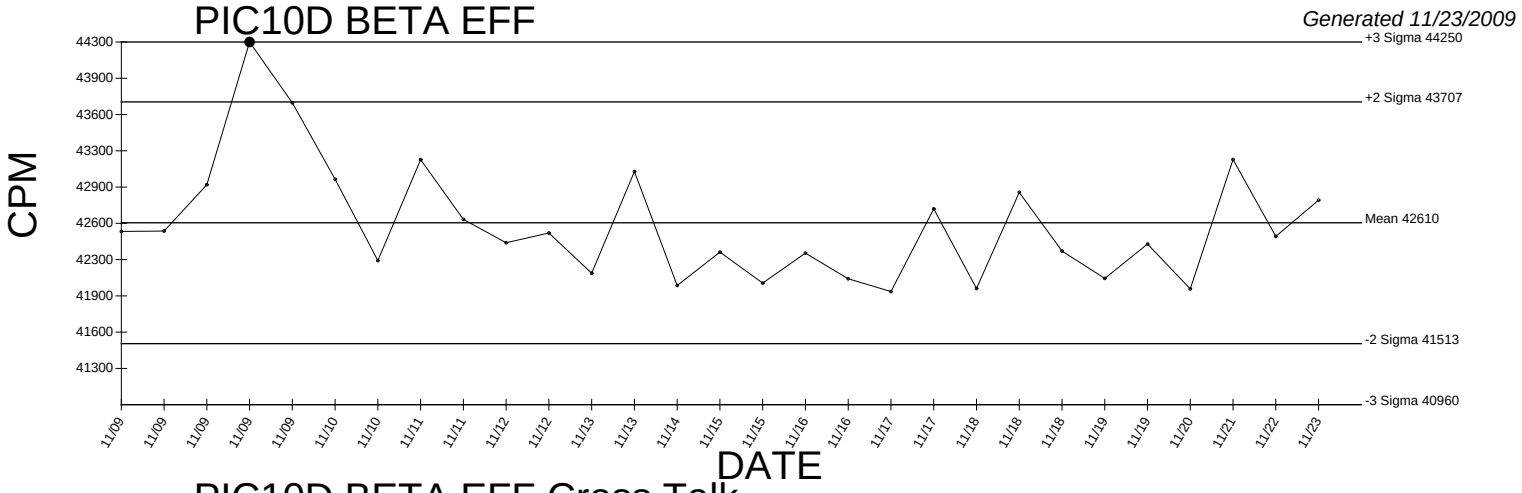

PIC10C ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.270
+2 Sigma 0.2077
Mean 0.08403
-2 Sigma -0.0396
-3 Sigma -0.1014
PIC10C ALPHA EFF
+3 Sigma 22900
+2 Sigma 22746
Mean 22440
-2 Sigma 22134
-3 Sigma 21980
PIC10C ALPHA EFF Cross Talk
+3 Sigma 0.294
+2 Sigma 0.289
Mean 0.2801
-2 Sigma 0.2711
-3 Sigma 0.267
PIC10C BETA BKG
+3 Sigma 1.28
+2 Sigma 1.04
Mean 0.552
-2 Sigma 0.064
-3 Sigma -0.180
Denotes Outlier

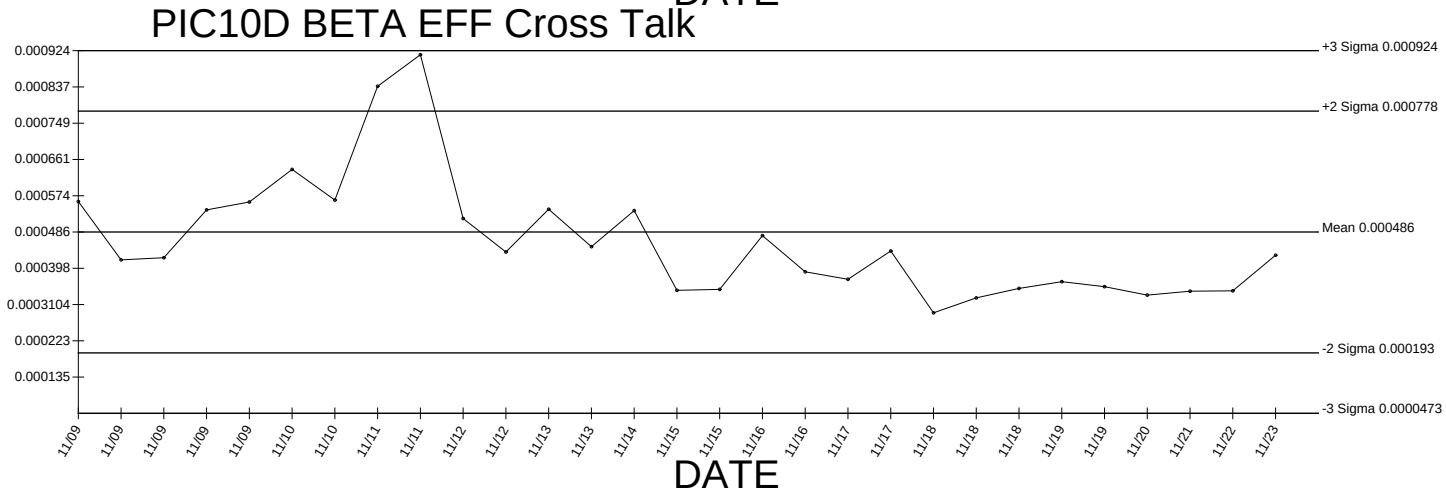




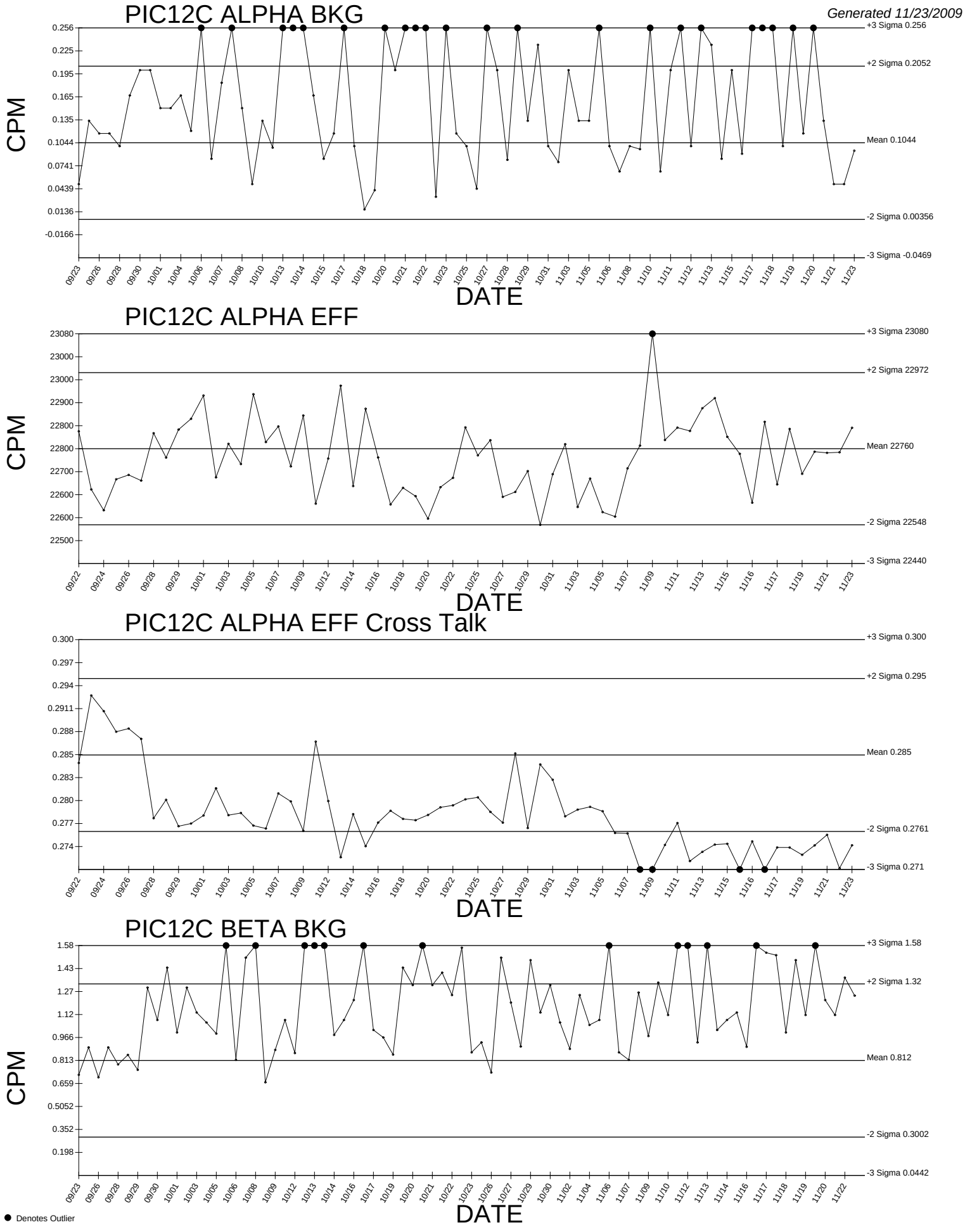
● Denotes Outlier

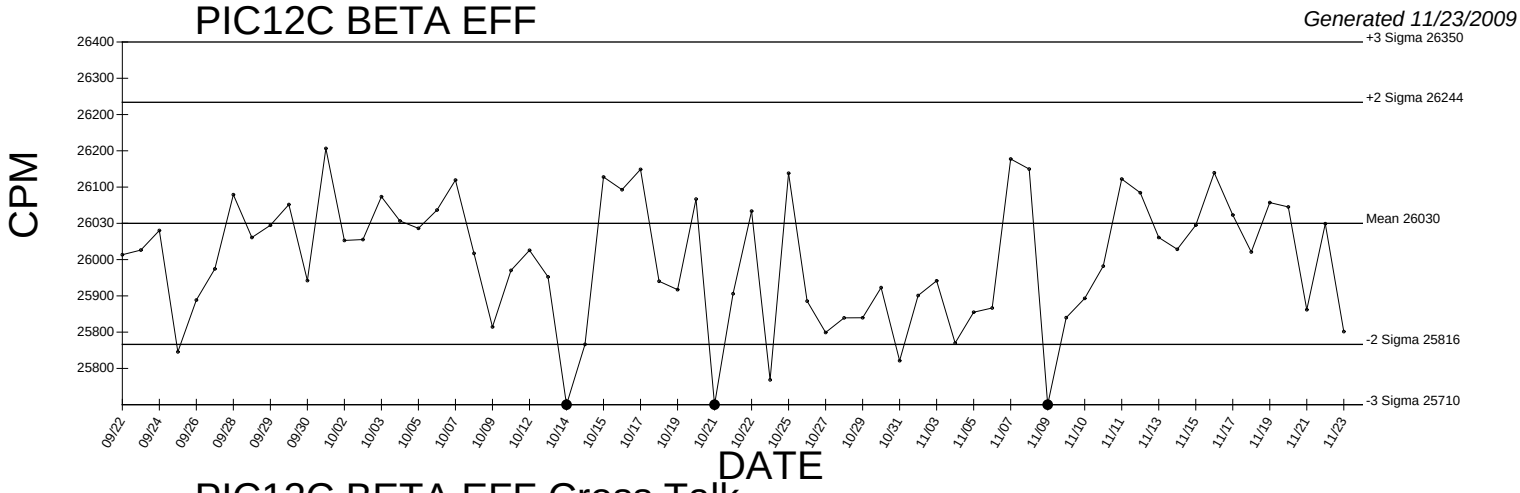

PIC10D ALPHA BKG
Generated 11/23/2009
CPM
0.587
0.540
0.493
0.446
0.399
0.353
0.3059
0.259
0.212
0.166
+3 Sigma 0.587
+2 Sigma 0.5086
Mean 0.353
-2 Sigma 0.197
-3 Sigma 0.119
11/09
11/09
11/10
11/11
11/12
11/13
11/14
11/15
11/16
11/16
11/17
11/18
11/19
11/20
11/21
11/21
11/22
11/23
11/23
DATE
PIC10D ALPHA EFF
CPM
17800
17700
17700
17600
17600
17500
17500
17500
17400
17400
+3 Sigma 17780
+2 Sigma 17698
Mean 17540
-2 Sigma 17382
-3 Sigma 17310
11/09
11/10
11/11
11/12
11/13
11/14
11/15
11/16
11/17
11/18
11/19
11/20
11/21
11/22
11/23
DATE
PIC10D ALPHA EFF Cross Talk
0.292
0.290
0.288
0.287
0.285
0.283
0.282
0.2801
0.278
0.277
+3 Sigma 0.292
+2 Sigma 0.289
Mean 0.283
-2 Sigma 0.278
-3 Sigma 0.275
11/09
11/10
11/11
11/12
11/13
11/14
11/15
11/16
11/17
11/18
11/19
11/20
11/21
11/22
11/23
DATE
PIC10D BETA BKG
CPM
1.28
1.19
1.09
0.997
0.9036
0.8098
0.716
0.622
0.528
0.434
+3 Sigma 1.28
+2 Sigma 1.12
Mean 0.8097
-2 Sigma 0.497
-3 Sigma 0.3406
11/09
11/09
11/10
11/11
11/12
11/13
11/14
11/15
11/16
11/16
11/17
11/18
11/19
11/20
11/21
11/21
11/22
11/23
11/23
DATE
● Denotes Outlier

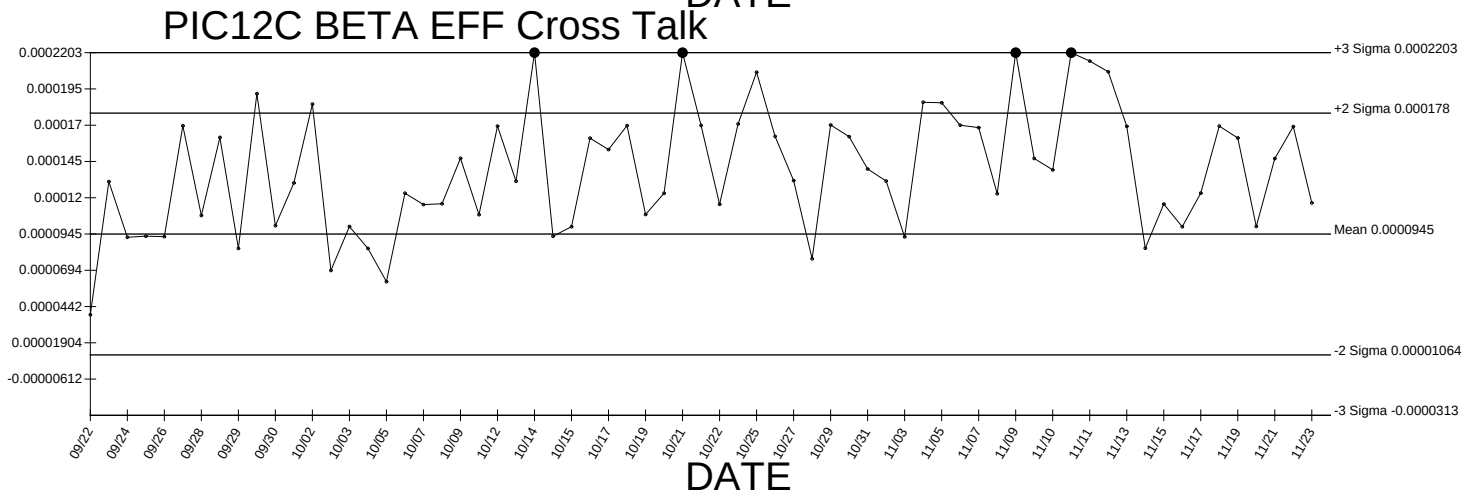




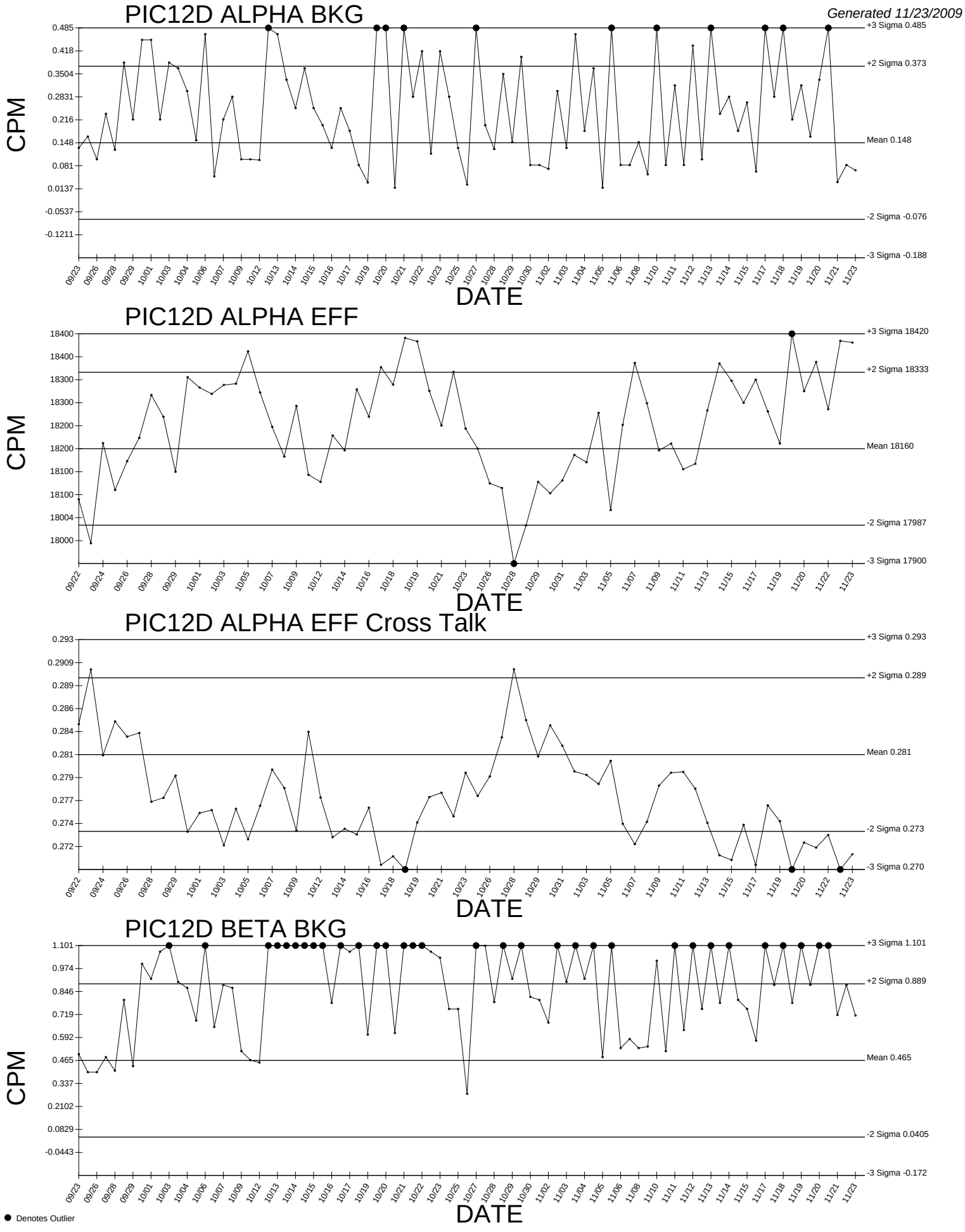
● Denotes Outlier

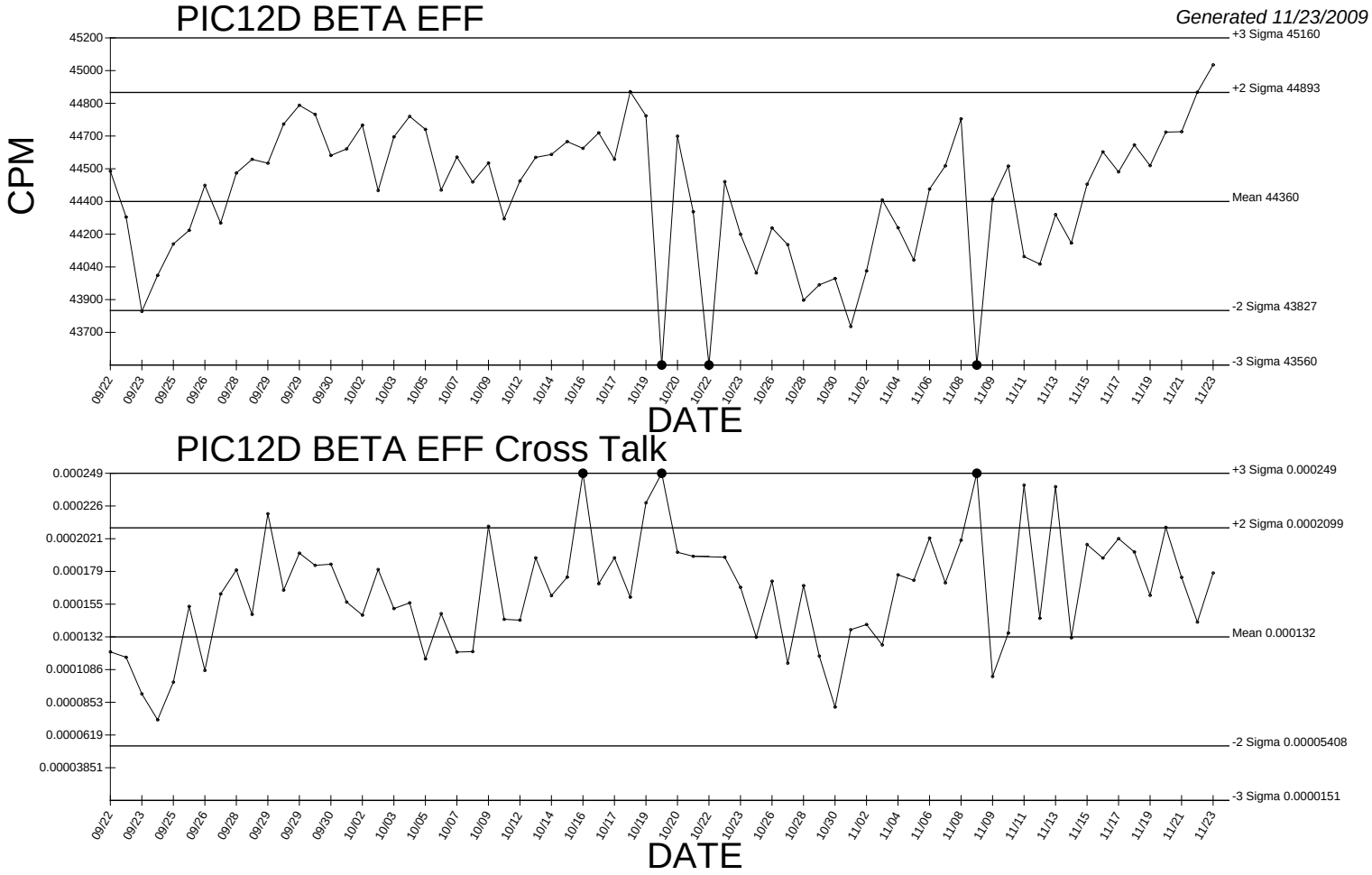

PIC12C ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.256
+2 Sigma 0.2052
Mean 0.1044
-2 Sigma 0.00356
-3 Sigma -0.0469
PIC12C ALPHA EFF
+3 Sigma 23080
+2 Sigma 22972
Mean 22760
-2 Sigma 22548
-3 Sigma 22440
PIC12C ALPHA EFF Cross Talk
+3 Sigma 0.300
+2 Sigma 0.295
Mean 0.285
-2 Sigma 0.2761
-3 Sigma 0.271
PIC12C BETA BKG
+3 Sigma 1.58
+2 Sigma 1.32
Mean 0.812
-2 Sigma 0.3002
-3 Sigma 0.0442
● Denotes Outlier



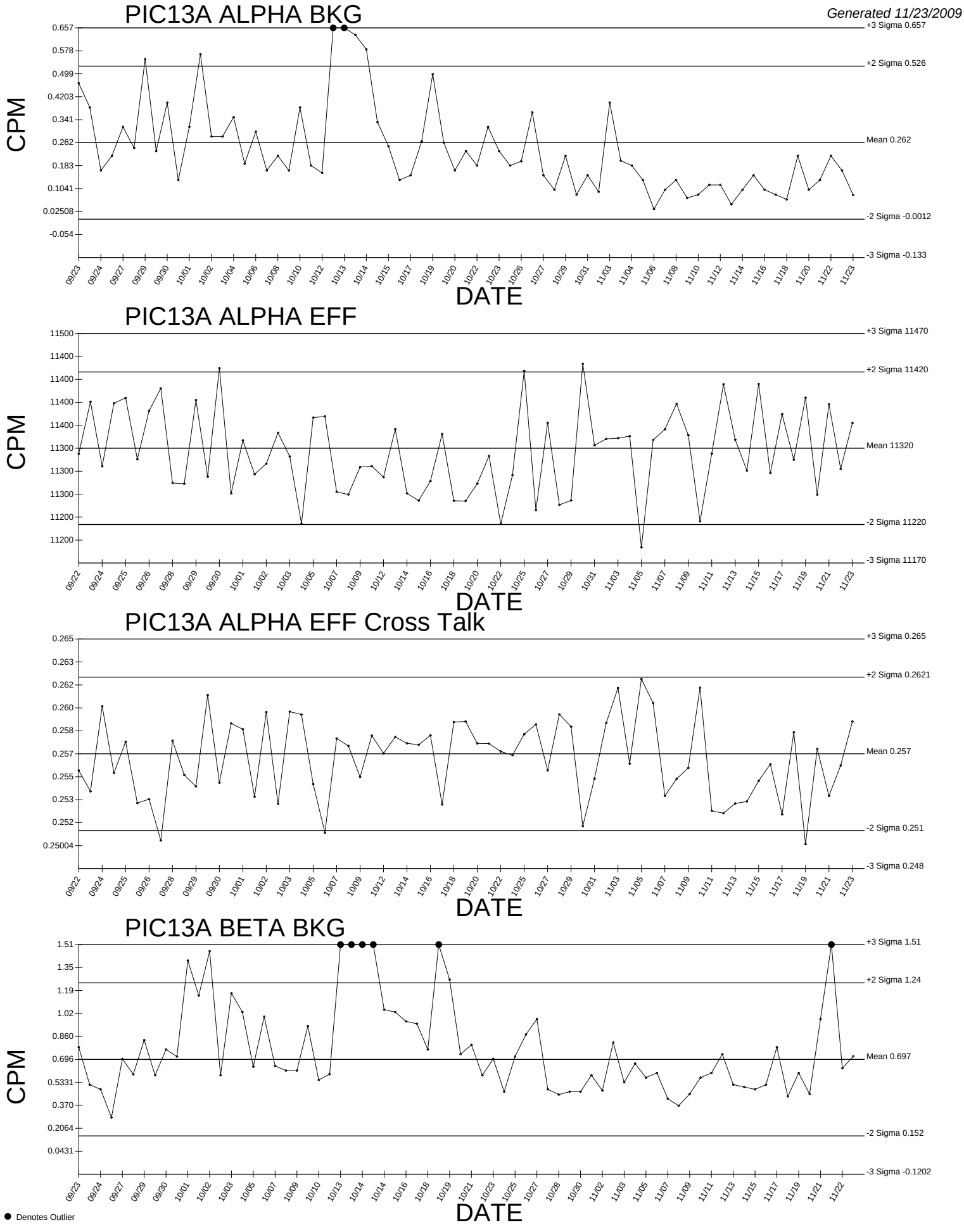


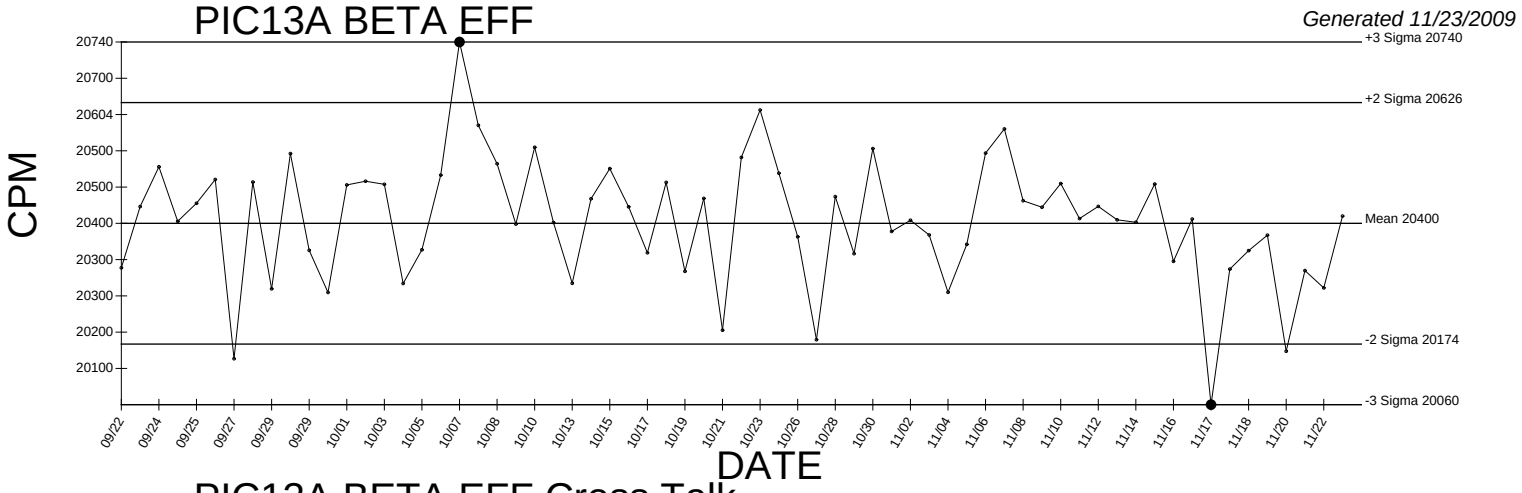
● Denotes Outlier

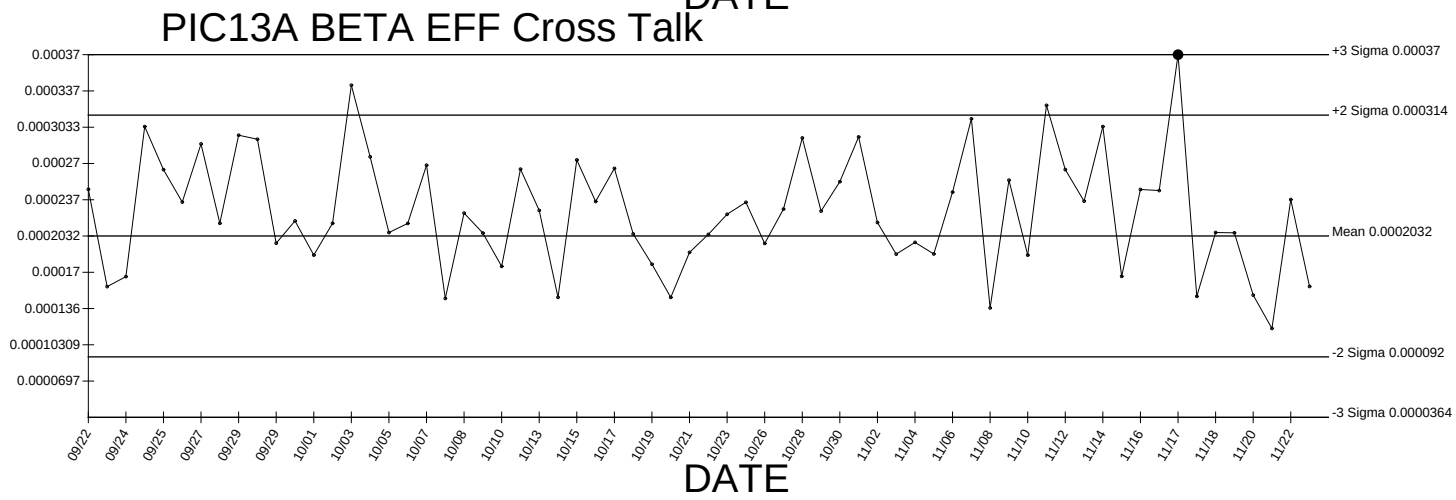

PIC12D ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.485
+2 Sigma 0.373
Mean 0.148
-2 Sigma -0.076
-3 Sigma -0.188
PIC12D ALPHA EFF
+3 Sigma 18420
+2 Sigma 18333
Mean 18160
-2 Sigma 17987
-3 Sigma 17900
PIC12D ALPHA EFF Cross Talk
+3 Sigma 0.293
+2 Sigma 0.289
Mean 0.281
-2 Sigma 0.273
-3 Sigma 0.270
PIC12D BETA BKG
+3 Sigma 1.101
+2 Sigma 0.889
Mean 0.465
-2 Sigma 0.0405
-3 Sigma -0.172
● Denotes Outlier



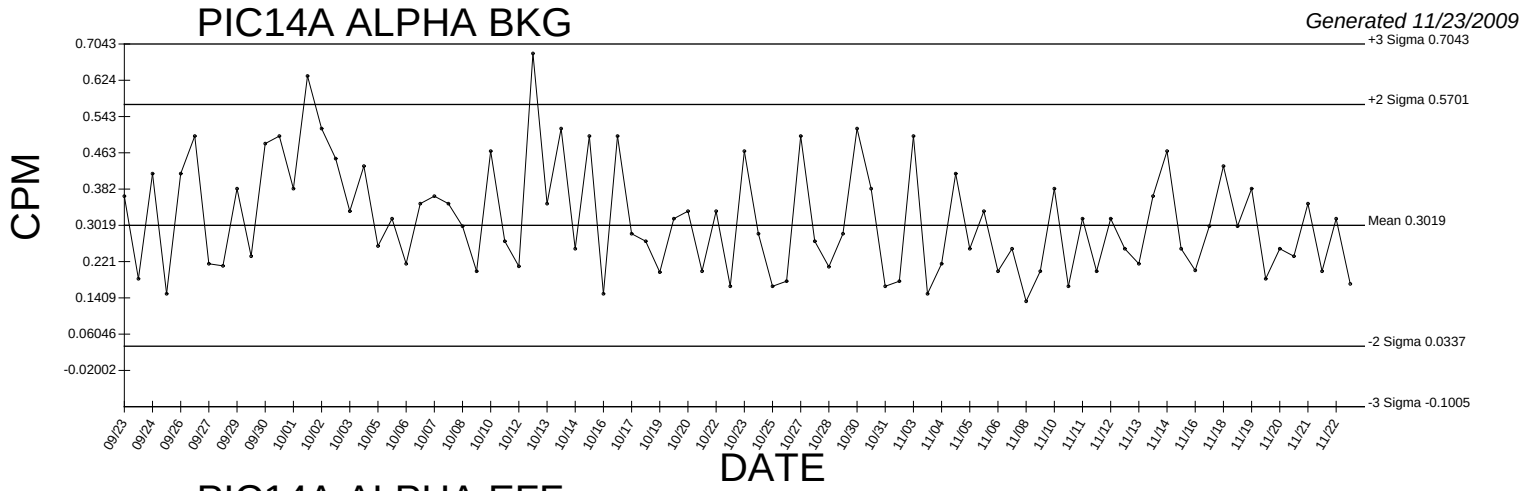
● Denotes Outlier

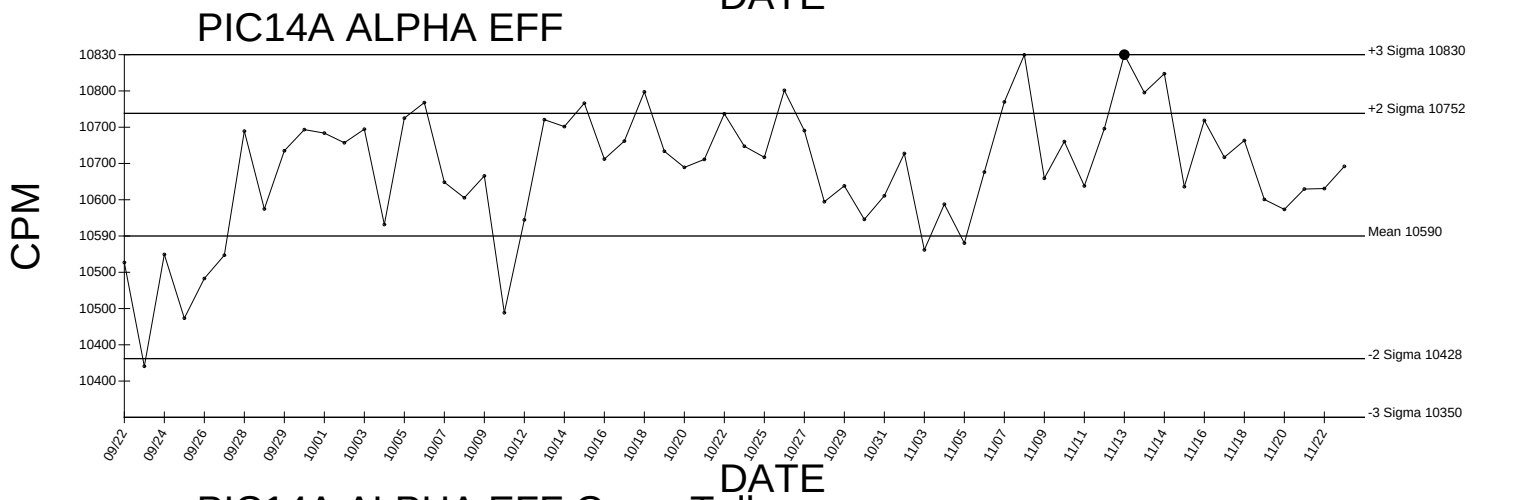

PIC13A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.657
+2 Sigma 0.526
Mean 0.262
-2 Sigma -0.0012
-3 Sigma -0.133
PIC13A ALPHA EFF
+3 Sigma 11470
+2 Sigma 11420
Mean 11320
-2 Sigma 11220
-3 Sigma 11170
PIC13A ALPHA EFF Cross Talk
+3 Sigma 0.265
+2 Sigma 0.2621
Mean 0.257
-2 Sigma 0.251
-3 Sigma 0.248
PIC13A BETA BKG
+3 Sigma 1.51
+2 Sigma 1.24
Mean 0.697
-2 Sigma 0.152
-3 Sigma -0.1202
● Denotes Outlier

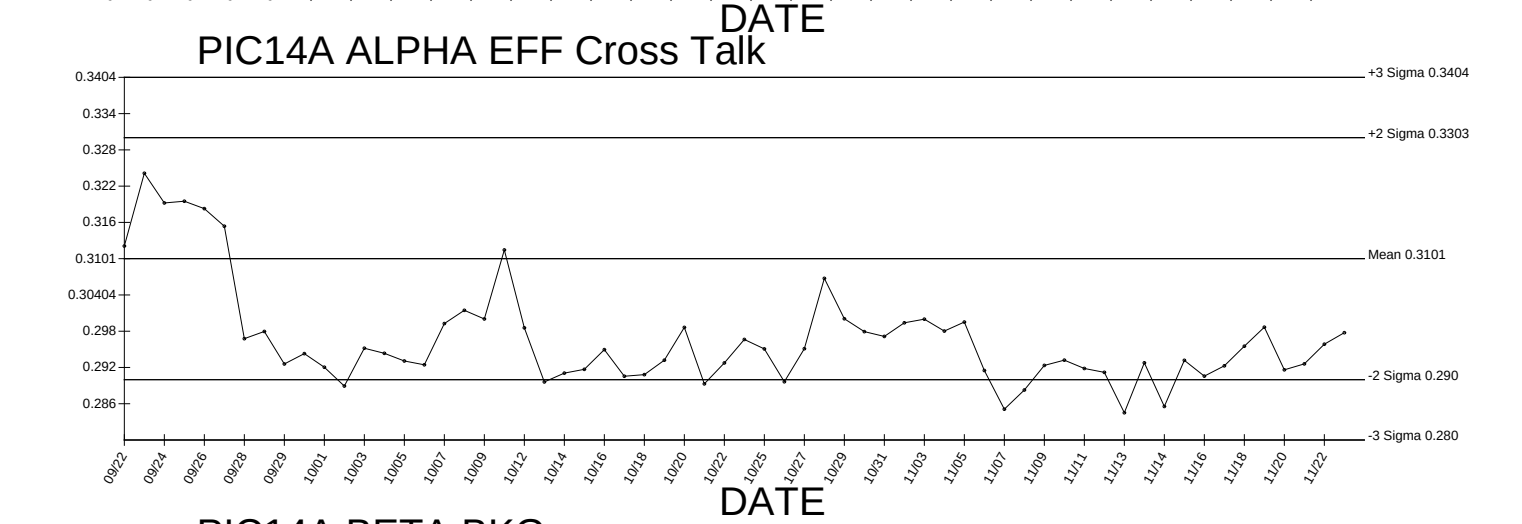


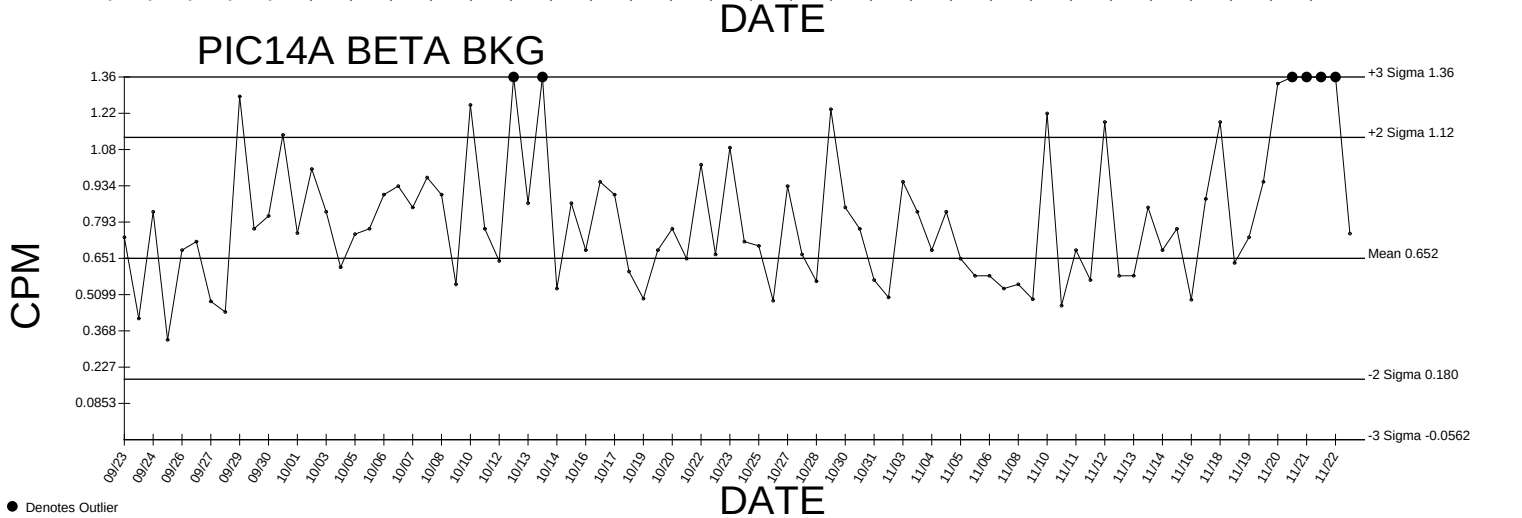


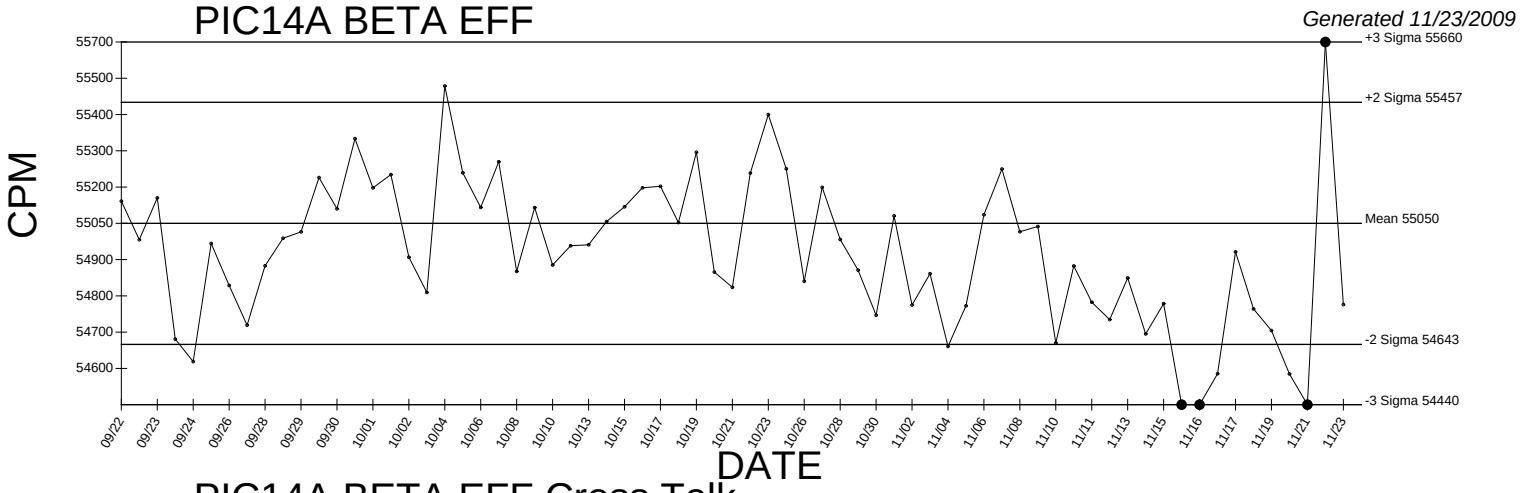
● Denotes Outlier

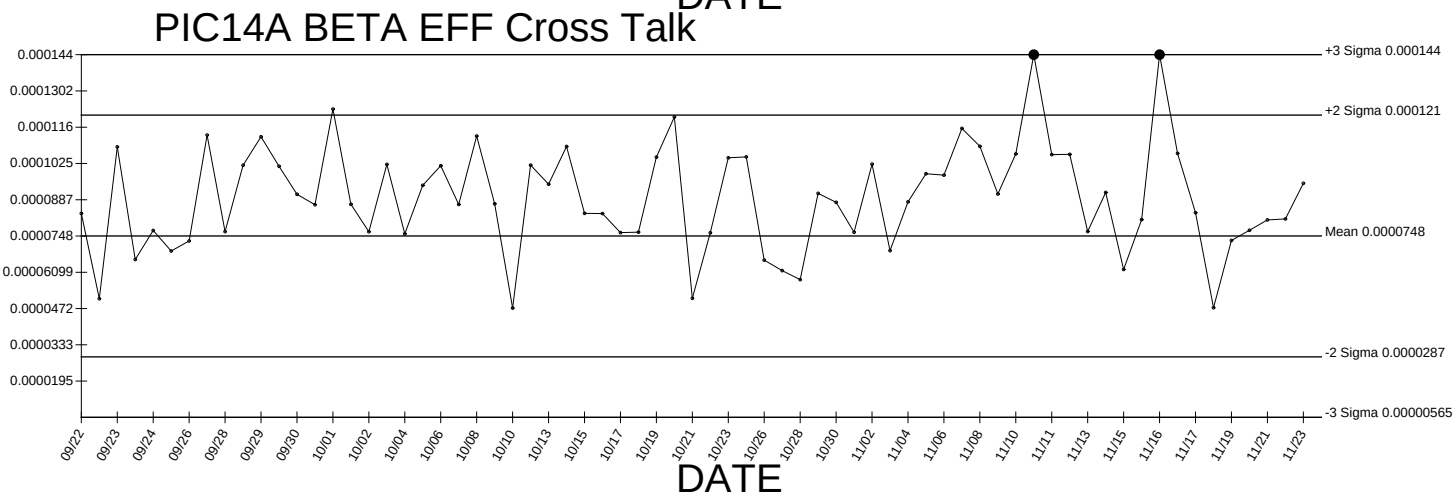

PIC14A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.7043
+2 Sigma 0.5701
Mean 0.3019
-2 Sigma 0.0337
-3 Sigma -0.1005


PIC14A ALPHA EFF
CPM
DATE
+3 Sigma 10830
+2 Sigma 10752
Mean 10590
-2 Sigma 10428
-3 Sigma 10350

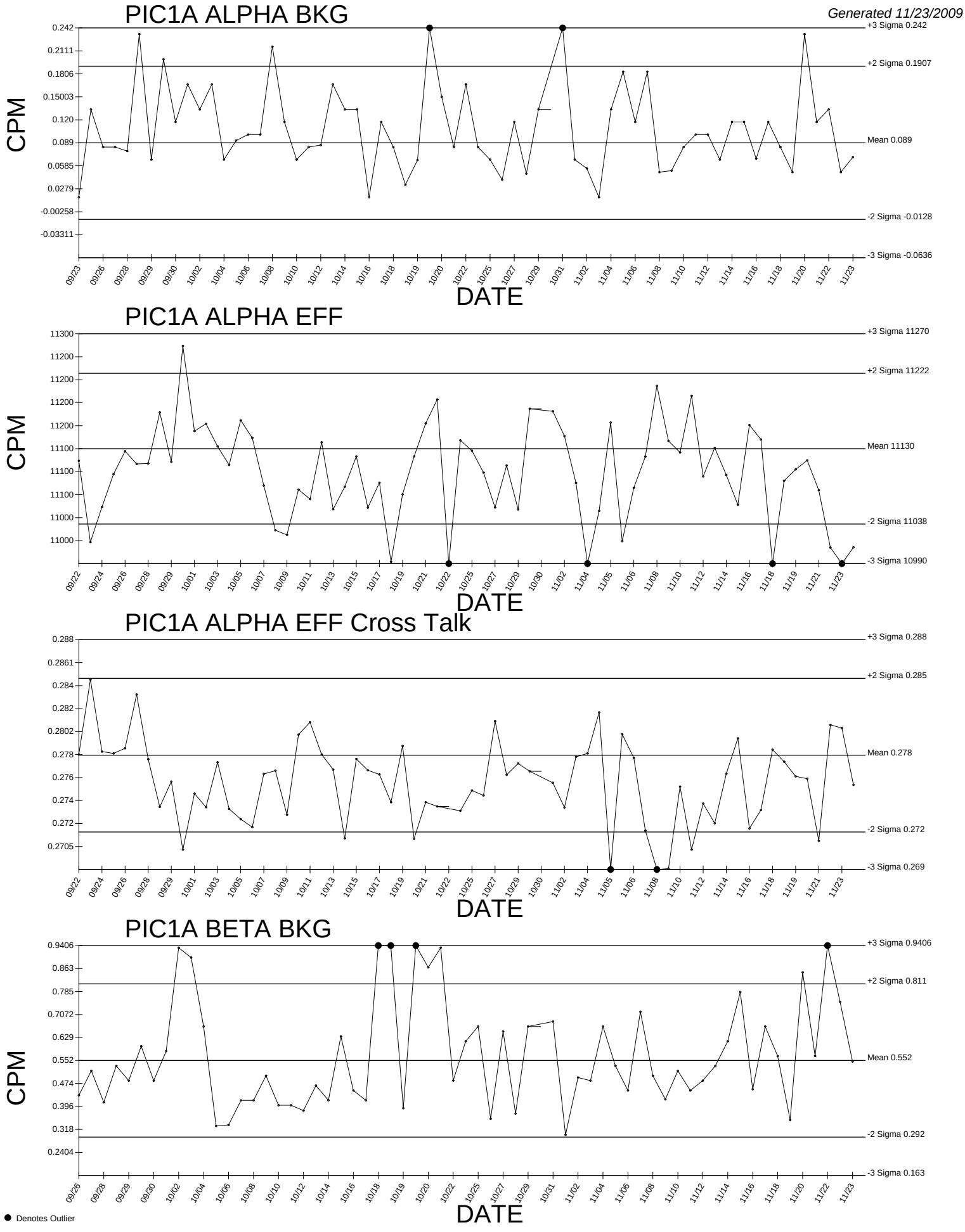

PIC14A ALPHA EFF Cross Talk
DATE
+3 Sigma 0.3404
+2 Sigma 0.3303
Mean 0.3101
-2 Sigma 0.290
-3 Sigma 0.280

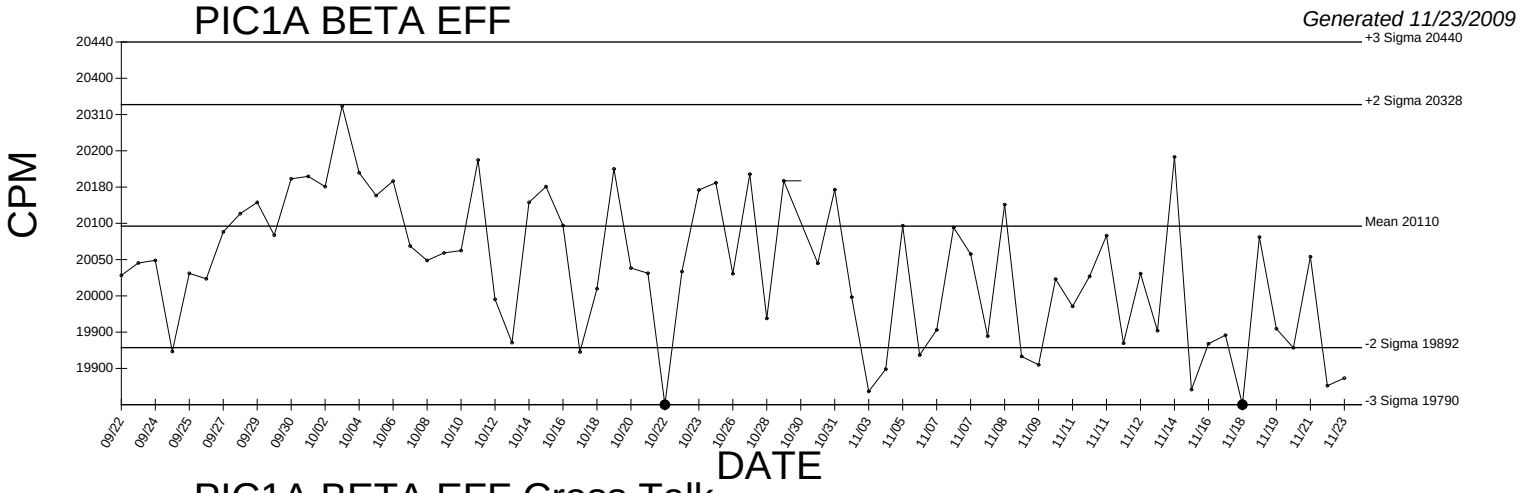

PIC14A BETA BKG
CPM
DATE
+3 Sigma 1.36
+2 Sigma 1.12
Mean 0.652
-2 Sigma 0.180
-3 Sigma -0.0562
Denotes Outlier

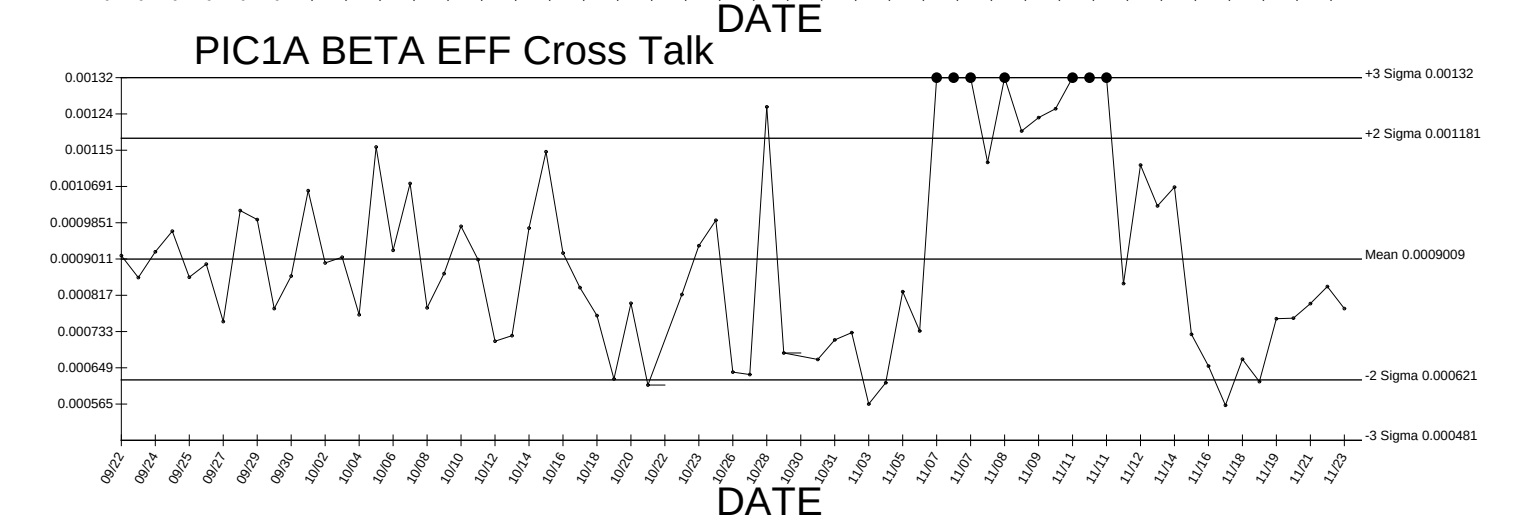




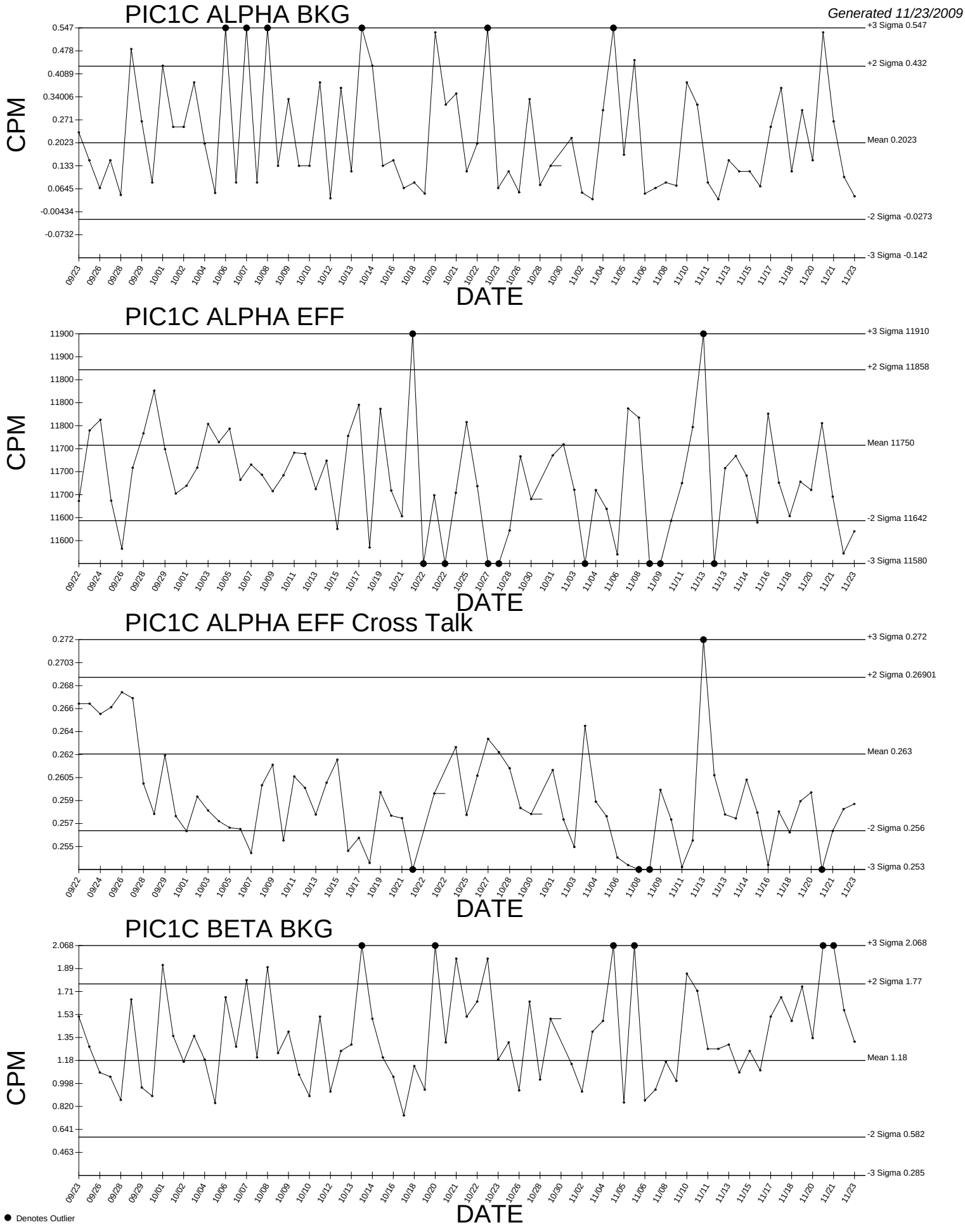
● Denotes Outlier

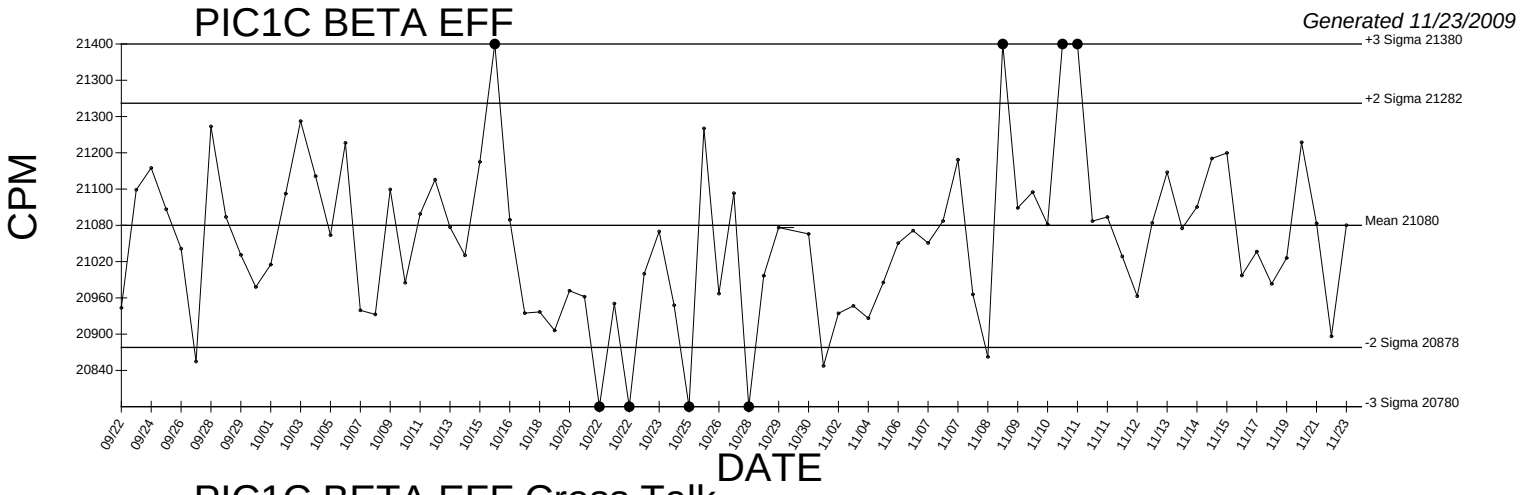

PIC1A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.242
+2 Sigma 0.1907
Mean 0.089
-2 Sigma -0.0128
-3 Sigma -0.0636
PIC1A ALPHA EFF
+3 Sigma 11270
+2 Sigma 11222
Mean 11130
-2 Sigma 11038
-3 Sigma 10990
PIC1A ALPHA EFF Cross Talk
+3 Sigma 0.288
+2 Sigma 0.285
Mean 0.278
-2 Sigma 0.272
-3 Sigma 0.269
PIC1A BETA BKG
+3 Sigma 0.9406
+2 Sigma 0.811
Mean 0.552
-2 Sigma 0.292
-3 Sigma 0.163
● Denotes Outlier

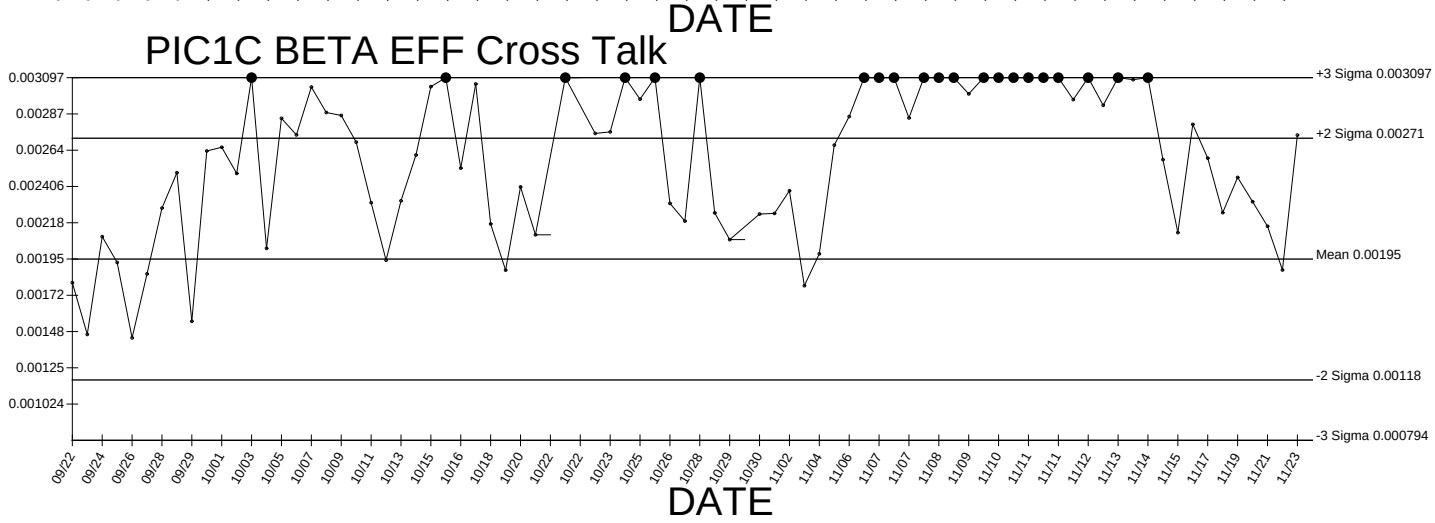




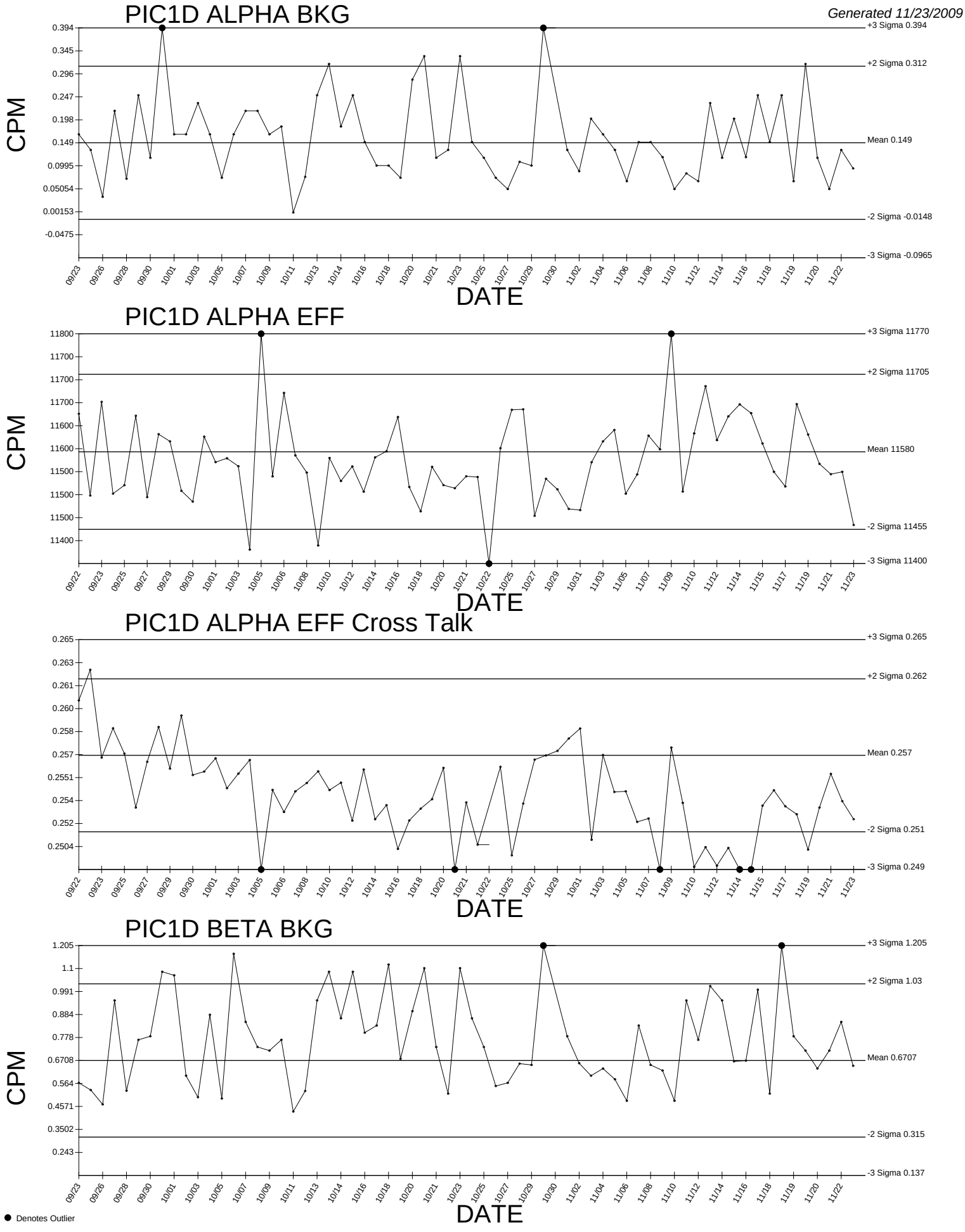
● Denotes Outlier

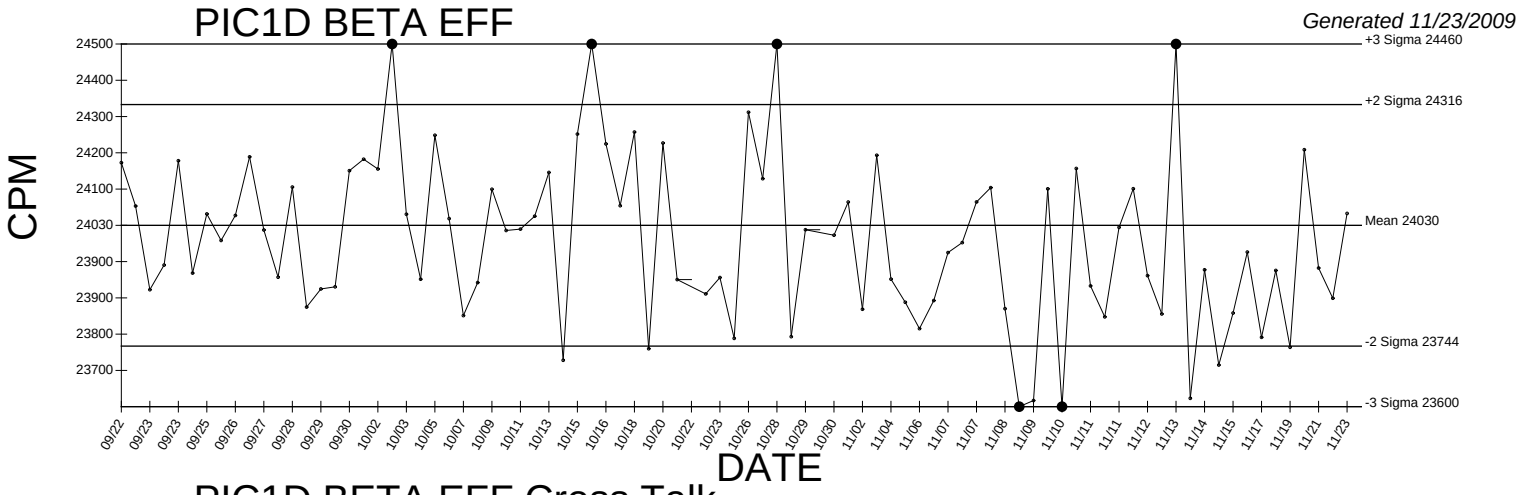

PIC1C ALPHA BKG
Generated 11/23/2009
CPM
0.547
0.478
0.4089
0.34006
0.271
0.2023
0.133
0.0645
-0.00434
-0.0732
+3 Sigma 0.547
+2 Sigma 0.432
Mean 0.2023
-2 Sigma -0.0273
-3 Sigma -0.142
09/23 09/26 09/28 09/29 10/01 10/02 10/04 10/06 10/07 10/08 10/09 10/10 10/12 10/13 10/14 10/16 10/18 10/20 10/21 10/22 10/23 10/26 10/28 10/30 11/02 11/04 11/05 11/06 11/08 11/10 11/11 11/13 11/15 11/17 11/18 11/20 11/21 11/23
DATE
PIC1C ALPHA EFF
CPM
11900
11900
11800
11800
11800
11700
11700
11600
11600
+3 Sigma 11910
+2 Sigma 11858
Mean 11750
-2 Sigma 11642
-3 Sigma 11580
09/22 09/24 09/26 09/28 09/29 10/01 10/03 10/05 10/07 10/09 10/11 10/13 10/15 10/17 10/19 10/21 10/22 10/22 10/25 10/27 10/28 10/30 10/31 11/03 11/04 11/06 11/08 11/09 11/11 11/13 11/13 11/14 11/16 11/18 11/20 11/21 11/23
DATE
PIC1C ALPHA EFF Cross Talk
0.272
0.2703
0.268
0.266
0.264
0.262
0.2605
0.259
0.257
0.255
+3 Sigma 0.272
+2 Sigma 0.26901
Mean 0.263
-2 Sigma 0.256
-3 Sigma 0.253
09/22 09/24 09/26 09/28 09/29 10/01 10/03 10/05 10/07 10/09 10/11 10/13 10/15 10/17 10/19 10/21 10/22 10/22 10/25 10/27 10/28 10/30 10/31 11/03 11/04 11/06 11/08 11/09 11/11 11/13 11/13 11/14 11/16 11/18 11/20 11/21 11/23
DATE
PIC1C BETA BKG
CPM
2.068
1.89
1.71
1.53
1.35
1.18
0.998
0.820
0.641
0.463
+3 Sigma 2.068
+2 Sigma 1.77
Mean 1.18
-2 Sigma 0.582
-3 Sigma 0.285
09/23 09/26 09/28 09/29 10/01 10/02 10/04 10/06 10/07 10/08 10/09 10/10 10/12 10/13 10/14 10/16 10/18 10/20 10/21 10/22 10/23 10/26 10/28 10/30 11/02 11/04 11/05 11/06 11/08 11/10 11/11 11/13 11/15 11/17 11/18 11/20 11/21 11/23
DATE
● Denotes Outlier

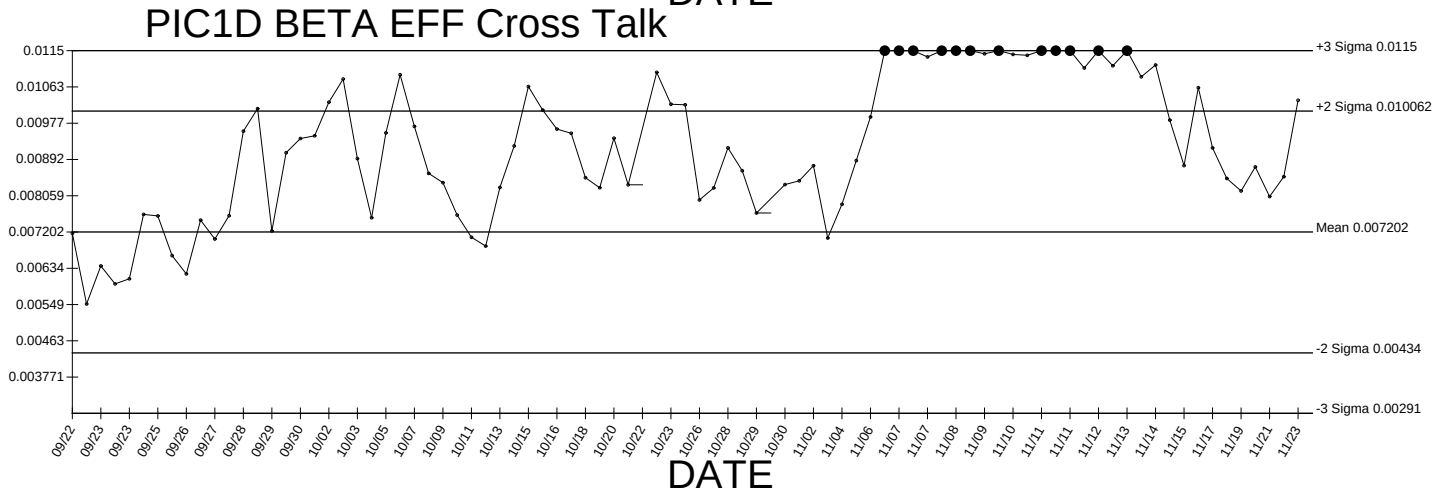




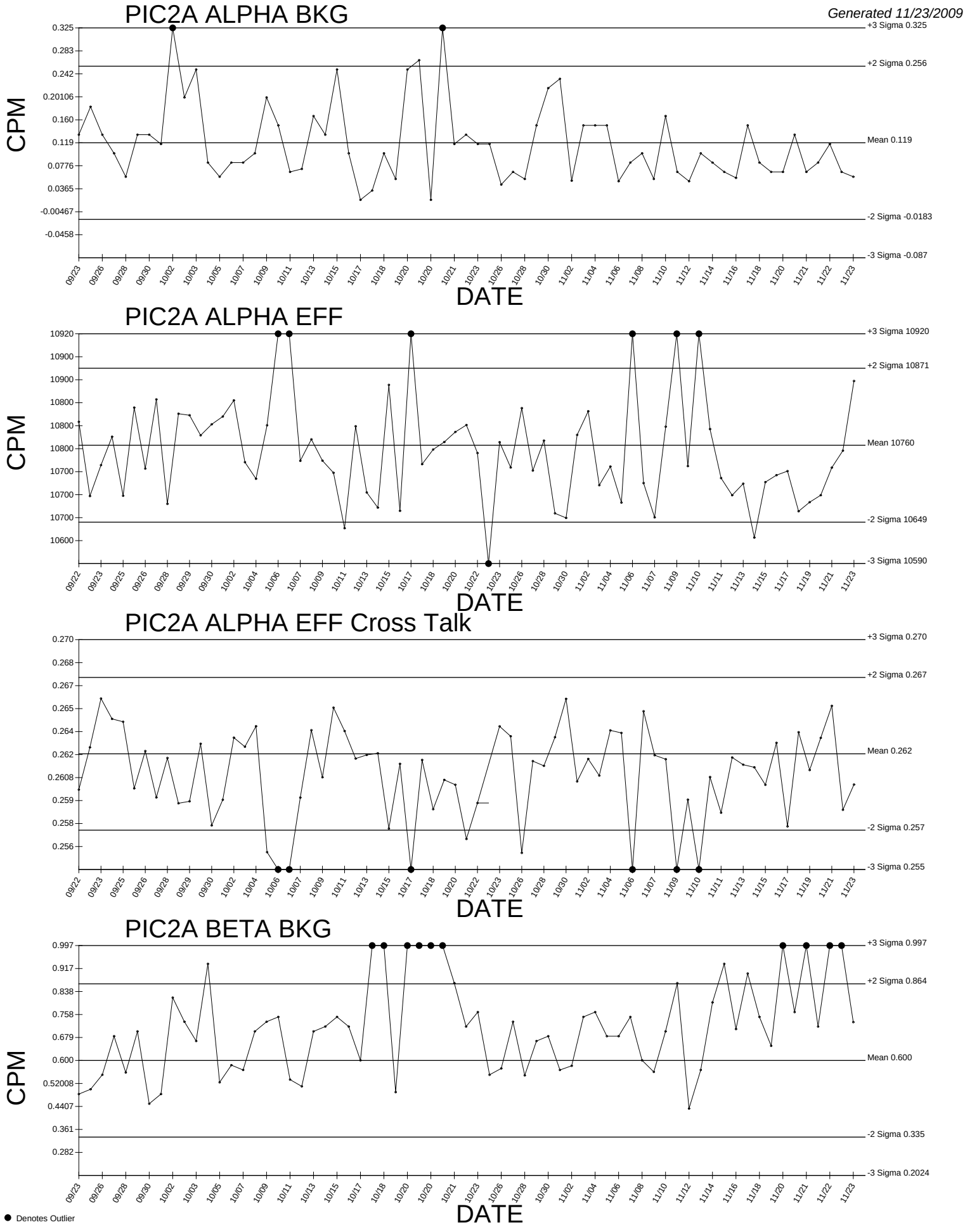
● Denotes Outlier

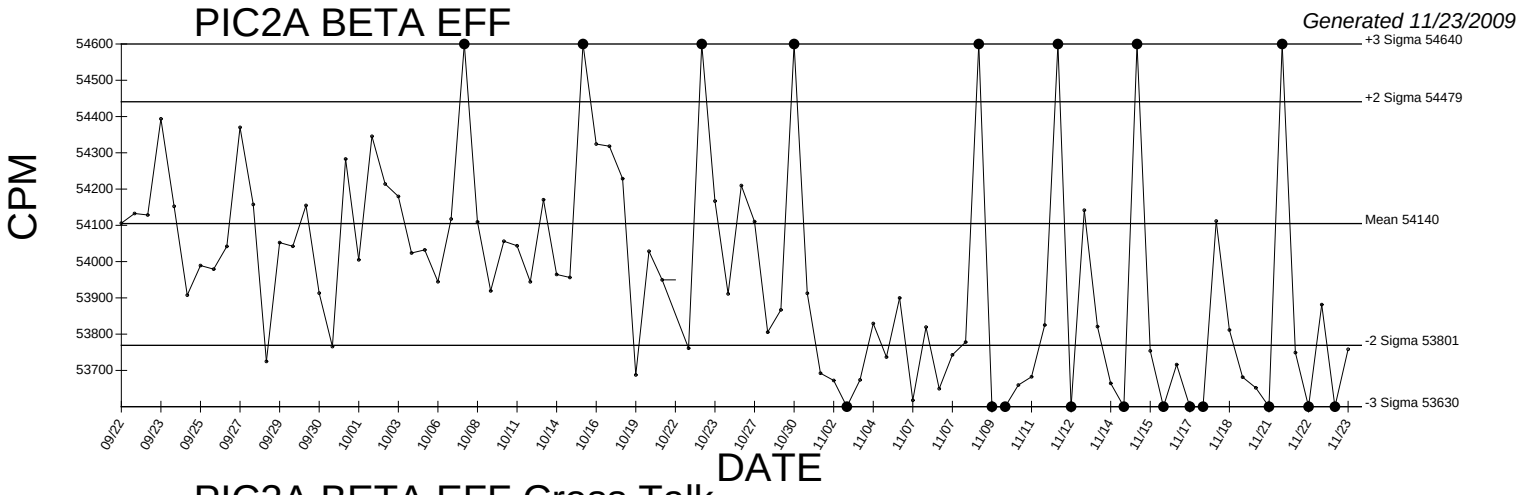

PIC1D ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.394
+2 Sigma 0.312
Mean 0.149
-2 Sigma -0.0148
-3 Sigma -0.0965
PIC1D ALPHA EFF
+3 Sigma 11770
+2 Sigma 11705
Mean 11580
-2 Sigma 11455
-3 Sigma 11400
PIC1D ALPHA EFF Cross Talk
+3 Sigma 0.265
+2 Sigma 0.262
Mean 0.257
-2 Sigma 0.251
-3 Sigma 0.249
PIC1D BETA BKG
+3 Sigma 1.205
+2 Sigma 1.03
Mean 0.6707
-2 Sigma 0.315
-3 Sigma 0.137
● Denotes Outlier

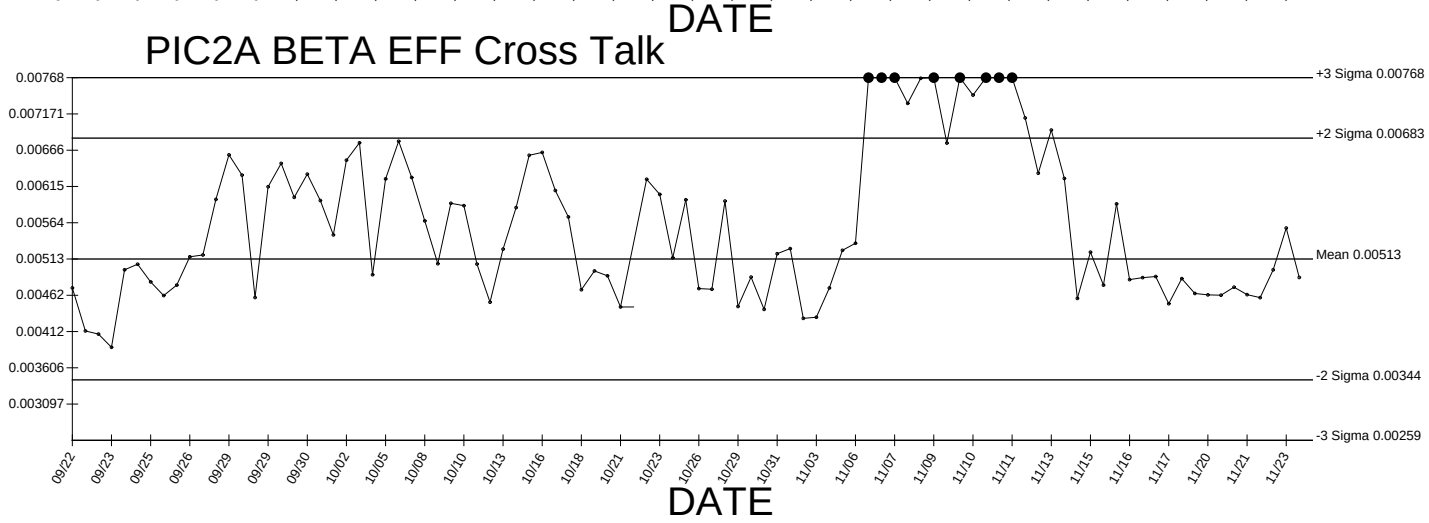




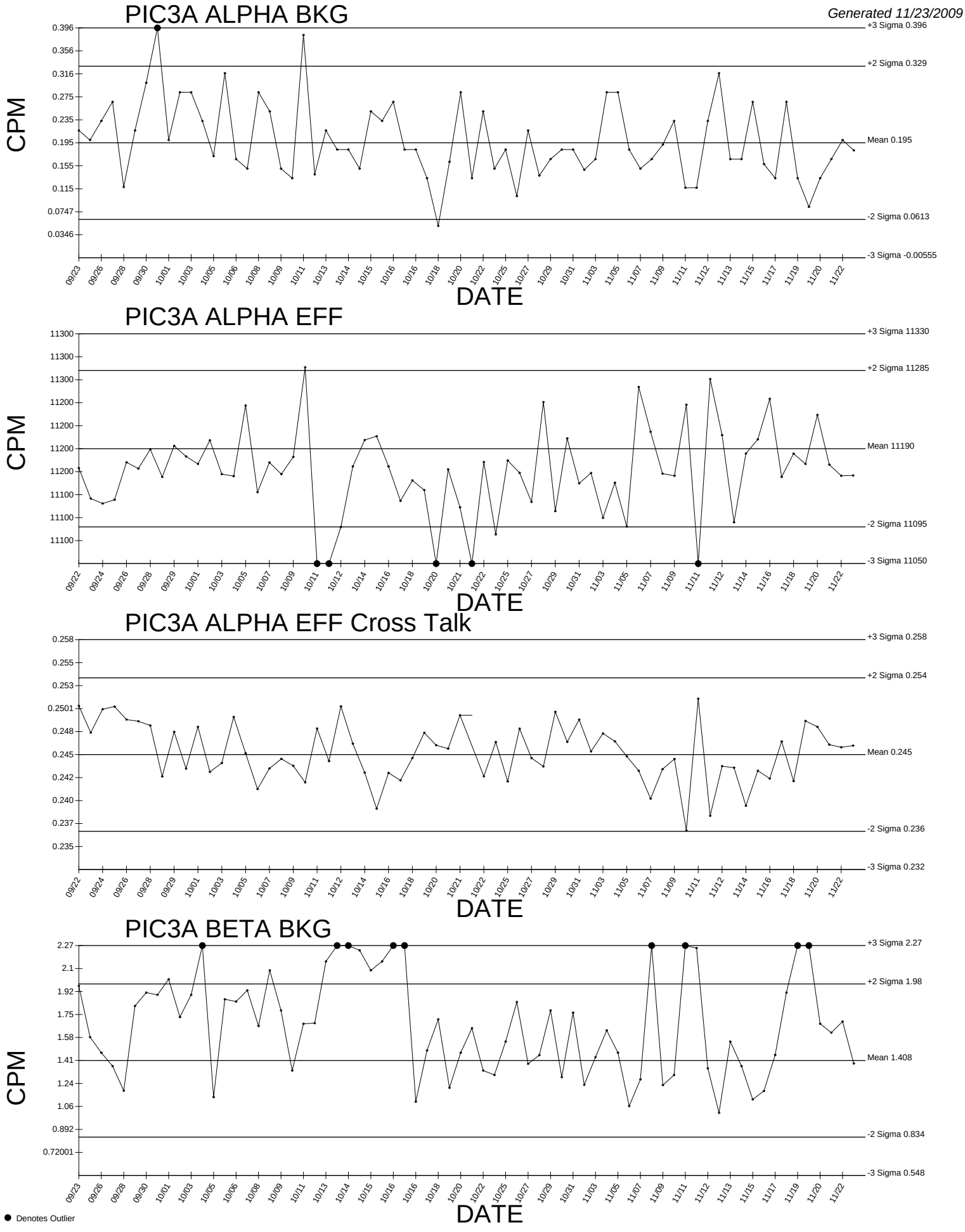
● Denotes Outlier

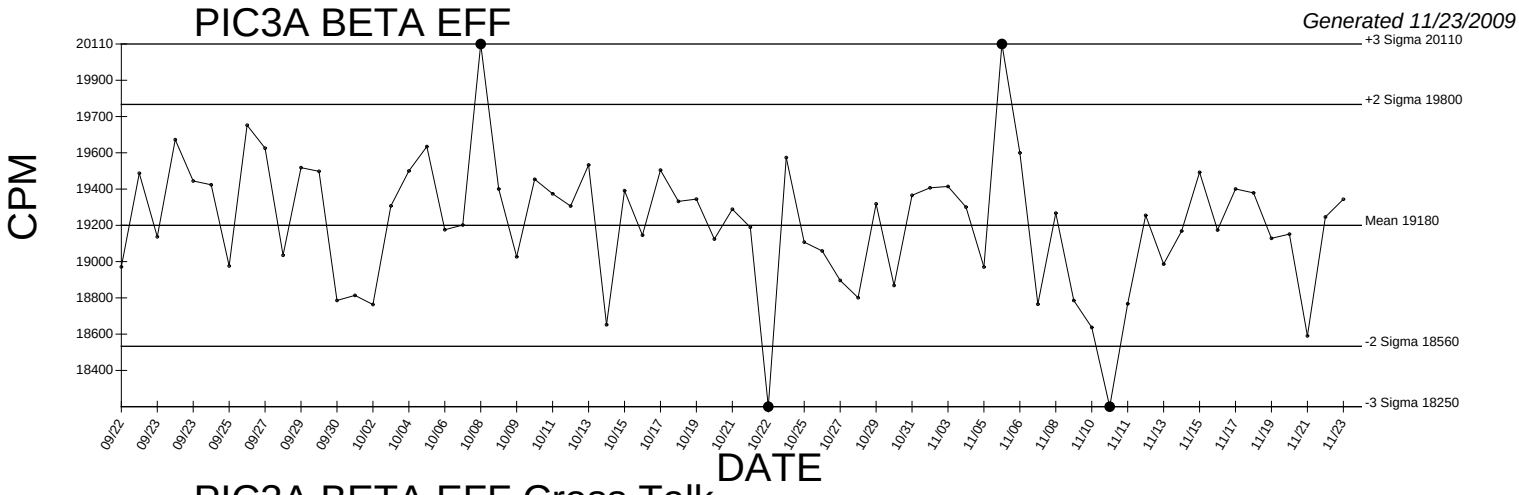

PIC2A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.325
+2 Sigma 0.256
Mean 0.119
-2 Sigma -0.0183
-3 Sigma -0.087
PIC2A ALPHA EFF
+3 Sigma 10920
+2 Sigma 10871
Mean 10760
-2 Sigma 10649
-3 Sigma 10590
PIC2A ALPHA EFF Cross Talk
+3 Sigma 0.270
+2 Sigma 0.267
Mean 0.262
-2 Sigma 0.257
-3 Sigma 0.255
PIC2A BETA BKG
+3 Sigma 0.997
+2 Sigma 0.864
Mean 0.600
-2 Sigma 0.335
-3 Sigma 0.2024
● Denotes Outlier

