

LOG-IN VERIFICATION
All samples
All planchets

PT
327

PB#6107 M. 20

R702124 TA_IRVINE
TestAmerica - Irvin
17461 Derian Avenu

Pr Mgr.... MCM Rcvd... 02/21/07
Charge.... 00-000 Due.... 03/14/07
Chemist... Value... 0.
Created... 22-FEB-07 Billed.. 0.
Billing status.. open
Calc. units.... PCI /Unit alq Min Pri
0

PROJECT# IQB2024

smp	elm	typ	mg	rec	dpm rec Ash wgt	1st sep	2nd sep	aliquot	carr/ trac
1	80		107.20		0.0000	0.000	0 0.000 0	0.2000 - 1	# 0

Carriers/Tracers used -----

8656, 8657, 8658, 8659

WORK RECORD

2.22.07

Date	Analysis	Proc / steps	Sample	Analyt	Remarks
02.21.07	Vred, pH	DWP-007	ALL	LS	
"	FILTR'N.	DWP-050	8657-1	LS/AR	SAMPLE ALIQUOTE FOR Ac AND Ra ANALYSIS HAVE BEEN FILTERED AND FILTERS DIGESTED. LS/AR.
02.22.07	Ac, Ra SR	DWP-062	8657-1,4	LS	
"	Ra	"	8657-1,4,5	LS	
"	[80]	DWP-121	8656-1 8657-1,4,5 8658-1 8659-1	LS	7.1-7.2
03.06.07	[80]	DWP 121 → 7.2 → 8.10	ALL	DWP	
03.16.07	[80]	DWP 121 → ALL	8657-5R	DWP	

8656 -
8657 -

8658 -
8659 -

RECOVERY:

[80]

	E	T	N	DONE BY
8657-5R	19.2825	19.2140	685	

8656 -
8657 -

8658 -
8659 -

2.22.07 8656, 8657, 8658, 8659

WATER

Rec'd: 02.21.07
DUE: 03.14.07

[80], [Ac], [Ra], [SR]

uk DWP

02 Ac AND R
TELED AND

LS/AR

Cent. ID TO	FRACT	VOLUME RSJ(L)	PH	MLQ 80(L)	MLQ Ac(L)	MLQ Ra(L)	MLQ SR(L)
8656-1 IQB2021-01 02.19.07 09:30	1	10.0	6.5	0.3	HOLD	HOLD	HOLD
8657-1 IQB2022-01 02.19.07 12:00	1	10.0	6.2	0.3	1.8	0.1	0.5
-2 LCS							
-3 BLANK							
-4 Dup. #1 2.19.07 12:00				0.3	1.8	0.1	0.5
-5 MS #1 2.19.07 12:00				0.3	N/A	0.1	N/A
8658-1 IQB2023-01 02.19.07 11:15	1	7.00	6.0	0.120	HOLD	HOLD	HOLD
8659-1 IQB2024-01 02.19.07 10:15	1	10.00	7.0	0.200	HOLD	HOLD	HOLD
DONE BY:				LS 2/22			

Recovery:

[80]

	G	T	N	DONE BY	CHKD BY
8656-1	19.2568	19.1855	71.3	DWP 03.06.07	JKM 03.06.07
8657-1	19.3392	19.2783	60.9		
✓	19.3643	19.3005	63.8		
3	19.3792	19.3159	63.3		
4	19.2724	19.2126	59.8		
5	19.2738	19.2140	59.8		
8658-1	19.3469	19.2860	90.9		
8659-1	19.3338	19.2766	107.2		

6

1st
2/26/07

8657

DUE: 03-14-07

TA IRVINE (Water)

[Ac, HdST, Ra, Sr]

1-4

spikes

- | # | CUST ID | T ^o |
|---|--|--|
| 1 | IQB2022-01 | 02-19-07 12:00 |
| 2 | LCS #60404 [Ra] ^{BM} ₀₂₋₂₇₋₀₇ | SY ^{WA} 02-27-07; [Ac] ^{TAC} ₂₋₂₇₋₀₇ 3-1-07 INIA |
| 3 | Blank | |
| 4 | Dup # 1 | |
| 5 | MS # 1 #60407 [Ra] ^{BM} ₀₂₋₂₇₋₀₇ | |

1-4

-07

8657

Carrier / Tracers

1-4 5x Carrier 1.0 ml M-A1-(06) *WV/EM* 02-27-07

spiked 8657-1-5 HPST 0.1ml H^3 AF1-A-(07) ^{24h} 3/7/07

1-4 Y Carrier 1.0 ml E-D1-(03) *OXAL* *WV/SS* 03-05-07

LNA

8657

Recovery
H

(DST)

	FRACT.	VOLUME RECD (ML)	DISTILL (ML)	DISTILLATE (ML)	COUNT: 20.0 10.0 2-1-07	ALIQ (L)	BM ST	DATE BY JWA 3-1-07	CHK BY BM 3-1-07	P
8657	1	3	150.0	50.0	20.0	10.0	0.010L			
	2		100.0			1.06MPL				
	3		↓			↓				
	4		50.0			0.010L				
	5		50.1			0.050L	↓	↓	↓	

USED Pico FLOOR WT. TRACER 0.1ML H-3 AF1-A- (07)

[Ac]

	G	T	N	Sep Time	Done by TAC	Checked by BM
8657-1	63.84	41.35	22.49	071.754	3.12.07	3.12.07
2	60.17	41.97	18.20	↓	↓	↓
3	64.87	40.77	24.10	↓	↓	↓
4	62.17	41.43	20.74	↓	↓	↓

8657

Recovery

SV

	G	T	N	SEP Time	Done by	Checked by
1	55.74	41.07	14.67	061667	WJ 03-02-07	BM 03-02-07
2	54.36	39.70	14.66	↓	↓	↓
3	55.66	41.09	14.57	↓	↓	↓
4	56.13	41.64	14.49	↓	↓	↓

- (W) P
 BX
 BM
 7 2.1.7 P

(07)

SAMPLE #	FIRST DM	SECOND DM	GMT ON	COUNT TIME	AUGT UNIT	CELL #	BKG (cpm)	SYS #	RN #	GROSS (cpm)
02.20-07										
8842-1	052.939	060.733	060.900	90.80		67	0.22	3	11	1.04
DDP#1-2	↓	↓	↓	↓		4	0.20	4	12	1.28
LCS-3	↓	↓	↓	↓	1.0 SMPL	25	0.31	1	9	21.67
BLK-4	↓	↓	↓	↓	↓	58	0.13	2	10	0.10
02.22-07										
9682-2	058.872	061.753	061.946	98.30		29	0.13	5	13	0.88
LCS-3	↓	↓	↓	101.25	1.0 SMPL	46	0.21	6	14	34.73
BLK-4	↓	↓	061.930	65.52	↓	7	0.11	7	15	0.17
6	↓	↓	↓	118.72		72	0.23	8	16	0.45
02.22-07										
9683-1	058.896	064.736	064.903	90.56		74	0.12	2	10	0.81
LCS-2	↓	↓	↓	↓	1.0 SMPL	75	0.08	3	11	19.88
BLK-3	↓	↓	↓	↓	↓	20	0.15	4	12	0.86
02.22-07										
9684-1	058.929	064.736	064.903	98.00		53	0.20	5	13	0.67
LCS-2	↓	↓	↓	93.44	1.0 SMPL	62	0.22	6	14	58.09
BLK-3	↓	↓	↓	90.56	↓	63	0.14	7	15	0.98
5	↓	↓	↓	121.41		64	0.24	8	16	0.55
02.23-07										
7604-1A	054.911	061.734	061.903	59.20		12	0.16	4	12	2.62
2A	↓	↓	↓	↓		18	0.19	5	13	3.06
3A	↓	↓	↓	↓		6	0.21	6	14	2.35
LCS-7	↓	↓	↓	86.48	1.0 SMPL	33	0.29	1	9	41.78
BLK-8	↓	↓	↓	59.20	↓	66	0.14	2	10	0.08
DDP#1A-9	↓	↓	↓	↓		51	0.14	3	11	2.77
02.26-07										
8657-1	057.906	065.737	065.904	60.02		29	0.21	5	13	0.13
LCS-2	↓	↓	66.02-8M	100.19	1.0 SMPL	1	0.39	1	9	19.45
BLK-3	↓	↓	100.19 ⁸⁵	60.02	↓	66	0.16	2	10	0.18
DDP#1-4	↓	↓	60.02 ⁰⁷	↓		43	0.19	3	11	0.18
MS#1-5	↓	↓	↓	↓		52	0.21	4	12	39.39
9682(LCS)3R1	061.753	068.735	068.906	91.83	1.0 SMPL	31	0.18	7	15	30.83

LOG-IN VERIFICATION

All samples

All planchets

RT
3.12.7

PB # 6107 m. 37

R703026 TA_IRVINE
TestAmerica - Irvin
17461 Derian Avenue

Pr Mgr.... MCM Rcvd... 03/03/07
Charge.... 00-000 Due.... 04/02/07
Chemist... Value... 0.
Created... 06-MAR-07 Billed.. 0.
Billing status.. open
Calc. units..... PCI /Unit alq Min Pri
/ 0

PROJECT# IQC0154

smp	elm	typ	mg	rec	dpm rec Ash wgt	1st sep	2nd sep	aliquot	carr/ trac
1	80		70.60	0.0000		0.000 0	0.000 0	8.0000E-021 -	# 0
2	80		60.50	0.0000		0.000 0	0.000 0	1.000 ~ smp1	# 0
3	80		61.80	0.0000		0.000 0	0.000 0	1.000 - smp1	# 0
4	80		69.90	0.0000		0.000 0	0.000 0	8.0000E-021 -	# 0
5	80		70.70	0.0000		0.000 0	0.000 0	8.0000E-021 -	# 0

Carriers/Tracers used -----

LOG-IN VERIFICATION
All samples
All planchets

KT
3157

R703047 TA_IRVINE
TestAmerica - Irvin
17461 Derian Avenu

PB# 6107 M.37

Pr Mgr.... MCM Rcvd... 03/06/07
Charge.... 00-000 Due.... 04/05/07
Chemist... Value... 0.
Created... 06-MAR-07 Billed.. 0.
Billing status.. open
Calc. units..... PCI /Unit alq Min Pri
/ 0

PROJECT# IQC0289

smp	elm	typ	mg	rec	dpm rec Ash wgt	1st sep	2nd sep	aliquot	carr/ trac	
1	80		86.60	0.0000	0.000	0	0.000	0	7.0000E-021	# 0

Carriers/Tracers used -----

703026

1.07.
1.07.

8660, 8661

WORK RECORD

Date	Analysis	Proc. / Steps	Sample	Analyte	Remarks
05.06.07.	Vred. pH	DWP-007	8660-N 8661-1	LS	
"	[80]	DWP-121	7.1-7.2	8660-1,4,5 8661-1	LS
03-09-07	[80]	DWP-121 → 7.2 → 5.0	AU	DVP	

38

703026

Te St. America

Rec'd: 03.03.07

Due: 04.02.07

3. 05. 07

8660, 8661

WATER

[80]

Date

03.09.07

FRAG	VOLUME RSV(L)	PH	ALIQ 80(L)
Cust. ID To			
8660-1	1QC154-01	03.01.07 11:15	1 0.080
- 2	LES		
- 3	BLANK		
- 4	Dup #1		0.080
- 5	MS #1		0.080
8661-1	1QC0289-01	03.02.07 11:45	1 0.070
DONE BY:		LS 3/6	→

RECOVER:

[80]

G	T	✓	DATE of DVP 03.09.07	DATE of from 03.09.07
8660-1	19.2737	19.2031	70.6	
✓	19.2307	19.1702	60.5	
3	19.2293	19.1675	61.8	
4	19.2674	19.1975	69.9	
5	19.2782	19.2075	70.7	
8661-1	19.3194	19.2328	86.6	

Section 2
Standards Certification &
Preparation Logs for Quality Control Samples

410 Rec'd 12/21/05 K Prenton

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

72015A-207

Am²⁴¹ R1

Am-241 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.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. 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:	Am-241
ACTIVITY (dps):	3.768 E3
HALF-LIFE:	4.322 E2 years
CALIBRATION DATE:	December 19, 2005 12:00 EST 353.708 05
RELATIVE EXPANDED UNCERTAINTY (k=2):	2.0%

Impurities: γ -impurities <0.1%
 α -impurities <0.1%

5.06320 grams 1M HCl solution.

P O NUMBER 00003035, Item 1

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

Q A APPROVED:

Sh... 12-20-2005

Am-241 R1 in 1M HCl Prep'd 9/14/06

$$\frac{5.03719 \text{ g} \times 3768 \text{ dps}}{5.063209 \text{ g}} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{1}{100 \text{ mL}} = 2249 \text{ dpm/mL} \pm 1.0\%$$

@ 353.708 05

K Prenton

v K. Yamamoto 9/14/06

9/14/06
RPPrep of Am-241 R1

IB QC

Gross wt 78.4395g
Tare wt 73.4024g
Net wt 5.0371g

Balanced Used
36

Procedure CT-T03 Rev 03 6/16/06

Tared a 100mL vol. flask + top. Opened

Am-241 Analytics 720/5A-207 vial, Log 410

3.768 E3 dps in 5.06320g on Dec. 19, 2005
12:00 EST

Transferred Am 241 solution into the tared
100mL vol. flask, Weigh Am-241 sol., flask
+ top.

Diluted to mark with 1N HCL, Mixed,
Trasferred to a 4oz PB.

$$5.0371 \text{ g} \times \frac{3768 \text{ dps}}{5.06320 \text{ g}} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{1}{100 \text{ mL}} = 2249 \text{ dpm/mL} \pm 1.0\% \text{ @ } 353.708 \text{ OS}$$

R. Prentiss

✓ K. Yamamoto 9/14/06

146

9/15/06
RP

Verif of Am²⁴¹ RI IB QC

Pipetted into 3 ea 50mL beakers;

0.1mL Am²⁴¹ RI + 0.5mL Am²⁴³ SI

Cont'd Procedure CT-VAM-2 Rev03 6/16/06

1501499-501 R. Prenton

9/15/06
RP

Prep of U²³² F-Q1-A-(08) 3

Transferred 250mL U²³² F-Q1-A-(06)

into 8oz WM PB

18.04 dpm/mL \pm 0.4 @ 076.766-06

R. Prenton

9/18/06
RP

Prep of H³ AFI-A-(08) BA

Transferred 100mL H³ AFA

into a 4oz WM PB.

1.324E5 dpm/mL \pm 0.9% @ 246.708 98

R. Prenton

10/27/06
RP

Prep of Sr⁹⁰ AA1-B-(15) QC 1B

Procedure CT-T04 Rev 03 6/16/06

Pipetted 0.5 mL ± 0.50g of Sr⁹⁰ AA1
13653 dpm/mL ± 0.4% into a 250 mL vol. flask.

Added 1 mL Sr M-A1 carrier 17.90 mg/mL +
1 mL Y E-D1 " 15.23 "

into same vol. flask.
Diluted to mark with 0.1N HCl. Transferred to
a 8oz WM PB.

27.31 dpm/mL ± 0.5% @ 306,500 96

R. Prenton

10/27/06
RP

Prep of Am²⁴¹ R1-A QC1B

Procedure CT-T04 Rev 03 6/16/06

Pipetted 2.5 mL (2x1000 mL + 500 mL) = 2.55g
of Am²⁴¹ R1 2249 dpm/mL ± 1.0%

into a 250 mL vol. flask. Diluted to
mark with 1N HCl. Transferred
into 8oz WM PB.