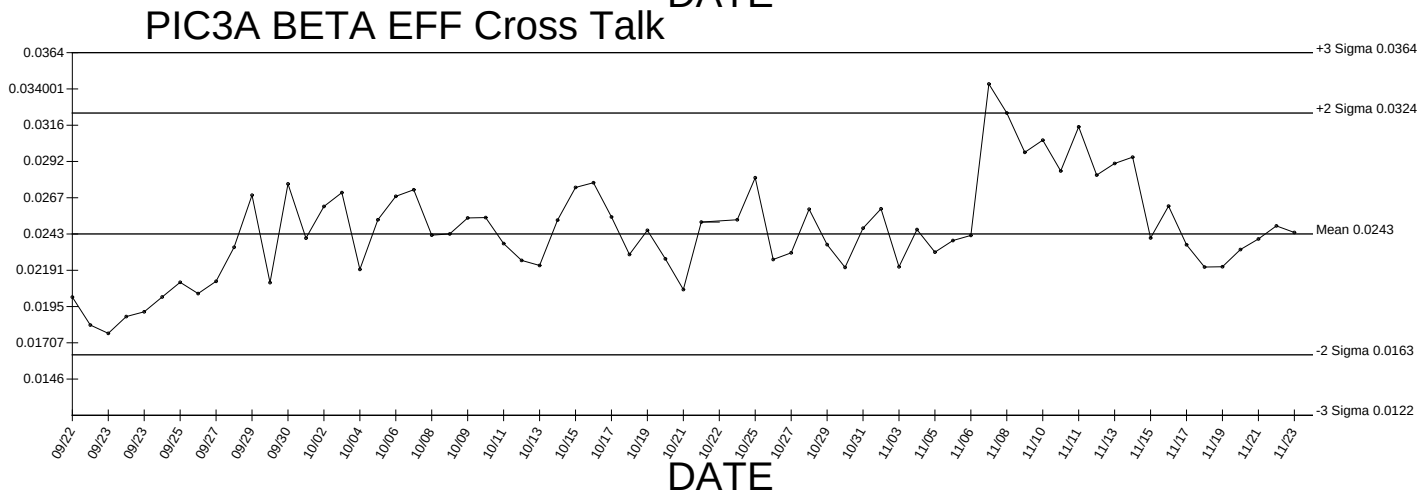




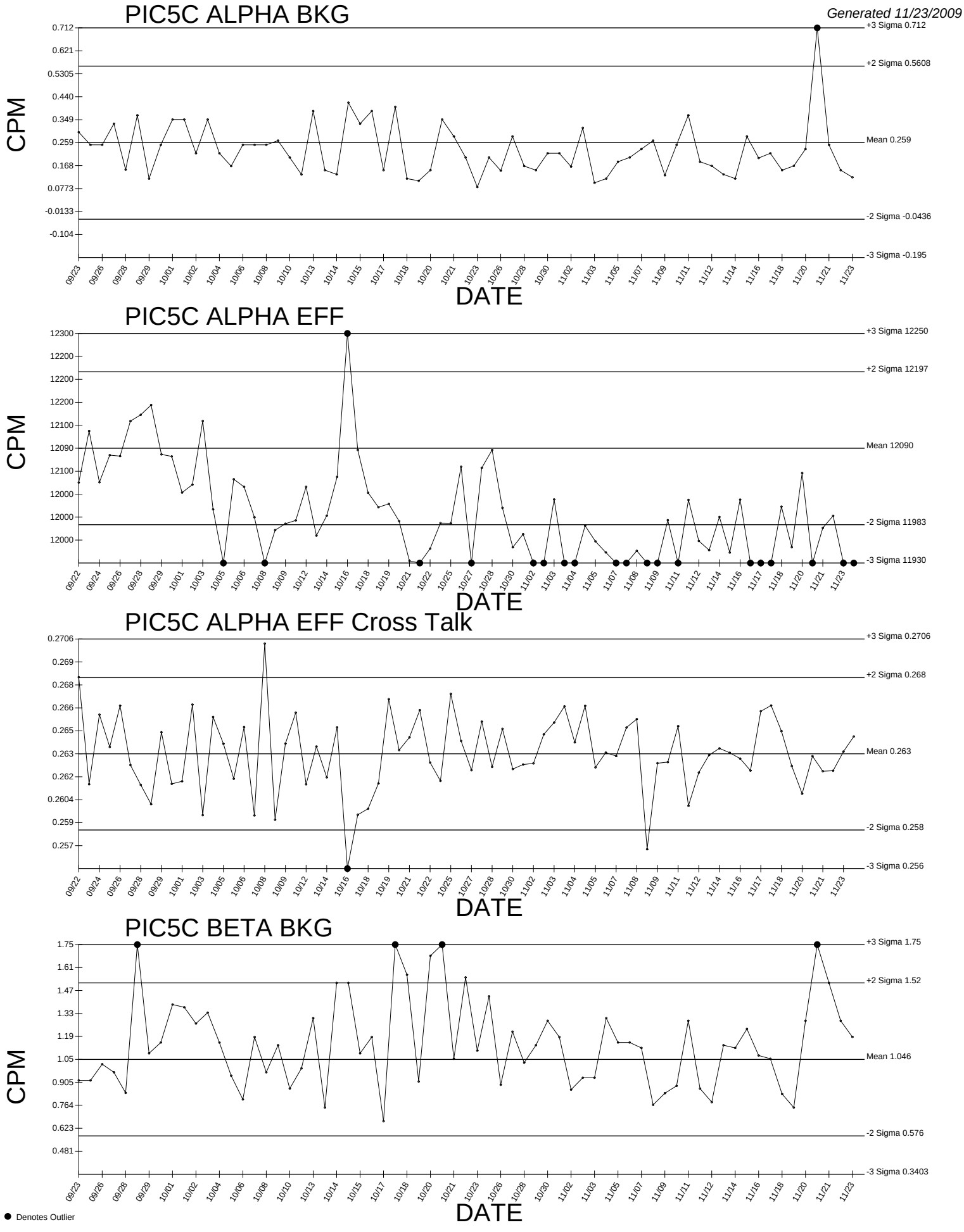
● Denotes Outlier

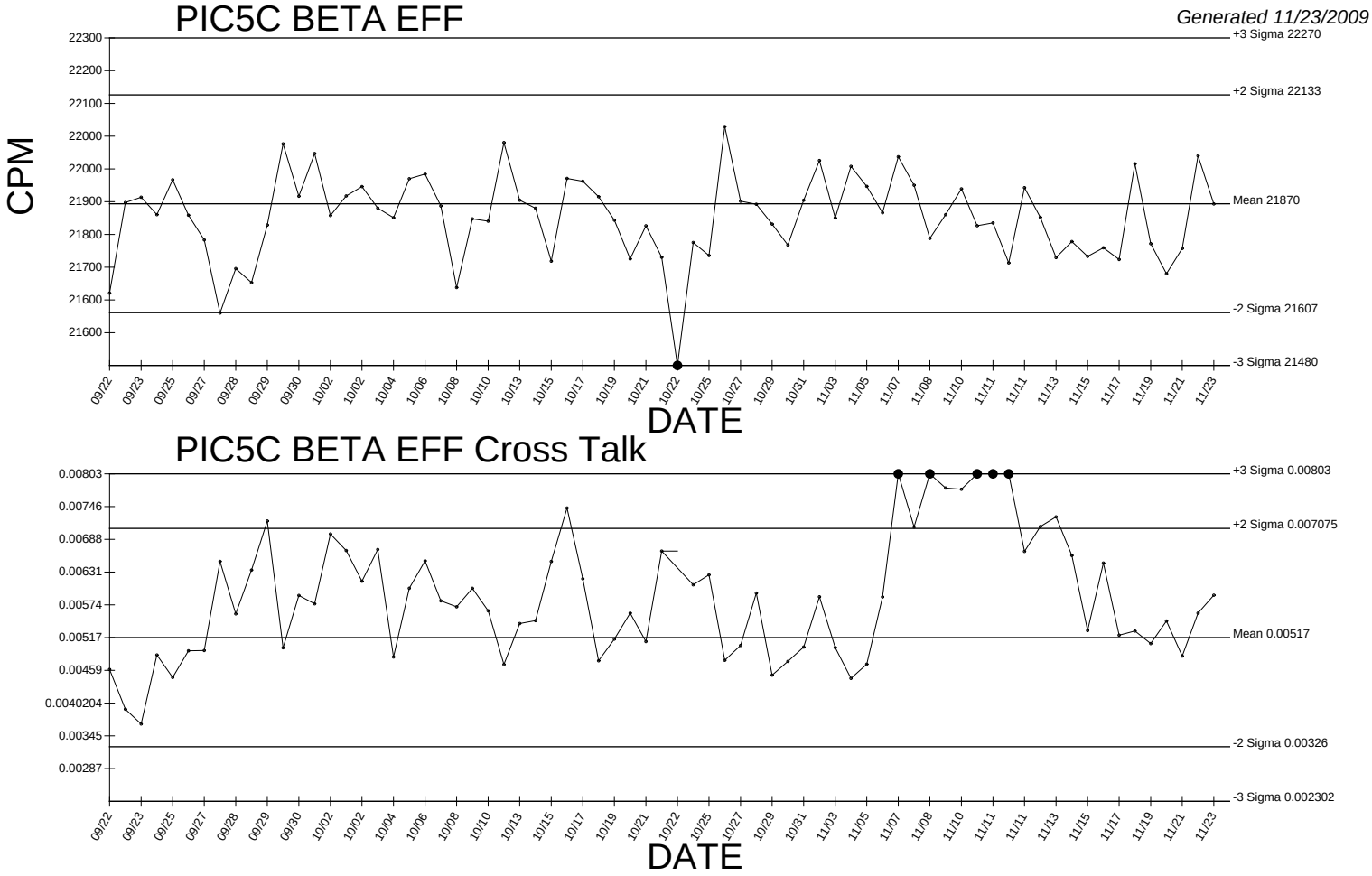

PIC3A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.396
+2 Sigma 0.329
Mean 0.195
-2 Sigma 0.0613
-3 Sigma -0.00555
PIC3A ALPHA EFF
+3 Sigma 11330
+2 Sigma 11285
Mean 11190
-2 Sigma 11095
-3 Sigma 11050
PIC3A ALPHA EFF Cross Talk
+3 Sigma 0.258
+2 Sigma 0.254
Mean 0.245
-2 Sigma 0.236
-3 Sigma 0.232
PIC3A BETA BKG
+3 Sigma 2.27
+2 Sigma 1.98
Mean 1.408
-2 Sigma 0.834
-3 Sigma 0.548
● Denotes Outlier



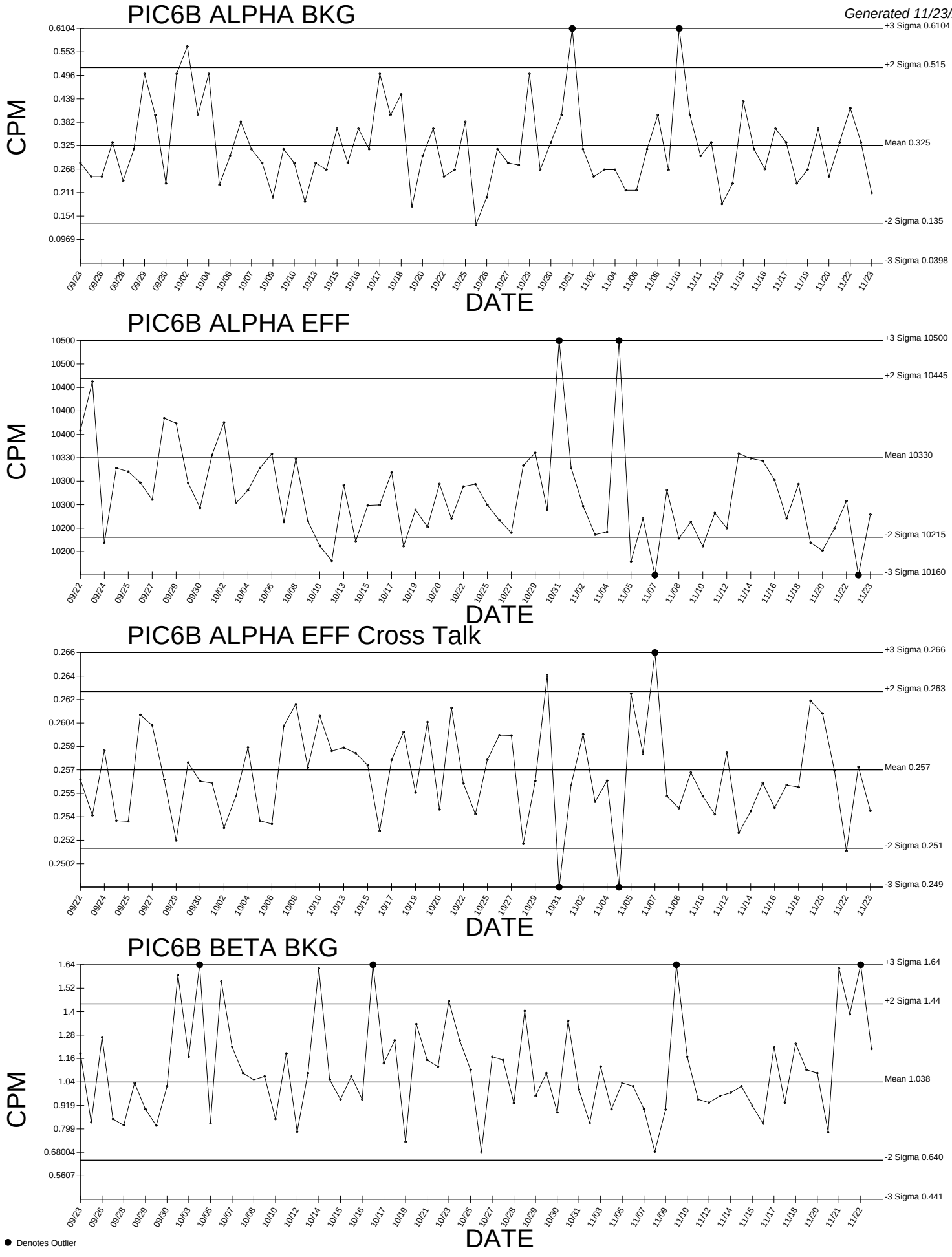


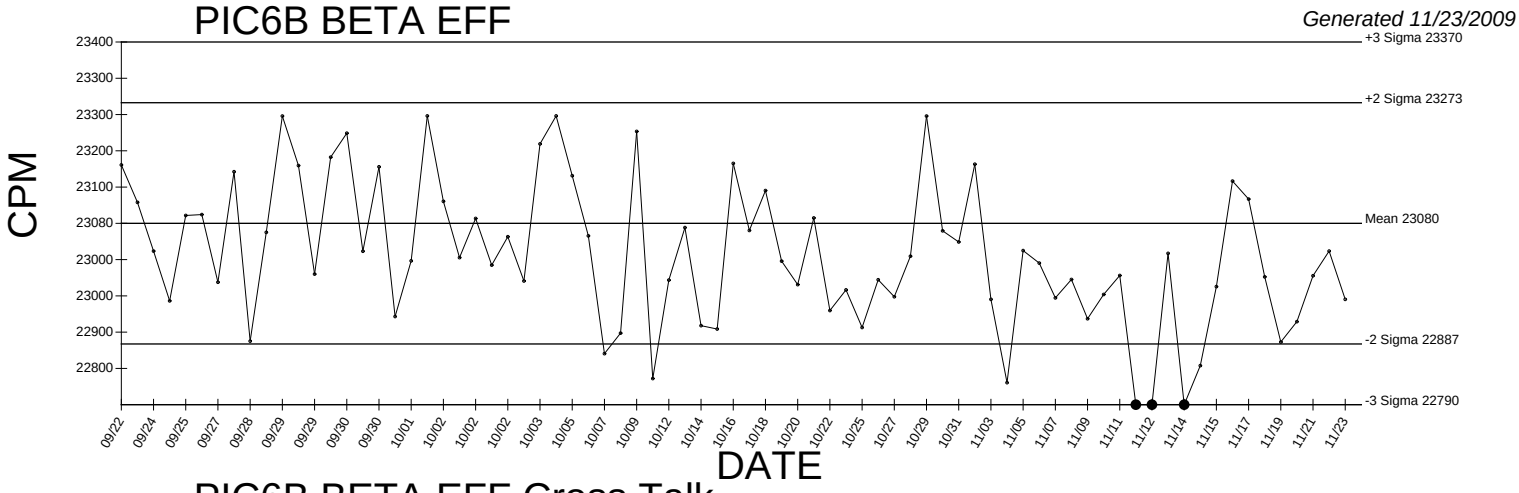
● Denotes Outlier

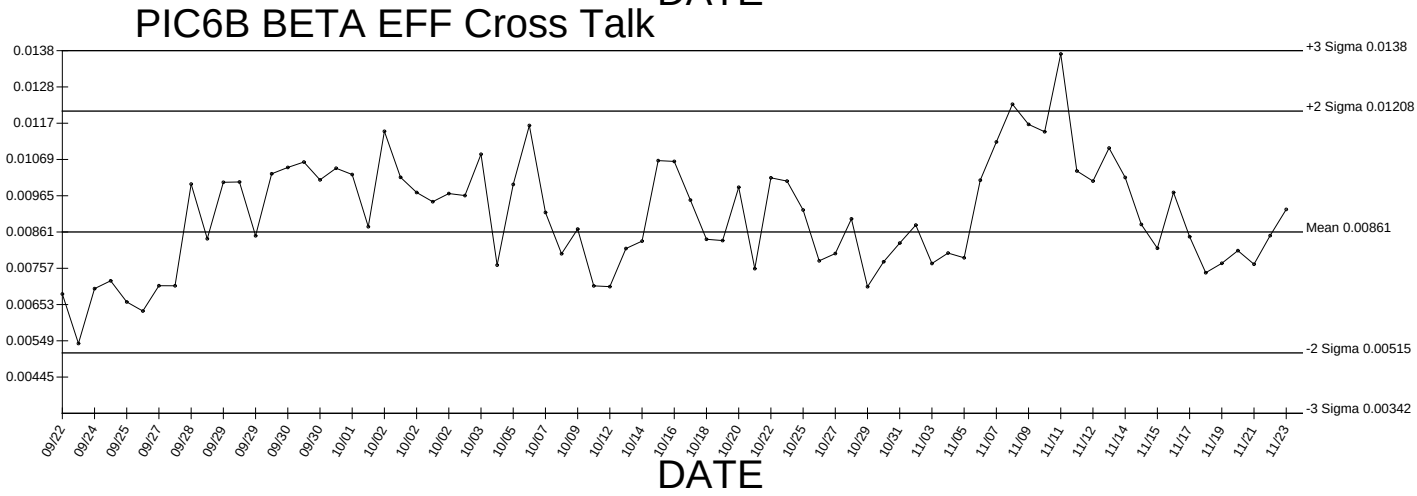

PIC5C ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.712
+2 Sigma 0.5608
Mean 0.259
-2 Sigma -0.0436
-3 Sigma -0.195
PIC5C ALPHA EFF
+3 Sigma 12250
+2 Sigma 12197
Mean 12090
-2 Sigma 11983
-3 Sigma 11930
PIC5C ALPHA EFF Cross Talk
+3 Sigma 0.2706
+2 Sigma 0.268
Mean 0.263
-2 Sigma 0.258
-3 Sigma 0.256
PIC5C BETA BKG
+3 Sigma 1.75
+2 Sigma 1.52
Mean 1.046
-2 Sigma 0.576
-3 Sigma 0.3403
● Denotes Outlier



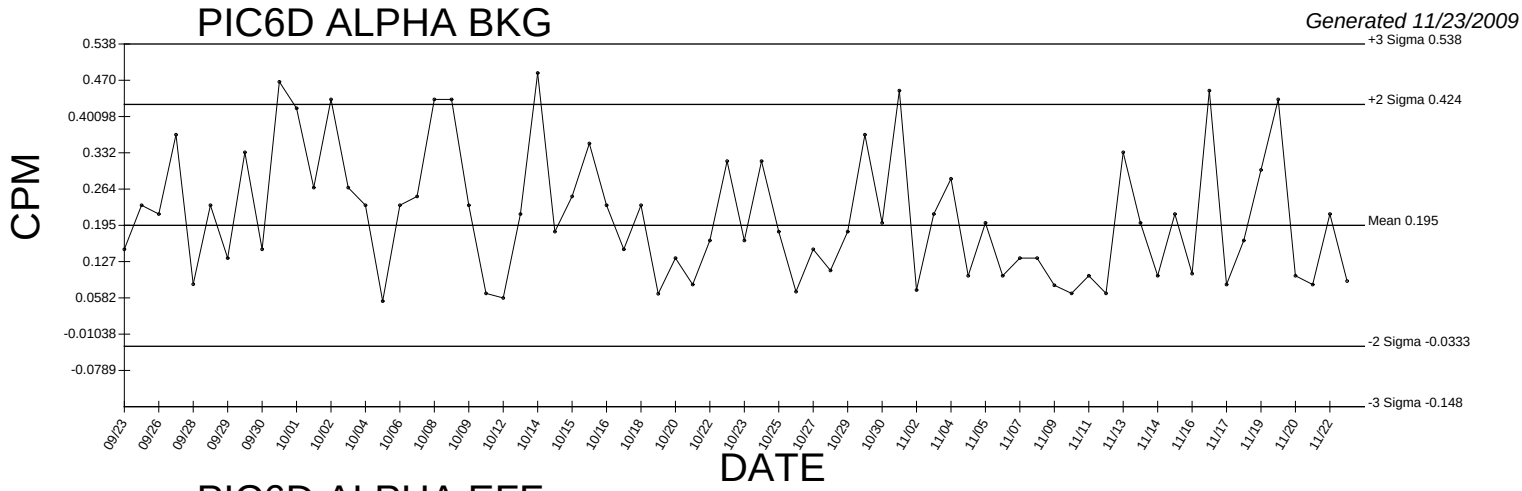
● Denotes Outlier

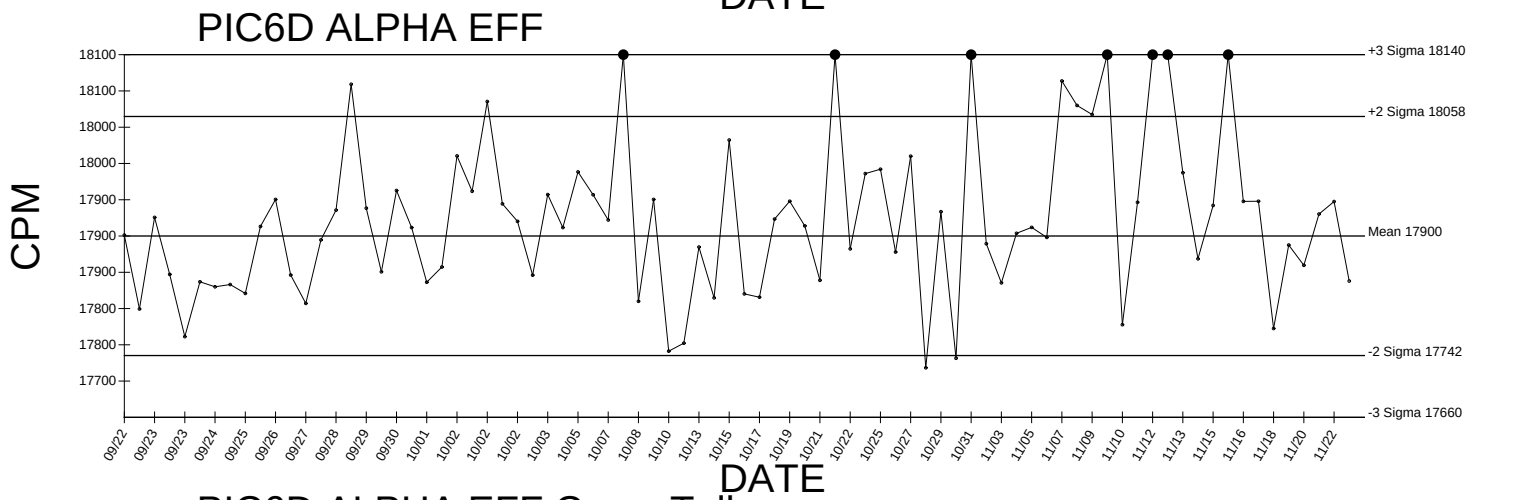

PIC6B ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.6104
+2 Sigma 0.515
Mean 0.325
-2 Sigma 0.135
-3 Sigma 0.0398
PIC6B ALPHA EFF
+3 Sigma 10500
+2 Sigma 10445
Mean 10330
-2 Sigma 10215
-3 Sigma 10160
PIC6B ALPHA EFF Cross Talk
+3 Sigma 0.266
+2 Sigma 0.263
Mean 0.257
-2 Sigma 0.251
-3 Sigma 0.249
PIC6B BETA BKG
+3 Sigma 1.64
+2 Sigma 1.44
Mean 1.038
-2 Sigma 0.640
-3 Sigma 0.441
● Denotes Outlier

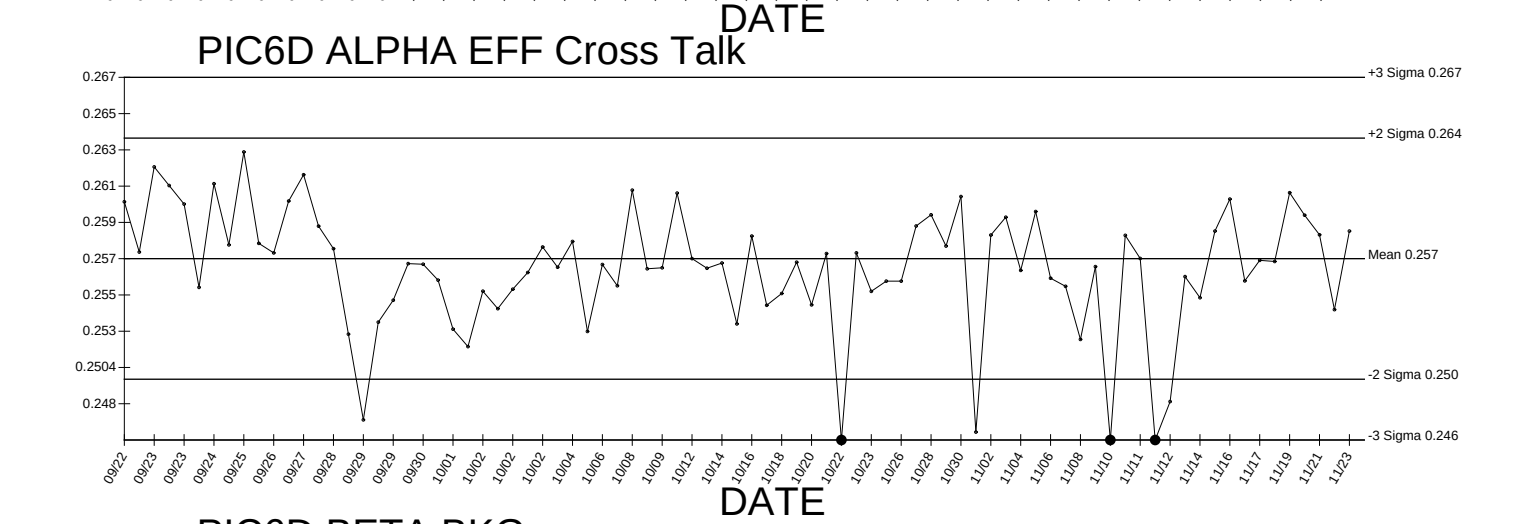


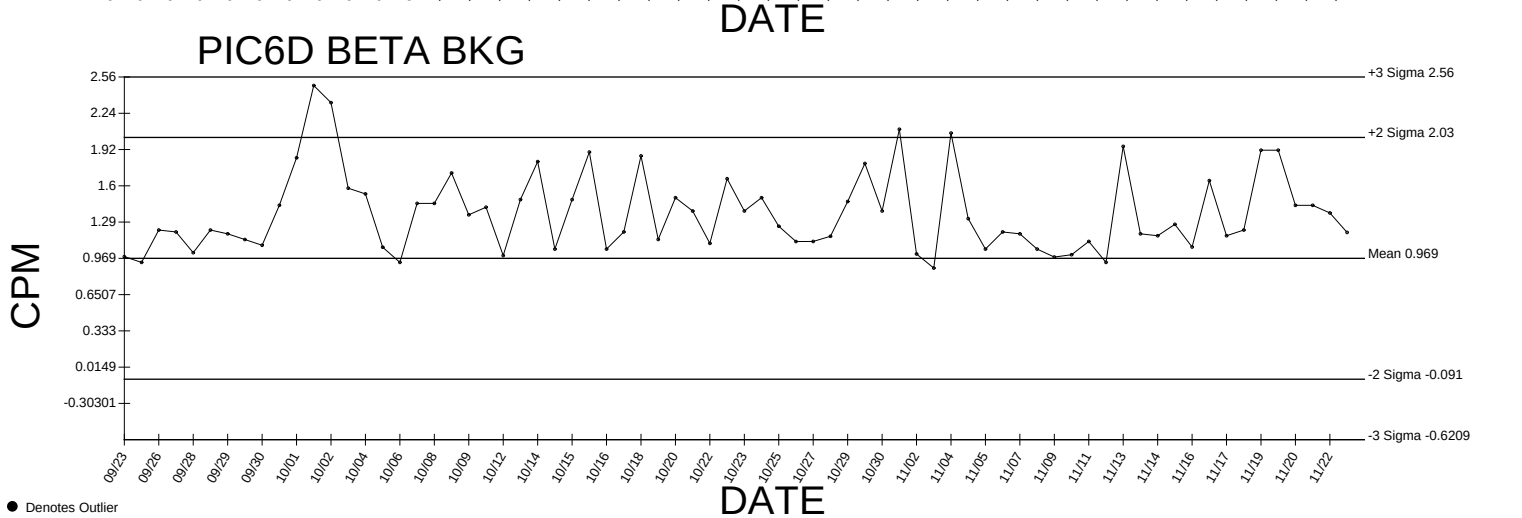


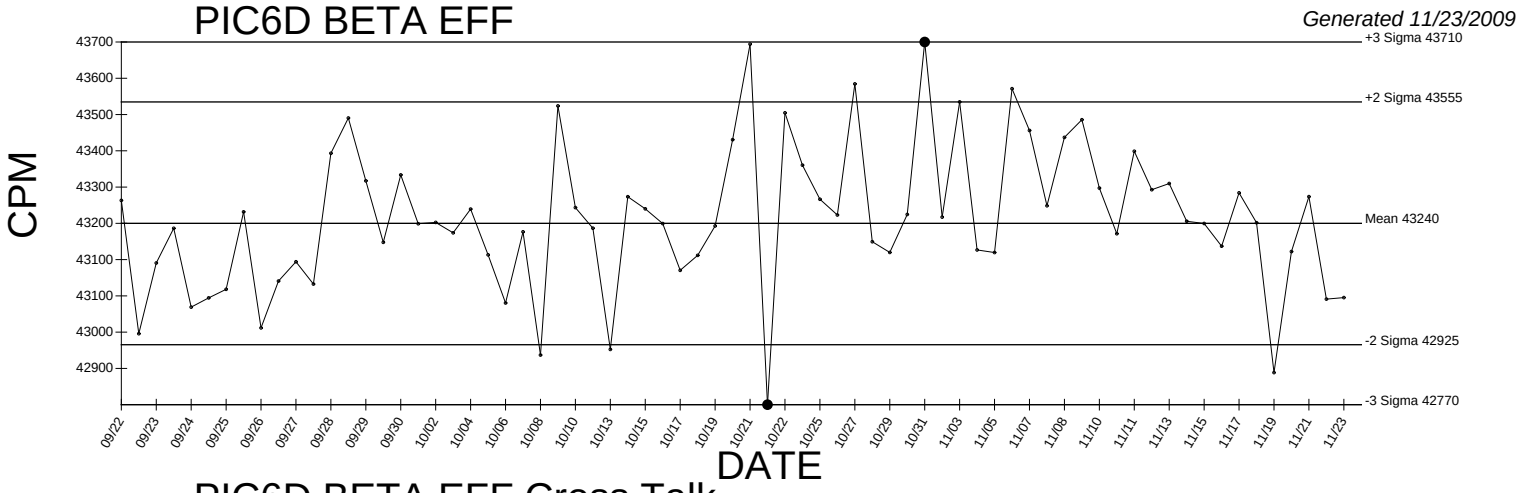
● Denotes Outlier

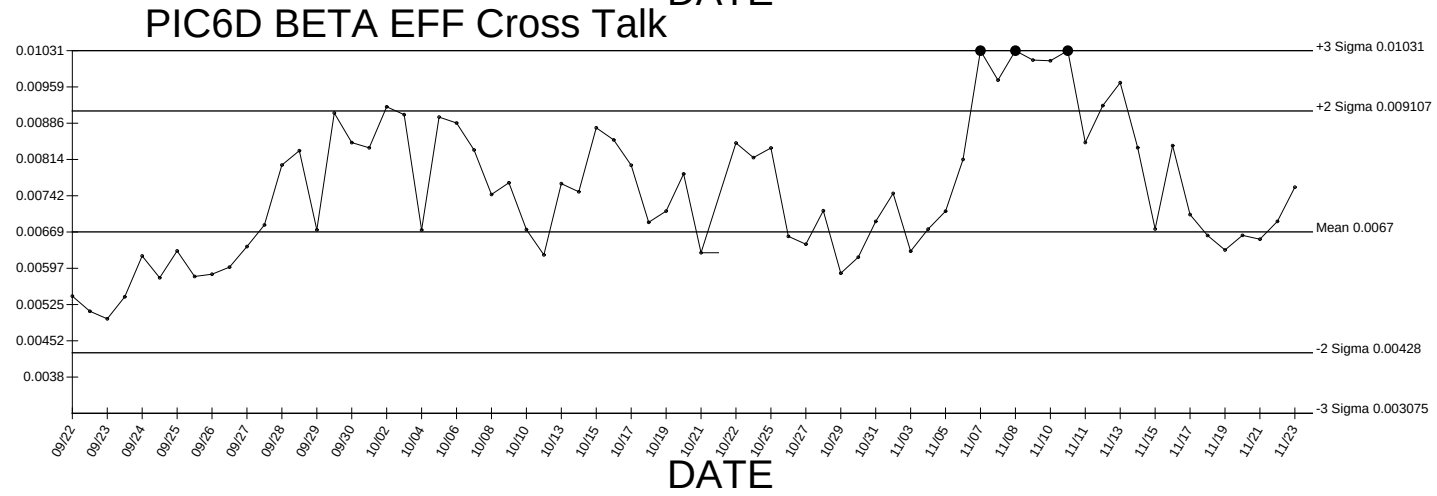

PIC6D ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.538
+2 Sigma 0.424
Mean 0.195
-2 Sigma -0.0333
-3 Sigma -0.148


PIC6D ALPHA EFF
CPM
DATE
+3 Sigma 18140
+2 Sigma 18058
Mean 17900
-2 Sigma 17742
-3 Sigma 17660

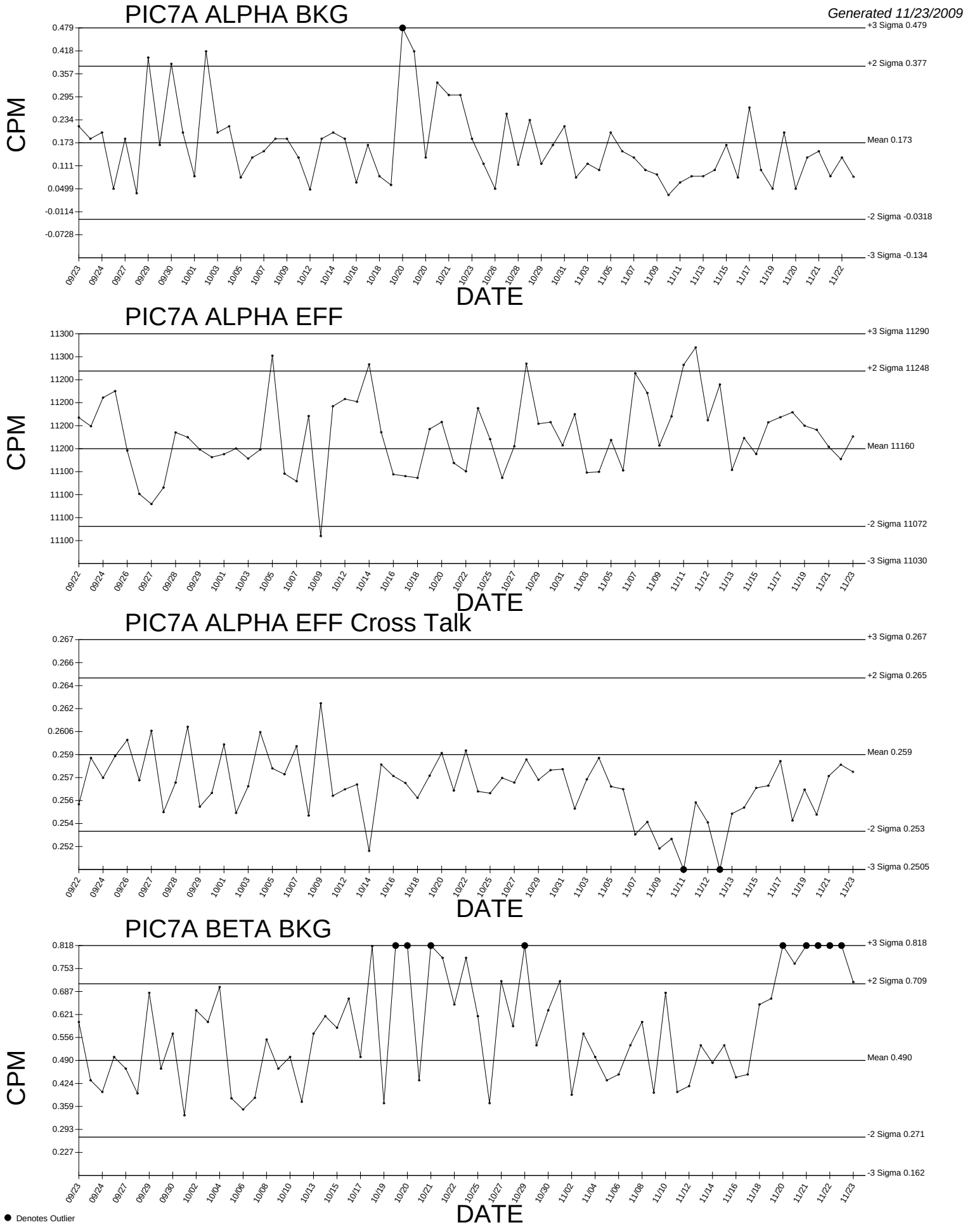

PIC6D ALPHA EFF Cross Talk
DATE
+3 Sigma 0.267
+2 Sigma 0.264
Mean 0.257
-2 Sigma 0.250
-3 Sigma 0.246

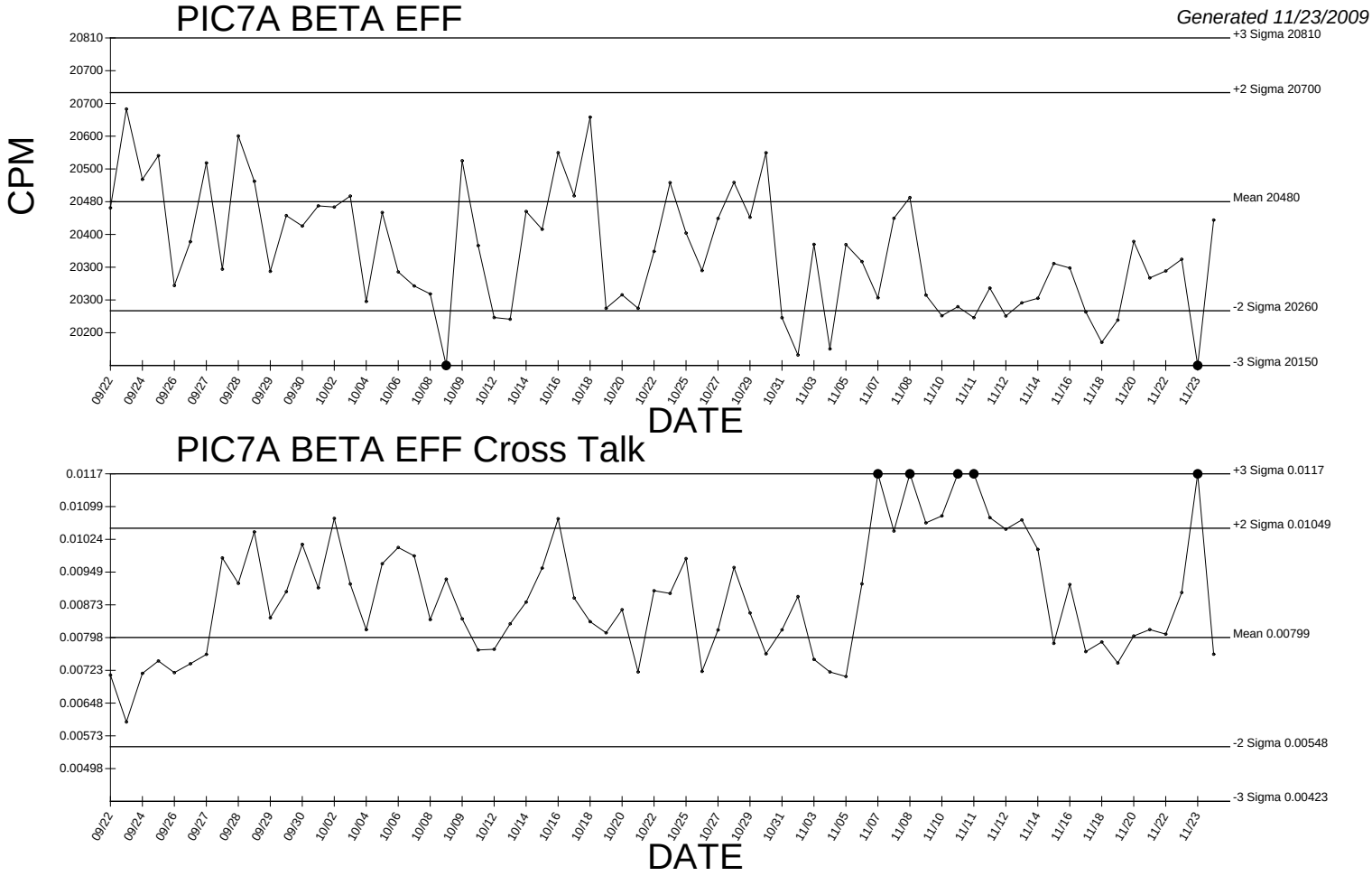

PIC6D BETA BKG
CPM
DATE
+3 Sigma 2.56
+2 Sigma 2.03
Mean 0.969
-2 Sigma -0.091
-3 Sigma -0.6209
Denotes Outlier



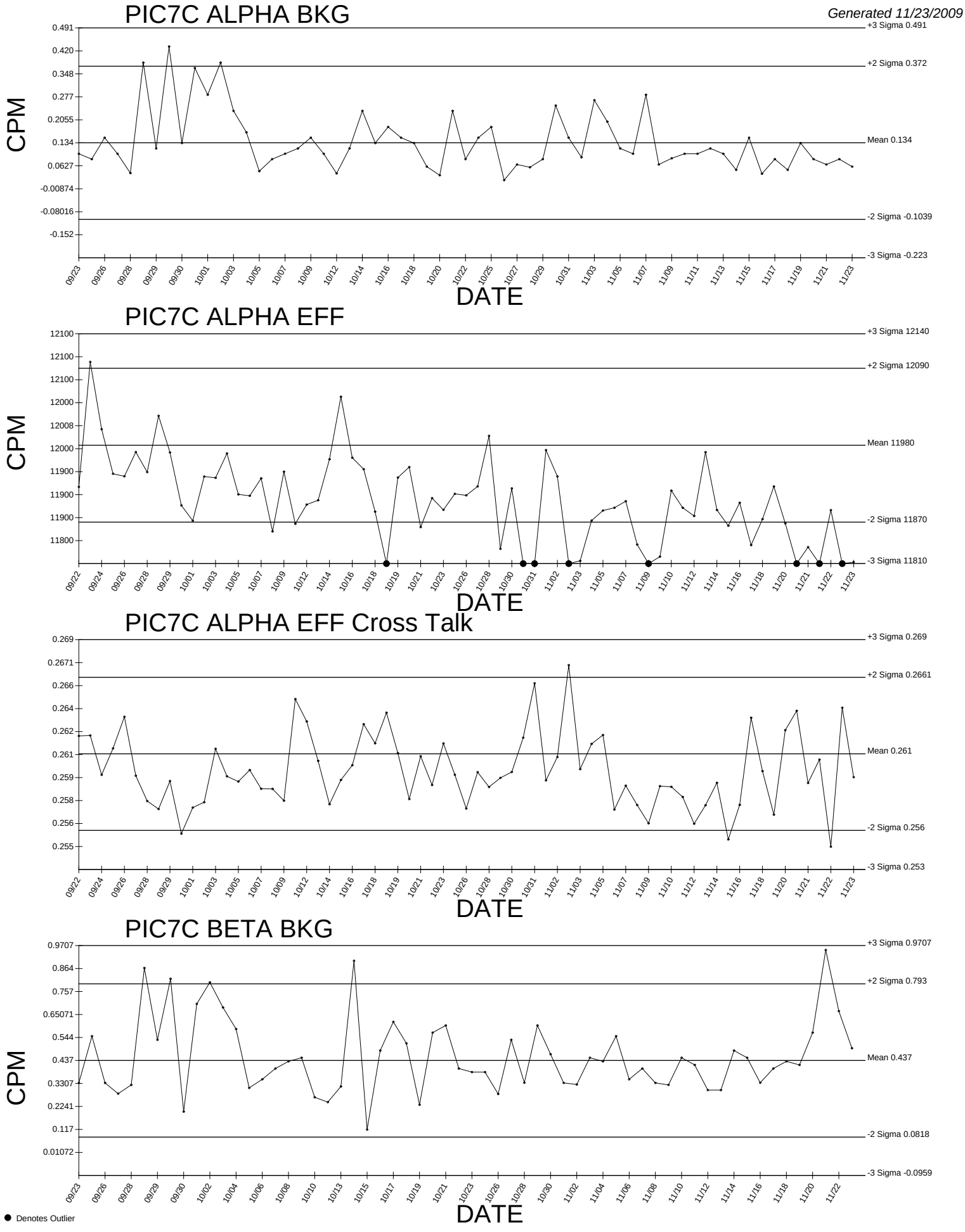


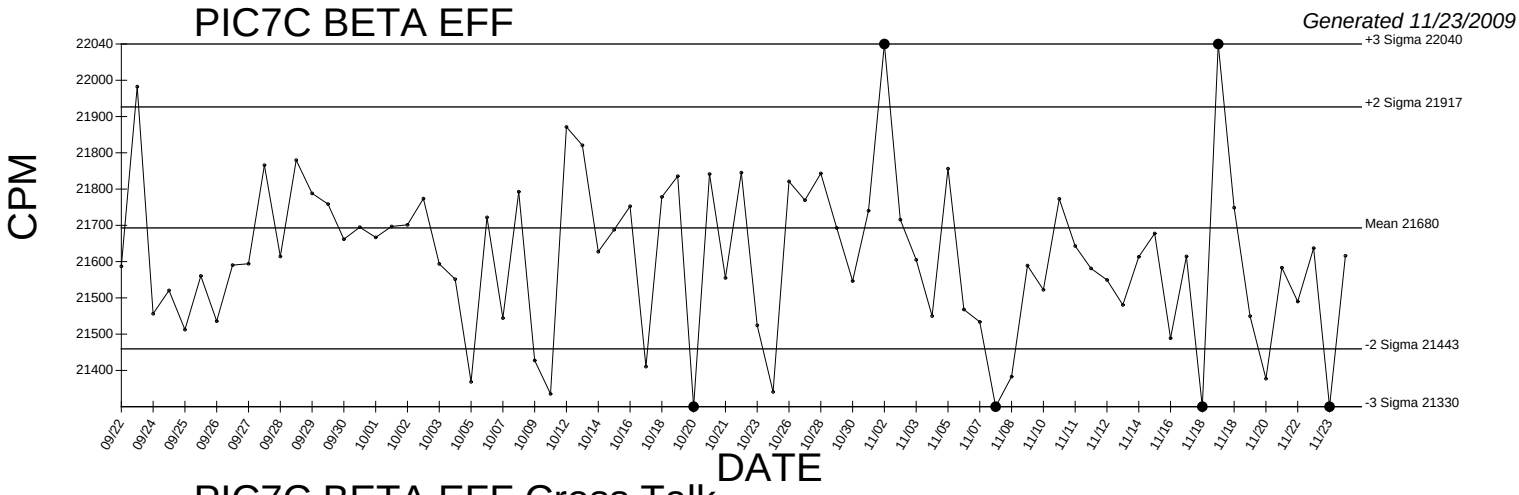
● Denotes Outlier

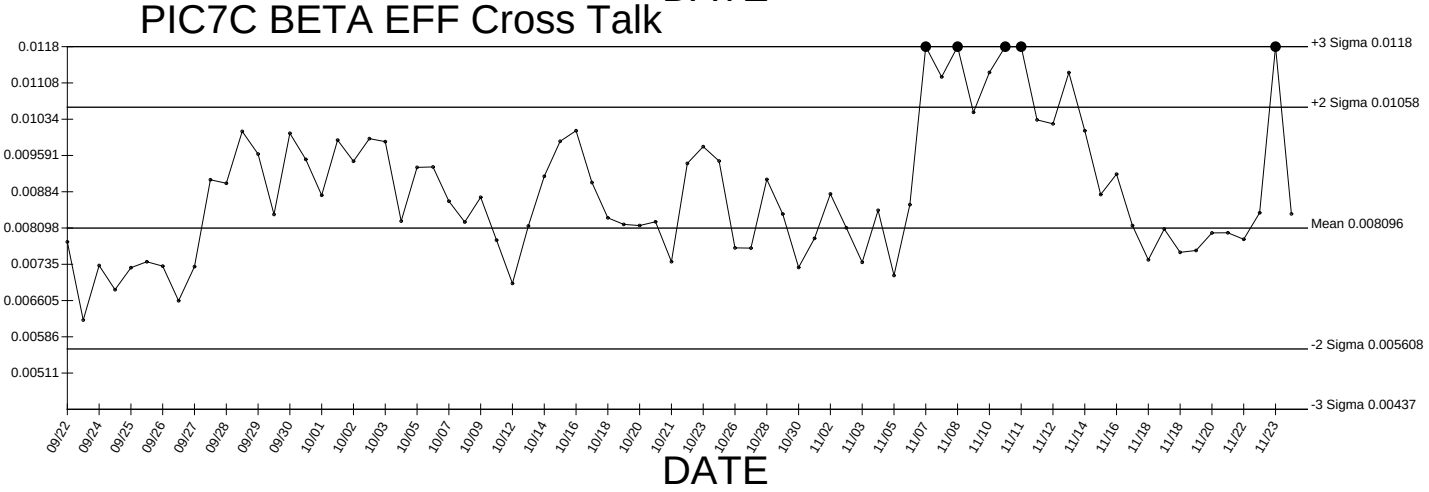

PIC7A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.479
+2 Sigma 0.377
Mean 0.173
-2 Sigma -0.0318
-3 Sigma -0.134
PIC7A ALPHA EFF
+3 Sigma 11290
+2 Sigma 11248
Mean 11160
-2 Sigma 11072
-3 Sigma 11030
PIC7A ALPHA EFF Cross Talk
+3 Sigma 0.267
+2 Sigma 0.265
Mean 0.259
-2 Sigma 0.253
-3 Sigma 0.2505
PIC7A BETA BKG
+3 Sigma 0.818
+2 Sigma 0.709
Mean 0.490
-2 Sigma 0.271
-3 Sigma 0.162
● Denotes Outlier



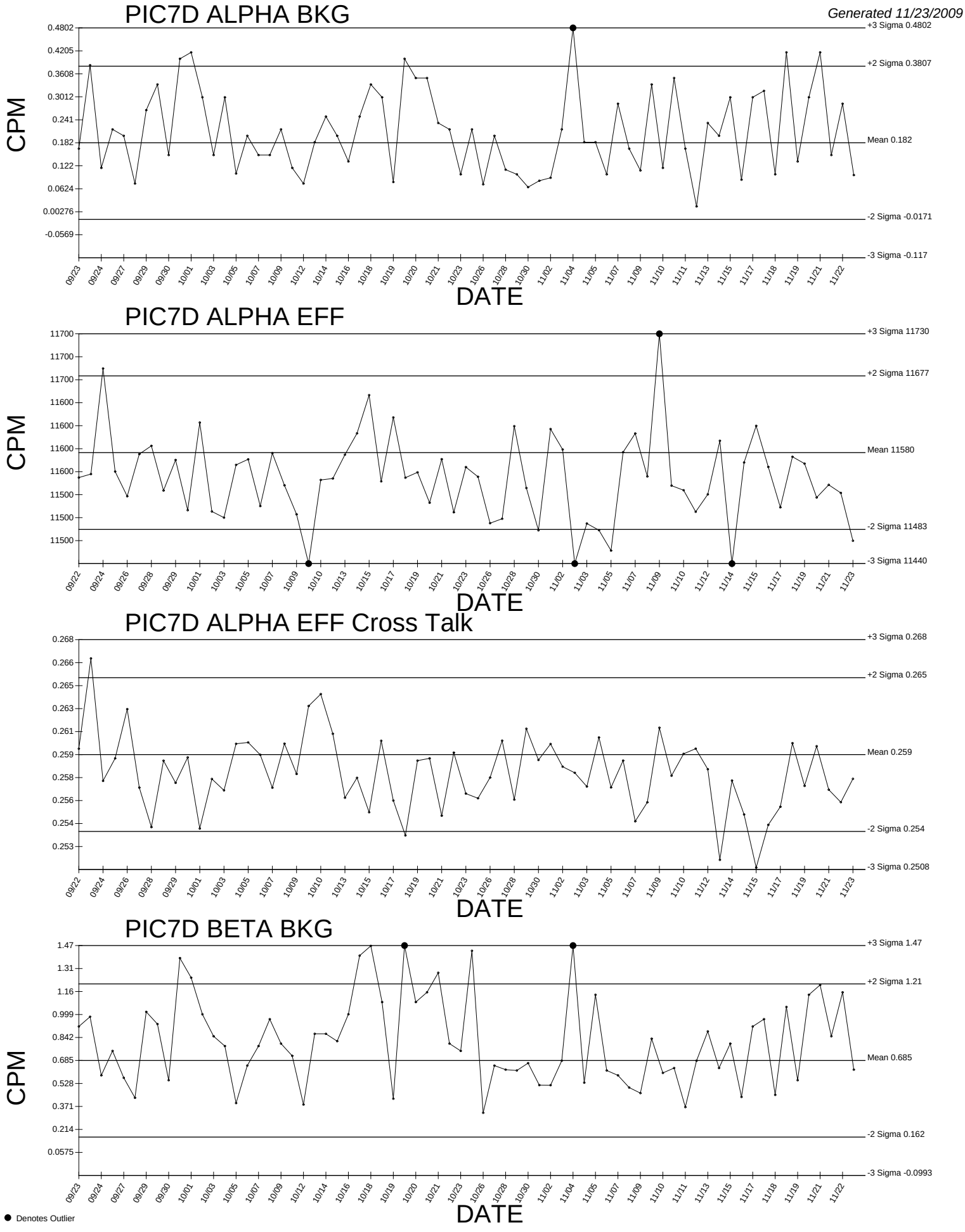
● Denotes Outlier

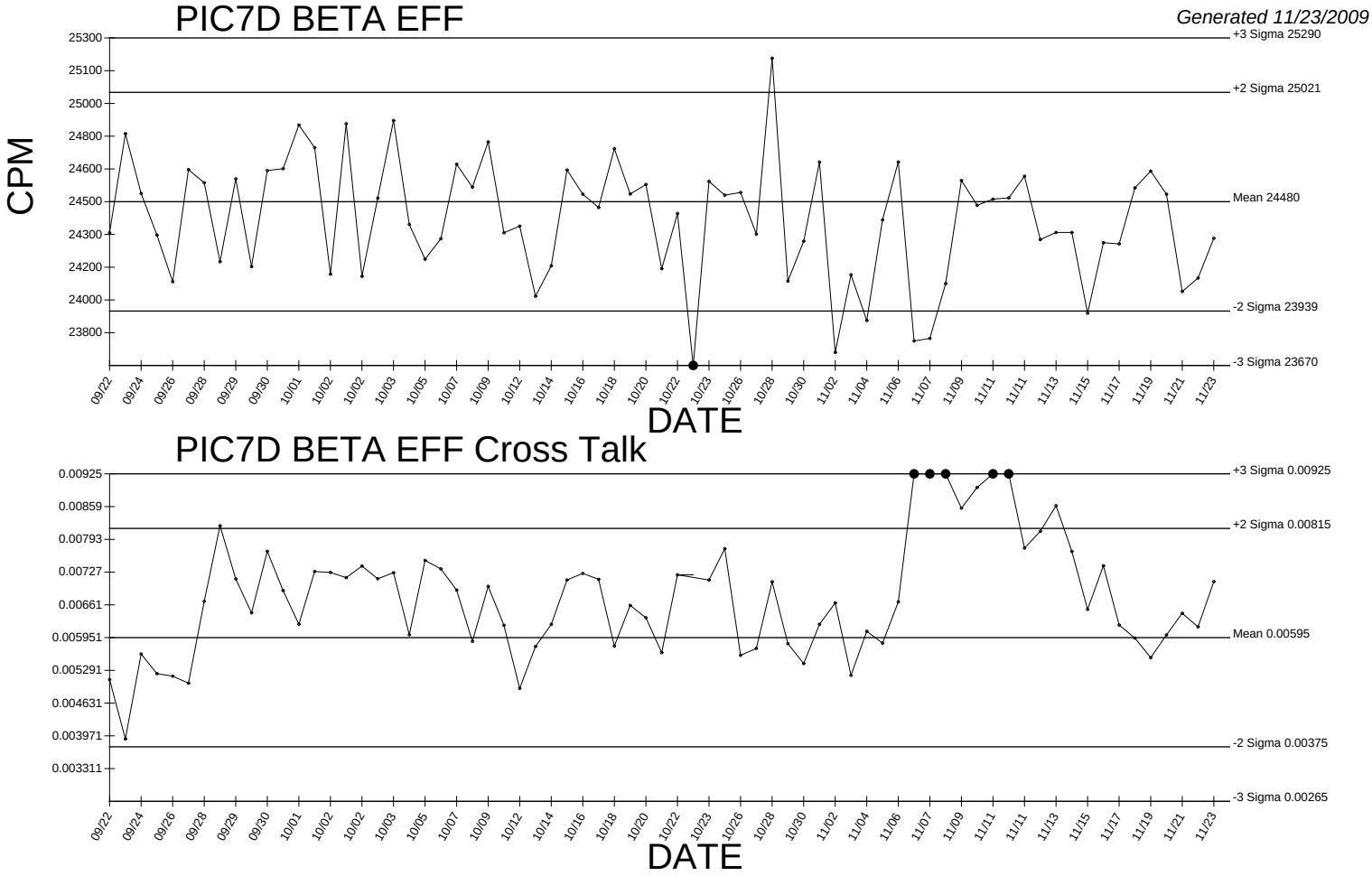

PIC7C ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.491
+2 Sigma 0.372
Mean 0.134
-2 Sigma -0.1039
-3 Sigma -0.223
PIC7C ALPHA EFF
+3 Sigma 12140
+2 Sigma 12090
Mean 11980
-2 Sigma 11870
-3 Sigma 11810
PIC7C ALPHA EFF Cross Talk
+3 Sigma 0.269
+2 Sigma 0.2661
Mean 0.261
-2 Sigma 0.256
-3 Sigma 0.253
PIC7C BETA BKG
+3 Sigma 0.9707
+2 Sigma 0.793
Mean 0.437
-2 Sigma 0.0818
-3 Sigma -0.0959
● Denotes Outlier



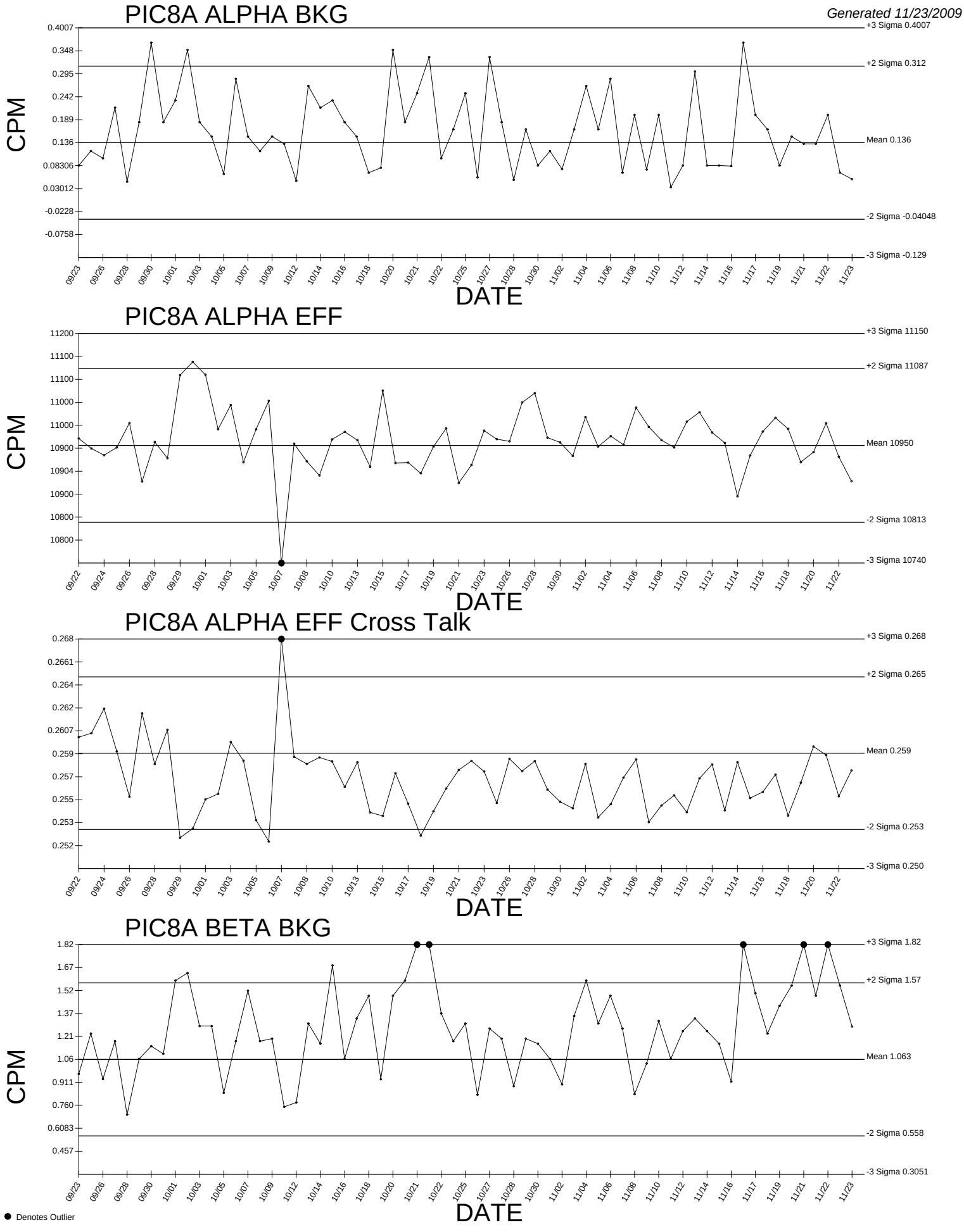


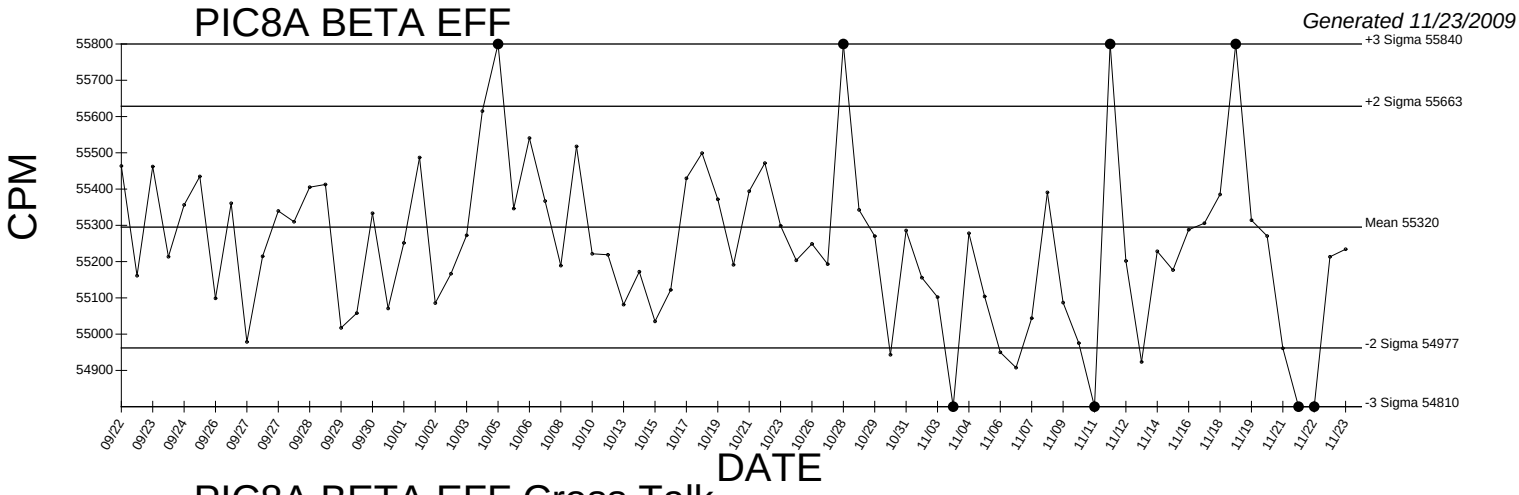
● Denotes Outlier

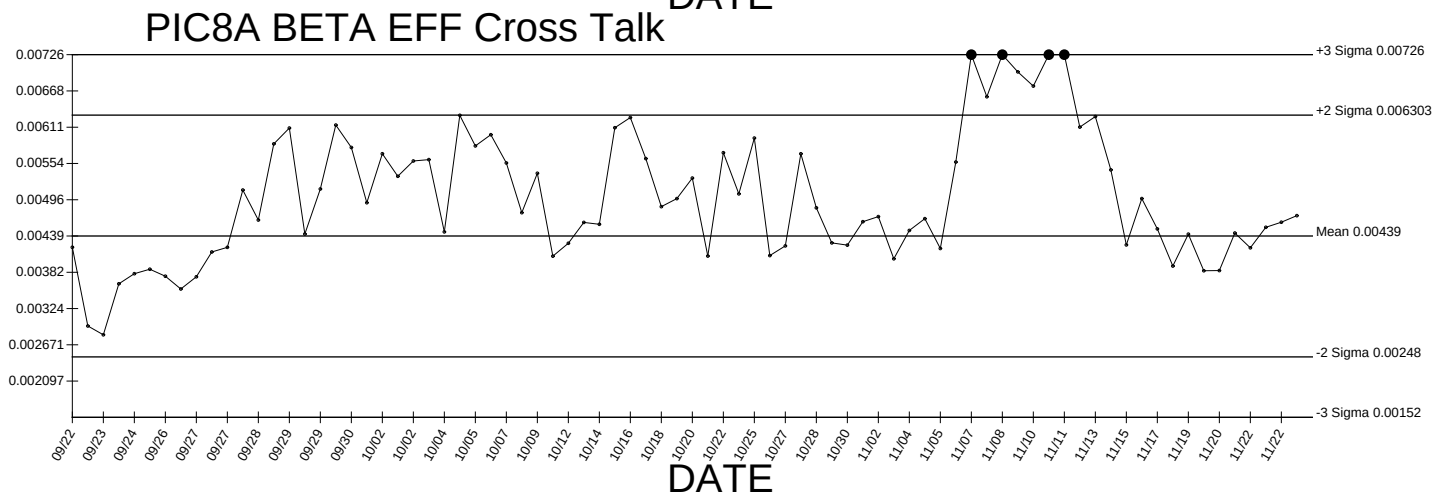

PIC7D ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.4802
+2 Sigma 0.3807
Mean 0.182
-2 Sigma -0.0171
-3 Sigma -0.117
PIC7D ALPHA EFF
+3 Sigma 11730
+2 Sigma 11677
Mean 11580
-2 Sigma 11483
-3 Sigma 11440
PIC7D ALPHA EFF Cross Talk
+3 Sigma 0.268
+2 Sigma 0.265
Mean 0.259
-2 Sigma 0.254
-3 Sigma 0.2508
PIC7D BETA BKG
+3 Sigma 1.47
+2 Sigma 1.21
Mean 0.685
-2 Sigma 0.162
-3 Sigma -0.0993
● Denotes Outlier



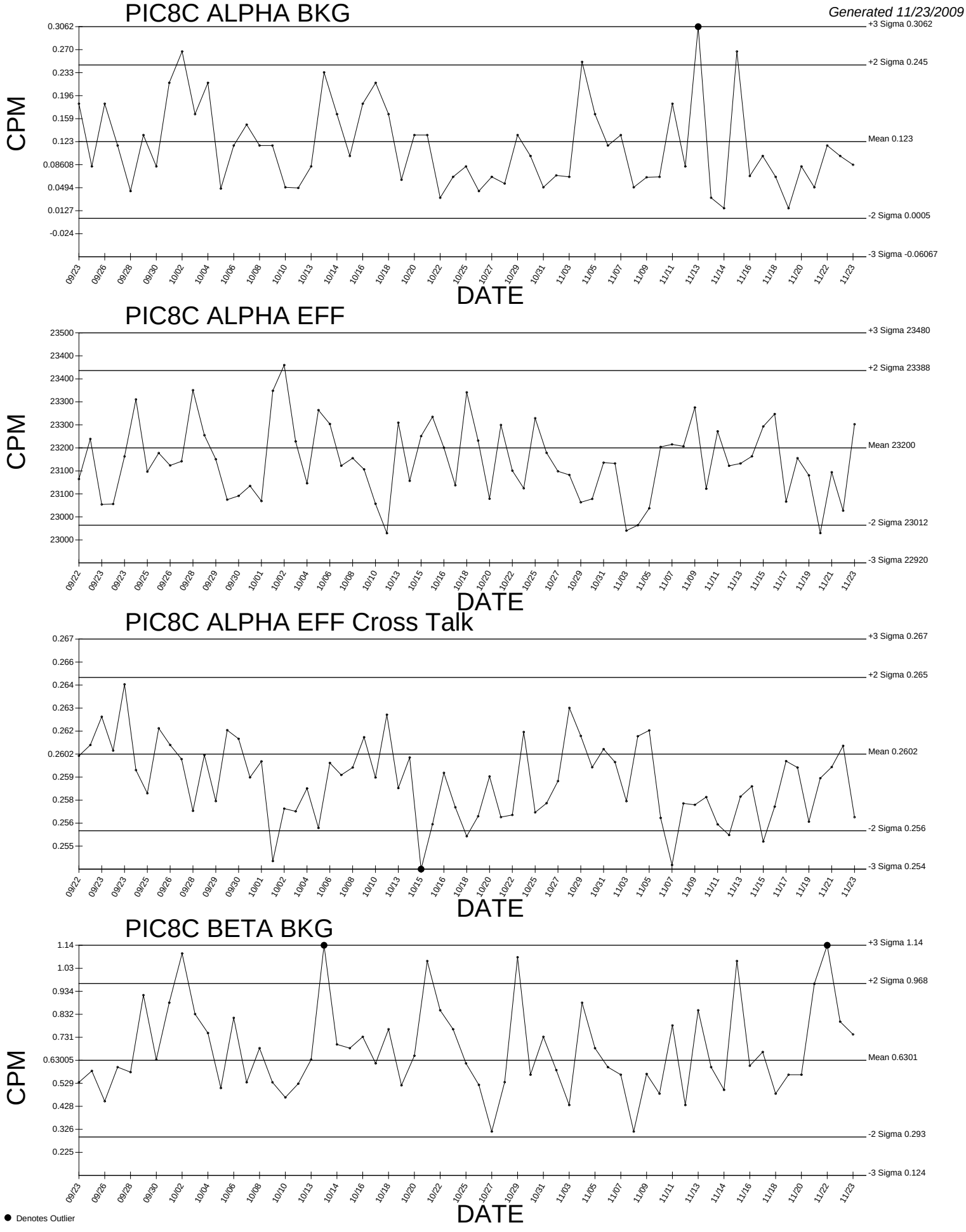
● Denotes Outlier

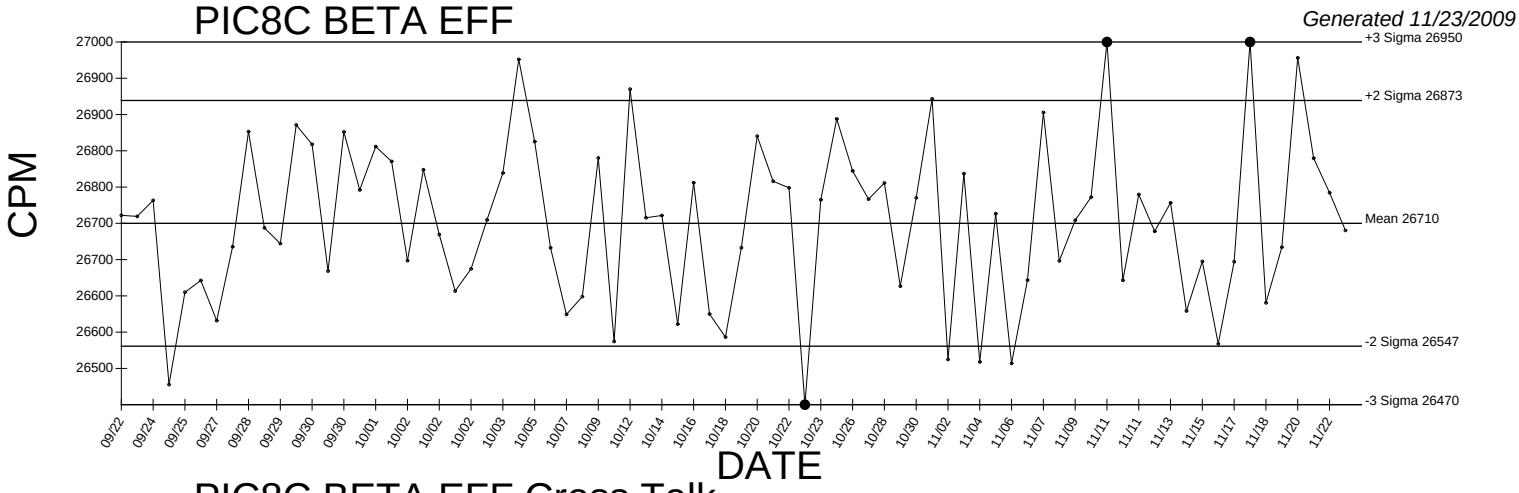

PIC8A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.4007
+2 Sigma 0.312
Mean 0.136
-2 Sigma -0.04048
-3 Sigma -0.129
PIC8A ALPHA EFF
+3 Sigma 11150
+2 Sigma 11087
Mean 10950
-2 Sigma 10813
-3 Sigma 10740
PIC8A ALPHA EFF Cross Talk
+3 Sigma 0.268
+2 Sigma 0.265
Mean 0.259
-2 Sigma 0.253
-3 Sigma 0.250
PIC8A BETA BKG
+3 Sigma 1.82
+2 Sigma 1.57
Mean 1.063
-2 Sigma 0.558
-3 Sigma 0.3051
● Denotes Outlier

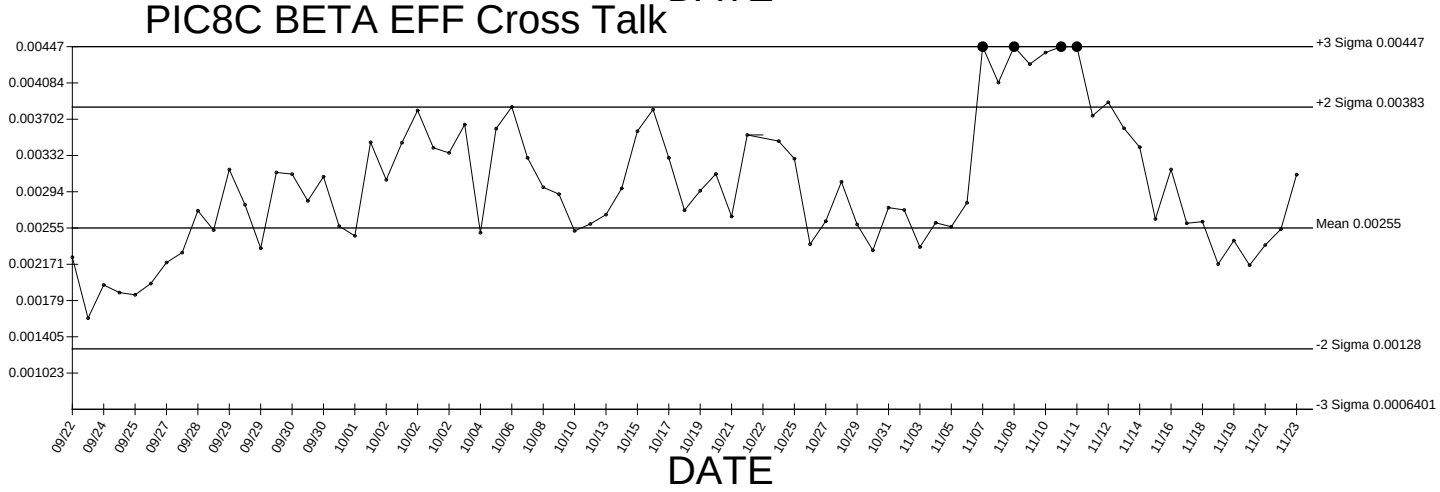




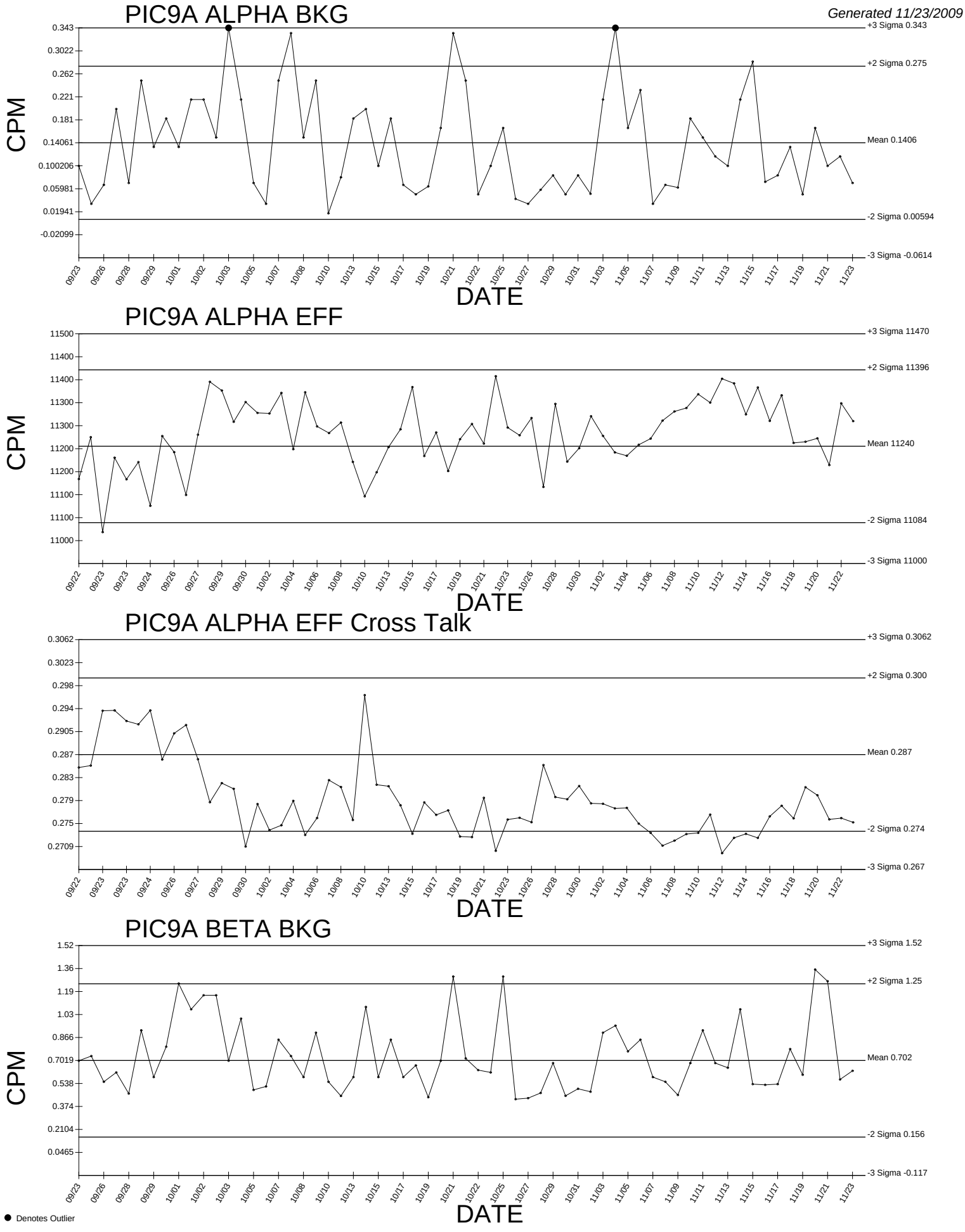
● Denotes Outlier

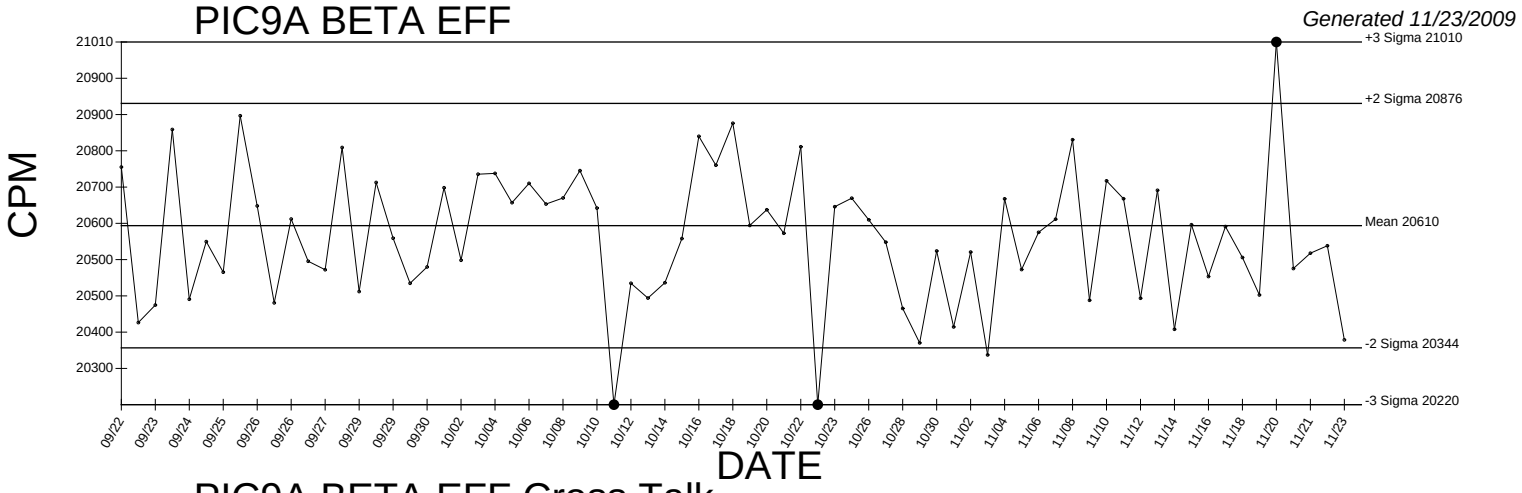

PIC8C ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.3062
+2 Sigma 0.245
Mean 0.123
-2 Sigma 0.0005
-3 Sigma -0.06067
PIC8C ALPHA EFF
+3 Sigma 23480
+2 Sigma 23388
Mean 23200
-2 Sigma 23012
-3 Sigma 22920
PIC8C ALPHA EFF Cross Talk
+3 Sigma 0.267
+2 Sigma 0.265
Mean 0.2602
-2 Sigma 0.256
-3 Sigma 0.254
PIC8C BETA BKG
+3 Sigma 1.14
+2 Sigma 0.968
Mean 0.6301
-2 Sigma 0.293
-3 Sigma 0.124
● Denotes Outlier

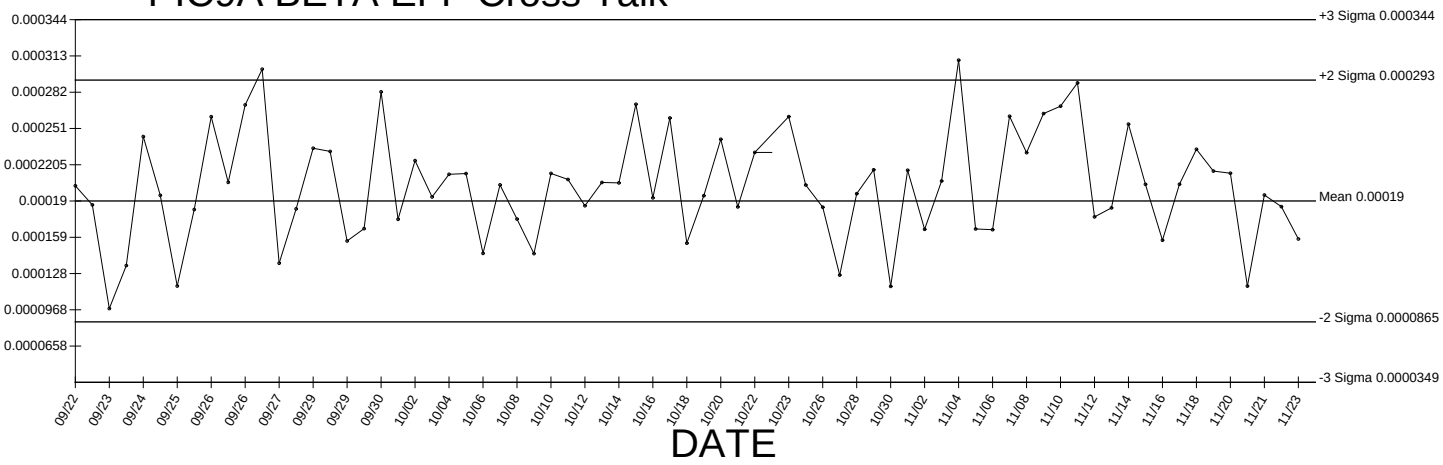




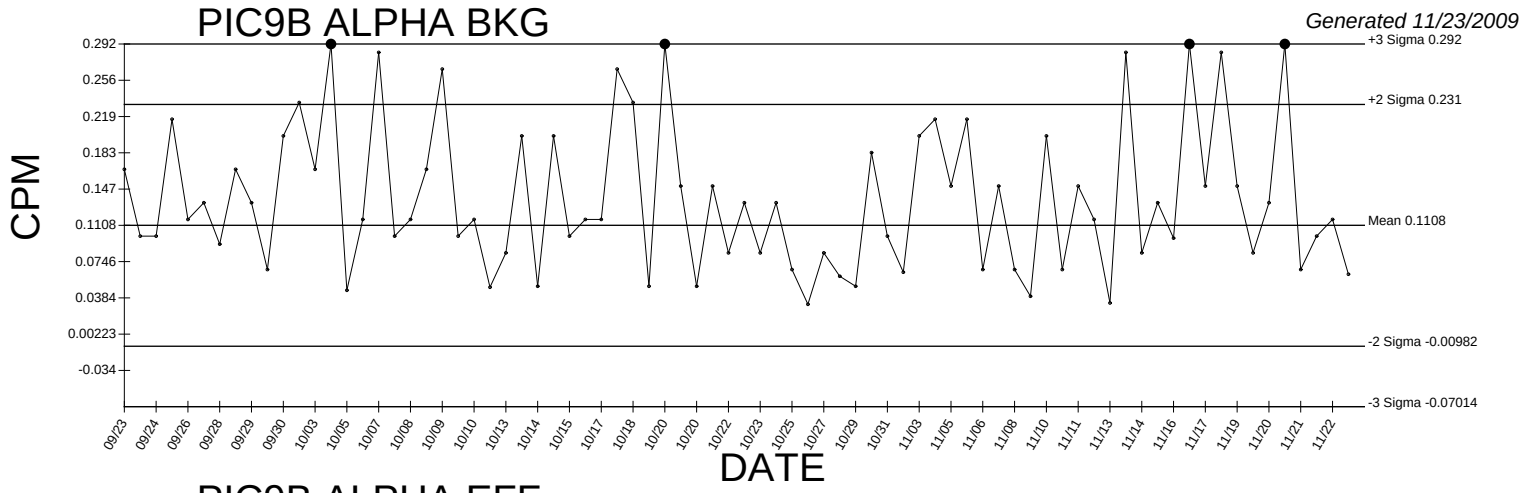
● Denotes Outlier

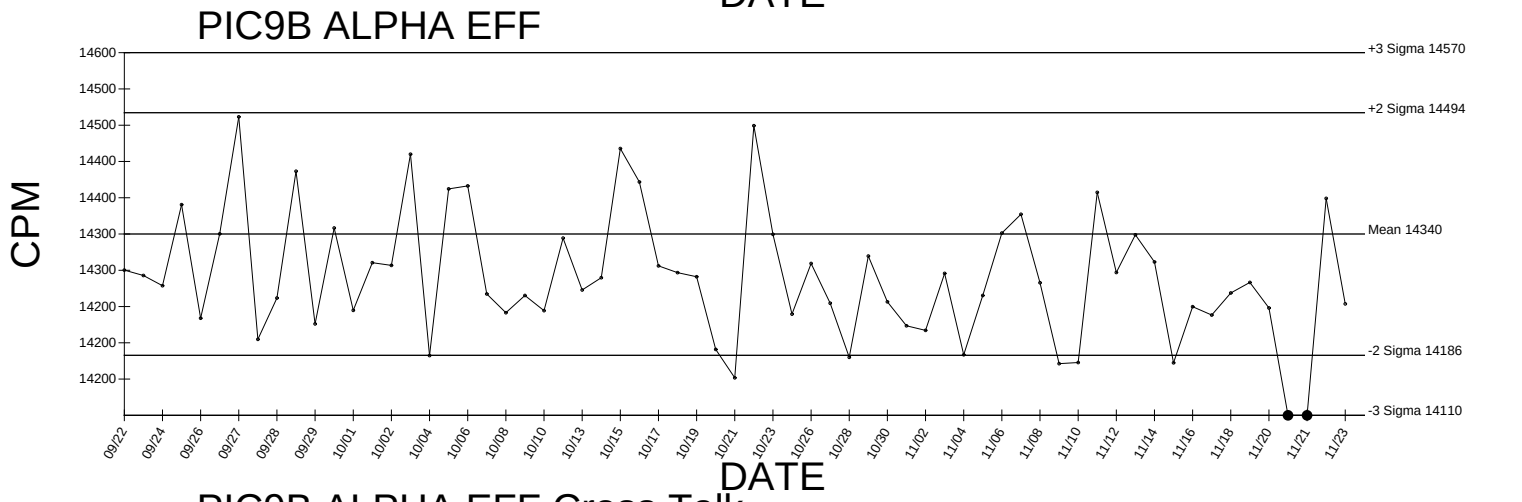

PIC9A ALPHA BKG
Generated 11/23/2009
CPM
DATE
+3 Sigma 0.343
+2 Sigma 0.275
Mean 0.1406
-2 Sigma 0.00594
-3 Sigma -0.0614
PIC9A ALPHA EFF
+3 Sigma 11470
+2 Sigma 11396
Mean 11240
-2 Sigma 11084
-3 Sigma 11000
PIC9A ALPHA EFF Cross Talk
+3 Sigma 0.3062
+2 Sigma 0.300
Mean 0.287
-2 Sigma 0.274
-3 Sigma 0.267
PIC9A BETA BKG
+3 Sigma 1.52
+2 Sigma 1.25
Mean 0.702
-2 Sigma 0.156
-3 Sigma -0.117
● Denotes Outlier

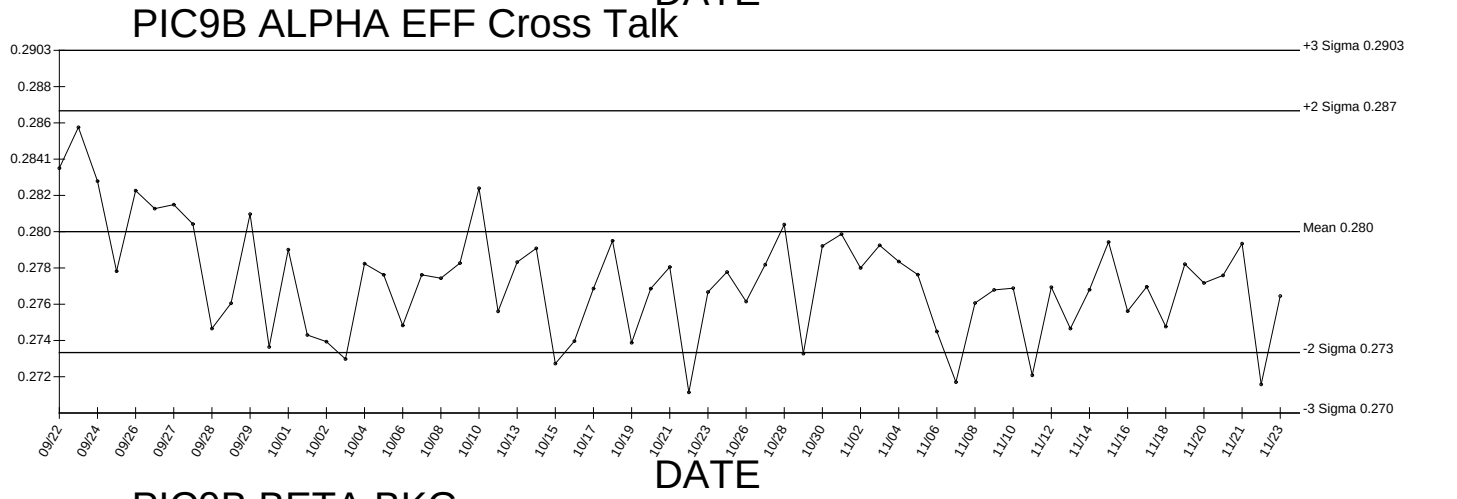


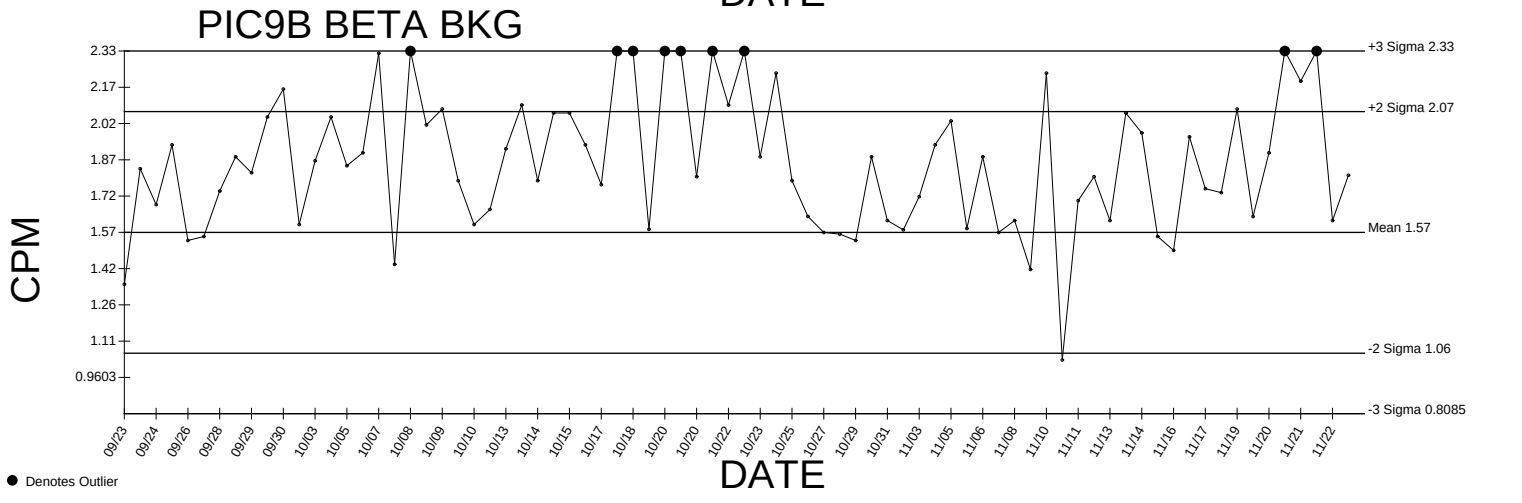


● Denotes Outlier

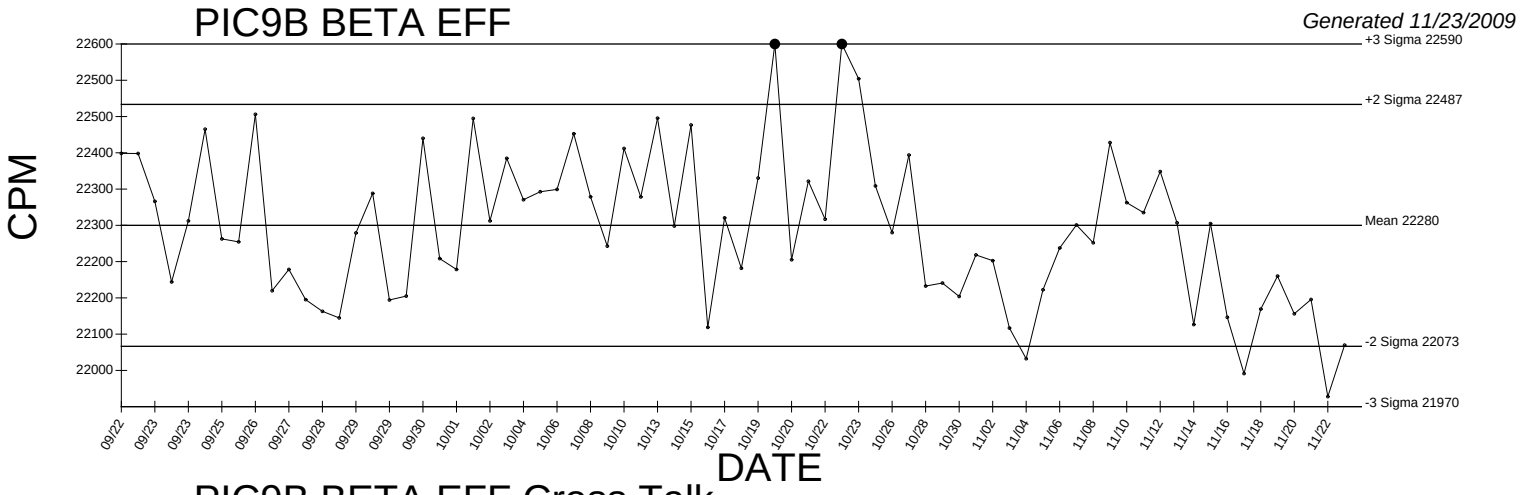


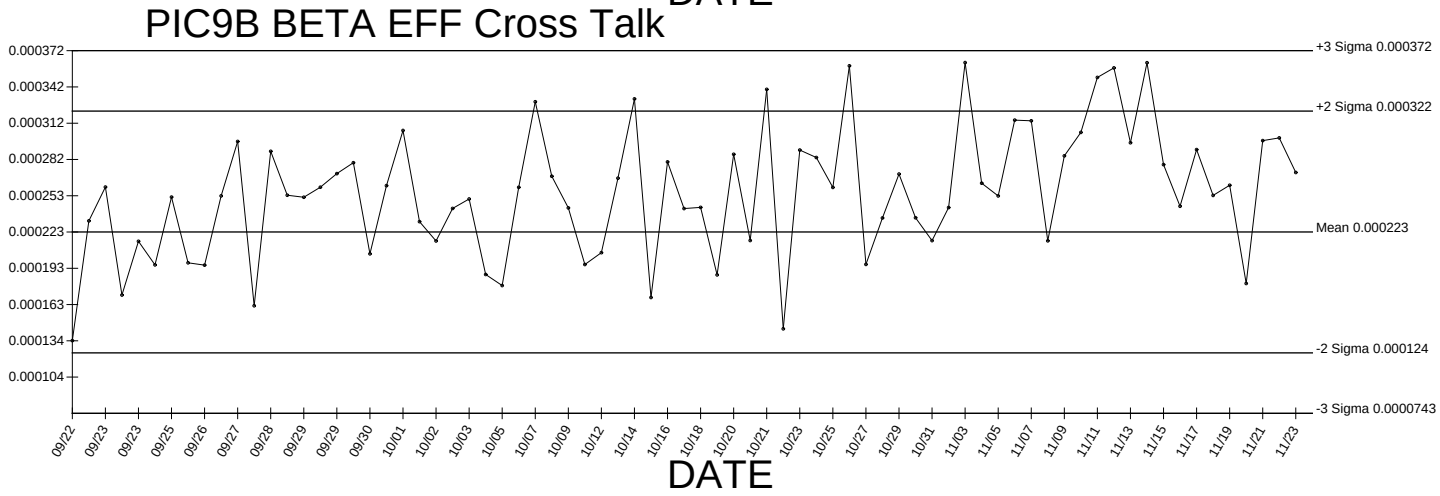




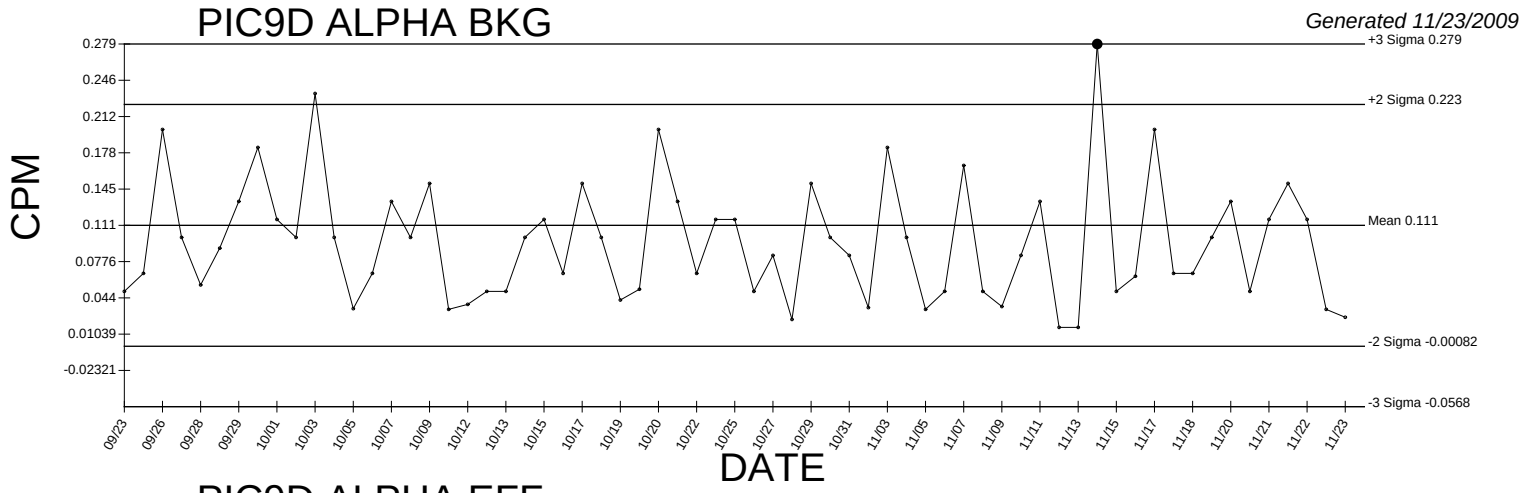


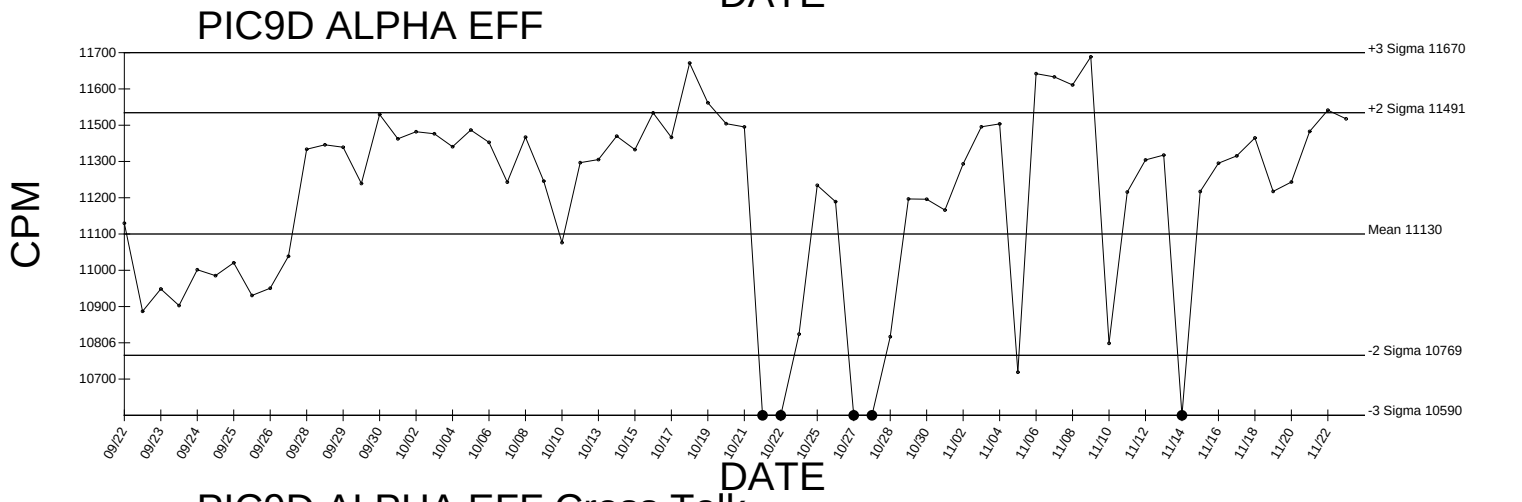
● Denotes Outlier

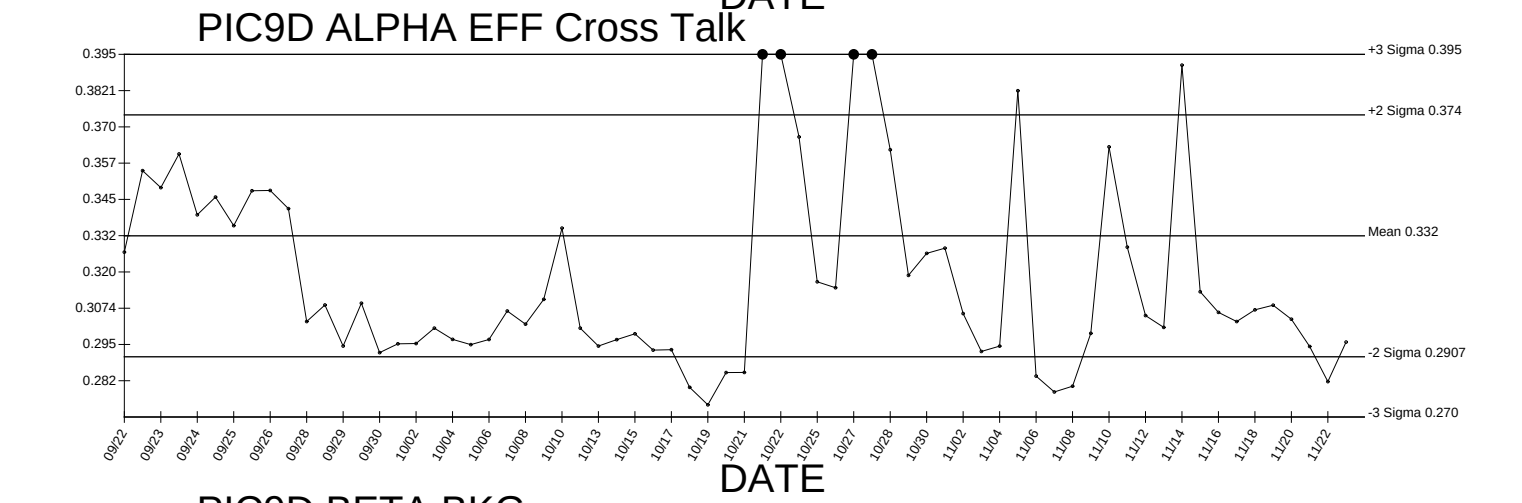


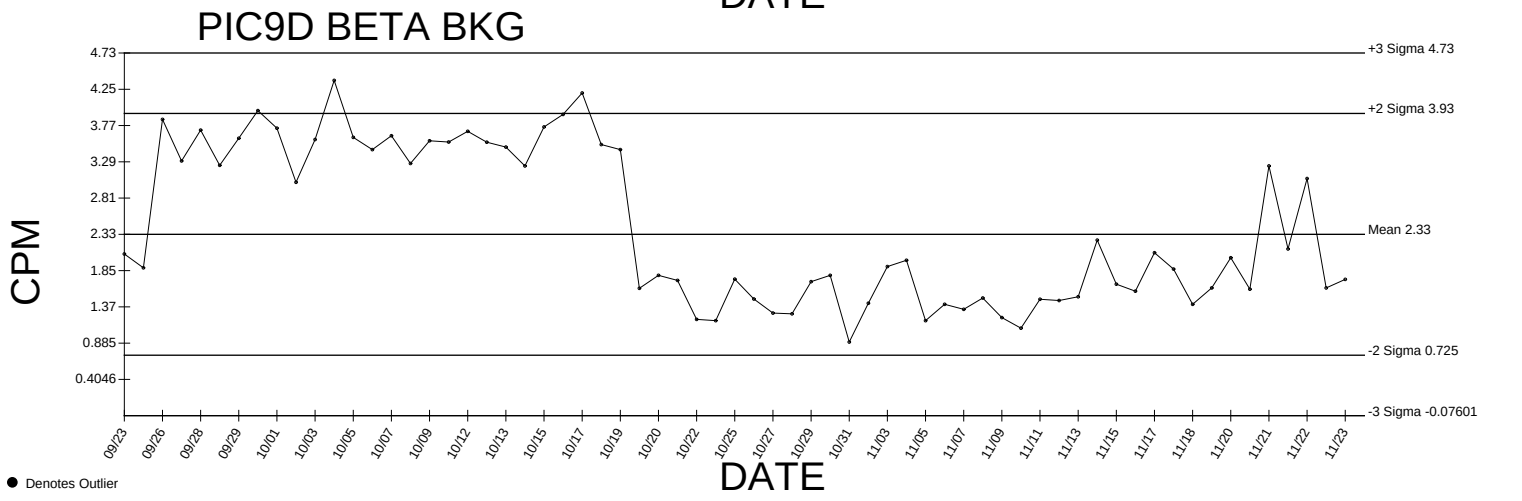


● Denotes Outlier

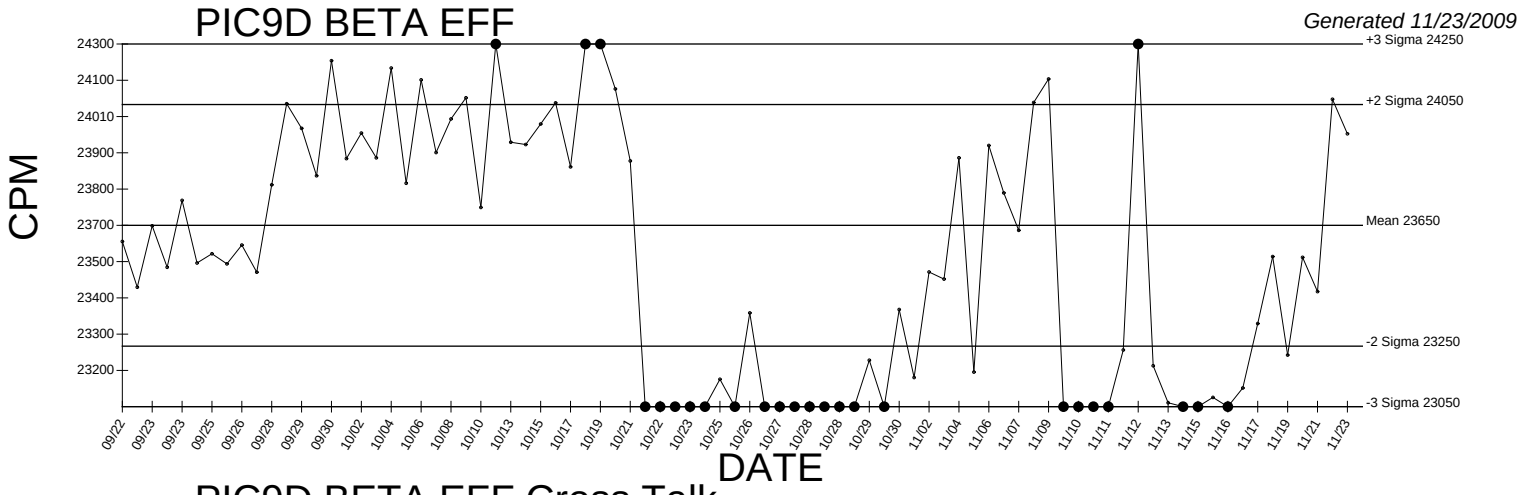


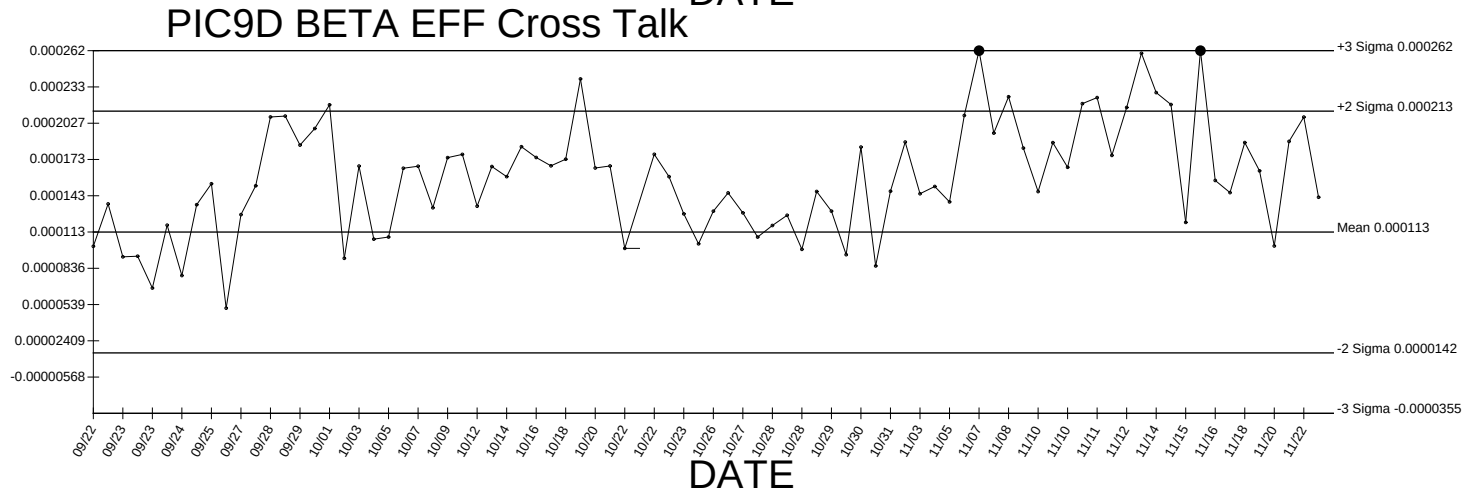






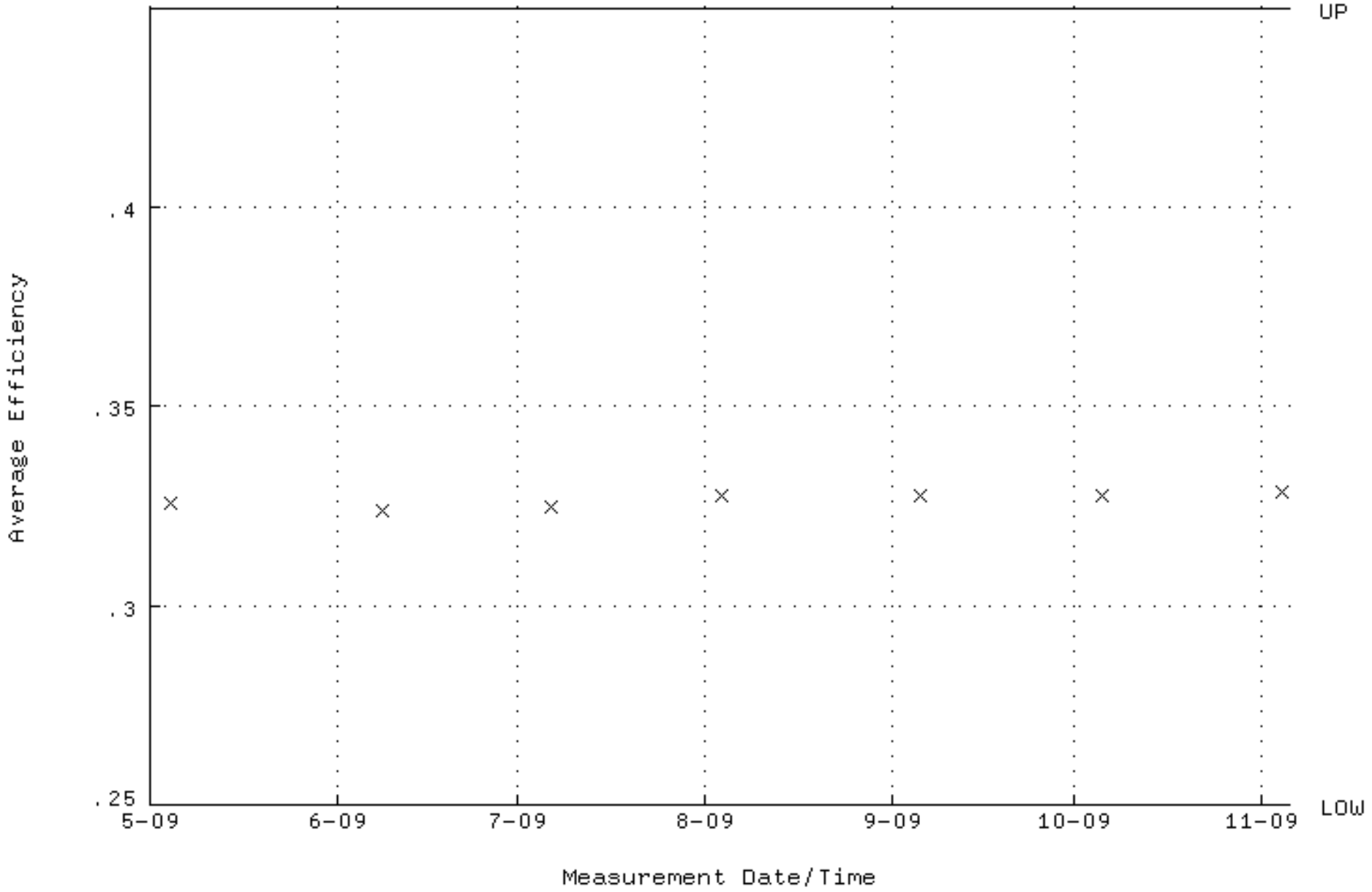
● Denotes Outlier



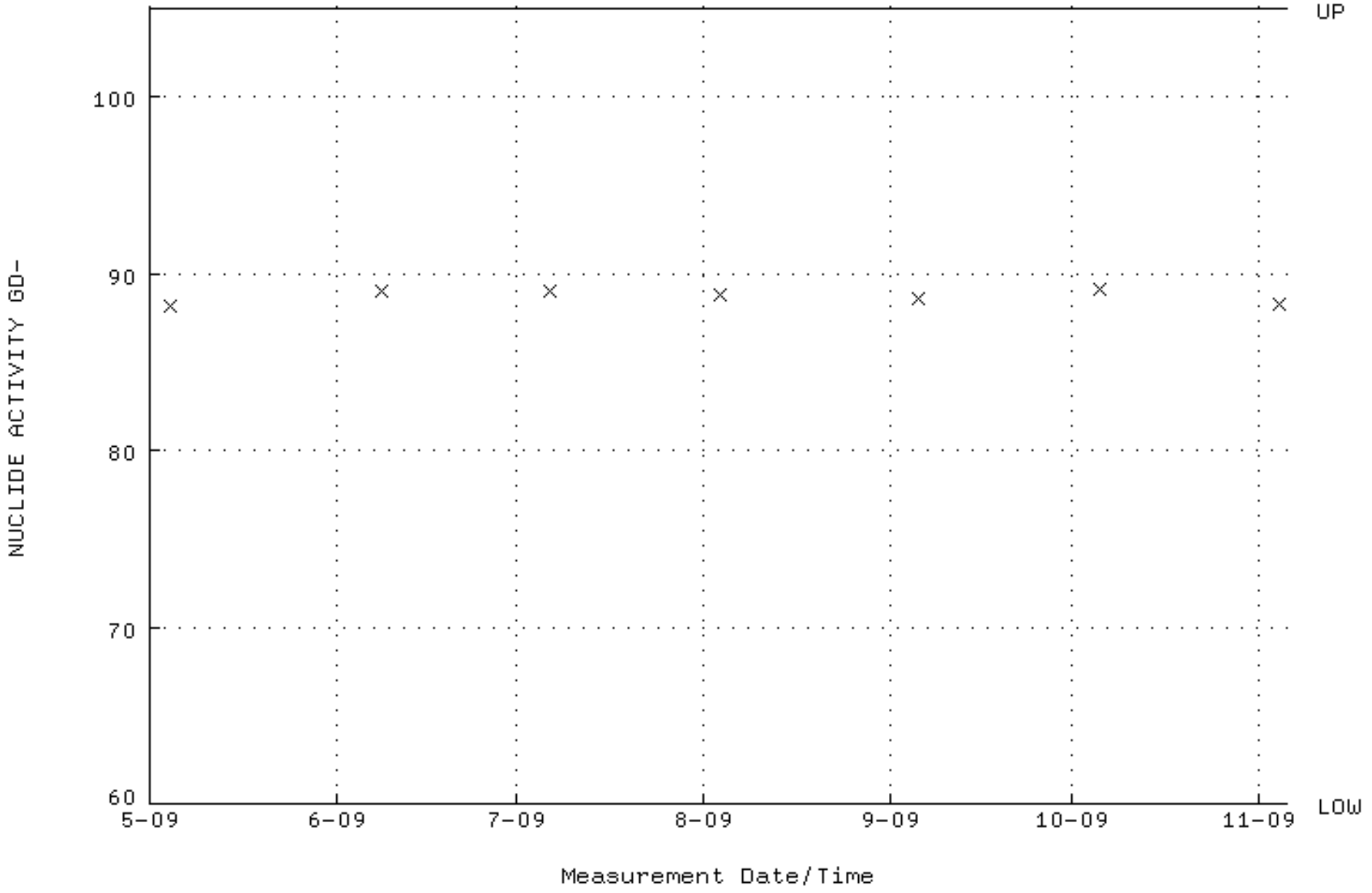


● Denotes Outlier

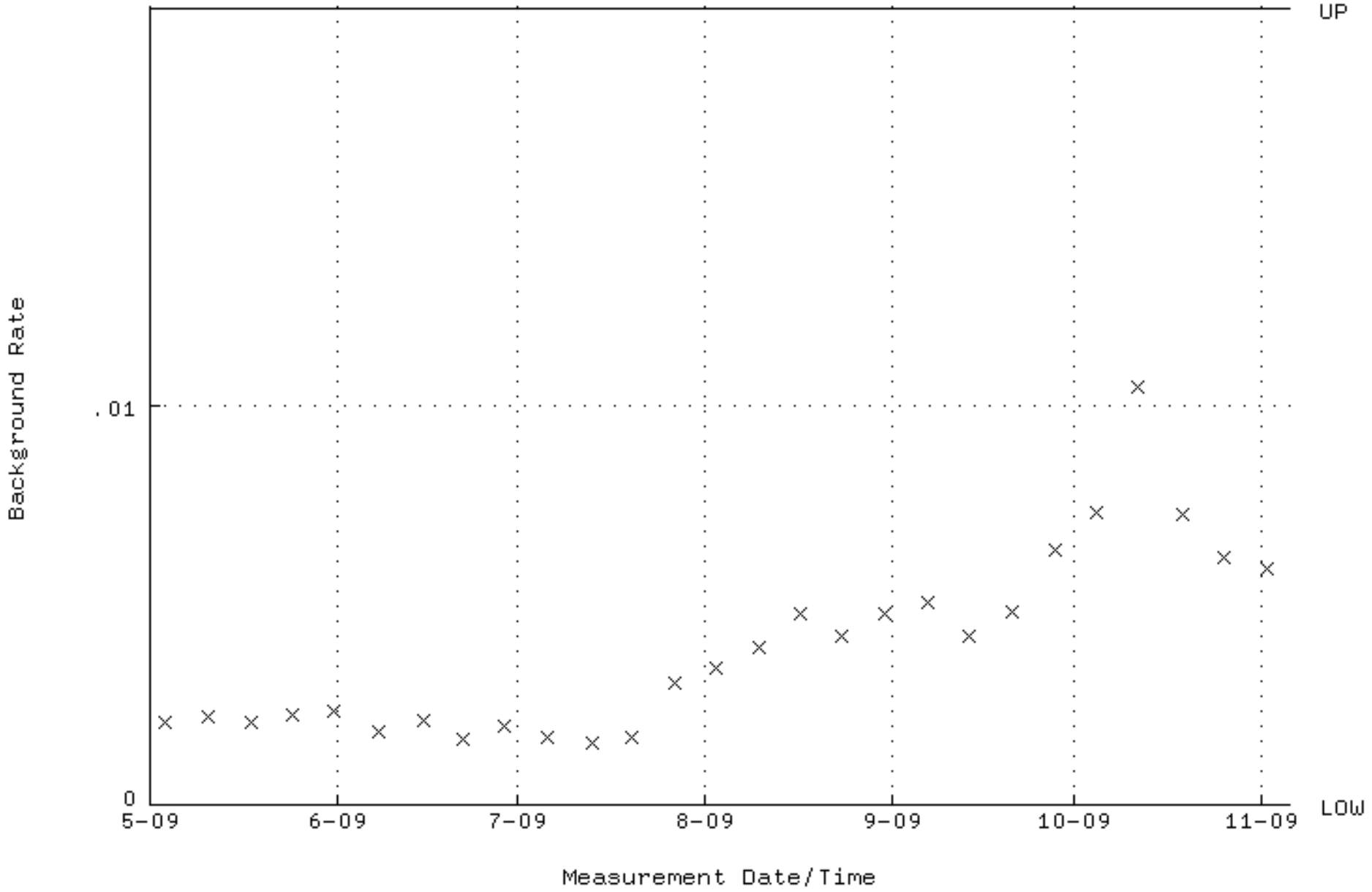
QA filename : DKA100:[ENV_ALPHA.QA.W]W025.QAF;4
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.250000 through 0.450000



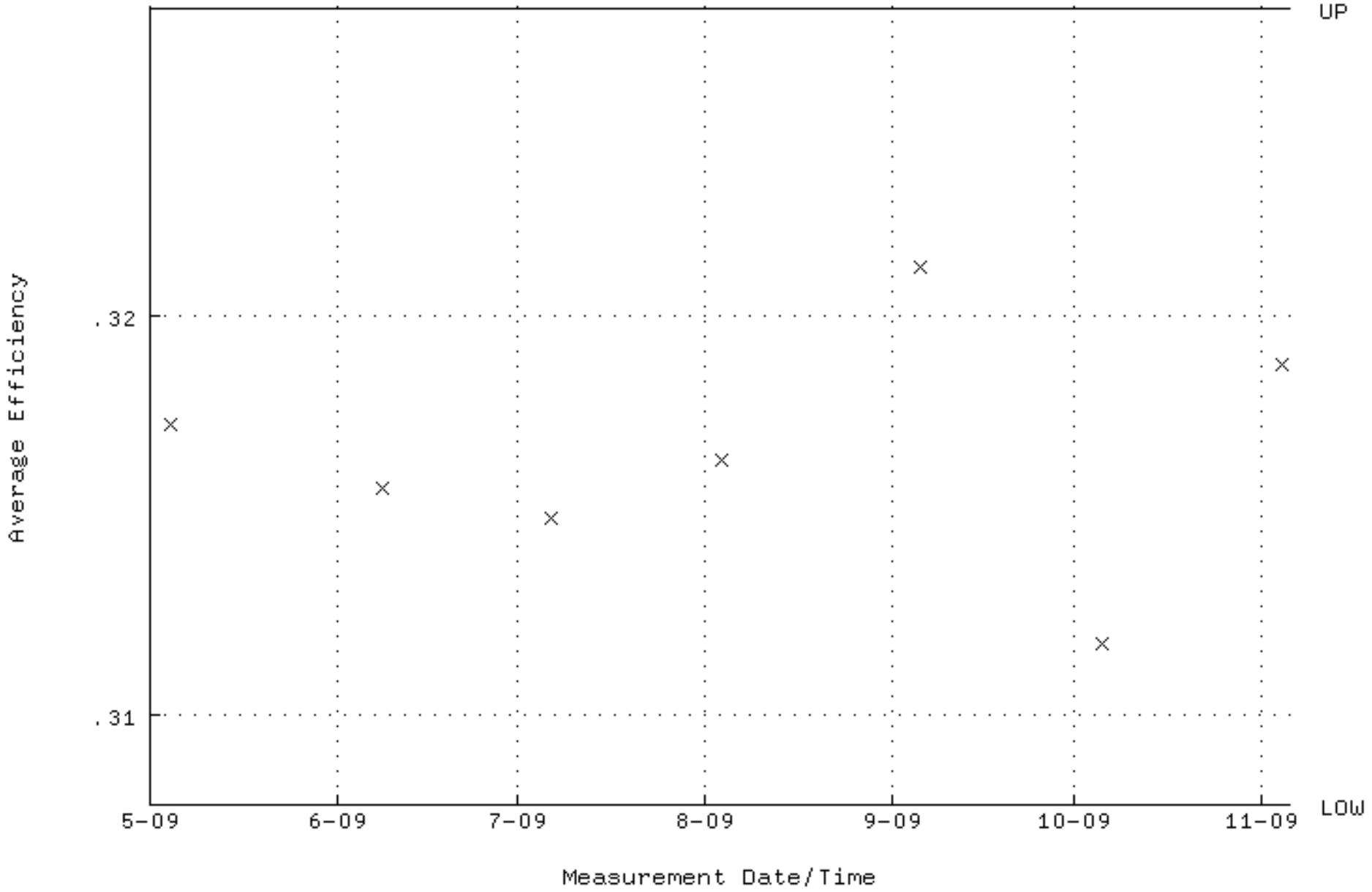
QA filename : DKA100:[ENV_ALPHA.QA.W]W025.QAF;4
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 60.0000 through 105.000



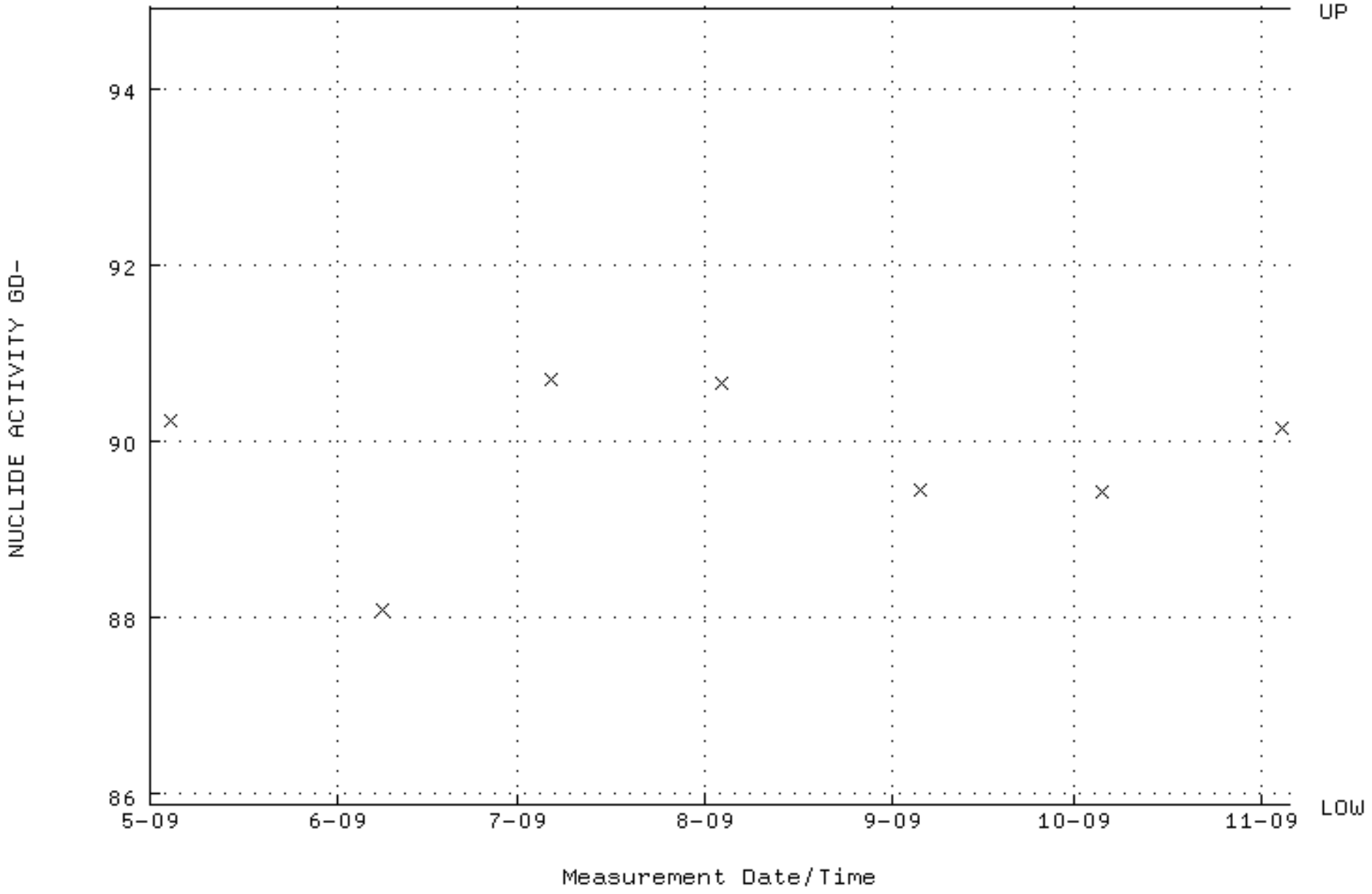
QA filename : DKA100:[ENV_ALPHA.QA.B]B025.QAF;2
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:51 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



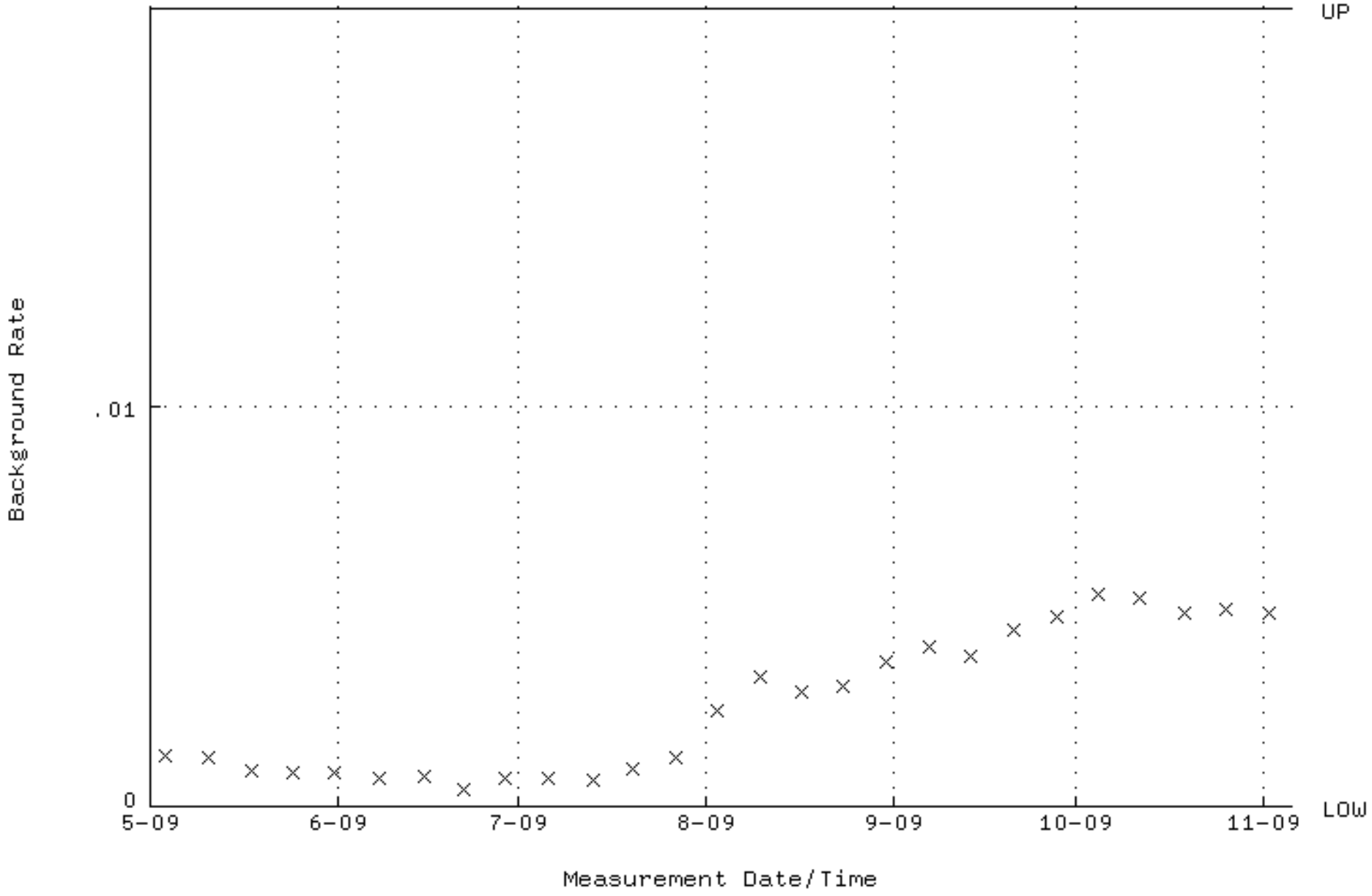
QA filename : DKA100:[ENV_ALPHA.QA.W]W026.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.307728 through 0.327728



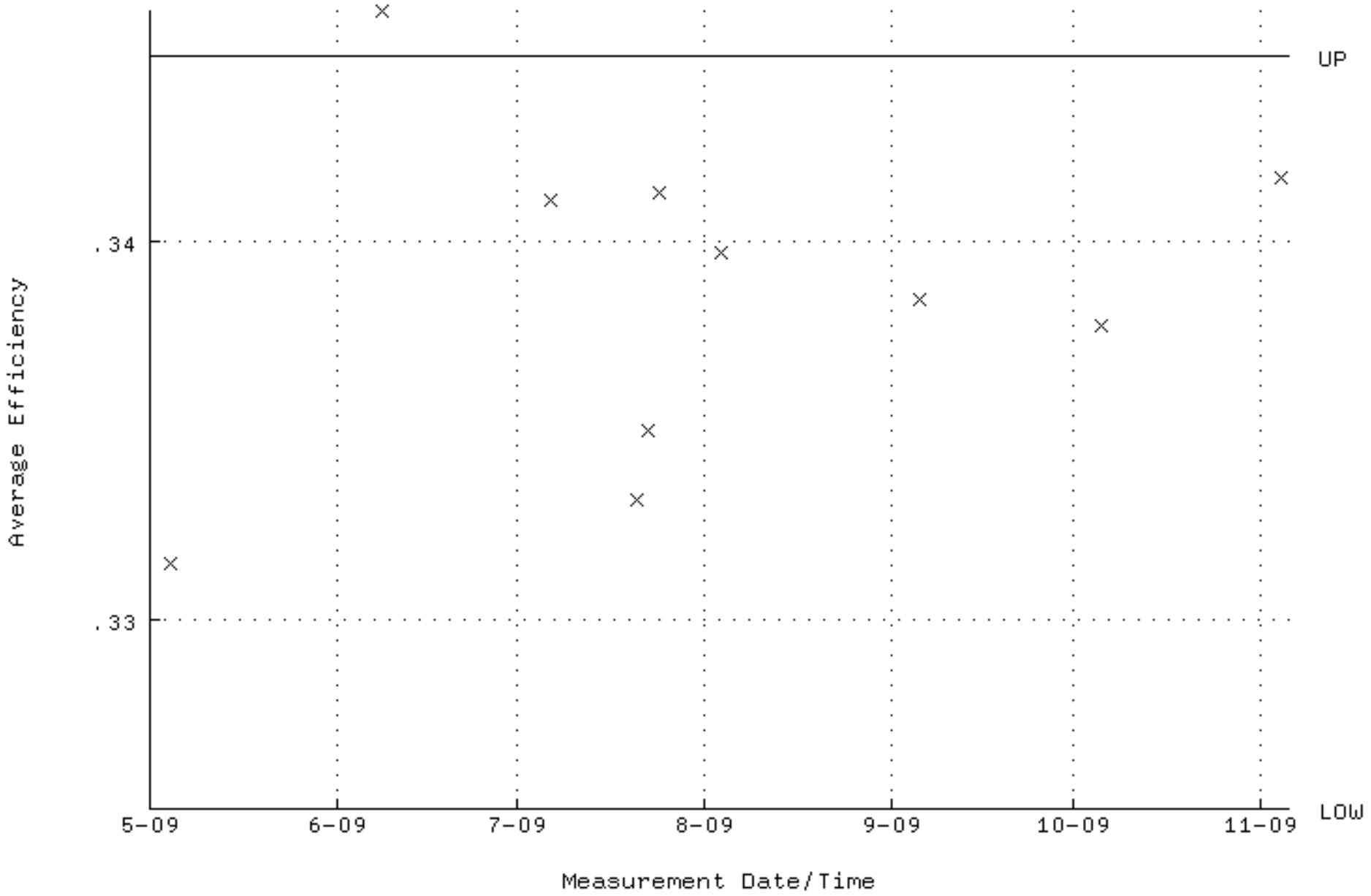
QA filename : DKA100:[ENV_ALPHA.QA.W]W026.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 85.8763 through 94.9159



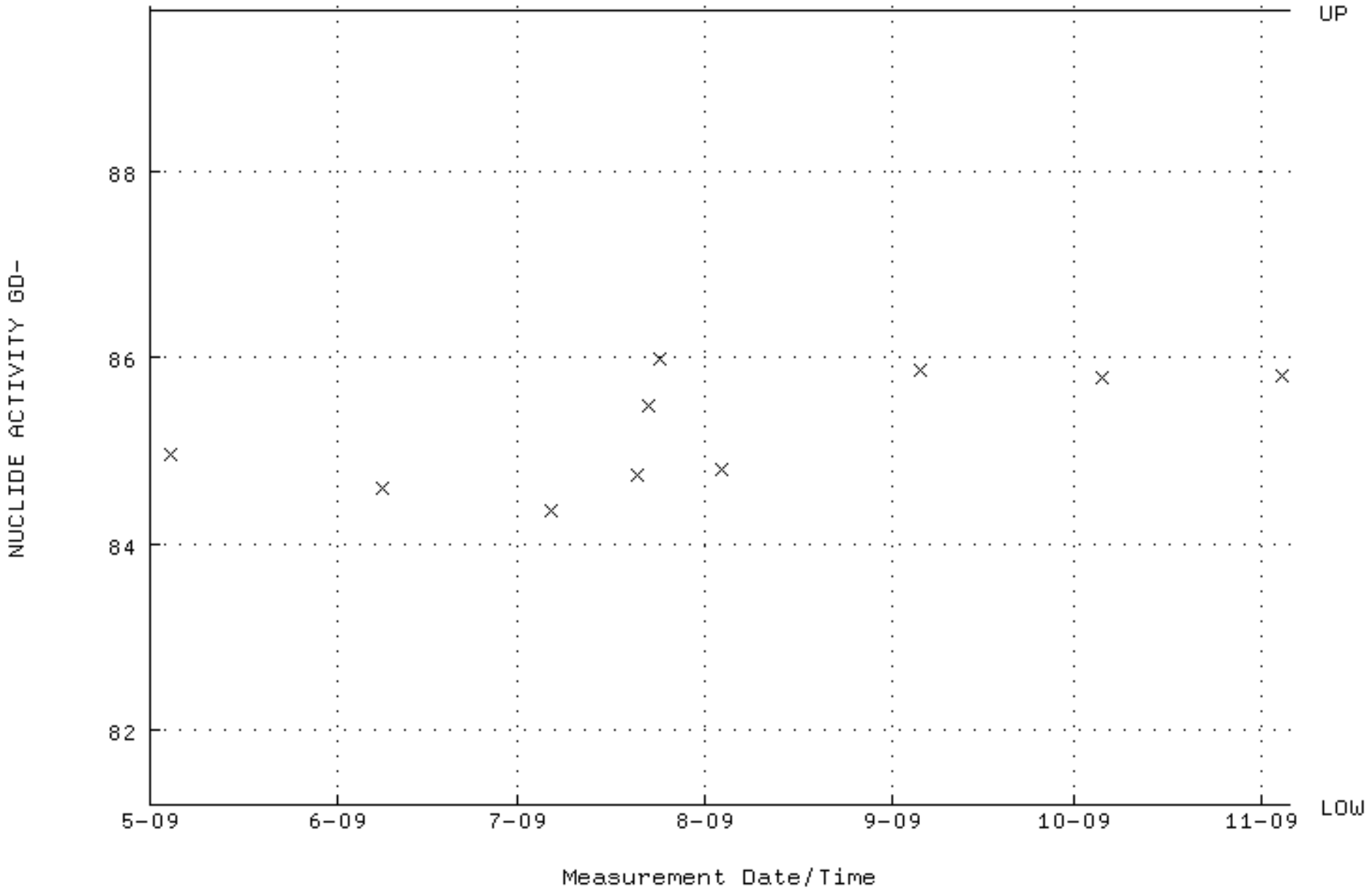
QA filename : DKA100:[ENV_ALPHA.QA.B]B026.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:51 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



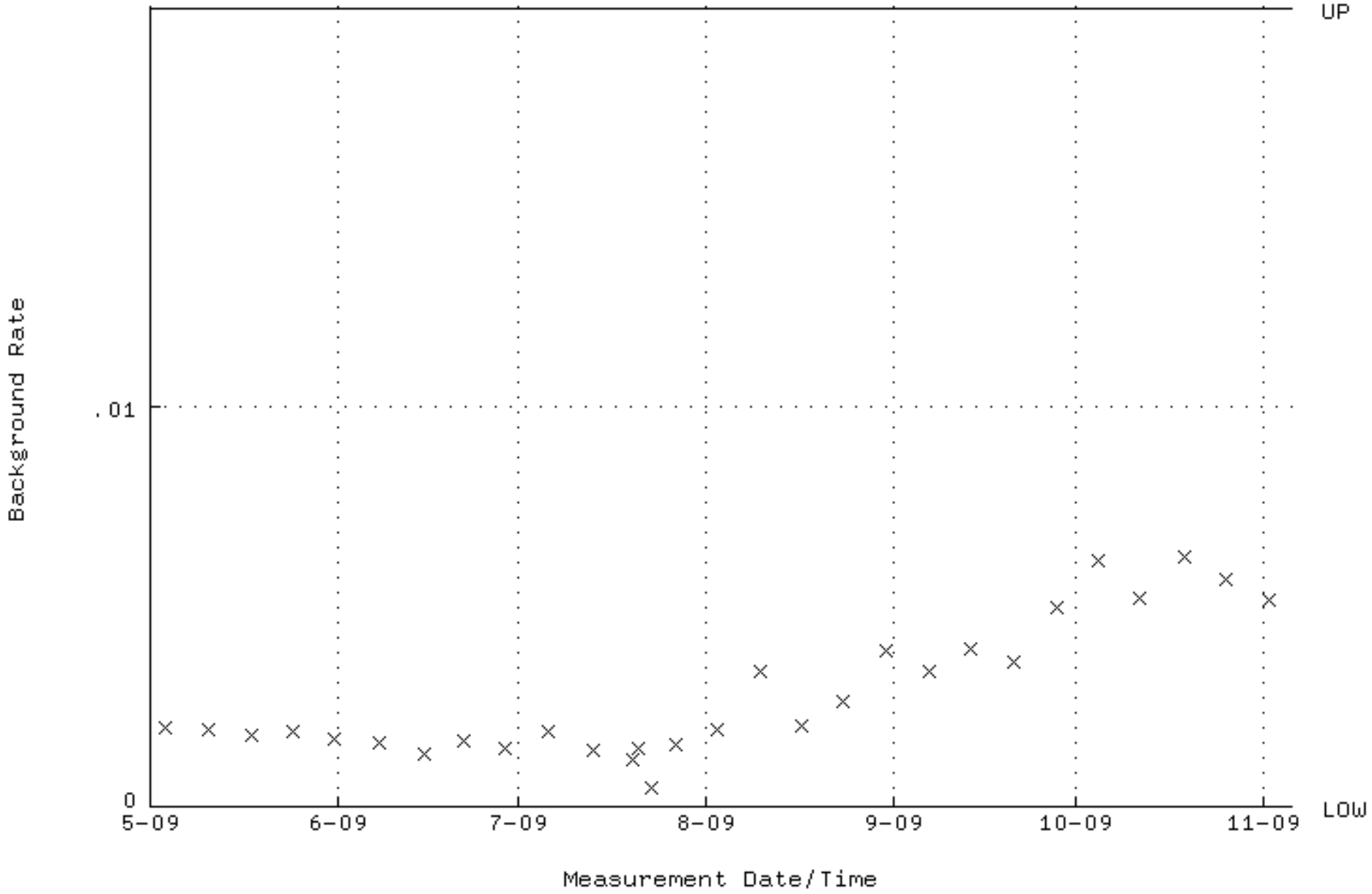
QA filename : DKA100:[ENV_ALPHA.QA.W]W027.QAF;4
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.324980 through 0.344980



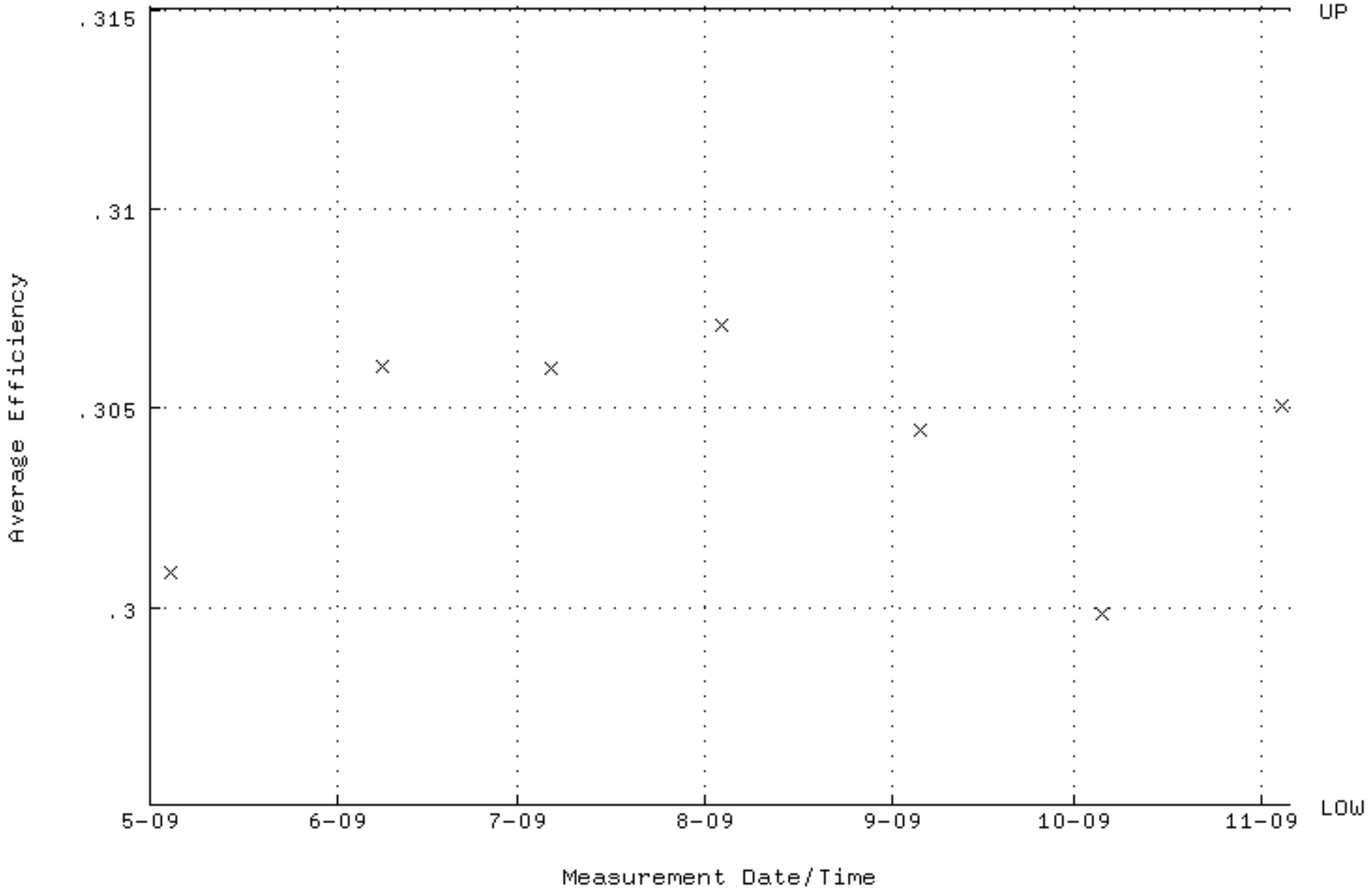
QA filename : DKA100:[ENV_ALPHA.QA.W]W027.QAF;4
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 81.2030 through 89.7506



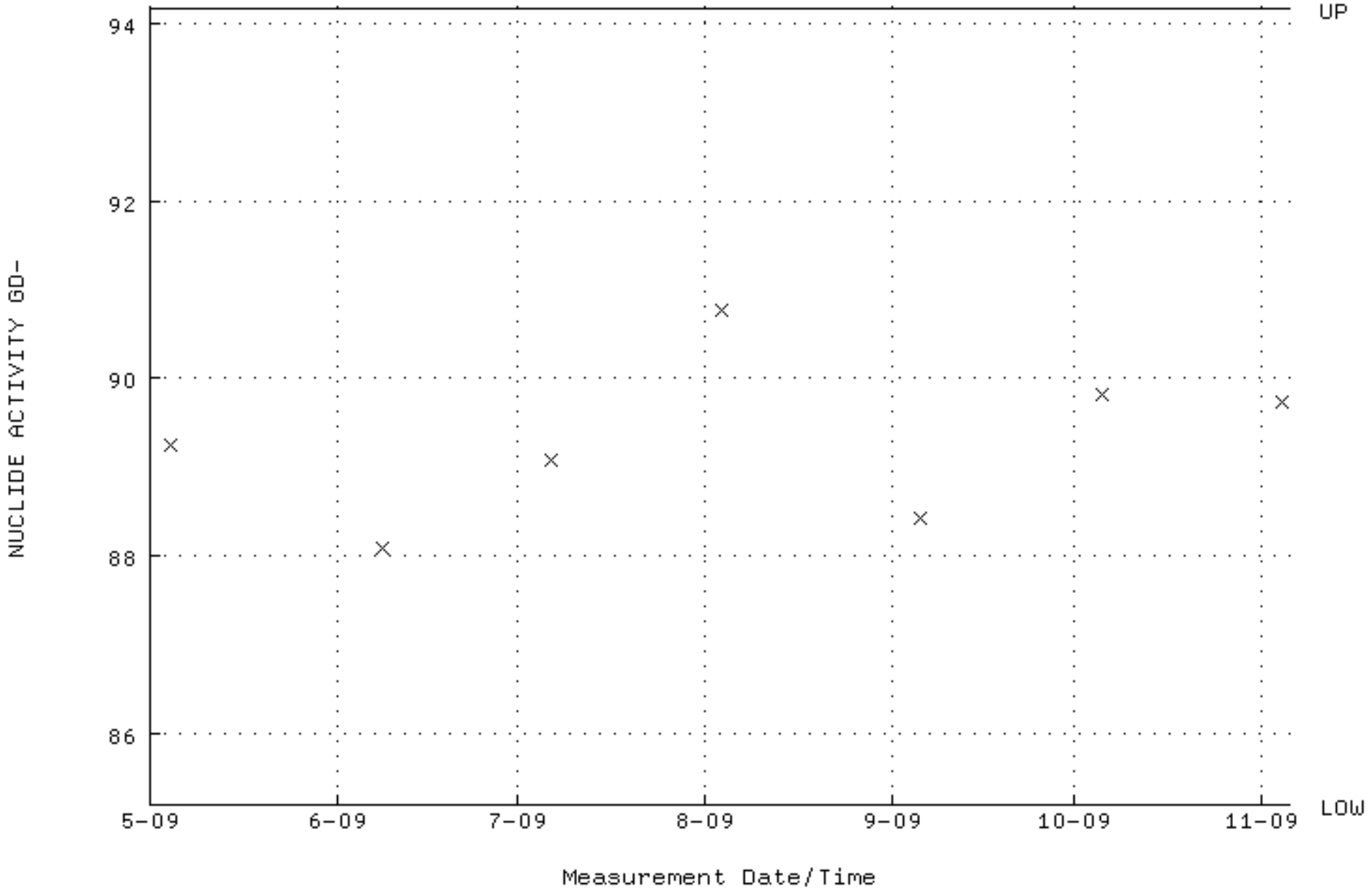
QA filename : DKA100:[ENV_ALPHA.QA.B]B027.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:51 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



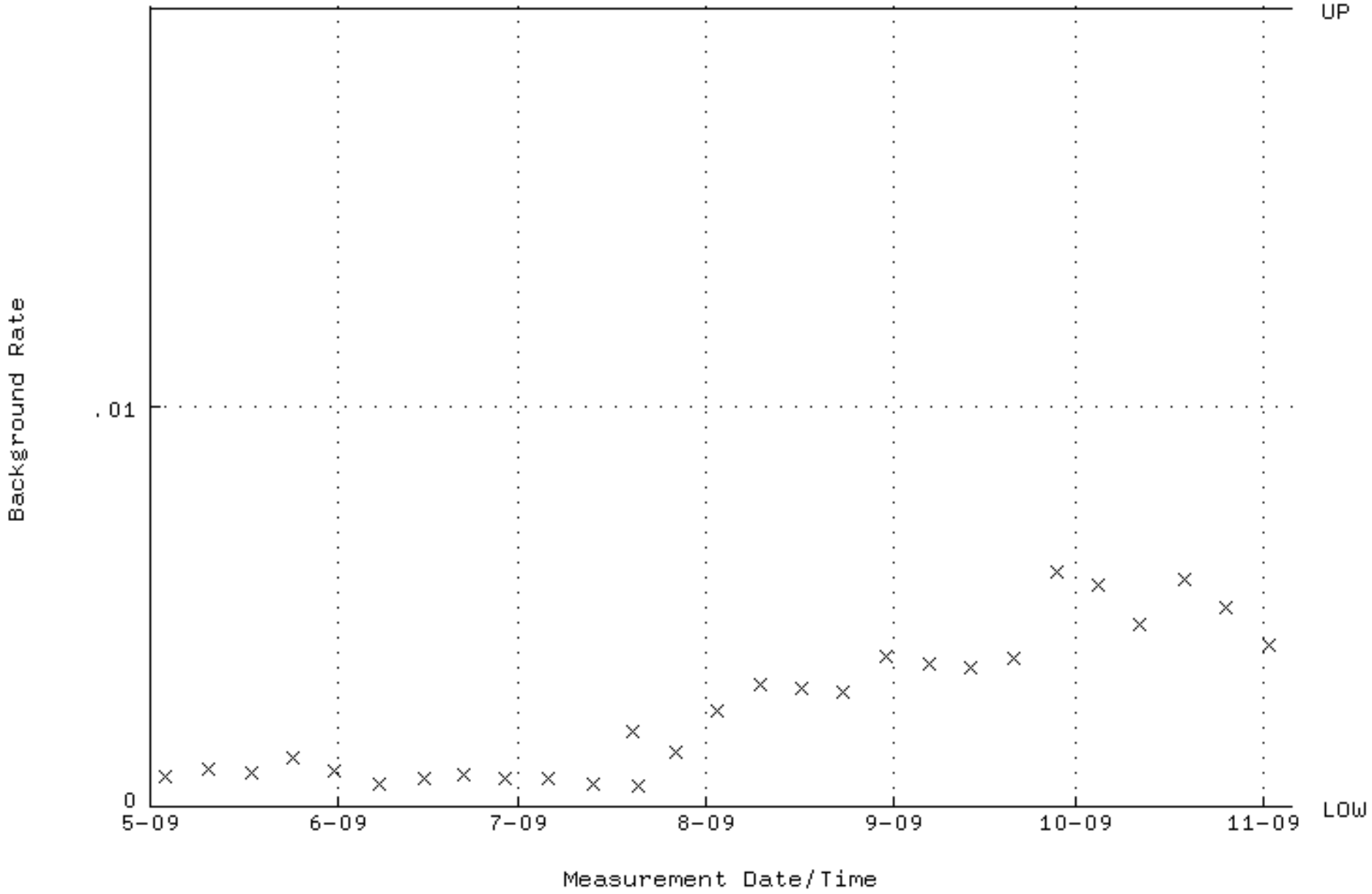
QA filename : DKA100:[ENV_ALPHA.QA.W]W028.QAF;4
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.295040 through 0.315040



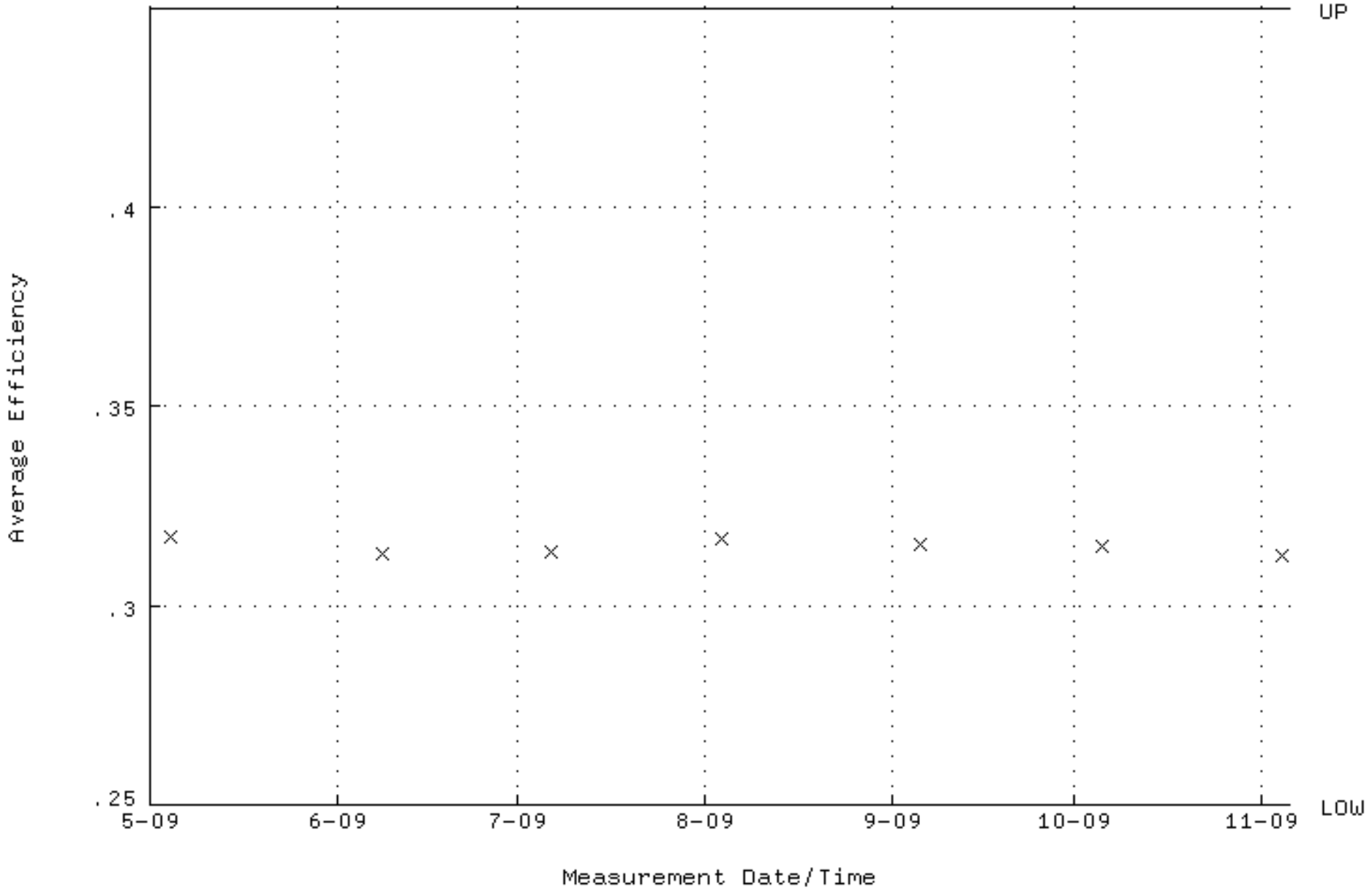
QA filename : DKA100:[ENV_ALPHA.QA.W]W028.QAF;4
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 85.1965 through 94.1645



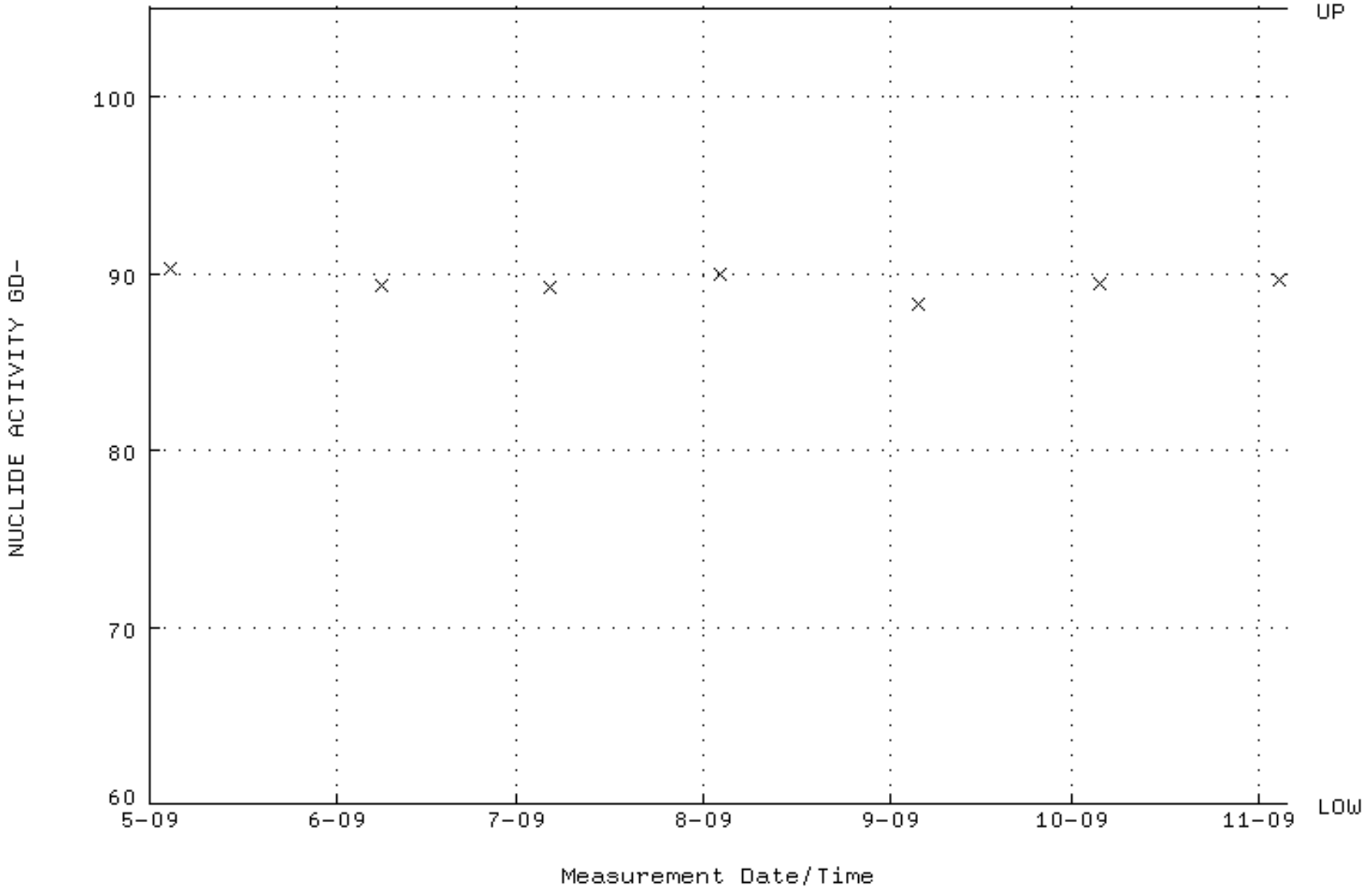
QA filename : DKA100:[ENV_ALPHA.QA.B]B028.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:51 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



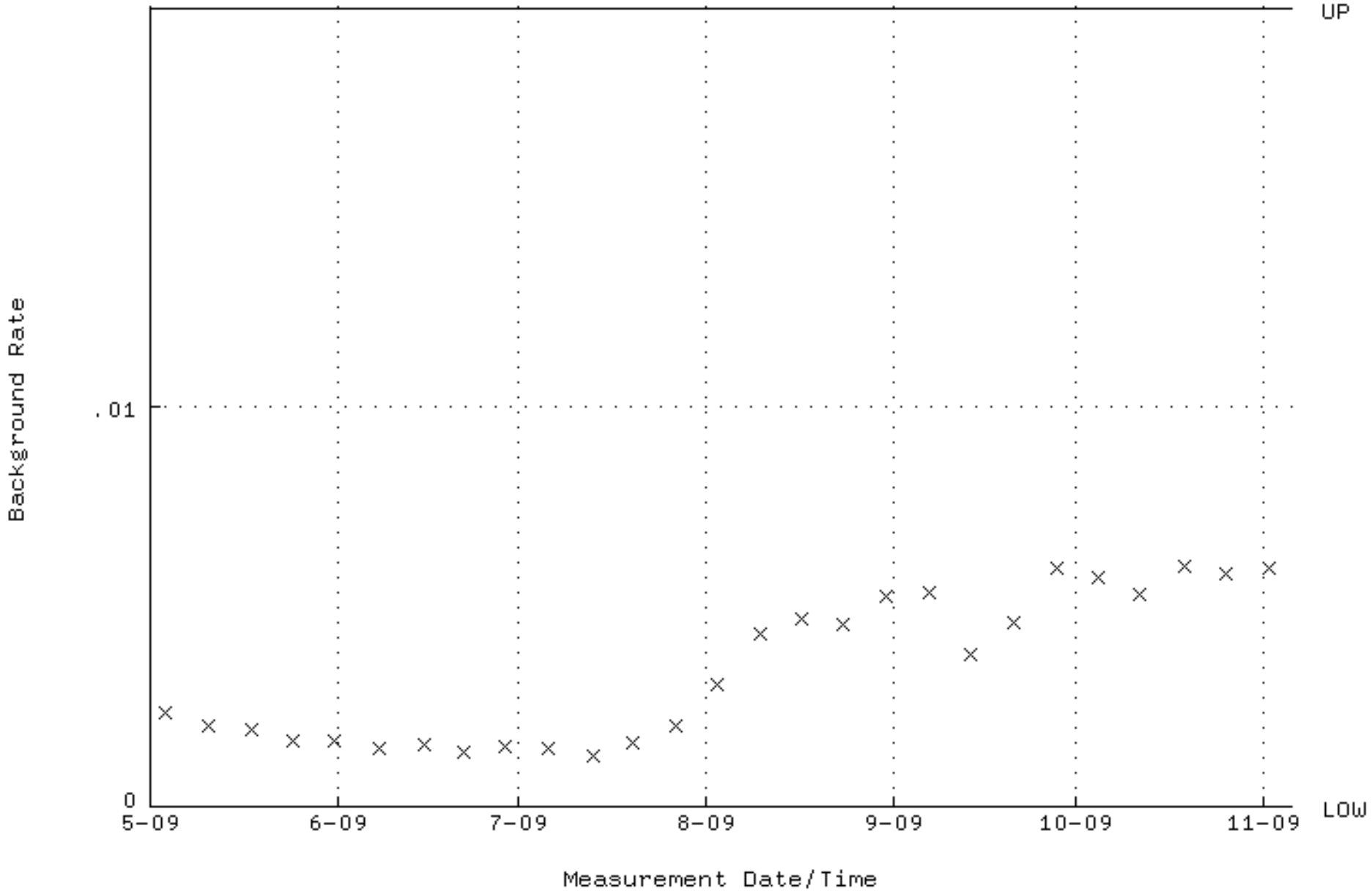
QA filename : DKA100:[ENV_ALPHA.QA.W]W029.QAF;6
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.250000 through 0.450000



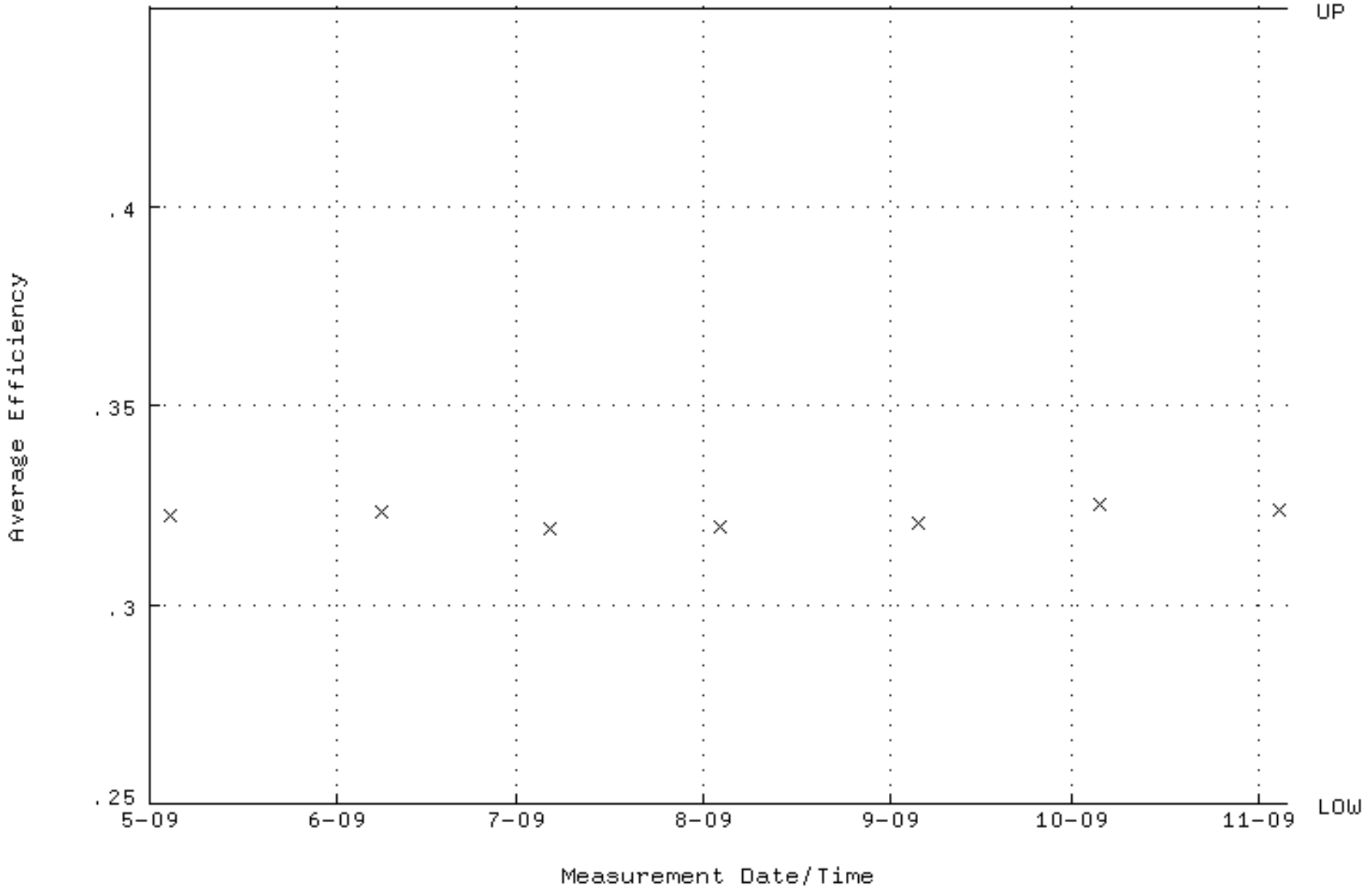
QA filename : DKA100:[ENV_ALPHA.QA.W]W029.QAF;6
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 60.0000 through 105.000



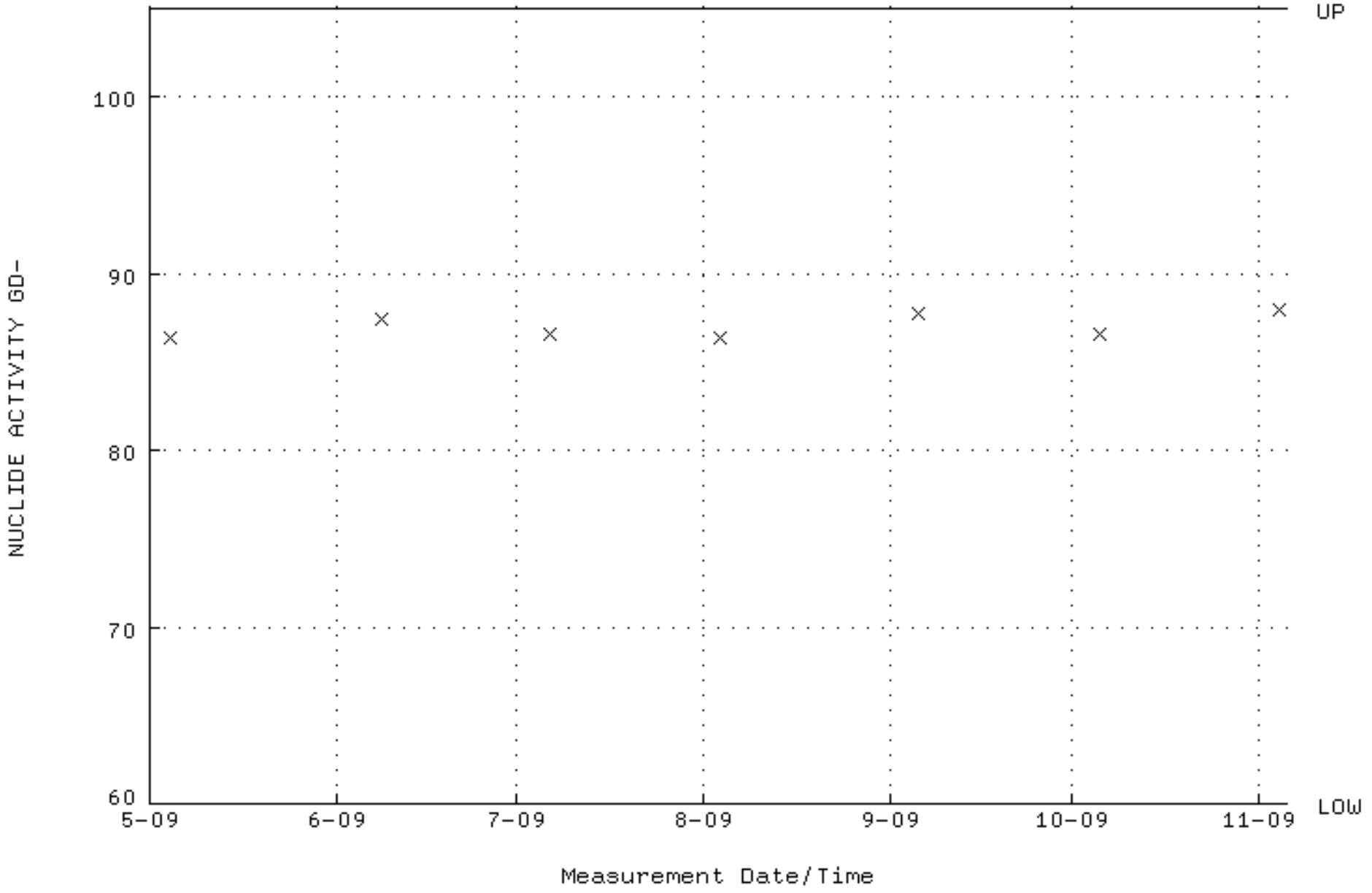
QA filename : DKA100:[ENV_ALPHA.QA.B]B029.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:51 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