22.49 dpm/mL ± 1.1% @ 353,708 05

R. Prenton

Ky 11/2/06

#372 Rec'd 4/2/2001 R Brenton P.O. 8555



Certificate of calibration of absolutely
standardised radioactive solutions

Sr⁹⁰AA1

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

ISSUED FOR: AEA Technology plc
Isotrak
329 Harwell
Didcot
Oxfordshire
OX11 0QJ

*Sr⁹⁰ 13653 dpm/ml ± 0.4% @ 306,500-96 5/7/01 R Brenton
in 1N HCl carrier content 0.1899 SrCO₃ mg/ml + D1.580 mg/ml Y₂O₃*

Description Principal radionuclide: Strontium-90 Product code: SIZ24 *K. Yamamoto 5/7/01*
Daughter radionuclide: Yttrium-90 Solution number: S6/11/196

Measurement Reference time: 1200 GMT on 1 November 1996 *306,500-96*
Radioactive concentration of strontium-90: 4.557 kilobecquerels per gram of solution
which is equivalent to: 123.2 nanocuries per gram of solution
Mass of solution: 5.0309 grams
Total activity of strontium-90: 22.93 kilobecquerels
which is equivalent to: 620 nanocuries

Method of measurement used:
4π efficiency tracing using a liquid scintillation counter.
Calibration date(s): 17 November 1996 to 30 November 1996
The calibration date is provided for added information only, and must not be confused with the reference date. It is the reference date that must be used in all calculations relating to the values of activity.

Uncertainty Expanded uncertainty in the radioactive concentration quoted above: ± 0.88 %
Combined Type A uncertainty: ± 0.09 %
Combined Type B uncertainty: ± 0.43 %

Approved Signatory *D A Tattam* Date of issue 20 March 2001

D A Tattam Page 1 of 2 pages

Nycomed Amersham

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

#372 Rec'd 4/2/00, R. Prenton Po 8555

Certificate of calibration of absolutely standardised radioactive solution

UKAS ACCREDITED CALIBRATION LABORATORY No. 0146

Radionuclidic Purity 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.

Other radionuclides 0.002(1) %

Chemical Composition 0.1M HCl containing 100 micrograms of strontium and 100 micrograms of yttrium per ml.

Physical Data Recommended half life: 29.12 ± 0.24 years (1 year = 365.25 days)

Strontium-90: 100% beta particle emission.

Yttrium-90: 100% beta particle emission. Half life 2.670 ± 0.004 days.

The activity of the yttrium-90 is equal to the activity of the strontium-90.

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

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

Tests made over a period of 2 years on standardised solutions of strontium-90 stored in glass ampoules have shown that loss of strontium-90 from solution is negligible other than by radioactive decay.

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

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

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

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

10/27/06
RP

Prep of Sr⁹⁰ AA1-B-(15) QC 1B

Procedure CT-T04 Rev 03 6/16/06

Pipetted 0.5 mL = 0.50g of Sr⁹⁰ AA1
13653 dpm/mL \pm 0.4% into a 250 mL vol. flask.

Added 1 mL Sr M-A1 carrier 17.90 mg/mL +
1 mL Y E-D1 " 15.23 "

into same vol. flask.

Diluted to mark with 0.1N HCl. Transferred to
a 8oz WM PB.

27.31 dpm/mL \pm 0.5% @ 306,500 96

R. Prenton

10/27/06
RP

Prep of Am²⁴¹ RI-A QC 1B

Procedure CT-T04 Rev 03 6/16/06

Pipetted 2.5 mL (2x1000 mL + 500 mL) = 2.55g
of Am²⁴¹ RI 2249 dpm/mL \pm 1.0%

into a 250 mL vol. flask. Diluted to
mark with 1N HCl. Transferred
into 8oz WM PB.

22.49 dpm/mL \pm 1.1% @ 353,708 05

R. Prenton

Key 11/2/06

3/8/06
RP

Prep + Standardization of Sr M-Al carrier

Procedure CT-CSr, Rev 02, 4/15/02

7.1 Weighed 100.0g SrNO₃ Strontium Nitrate
Fisher Certified ACS Lot 984987
Balance used #36

7.2 5mL aliquot used.

	1	2	3	4	4-
3/6/06 Tare wt	13.4839 g	13.5283 g	13.7109 g	13.7597 g	
"	<u>13.4838</u>	<u>13.5283</u>	<u>13.7109</u>	<u>13.7597</u>	
Avg "	13.48385 g	13.5283 g	13.7109 g	13.7597 g	
3/9/06 Gross wt	13.5733 g	13.6179 g	13.8015 g	13.8490 g	
"	<u>13.5734</u>	<u>13.6181</u>	<u>13.8015</u>	<u>13.8490</u>	
Avg "	13.57335 g	13.6180 g	13.8015 g	13.8490 g	
	13.57335 g	13.6180 g	13.8015 g	13.8490 g	
	<u>13.48385</u>	<u>13.5283</u>	<u>13.7109</u>	<u>13.7597</u>	
Netwt	0.08950 g	0.0897 g	0.0906 g	0.0893 g	

#3 rejected Using Chauvenet Criterion

Mean $\frac{89.50 \text{ mg}}{5 \text{ mL}} = 17.90 \text{ mg/mL SrCO}_3 \pm 0.13\% @ 0.07-0.6$

R. Brenton

✓ K. Yamamoto 3/14/06

10/24/06
RPPrep of Cs D-A6-(03) carrierTransferred - 50 mL Cs D-A6 carrier
into a 4oz WM PB.50.77 mg/mL \pm 0.17% @ 180 05

RPrenton

11/14/06
RPPrep of Sr M-A1-(06) BATransferred - ~~50~~ 1000 mL of Sr M-A1
into a 32 oz PB17.90 mg/mL \pm 0.1% @ 067 06

RPrenton

11/14/06
RPPrep of Y E-D1-(03) BATransferred 500 mL of Y E-D1
into a 16oz PB40.74 mg/mL Y₂O₃ \pm 0.1% @ 171 06
15.23 mg/mL Y₂O₃

RPrenton

RP 12/6/06



#399 Rec'd 8/16/04, P.O. 1647 R. Prenton

H³AEI

ISSUED BY: Amersham plc
Radiation & Radioactivity
Calibration Laboratory
The Grove Centre
White Lion Road
Amersham
Buckinghamshire
HP7 9LL

ISSUED FOR: AEA Technology QSA GmbH
Isotrak
Gieselweg 1
D-38110 Braunschweig
Germany

Description	Principal radionuclide:	Hydrogen-3 (tritium)	Product code:	TRY44
	Chemical form:	Water	Batch:	134
Measurement	Reference time:	1200 GMT on 1 November 2002	<u>305.500 02</u>	
	Radioactive concentration of hydrogen-3:	49.73	kilobecquerels per gram of water	
	which is equivalent to:	1.344	microcuries per gram of water	
	or:	2.984 x 10 ⁶	disintegrations per minute per gram of water	

Method of measurement used:
This reference material was calibrated by direct comparison with a standard of tritium-labelled water obtained from the National Institute of Standards and Technology, USA.

Calibration date(s): 20 September 2002 to 23 September 2002
The calibration date is provided for added information only, and must not be confused with the reference date. It is the reference date that must be used in all calculations relating to the values of activity.

Uncertainty Expanded uncertainty in the radioactive concentration quoted above: ± 1.3 %

H³AEI in H₂O

$$4.9879 \text{ g} \times 2.984 \times 10^6 \frac{\text{dpm}}{\text{g}} \times \frac{1}{100 \text{ mL}} = 1.488 \times 10^5 \text{ dpm/mL} \pm 1.6\% @ 305.500 \text{ 02}$$

8/20/04 RP AE R. Prenton 8/20/04

Approved Signatory

Date of issue

29th March 2004 ✓ K. Yamamoto 8/20/04



#399 Rec'd 8/16/04 PD 1647 R. Prenton
UKAS ACCREDITED CALIBRATION LABORATORY No. 0146

H³AEI

Purity No radioactive impurities were detected. (Impurities with a total activity greater than 0.001% of the activity of the tritium would have been detected).