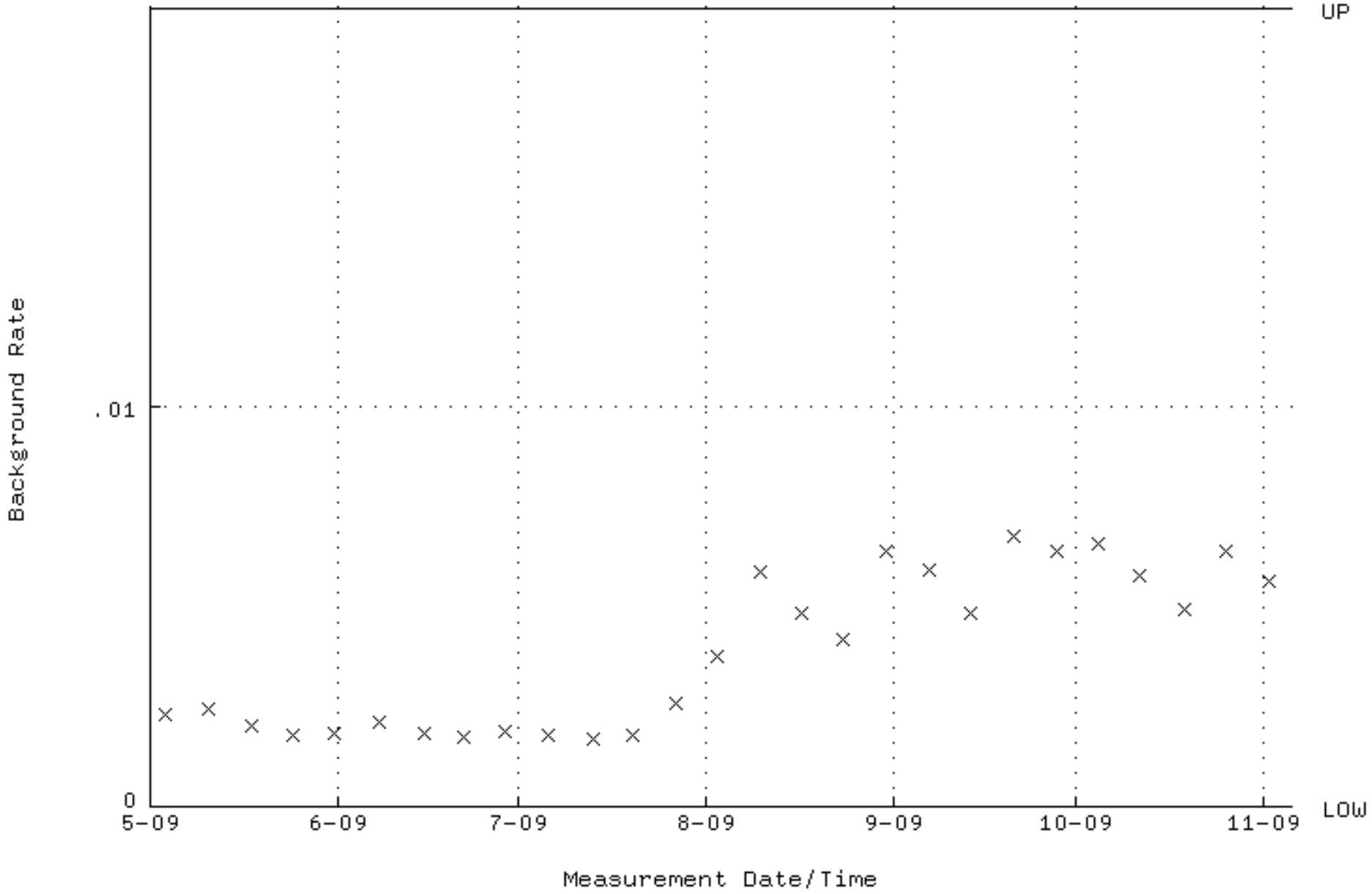
QA filename : DKA100:[ENV_ALPHA.QA.W]W030.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.250000 through 0.450000



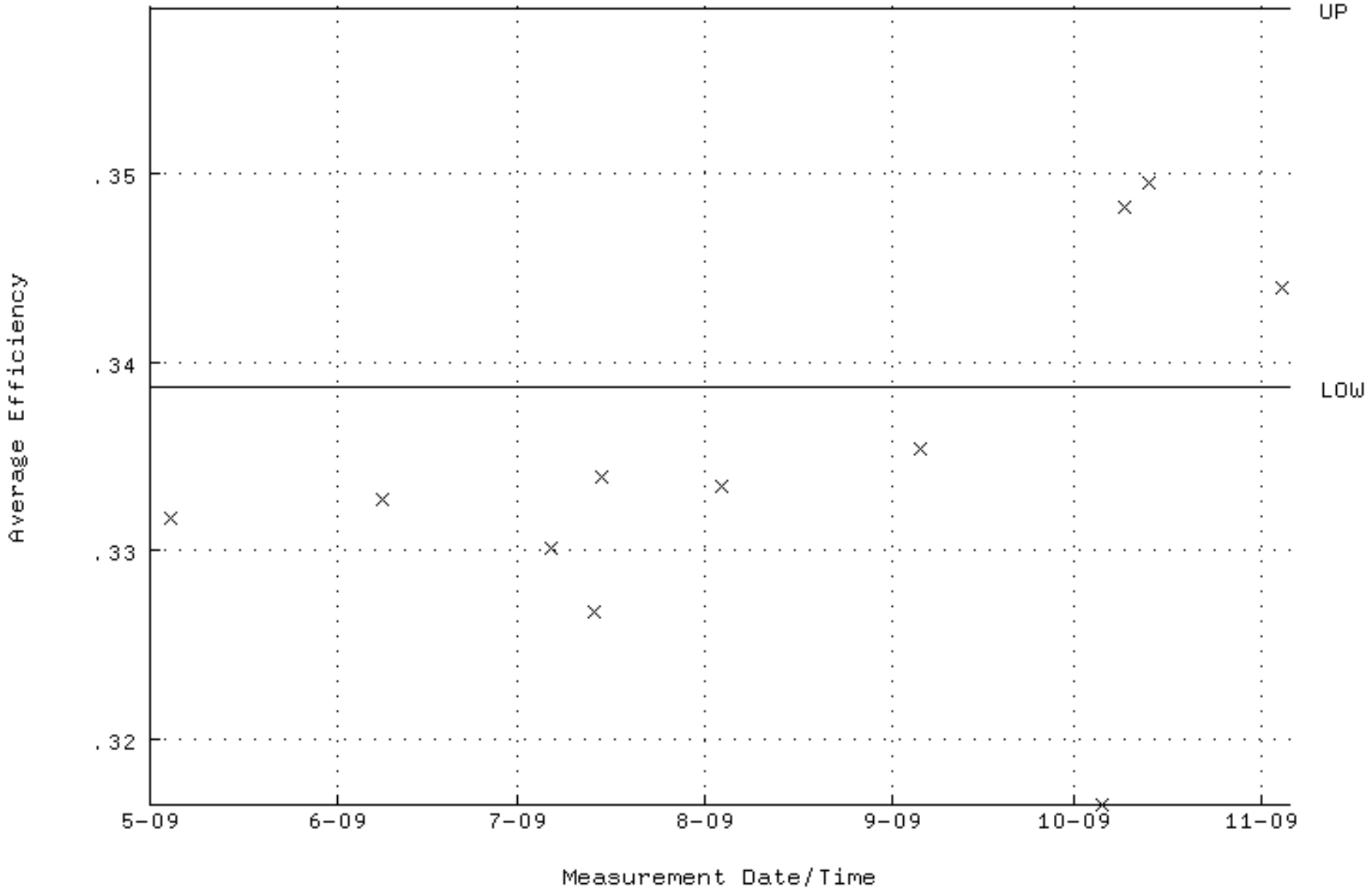
QA filename : DKA100:[ENV_ALPHA.QA.W]W030.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:08 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 60.0000 through 105.000



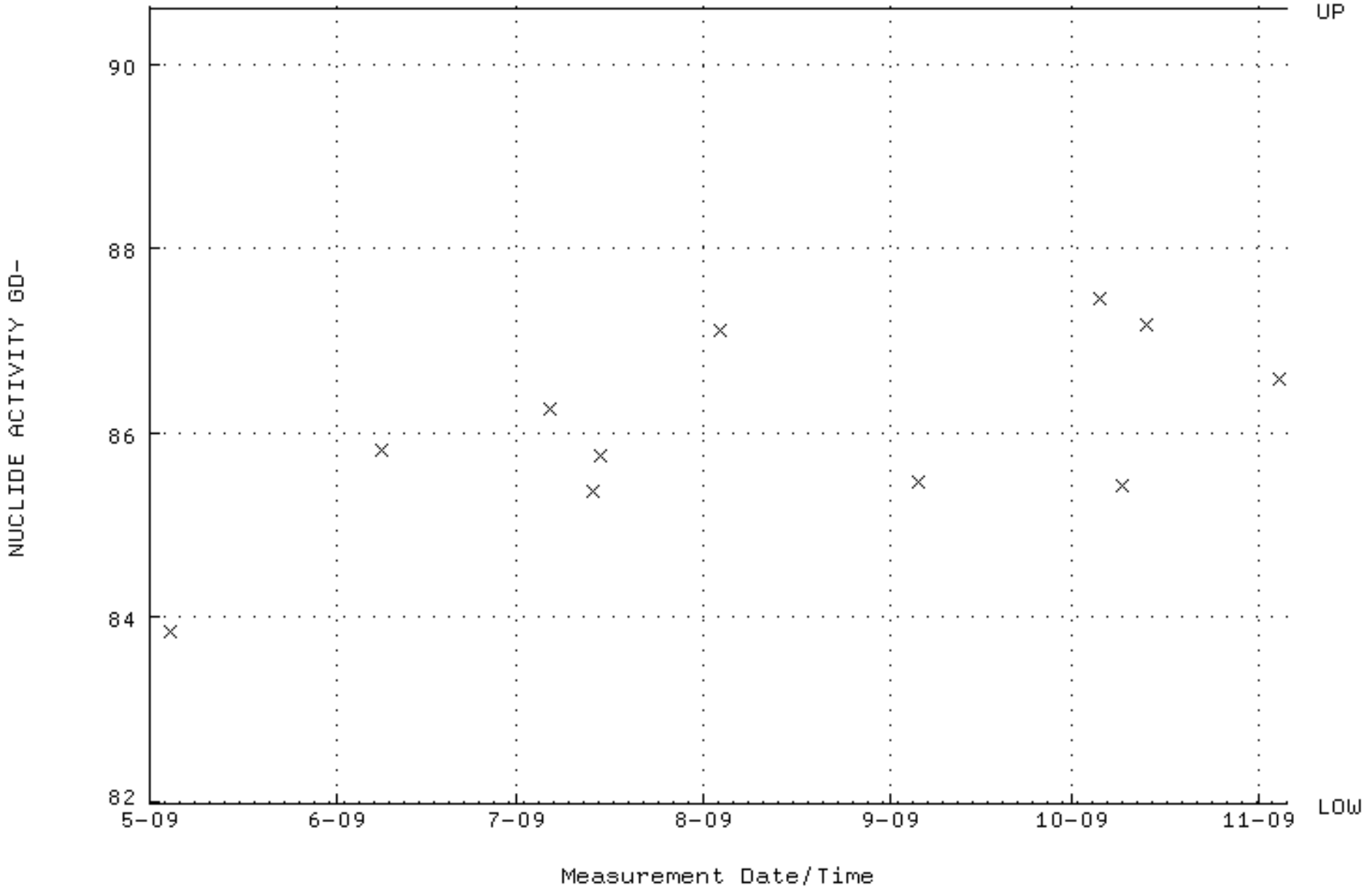
QA filename : DKA100:[ENV_ALPHA.QA.B]B030.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:51 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



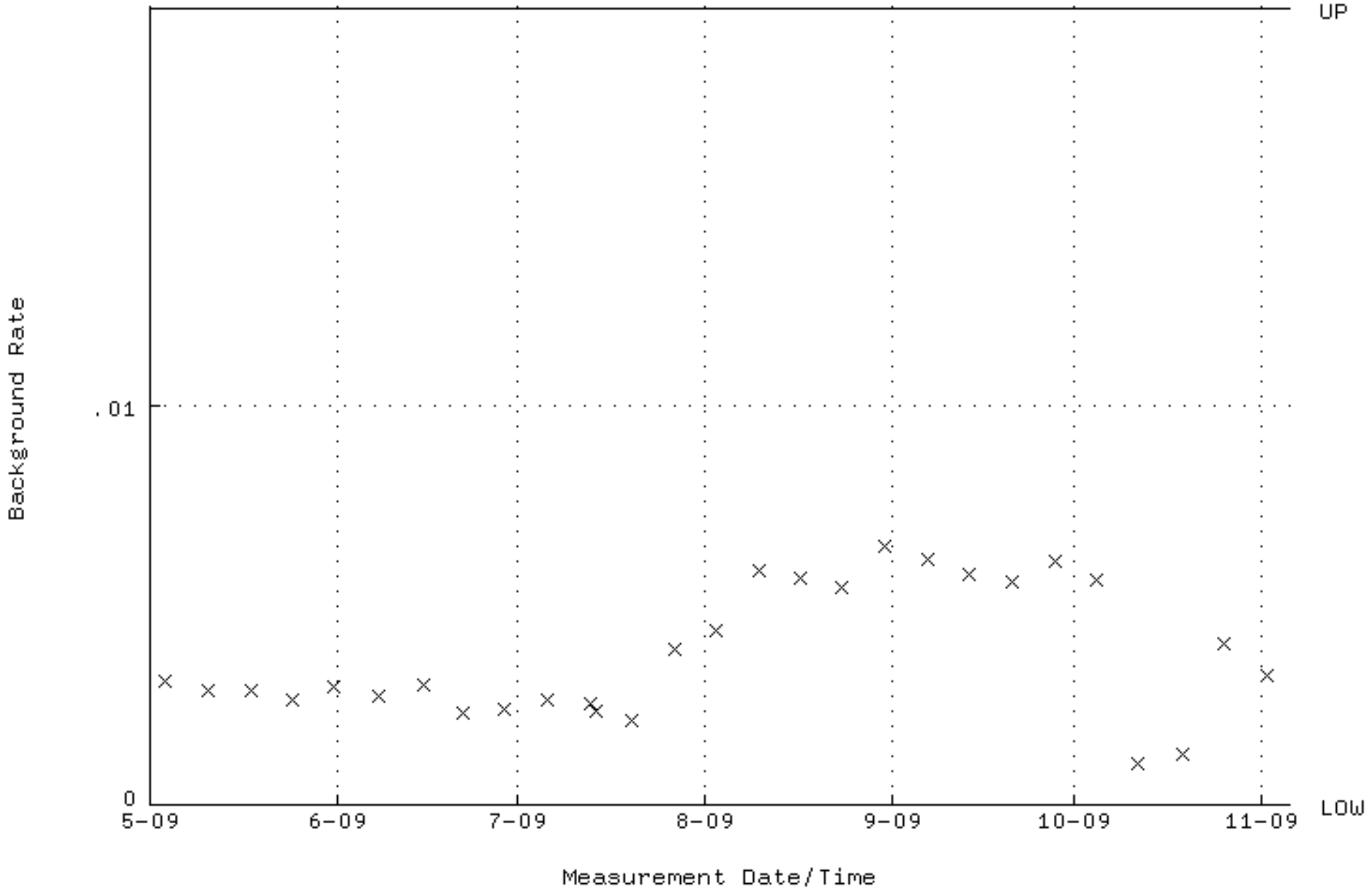
QA filename : DKA100:[ENV_ALPHA.QA.W]W031.QAF;4
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.338790 through 0.358790



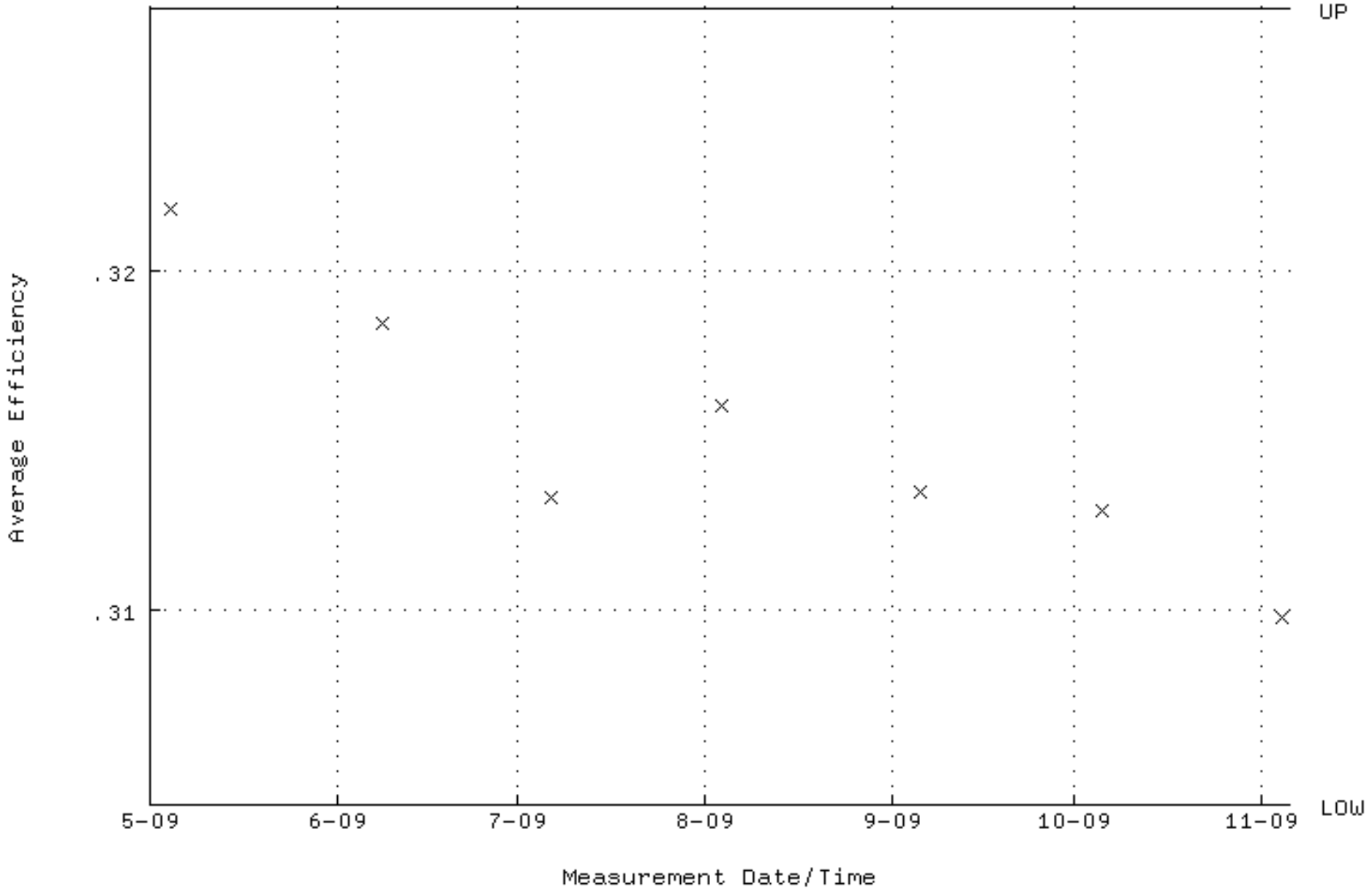
QA filename : DKA100:[ENV_ALPHA.QA.W]W031.QAF;4
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 81.9728 through 90.6016



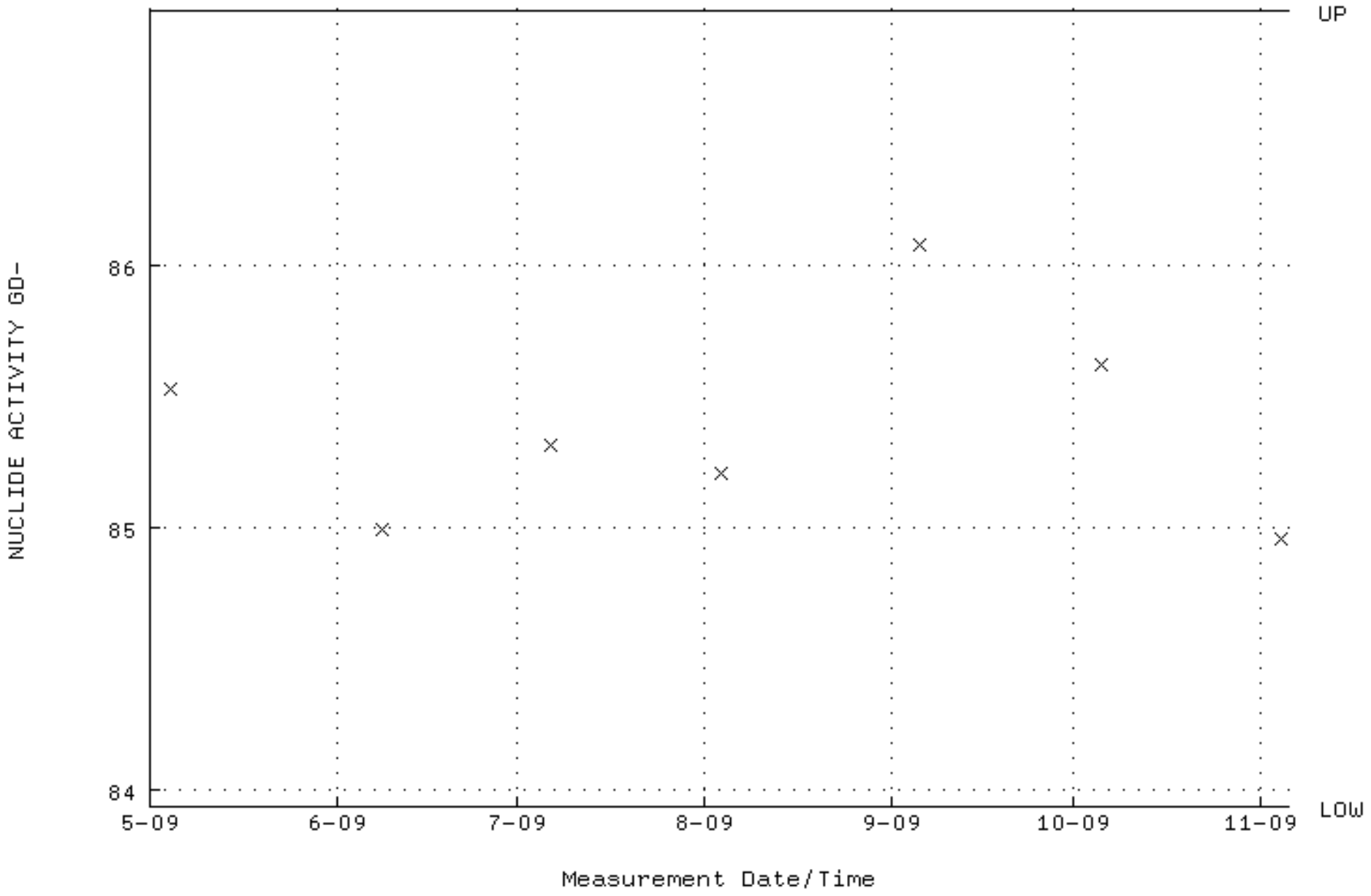
QA filename : DKA100:[ENV_ALPHA.QA.B]B031.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:52 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



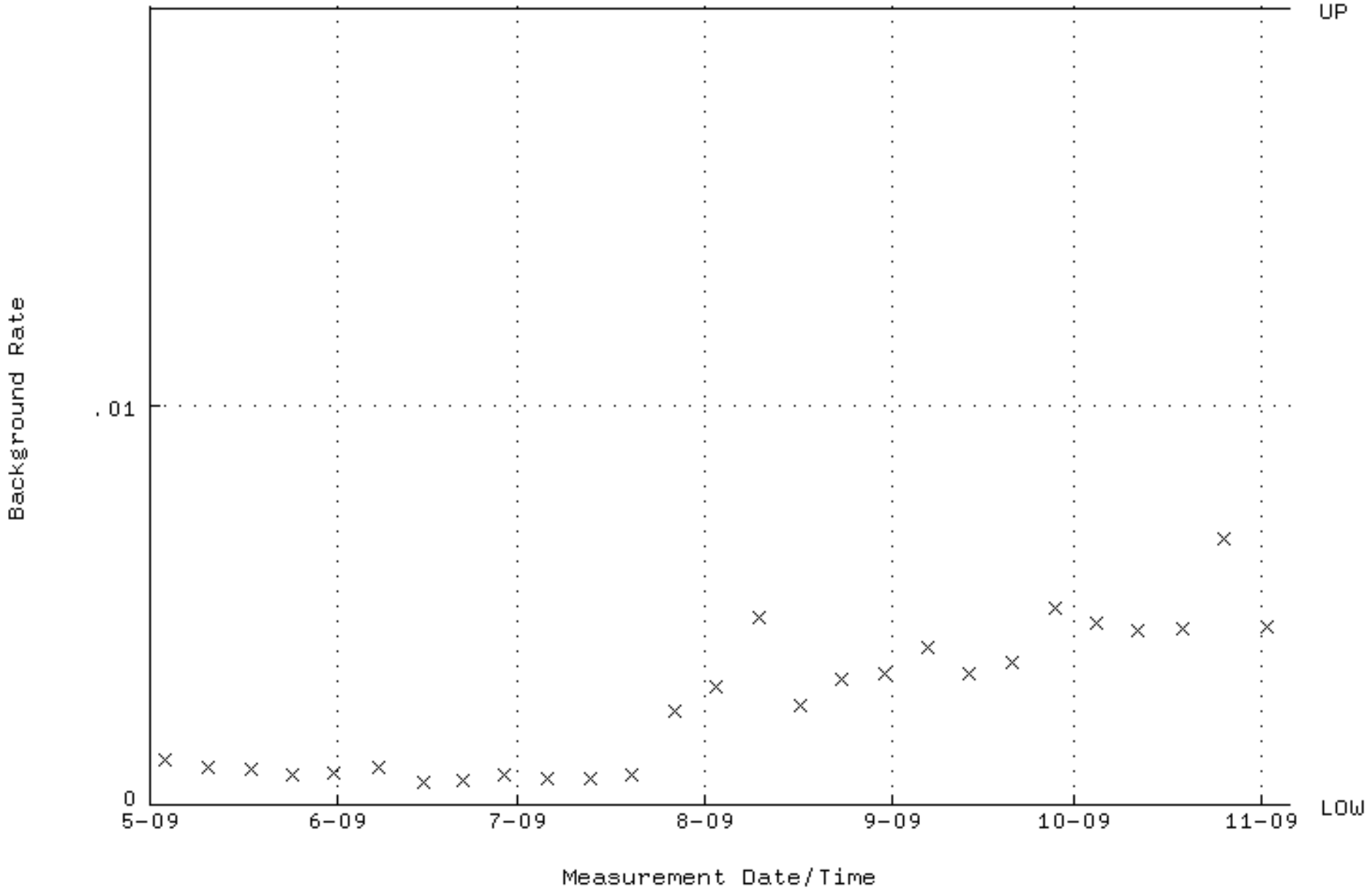
QA filename : DKA100:[ENV_ALPHA.QA.W]W033.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.304222 through 0.327748



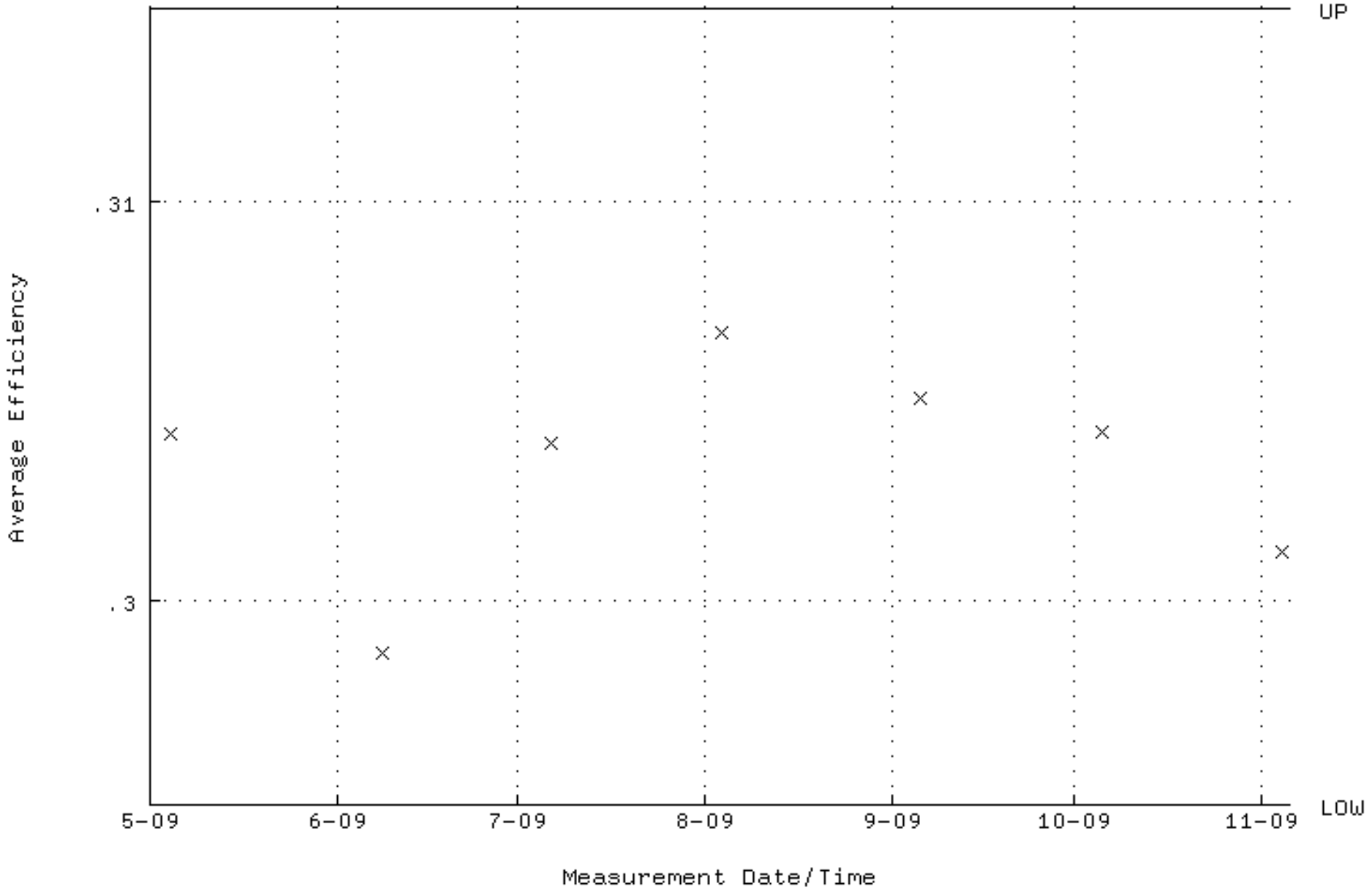
QA filename : DKA100:[ENV_ALPHA.QA.W]W033.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 83.9373 through 86.9661



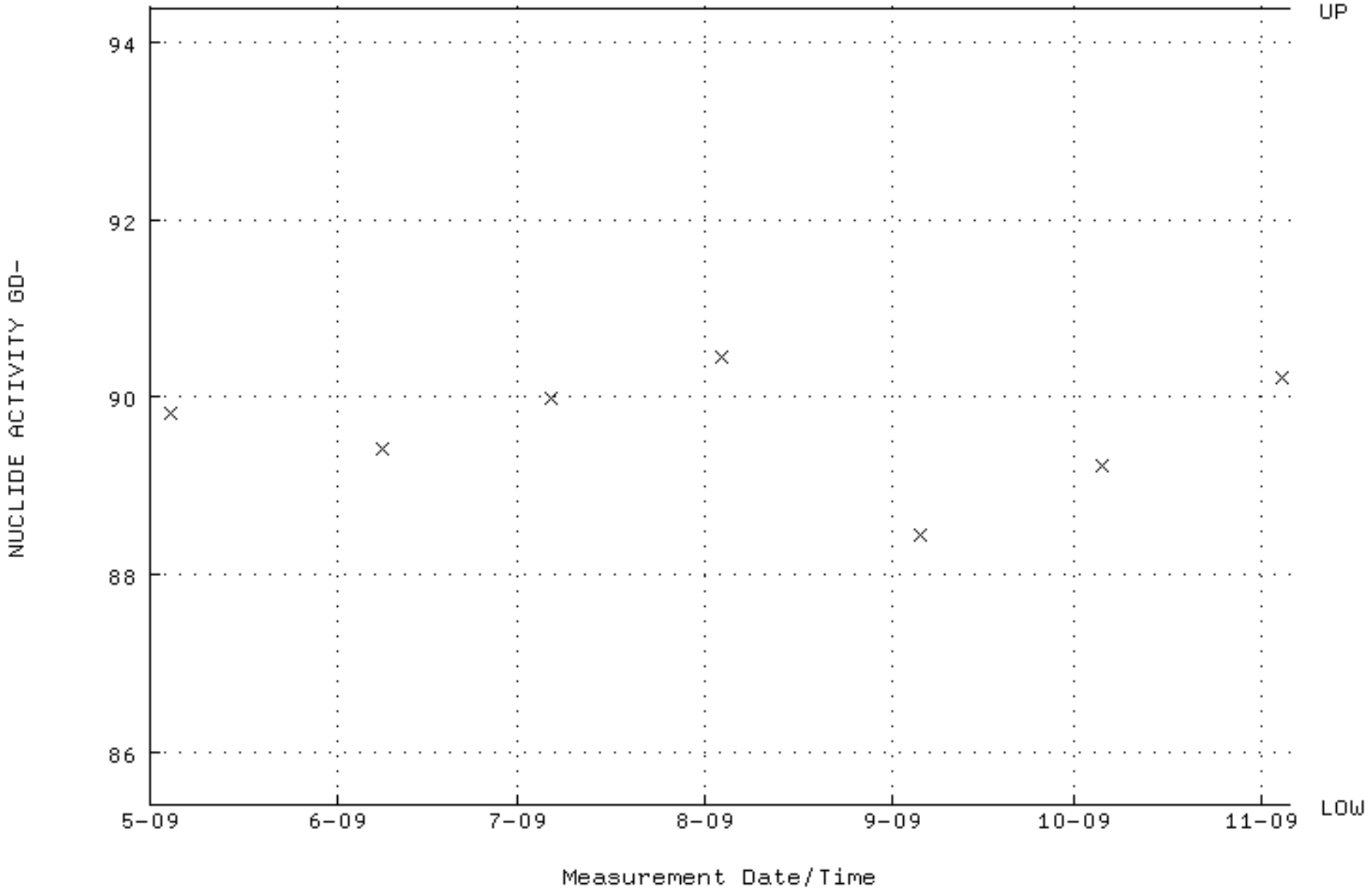
QA filename : DKA100:[ENV_ALPHA.QA.B]B033.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:52 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



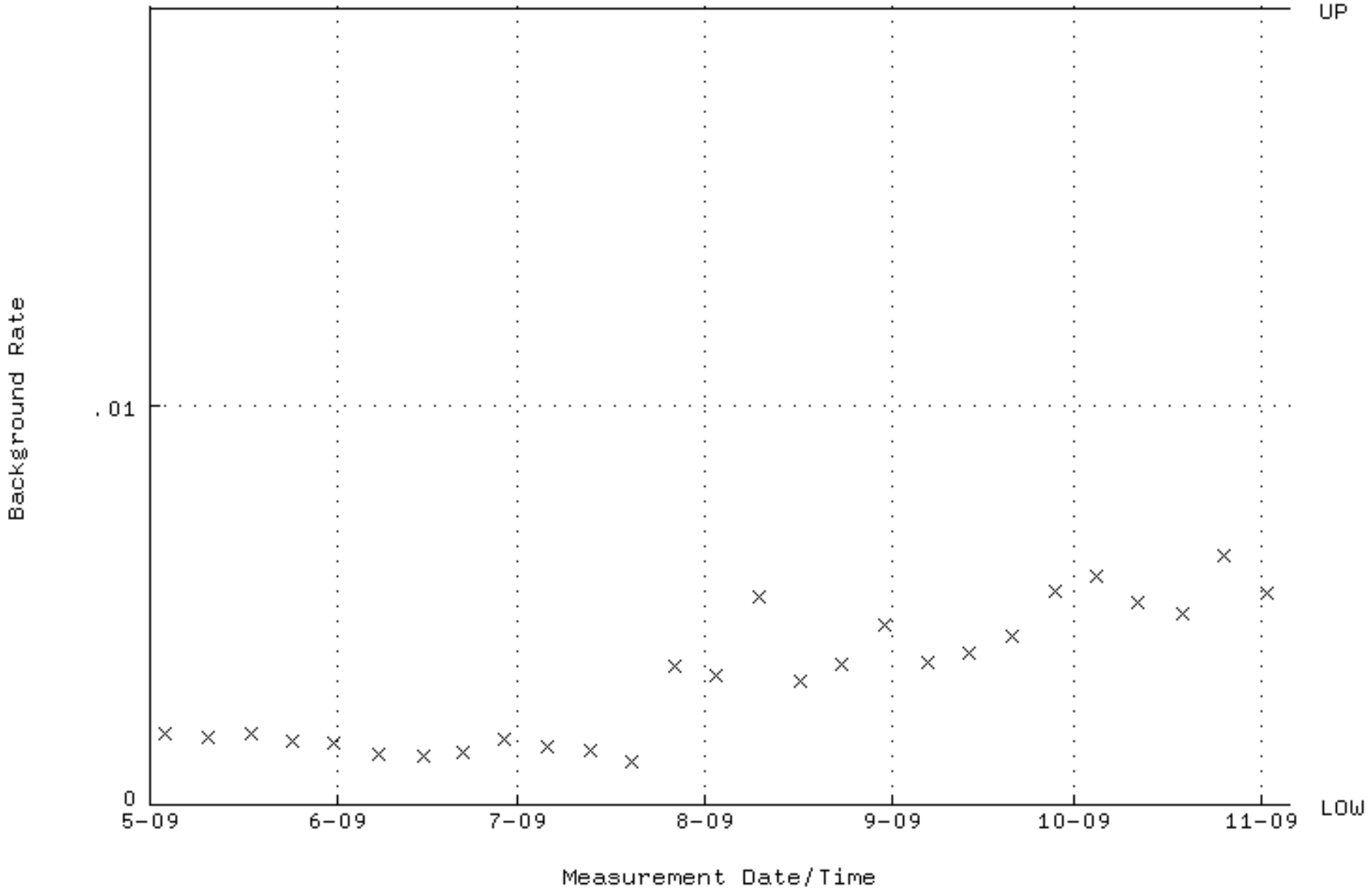
QA filename : DKA100:[ENV_ALPHA.QA.W]W035.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.294859 through 0.314859



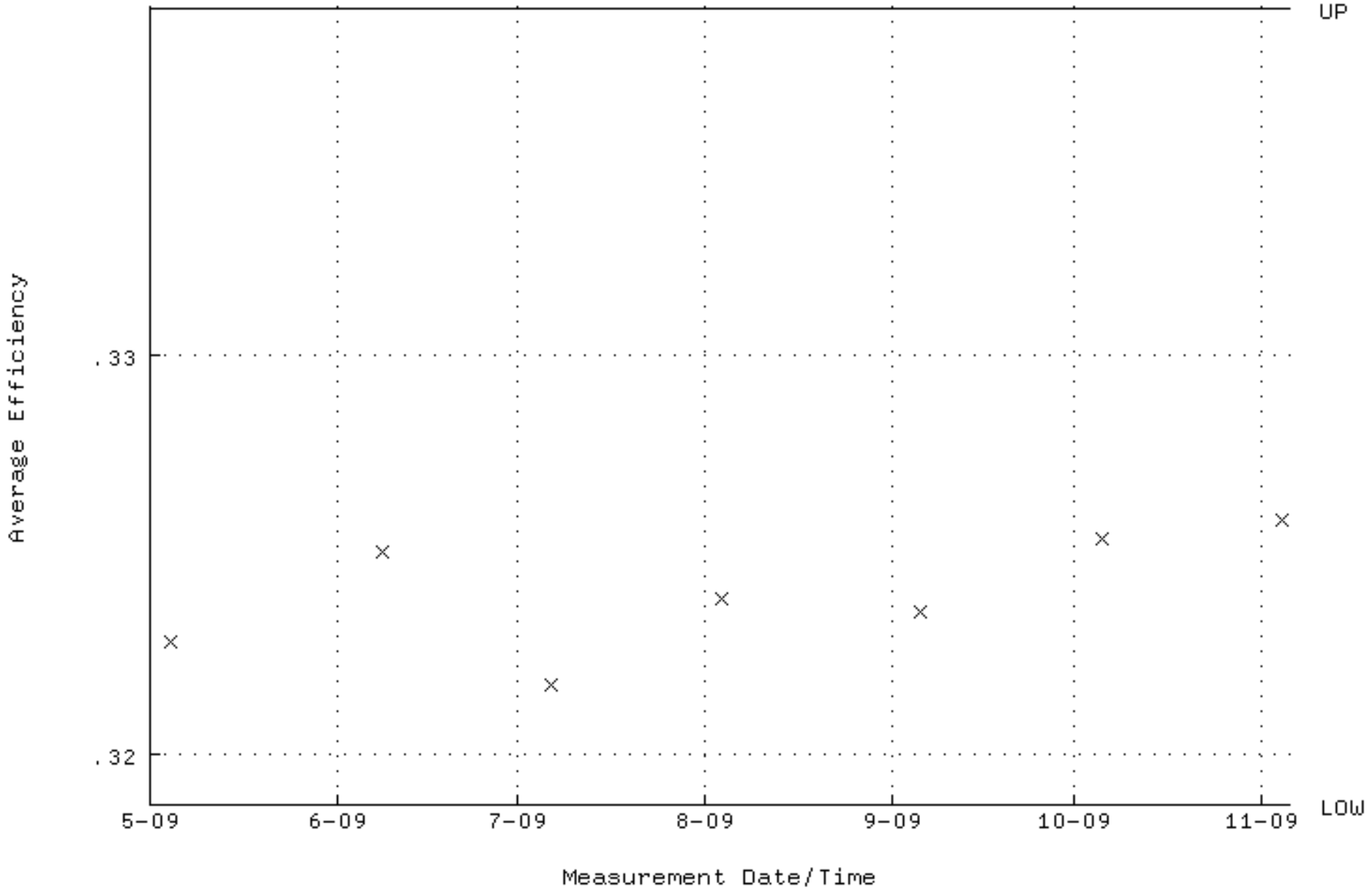
QA filename : DKA100:[ENV_ALPHA.QA.W]W035.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 85.3984 through 94.3878



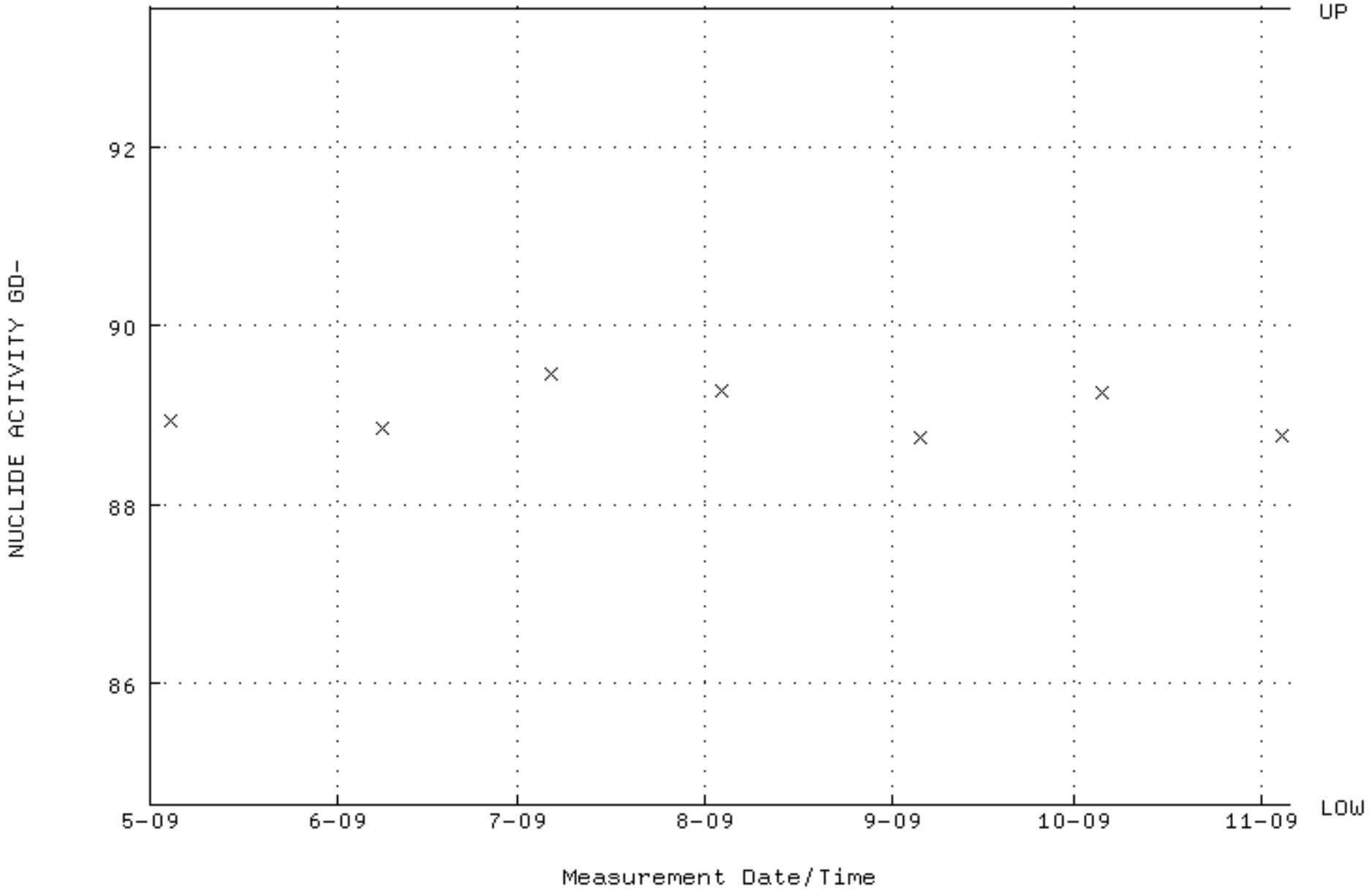
QA filename : DKA100:[ENV_ALPHA.QA.B]B035.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:52 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



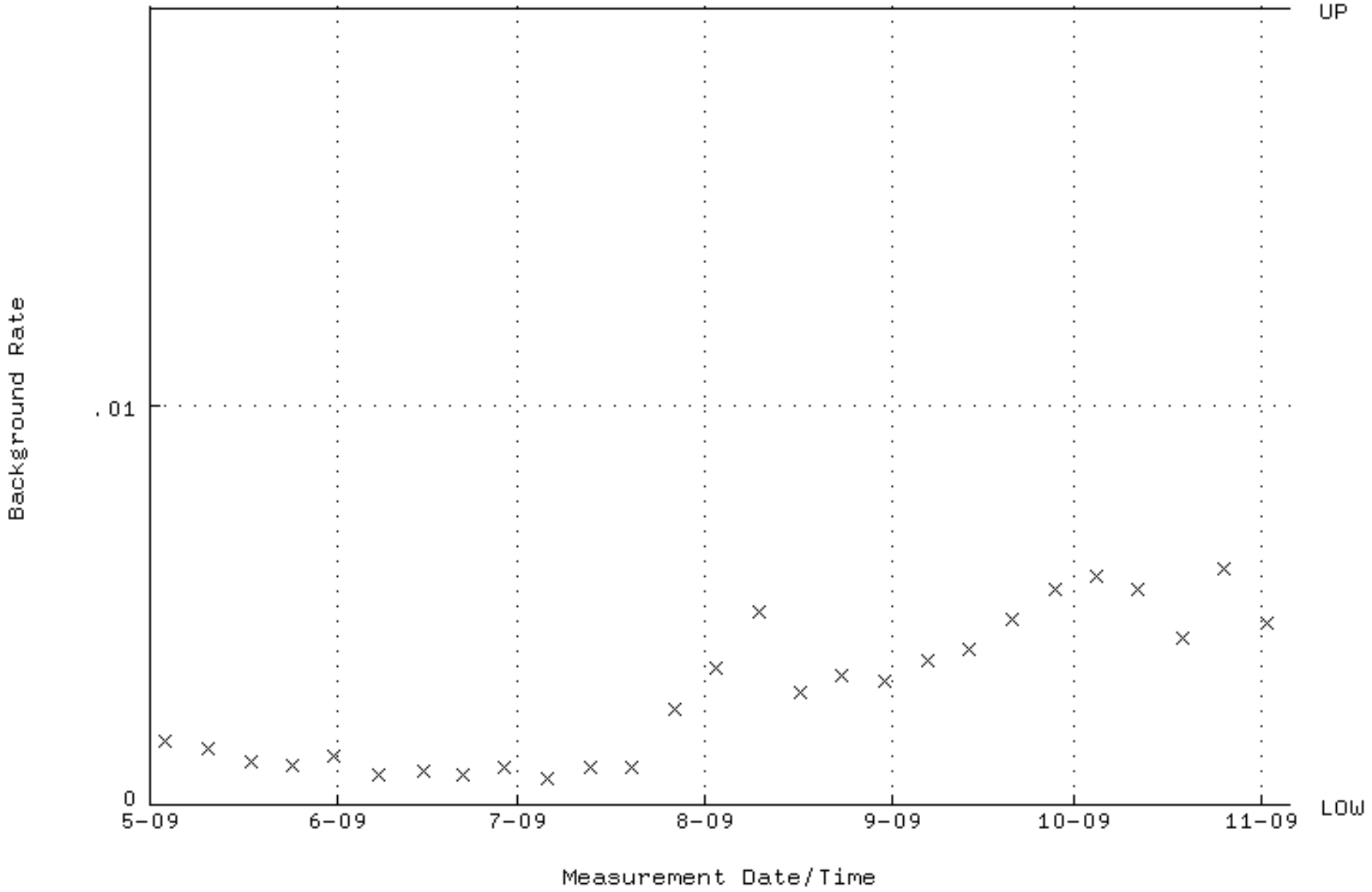
QA filename : DKA100:[ENV_ALPHA.QA.W]W036.QAF;2
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.318717 through 0.338717



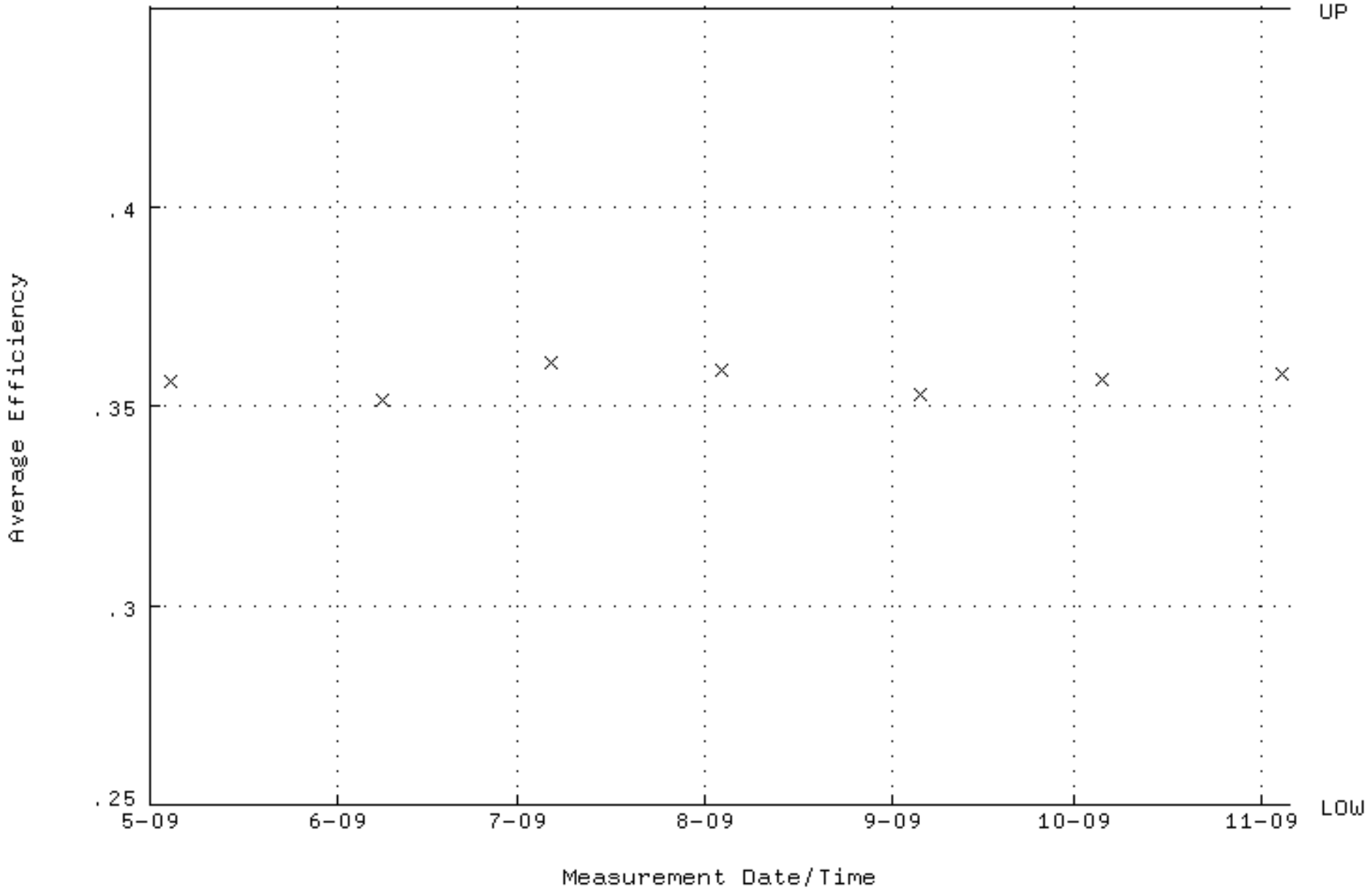
QA filename : DKA100:[ENV_ALPHA.QA.W]W036.QAF;2
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:09 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 84.6422 through 93.5518



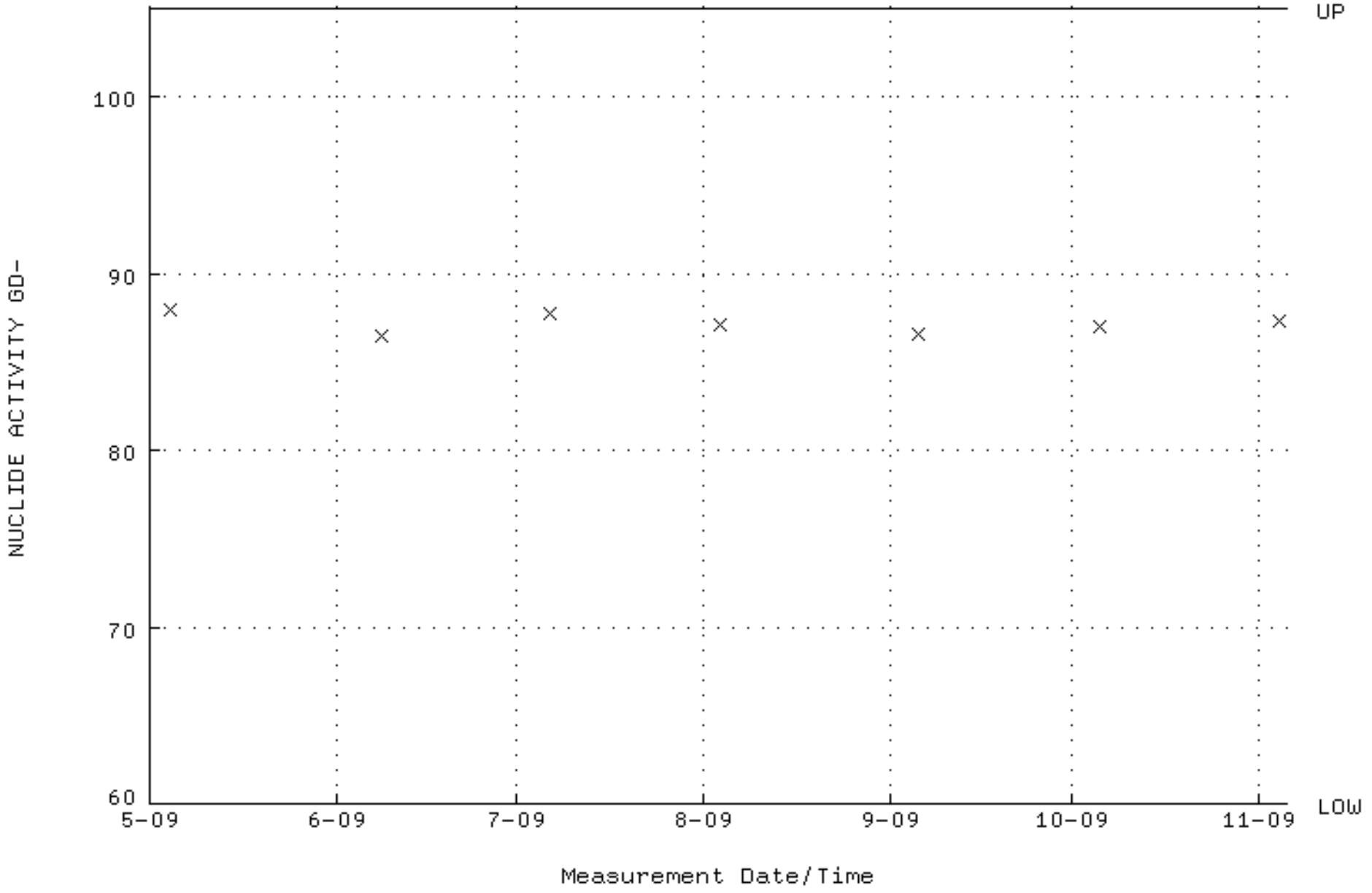
QA filename : DKA100:[ENV_ALPHA.QA.B]B036.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:52 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



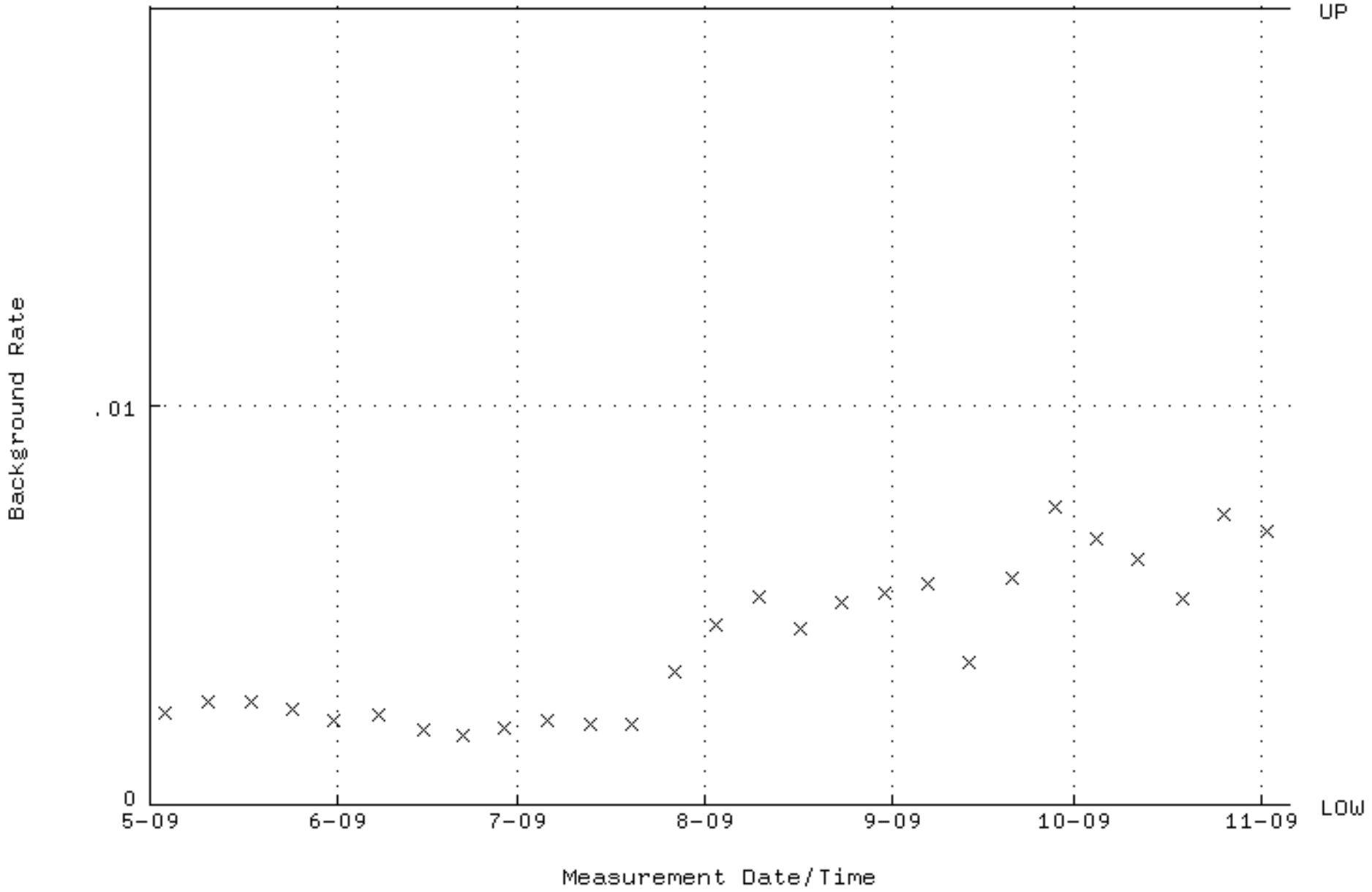
QA filename : DKA100:[ENV_ALPHA.QA.W]W037.QAF;4
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.250000 through 0.450000



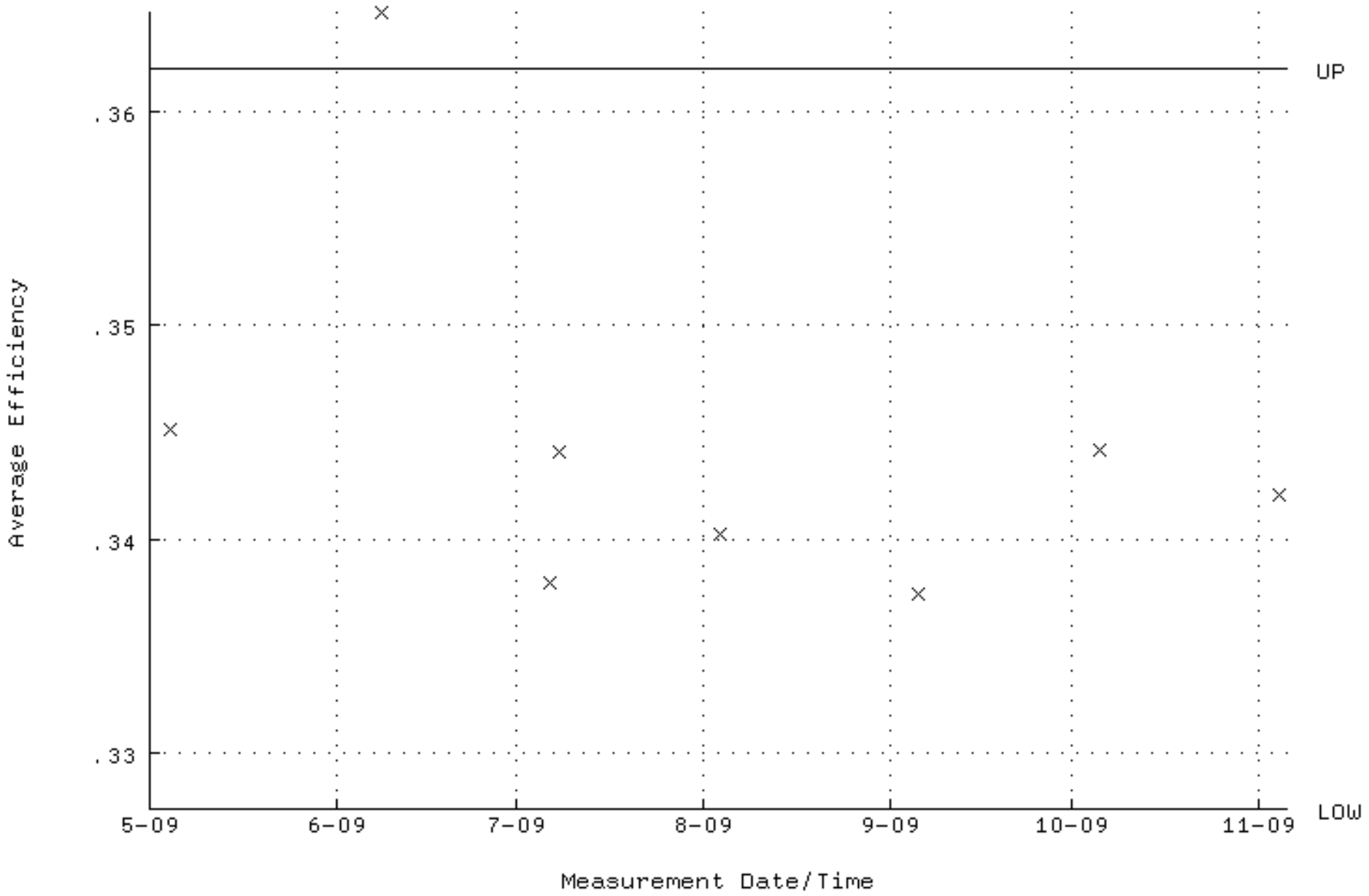
QA filename : DKA100:[ENV_ALPHA.QA.W]W037.QAF;4
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 60.0000 through 105.000



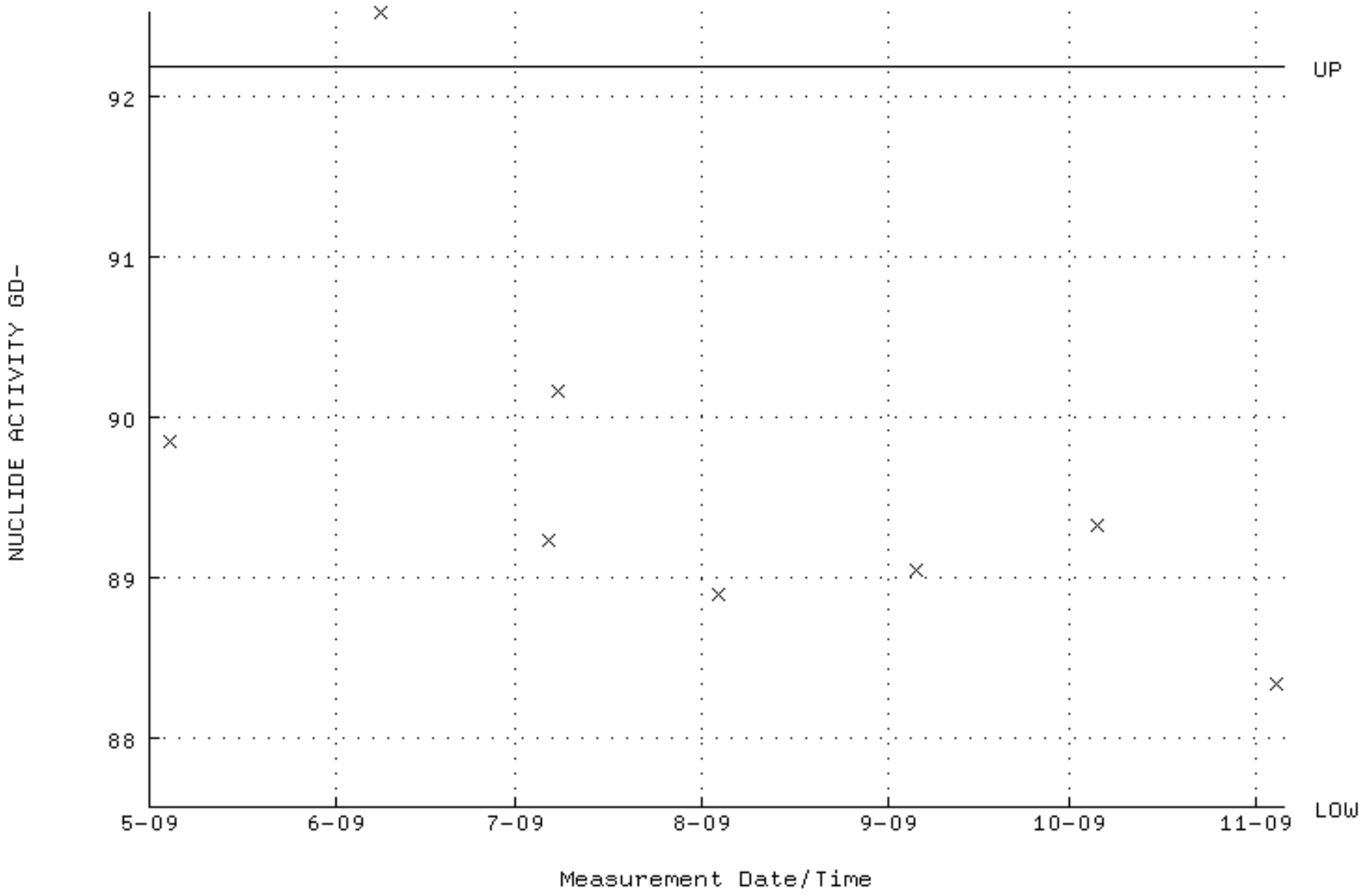
QA filename : DKA100:[ENV_ALPHA.QA.B]B037.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:53 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



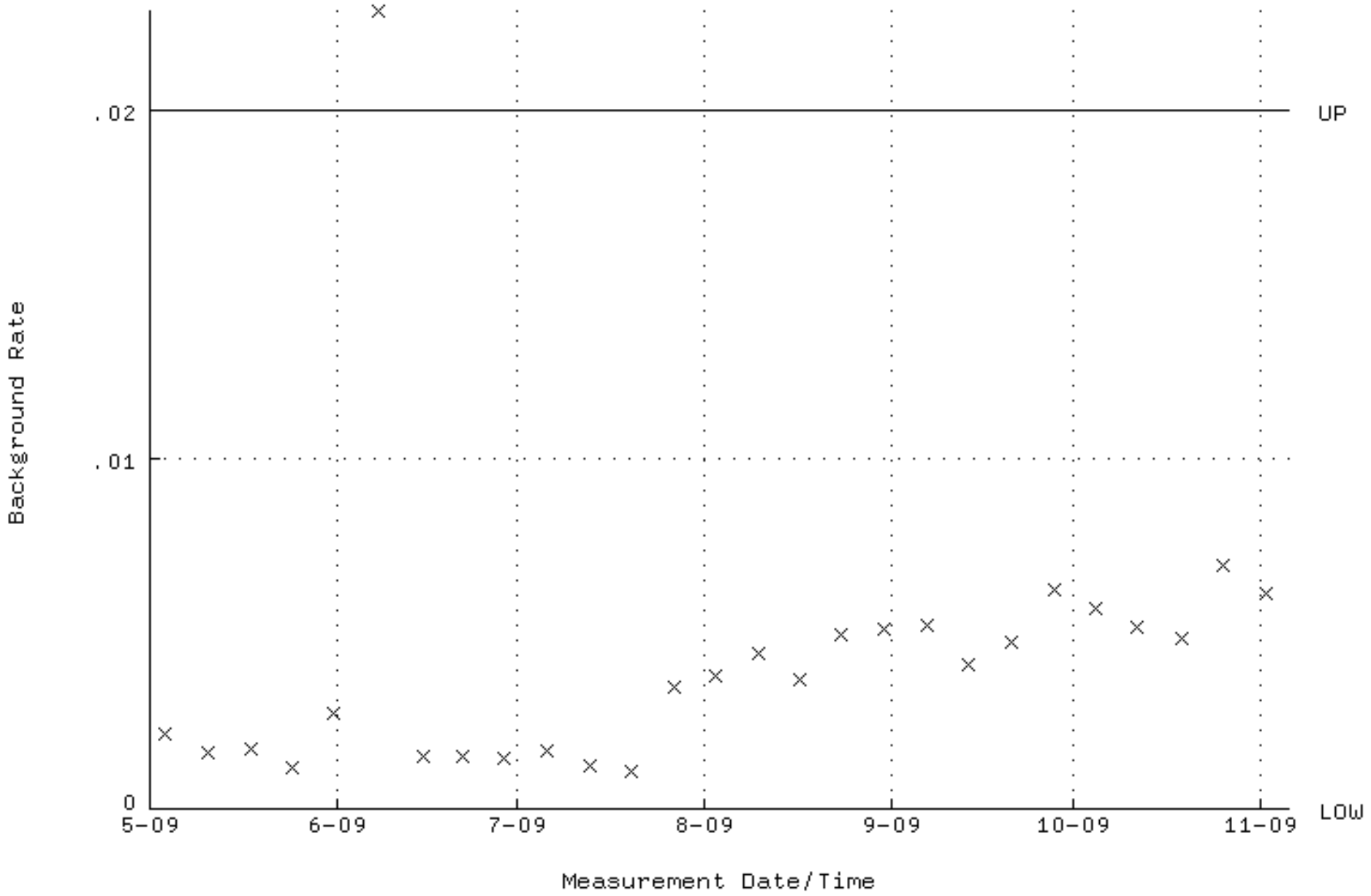
QA filename : DKA100:[ENV_ALPHA.QA.W]W038.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.327380 through 0.362086



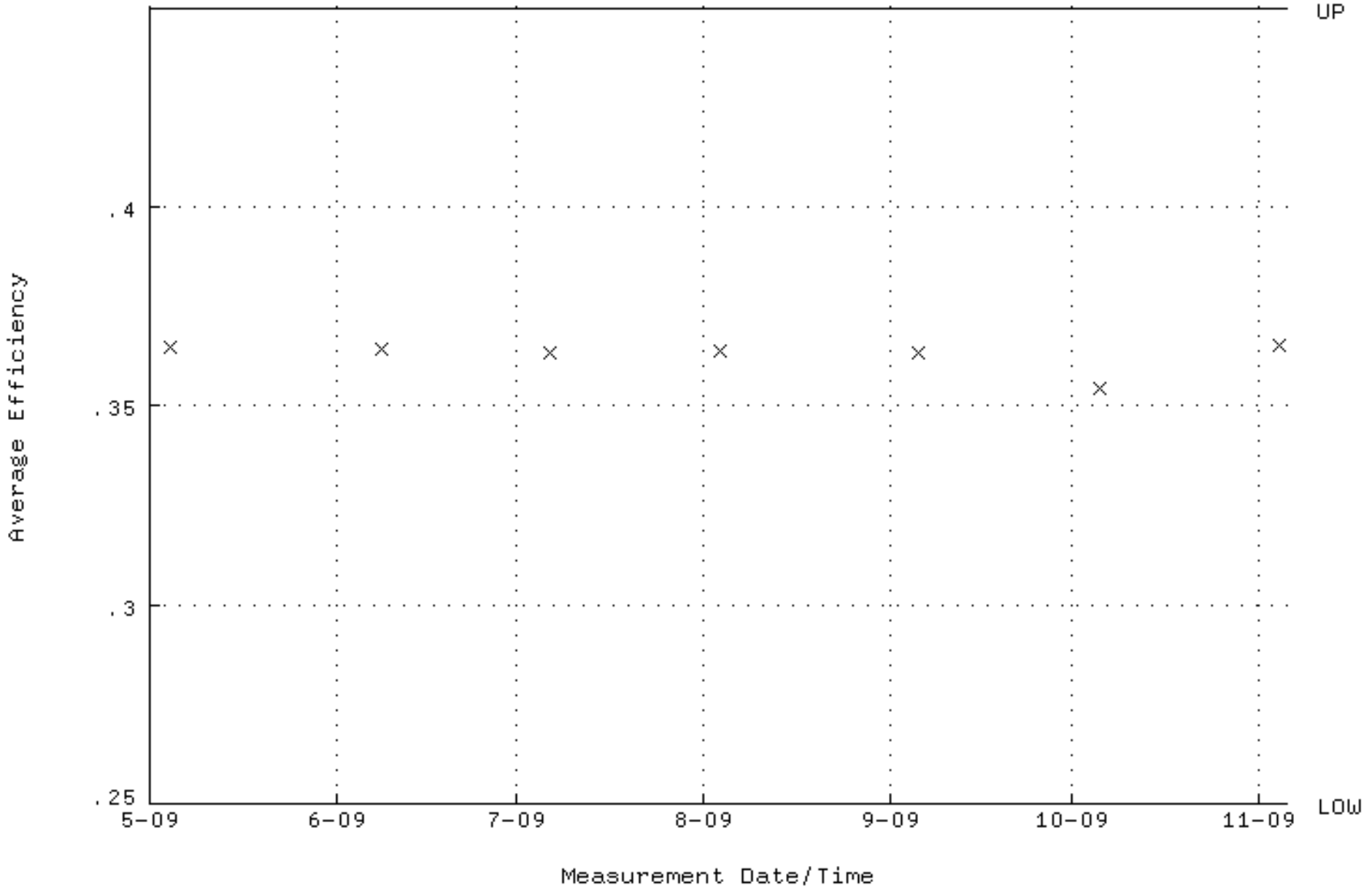
QA filename : DKA100:[ENV_ALPHA.QA.W]W038.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 87.5715 through 92.1899



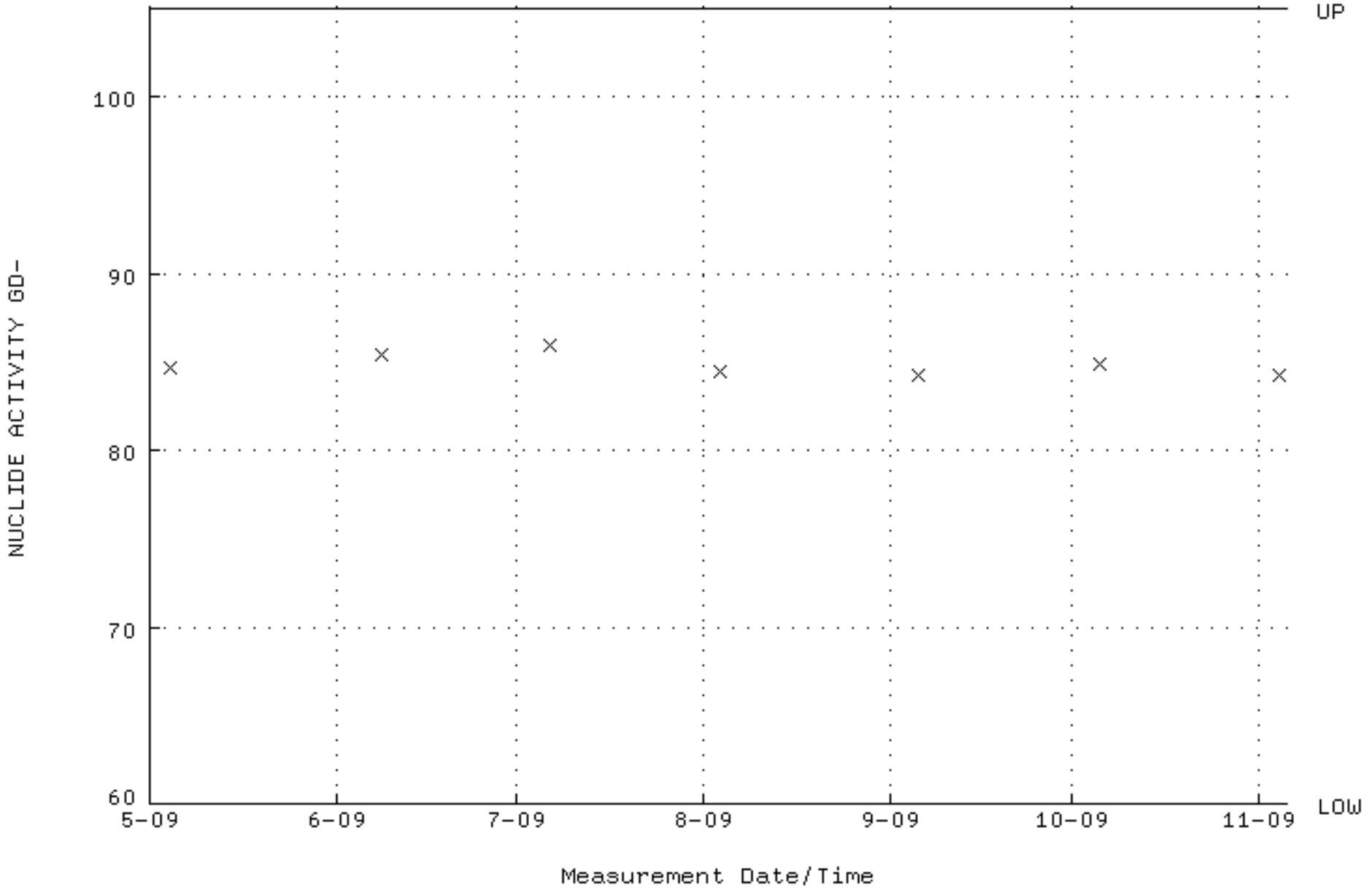
QA filename : DKA100:[ENV_ALPHA.QA.B]B038.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:53 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



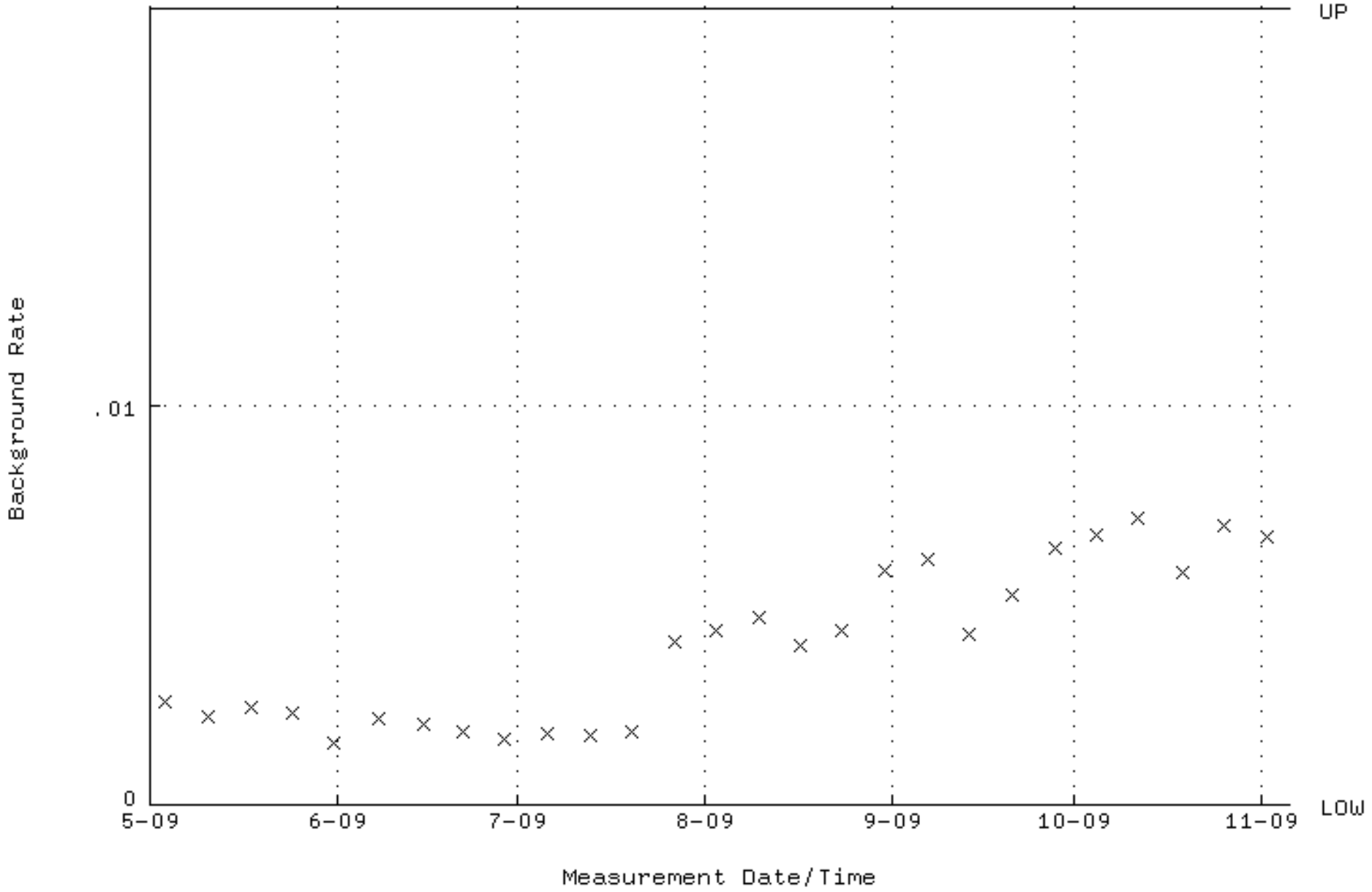
QA filename : DKA100:[ENV_ALPHA.QA.W]W039.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.250000 through 0.450000



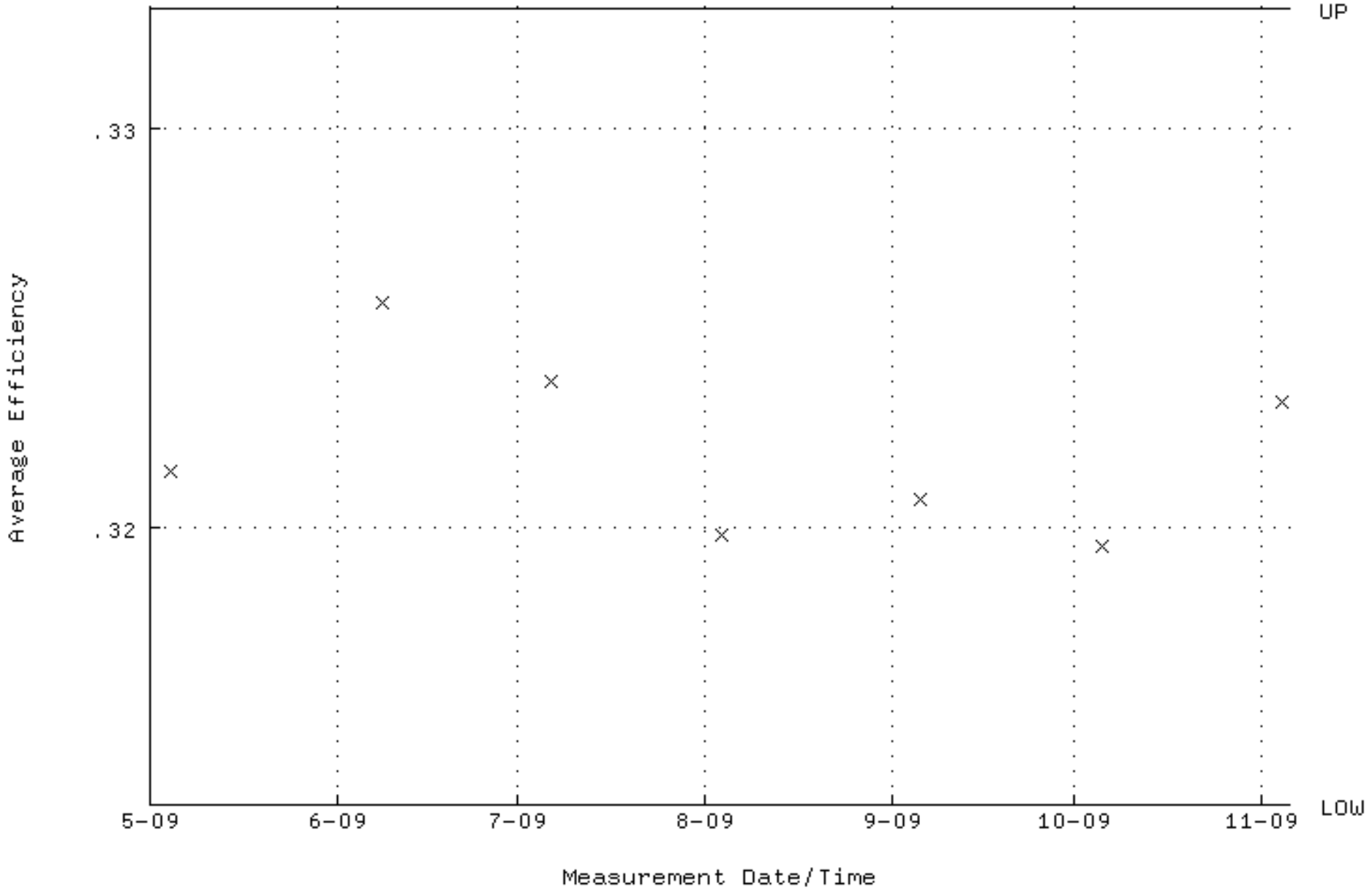
QA filename : DKA100:[ENV_ALPHA.QA.W]W039.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 60.0000 through 105.000



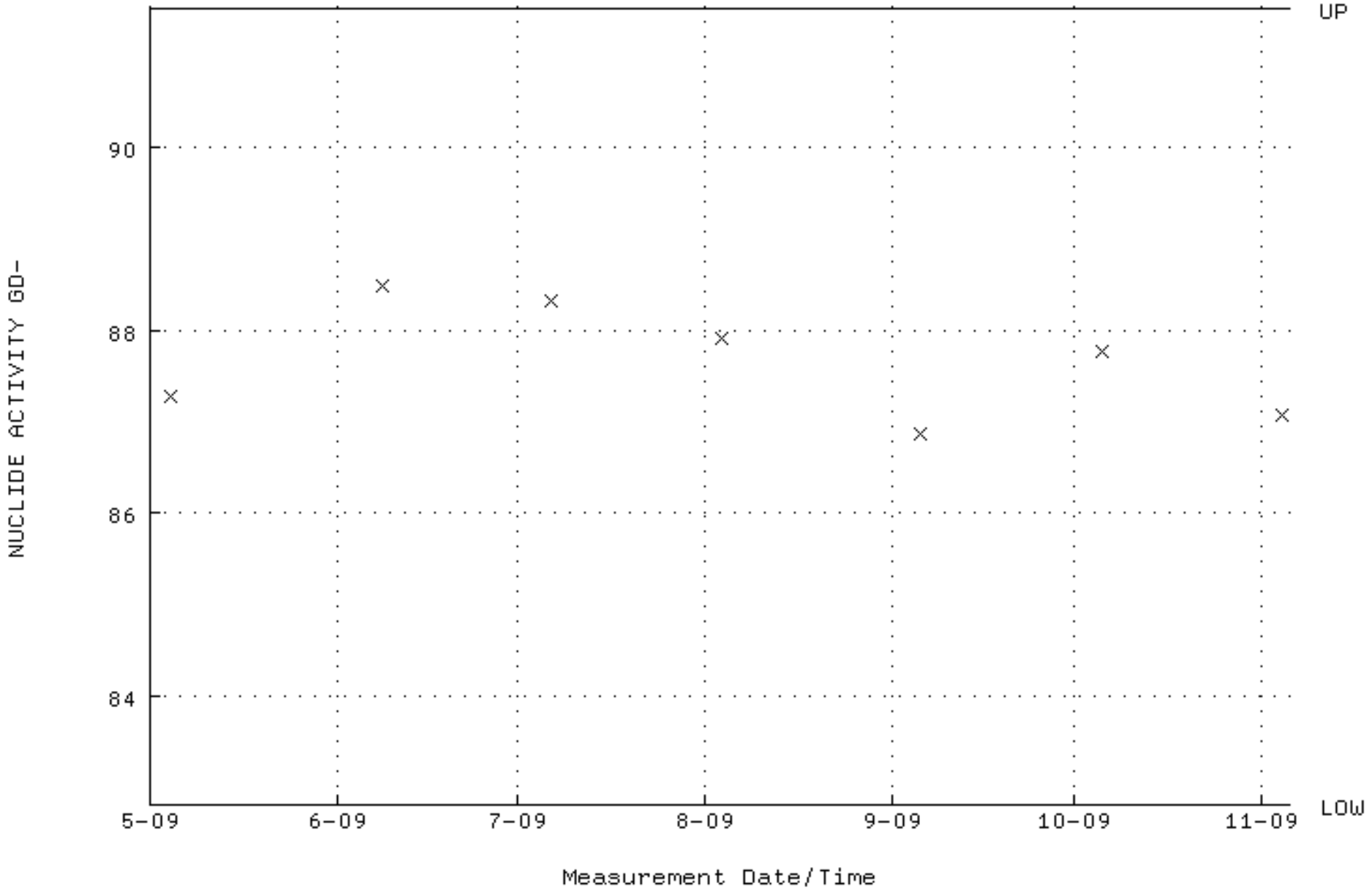
QA filename : DKA100:[ENV_ALPHA.QA.B]B039.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:53 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



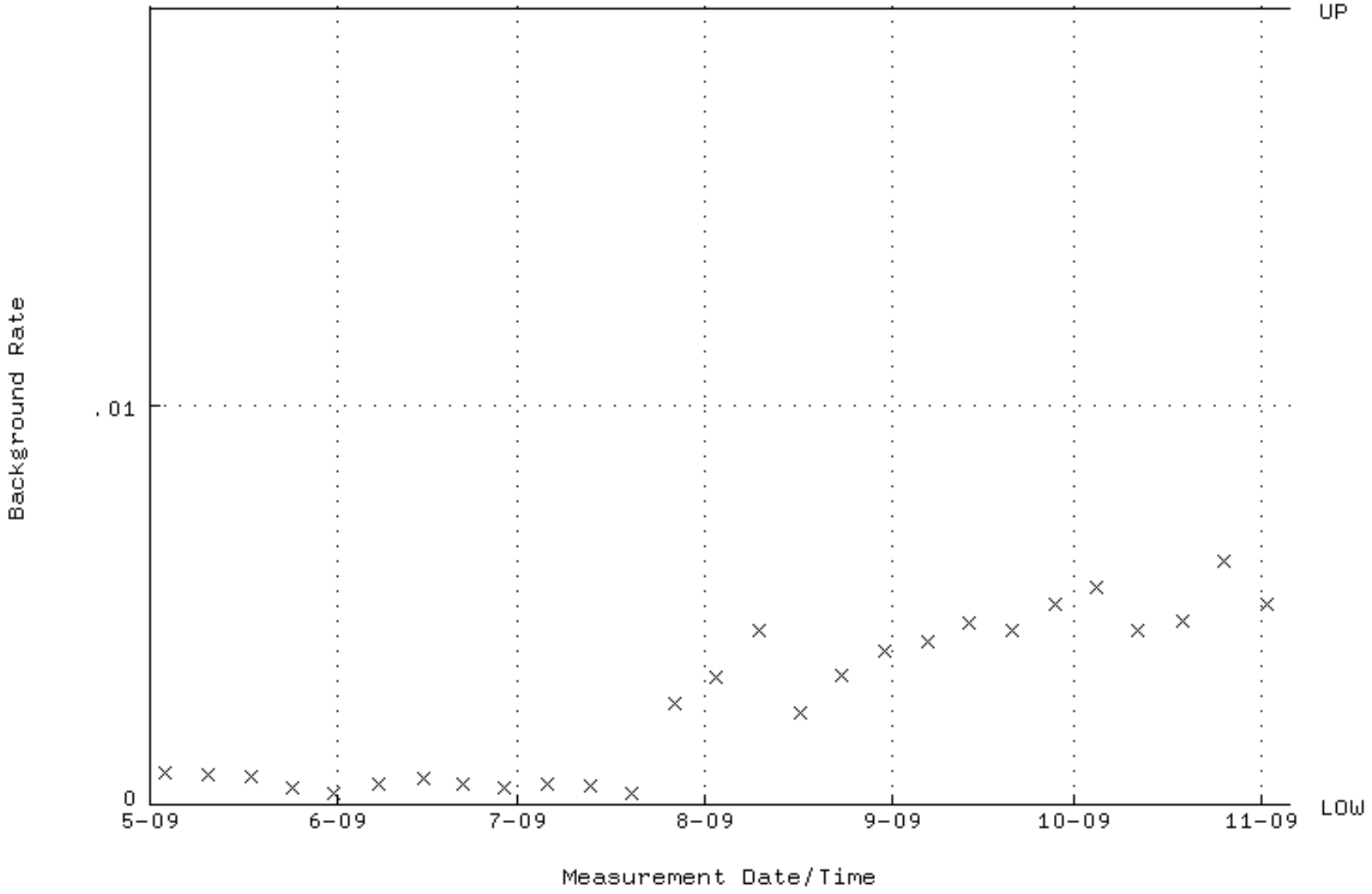
QA filename : DKA100:[ENV_ALPHA.QA.W]W040.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.313016 through 0.333016



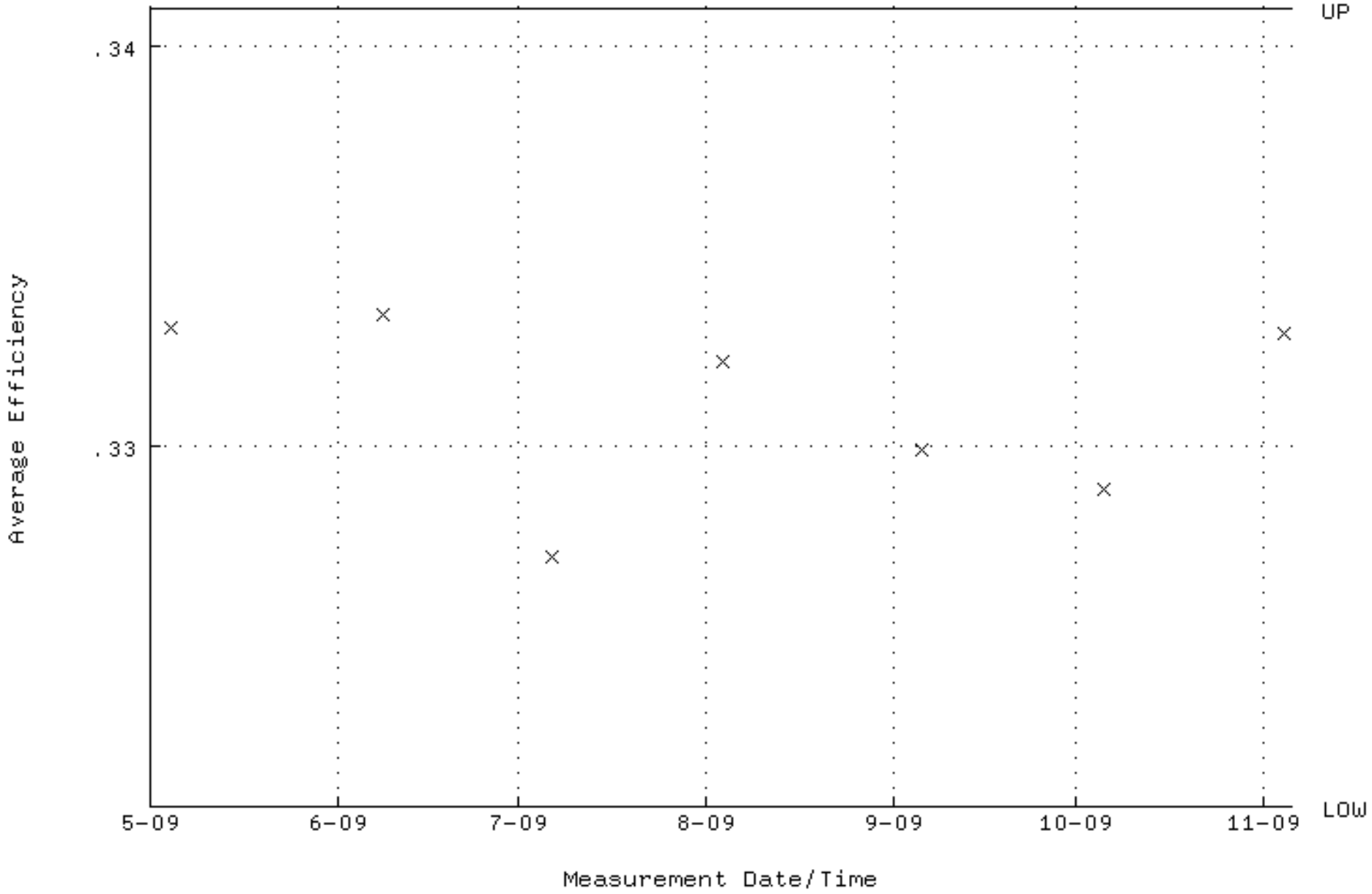
QA filename : DKA100:[ENV_ALPHA.QA.W]W040.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 82.8065 through 91.5229



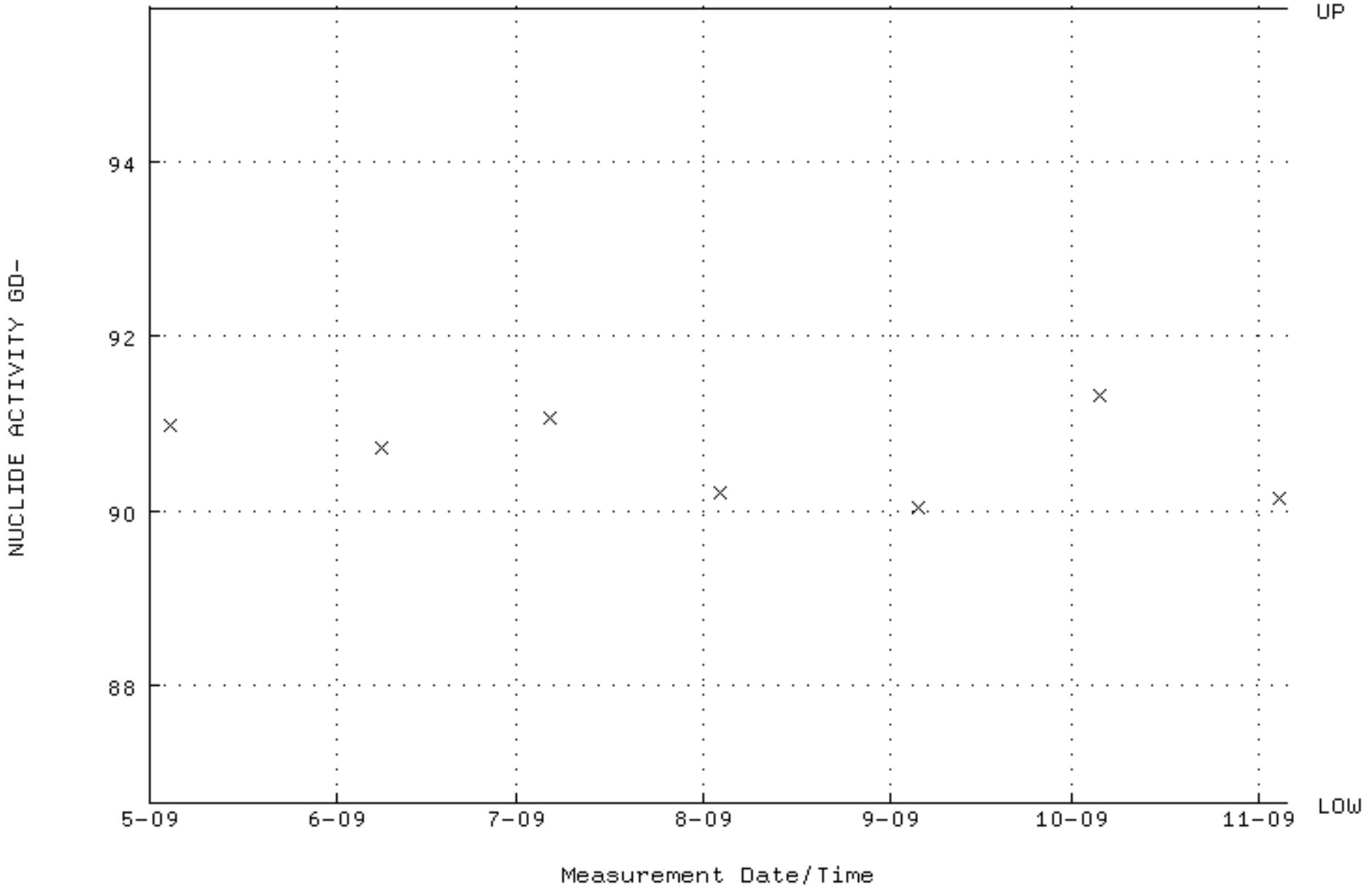
QA filename : DKA100:[ENV_ALPHA.QA.B]B040.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:53 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



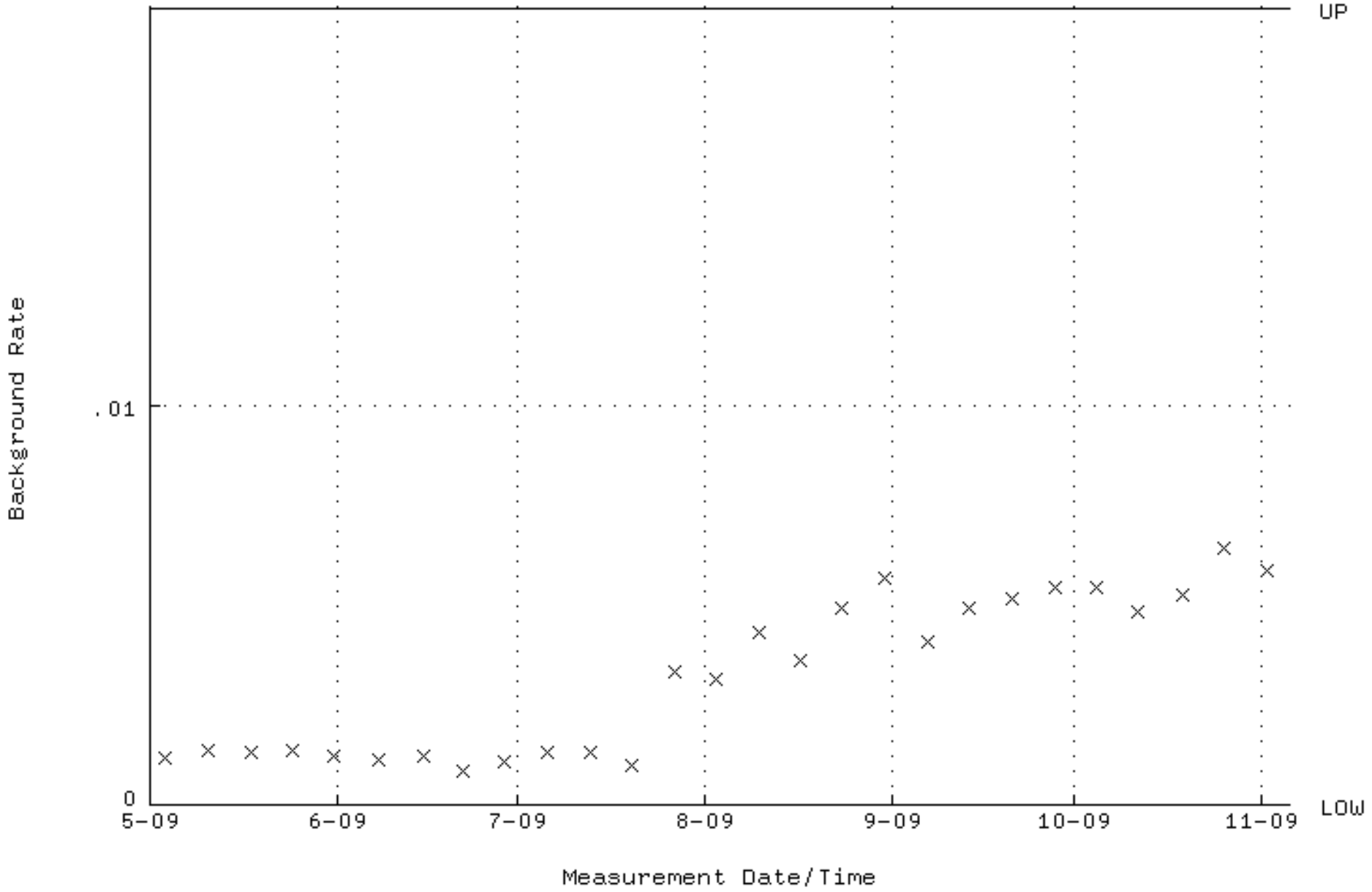
QA filename : DKA100:[ENV_ALPHA.QA.W]W041.QAF;5
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.320943 through 0.340943



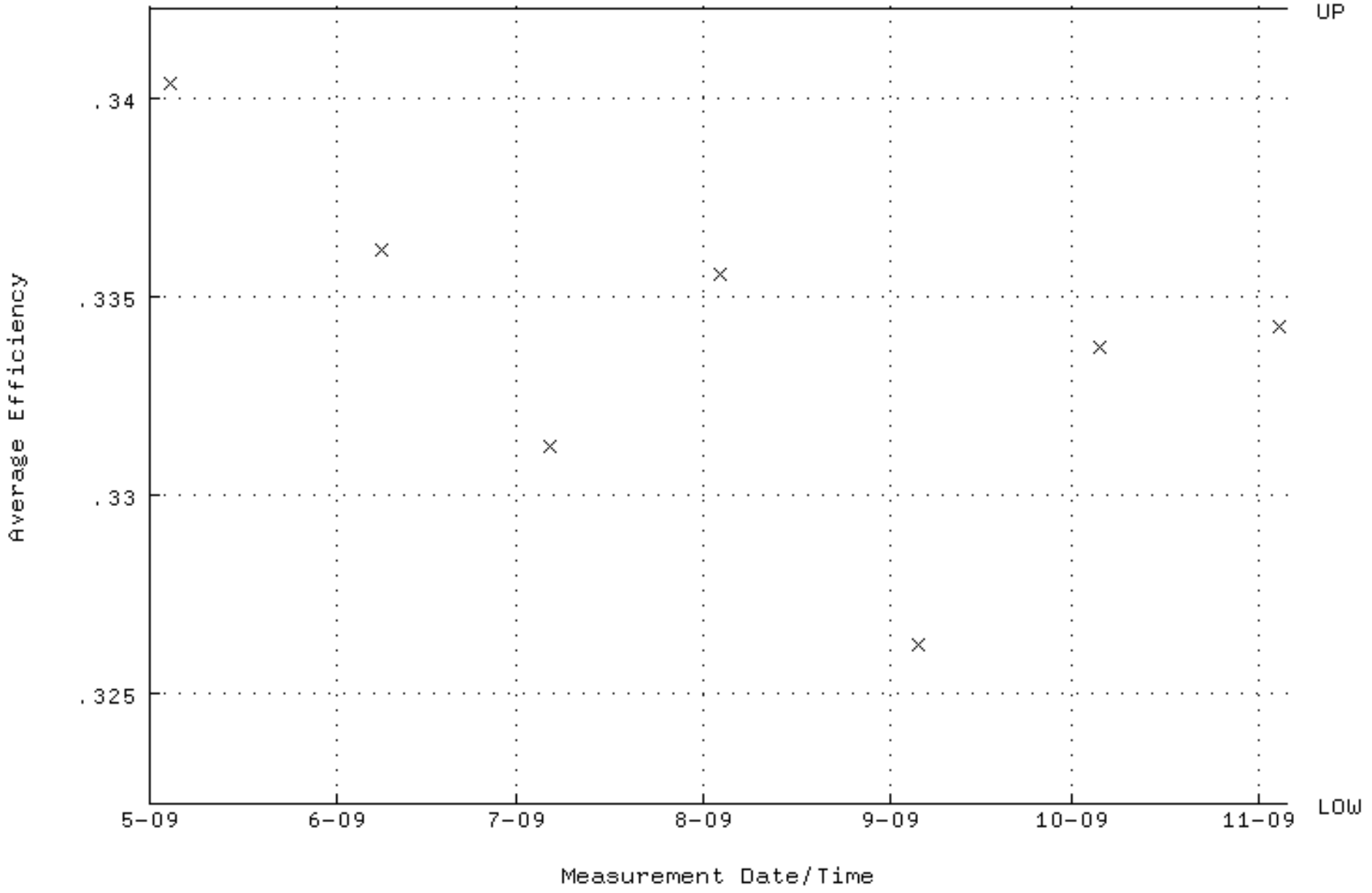
QA filename : DKA100:[ENV_ALPHA.QA.W]W041.QAF;5
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 86.6435 through 95.7639



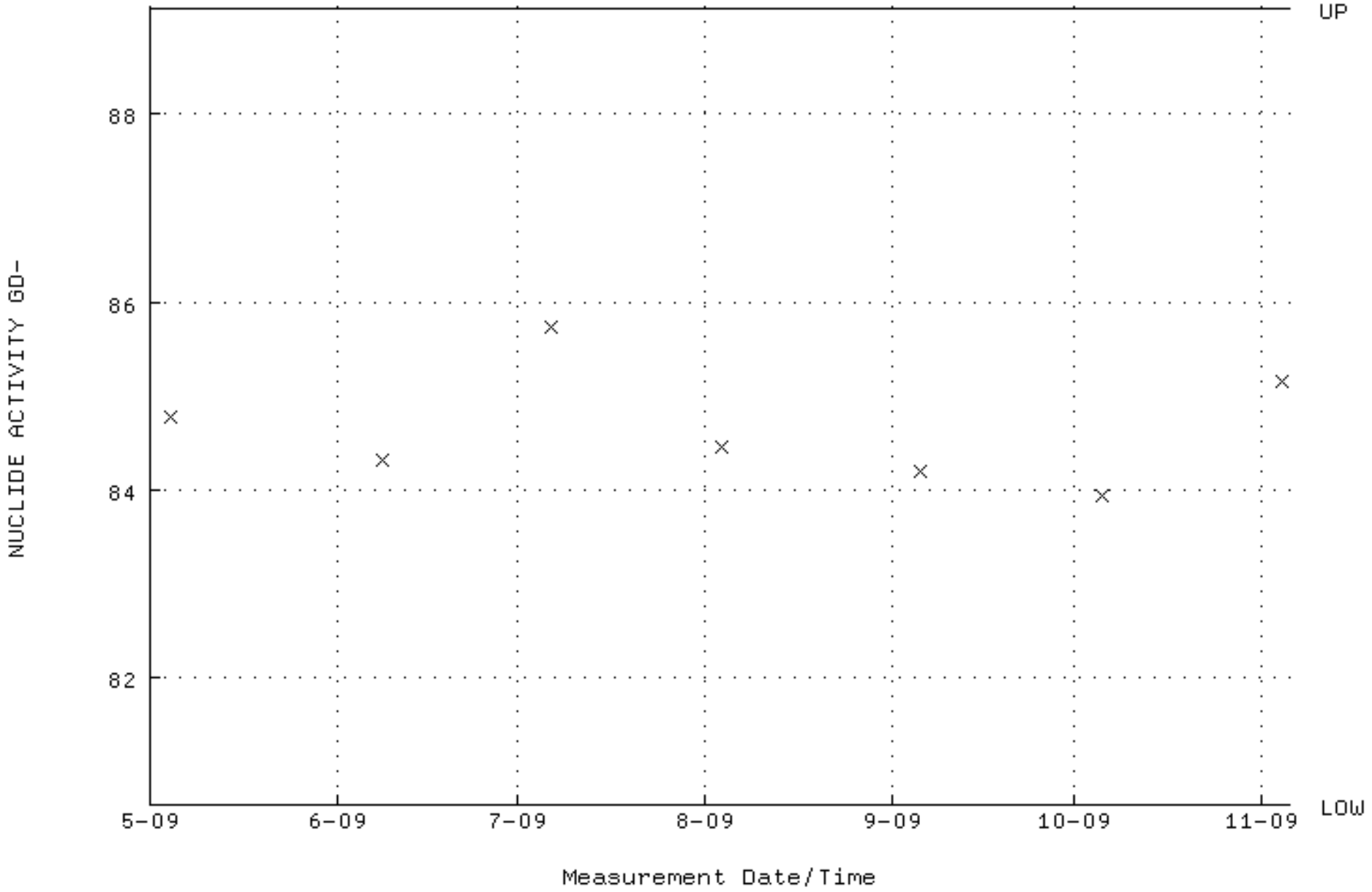
QA filename : DKA100:[ENV_ALPHA.QA.B]B041.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:53 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



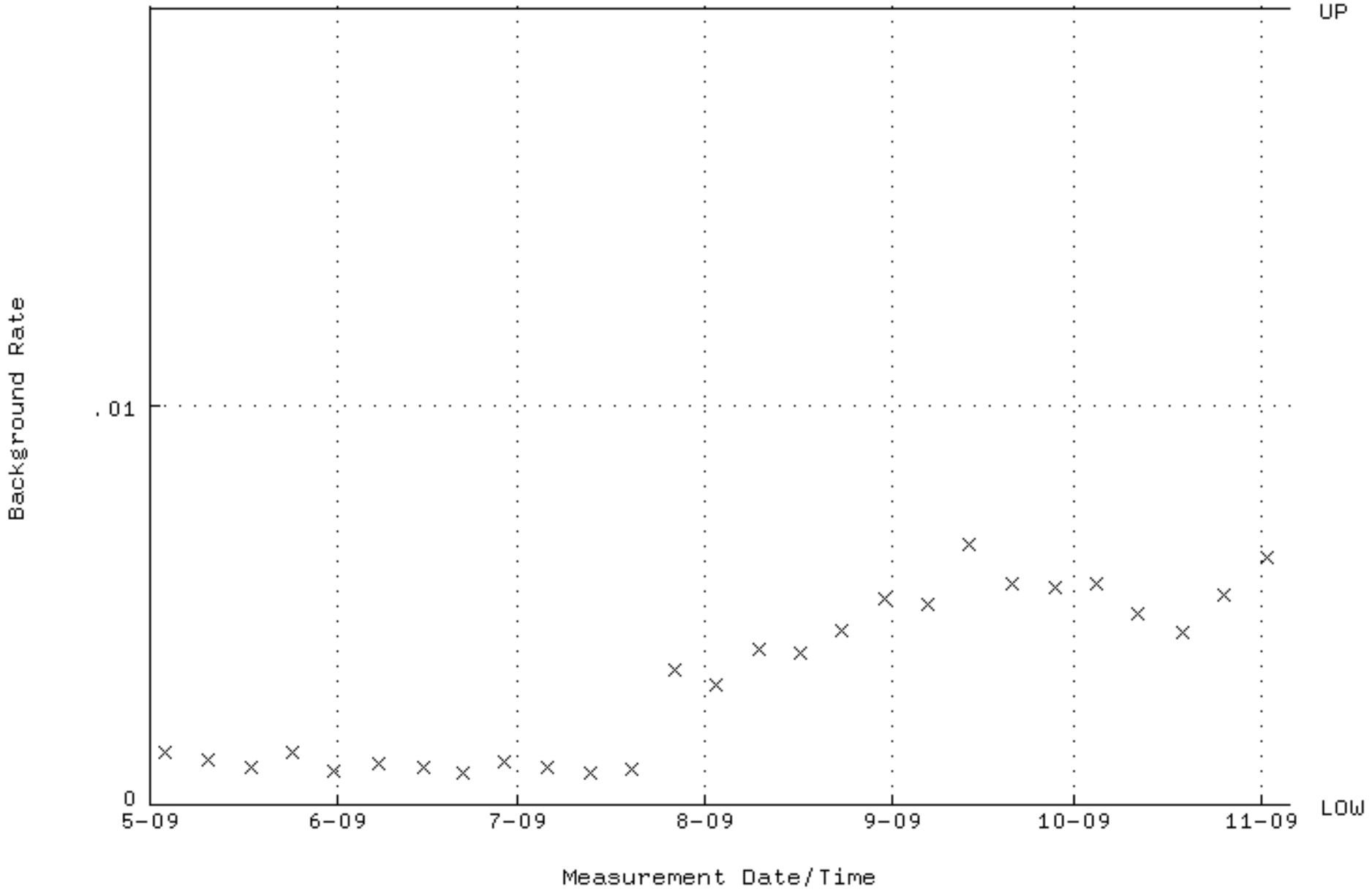
QA filename : DKA100:[ENV_ALPHA.QA.W]W042.QAF;3
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.322243 through 0.342243



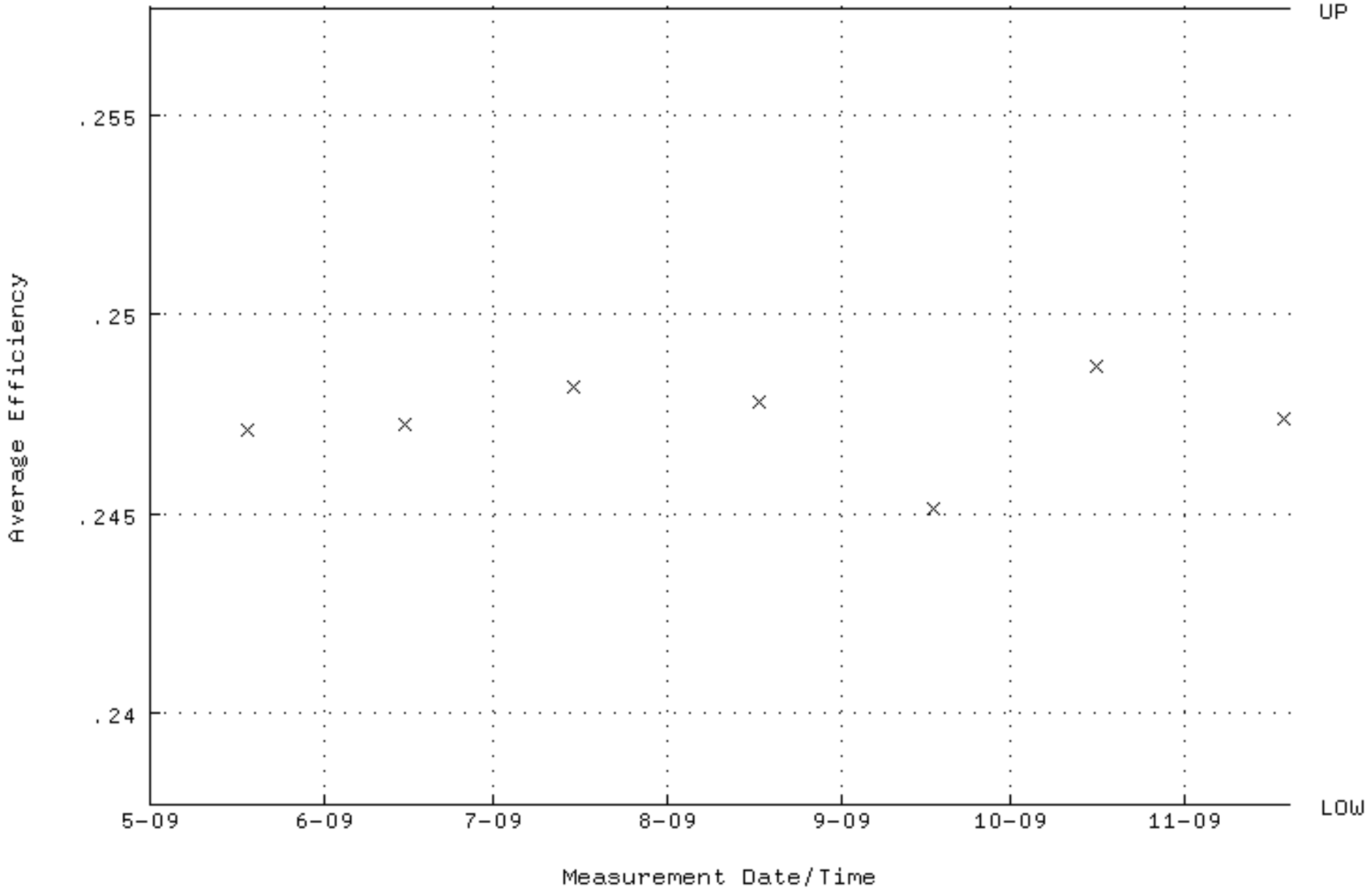
QA filename : DKA100:[ENV_ALPHA.QA.W]W042.QAF;3
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 4-MAY-2009 09:38:10 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 80.6389 through 89.1273



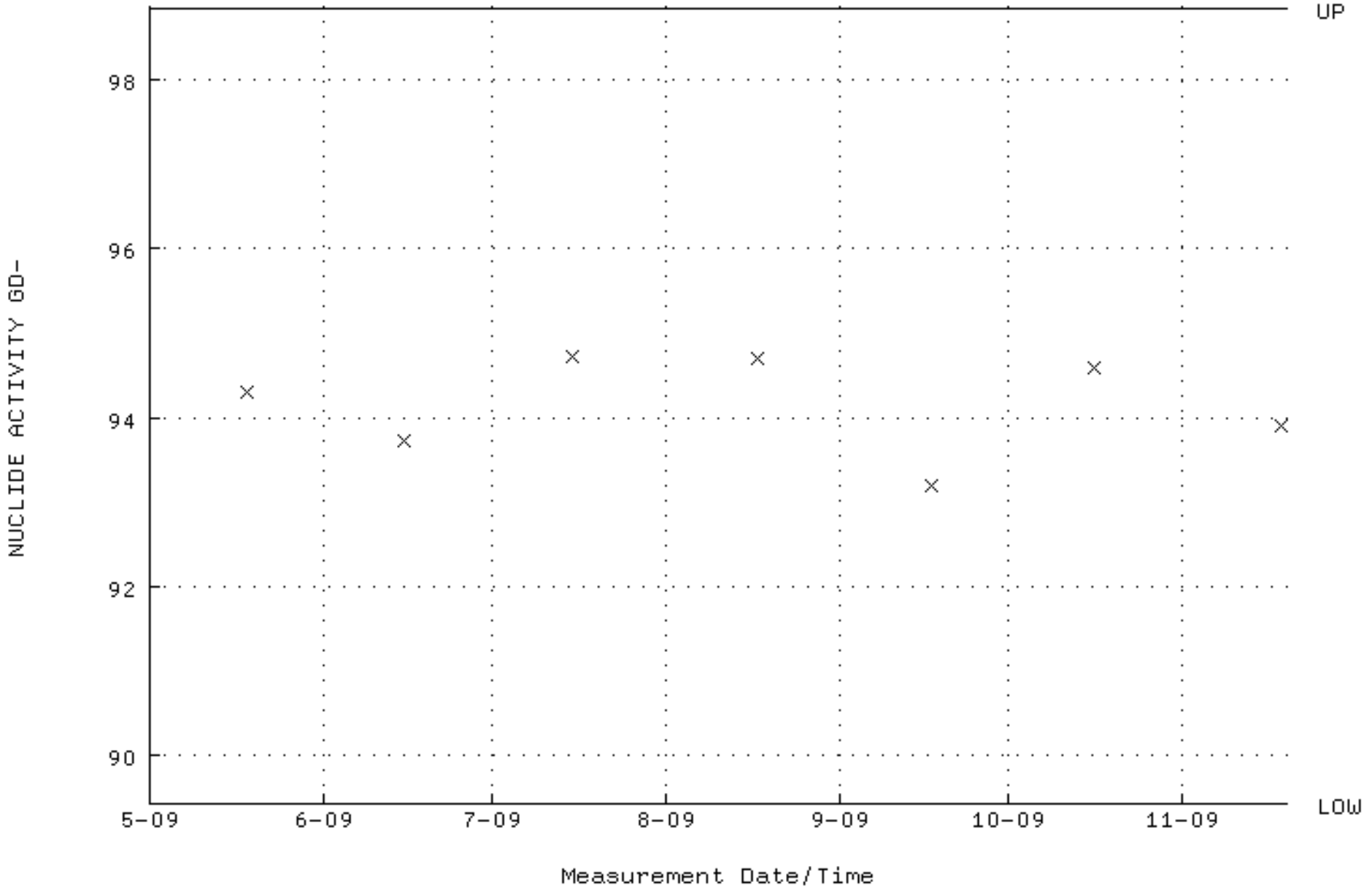
QA filename : DKA100:[ENV_ALPHA.QA.B]B042.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 12:03:53 through 5-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 2.000000E-02



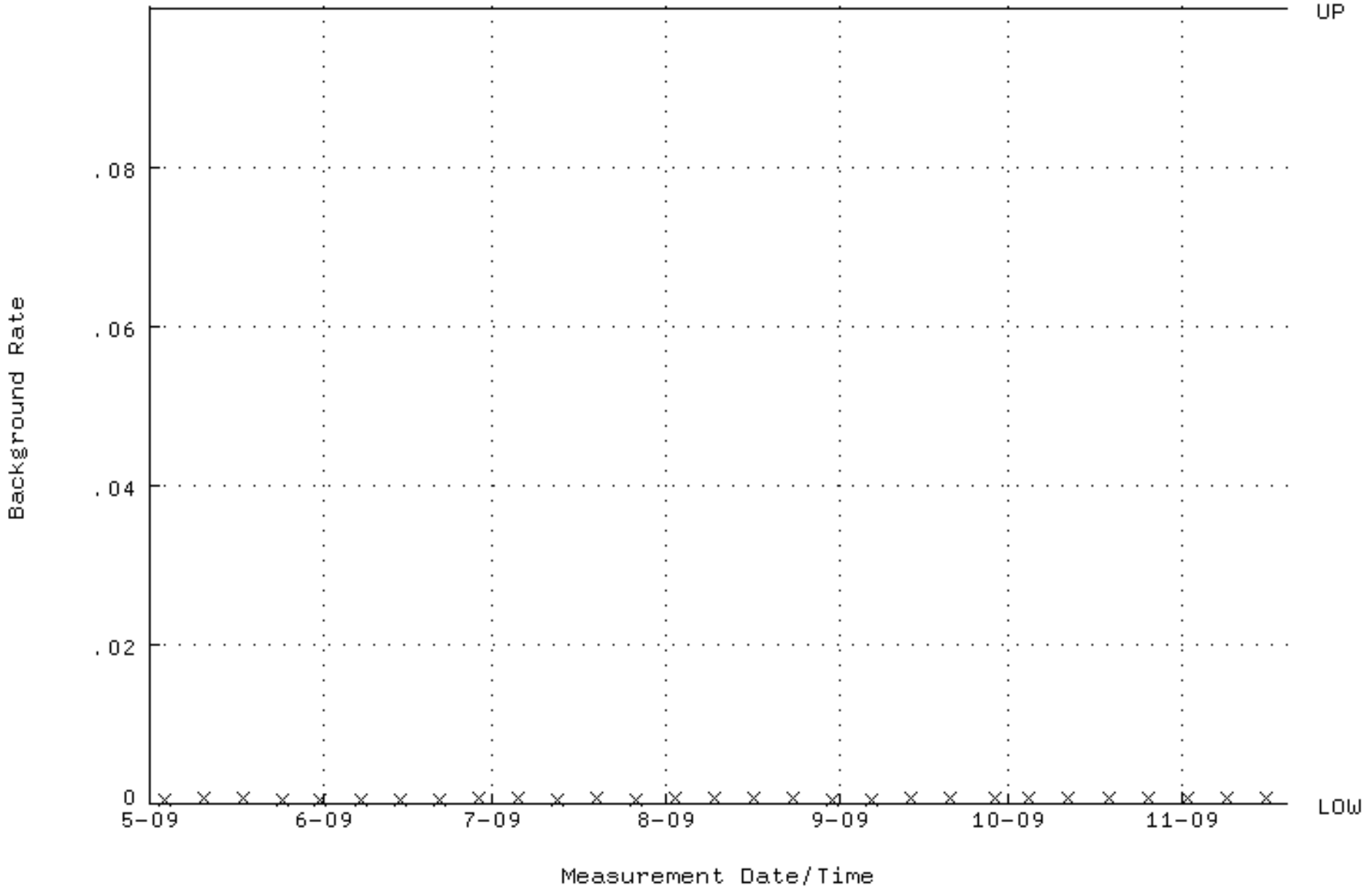
QA filename : DKA100:[ENV_ALPHA.QA.W]W121.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:45:23 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.237686 through 0.257686



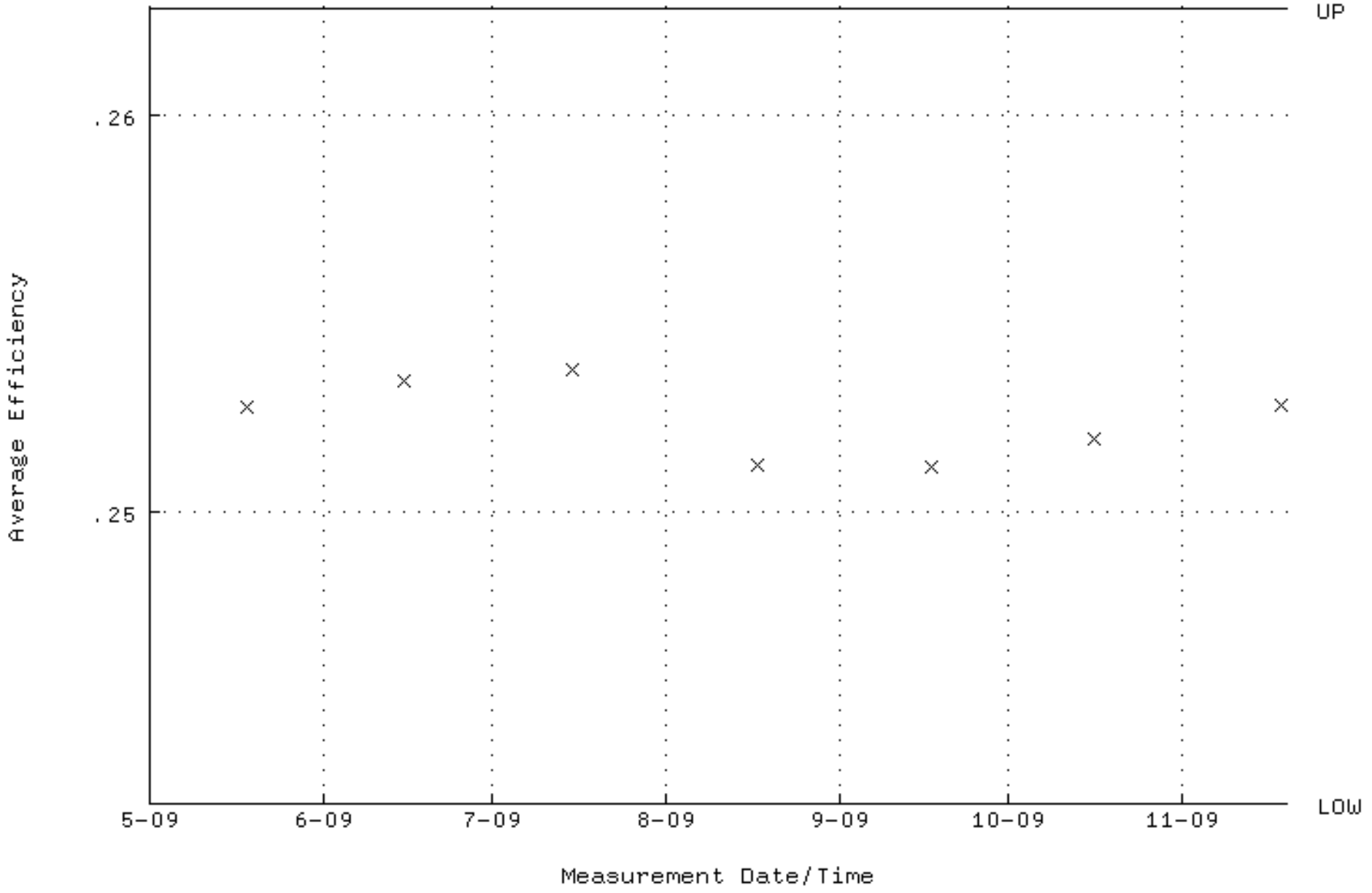
QA filename : DKA100:[ENV_ALPHA.QA.W]W121.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:45:23 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 89.4263 through 98.8395



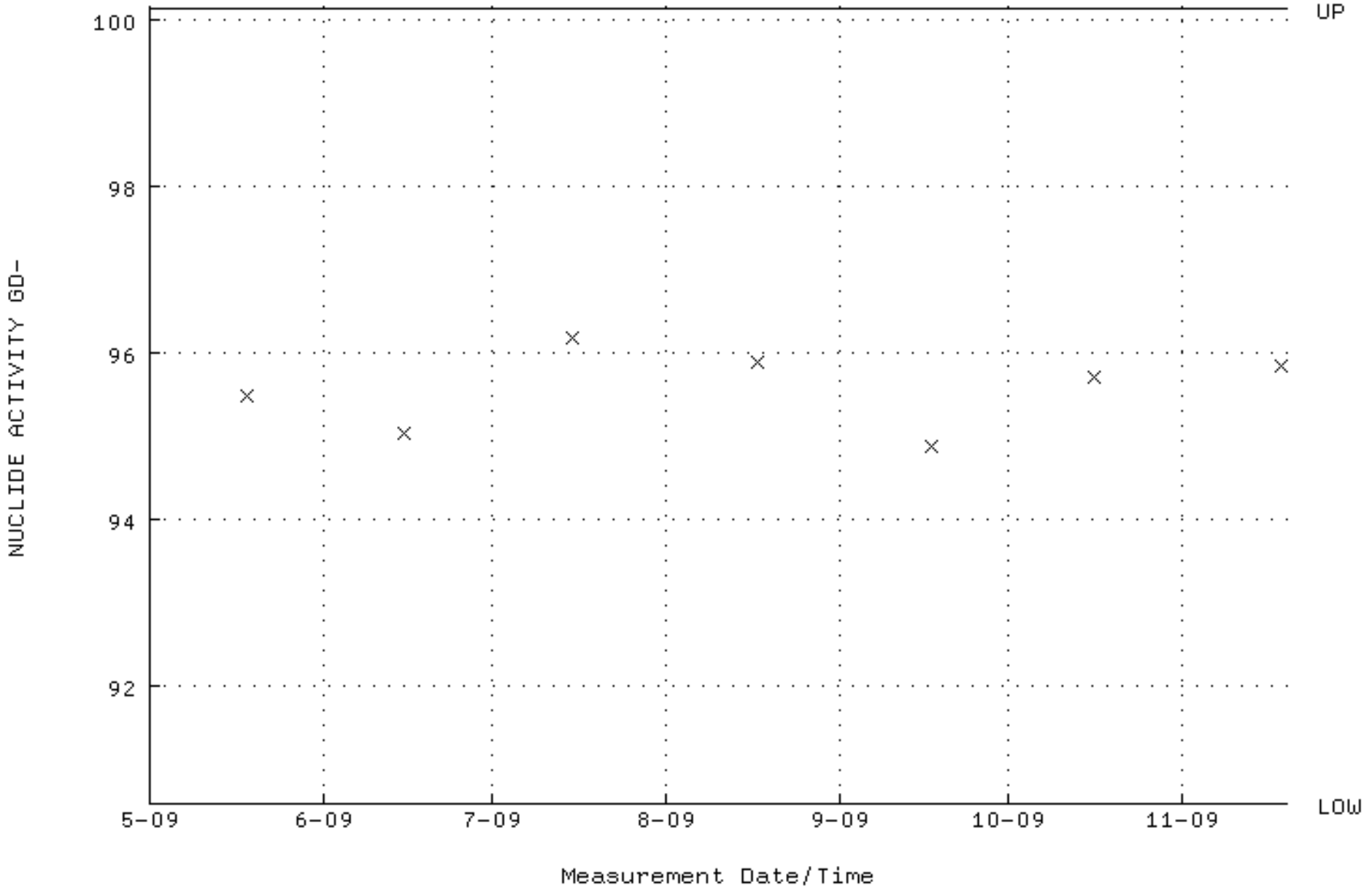
QA filename : DKA100:[ENV_ALPHA.QA.B]B121.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:50:31 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



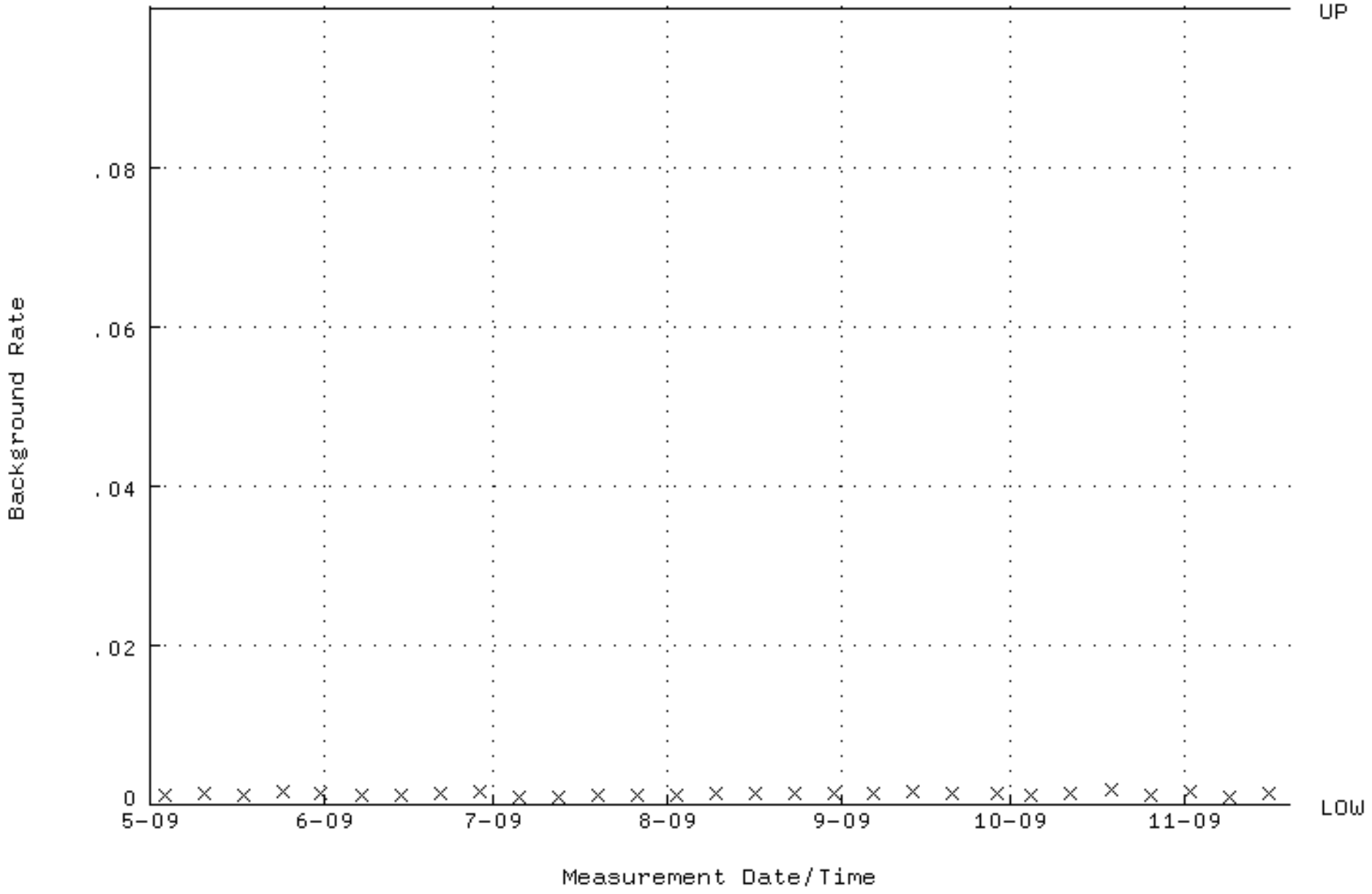
QA filename : DKA100:[ENV_ALPHA.QA.W]W122.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:45:28 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.242659 through 0.262659



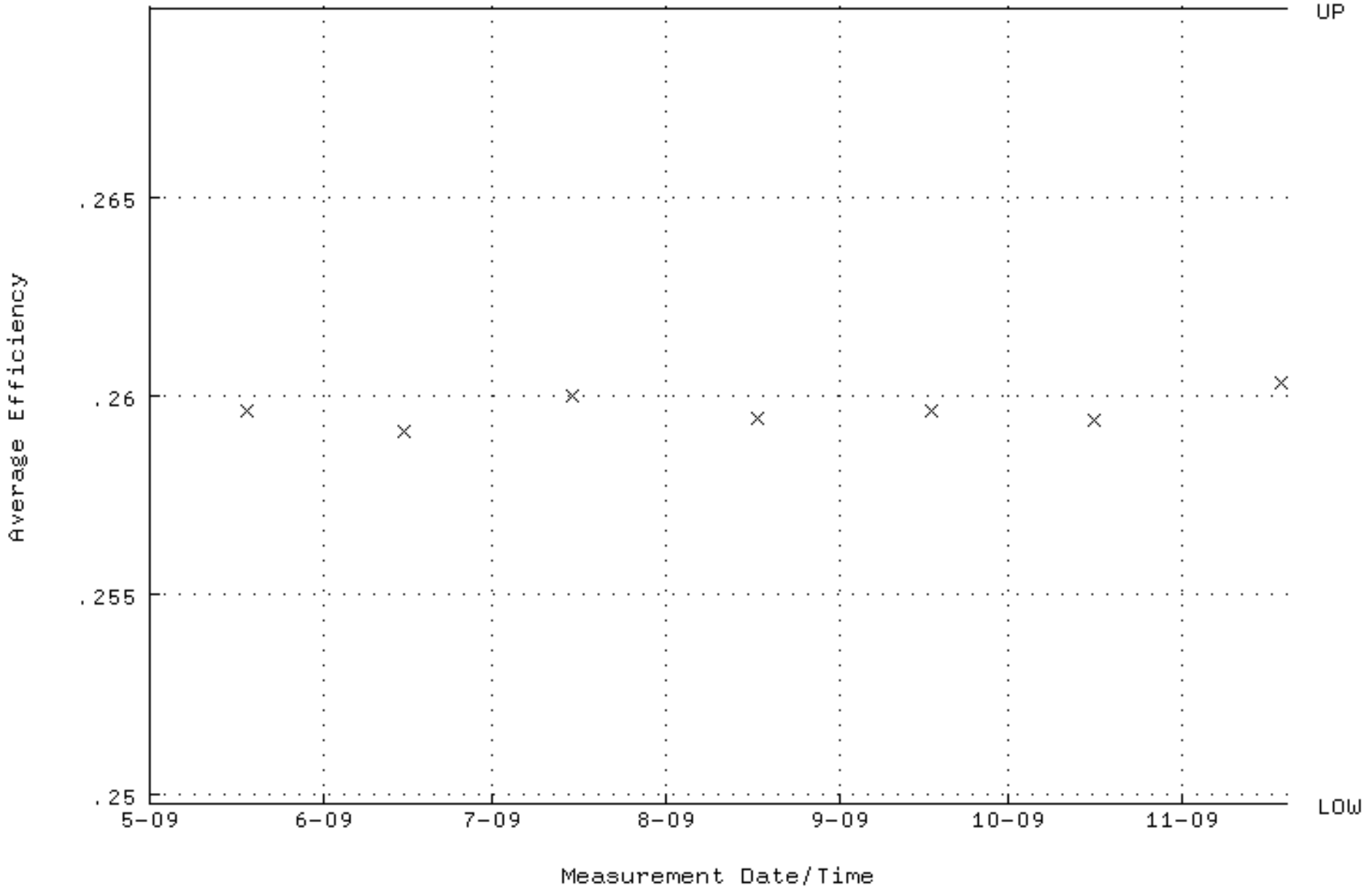
QA filename : DKA100:[ENV_ALPHA.QA.W]W122.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:45:28 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 90.5949 through 100.131



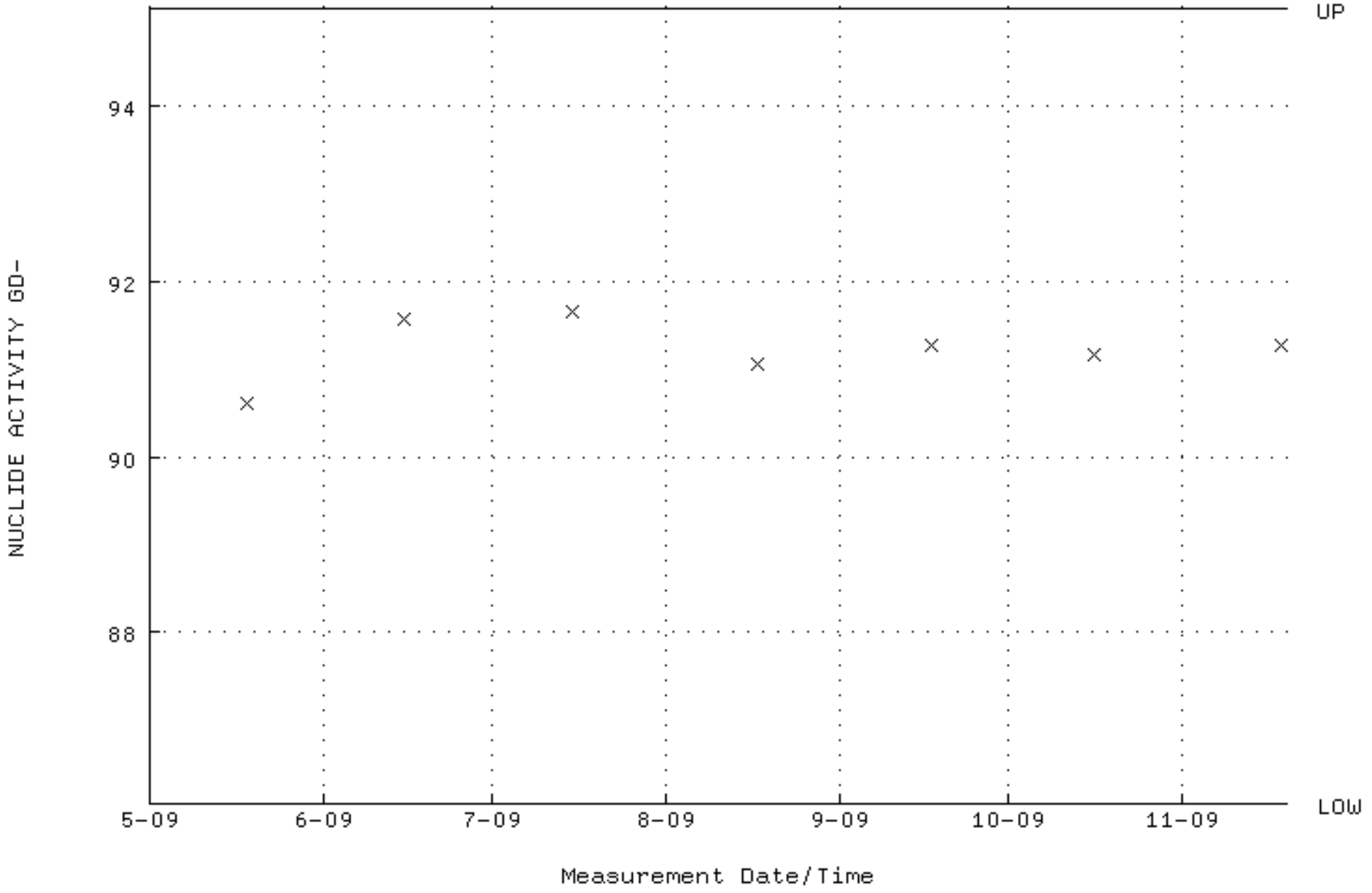
QA filename : DKA100:[ENV_ALPHA.QA.B]B122.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:50:35 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



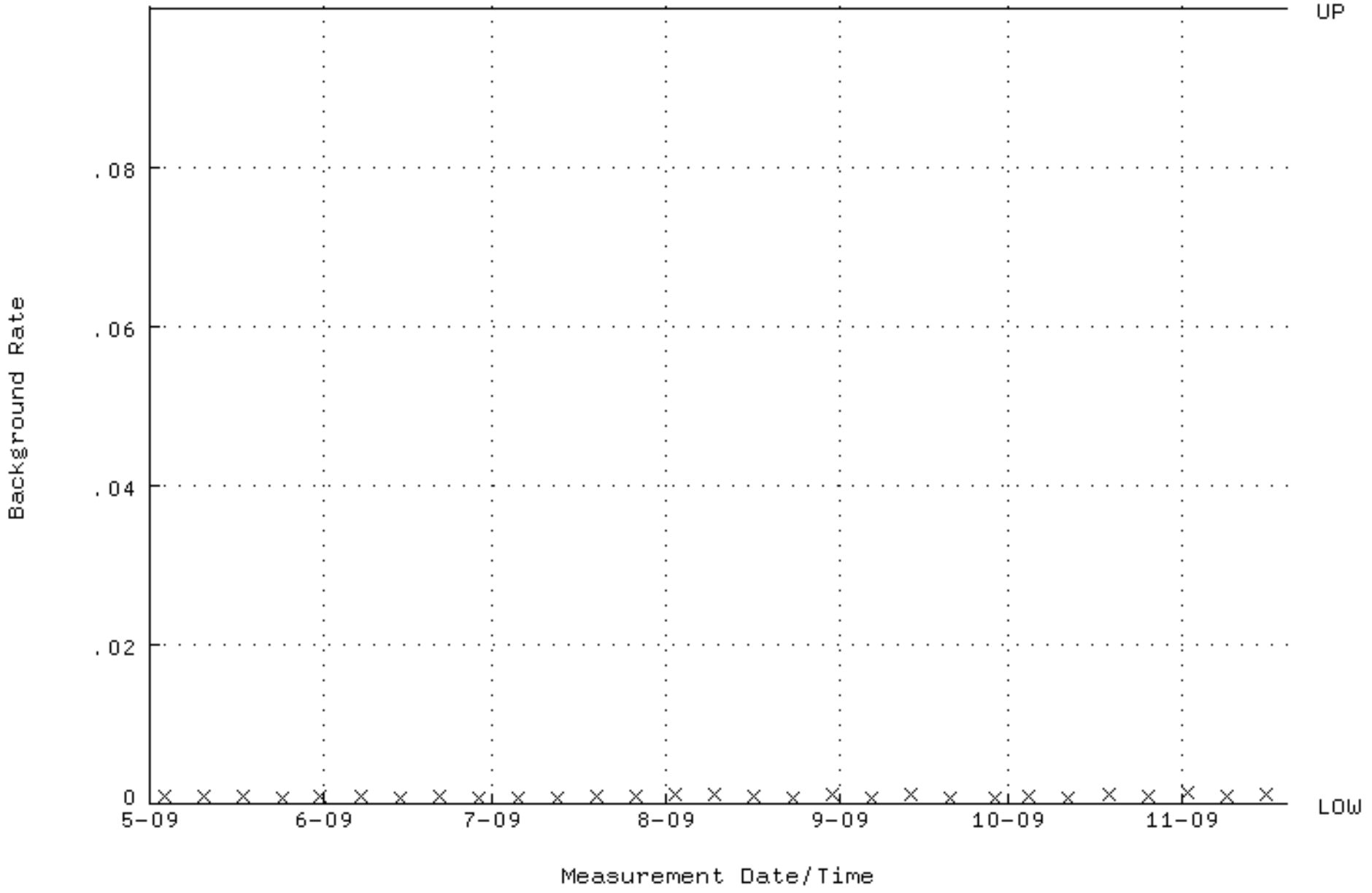
QA filename : DKA100:[ENV_ALPHA.QA.W]W123.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:45:32 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.249752 through 0.269752



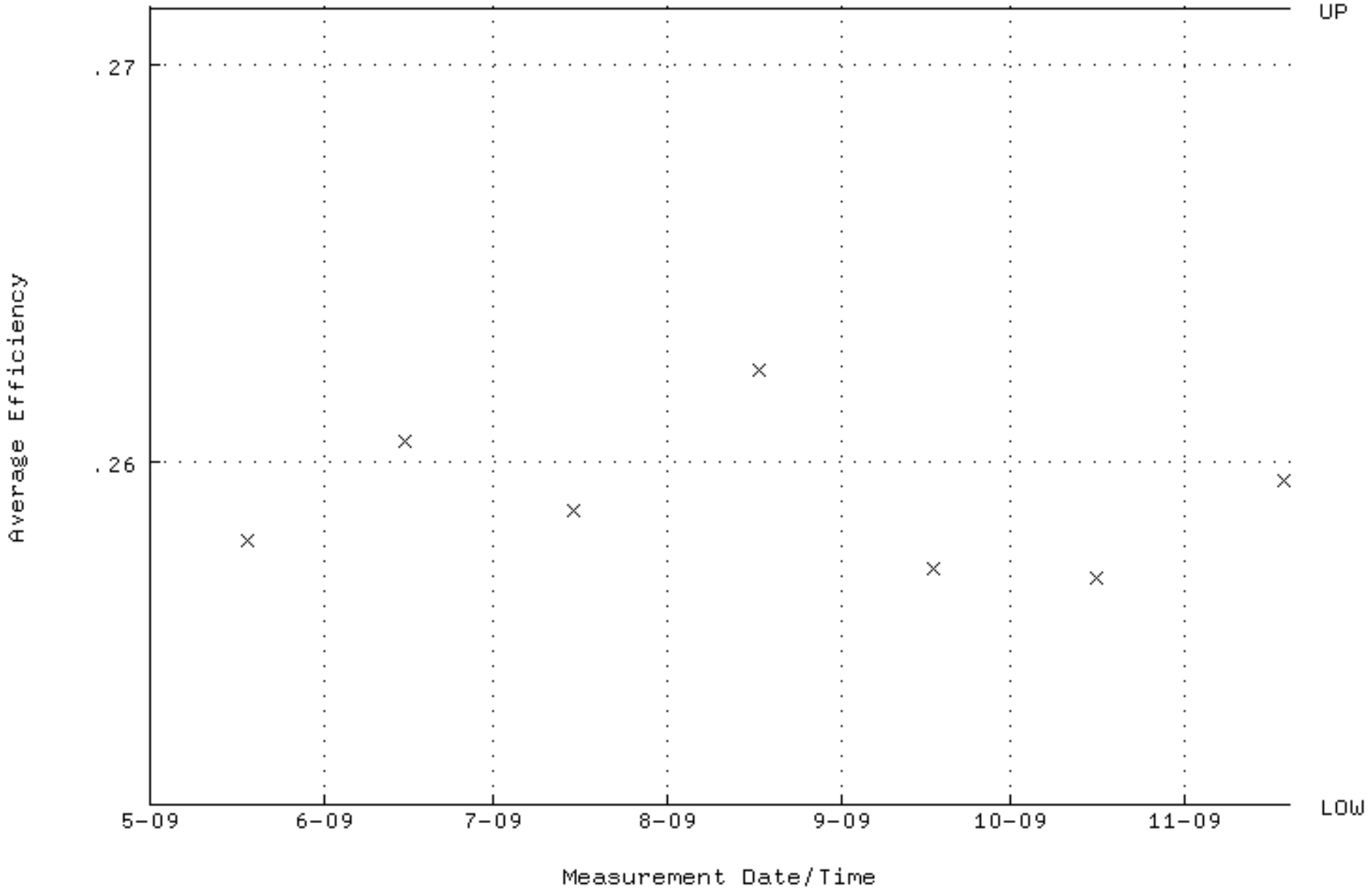
QA filename : DKA100:[ENV_ALPHA.QA.W]W123.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:45:32 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 86.0496 through 95.1074



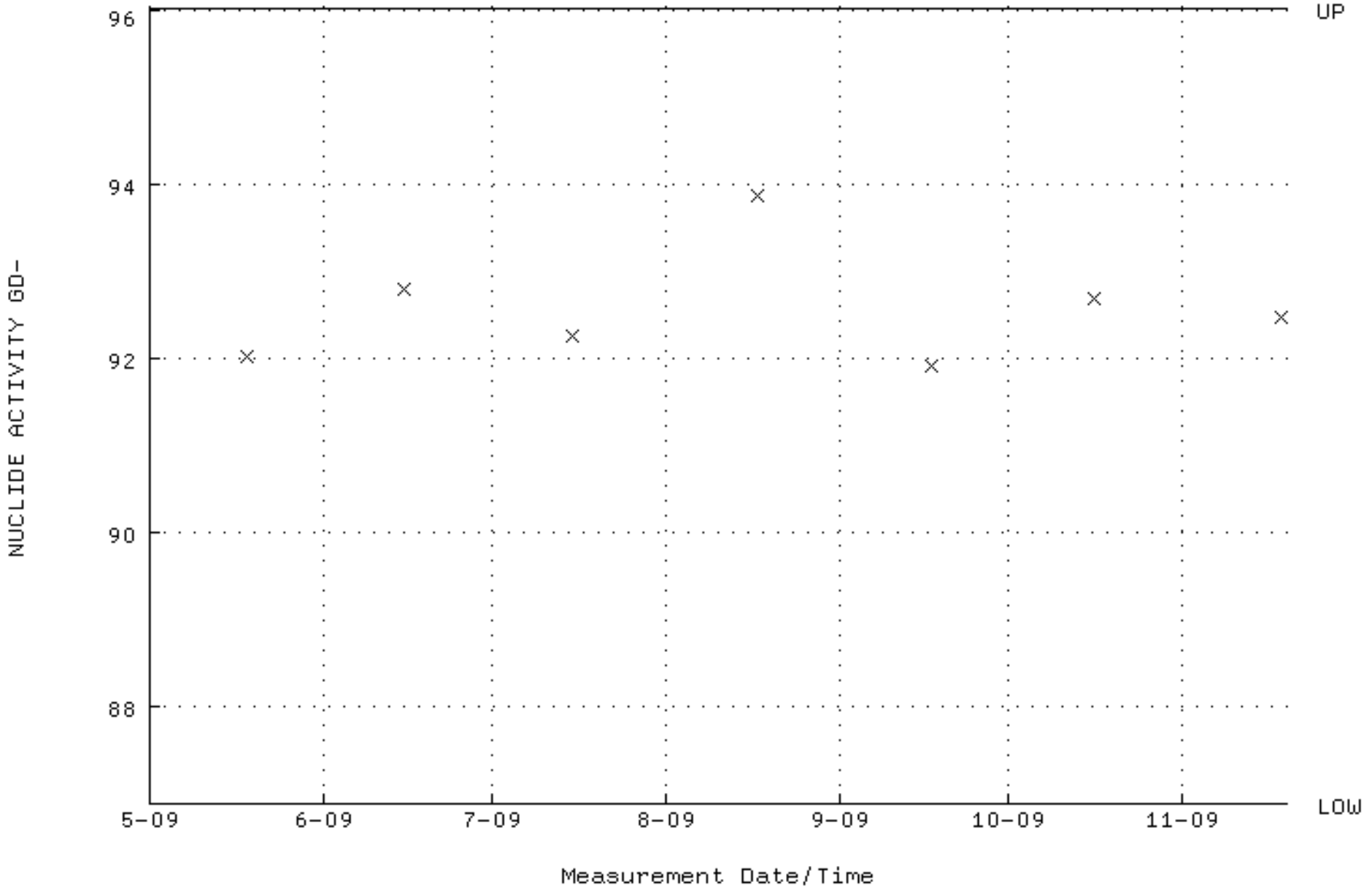
QA filename : DKA100:[ENV_ALPHA.QA.B]B123.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:50:39 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



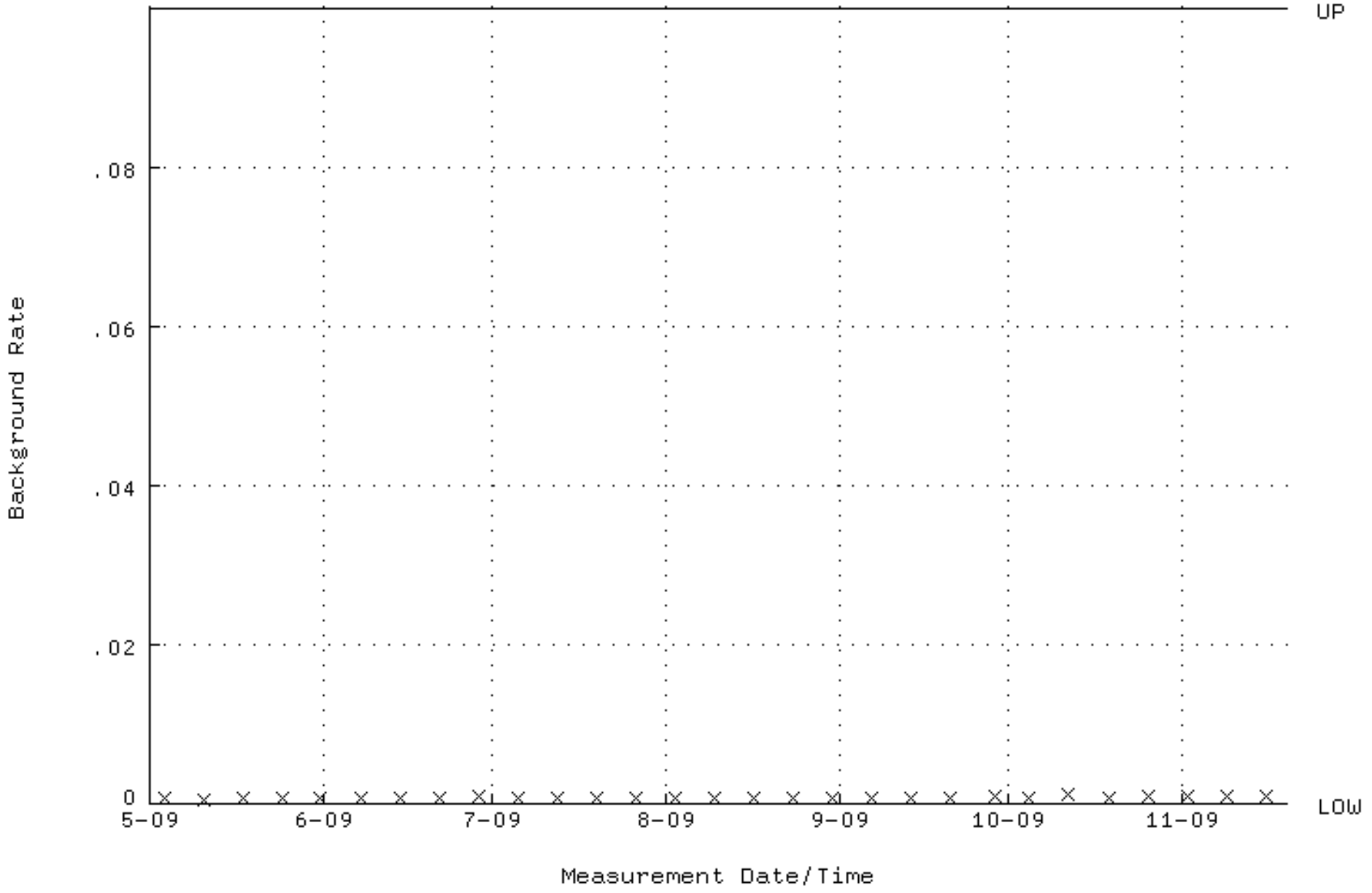
QA filename : DKA100:[ENV_ALPHA.QA.W]W124.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:45:37 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.251398 through 0.271398



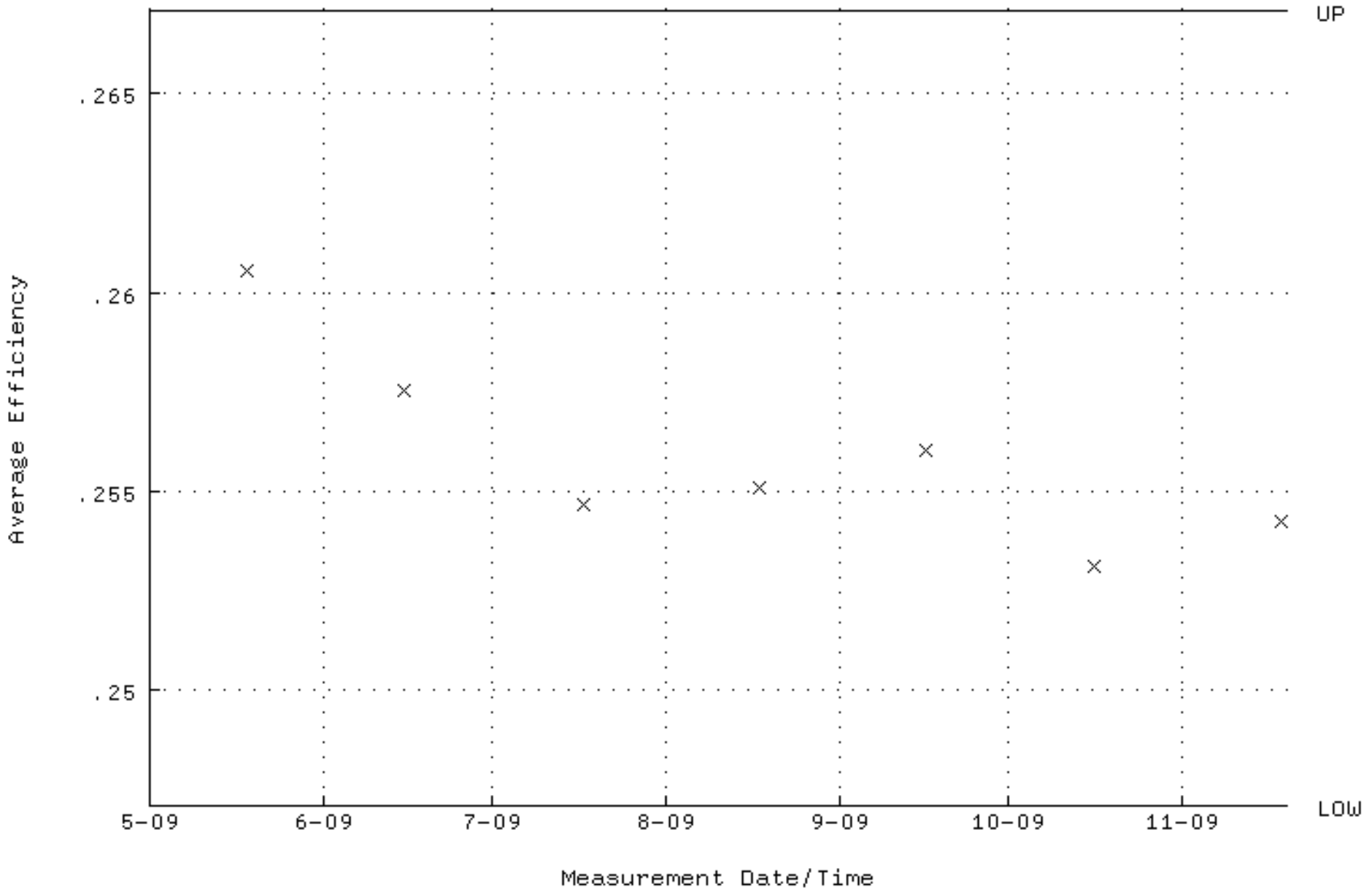
QA filename : DKA100:[ENV_ALPHA.QA.W]W124.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:45:37 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 86.8862 through 96.0322



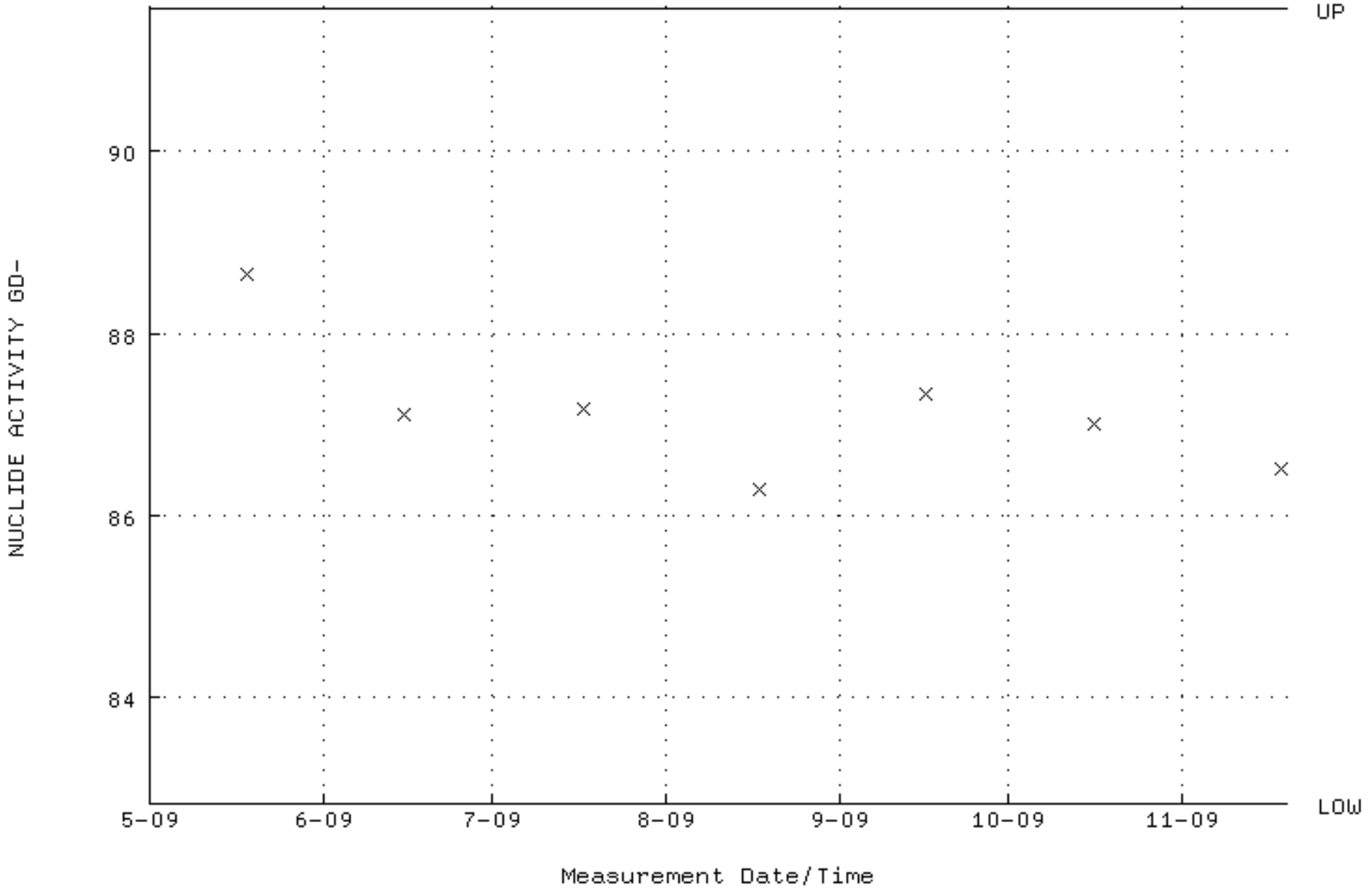
QA filename : DKA100:[ENV_ALPHA.QA.B]B124.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:50:44 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



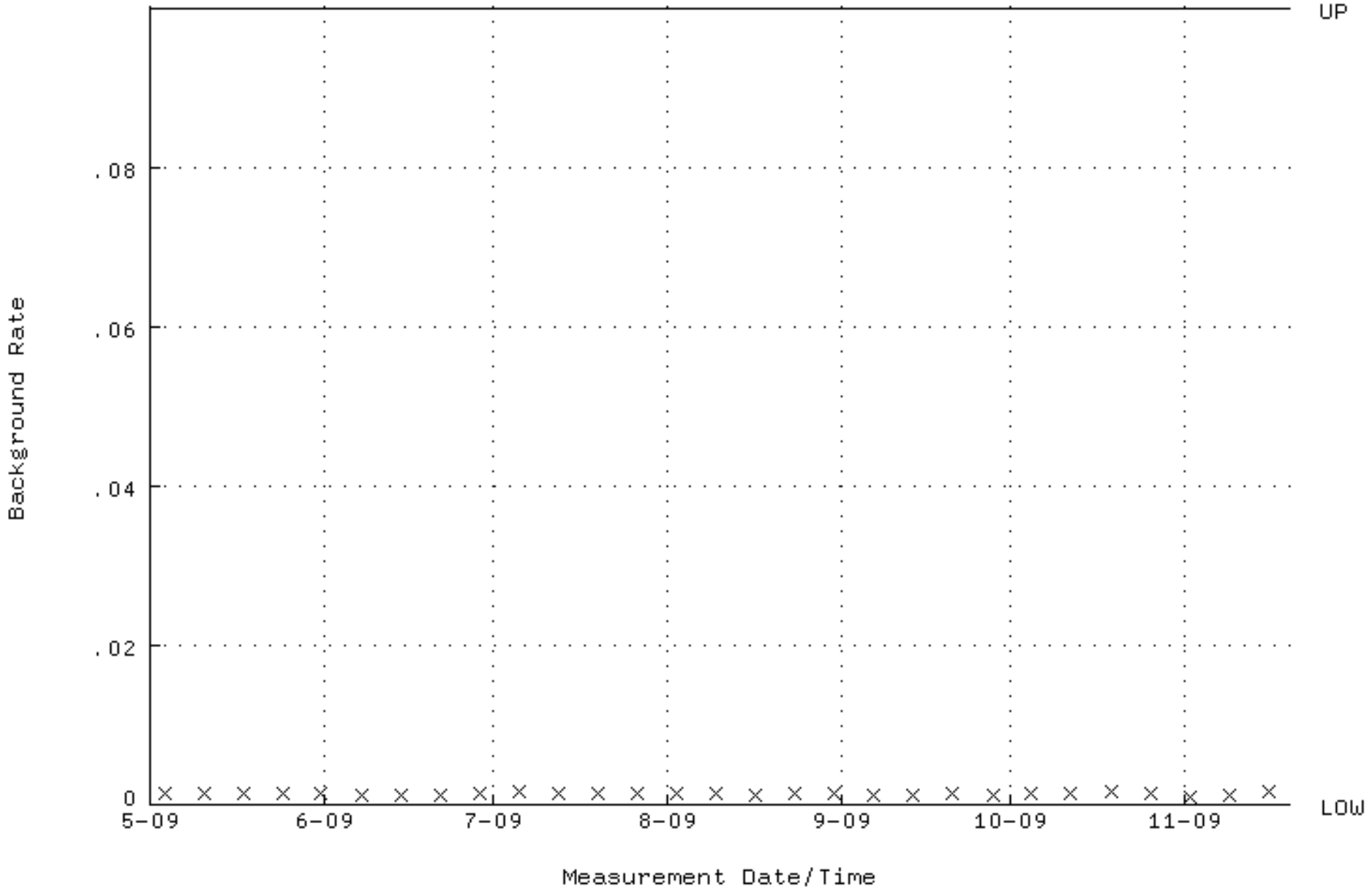
QA filename : DKA100:[ENV_ALPHA.QA.W]W138.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:46:47 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.247085 through 0.267085



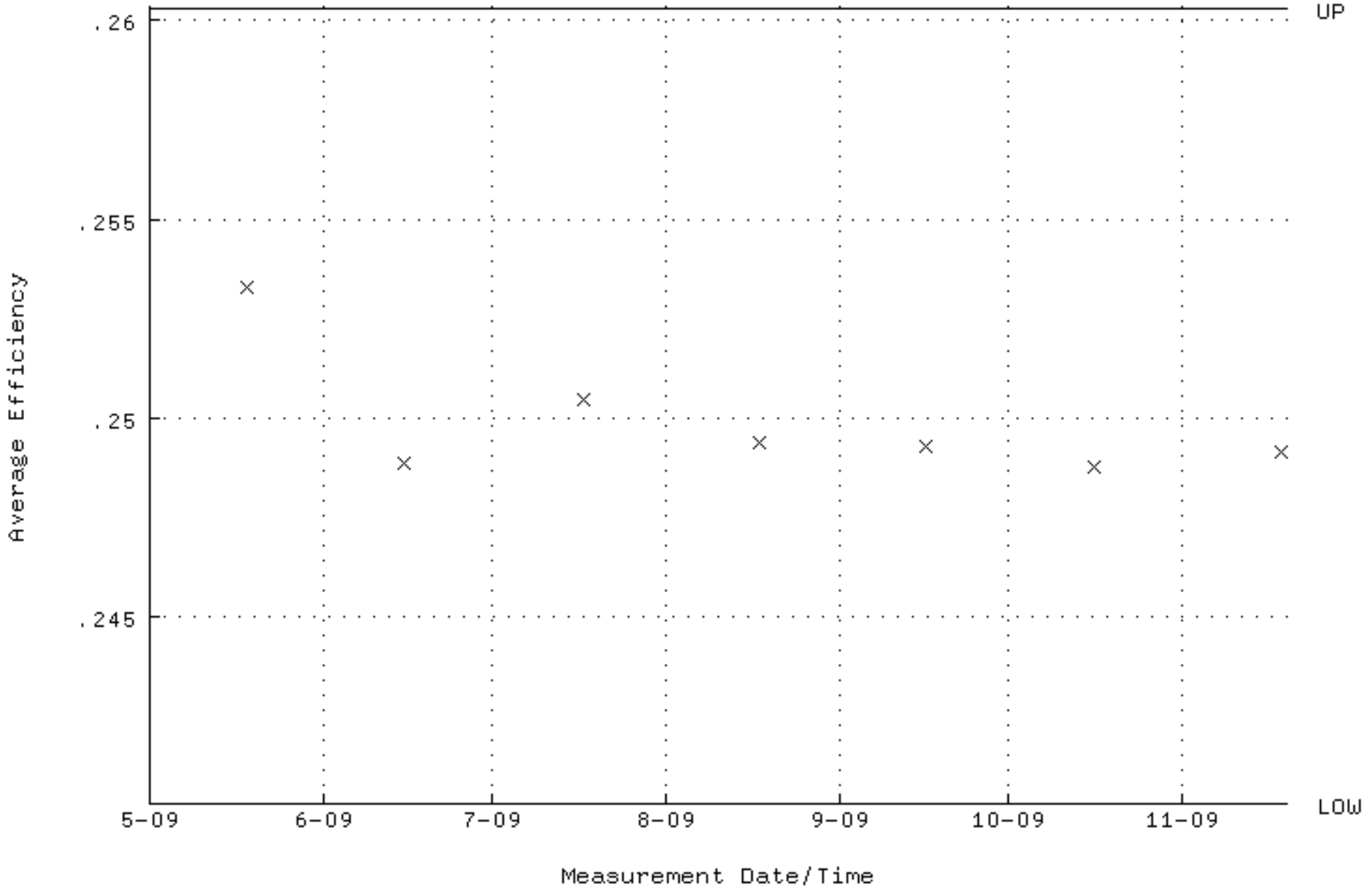
QA filename : DKA100:[ENV_ALPHA.QA.W]W138.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:46:47 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 82.8399 through 91.5599