Physical Data Recommended half life: 12.33 ± 0.02 years (1 year = 365.25 days)
Maximum beta energy of tritium: 18.6 keV

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

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

The S.I. unit of radioactivity is the becquerel

1 becquerel (Bq) = 1 nuclear transformation per second, therefore
1 Curie (Ci) = 3.7 x 10¹⁰ becquerels exactly.

Useful conversion factors are:

1 microcurie (μCi) = 3.7 x 10⁴ becquerels exactly.
1 kilobecquerel = 27.027 nanocuries (nCi)

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

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

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

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

8/20/04
RPPrep of H³ AE1

IA (C)

Gross Wt	71.5396 g
Tare Wt	<u>66.5517</u>
Net Wt	4.9879 g

Balance Used
#2 Sartorius 1702

Procedure CT-TO3 Rev02, 4/15/02

Tared by 100 mL vol. flask and top.

Opened H-3 vial Amersham K 6310, Log 399
2.984 ^{8/20/04 RP} EB dpm/g on 1 Nov 2002 1200 GMT.

Transferred the solution into the tared
vol. flask. Weighted the H-3 sol.,
vol. flask + top. Diluted to mark with
DIH₂O. Mixed. Transferred to 4oz. PB.

$$4.9879 \text{ g} \times 2.984 \times 10^6 \frac{\text{dpm}}{\text{g}} \times \frac{1}{100 \text{ mL}} = 1.488 \times 10^5 \frac{\text{dpm}}{\text{mL}} \pm 0.6\% @ 305.500 \text{ OZ}$$

K. Yamamoto

K. Yamamoto 8/20/04

4/3/06 Prep of Th²²⁹ C2-A-(24) IC

RP Procedure CT-T04 Rev 02 4/15/02

Pipetted 0.7 mL (500 mL + 200 mL) ~ 0.10g of Th-229 C2 8415, dpm/mL \pm 0.23% into a 500 mL vol flask. Diluted to mark with 2N HNO₃, transferred to 1602 PB

11.78 dpm/mL \pm 0.6% @ 032.833 02

R. Prenter

4/3/06 Prep of H³ AEI-C-(31) QC LB
RJ

Pipetted 1.0 mL ~ 1.00g of H³ AEI 148800 dpm/mL \pm 0.6% into a 250 mL vol flask. Diluted to mark with D.I H₂O. Transferred to a 802 WM PB

595.2 dpm/mL \pm 0.7% @ 305.500 02

R. Prenter

Ry 4/10/06



408 R Id 9/26/05 P.O. 287 K. Brennan 10/4/05

National Institute of Standards & Technology

Certificate

H3 AF1

Standard Reference Material 4927F Hydrogen-3 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive hydrogen-3, as water, 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 beta-particle counting instruments and for the monitoring of radiochemical procedures.

Radiological Hazard

The SRM ampoule contains hydrogen-3 with a total activity of approximately 3.2 MBq. Hydrogen-3 decays by beta-particle emission. None of the beta particles escape from the SRM ampoule. During the decay process no photons are emitted. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. There is no detectable external radiation. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains only distilled water. There is no chemical hazard. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2.

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 September 2008.

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) because of the radioactivity.

Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, L.R. Karam, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas and M.P. Unterweger 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 J.W.L. Thomas.

Bert M. Coursey, Chief
Ionizing Radiation Division

Nancy M. Trahey, Chief
Standard Reference Materials Program

Gaithersburg, Maryland 20899
June 1999
Half-life and text revised October 2000

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.
- 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]*.

H³ AFI

PROPERTIES OF SRM 4927F

Certified values

Solution density	(0.998 ± 0.002) g·mL ⁻¹ at 20.0 °C [b]*
Radionuclide	Hydrogen-3
Reference time	1200 EST, 3 September 1998 <i>246,708 98</i>
Massic activity of the solution [c]	634.7 kBq·g ⁻¹
Relative expanded uncertainty (k=2)	0.72% [d] [e]

Uncertified values

Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall Thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution mass	Approximately 5.0 g		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O ³ HHO	55 6 × 10 ⁻⁷	1.00 1 × 10 ⁻⁸
Radiological Properties:			
Radionuclidic impurities	None detected [f]		
Half lives used	Hydrogen-3: (4500 ± 8) d [g]		
Calibration method and measuring instrument(s)	4πβ gas counting of SRM 4927E using the NIST length-compensated internal gas proportional counters and intercomparison of SRMs 4927E/4927F using two 4πβ liquid-scintillation counting systems [h]		

H³ AFI in H₂O Prep'd 10/5/05

$$4.9688 \text{ g} \times \frac{634.7 \text{ kBq}}{\text{g}} \times \frac{60 \text{ dpm}}{\text{Bq}} \times 1000 \times \frac{1}{50 \text{ mL}} = 3.784 \text{ E6 dpm/mL} \pm 0.4\%$$

*@ 246,708-98
10/5/05 A. Yamamoto*

✓ A. Yamamoto 10/5/05

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [i]	Relative Sensitivity Factor, $|\partial y/\partial x_i| \cdot$ (x_i/y) [j]	Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [k]
Massic count rate of SRM 4927E, corrected for background and decay [h]	Standard deviation of the mean for 23 sets of gas counting measurements (A)	0.18	1.0	0.18
Gram-mole measurements	Estimated (B)	0.20	1.0	0.20
Live-time [p]	Estimated (B)	0.10	1.0	0.10
Extrapolation of count-rate-versus-energy to zero energy	Estimated (B)	0.20	1.0	0.20
Half life of H-3	Standard uncertainty of the half life (A)	0.18 [m]	0.009 [n]	0.002
Liquid-scintillation intercomparison of SRM 4927F and SRM 4927E	Standard deviation of the mean for 7 sets of liquid-scintillation measurements (A)	0.06	1.0	0.06
Radionuclidic impurities	Limit of detection (B) [q]	100.	0.0005	0.05
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.36
Coverage Factor, k				<u>x 2</u>
Relative Expanded Uncertainty of the Output Quantity, U/y , (%)				0.72

H³ AFI

NOTES

- [a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
Distance from Ampoule (cm): 1 30 100
Approximate Dose Rate ($\mu\text{Sv/h}$): <0.1 (Not detectable)
- [b] The stated uncertainty is two times the standard uncertainty.
- [c] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].
- [d] The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.
- The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) \equiv |\partial y / \partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .
- The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.
- The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain U , the **expanded uncertainty** of y .
- Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.
- For further information on the expression of uncertainties, see references [2] and [3].
- [e] The value of each standard uncertainty component, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the massic response is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).
- [f] The estimated limit of detection for radionuclidic impurities is $300 \text{ Bq} \cdot \text{g}^{-1}$.
- [g] The stated uncertainty is the standard uncertainty. See reference [5].
- [h] Extensive gas-counting measurements were made on the SRM 4927E solution during 1998 and 1999. The SRM 4927F solution was intercompared with the SRM 4927E solution using liquid-scintillation counting.
- [i] Relative standard uncertainty of the input quantity x_i .

- [j] 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 .
- [k] Relative component of combined standard uncertainty of output quantity, 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.
- [m] 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.
- [n] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of H-3})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of H-3})\}$. 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] L.L. Lucas and M.P. Unterweger, *Comprehensive Review and Critical Evaluation of the Half-Life of Tritium*, J. Res. Natl. Inst. Stand. Technol. **105**, 541-549 (2000).

10/12/05
RPPrep of H^3 AFI-A IC Qspike

Procedure CT-T04, Rev 02 4/15/02

Pipetted 7mL (7x100mL) 7.00g of H^3 AFI, 3.784E6 dpm/mL $\pm 0.4\%$ into a 200mL vol. flask. Repeated. Transferred into a 1602 PB.1.324E5 dpm/mL $\pm 0.9\%$ @ 246.708 98

A. Brenton

10/13/05 Dilution check H^3 AFI-A 1213 77-82

Pipetted into 3ea LSC Vials;

1213-77, 78, 79 0.1mL H^3 AFI-A
1213-80, 81, 82 0.1mL H^3 AFI
1213-316 BlankCont'd CT-VH1, Rev 01, 4/15/02
Step 7.2

A. Brenton

ky 10/13/05

10/4/06
RP

Prep of H³ AFI-A-106 IC respire
 Procedure CT-T04, Rev 03 6/16/06
 Pipetted 17.5 mL (15 mL + 2x 1000 μL + 500 μL) = 17.509
 of H³ AFI 3.784E6 dpm/mL ± 0.4% into
 a 500 mL vol. flask, Diluted to mark with H₂O
 Transferred to 1602 PB
 1.324E5 dpm/mL ± 0.7% @ 246,708 98
 RPrenon

10/4/06
RP

Dilution check H³ AFI-A-106

1213 89-94

Pipetted into 3ea LSC Vials;
 1213 89-91 0.1 mL H³ AFI-A-106
 1213 91-93 0.1 mL H³ AFI
 1213 318 Blank

Cont'd ~~CT-VH-1~~ ^{10/4/06 RP} CT-VH-1, Rev 02 6/16/06
 Step 7.2

RPrenon

14, 10/16/06

12/7/06
RPPrep of Tl^{229} C2-A-(32) BATransferred 100mL Tl^{229} C2-A-(29)
into a 4oz WM PB11.78 dpm/mL \pm 0.7% @ 032.833 06

R. Prenton

12/14/06
RPPrep of H^3 AF1-A-(07) BATransferred 100mL H^3 AF1-A-(06)
into a 4oz WM PB1.324E5 dpm/mL \pm 0.7% @ 246.708 98

R. Prenton

12/14/06
RPPrep of U^{232} F-Q1A-(10) BATransferred - 250mL U^{232} F-Q1A-(06)
into a 250mL WM PB,18.04 dpm/mL \pm 0.4% @ 076.766 06

Ruby Prenton

12/19/06



389 P O # 00000081 Rec'd 1/16/03 R Prenton
 National Institute of Standards & Technology

Certificate *Ra²²⁶NI*

Standard Reference Material 4967
 Radioactivity Standard

Radionuclide	Radium-226 ^{(1)*}
Source identification	SRM 4967
Source description	Liquid in a 5-mL, flame-sealed NIST borosilicate-glass ampoule ⁽²⁾
Solution composition	Approximately 1.4 mol • L ⁻¹ HCl ⁽³⁾ containing 1.74 mg BaCl ₂ per gram of solution ⁽⁴⁾ and Ra ⁺² ⁽⁵⁾
Solution density	1.019 ± 0.001 g • mL ⁻¹ at 22 °C ⁽⁶⁾
Solution mass	5.1167 ± 0.0027 g ⁽⁷⁾
Radium-226 activity concentration	2729 Bq • g ⁻¹ ⁽⁸⁾
Reference time	1200 EST 9 September 1991 <i>252.708-91</i>
Overall uncertainty	1.18 percent ⁽⁹⁾
Half life	1600 ± 7 years ⁽¹⁰⁾
Calibration method	NIST pressurized "4π"γ ionization chamber "A" calibrated with the national radium standards ⁽¹¹⁾ ; and confirmatory measurements ⁽¹²⁾

This standard reference material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD
 January 1992

William P. Reed, Chief
 Standard Reference Materials Program

Ra²²⁶NI in 1.4M HCl
 $5.0800 \text{ g} \times 2729 \frac{\text{Bq}}{\text{g}} \times \frac{60 \text{ dpm}}{\text{Bq}} \times \frac{1}{100 \text{ mL}} = 8318 \text{ dpm/mL}$
carrier content 0.0991 mg/mL BaSO₄

*Notes on back
 $8318 \text{ dpm/mL Ra}^{226} \pm 0.4\% @ 252.708-91$
R Prenton 1/20/03
K. Yamamoto 1/20/03

11/20/03 Prep of Ra^{226} NI

113 R.C.

RP

Gross wt. 73.8875 g

Balance Used # 2

Tare wt. 68.8075

Satorius Model 1702

Net wt. 5.0800 g

Tared a 100 mL vol. flask a top. Opened Ra^{226} vial NIST SRM 4967, Lot # 389, 2729 Bq g^{-1} on 1200 EST 9 Sept. 1991. Transferred Ra^{226} solution into tared vol. flask.

Weighed Ra^{226} sol. flask + top. Diluted to mark with 1.4 M HCl. Transferred 4oz P.B. Carrier content ~~88~~^{180/03 RP} mg/mL $BaCl_2$ or 0.0991 mg/mL $BaSO_4$
0.0884

$$5.0800 g \times 2729 \frac{Bq}{g} \times 60 \frac{dem}{g} \times 1 = 8318 \frac{dem}{mL} Ra^{226} \\ \frac{g}{Bq} \quad \frac{100mL}{\pm 0.4\% @ 252,708-91}$$

A. Prenton

Calculations checked K. Yamamoto 1/20/03

11/20/03 Prep of Ra^{226} NI-A

R.C. 1B

RP

Pipetted 0.3 mL (3x 100 μ L) - 0.3055 g of Ra^{226} NI, 8318 $dem/mL \pm 0.4\%$ into a 100 mL vol. flask. Added 10 mL of $BaH-B3$ carrier 17.30 mg/mL $BaSO_4$ into same flask. Diluted to mark with 1.4 M HCl. Transferred to 4oz W.M. P.B.

$$24.95 \frac{mg}{dem/mL} Ra^{226} \pm 0.7\% @ 252,708-91 \\ \text{11/20/03 RP}$$

carrier content 0.002 mg/mL $BaSO_4$

A. Prenton

7/25/06
RP Verif of U Mix A3-(17) 1501 490-492

Pipetted into 3 ea 50mL beakers;

7.0mL U Mix A3-(17) and 0.5mL U²³² J1

Contd Procedure CT-C VU-4, Rev 01 6/16/06
Septime 206.658-06 7/24/06 RP

R. Prenton

7/26/07
RP Prep of Ra²²⁶ N1-A-(09) 1B Q C

Procedure CT-T04, Rev 03 6/16/06

Pipetted 0.6mL (100mL + 500mL) ~ 0.61 g of
Ra²²⁶ N1 8318 dpm/mL $\pm 0.4\%$ into a 200mL

vol. flask. Added 20mL BaH-B4 carrier

17.27mg/mL BaSO₄. Diluted to mark with 1.4M HCL.

Transferred to a 802 WM PB.

24.95 dpm/mL $\pm 0.6\%$ @ 252.708 9/

R. Prenton

RP 8/1/06

10/7/04
~~10/7/02~~
 RP
~~10/17/04 RP~~

Standardization of Ba H-B⁴ carrier IF

Prod Procedure CT-CBA, Rev 02, 4/15/02
 7.2 Standardization; Balance used # Sartorius 151702
 Aliquot taken from Ba H-B³. Prep see
 Book C-3, Pg 116, 11/25/98

	1	2	3	4
Tare wt	17.0842 g	17.2560 g	17.4847 g	17.5220 g
"	17.0842	17.2560	17.4847	17.5220
Avg "	17.0842 g	17.2560 g	17.4847 g	17.5220 g

17.1709 g	17.3422 g	17.5709 g	17.6083 g
17.1708	17.3422	17.50	17.6083
<u>17.17085 g</u>	<u>17.3422 g</u>	<u>17.5709</u>	<u>17.6083 g</u>
17.08420	17.2560	17.4	17.5220
<u>0.086656</u>	<u>0.0862 g</u>	<u>17.5709 g</u>	<u>0.0863 g</u>
		17.4847	
		<u>0.0862 g</u>	

mean $\frac{86.338 \text{ mg}}{5 \text{ mL}} = 17.27 \text{ mg/mL Ba SO}_4 \pm 0.12 \%$ 281 - ⁰⁴~~02~~
 10/17/04 RP

R Prenton

K. Yamamoto 10/8/04

ANALYTICS

#370 Rec'd 1/18/01 R. Benton

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

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

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

Ra²²⁸SI

60867-207

Ra-228 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared using an aliquot measured gravimetrically from a calibrated master radionuclide solution source which 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):	3.845 E3
HALF-LIFE:	5.75 years
CALIBRATION DATE:	January 16, 2001 12:00 EST <i>D16,708-D1</i>
TOTAL UNCERTAINTY*:	5.1%
SYSTEMATIC:	3.6%
RANDOM:	1.5%

*99% Confidence Level

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

5.044433 grams 0.1M HCl solution with 50 ppm Ba carrier.