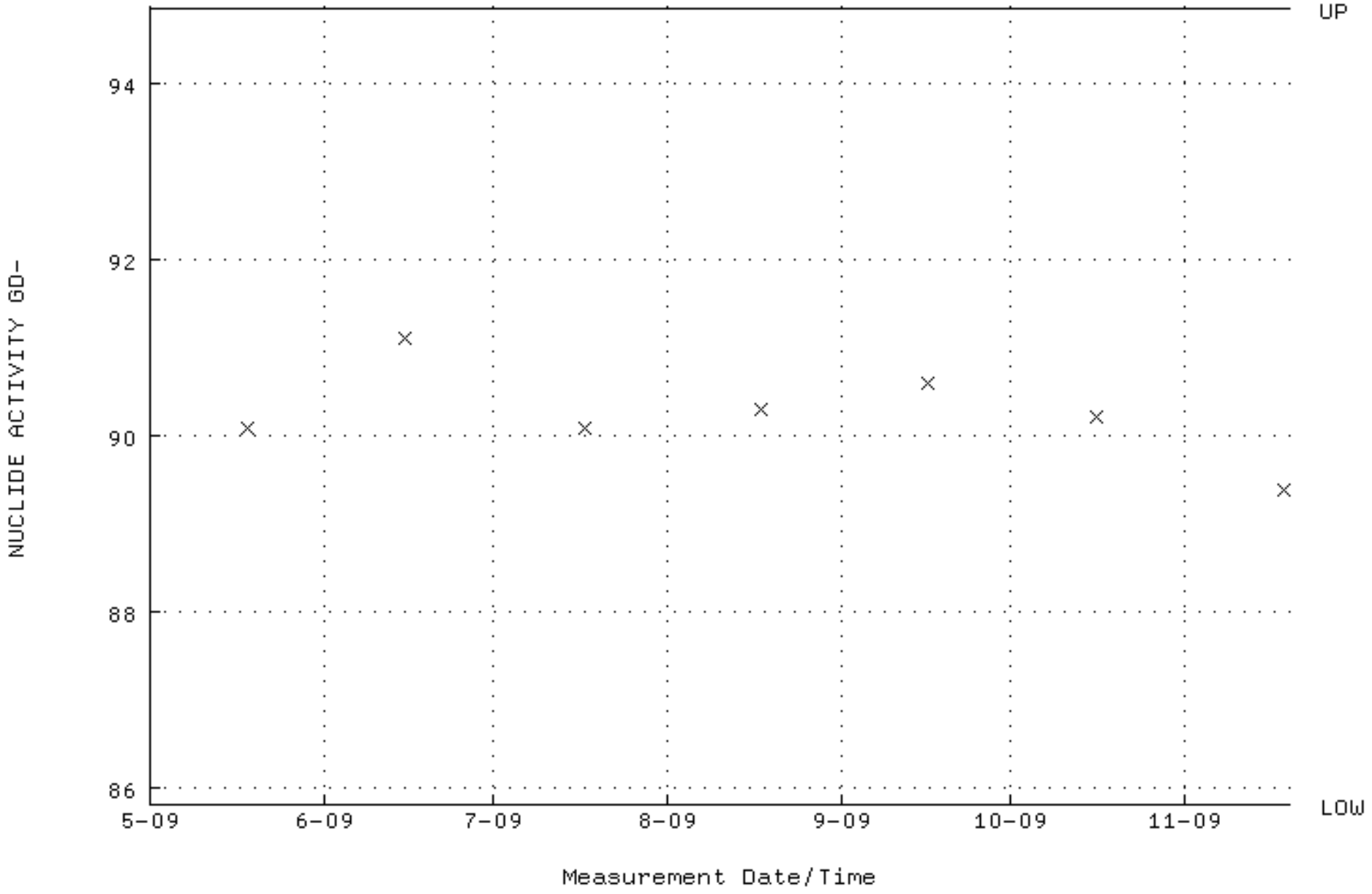
QA filename : DKA100:[ENV_ALPHA.QA.B]B138.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:51:44 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



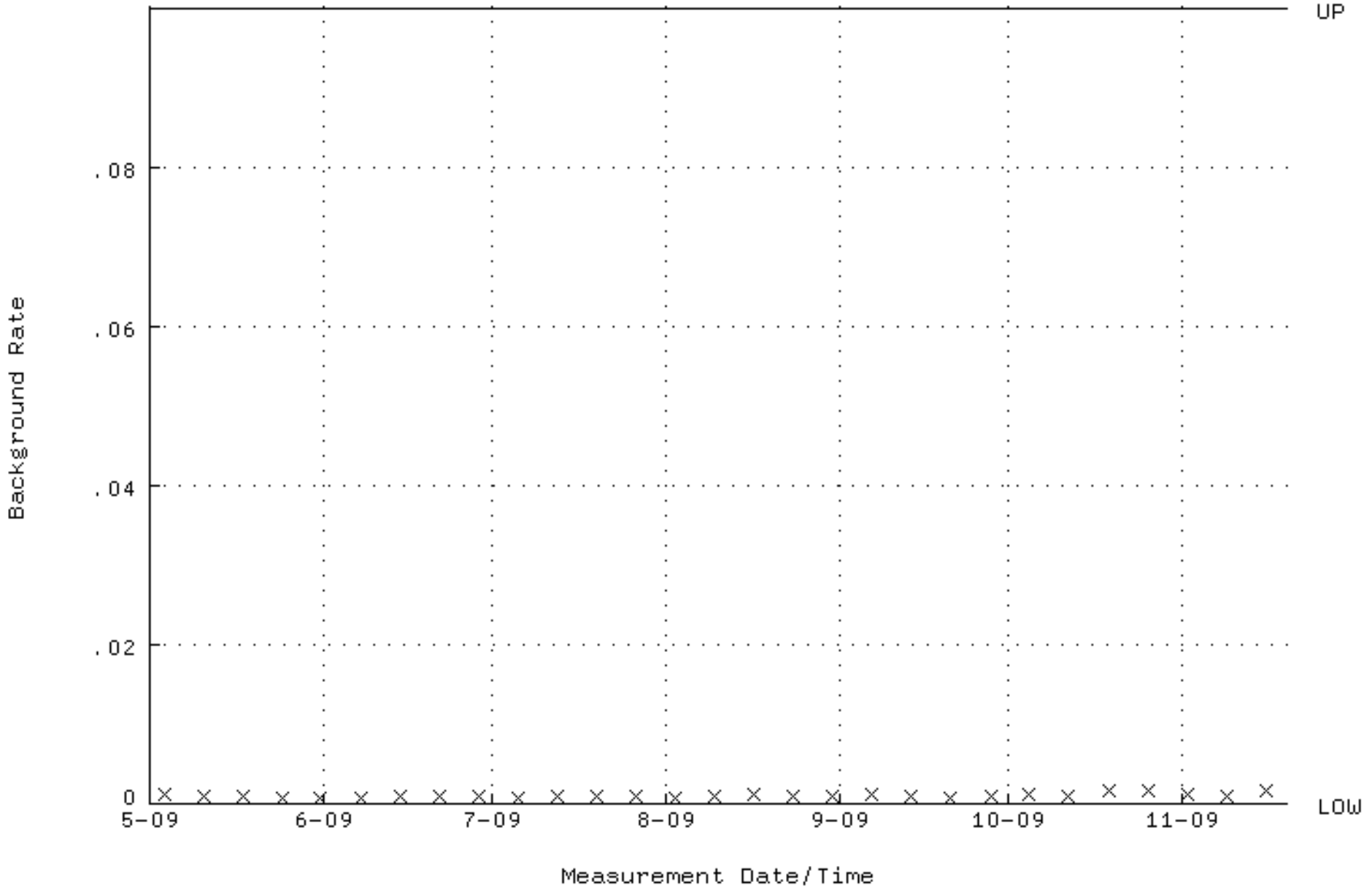
QA filename : DKA100:[ENV_ALPHA.QA.W]W139.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:46:51 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.240299 through 0.260299



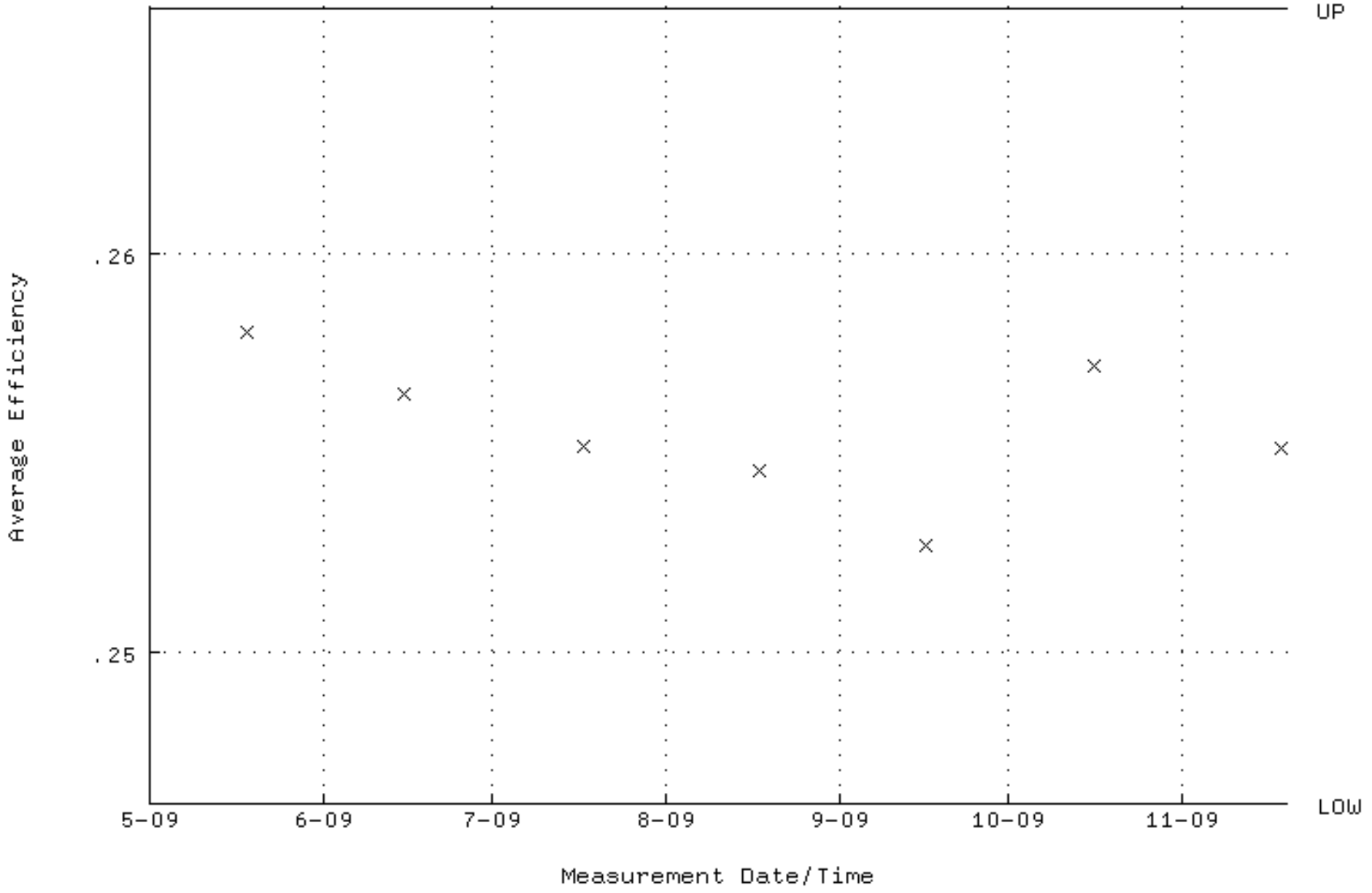
QA filename : DKA100:[ENV_ALPHA.QA.W]W139.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:46:51 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 85.8145 through 94.8477



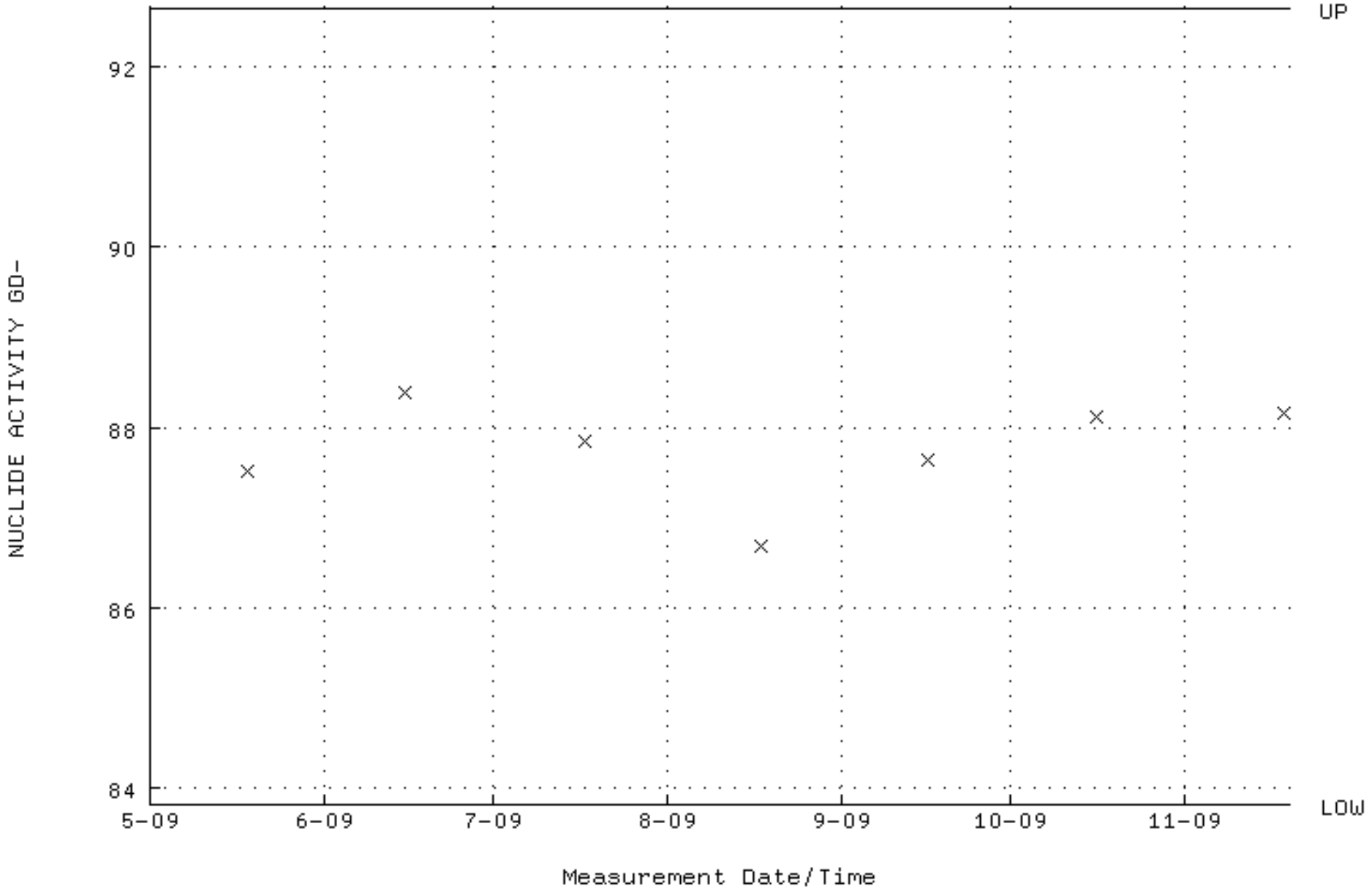
QA filename : DKA100:[ENV_ALPHA.QA.B]B139.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:51:49 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



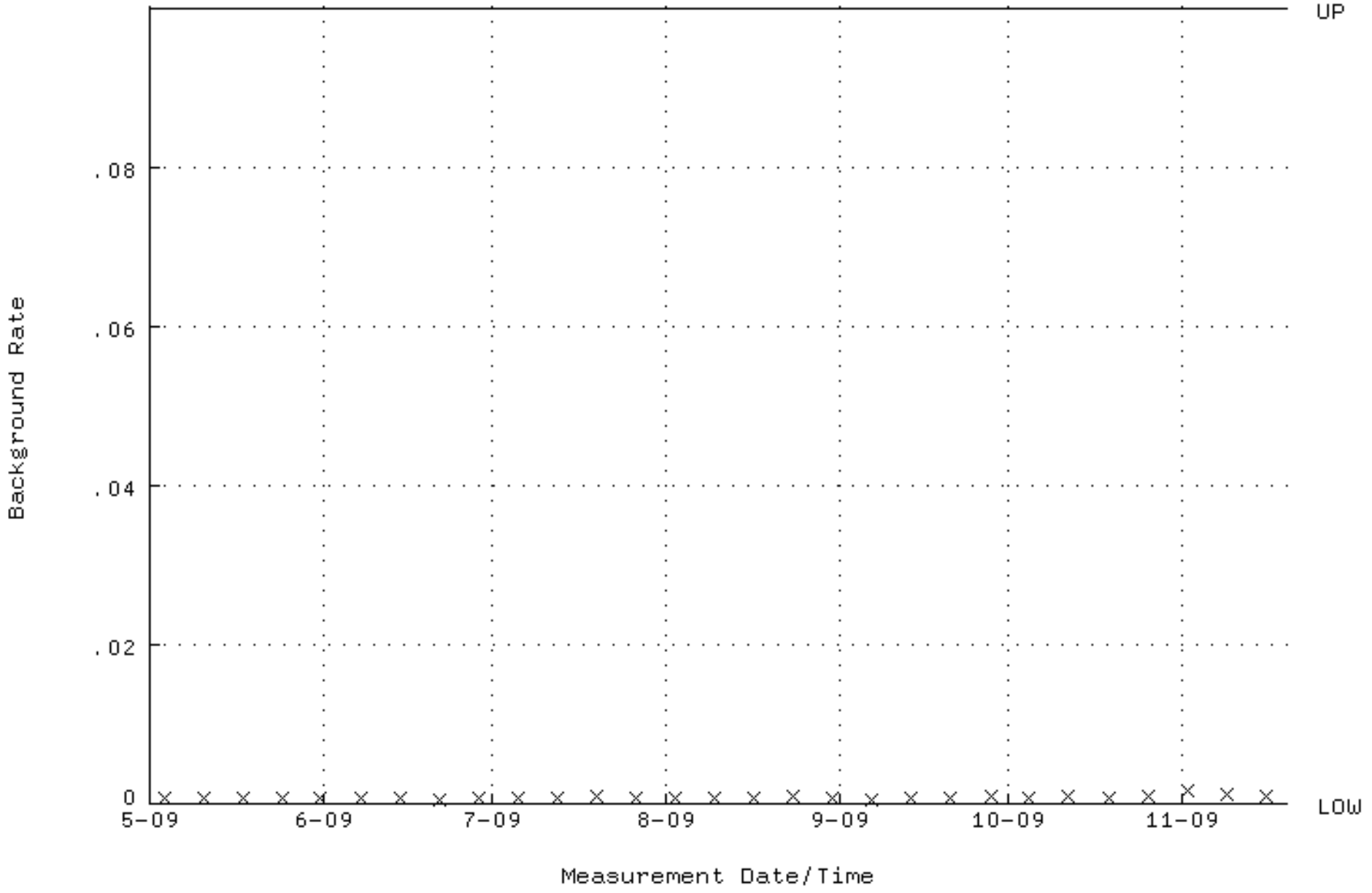
QA filename : DKA100:[ENV_ALPHA.QA.W]W140.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:46:56 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.246178 through 0.266178



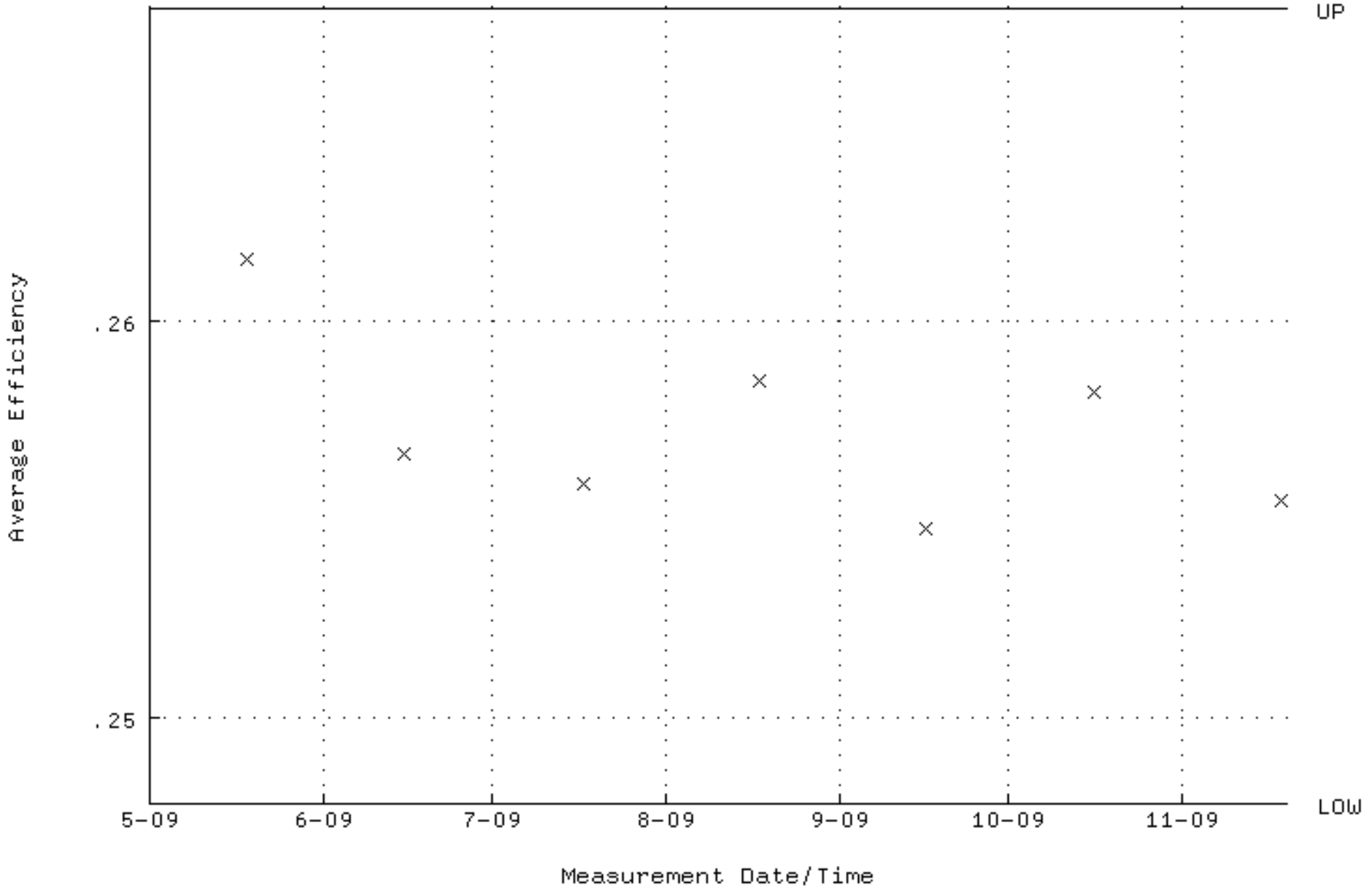
QA filename : DKA100:[ENV_ALPHA.QA.W]W140.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:46:56 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 83.8171 through 92.6399



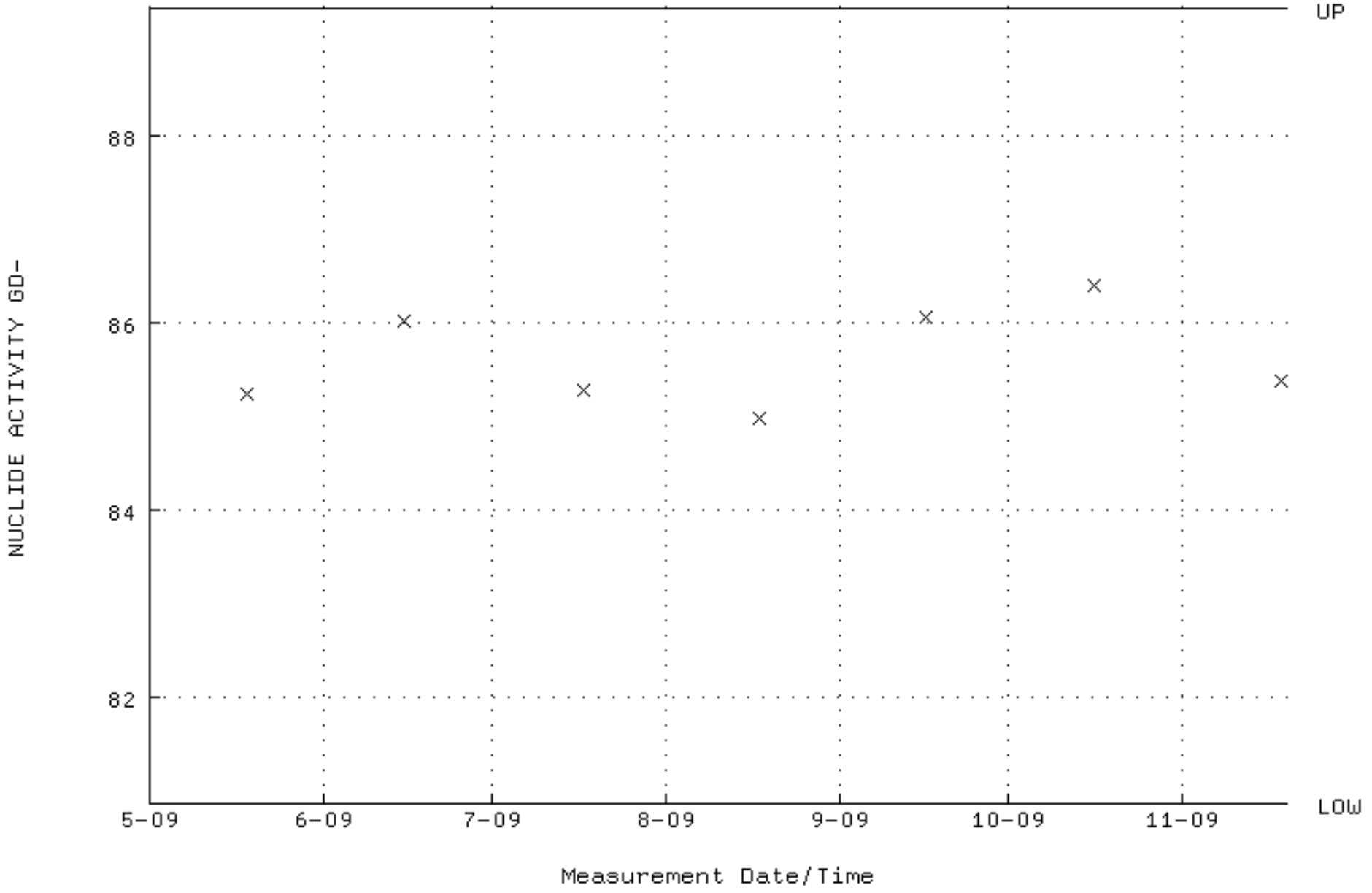
QA filename : DKA100:[ENV_ALPHA.QA.B]B140.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:51:53 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



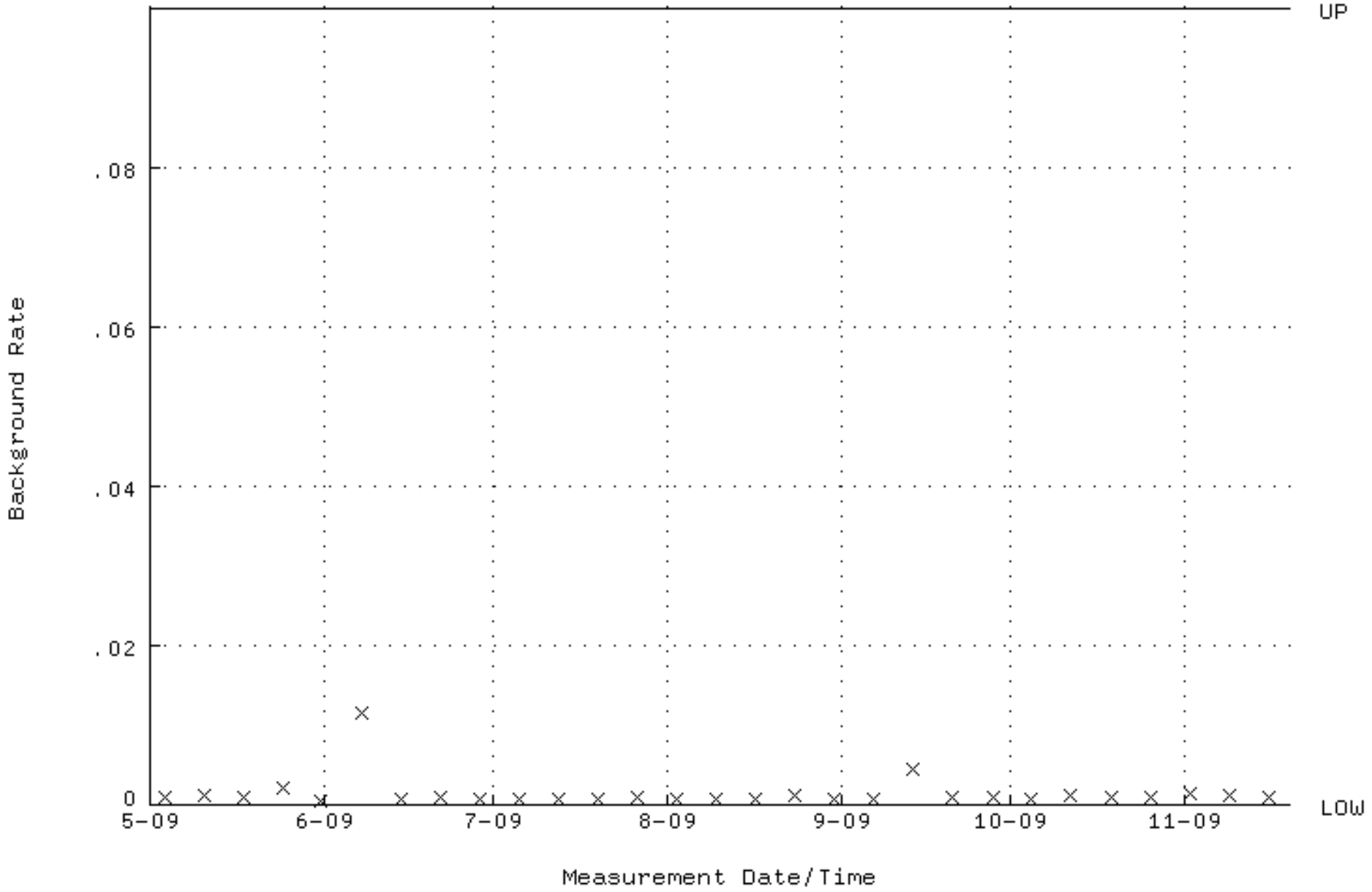
QA filename : DKA100:[ENV_ALPHA.QA.W]W141.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:00 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.247845 through 0.267845



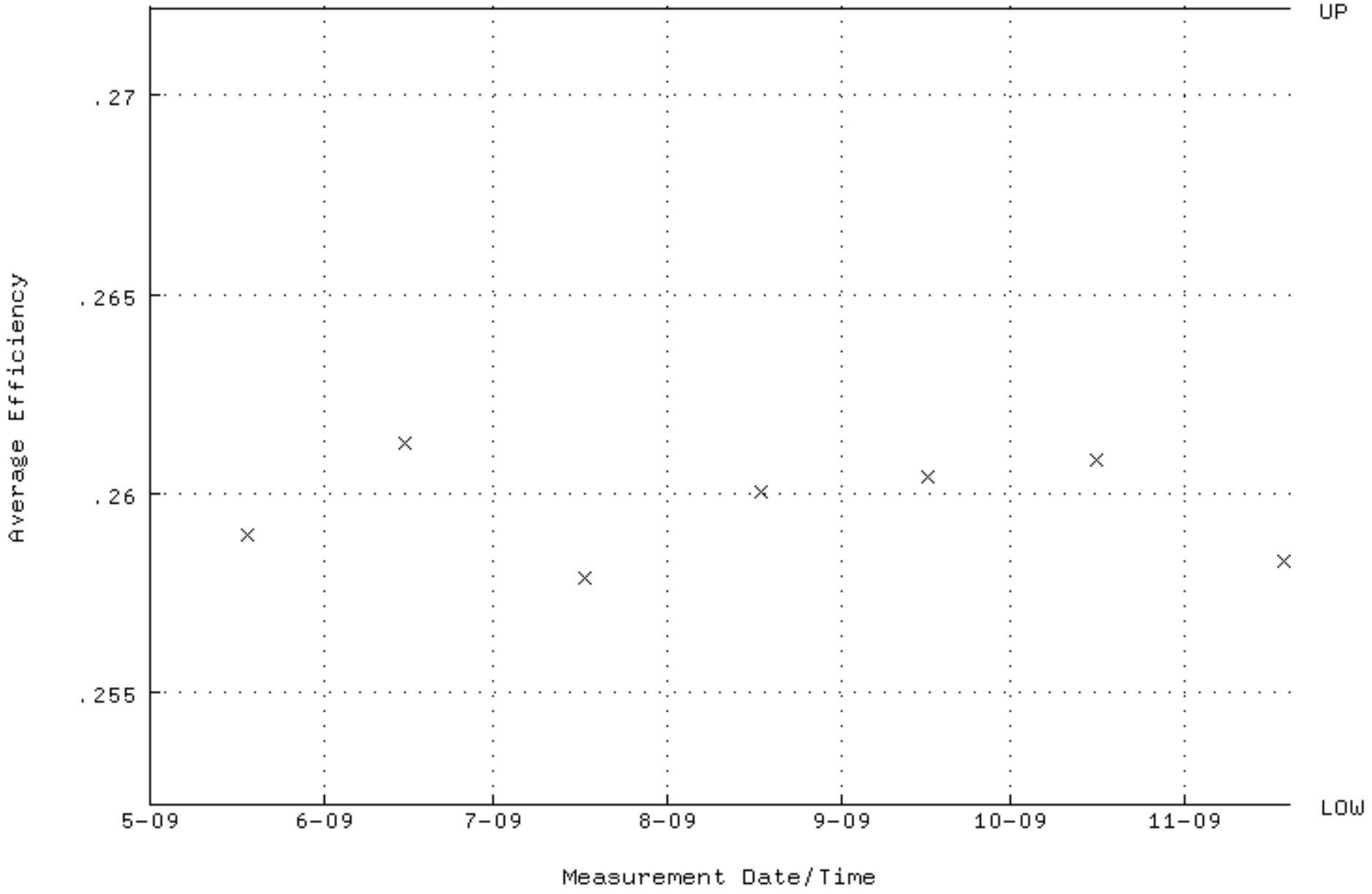
QA filename : DKA100:[ENV_ALPHA.QA.W]W141.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:00 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 80.8595 through 89.3711



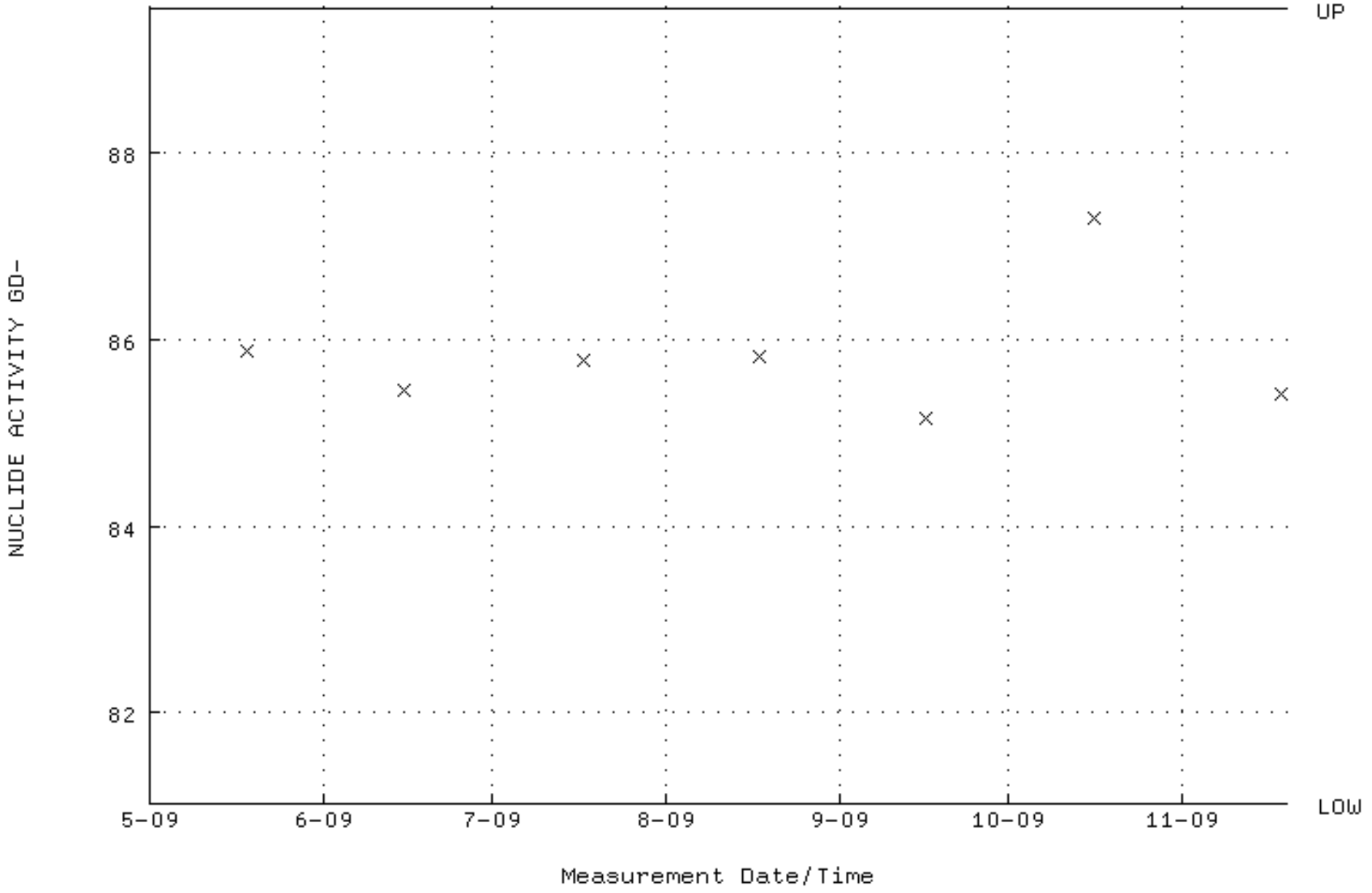
QA filename : DKA100:[ENV_ALPHA.QA.B]B141.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:51:57 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



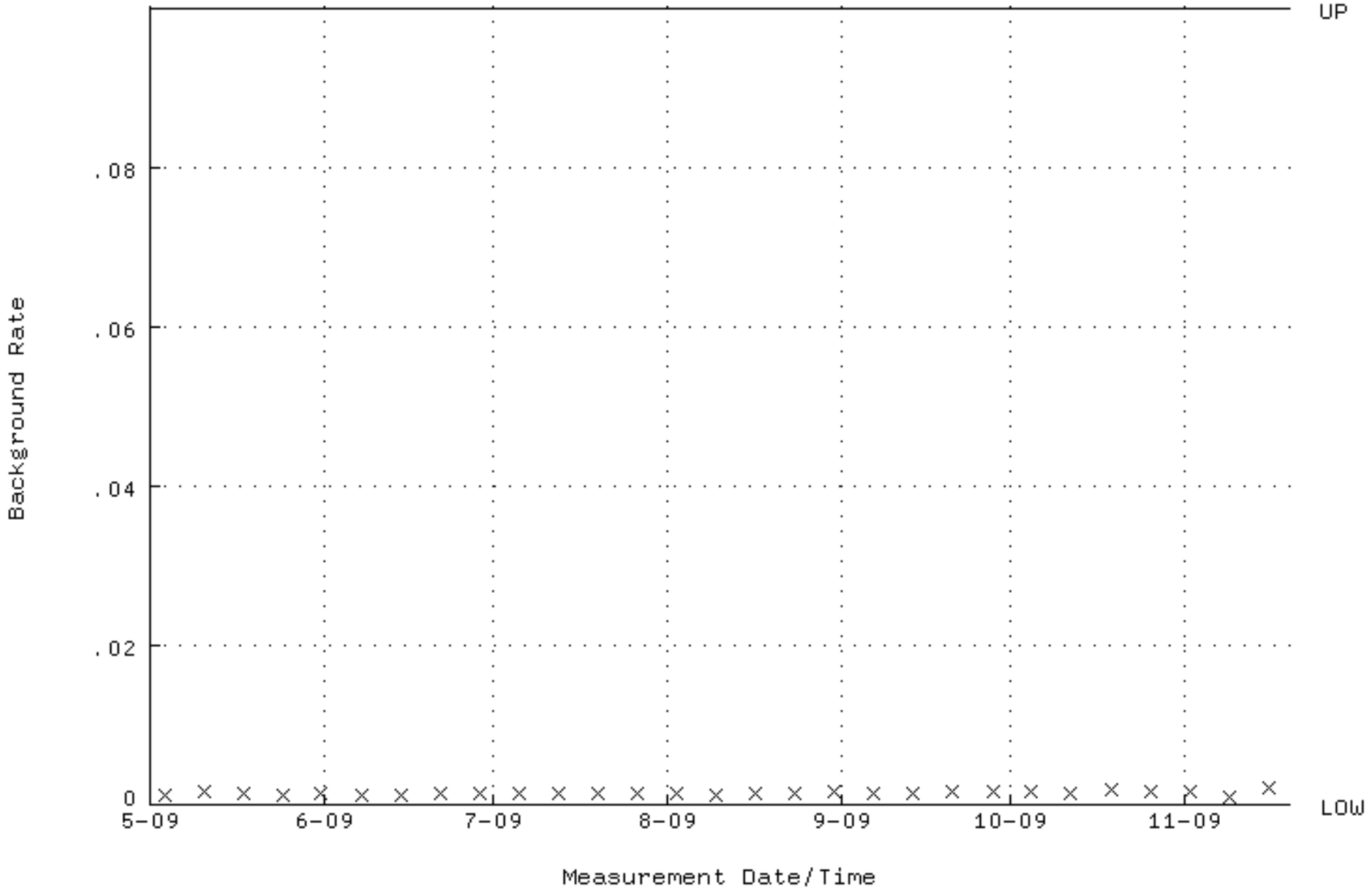
QA filename : DKA100:[ENV_ALPHA.QA.W]W142.QAF;2
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:04 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.252182 through 0.272182



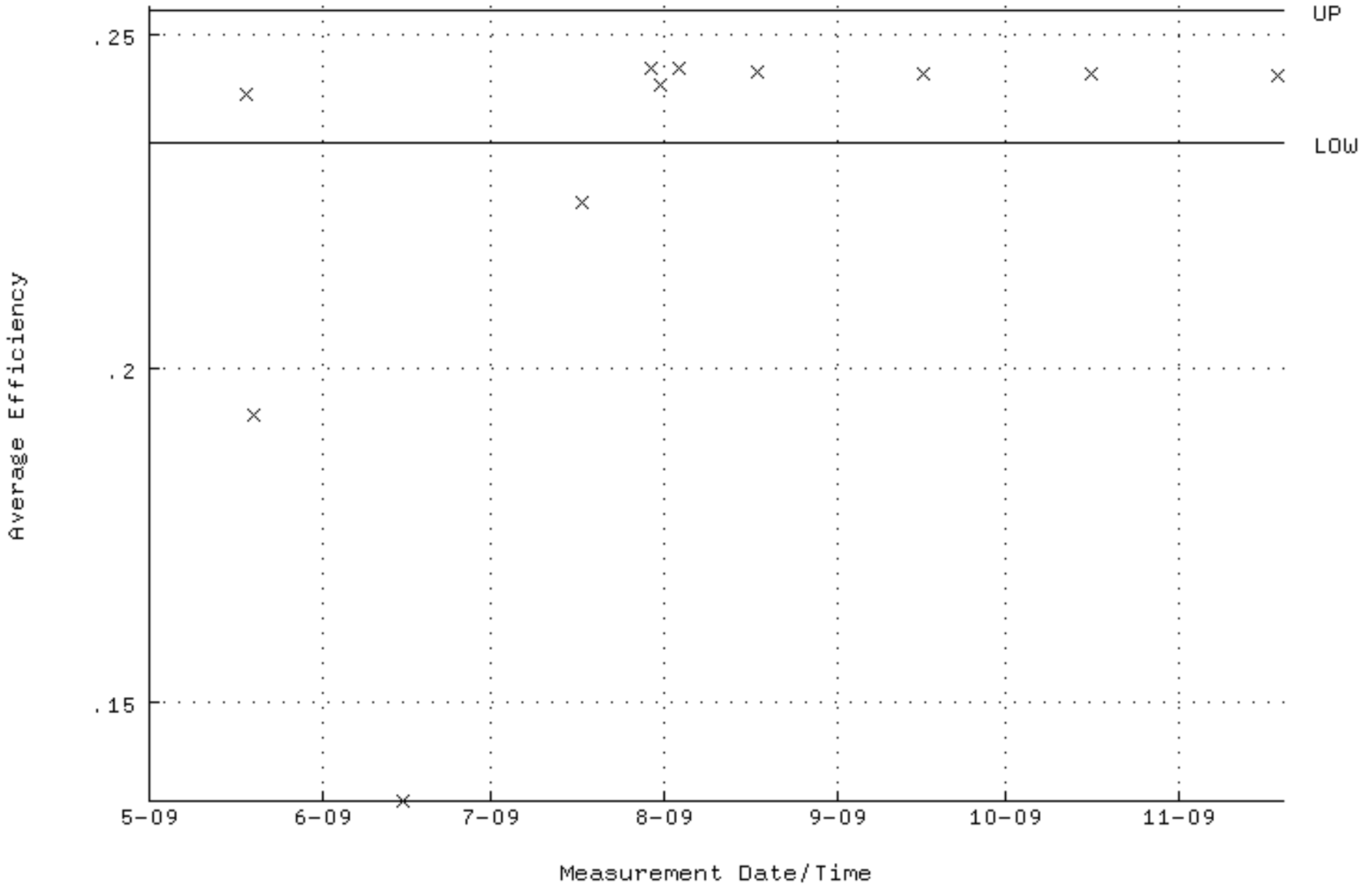
QA filename : DKA100:[ENV_ALPHA.QA.W]W142.QAF;2
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:04 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 81.0245 through 89.5533



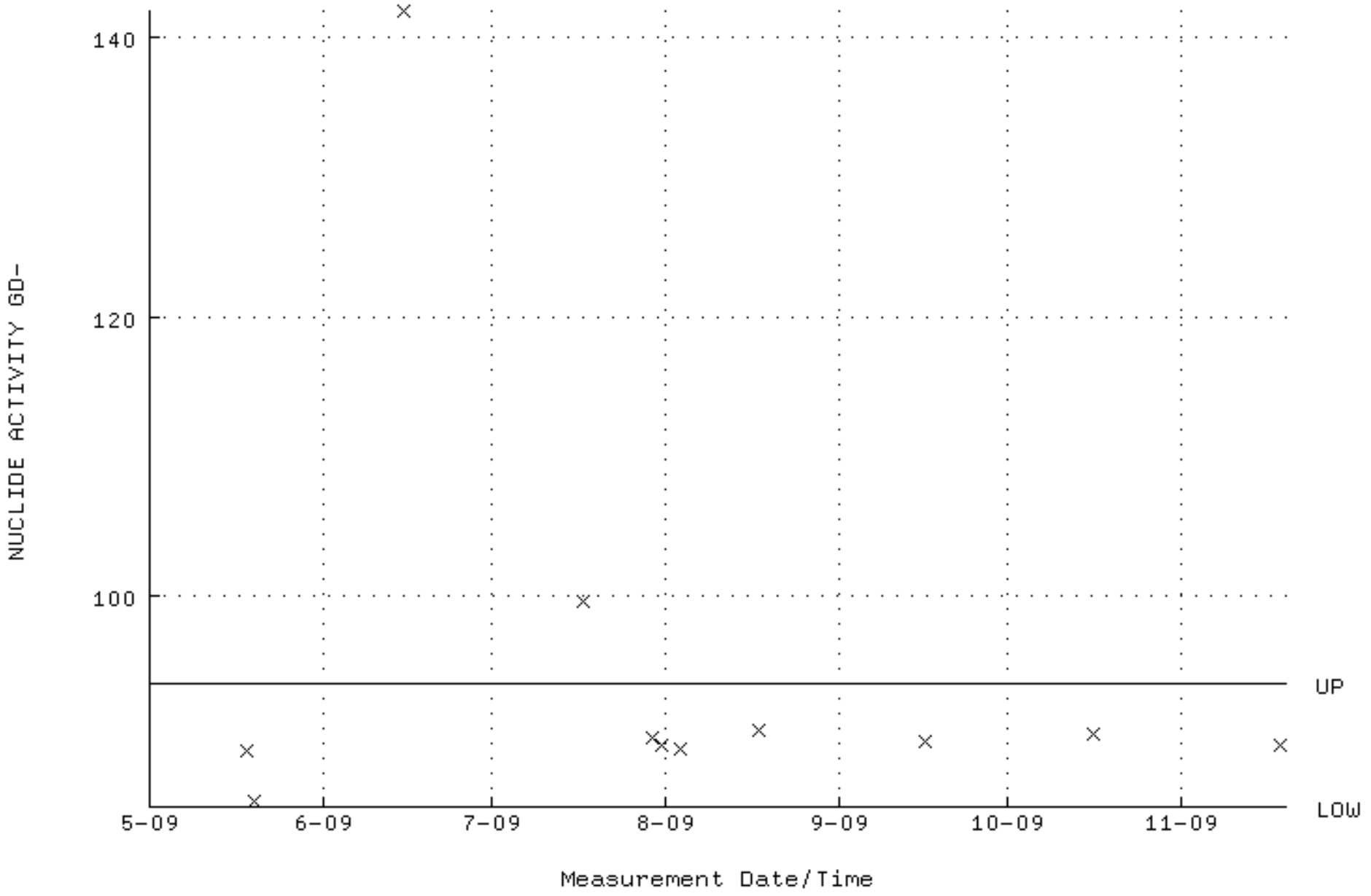
QA filename : DKA100:[ENV_ALPHA.QA.B]B142.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:01 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



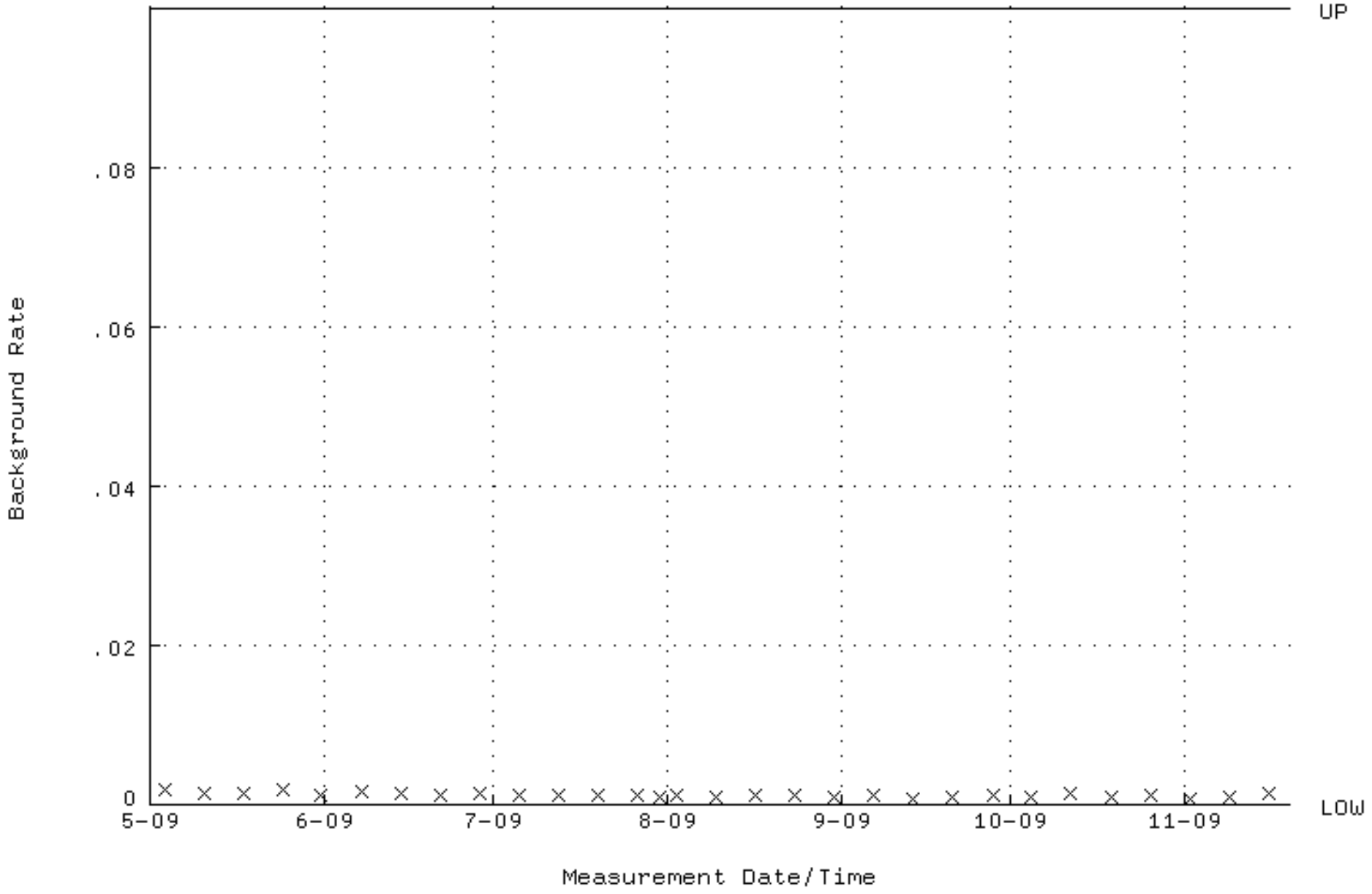
QA filename : DKA100:[ENV_ALPHA.QA.W]W143.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:09 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.233879 through 0.253879



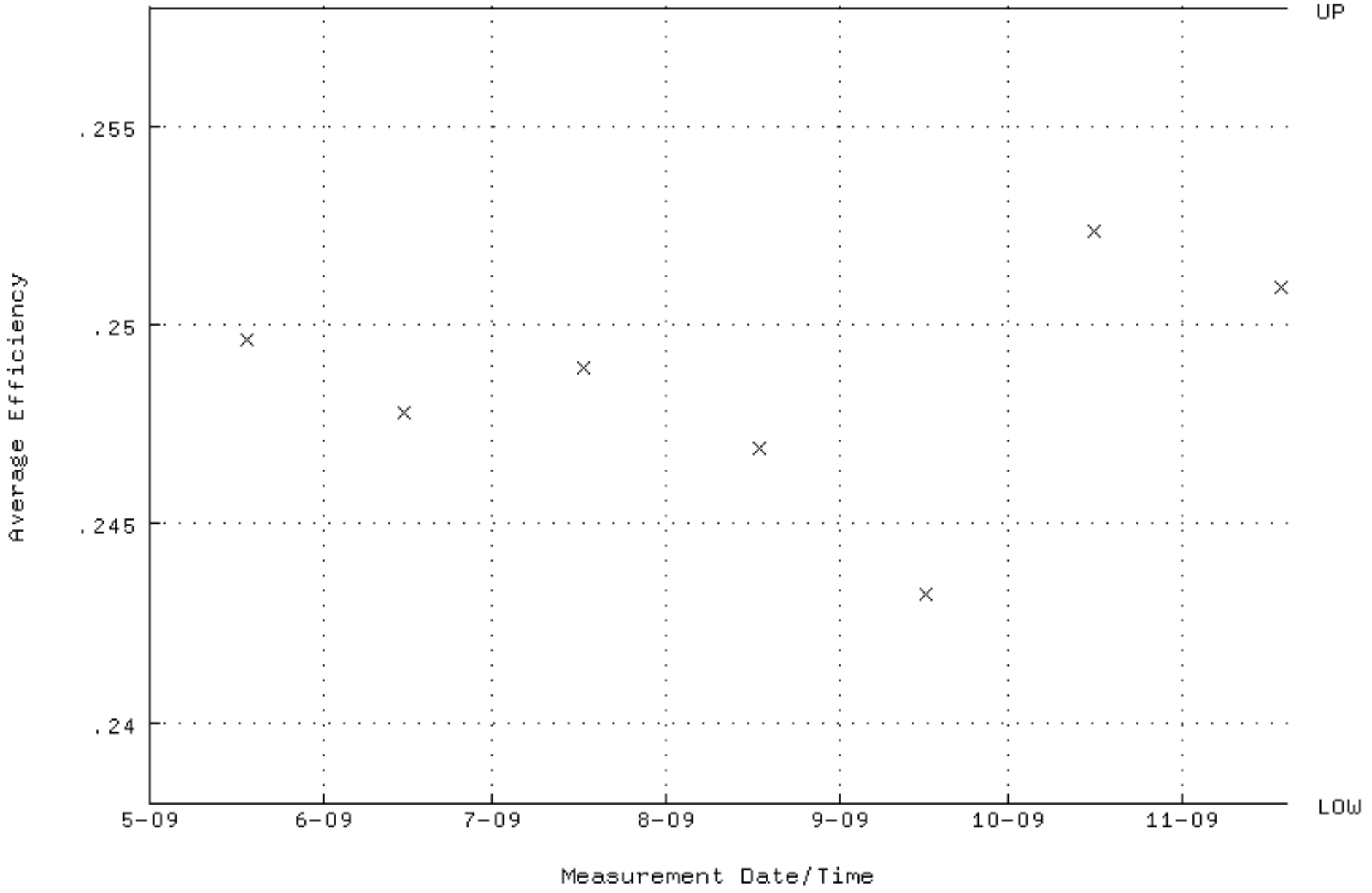
QA filename : DKA100:[ENV_ALPHA.QA.W]W143.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:09 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 84.9200 through 93.8590



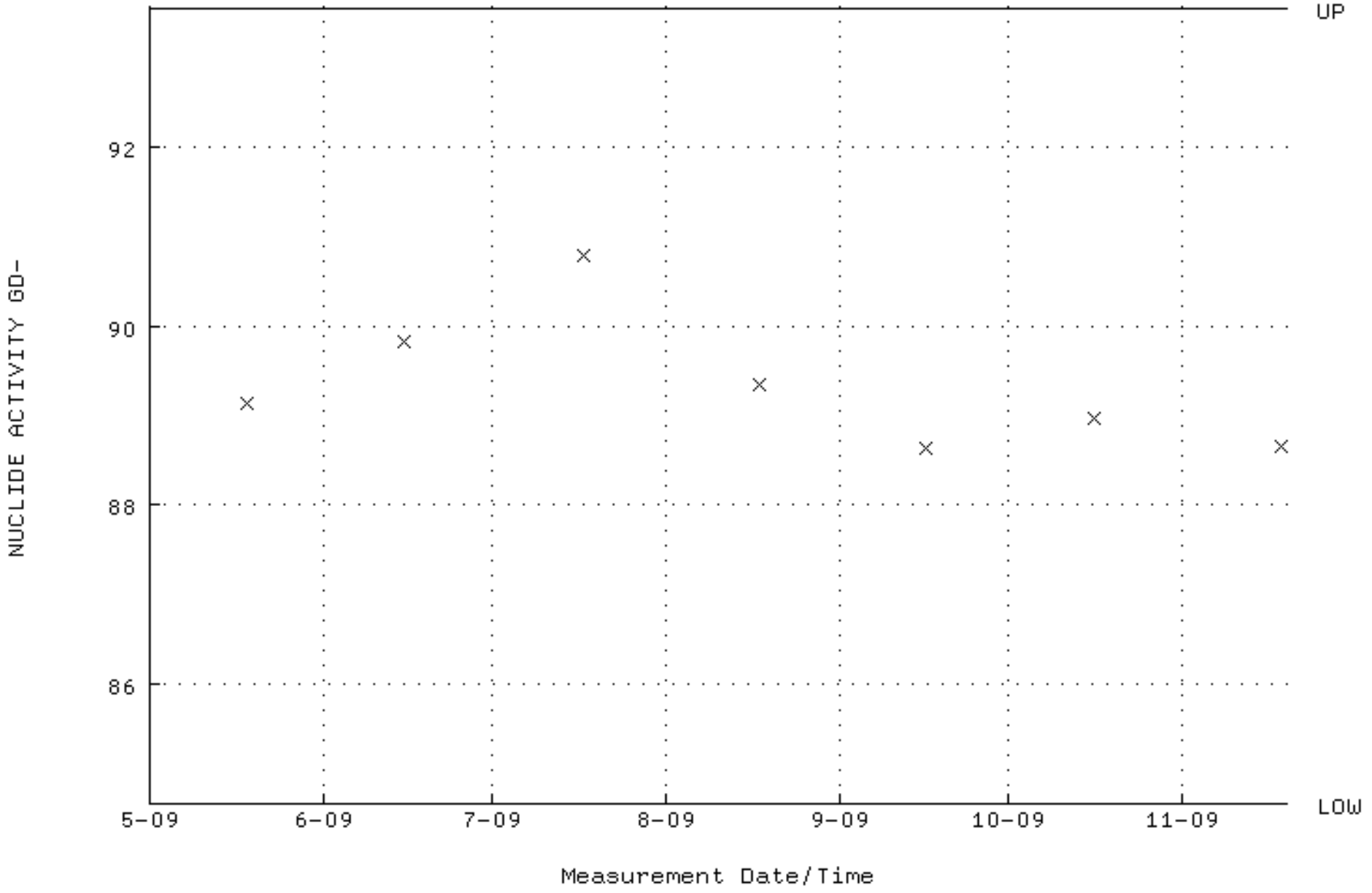
QA filename : DKA100:[ENV_ALPHA.QA.B]B143.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:05 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



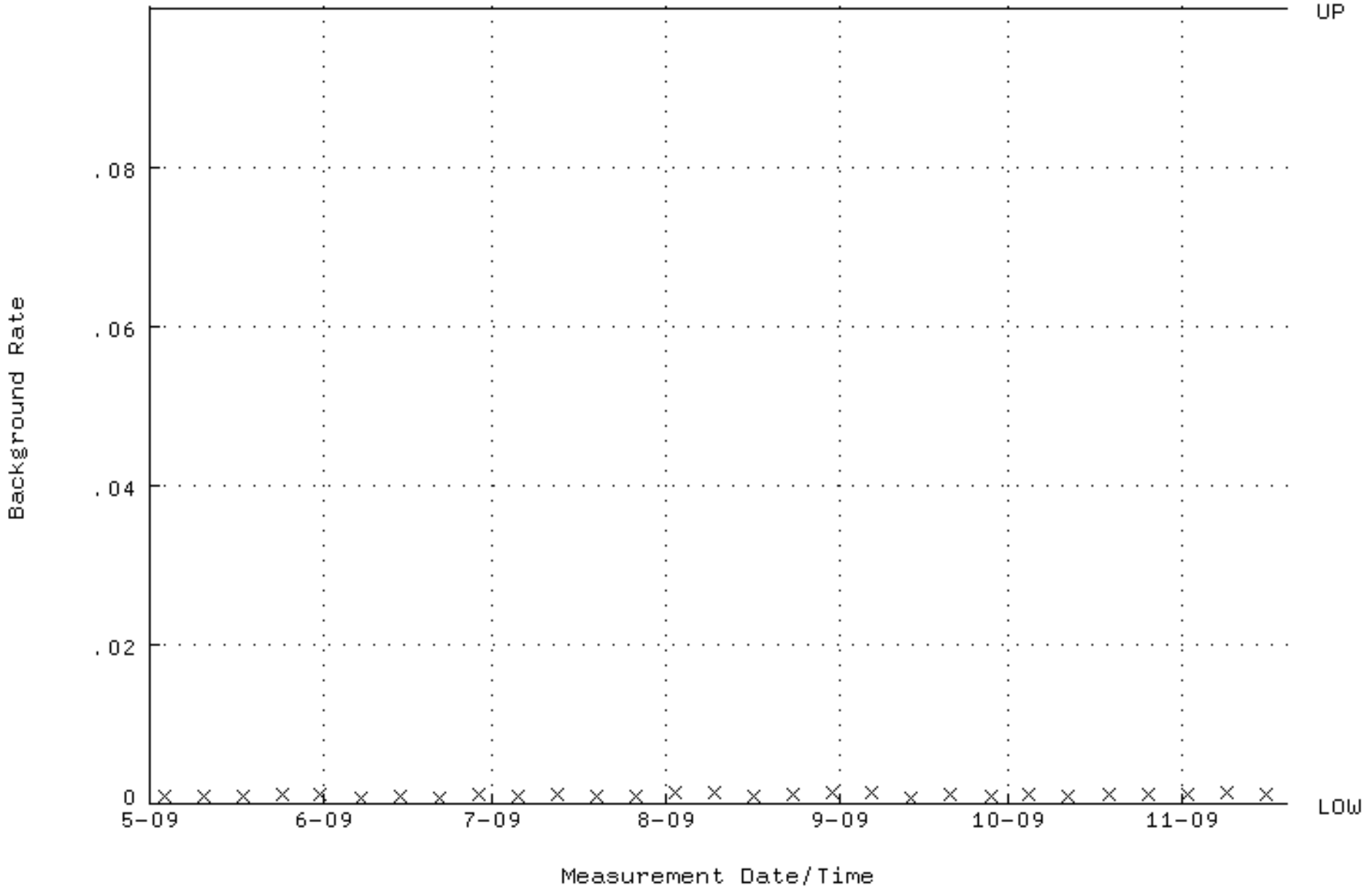
QA filename : DKA100:[ENV_ALPHA.QA.W]W144.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:13 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.237963 through 0.257963



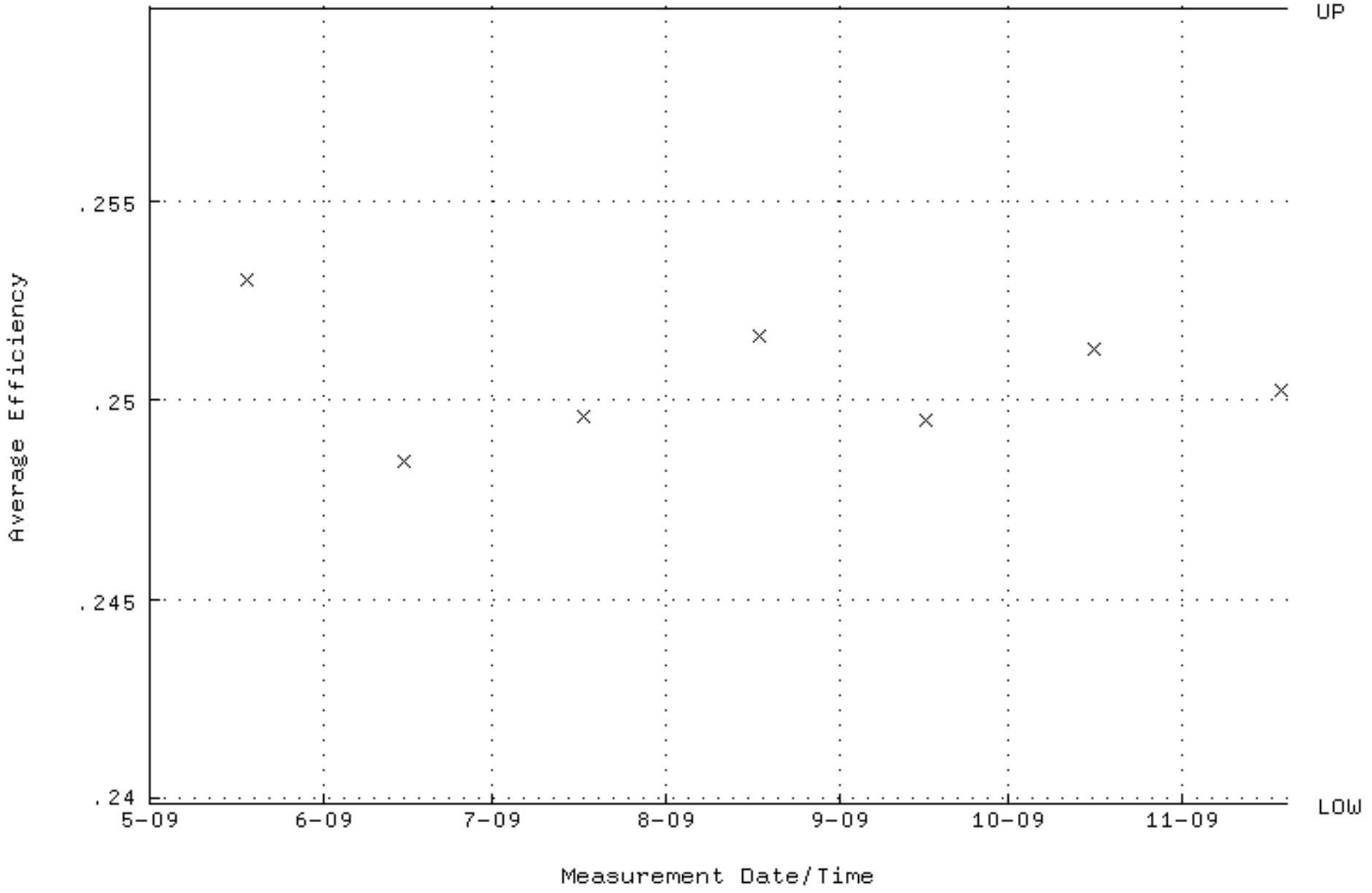
QA filename : DKA100:[ENV_ALPHA.QA.W]W144.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:13 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 84.6507 through 93.5613



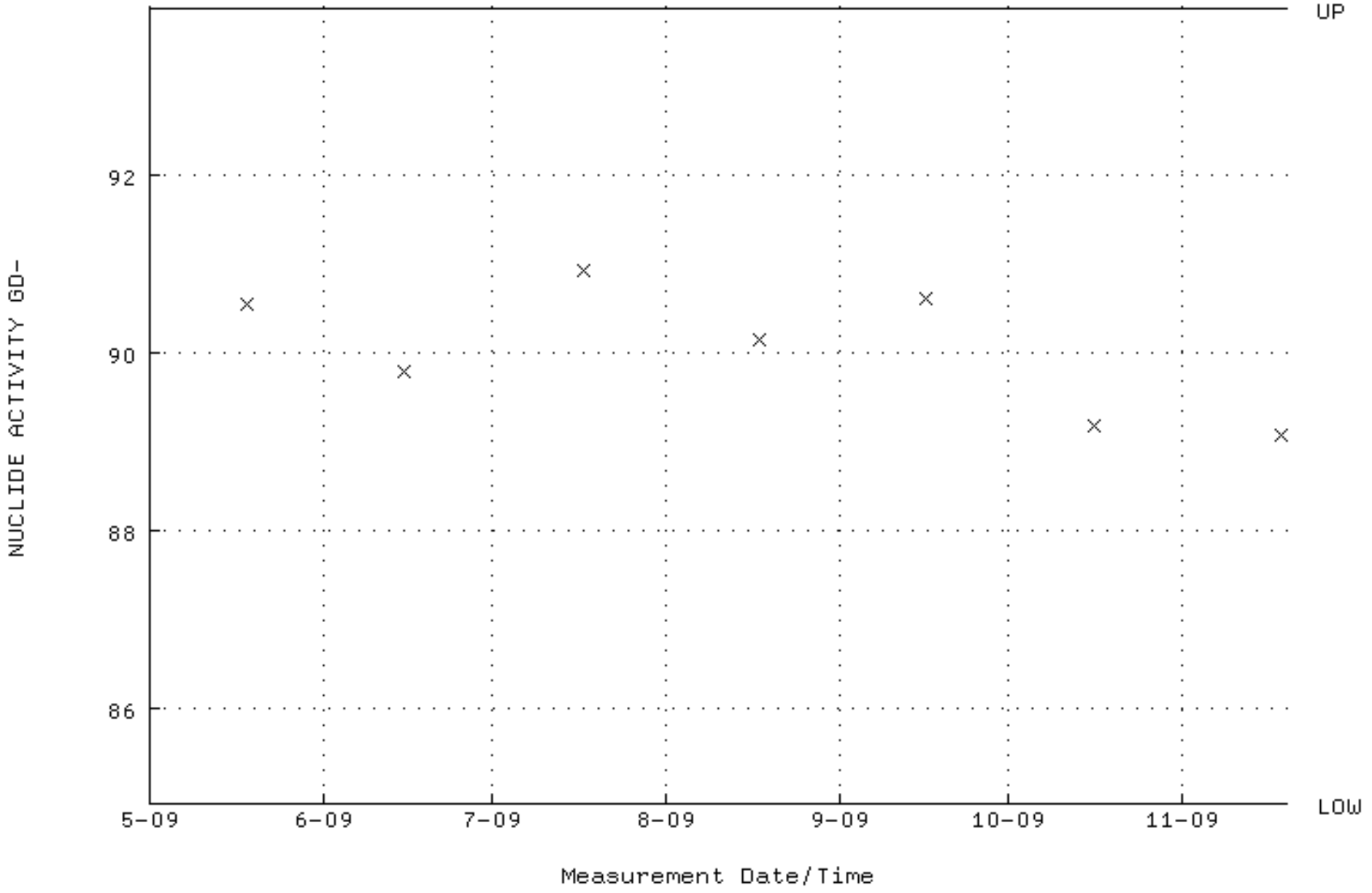
QA filename : DKA100:[ENV_ALPHA.QA.B]B144.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:10 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



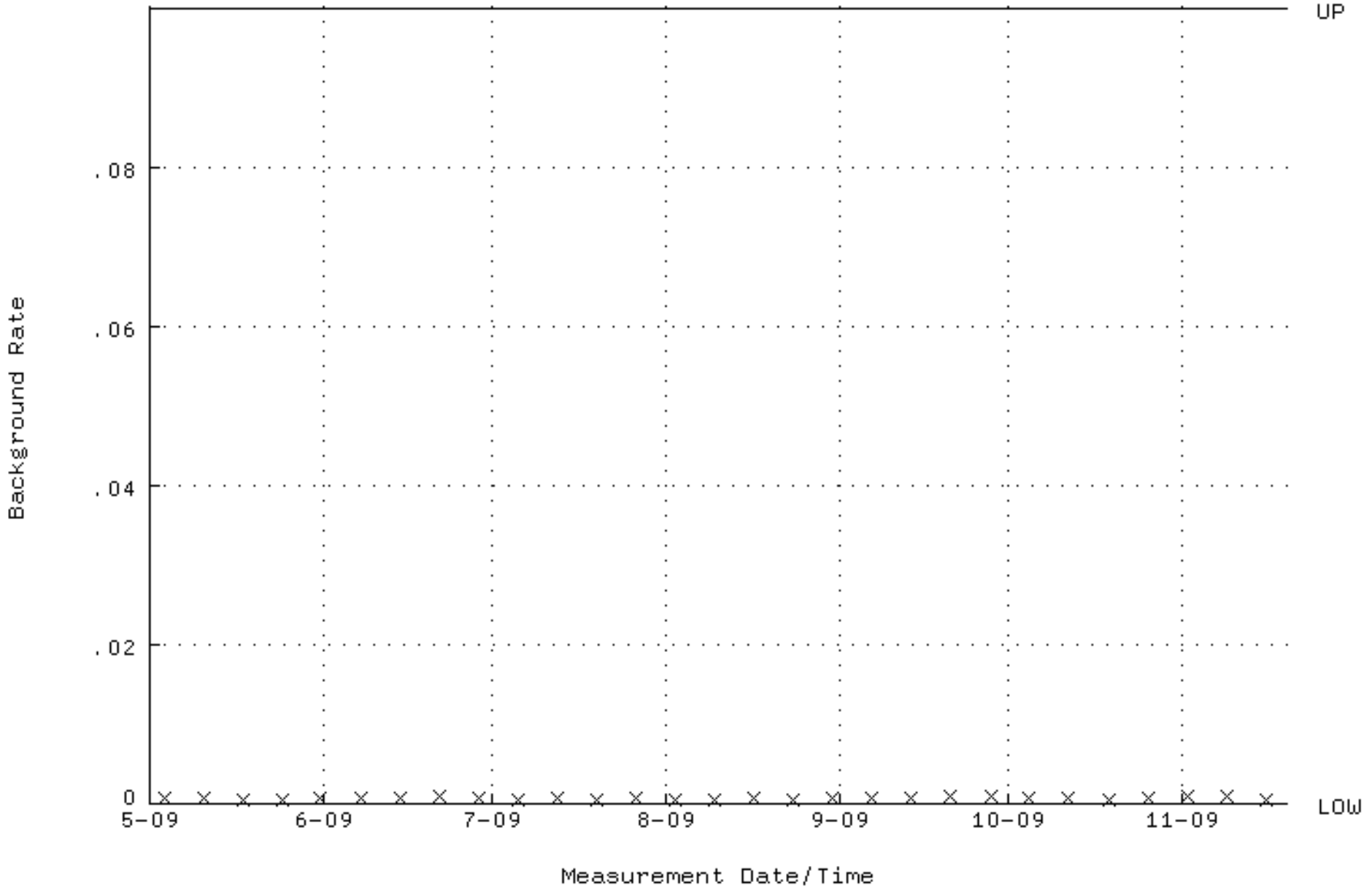
QA filename : DKA100:[ENV_ALPHA.QA.W]W145.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:17 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.239850 through 0.259850



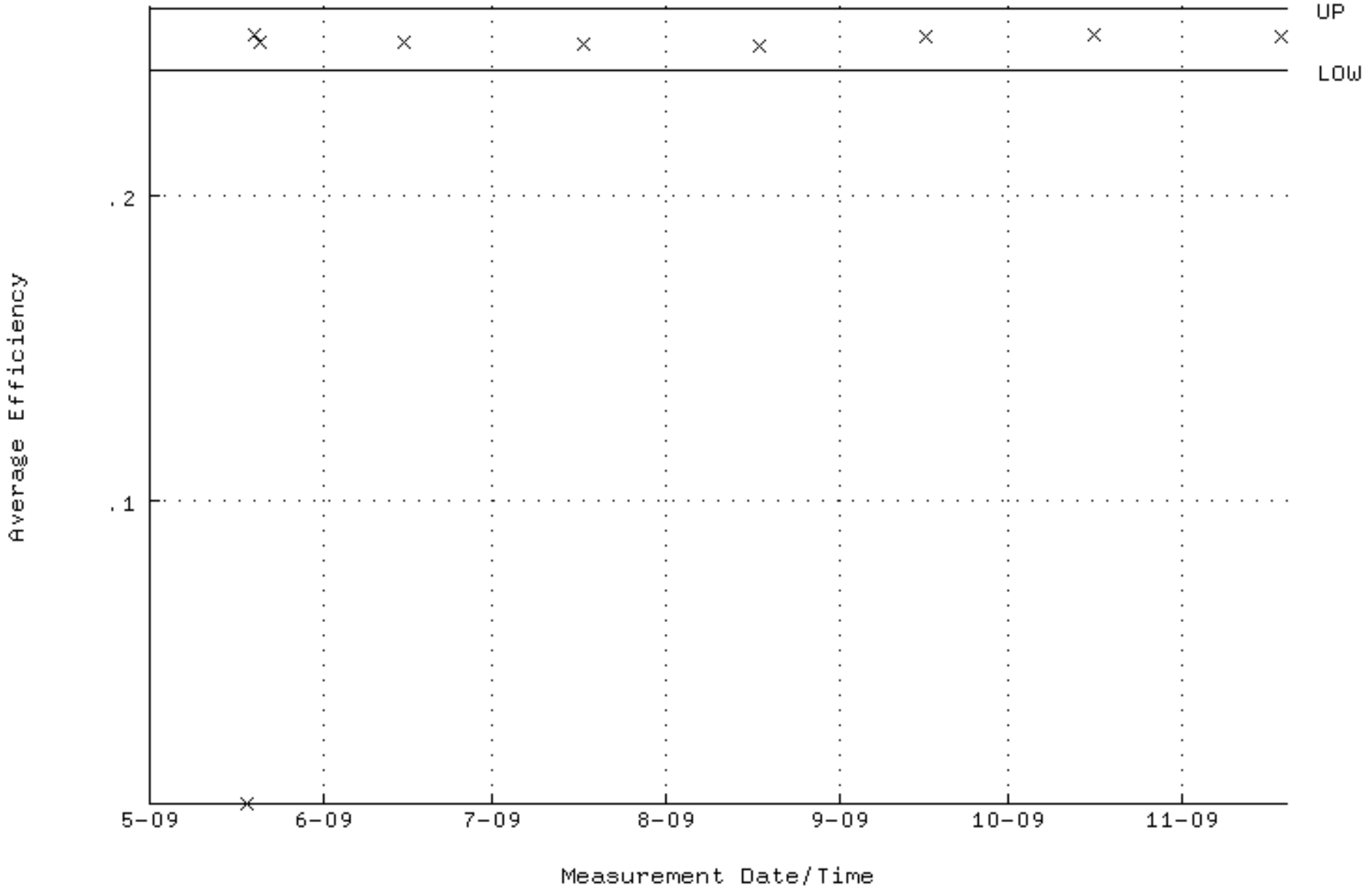
QA filename : DKA100:[ENV_ALPHA.QA.W]W145.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:17 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 84.9354 through 93.8760



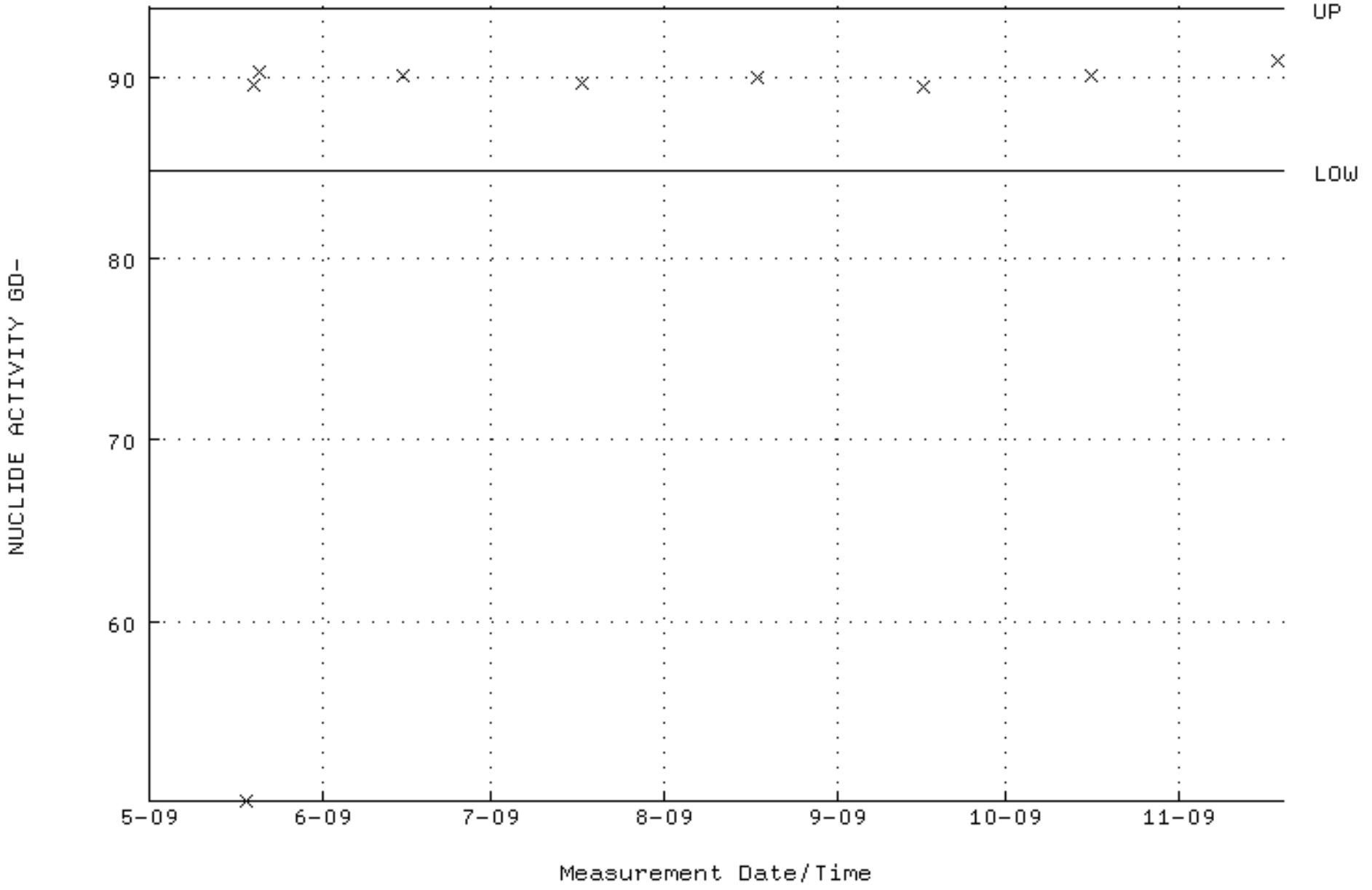
QA filename : DKA100:[ENV_ALPHA.QA.B]B145.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:14 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



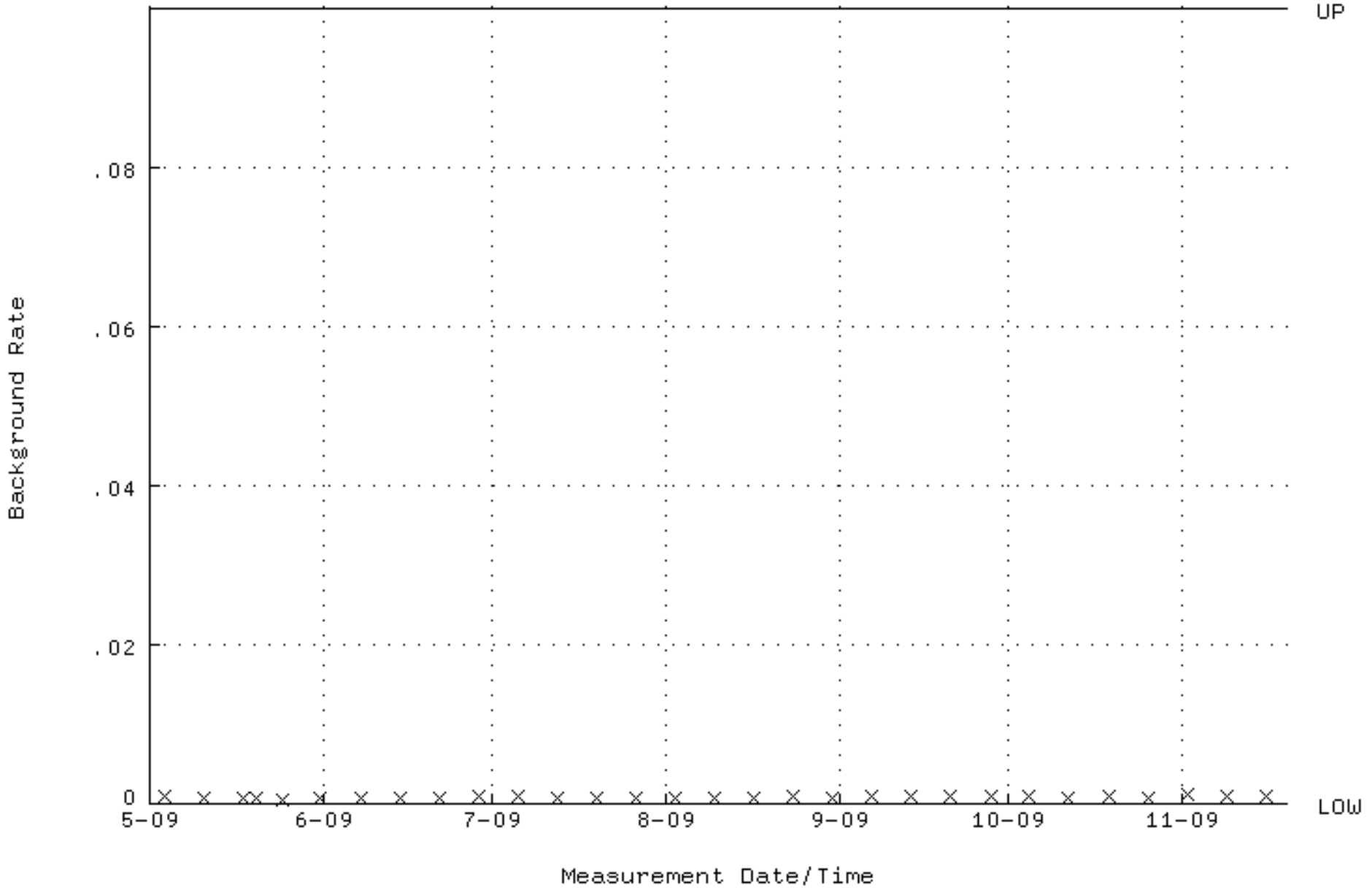
QA filename : DKA100:[ENV_ALPHA.QA.W]W146.QAF;2
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:22 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.241831 through 0.261831