P O NUMBER 00008301, Item 1

SOURCE PREPARED BY:

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

Q A APPROVED: *2/12/01 RP*

Rec'd 1/16/01

Ra²²⁸SI ~~Pre'd~~ *Pre'd* *2/12/01* in .1M HCl

$$\frac{5.0061g \times 3845 \text{ dps} \times 60 \text{ sec} \times \frac{1}{100 \text{ ml}}}{5.044433g} = 2289 \text{ dpm/ml/Ra}^{228} \approx 1.7\% @ \text{D16,708-D1}$$

R. Benton 2/12/01

carrier content *0.0902 mg/ml/BaSO₄ or 0.053/mg/ml/Ba²⁺* *K. Yamamoto 2/13/01*

2/12/01 Prep of Ra^{228} SI

RP

Gross 74.2294g

Tare 69.2233g

Net 5.0061g

Balance #2

Sartorius 1702

Tared a 100ml vol flask + top, Opened Ra^{228} Analytics 60867-207 vial 3.845E3 (dps) @ Jan. 16, 2001 17:00 EST. Transferred Ra^{228} sol. into the tared vol. flask. Weighed vol. flask + top + Ra^{228} solution. Pipetted 0.5ml of Ba H-B2 carrier 17.20 mg/ml $BaSO_4$ into same vol. flask. Diluted to mark with 0.1M HCl. Transferred to a 4oz P.B. #370

$$\frac{5.0061g \times 3845 \text{ dps}}{5.044433g} \times \left(\frac{60 \text{ sec}}{60 \text{ min}} \right) \times \frac{1}{100 \text{ ml}} = 2289 \text{ dpm/ml } Ra^{228} \pm 1.7\% @ 016.708-01$$

carrier content

$$\left[\frac{(0.5 \text{ ml} \times 17.20 \text{ mg/ml } BaSO_4)}{1.69943 \text{ BaSO}_4/Ba} + \frac{(5.0061g \times 25 \text{ mg } Ba^0)}{5.005044433g} \right] \times \frac{1}{100 \text{ ml}} = 0.0531 \text{ mg/ml } Ba^0$$

2/12/01 RP

or

0.0902 mg/ml $BaSO_4$

K. Yamamoto

Calculation checked. K. Yamamoto 2/13/01

-11-06 Prep of Ra²²⁸ Si-B-(7) 1B QC
TAC

Procedure CT-T04, Rev 02 4115102

Pipetted 3.75 mL (3 x 100 mL x 500 mL x 250 mL) ~ 3.73 g
of Ra²²⁸ Si, 2289 dpm/mL \pm 1.7% into a 250 mL Vol. Flask.
Added 1.0 mL Ba H-B4 17.27 mg/mL Ba SO₄ carrier into
same Vol. Flask.

Diluted to mark with 0.1 N HCl, transferred to a 802
WM PB

34.34 dpm/mL \pm 1.8% @ 0.16.708-01

T. ALAUI

+12-06 Prep of Pu²⁴² H-C2-(A)
TAC

Procedure CT-T04, Rev 02, 4115102.

Pipetted 10 mL (11.31) g Pu²⁴² H-C2 2284 dpm/mL \pm 0.5%
into 1000 mL Vol. Flask, Diluted to mark with 4 N HNO₃,
Transferred to a 3802 P.B.

22.84 dpm/mL \pm 0.5% @ 073.820-06

T. ALAUI

Prep of Th²²⁹ C2-A-(25)

4-12-06 Transferred 50 mL Th²²⁹ C2-A-(24) into a 202 WM PB

11.78 dpm/mL \pm 0.6% @ 032.833-02

T. ALAUI

Ky 1/14/06

6/16/06 RP Prep + Standardization of Y E-DI carrier

Procedure CT-CY, Rev 03, 6-16-06

7.1 Weighed 53.75g Y_2O_3 Yttrium Oxide
Aldrich Y_2O_3 , Lot KN08813 BY, Dissolved
Balance used #36, 37 in 3500mL INHNO₃

7.2 5mL aliquot used

	1	2		
6/19/06 RP Tare wt	11.2528 g	11.4685 g	11.5162 g	11.9110 g
" "	11.2528	11.4685	11.5163	11.9111
Avg "	11.2528 g	11.4685 g	11.51625 g	11.91105 g

6/20/06 RP Gross wt	11.3290 g	11.5445 g	11.5912 g	11.9871 g
" "	11.3291	11.5562	11.5912	11.9871
Avg Gross	11.32905 g	11.5446 g	11.5912 g	11.9871 g

Avg Gross	11.32905 g	11.5446 g	11.59120 g	11.98710 g
Avg Tare	11.25280	11.4685	11.51625	11.91105
Net	0.07625 g	0.0761 g	0.07495 g	0.07605 g

Sample #3 loss of ppt, wt not used

Mean $\frac{76.133 \text{ mg}}{5 \text{ mL}} = 15.23 \text{ mg/mL} \pm 0.1\%$
 @ 171.000 06

R. Brenton

K. Yamamoto

10/24/06
RPPrep of Cs D-A6-(03) carrierTransferred - 50mL Cs D-A6 carrier
into a 4oz WM PB.50.77 mg/mL \pm 0.17% @ 180 05

A. Prenton

11/14/06
RPPrep of Sr M-A1-(06) BATransferred - ~~50~~ 1000mL of Sr M-A1
into a 32oz PB17.90 mg/mL \pm 0.1% @ 067 06

A. Prenton

11/14/06
RPPrep of Y E-D1-(03) BATransferred 500mL of Y E-D1
into a 16oz PB40.74 mg/mL Y₂O₃ \pm 0.1% @ 171 06
15.23 mg/mL Y₂O₃

A. Prenton

RP 12/4/06

Section 3

Instrument Calibration Information

Richmond, CA Laboratory

Verification of Primary Calibration

Analysis Gross A/B Detector system LB4000 Date 2-26-03

Type: 80/93
TLW No. of Primary calibration being verified: _____ Date: _____

Standard Solution used: <u>Sr 90 Zr Am 241 Pl</u>	Prepared by: <u>RP</u>
Reference Date: <u>102 + 708 - 95 109 + 500 - 96</u>	Date: <u>11-10-00</u>

Preparation of secondary Solution(s):

Sample Preparation:

Counting Results:

Sample	Count GMT	Calculated Dpm ± 2σ error	Known Dpm	Ratio Found Dpm/ Known Dpm
See attached Summary: For Gross Alpha, only the results from D drawers were used in the calculation. Data from sample # B and BR were not used, (unreliable data). QAP-11 has a control limit of: 0.70 - 1.30 for GRA 0.80 - 1.20 for GRB The results of the verification is within the warning limits. CW 2-26-03				
Average Found/known ratio				$\frac{0.912}{0.90} \quad \frac{0.998}{0.93}$
Acceptance limits (from RCP-00, section 7.5)				$\frac{1.10}{1.07}$

Attach all raw data sheets Verification: outside limits within limits

Prepared by: <u>[Signature]</u> Signature	Date: <u>2-26-03</u>	Q.A. Review: <u>[Signature]</u> Signature	Date: <u>02-26-03</u>
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Gross Alpha / Beta Verification

										ALPHA		BETA
										WTSmg	AVG	AVG
SAMPLE	INST.ID	REGION	GMT	YR	DPM	DELTA	DECAY	DPM@TZ	F/A			
					Am-241 = 1074	DPM @ 109.500	1996		lambda(-d) =			4.0291E-06
					Sr-90 = 1186	DPM @ 182.708	1995		lambda(-d) =			6.8630E-05
1074-1	C1	BETA	20.697	2003	1950.06	2467.947	0.84419	1976.80	0.986	18.300		
1074-1	D2	BETA	27.869	2003	1893.32	2475.119	0.84378	1976.80	0.958	18.300		
1074-1	C1	BETA	30.874	2003	1959.57	2478.124	0.84360	1976.80	0.991	18.300		
1074-1	D3	BETA	31.861	2003	1963.10	2479.111	0.84419	1976.80	0.993	18.300		0.981
1074-2	C2	BETA	20.697	2003	1989.68	2467.947	0.99008	1976.80	1.007	29.400		
1074-2	D3	BETA	27.869	2003	1860.23	2475.119	0.99007	1976.80	0.941	29.400		
1074-2	D2	BETA	28.807	2003	1965.22	2476.057	0.99007	1976.80	0.994	29.400		
1074-2	C2	BETA	30.874	2003	1977.60	2478.124	1.00000	1976.80	1.000	29.400		0.985
1074-3	C3	BETA	20.697	2003	1987.18	2467.947	0.84419	1976.80	1.005	40.800		
1074-3	C3	BETA	30.874	2003	2003.12	2478.124	0.84360	1976.80	1.013	40.800		
1074-3	D3	BETA	34.867	2003	2004.16	2482.117	0.84337	1976.80	1.014	40.800		
1074-3	D3	BETA	37.653	2003	2001.45	2484.903	0.84321	1976.80	1.012	40.800		1.011
1074-4	C4	BETA	20.697	2003	2009.01	2467.947	0.84419	1976.80	1.016	53.500		
1074-4	C4	BETA	30.874	2003	2032.88	2478.124	0.84360	1976.80	1.028	53.500		
1074-4	D3	BETA	35.753	2003	1985.58	2483.003	0.84332	1976.80	1.004	53.500		
1074-4	D3	BETA	37.849	2003	2008.09	2485.099	0.84320	1976.80	1.016	53.500		
1074-5	C1	ALPHA	20.778	2003	865.81	2468.028	0.99011	1074.00	0.806	18.400		
1074-5	C1	ALPHA	28.807	2003	865.81	2476.057	0.99007	1074.00	0.806	18.400	0.806	
1074-5	D3	ALPHA	31.764	2003	1021.03	2479.014	0.99006	1074.00	0.951	18.400		
1074-5	D3	ALPHA	34.686	2003	1014.95	2481.936	0.99005	1074.00	0.945	18.400	0.948 *	
1074-6	C2	ALPHA	20.778	2003	800.12	2468.028	0.99011	1074.00	0.745	29.800		
1074-6	C2	ALPHA	28.807	2003	799.06	2476.057	0.99007	1074.00	0.744	29.800	0.745	
1074-6	D3	ALPHA	34.768	2003	959.56	2482.018	0.99005	1074.00	0.893	29.800		
1074-6	D2	ALPHA	44.652	2003	921.68	2491.902	0.99001	1074.00	0.858	29.800	0.876 *	
1074-7	C3	ALPHA	20.778	2003	834.94	2468.028	0.99011	1074.00	0.777	48.700		
1074-7	C3	ALPHA	28.807	2003	820.85	2476.057	0.99007	1074.00	0.764	48.700	0.771	
1074-7	D3	ALPHA	35.853	2003	973.05	2483.103	0.99005	1074.00	0.906	48.700		
1074-7	D3	ALPHA	44.652	2003	985.79	2491.902	0.99001	1074.00	0.918	48.700		
1074-8	C4	ALPHA	20.778	2003	717.54	2468.028	0.84419	1074.00	0.668	58.200		
1074-8	C4	ALPHA	28.807	2003	704.05	2476.057	0.84372	1074.00	0.656	58.200	0.662	
1074-8	D3	ALPHA	37.920	2003	874.15	2485.170	0.84320	1074.00	0.814	58.200		
1074-8	D2	ALPHA	44.756	2003	825.49	2492.006	0.84280	1074.00	0.769	58.200	0.791	
1074-8	B1	ALPHA	45.792	2003	739.75	2493.042	0.84274	1074.00	0.689	49.900		
1074-8	D2	ALPHA	52.655	2003	740.27	2499.905	0.84234	1074.00	0.689	49.900	0.689	
1074-8	C1	ALPHA	50.656	2003	897.94	2497.906	0.84246	1074.00	0.836	49.900		
1074-8	D2	ALPHA	52.892	2003	863.68	2500.142	0.84233	1074.00	0.804	49.900	0.82	

1.016
 Ave. 0.998 ± 1.8%
 CN
 2/26/03

0.912 *
 Ave. 0.912 ± 3.6% *
 CN
 2/26/03

GROSS ALPHA/BETA VERIFICATION CALIBRATION - 2/2003

SAMPLE NO.	INST. ID	WTS. MG	SR-90 ADDED	BETA CPM	ALPHA CPM	BETA EFF.	ALPHA FR BETA	EFF USED	F/A-EFF
1074-1	C1	18.3	1976.8	802.681	0.860	0.4061	0.0011	0.418	0.9714
1074-1	D2	18.3	1976.8	780.973	1.343	0.3951	0.0017	0.418	0.9451
1074-1	C1	18.3	1976.8	805.117	1.378	0.4073	0.0017	0.418	0.9744
1074-1	D3	18.3	1976.8	804.744	0.241	0.4071	0.0003	0.418	0.9739
1074-2	C2	29.4	1976.8	812.030	2.115	0.4108	0.0026	0.414	0.9922
1074-2	D3	29.4	1976.8	757.040	0.390	0.3830	0.0005	0.414	0.9250
1074-2	D2	29.4	1976.8	804.780	1.560	0.4071	0.0019	0.414	0.9834
1074-2	C2	29.4	1976.8	807.589	2.196	0.4085	0.0027	0.414	0.9868
1074-3	C3	40.8	1976.8	813.073	0.720	0.4113	0.0009	0.411	1.0007
1074-3	C3	40.8	1976.8	819.593	0.719	0.4146	0.0009	0.411	1.0088
1074-3	D3	40.8	1976.8	807.820	0.183	0.4087	0.0002	0.411	0.9943
1074-3	D3	40.8	1976.8	807.580	0.446	0.4085	0.0006	0.411	0.9940
1074-4	C4	53.5	1976.8	811.754	0.692	0.4106	0.0009	0.407	1.0089
1074-4	C4	53.5	1976.8	820.582	0.697	0.4151	0.0008	0.407	1.0199
1074-4	D3	53.5	1976.8	792.721	0.199	0.4010	0.0003	0.407	0.9853
1074-4	D3	53.5	1976.8	802.520	0.306	0.4060	0.0004	0.407	0.9975