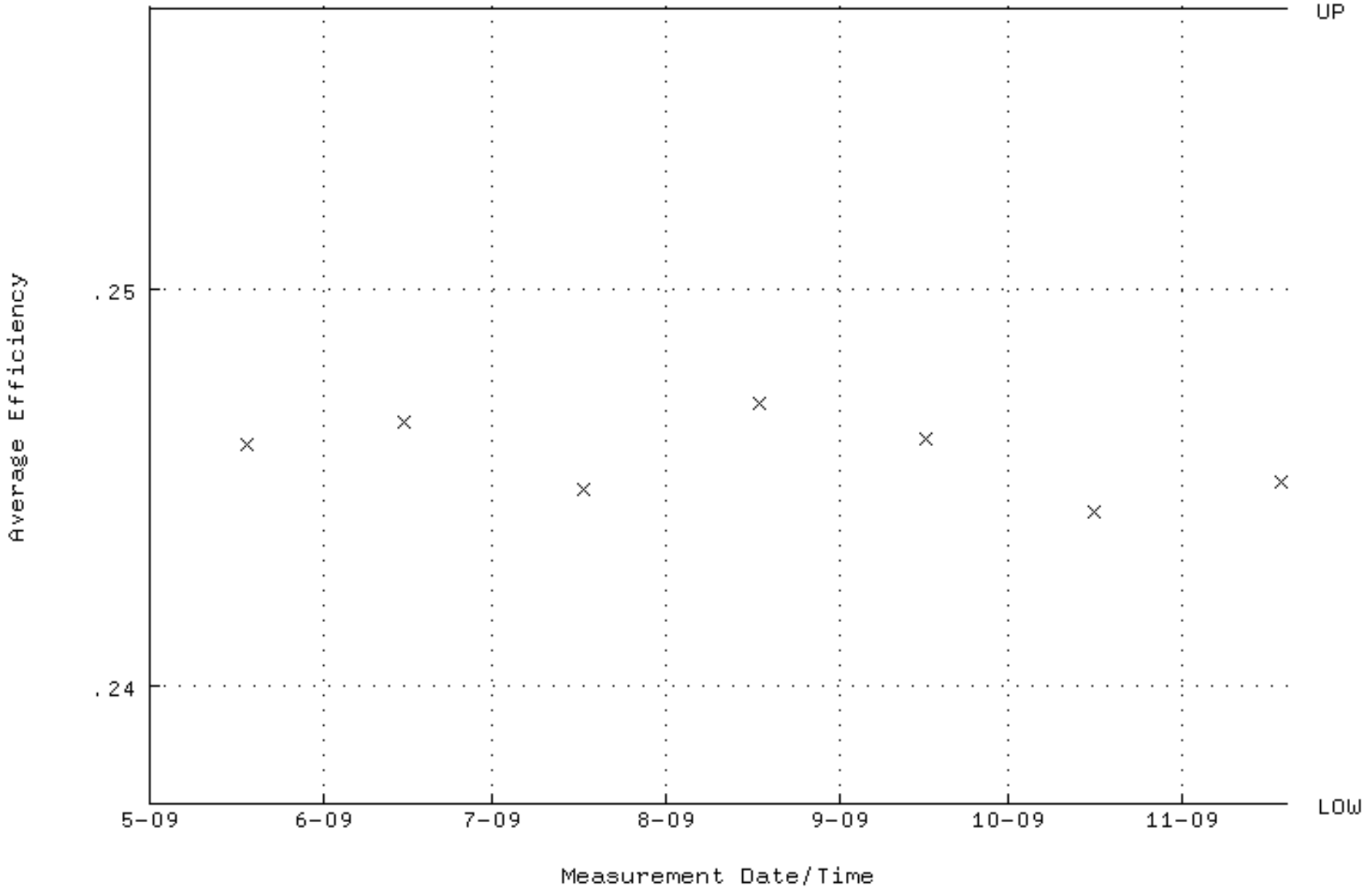
QA filename : DKA100:[ENV_ALPHA.QA.W]W146.QAF;2
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:22 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 84.8578 through 93.7902



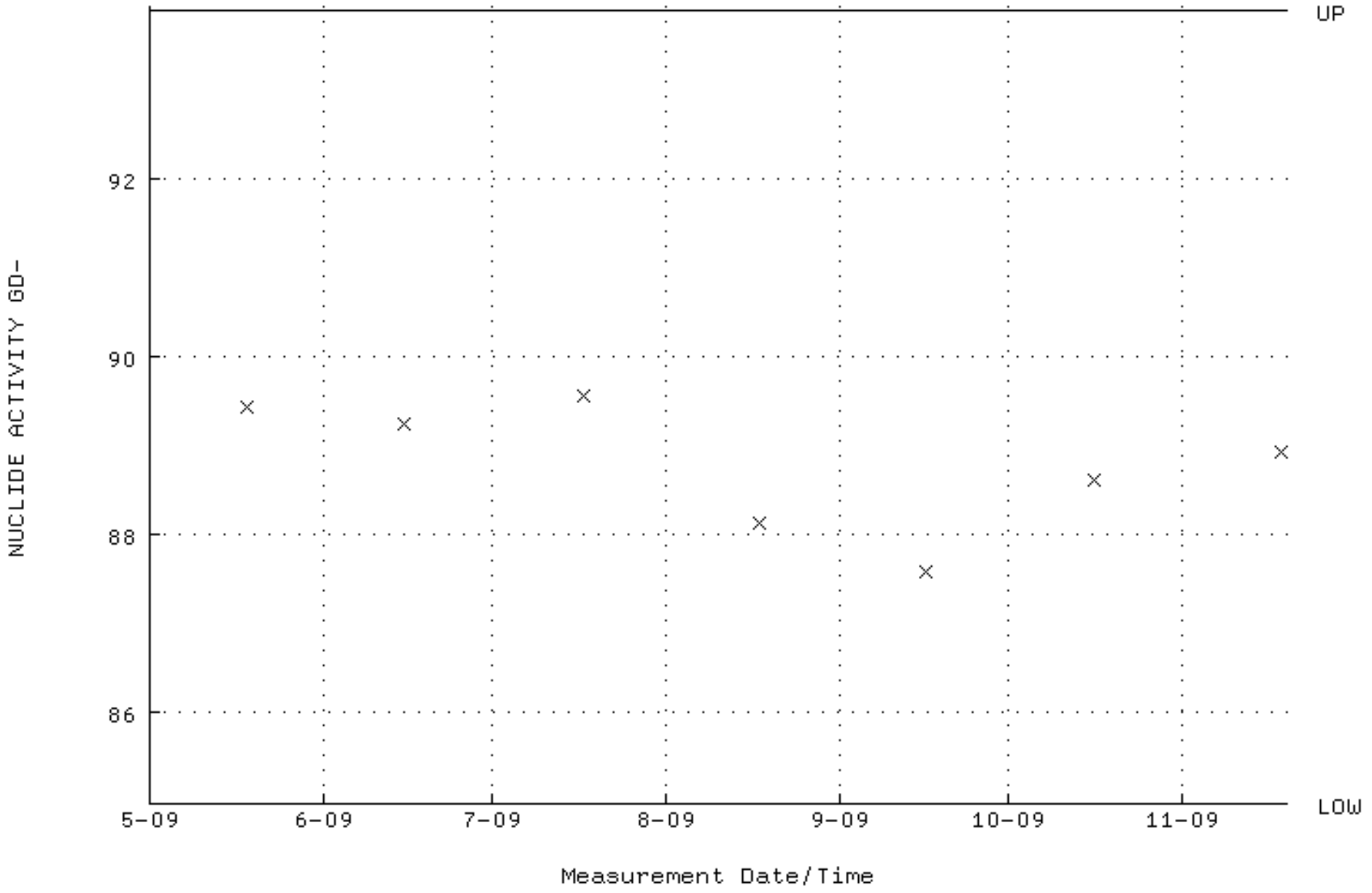
QA filename : DKA100:[ENV_ALPHA.QA.B]B146.QAF;2
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:19 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



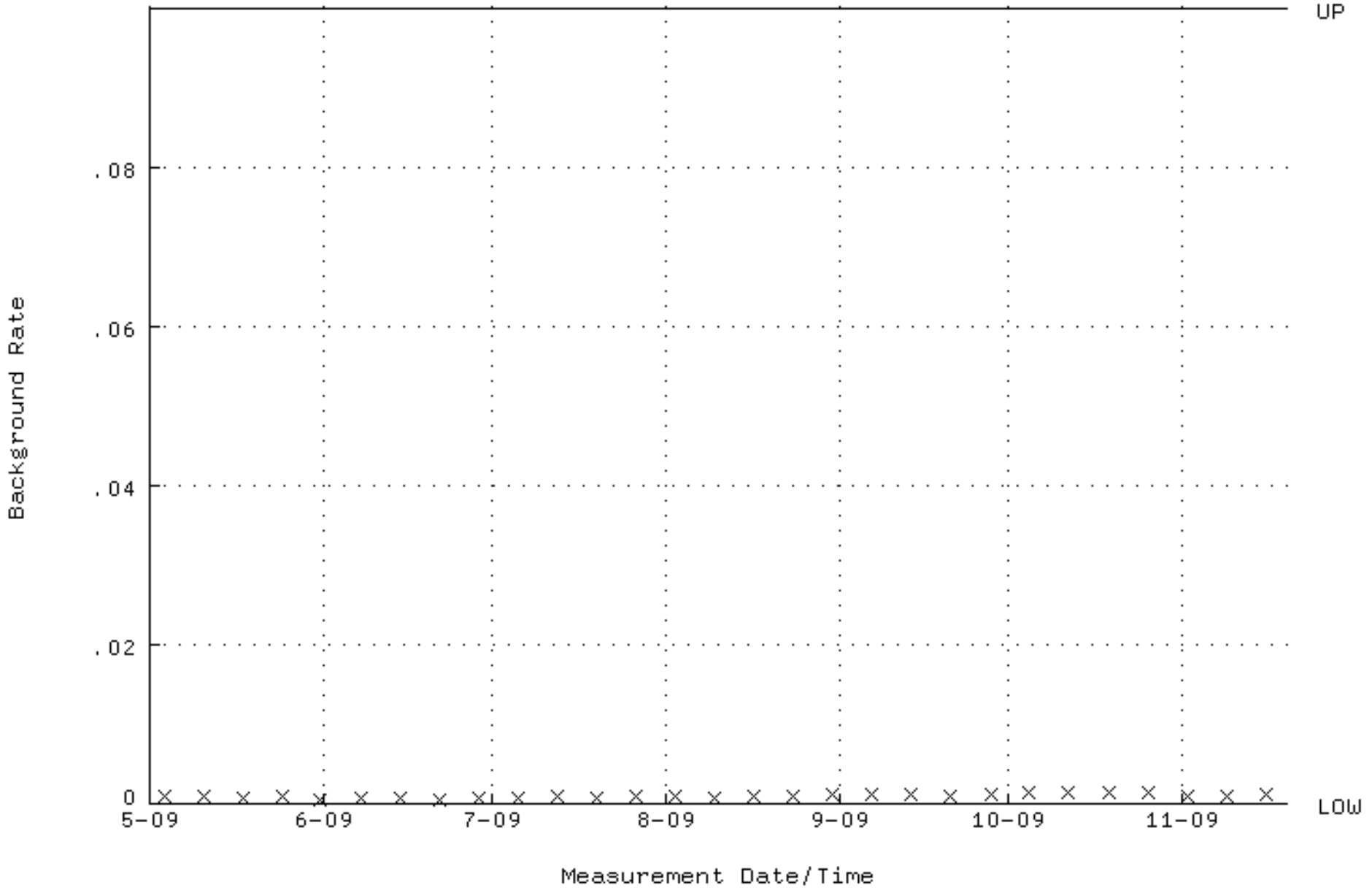
QA filename : DKA100:[ENV_ALPHA.QA.W]W147.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:26 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.237046 through 0.257046



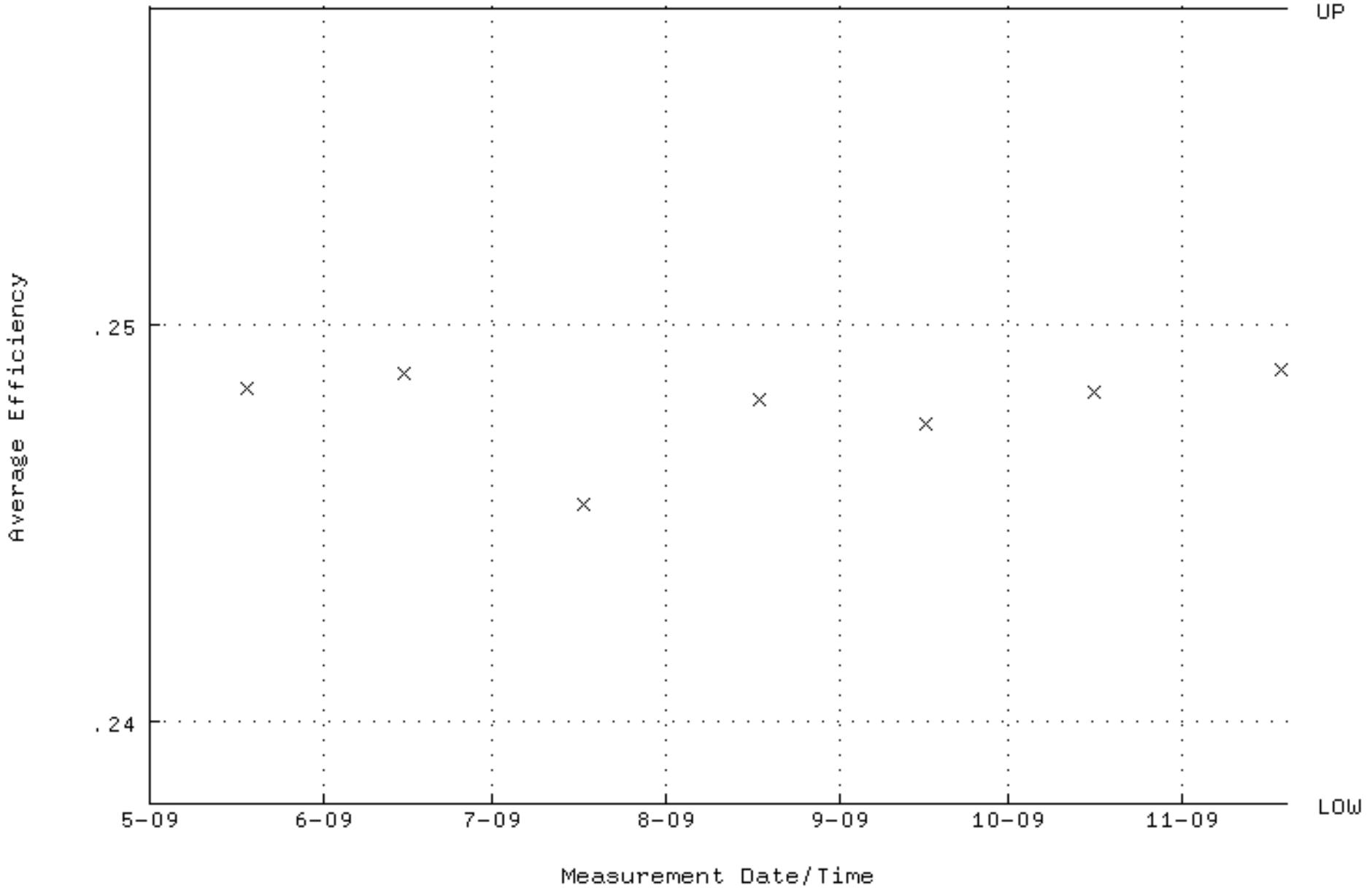
QA filename : DKA100:[ENV_ALPHA.QA.W]W147.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:26 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 84.9777 through 93.9227



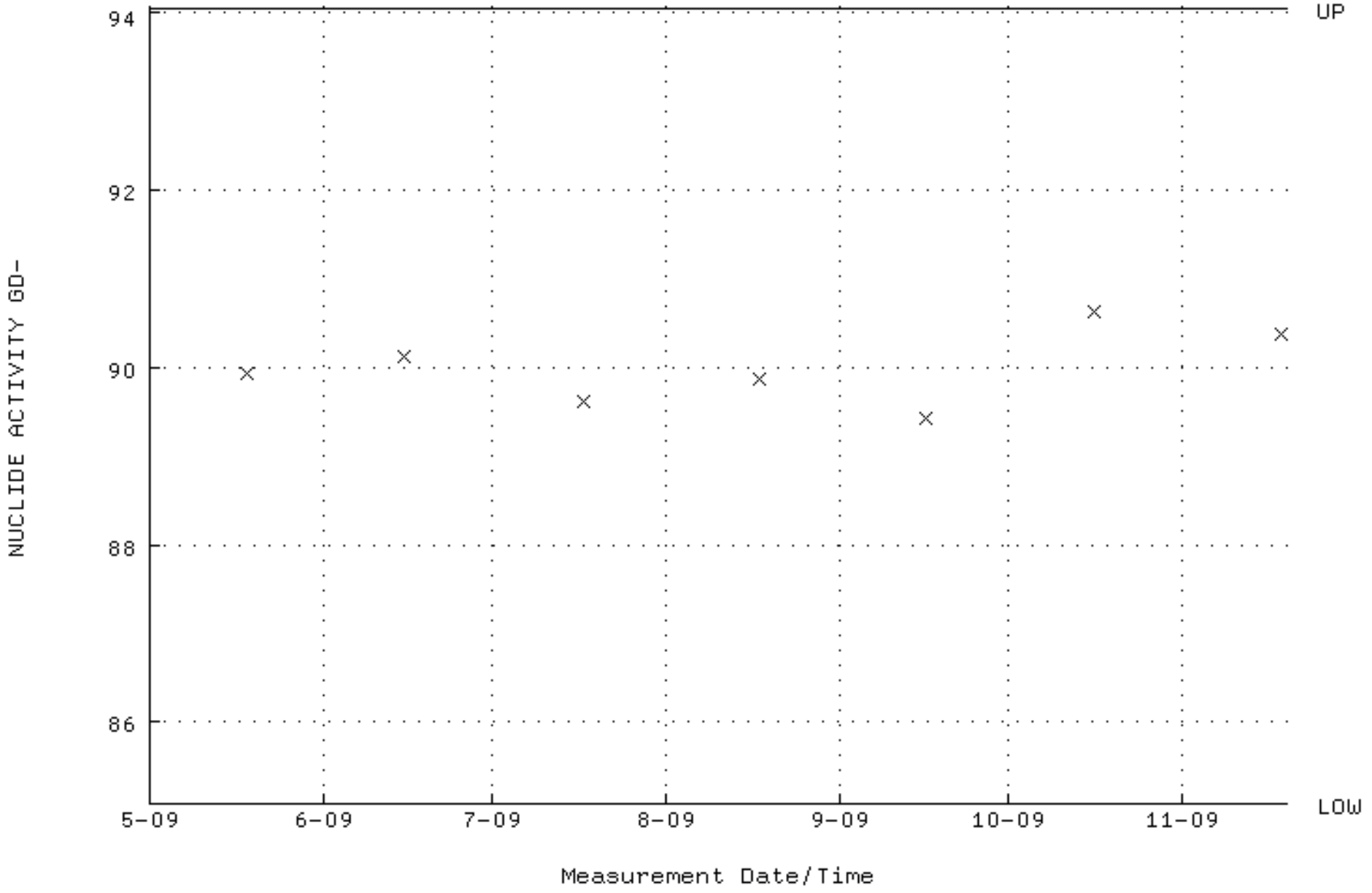
QA filename : DKA100:[ENV_ALPHA.QA.B]B147.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:23 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



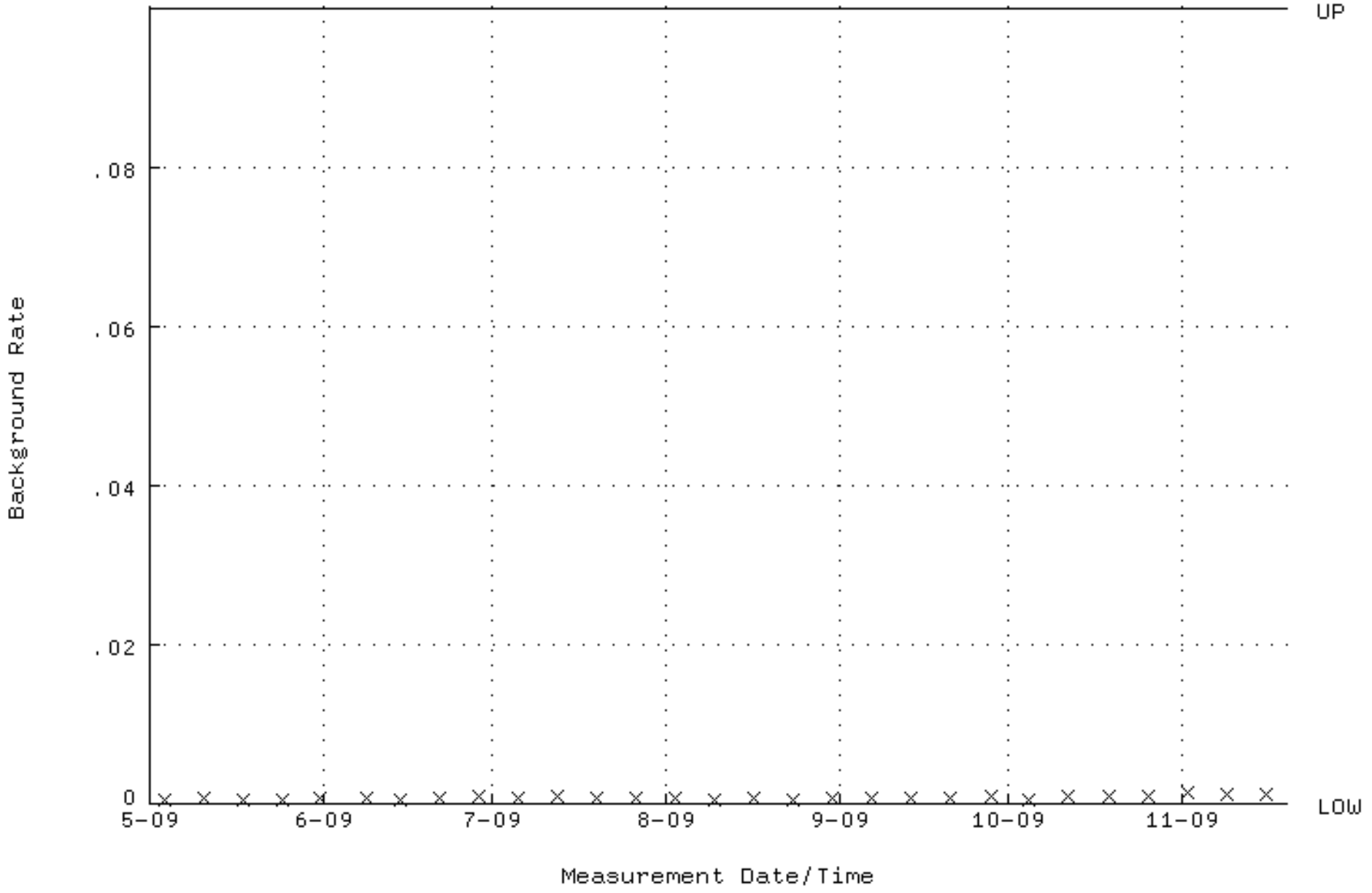
QA filename : DKA100:[ENV_ALPHA.QA.W]W148.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:30 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.237934 through 0.257934



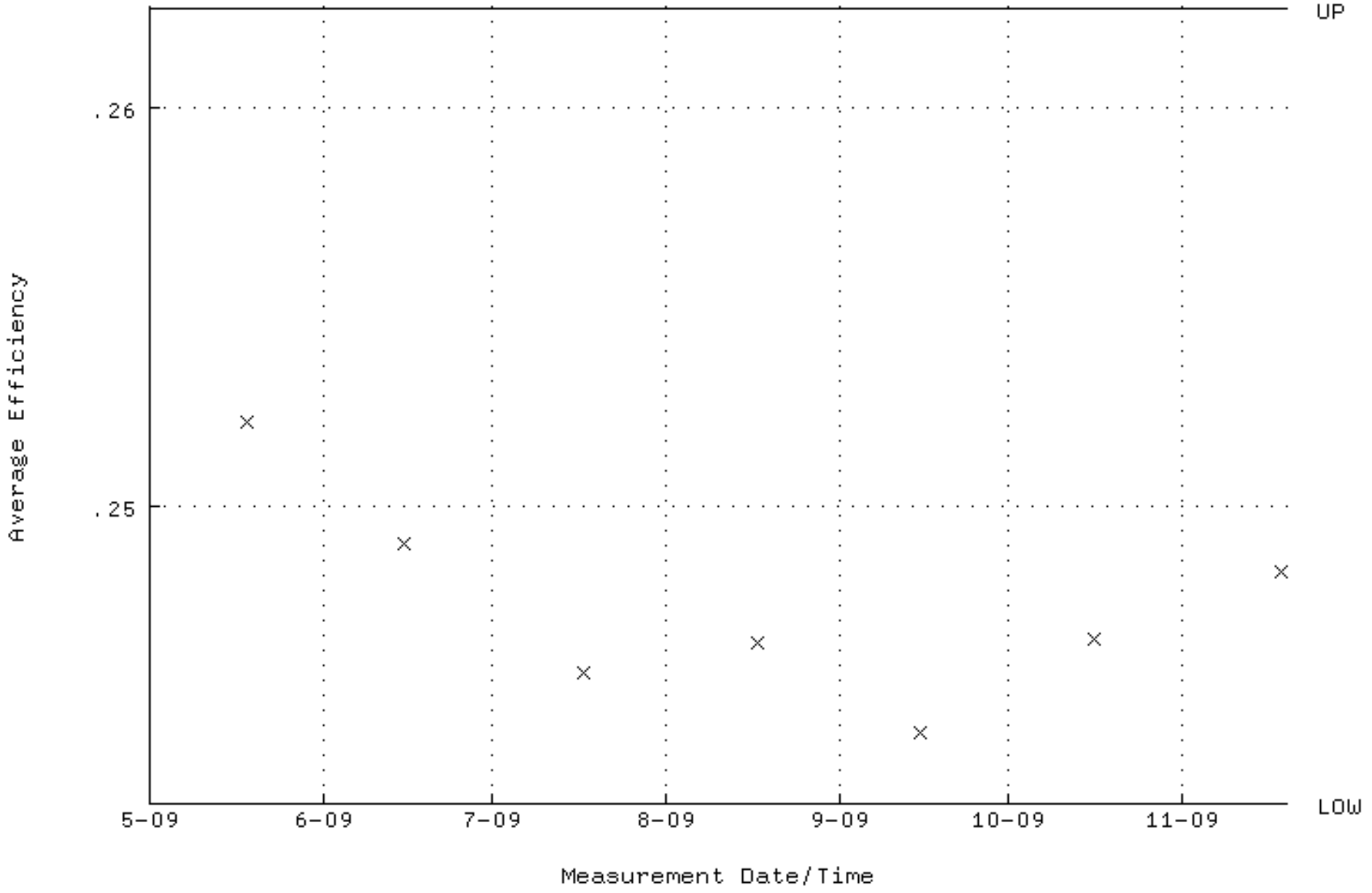
QA filename : DKA100:[ENV_ALPHA.QA.W]W148.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:30 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 85.0831 through 94.0393



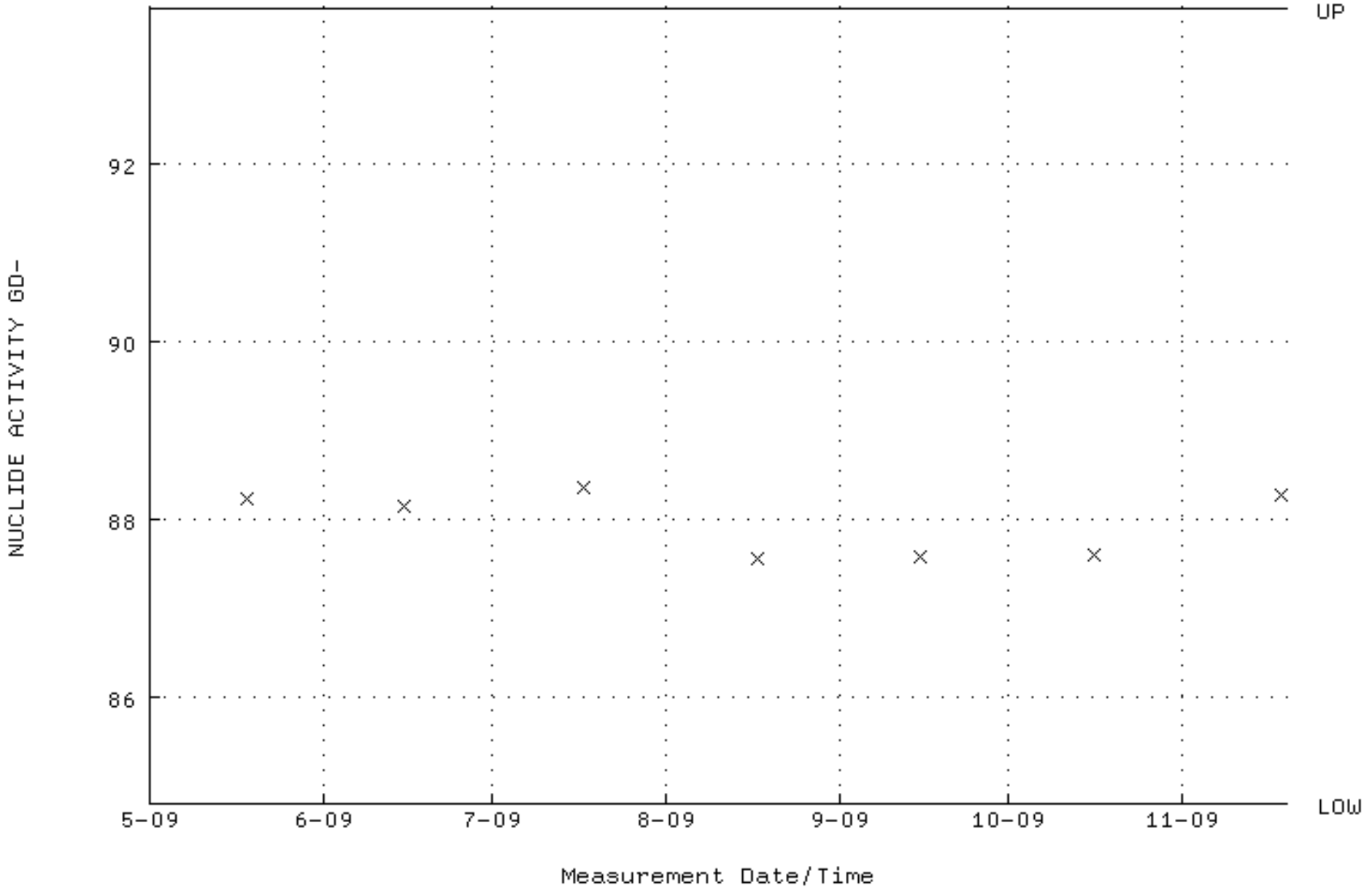
QA filename : DKA100:[ENV_ALPHA.QA.B]B148.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:27 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



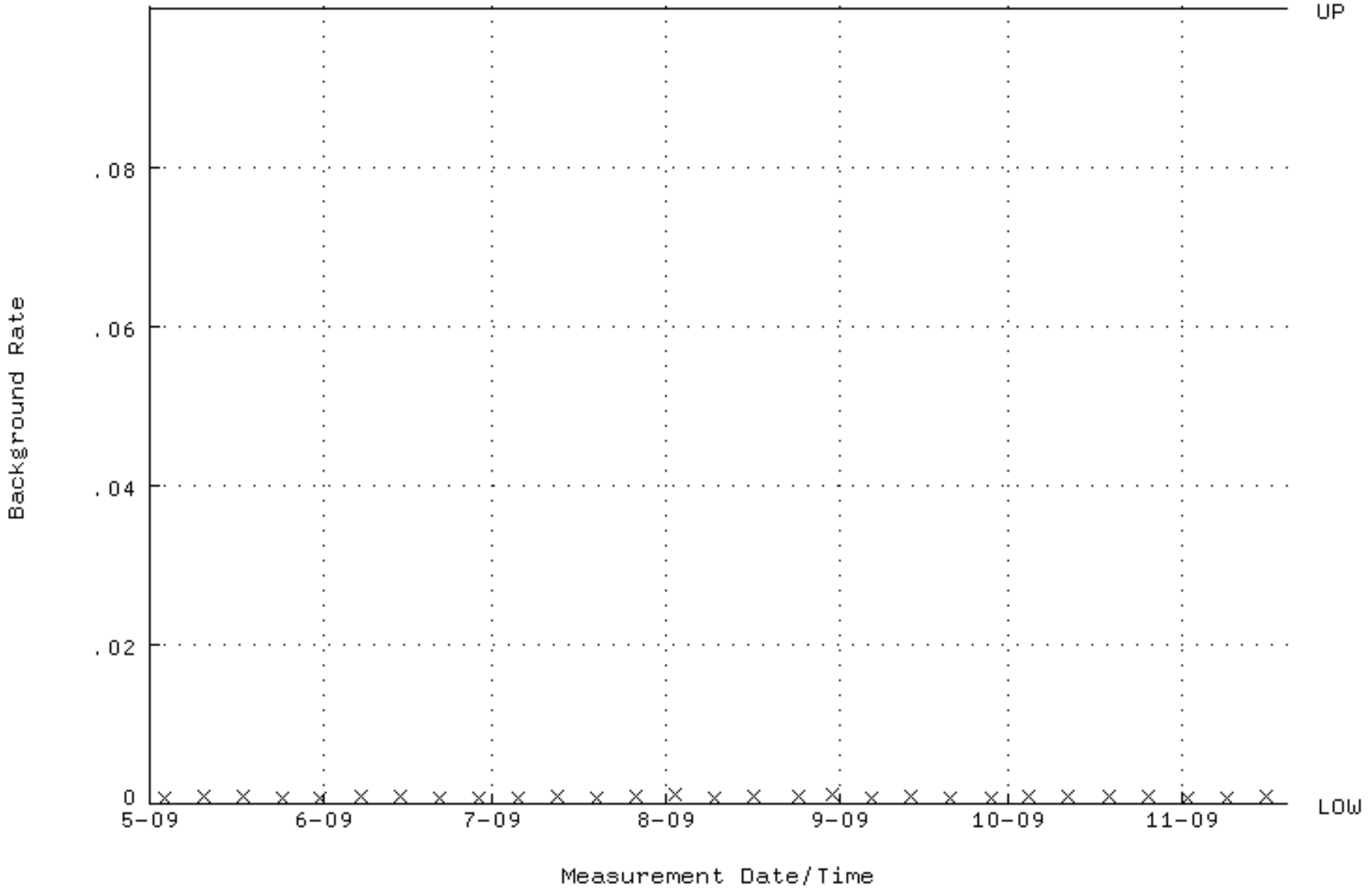
QA filename : DKA100:[ENV_ALPHA.QA.W]W149.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:34 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.242495 through 0.262495



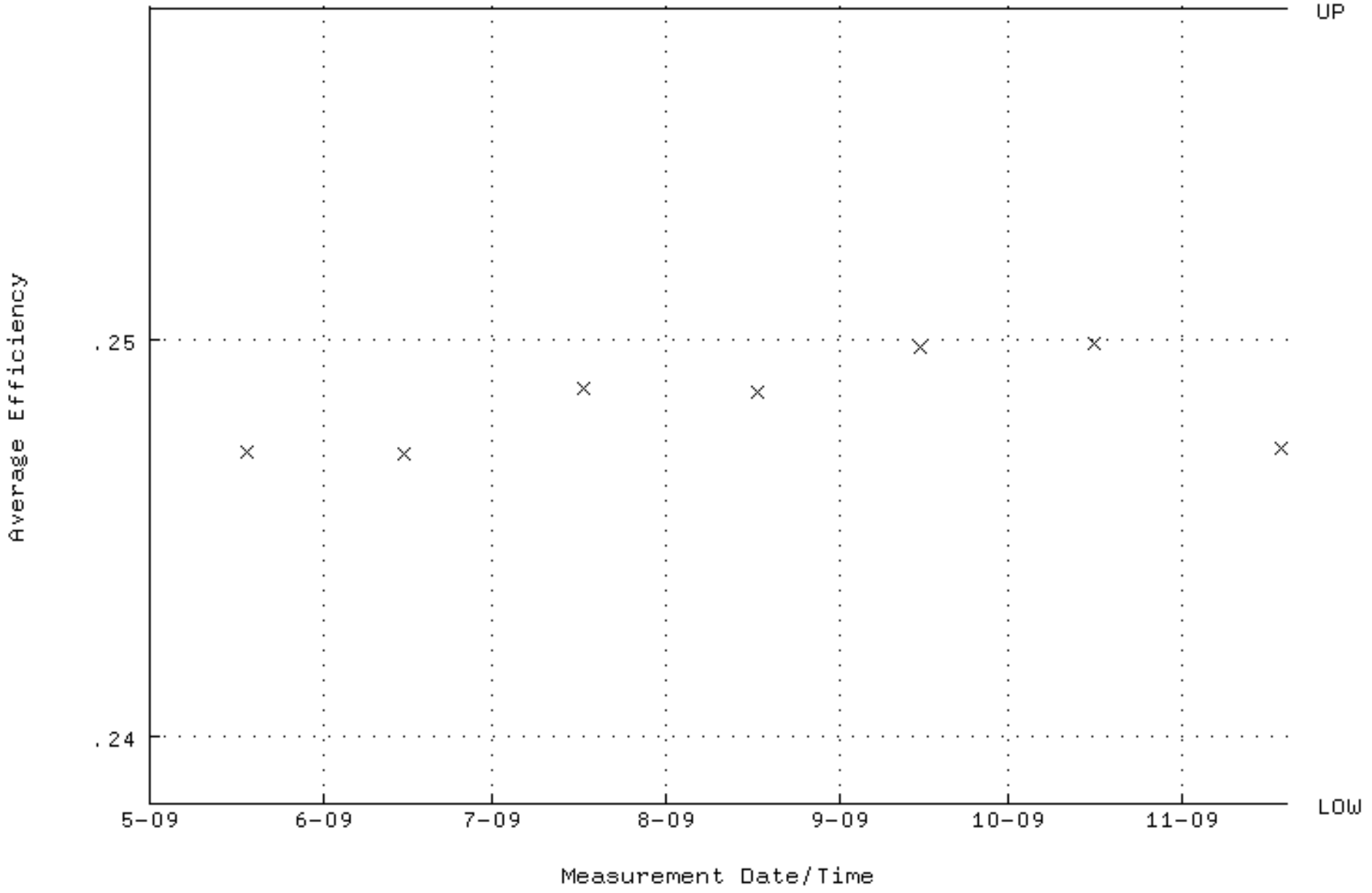
QA filename : DKA100:[ENV_ALPHA.QA.W]W149.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:34 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 84.8126 through 93.7402



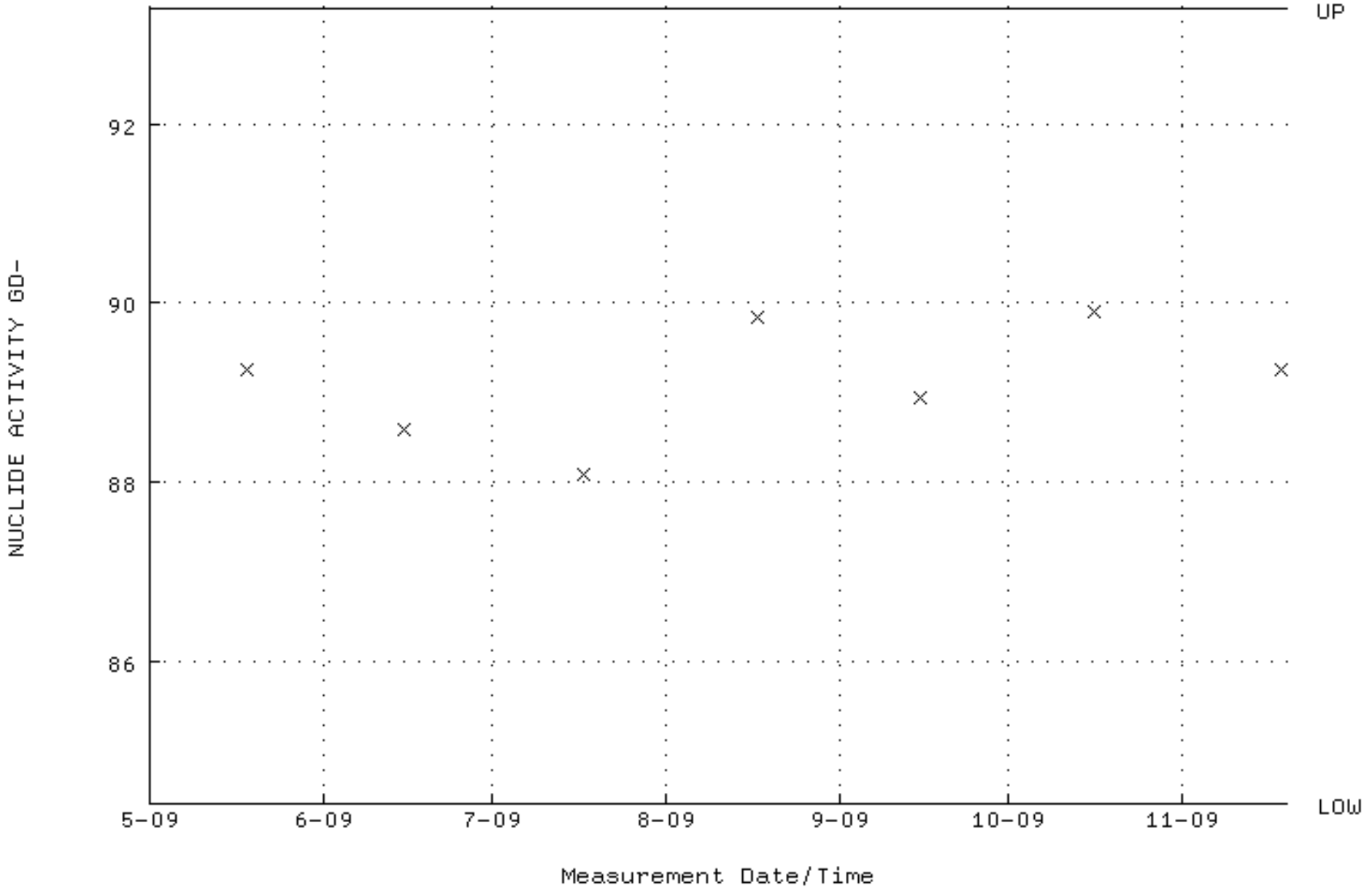
QA filename : DKA100:[ENV_ALPHA.QA.B]B149.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:31 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



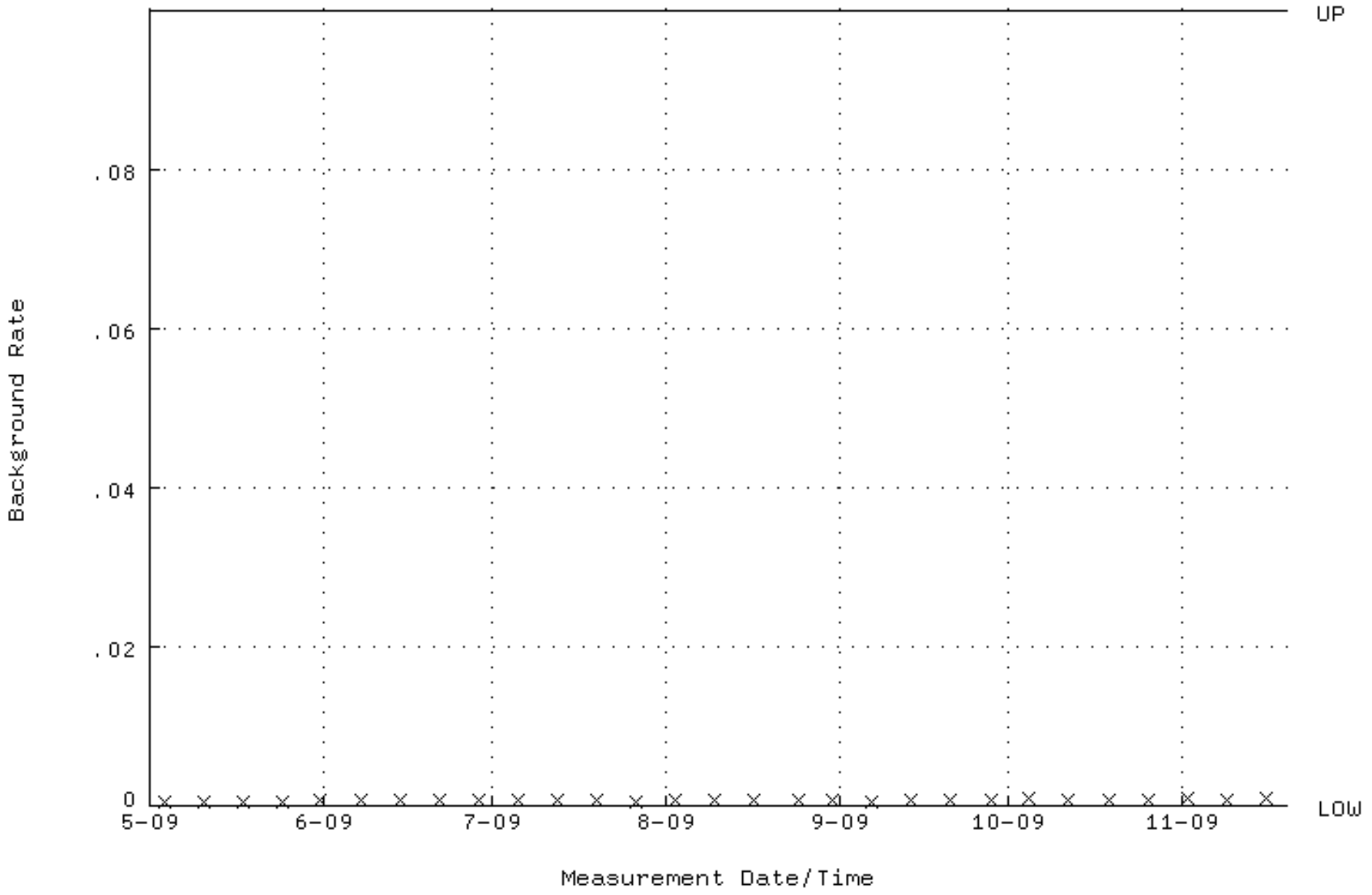
QA filename : DKA100:[ENV_ALPHA.QA.W]W150.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:39 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.238314 through 0.258314



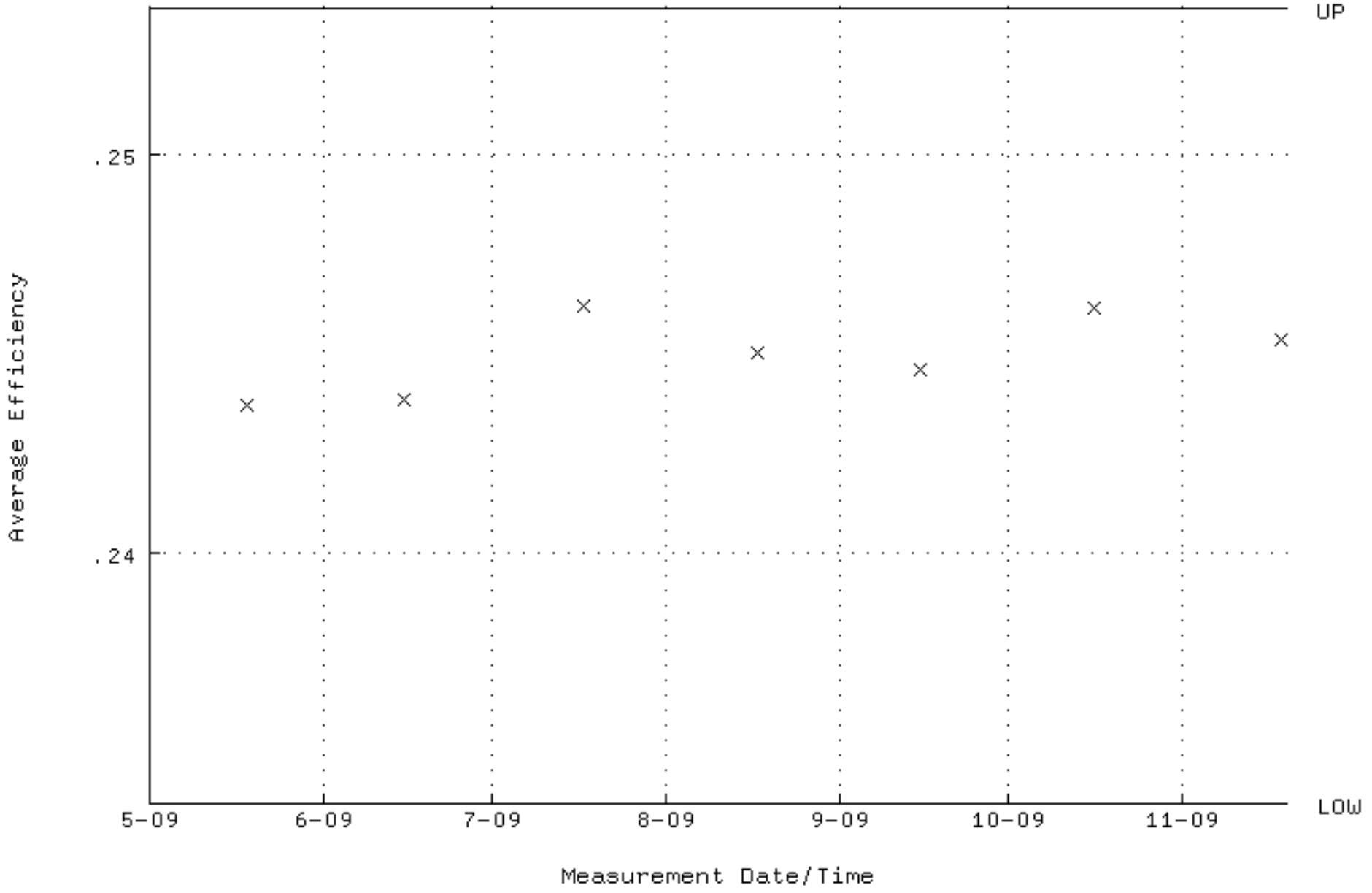
QA filename : DKA100:[ENV_ALPHA.QA.W]W150.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:39 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 84.4039 through 93.2885



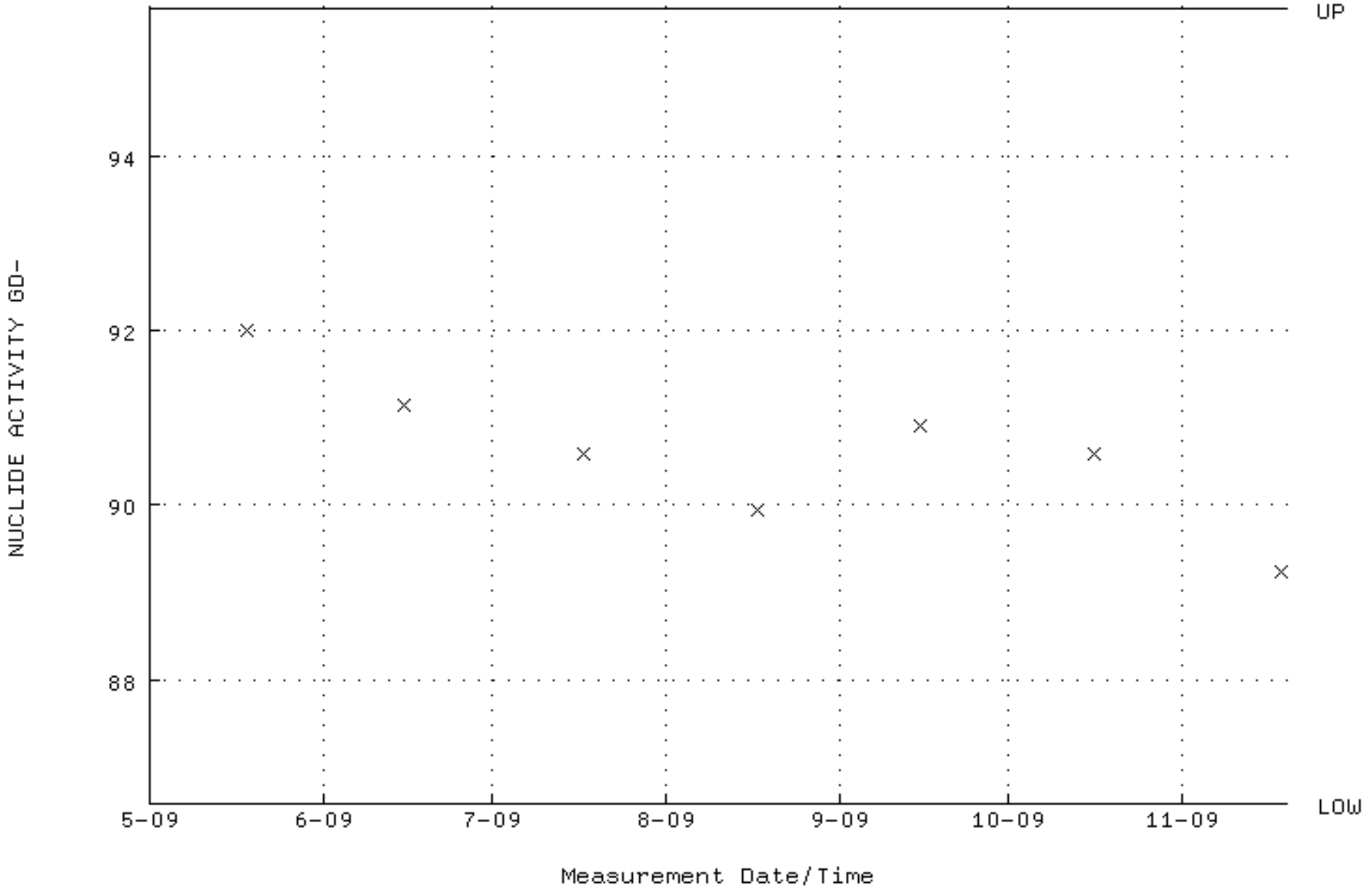
QA filename : DKA100:[ENV_ALPHA.QA.B]B150.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:35 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



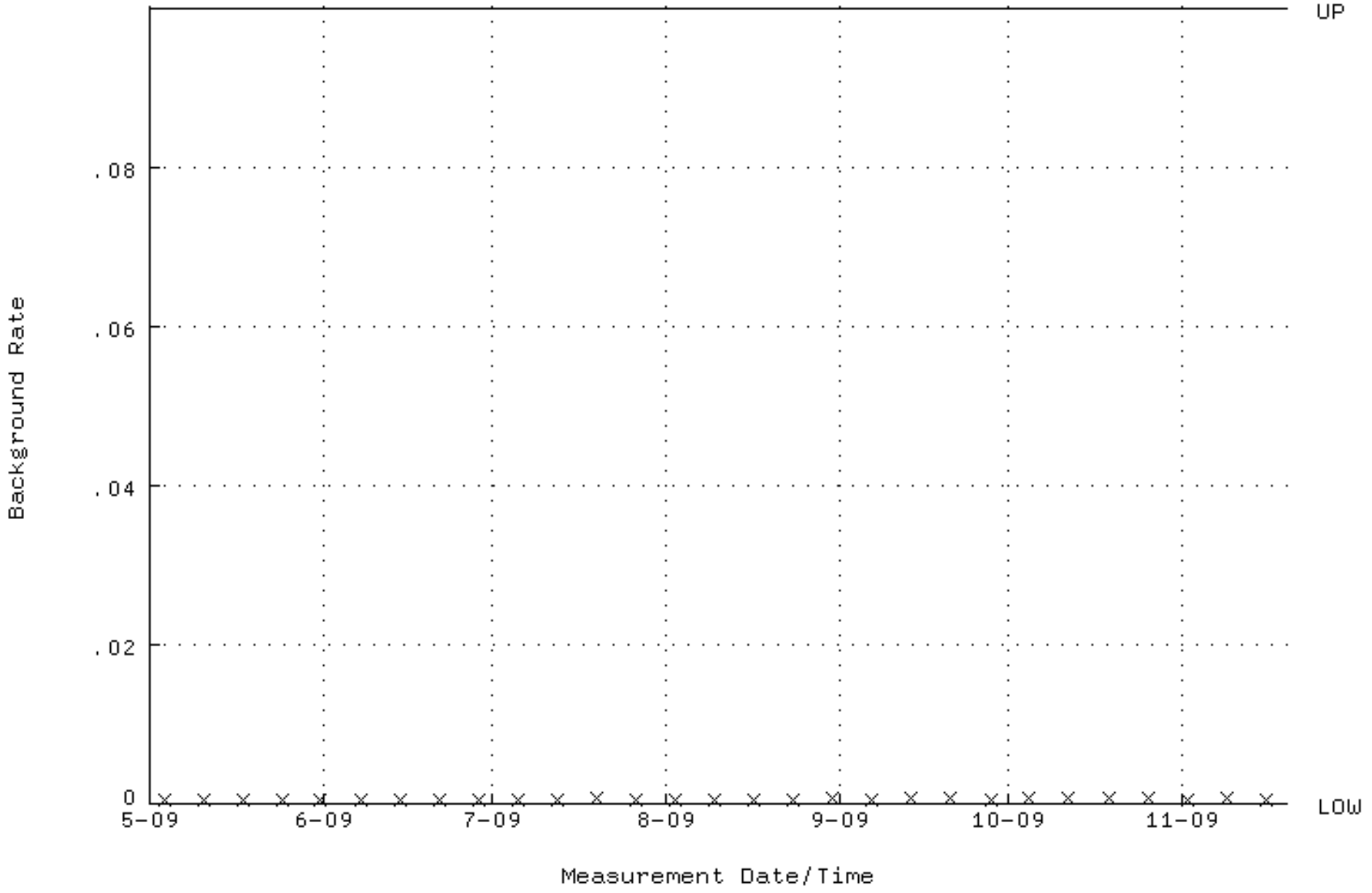
QA filename : DKA100:[ENV_ALPHA.QA.W]W151.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:43 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.233693 through 0.253693



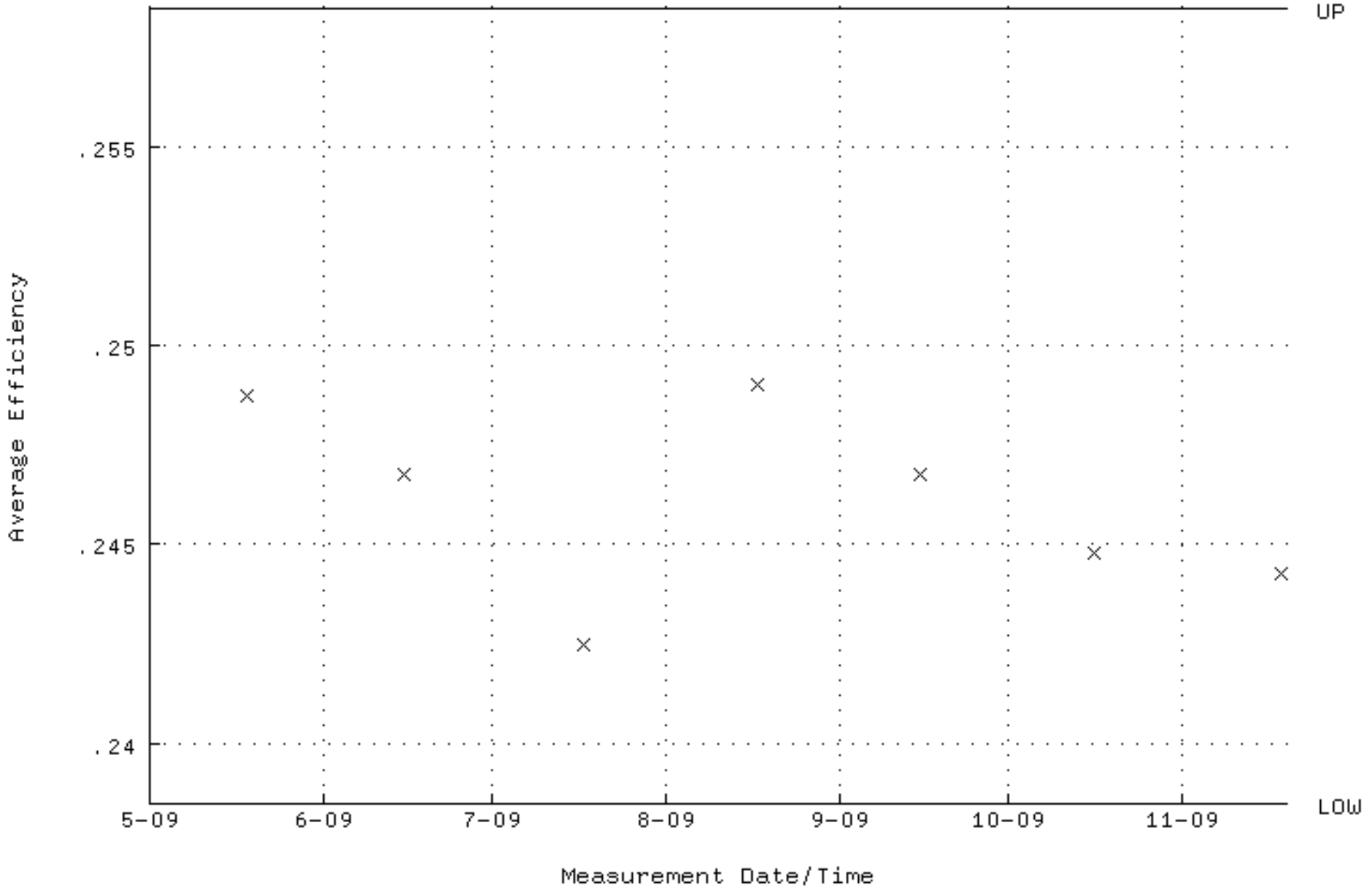
QA filename : DKA100:[ENV_ALPHA.QA.W]W151.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:43 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 86.5749 through 95.6881



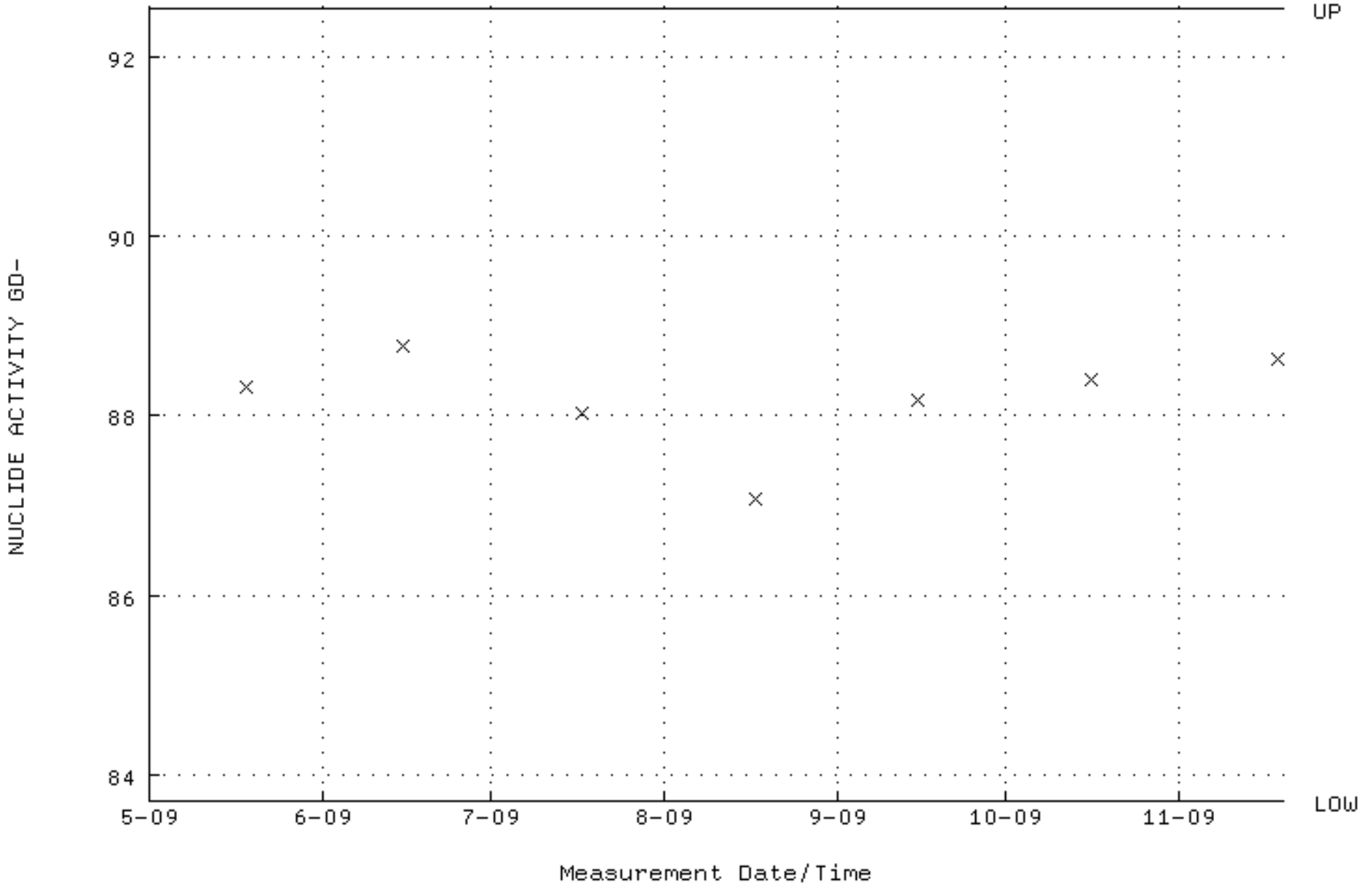
QA filename : DKA100:[ENV_ALPHA.QA.B]B151.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:39 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



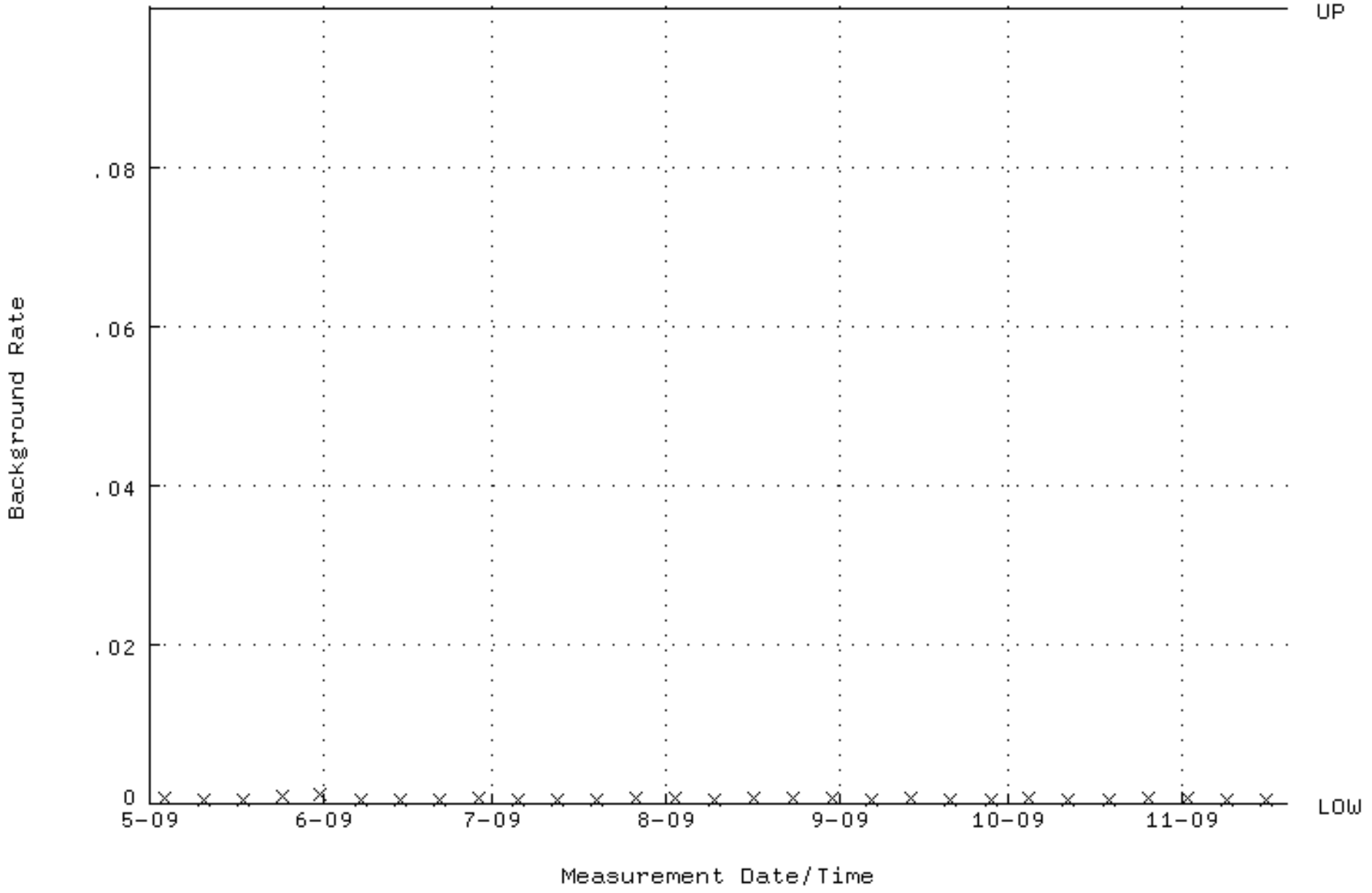
QA filename : DKA100:[ENV_ALPHA.QA.W]W152.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:48 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.238479 through 0.258479



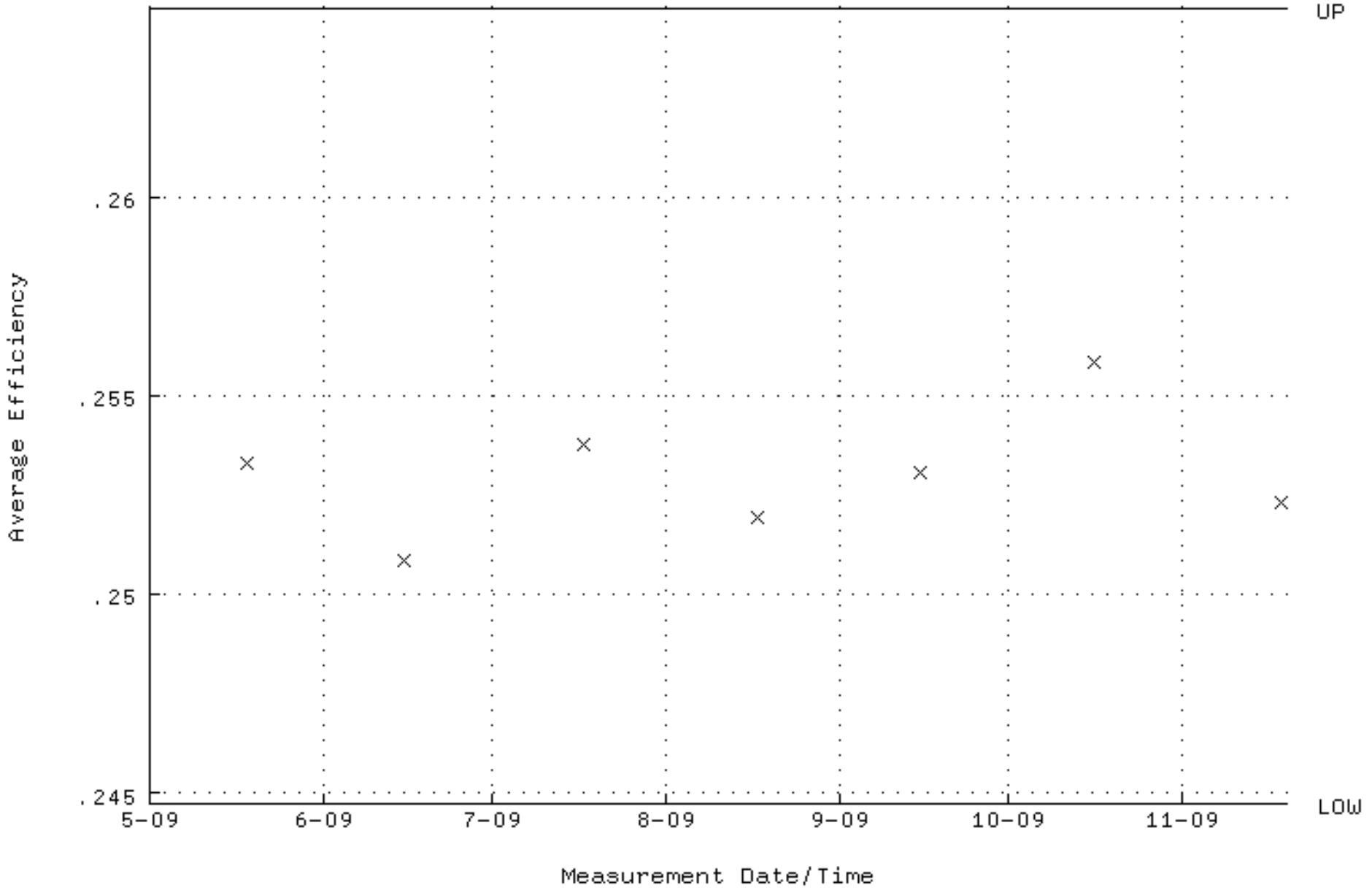
QA filename : DKA100:[ENV_ALPHA.QA.W]W152.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:48 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 83.7180 through 92.5304



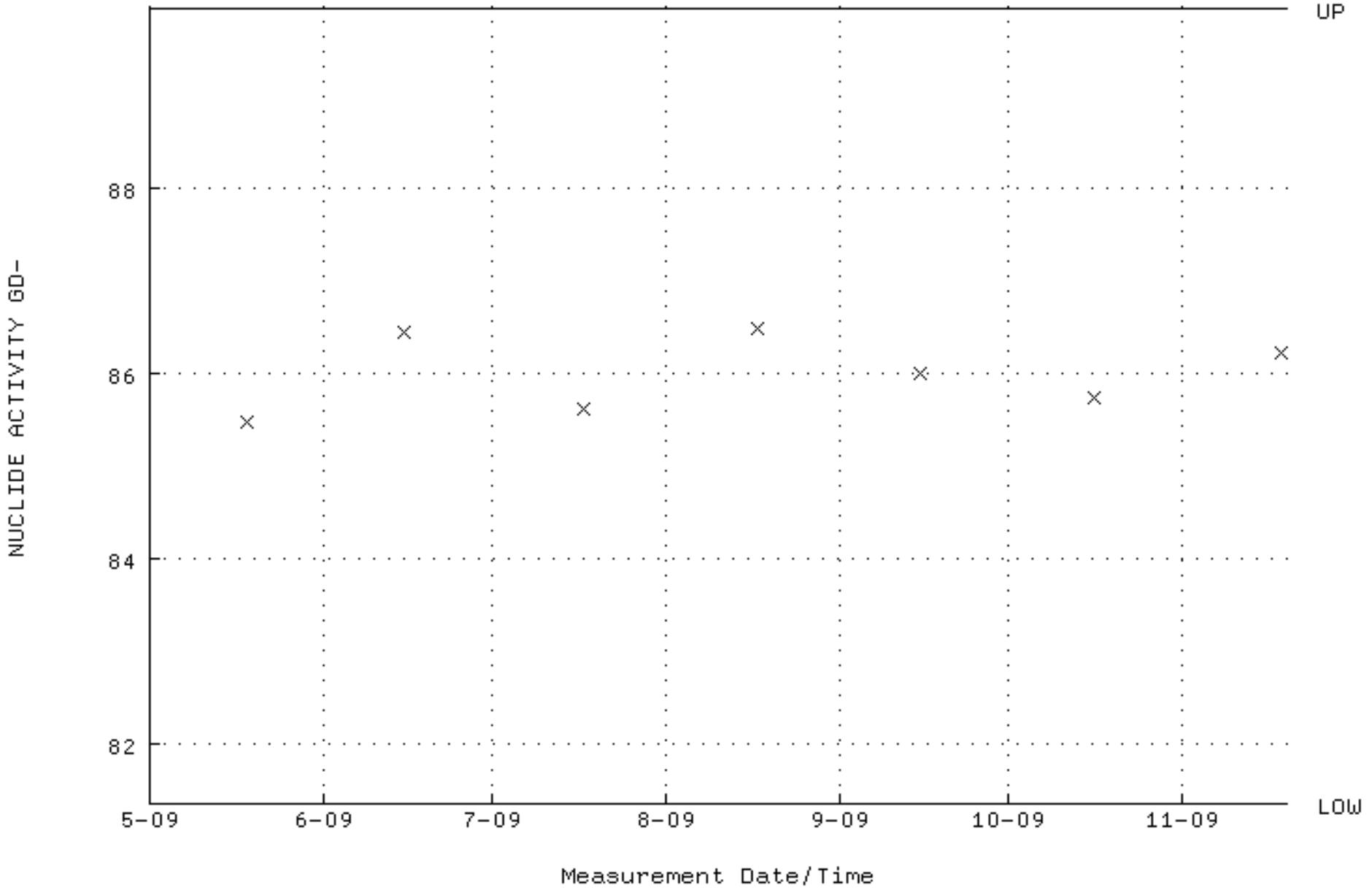
QA filename : DKA100:[ENV_ALPHA.QA.B]B152.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:43 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



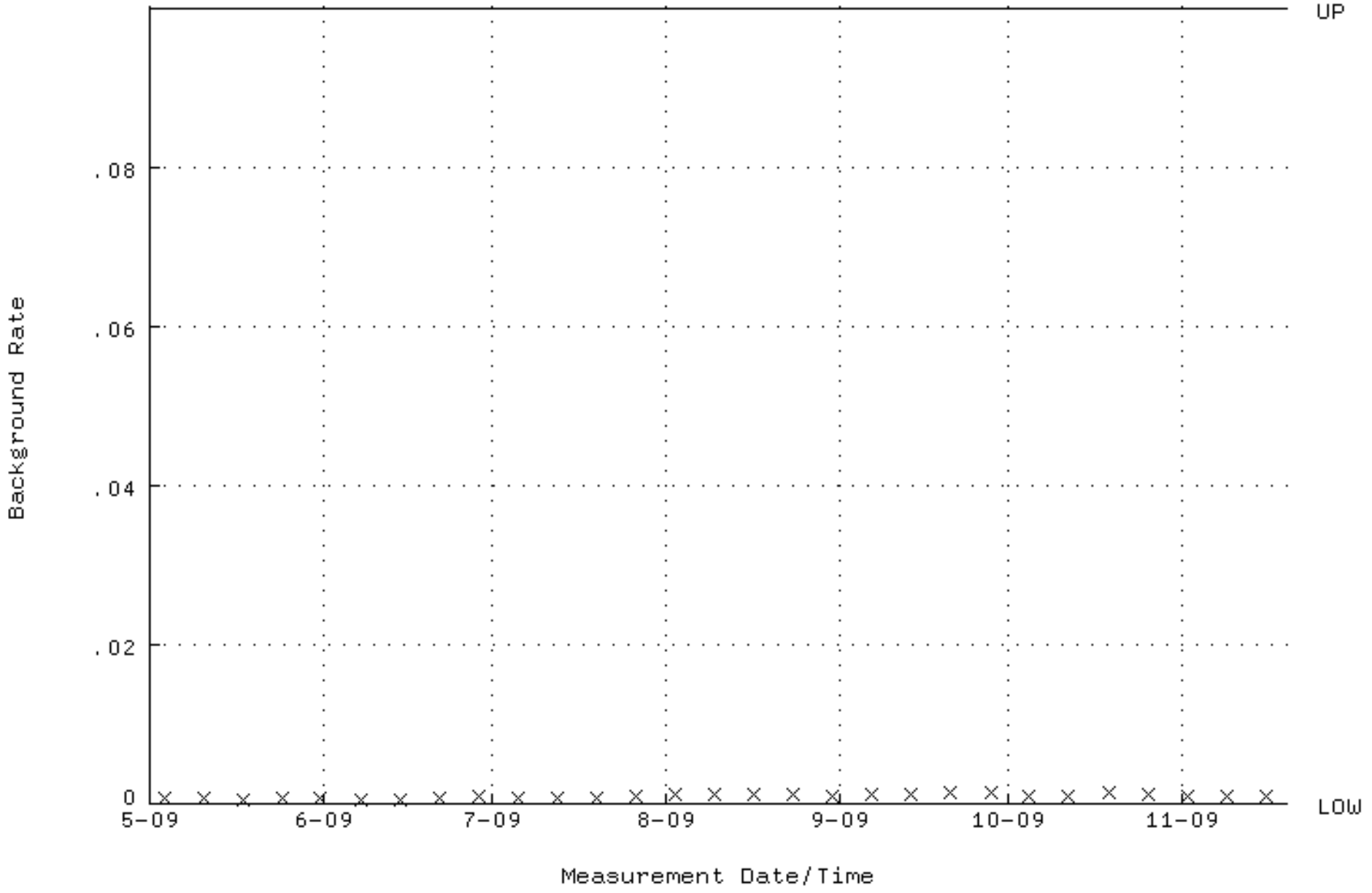
QA filename : DKA100:[ENV_ALPHA.QA.W]W153.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:52 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.244738 through 0.264738



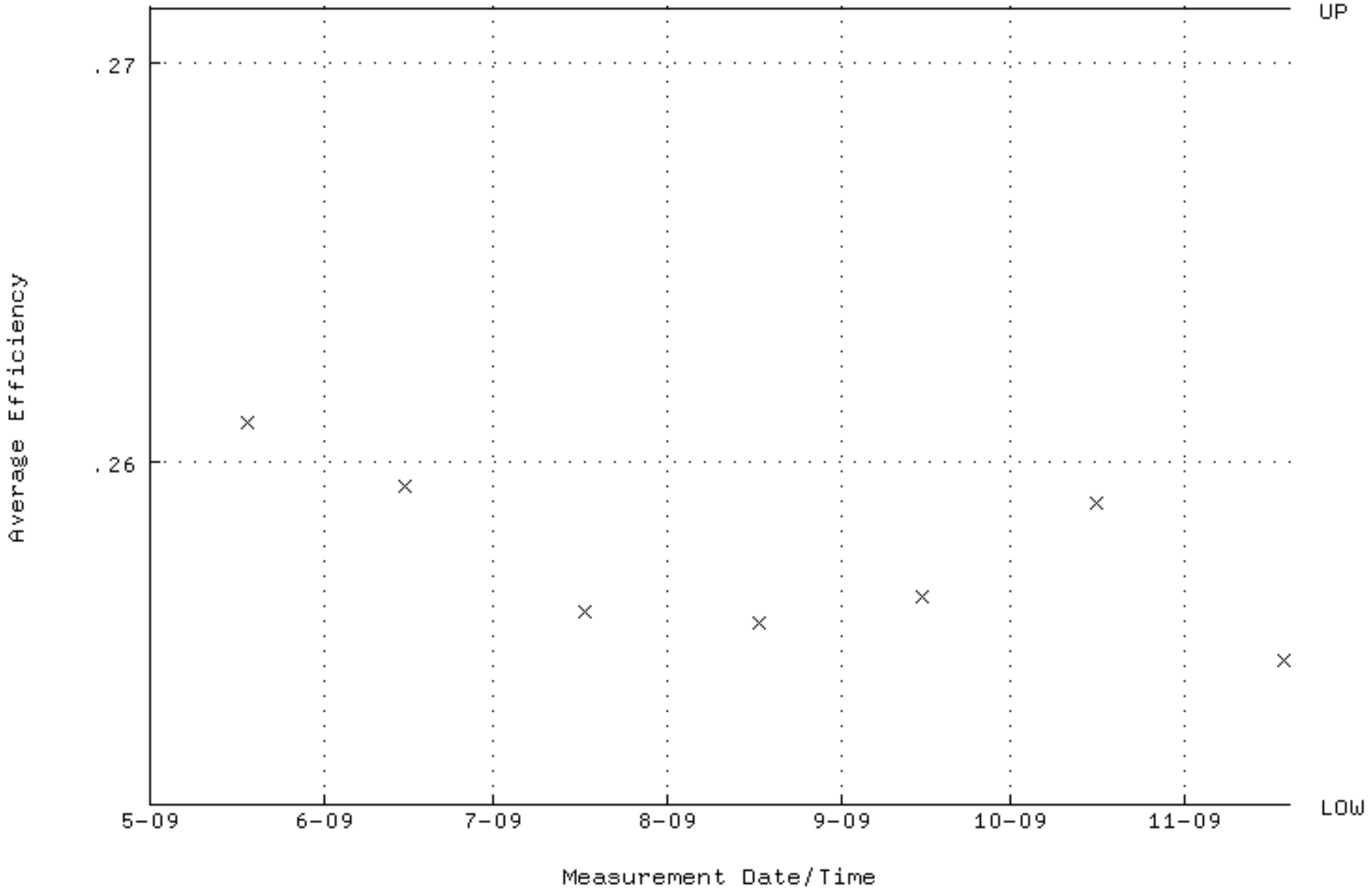
QA filename : DKA100:[ENV_ALPHA.QA.W]W153.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:52 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 81.3634 through 89.9280



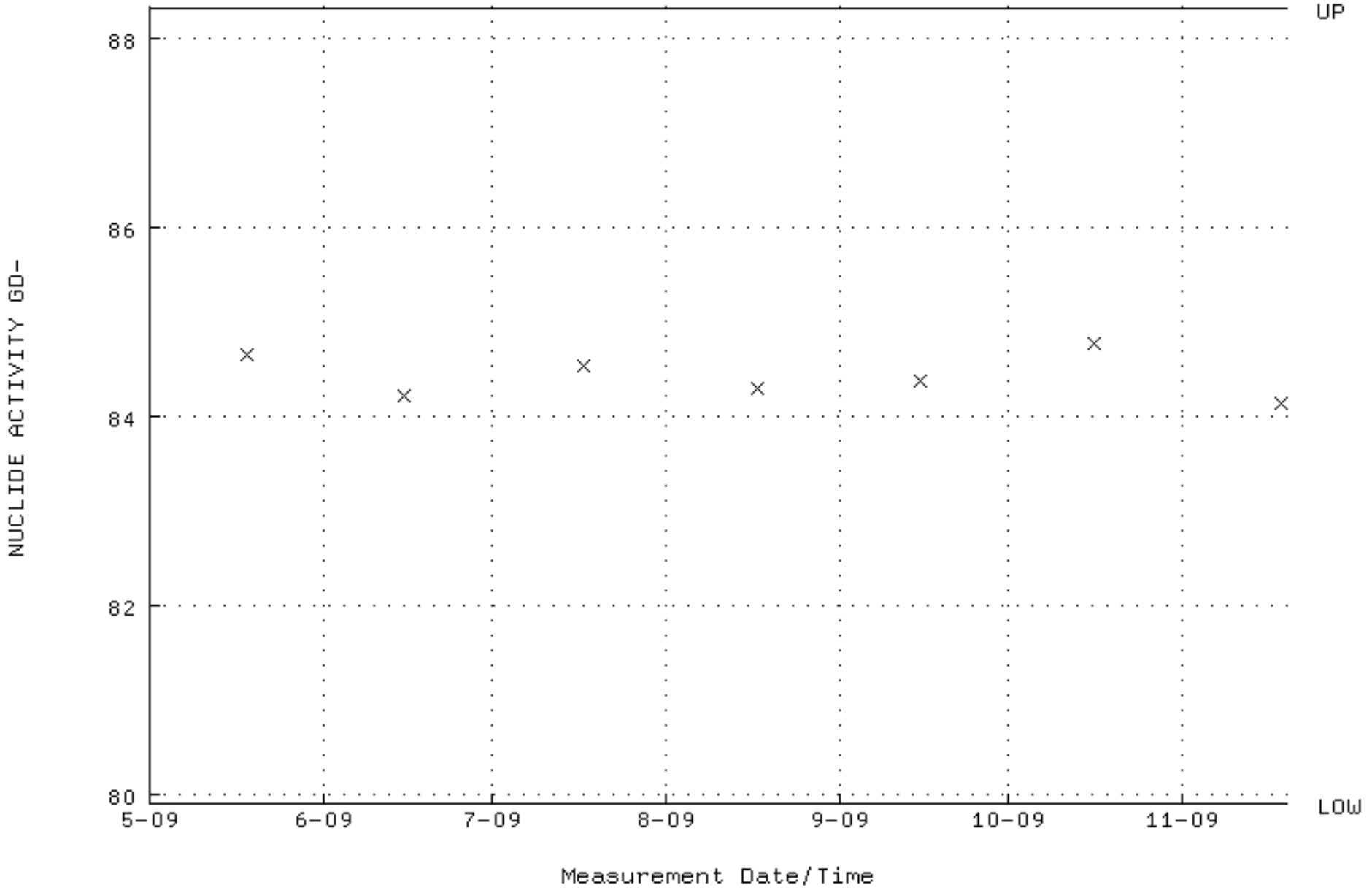
QA filename : DKA100:[ENV_ALPHA.QA.B]B153.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:47 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



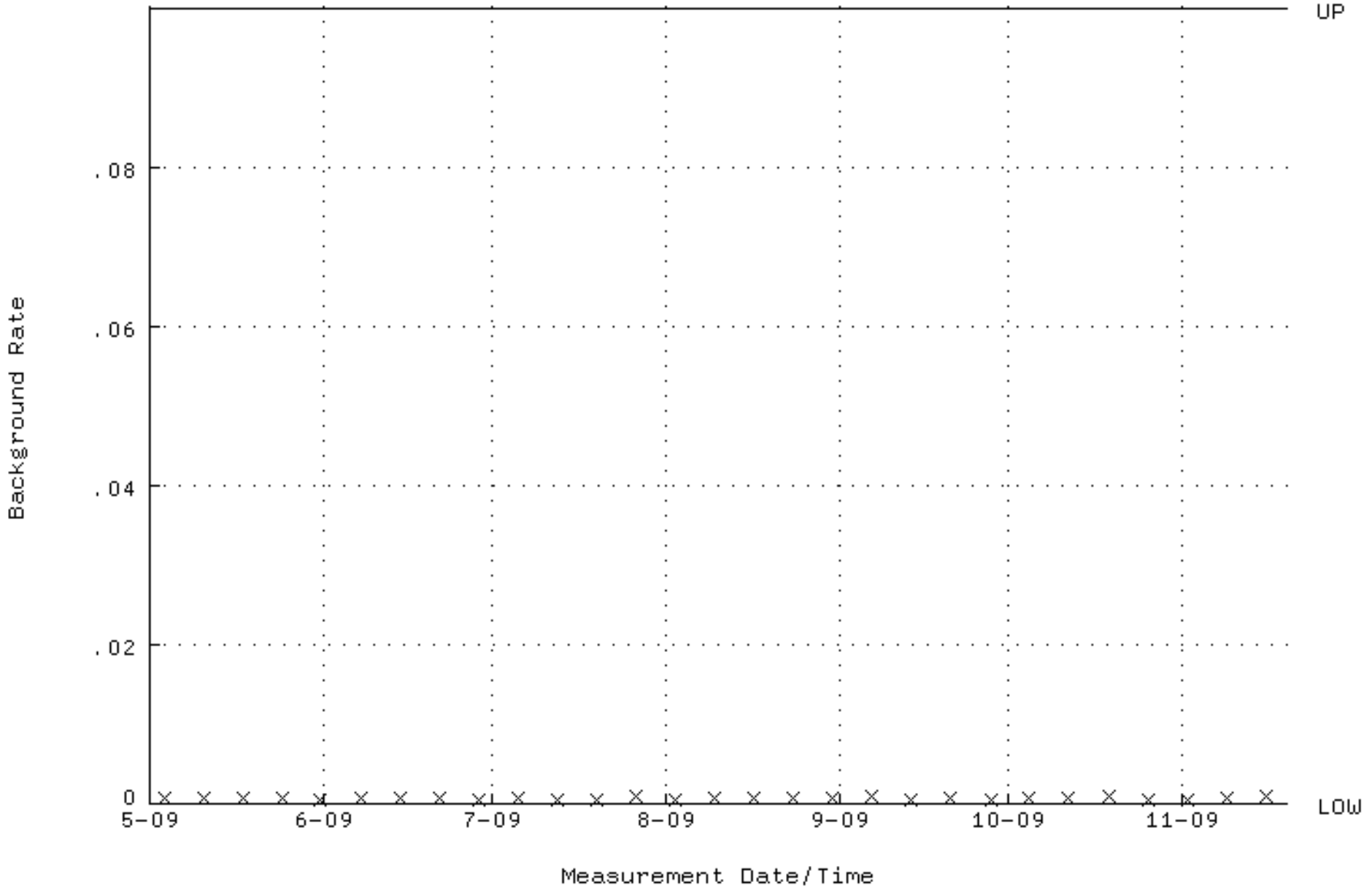
QA filename : DKA100:[ENV_ALPHA.QA.W]W154.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:47:57 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.251386 through 0.271386



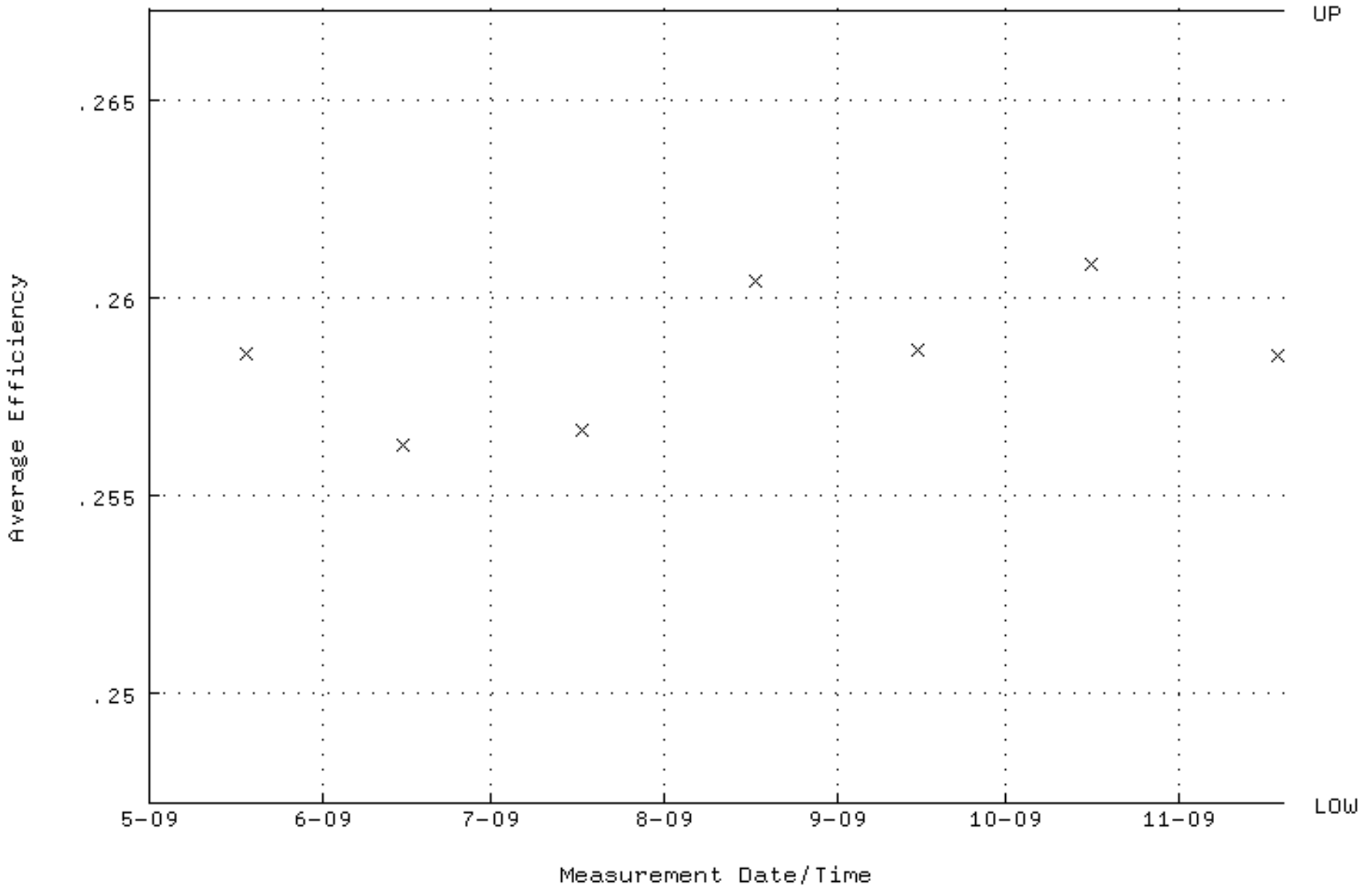
QA filename : DKA100:[ENV_ALPHA.QA.W]W154.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:47:57 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 79.9003 through 88.3109



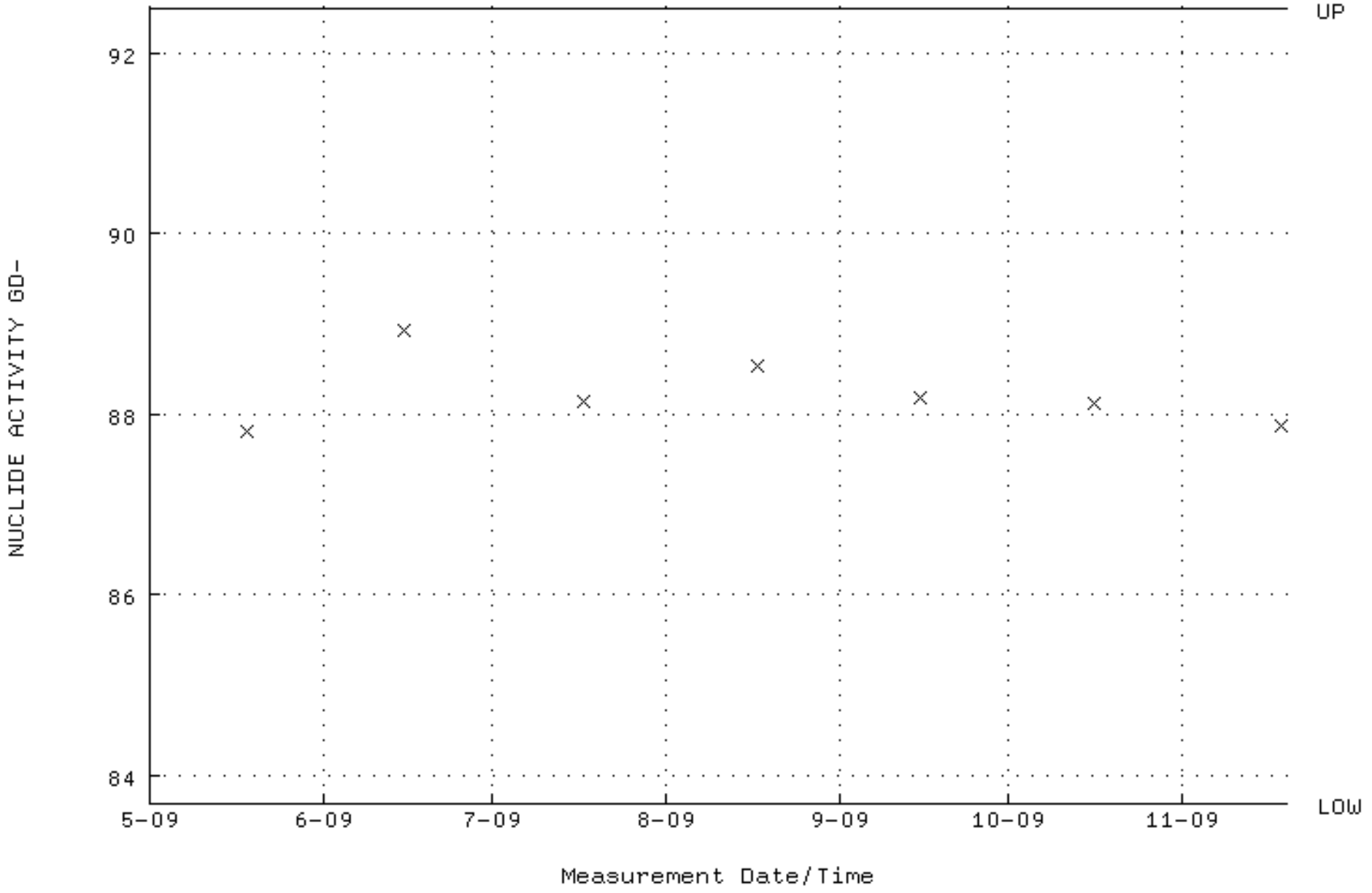
QA filename : DKA100:[ENV_ALPHA.QA.B]B154.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:51 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



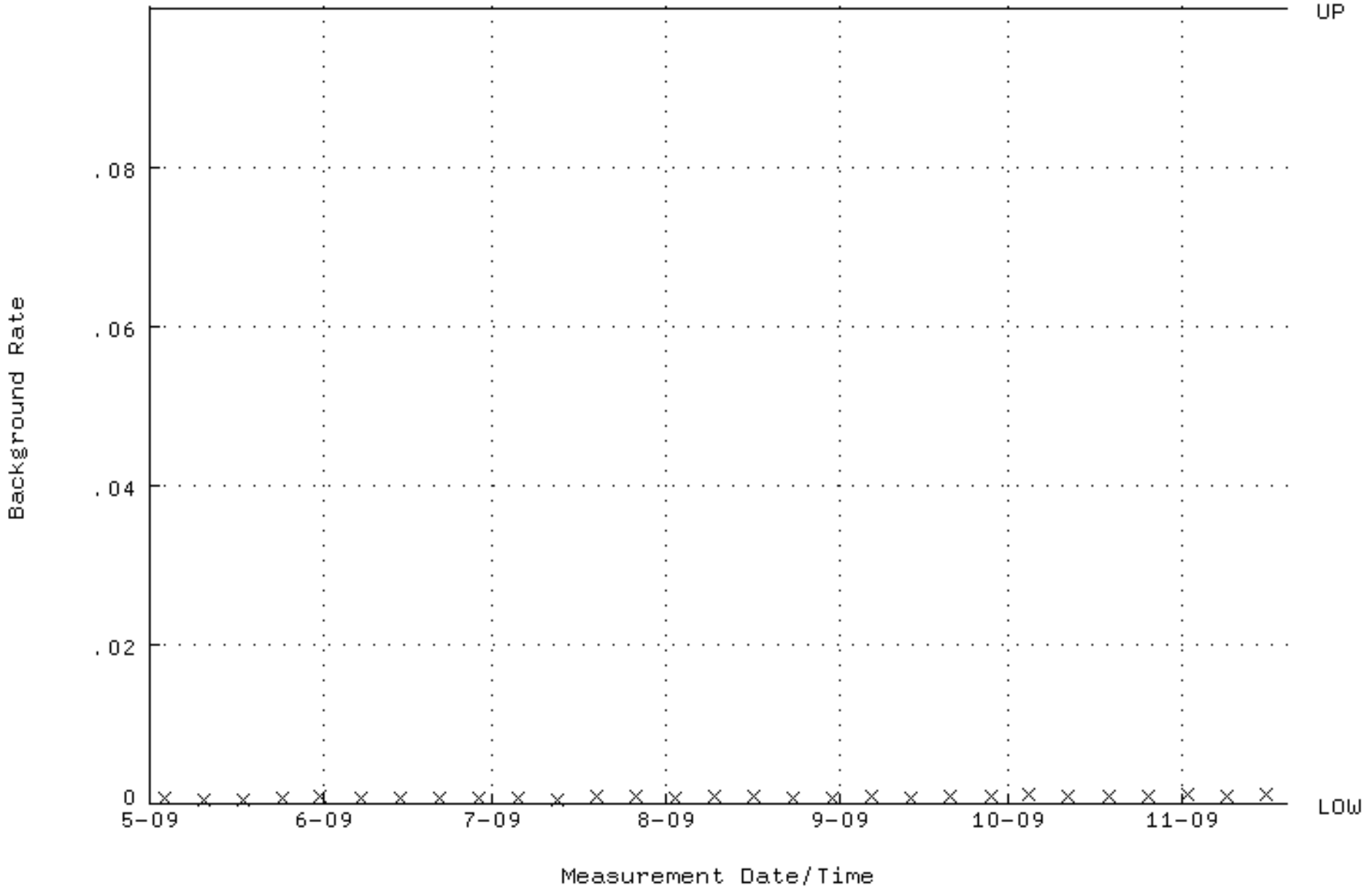
QA filename : DKA100:[ENV_ALPHA.QA.W]W155.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 18-MAY-2009 09:48:01 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.247241 through 0.267241



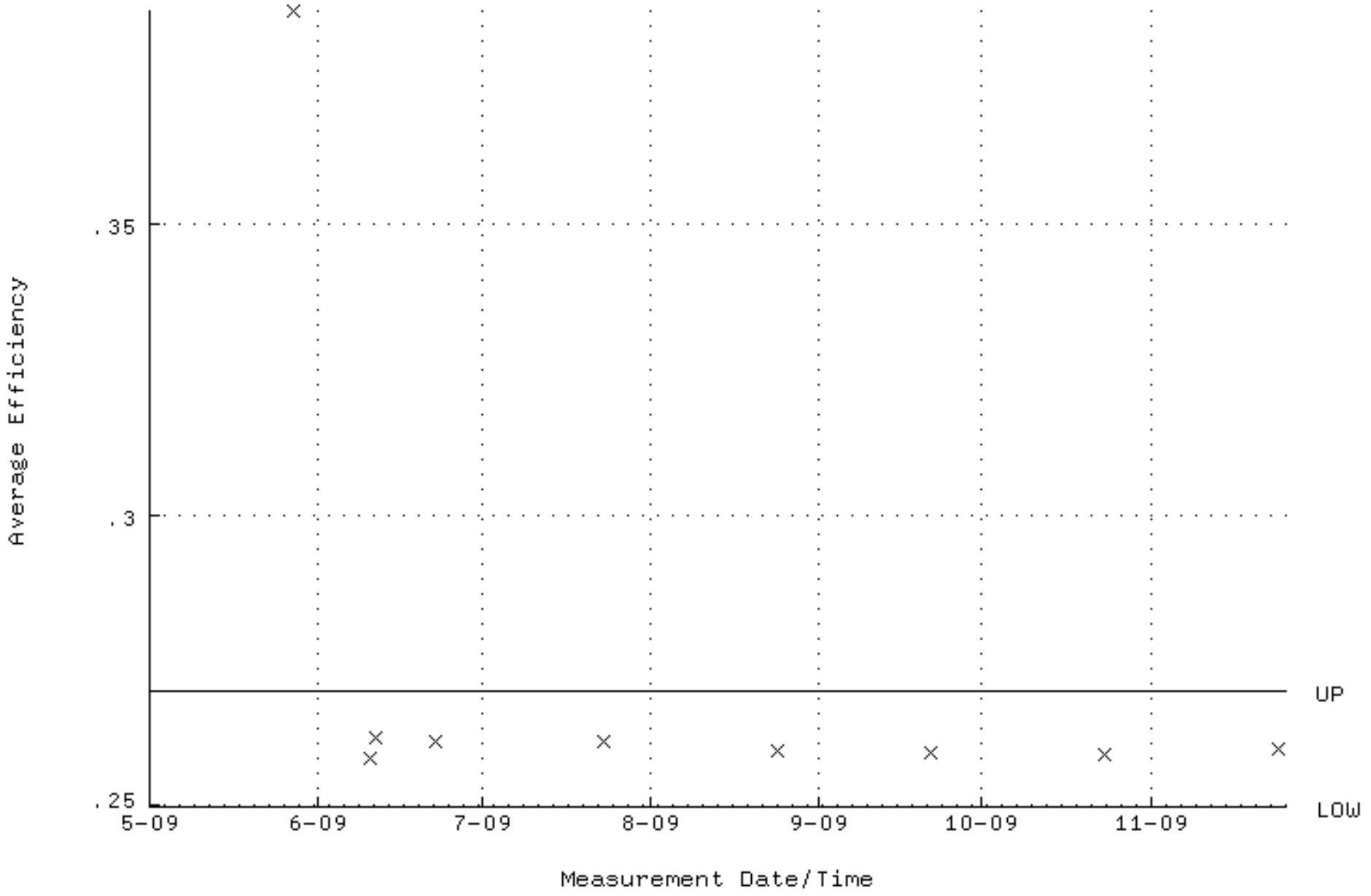
QA filename : DKA100:[ENV_ALPHA.QA.W]W155.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 18-MAY-2009 09:48:01 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 83.6873 through 92.4965



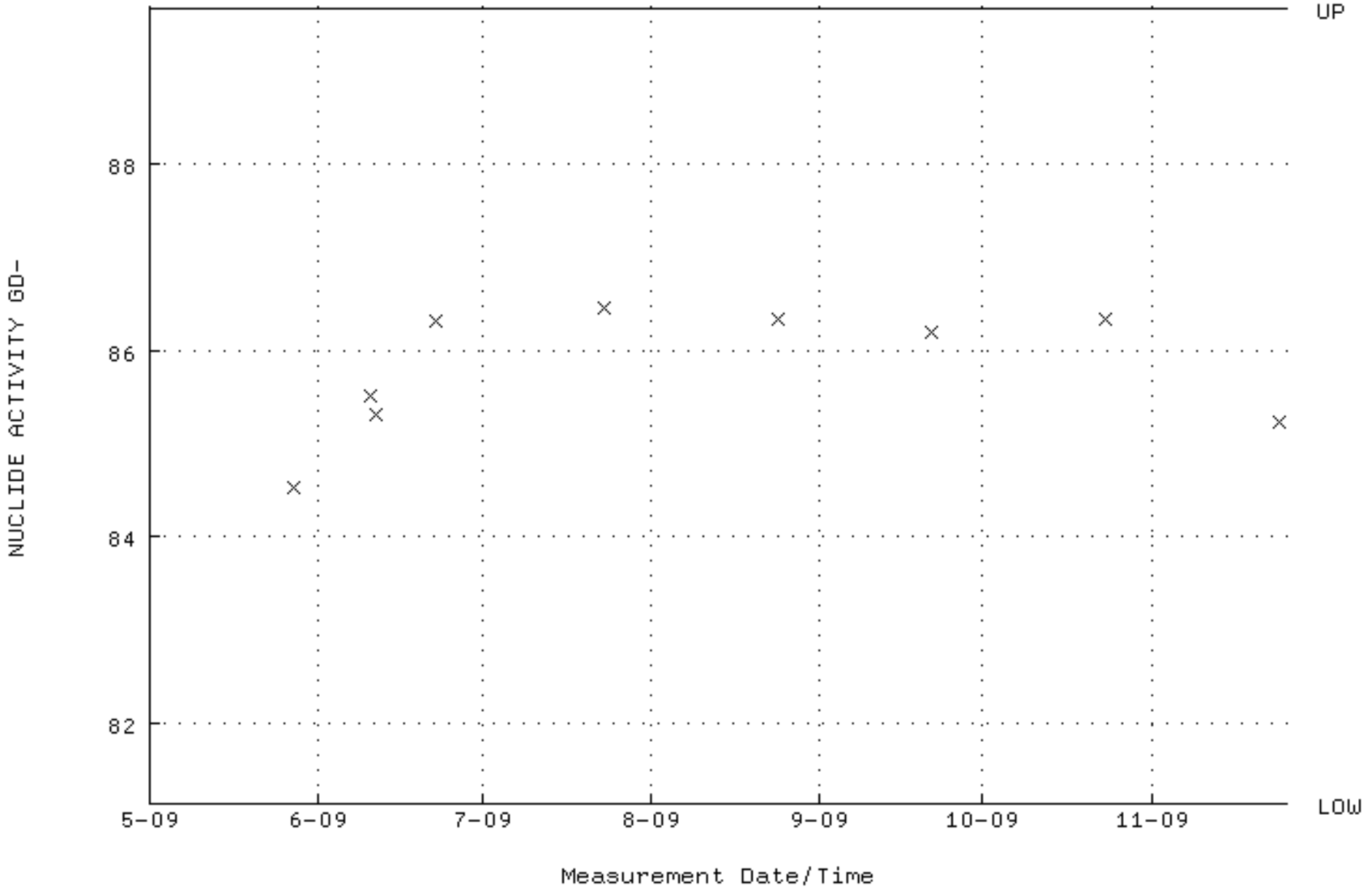
QA filename : DKA100:[ENV_ALPHA.QA.B]B155.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:52:54 through 19-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



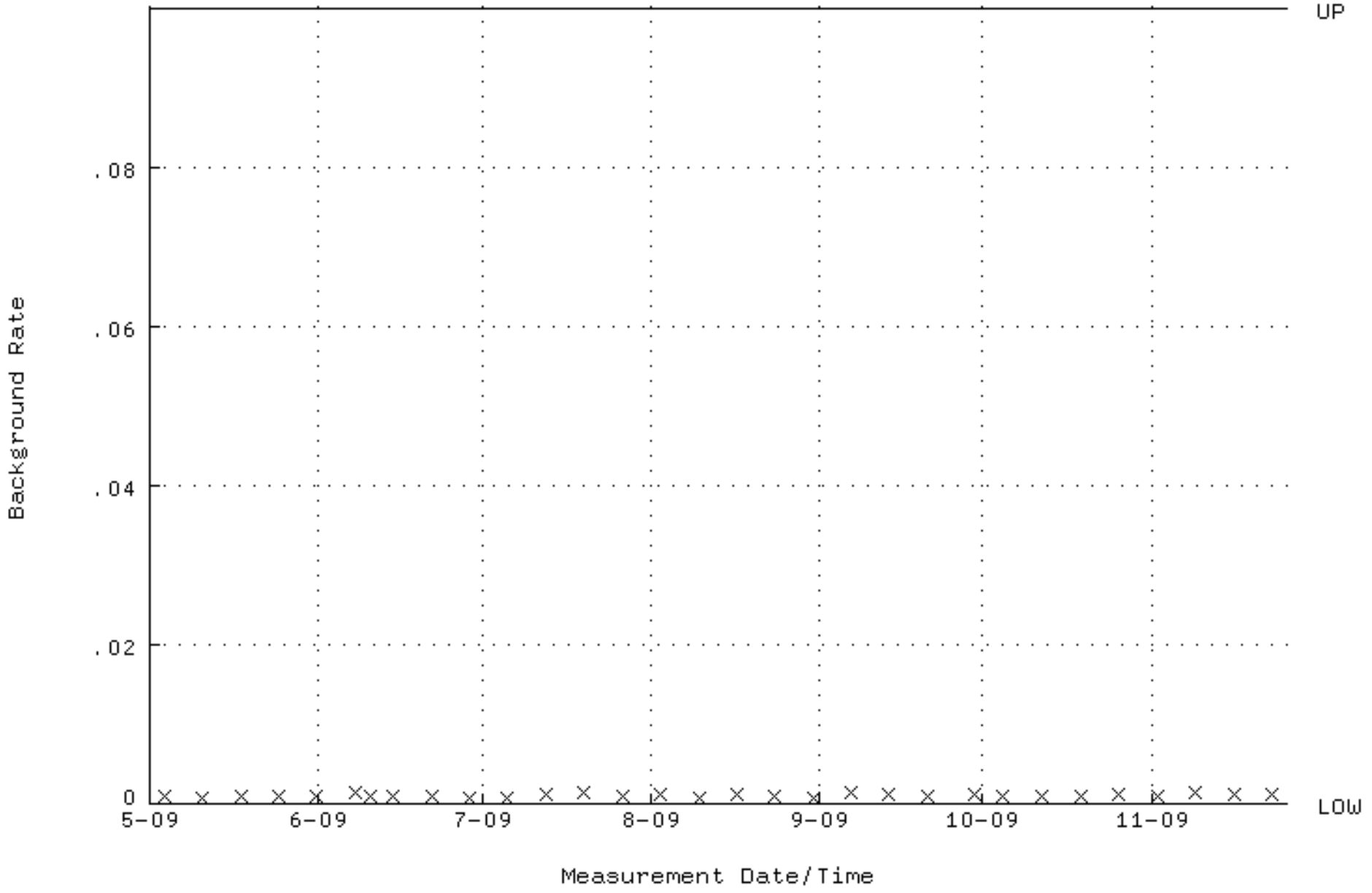
QA filename : DKA100:[ENV_ALPHA.QA.W]W201.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 27-MAY-2009 07:45:32 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.249568 through 0.269568



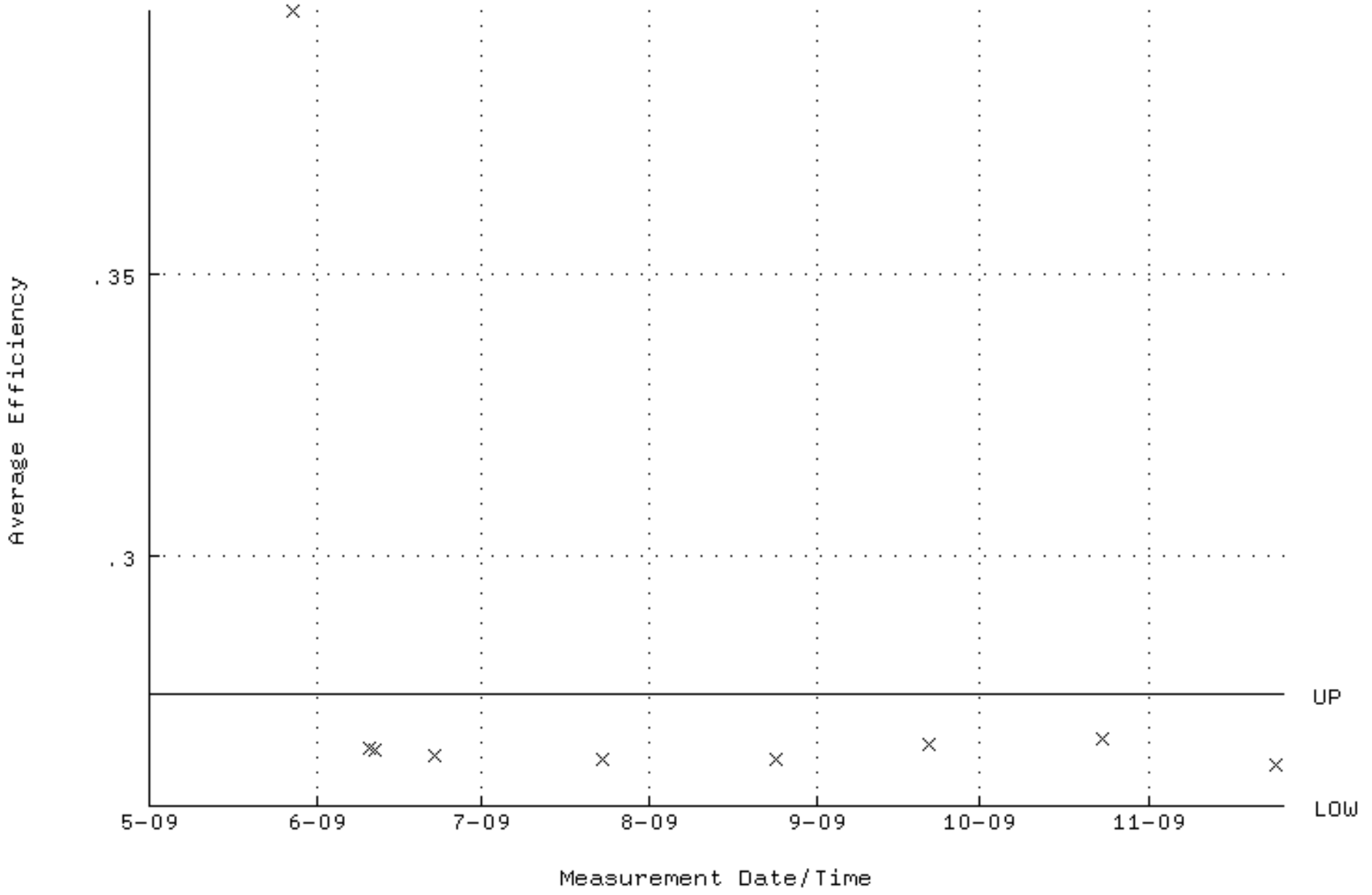
QA filename : DKA100:[ENV_ALPHA.QA.W]W201.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 27-MAY-2009 07:45:32 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 81.1299 through 89.6699



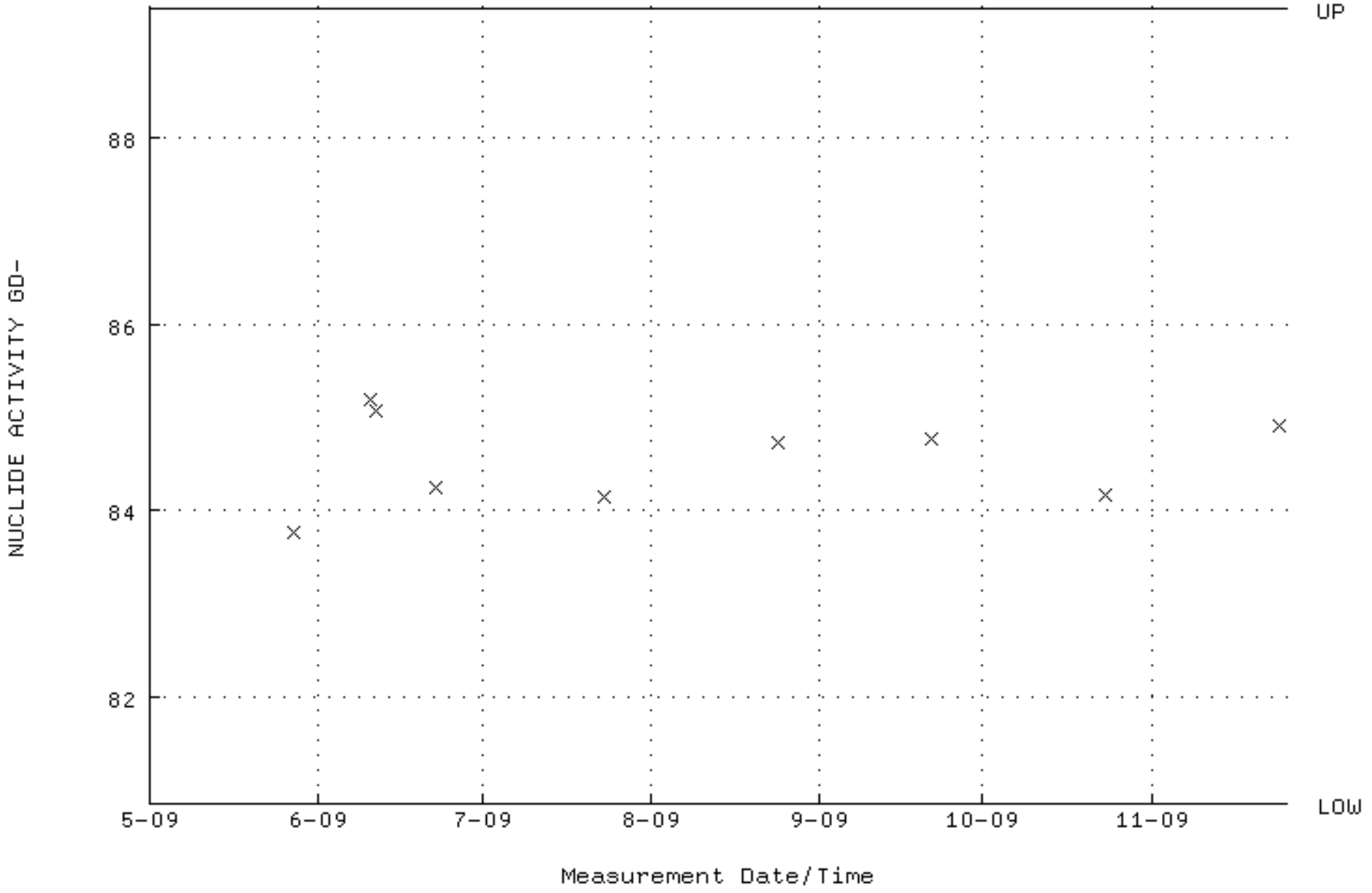
QA filename : DKA100:[ENV_ALPHA.QA.B]B201.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:55:50 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



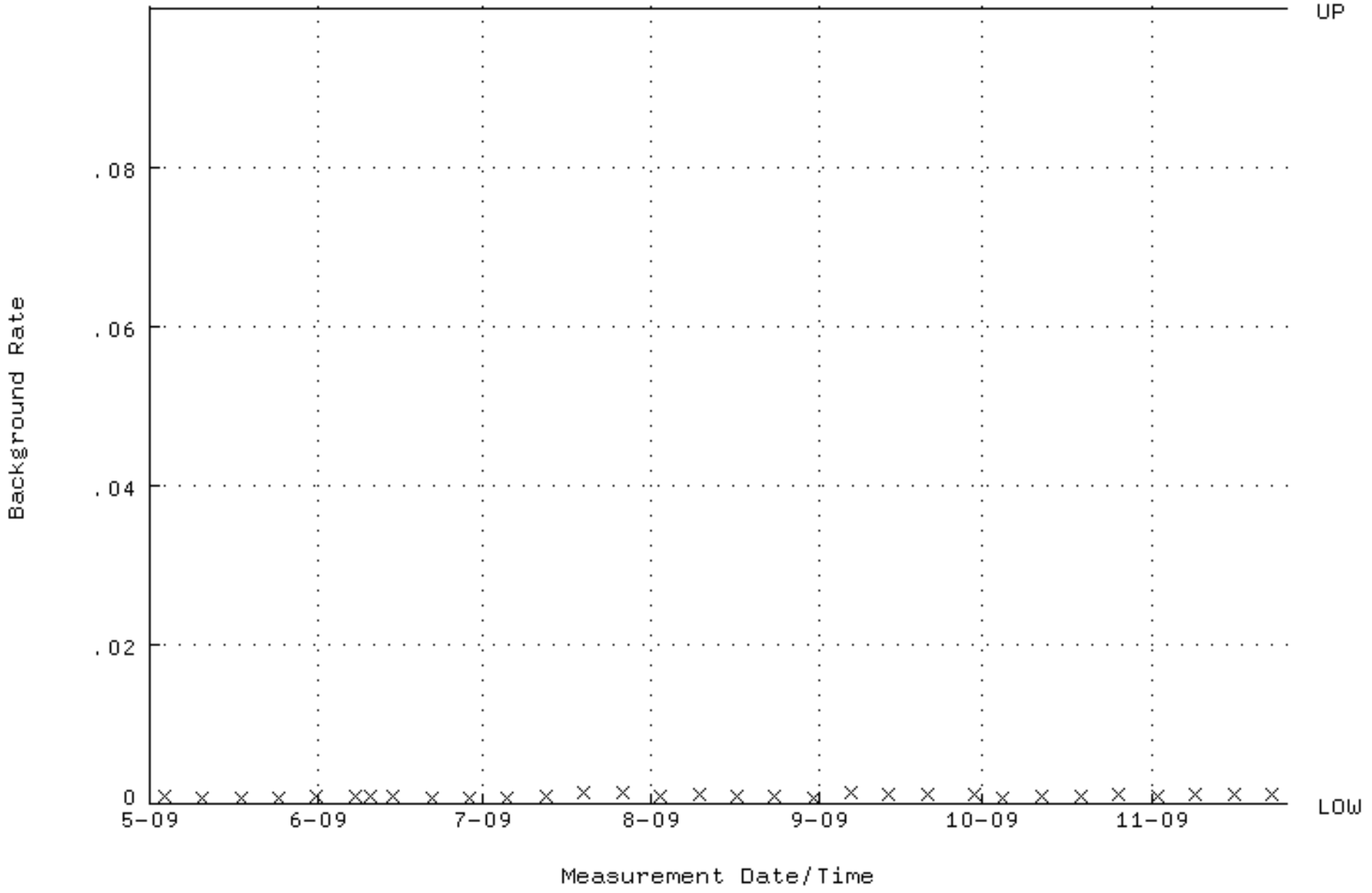
QA filename : DKA100:[ENV_ALPHA.QA.W]W202.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 27-MAY-2009 07:45:36 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.255511 through 0.275511



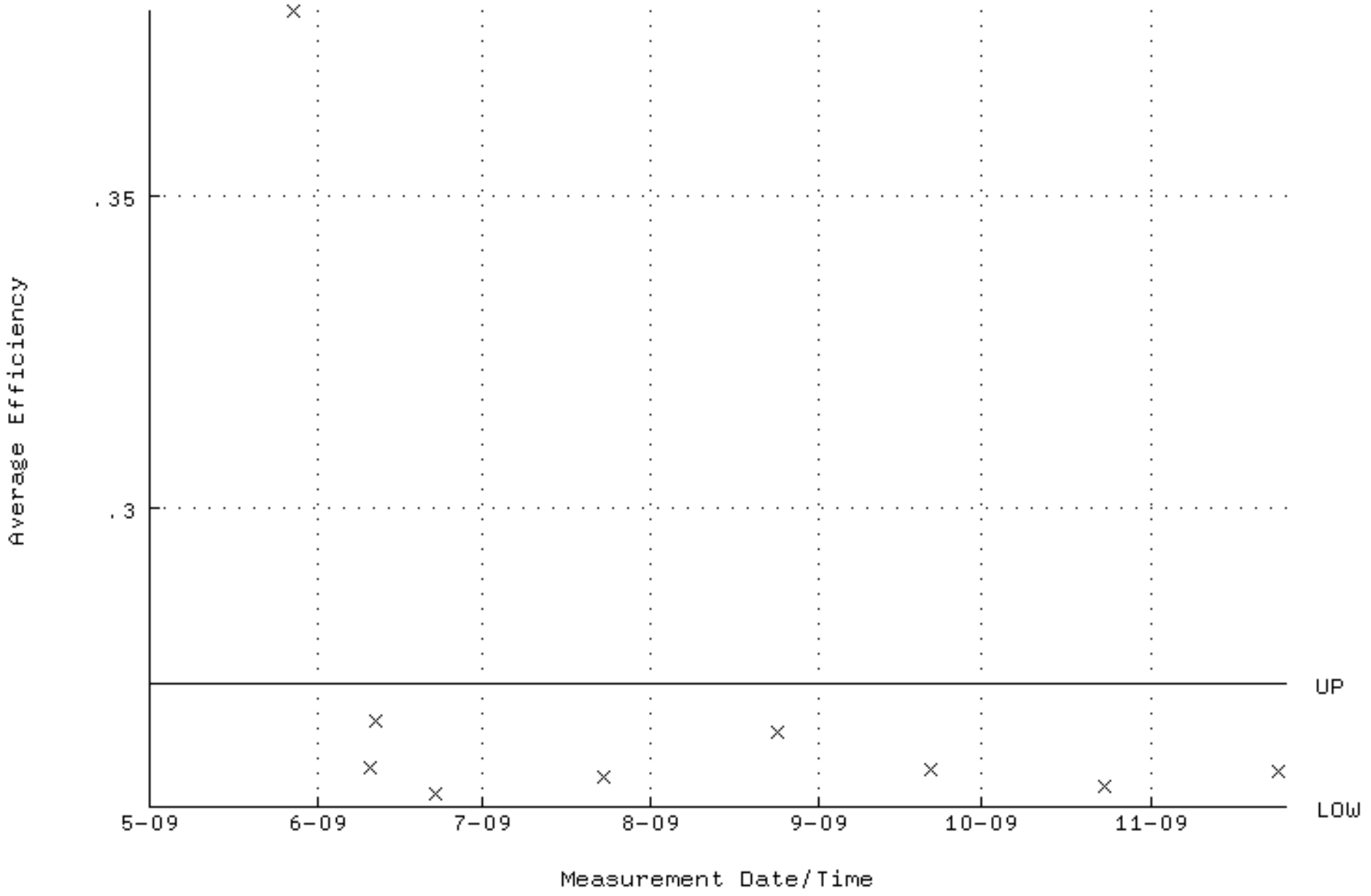
QA filename : DKA100:[ENV_ALPHA.QA.W]W202.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 27-MAY-2009 07:45:36 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 80.8649 through 89.3769



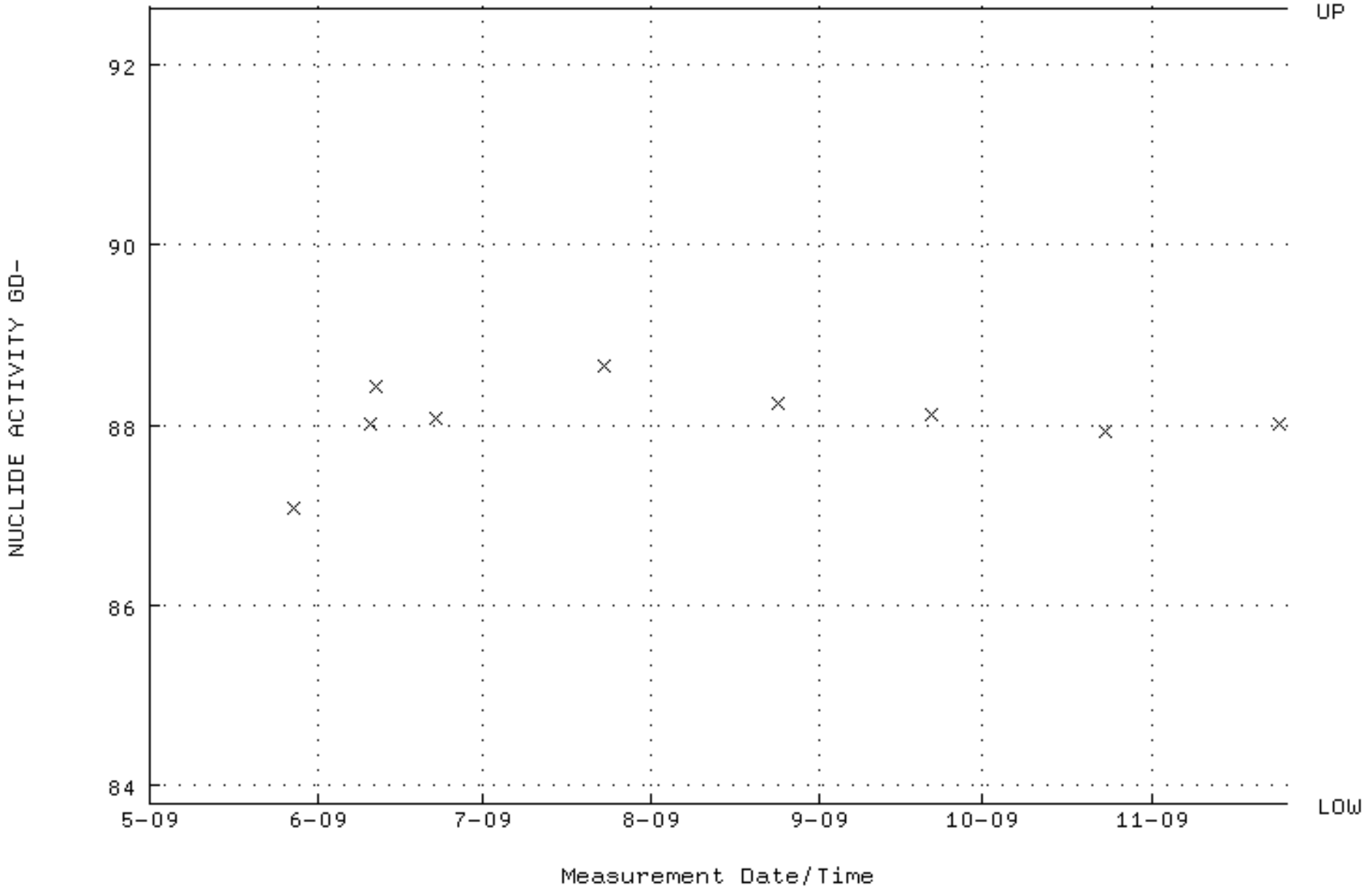
QA filename : DKA100:[ENV_ALPHA.QA.B]B202.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:55:54 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



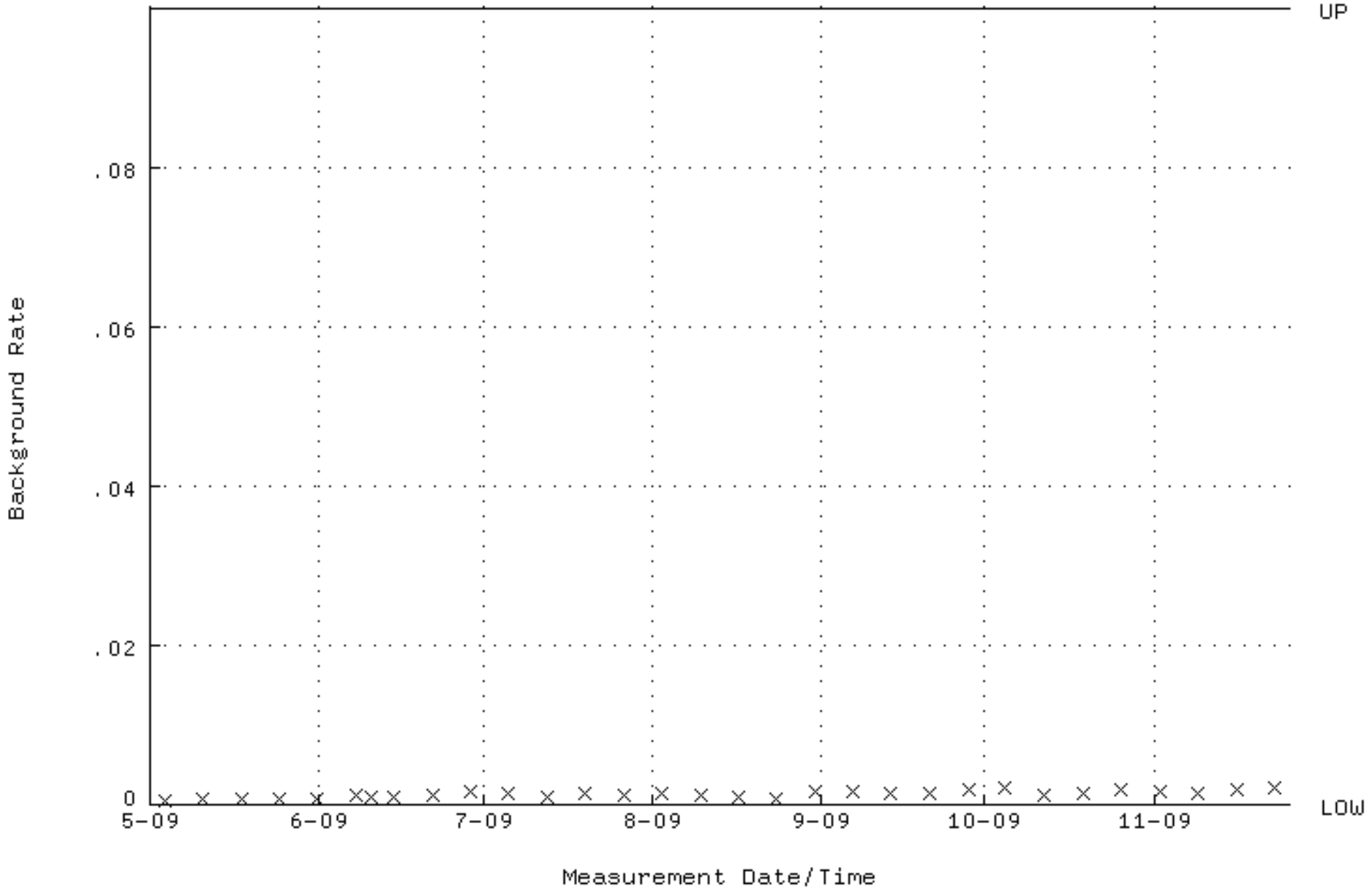
QA filename : DKA100:[ENV_ALPHA.QA.W]W203.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 27-MAY-2009 07:45:40 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.252203 through 0.272203



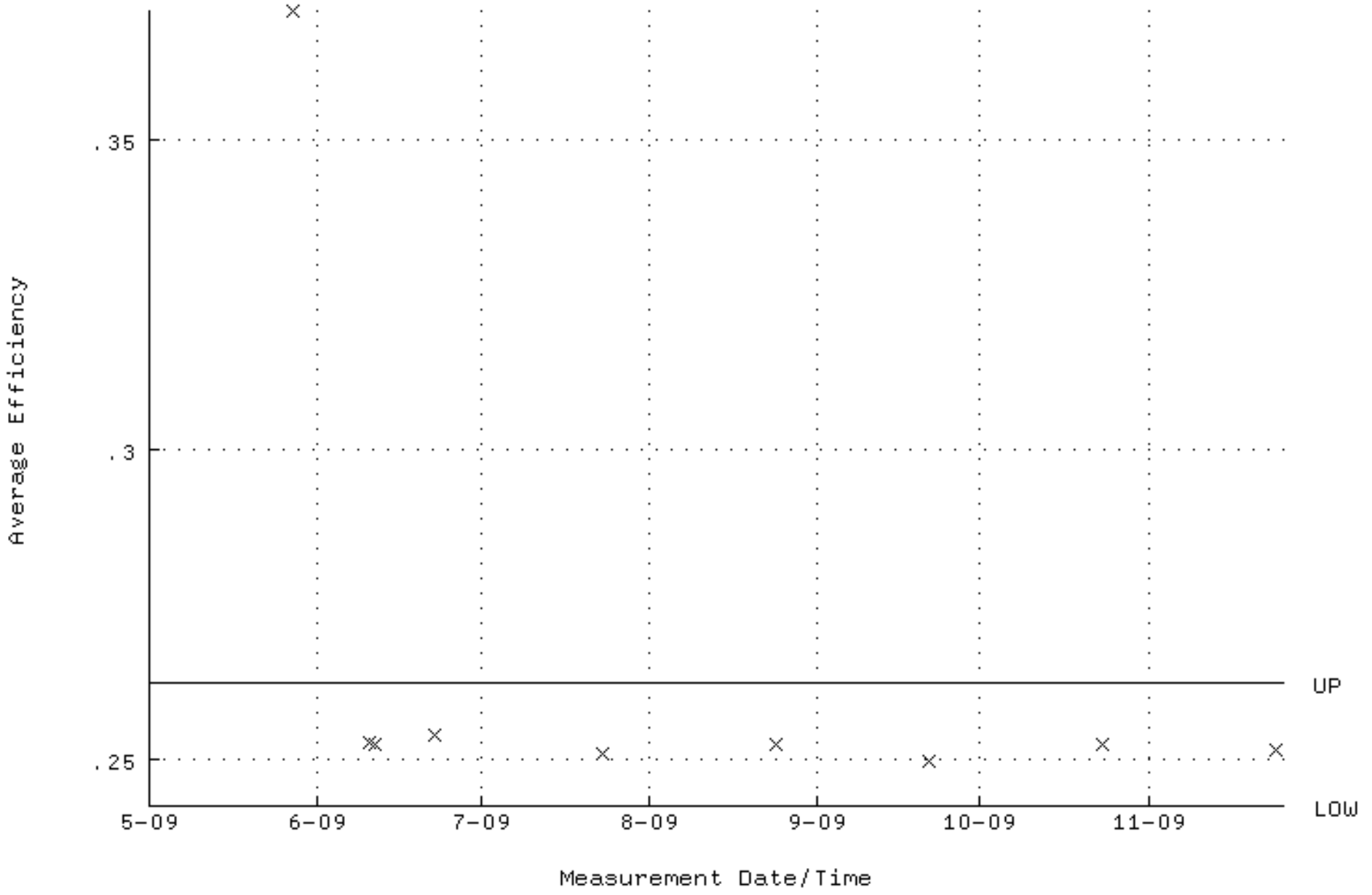
QA filename : DKA100:[ENV_ALPHA.QA.W]W203.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 27-MAY-2009 07:45:40 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 83.7993 through 92.6203



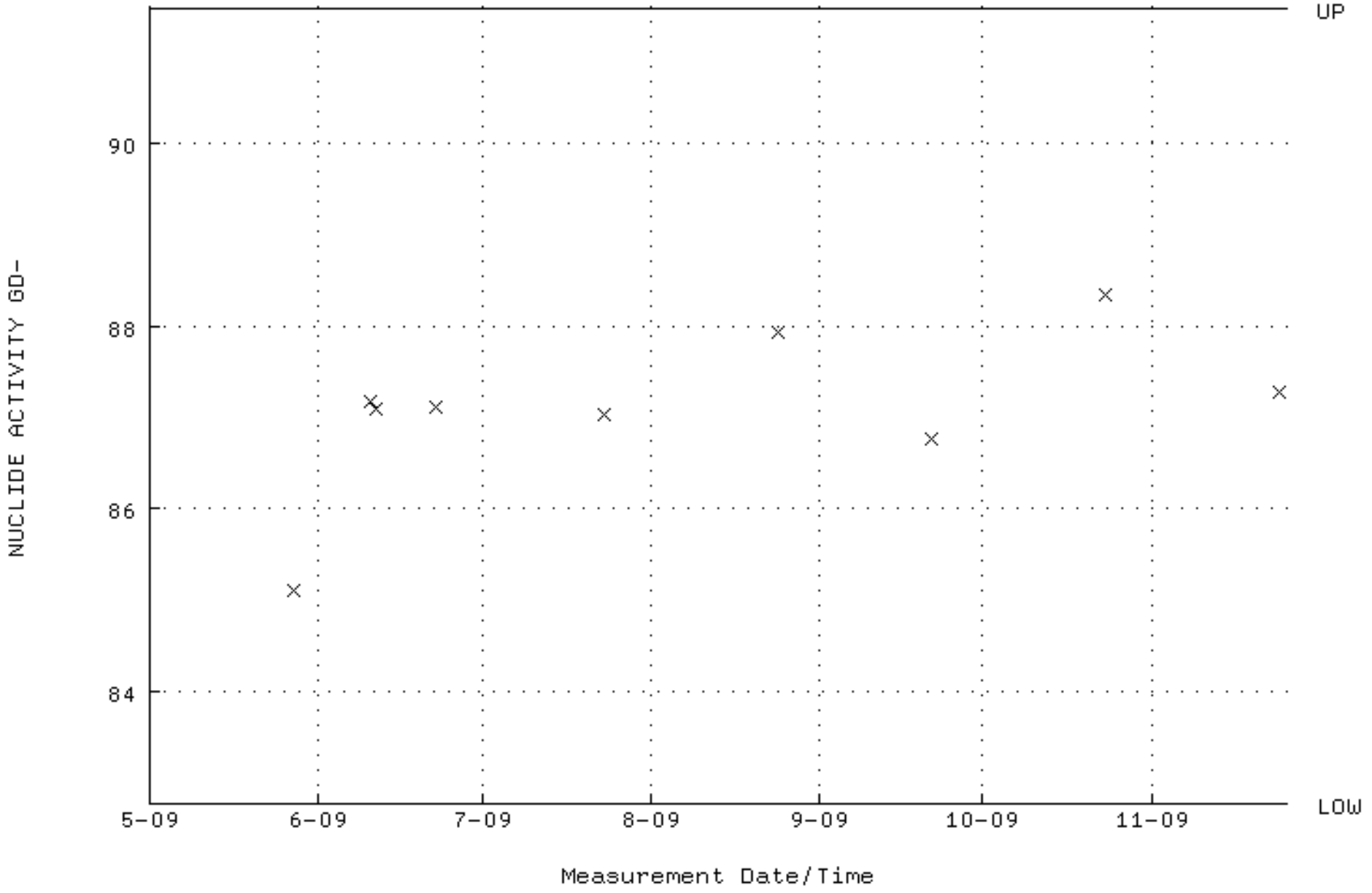
QA filename : DKA100:[ENV_ALPHA.QA.B]B203.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:55:58 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



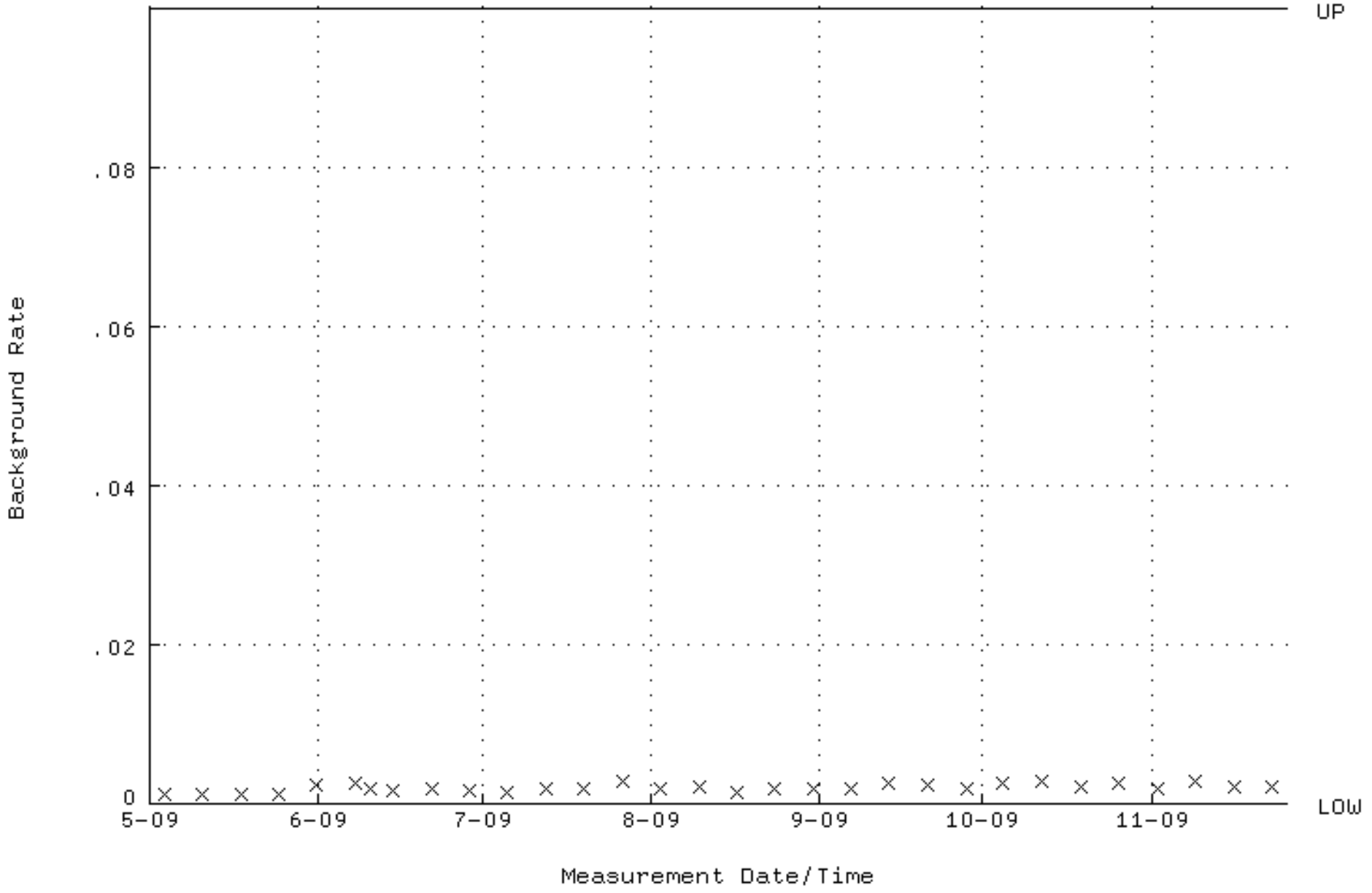
QA filename : DKA100:[ENV_ALPHA.QA.W]W204.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 27-MAY-2009 07:45:44 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.242368 through 0.262368



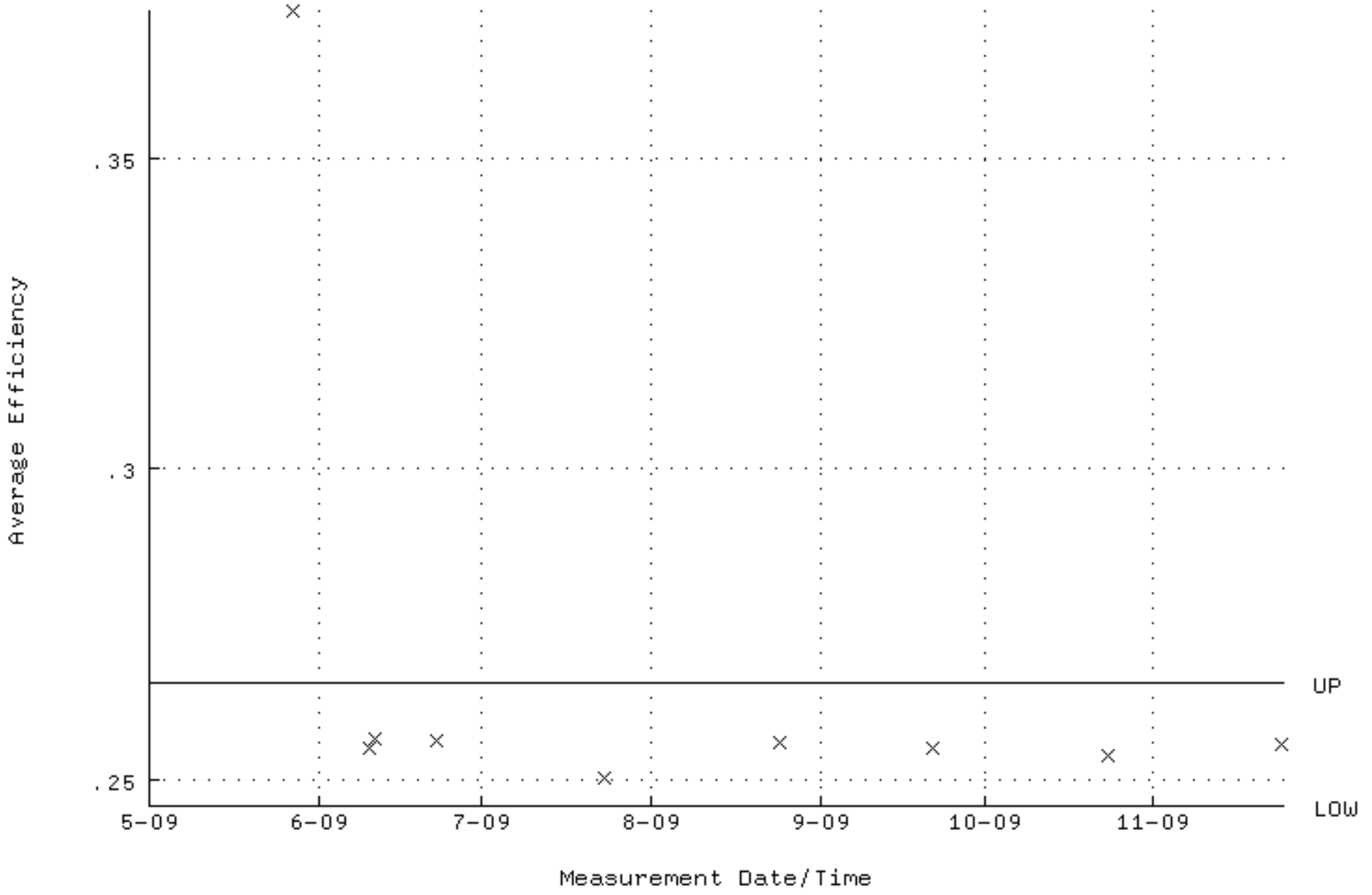
QA filename : DKA100:[ENV_ALPHA.QA.W]W204.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 27-MAY-2009 07:45:44 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 82.7661 through 91.4783



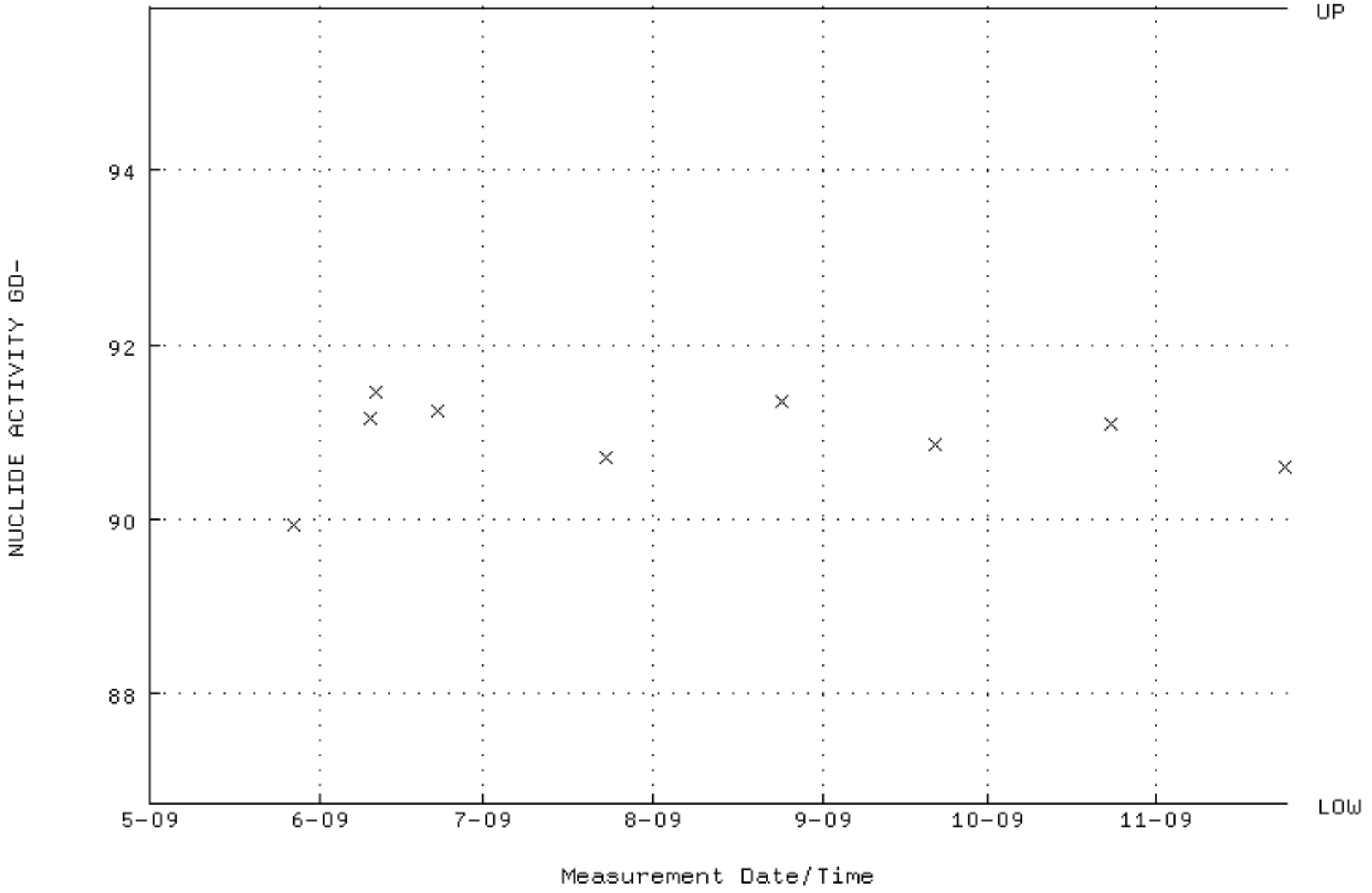
QA filename : DKA100:[ENV_ALPHA.QA.B]B204.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:56:02 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



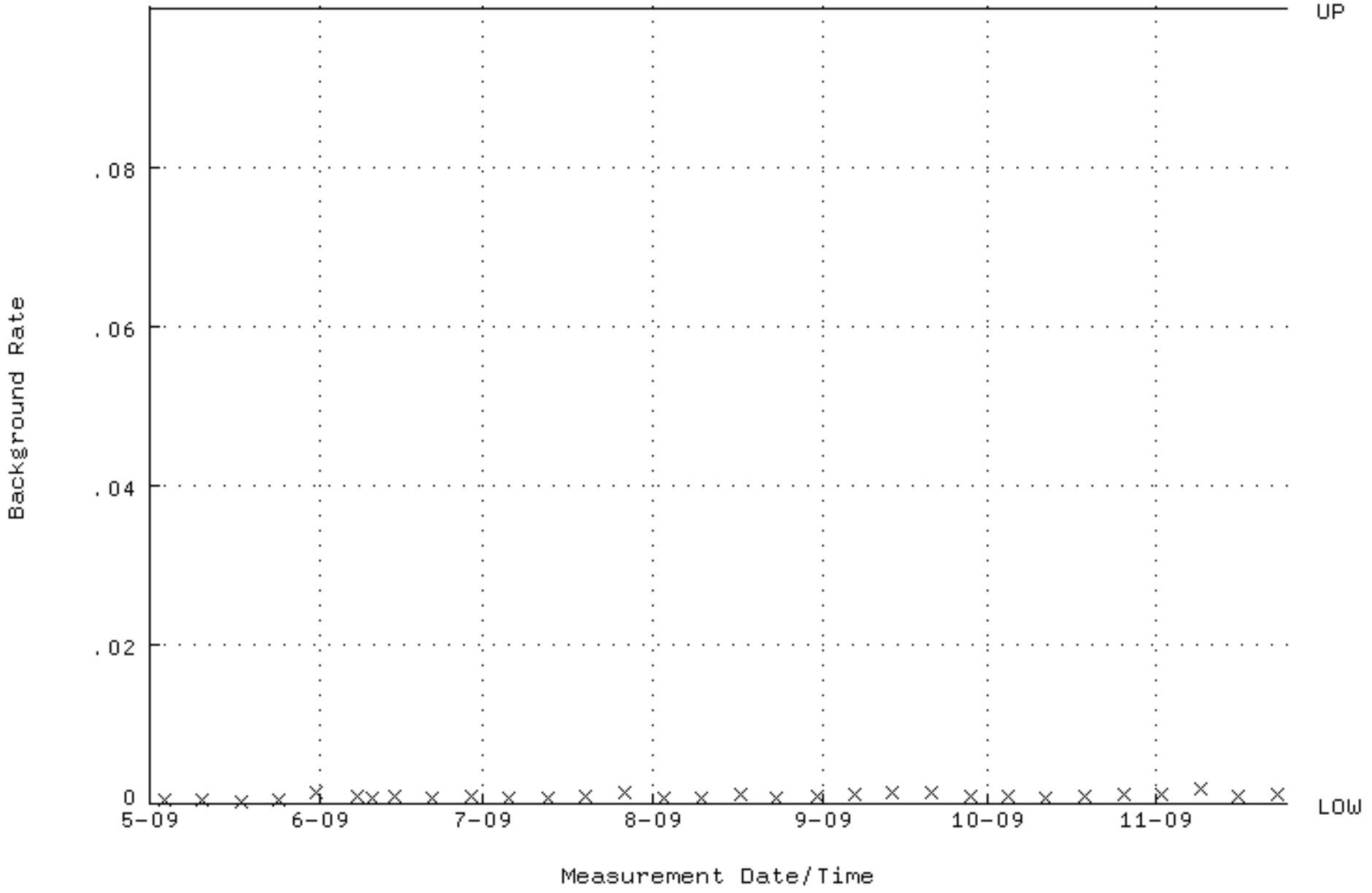
QA filename : DKA100:[ENV_ALPHA.QA.W]W205.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 27-MAY-2009 07:45:48 through 24-NOV-2009 12:00:00
Lower/Upper Lmts: 0.245702 through 0.265702



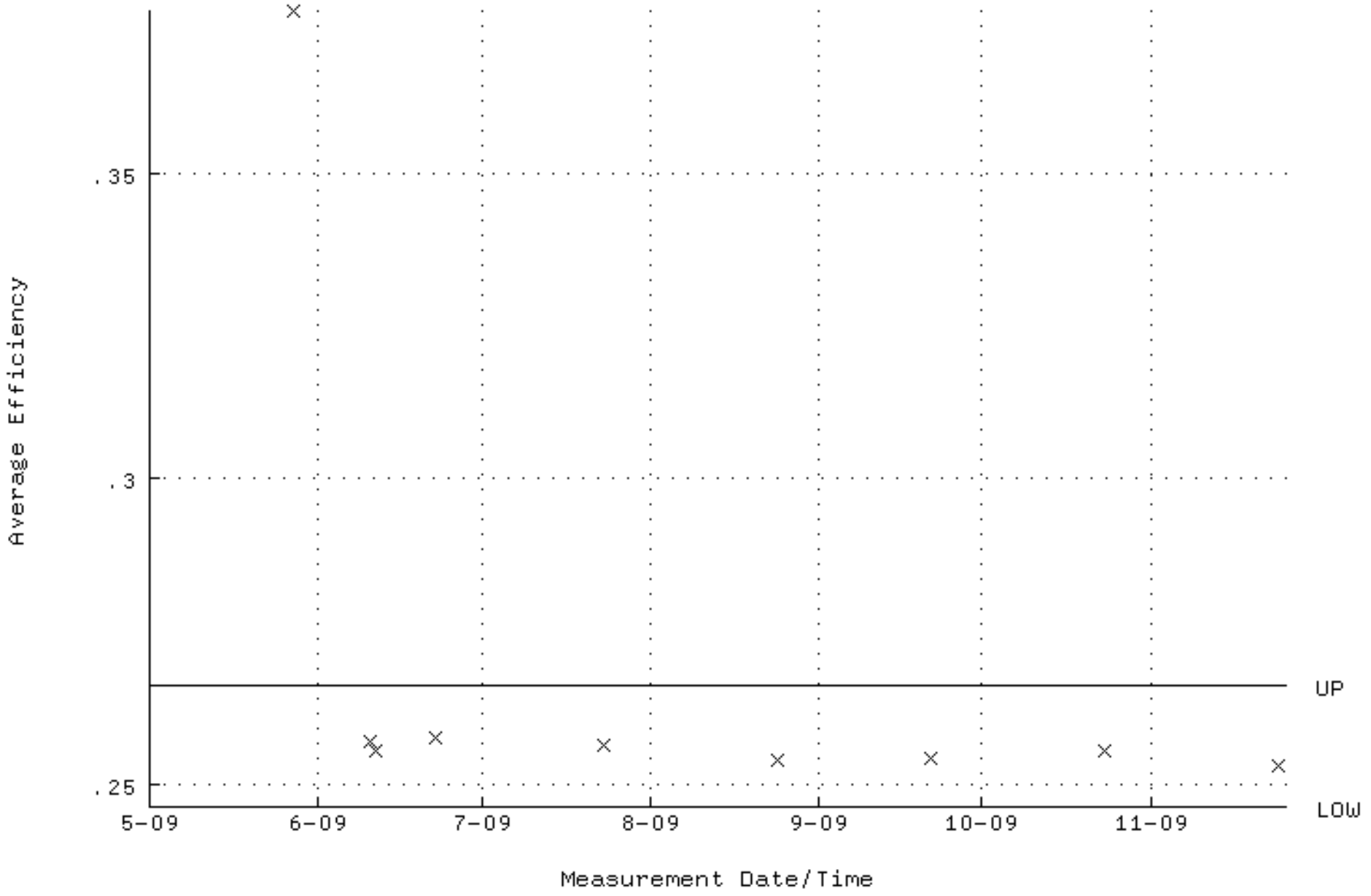
QA filename : DKA100:[ENV_ALPHA.QA.W]W205.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 27-MAY-2009 07:45:48 through 24-NOV-2009 12:00:00
Lower/Upper Lmts: 86.7285 through 95.8579



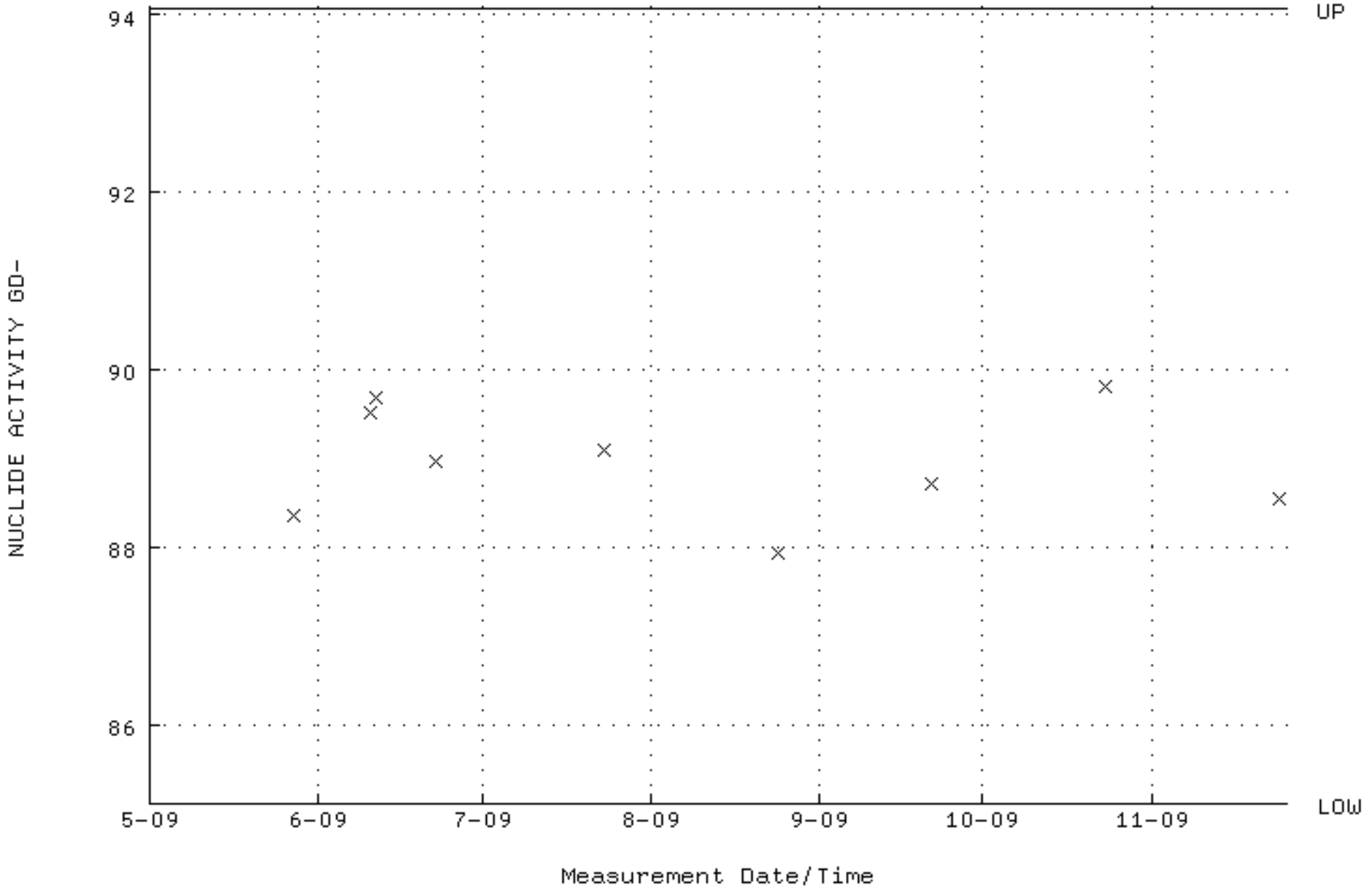
QA filename : DKA100:[ENV_ALPHA.QA.B]B205.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:56:06 through 24-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



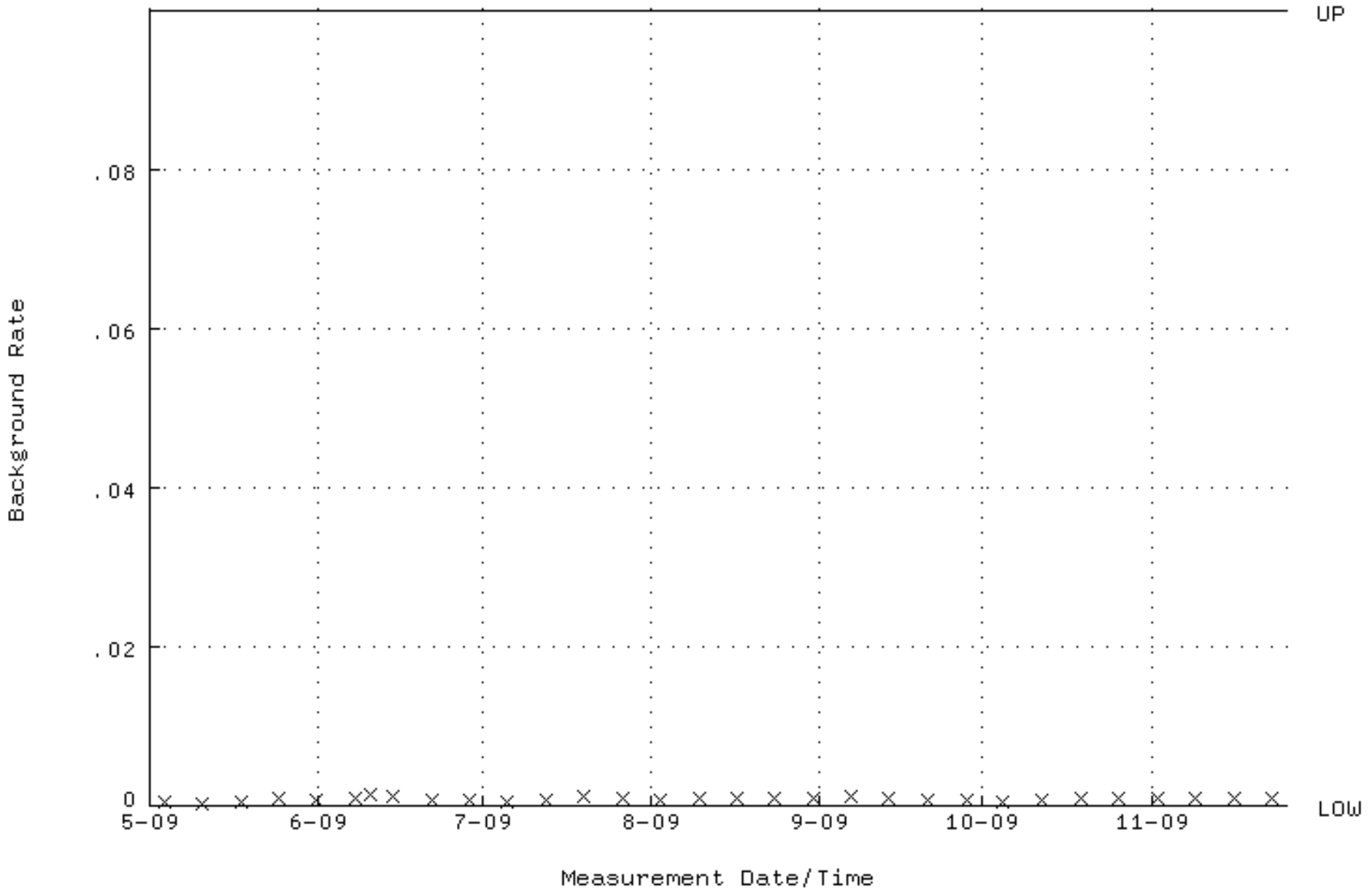
QA filename : DKA100:[ENV_ALPHA.QA.W]W206.QAF;1
Parameter Name : AVRGEFF (Average Efficiency)
Start/End Dates : 27-MAY-2009 07:45:52 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.246228 through 0.266228



QA filename : DKA100:[ENV_ALPHA.QA.W]W206.QAF;1
Parameter Name : NLACTVTY-GD148 (NUCLIDE ACTIVITY GD-148)
Start/End Dates : 27-MAY-2009 07:45:52 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 85.1104 through 94.0694



QA filename : DKA100:[ENV_ALPHA.QA.B]B206.QAF;1
Parameter Name : BACKRATE (Background Rate)
Start/End Dates : 3-MAY-2009 13:56:09 through 25-NOV-2009 12:00:00
Lower/Upper Lmts: 0.000000E+00 through 0.100000



RUNLOGS

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR **Batch ID: 920697**

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
239753001	SAMPLE	KSD1	LUCAS7	01-DEC-09 18:05	DONE	Lucas Cell	30-SEP-09 00:00
239753002	SAMPLE	KSD1	LUCAS1	01-DEC-09 18:40	DONE	Lucas Cell	31-AUG-09 00:00
239753003	SAMPLE	KSD1	LUCAS2	01-DEC-09 18:40	DONE	Lucas Cell	19-DEC-08 00:00
239753004	SAMPLE	KSD1	LUCAS3	01-DEC-09 18:40	DONE	Lucas Cell	04-FEB-09 00:00
239753005	SAMPLE	KSD1	LUCAS4	01-DEC-09 18:40	DONE	Lucas Cell	02-MAR-09 00:00
239753006	SAMPLE	KSD1	LUCAS5	01-DEC-09 18:40	DONE	Lucas Cell	25-MAR-09 00:00
239753007	SAMPLE	KSD1	LUCAS7	01-DEC-09 18:40	DONE	Lucas Cell	30-SEP-09 00:00
239753008	SAMPLE	KSD1	LUCAS1	01-DEC-09 19:10	DONE	Lucas Cell	31-AUG-09 00:00
239753009	SAMPLE	KSD1	LUCAS2	01-DEC-09 19:10	DONE	Lucas Cell	19-DEC-08 00:00
239753010	SAMPLE	KSD1	LUCAS3	01-DEC-09 19:10	DONE	Lucas Cell	04-FEB-09 00:00
239753011	SAMPLE	KSD1	LUCAS5	01-DEC-09 19:10	DONE	Lucas Cell	25-MAR-09 00:00
239753012	SAMPLE	KSD1	LUCAS7	01-DEC-09 19:10	DONE	Lucas Cell	30-SEP-09 00:00
239753013	SAMPLE	KSD1	LUCAS1	01-DEC-09 20:00	DONE	Lucas Cell	31-AUG-09 00:00
239753014	SAMPLE	KSD1	LUCAS2	01-DEC-09 20:00	DONE	Lucas Cell	19-DEC-08 00:00
239753015	SAMPLE	KSD1	LUCAS3	01-DEC-09 20:00	DONE	Lucas Cell	04-FEB-09 00:00
239753016	SAMPLE	KSD1	LUCAS5	01-DEC-09 20:00	DONE	Lucas Cell	25-MAR-09 00:00
239753017	SAMPLE	KSD1	LUCAS7	01-DEC-09 20:00	DONE	Lucas Cell	30-SEP-09 00:00
239753018	SAMPLE	KSD1	LUCAS2	01-DEC-09 20:35	DONE	Lucas Cell	19-DEC-08 00:00
1201967363	MB	KSD1	LUCAS3	01-DEC-09 20:35	DONE	Lucas Cell	04-FEB-09 00:00
1201967364	DUP	KSD1	LUCAS5	01-DEC-09 20:35	DONE	Lucas Cell	25-MAR-09 00:00
1201967365	MS	KSD1	LUCAS7	01-DEC-09 20:35	DONE	Lucas Cell	30-SEP-09 00:00
1201967366	LCS	KSD1	LUCAS7	01-DEC-09 21:25	DONE	Lucas Cell	30-SEP-09 00:00

Instrument Run Log

Instrument Type: GFPC **Batch ID: 922859**

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
239753002	SAMPLE	JXC5	PIC13A	23-NOV-09 17:23	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753011	SAMPLE	JXC5	PIC14A	23-NOV-09 17:23	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753012	SAMPLE	JXC5	PIC12C	23-NOV-09 17:23	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753018	SAMPLE	JXC5	PIC12D	23-NOV-09 17:23	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201972469	DUP	JXC5	PIC9A	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201972470	MS	JXC5	PIC9B	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201972471	LCS	JXC5	PIC3A	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753001	SAMPLE	JXC5	PIC1A	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753003	SAMPLE	JXC5	PIC8A	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753004	SAMPLE	JXC5	PIC1C	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753005	SAMPLE	JXC5	PIC2A	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753006	SAMPLE	JXC5	PIC7C	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753007	SAMPLE	JXC5	PIC6B	23-NOV-09 17:26	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753008	SAMPLE	JXC5	PIC5C	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753009	SAMPLE	JXC5	PIC9D	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753010	SAMPLE	JXC5	PIC7D	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753013	SAMPLE	JXC5	PIC10D	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753014	SAMPLE	JXC5	PIC1D	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753015	SAMPLE	JXC5	PIC8C	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753016	SAMPLE	JXC5	PIC7A	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
239753017	SAMPLE	JXC5	PIC10C	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00
1201972468	MB	JXC5	PIC6D	23-NOV-09 17:27	DONE	CeF on 25mm Filter	02-JUL-09 00:00

Instrument Run Log

Instrument Type: ALPHA SPECTROMETER **Batch ID: 923093**

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
239753016	SAMPLE	KXM4	1201	20-NOV-09 14:16	DONE		
239753017	SAMPLE	KXM4	1202	20-NOV-09 14:16	DONE		
239753018	SAMPLE	KXM4	1203	20-NOV-09 14:16	DONE		
1201973223	MB	KXM4	1204	20-NOV-09 14:16	DONE		
1201973224	DUP	KXM4	1205	20-NOV-09 14:16	DONE		
1201973225	MS	KXM4	1206	20-NOV-09 14:16	DONE		
239753001	SAMPLE	KXM4	1025	20-NOV-09 16:04	DONE		
239753002	SAMPLE	KXM4	1026	20-NOV-09 16:04	DONE		
239753003	SAMPLE	KXM4	1027	20-NOV-09 16:04	DONE		
239753004	SAMPLE	KXM4	1028	20-NOV-09 16:04	DONE		
239753005	SAMPLE	KXM4	1029	20-NOV-09 16:04	DONE		
239753006	SAMPLE	KXM4	1030	20-NOV-09 16:04	DONE		
239753007	SAMPLE	KXM4	1031	20-NOV-09 16:05	DONE		
239753008	SAMPLE	KXM4	1033	20-NOV-09 16:05	DONE		
239753009	SAMPLE	KXM4	1035	20-NOV-09 16:05	DONE		
239753010	SAMPLE	KXM4	1036	20-NOV-09 16:05	DONE		
239753011	SAMPLE	KXM4	1037	20-NOV-09 16:05	DONE		
239753012	SAMPLE	KXM4	1038	20-NOV-09 16:05	DONE		
239753013	SAMPLE	KXM4	1039	20-NOV-09 16:05	DONE		
239753014	SAMPLE	KXM4	1040	20-NOV-09 16:05	DONE		
239753015	SAMPLE	KXM4	1041	20-NOV-09 16:05	DONE		
1201973226	LCS	KXM4	1042	20-NOV-09 16:05	DONE		

Instrument Run Log

Instrument Type: ALPHA SPECTROMETER **Batch ID: 923094**

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
1201973227	MB	KXM4	1121	20-NOV-09 14:25	DONE		
1201973228	DUP	KXM4	1122	20-NOV-09 14:25	DONE		
1201973229	MS	KXM4	1123	20-NOV-09 14:25	DONE		
1201973230	LCS	KXM4	1124	20-NOV-09 14:25	DONE		
239753001	SAMPLE	KXM4	1138	21-NOV-09 15:52	DONE		
239753002	SAMPLE	KXM4	1139	21-NOV-09 15:52	DONE		
239753003	SAMPLE	KXM4	1140	21-NOV-09 15:52	DONE		
239753004	SAMPLE	KXM4	1141	21-NOV-09 15:52	DONE		
239753005	SAMPLE	KXM4	1142	21-NOV-09 15:52	DONE		
239753006	SAMPLE	KXM4	1143	21-NOV-09 15:52	DONE		
239753007	SAMPLE	KXM4	1144	21-NOV-09 15:52	DONE		
239753008	SAMPLE	KXM4	1145	21-NOV-09 15:52	DONE		
239753009	SAMPLE	KXM4	1146	21-NOV-09 15:52	DONE		
239753010	SAMPLE	KXM4	1147	21-NOV-09 15:52	DONE		
239753011	SAMPLE	KXM4	1148	21-NOV-09 15:52	DONE		
239753012	SAMPLE	KXM4	1149	21-NOV-09 15:52	DONE		
239753013	SAMPLE	KXM4	1150	21-NOV-09 15:52	DONE		
239753014	SAMPLE	KXM4	1151	21-NOV-09 15:52	DONE		
239753015	SAMPLE	KXM4	1152	21-NOV-09 15:52	DONE		
239753016	SAMPLE	KXM4	1153	21-NOV-09 15:52	DONE		
239753017	SAMPLE	KXM4	1154	21-NOV-09 15:52	DONE		
239753018	SAMPLE	KXM4	1155	21-NOV-09 15:52	DONE		