SAMPLE NO	INST. ID	WTS mg	Am-241 ADDED	ALPHA CPM	BETA CPM	ALPHA EFF	BETA FR. ALPHA	EFF. USED	F/A - EFF
1074-5	C1	18.4	1062	142.663	31.510	0.1343	0.2209	0.190	0.7070
1074-5	C1	18.4	1062	141.372	33.117	0.1331	0.2343	0.190	0.7006
1074-5	D3	18.4	1062	187.491	43.064	0.1765	0.2297	0.190	0.9292
1074-5	D3	18.4	1062	183.393	45.990	0.1727	0.2508	0.190	0.9089
1074-6	C2	29.8	1062	116.905	26.293	0.1101	0.2249	0.172	0.6400
1074-6	C2	29.8	1062	116.655	27.020	0.1098	0.2316	0.172	0.6386
1074-6	D3	29.8	1062	159.313	37.910	0.1500	0.2380	0.172	0.8722
1074-6	D2	29.8	1062	151.838	34.190	0.1430	0.2252	0.172	0.8312
1074-7	C3	48.7	1062	107.920	26.693	0.1016	0.2473	0.147	0.6913
1074-7	C3	48.7	1062	106.101	26.761	0.0999	0.2522	0.147	0.6796
1074-7	D3	48.7	1062	137.309	33.981	0.1293	0.2475	0.147	0.8795
1074-7	D3	48.7	1062	139.323	36.340	0.1312	0.2608	0.147	0.8924
1074-8	C4	58.2	1062	88.312	23.488	0.0832	0.2660	0.142	0.5856
1074-8	C4	58.2	1062	86.853	24.095	0.0818	0.2774	0.142	0.5759
1074-8	D3	58.2	1062	119.936	30.380	0.1129	0.2533	0.142	0.7953
1074-8	D2	58.2	1062	112.488	26.510	0.1059	0.2357	0.142	0.7459
1074-8R	B1	49.9	1062	93.749	24.961	0.0883	0.2663	0.145	0.6088
1074-8R	D2	49.9	1062	125.018	31.130	0.1177	0.2490	0.145	0.8119
1074-8R	C1	49.9	1062	92.132	25.278	0.0868	0.2744	0.145	0.5983
1074-8R	D2	49.9	1062	120.227	27.548	0.1132	0.2291	0.145	0.7807

Date: 1-13-03

To: Ruby Prenton/ Kats Yamamoto

From: Cesar Sangalang *CS*

Subj: Request for preparation of Calibration Standards of Group 1074 Gross Alpha/Beta

1074

Please prepare four (4) tubes each with about 1000 dpm of Sr-90 (soln. Sr-90 Z1) and another for tubes each with about 1000 dpm of Am-241 (soln. Am-241 P1).

Sample Nos. will be 1074-1 to 4 type "80" for Sr and 1074- 5 to 8 type "80" for Am .

I need to start with this work tomorrow, 1-14-03 with a projected finish date of 2-07-03

Thank you

Cesar

Verification
Book 2583 pg 86
565-572
Radiometrics Prep

Page 101, BK # 2775 Calibration

β efficiency -

counted in 2 diff. drawer C- Aluminized mylar
D- (Amidized) Gold in mylar.

2 counts on each drawer
& count per samples.

α efficiency -

β efficiency -

α from beta -

β from alpha -

Added 1186 dpm of Sr 90 Z1

1074 dpm of Am²⁴¹ P1

Log Book Group's Sample Entry #	DATE	ANALYSIS	Reg. Sample #	Volume & ID of TRACER ADDED	TOTAL ACTIVITY (CPM)	ACTIVITY DATE	STANDARD WT. (g)	MATRIX	CONTAINER	Event ID	Additional Information on Comment
564	10/18/02	Pu241	MUT RP	350uL Pu ²⁴¹ M1	2849.7	336.708-95	0.39	1.6542 ON HANDS + 18 mL U ²³⁵ MA Gold AB	LSC VIAL	MUT	Pu-241 Calib. check 10/18/02 K-gamma meter 2/14/03
565	1074-1	Type 80CS	RP	0.1 mL Sr ⁹⁰ Z1	1186	182.708-95	0.5	10m L/MNHCl	50mL Poly Tube	CS	GRB Verification 1/13/03 K-gamma meter
566	2	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
567	3	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
568	4	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
569	5	"	RP	0.1 mL Am ²⁴¹ PI	1074	109.500-96	0.92	2/15/03 RP	"	"	"
70	6	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	1.0	"	"	"	"
71	7	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
72	8	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
575	3	Rn ²²²	CS RP	6.0 mL Rn ²²² N1-A	149.7	252.708-91	0.13	6m L/MNHCl + 4mL H ₂ O	LSC VIAL	CS	Rn ²²² Verification 1/21/03 K-gamma meter 2/14/03
576	4	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
577	5	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
578	6	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
579	1	Sr ⁹⁰	CS RP	200uL Sr ⁹⁰ Z1	2372	182.708-95	0.21	0.1 N HNO ₃	50mL Poly Tube	CS	Sr ⁹⁰ Verification 2/14/03 K-gamma meter
580	2	"	RP	"	"	"	0.21	"	"	"	"
581	3	"	RP	"	"	"	0.21	"	"	"	"
582	4	"	RP	"	"	"	0.21	"	"	"	"
583	5	"	RP	"	"	"	0.21	"	"	"	"
584	6	"	RP	"	"	"	0.21	"	"	"	"

Log Book Group's Sample Entry #	DATE	ANALYSIS	Reg. Sample #	Volume & ID of TRACER ADDED	TOTAL ACTIVITY (CPM)	ACTIVITY DATE	STANDARD WT. (g)	MATRIX	CONTAINER	Event ID	Additional Information on Comment
564	10/18/02	Pu241	MUT RP	350uL Pu ²⁴¹ M1	2849.7	336.708-95	0.39	1.6542 ON HANDS + 18 mL U ²³⁵ MA Gold AB	LSC VIAL	MUT	Pu-241 Calib. check 10/18/02 K-gamma meter 2/14/03
565	1074-1	Type 80CS	RP	0.1 mL Sr ⁹⁰ Z1	1186	182.708-95	0.5	10m L/MNHCl	50mL Poly Tube	CS	GRB Verification 1/13/03 K-gamma meter
566	2	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
567	3	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
568	4	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
569	5	"	RP	0.1 mL Am ²⁴¹ PI	1074	109.500-96	0.92	2/15/03 RP	"	"	"
70	6	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	1.0	"	"	"	"
71	7	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
72	8	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
575	3	Rn ²²²	CS RP	6.0 mL Rn ²²² N1-A	149.7	252.708-91	0.13	6m L/MNHCl + 4mL H ₂ O	LSC VIAL	CS	Rn ²²² Verification 1/21/03 K-gamma meter 2/14/03
576	4	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
577	5	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
578	6	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
579	1	Sr ⁹⁰	CS RP	200uL Sr ⁹⁰ Z1	2372	182.708-95	0.21	0.1 N HNO ₃	50mL Poly Tube	CS	Sr ⁹⁰ Verification 2/14/03 K-gamma meter
580	2	"	RP	"	"	"	0.21	"	"	"	"
581	3	"	RP	"	"	"	0.21	"	"	"	"
582	4	"	RP	"	"	"	0.21	"	"	"	"
583	5	"	RP	"	"	"	0.21	"	"	"	"
584	6	"	RP	"	"	"	0.21	"	"	"	"



U.S. DEPARTMENT OF COMMERCE
National Institute of Standards & Technology
Gaithersburg, MD 20899

REPORT OF TRACEABILITY *Am-241 P1*

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada

Radionuclide Americium-241
Source identification 94030-1, prepared by EMSL
Source description Liquid in 5-mL flame-sealed glass ampoule
Source mass Approximately 5.0 grams
Source composition Americium-241 in 0.1 mol·L⁻¹ HCl
Reference time 0700 EST April 18, 1996

NIST DATA

EMSL DATA

Radioactivity concentration	3.574 x 10 ² Bq·g ⁻¹	9.6 nanocuries/gram
Expanded uncertainty	0.46 percent ^{(1,2)*}	±2.75 percent ⁽³⁾
Photon-emitting impurities	None observed ⁽⁴⁾	None reported
Measuring instrument	2π α liquid-scintillation counter	Liquid-scintillation counter
Half life	432.2 ± 0.7 years ⁽⁵⁾	
Difference from NIST		+0.06 percent ⁽⁶⁾

For the Director,

J.M. Robin Hutchinson, Group Leader
Radioactivity Group
Physics Laboratory

*Notes on next page

(over)

Gaithersburg, MD 20899
November 1996

As guidance for the proper use of this Report, it should be emphasized that the National Institute of Standards and Technology is concerned only with fostering good measurements capability and consistency with the national measurements system. The assurance of the proper application of that capability to the ultimate consumer products is the responsibility of each manufacturer of these products and of the Federal regulatory agencies.

A continuing traceability program in radioactivity demonstrates, to the degree established by the periodic assays of calibrated radioactivity samples, a continuing competence to maintain the instrument systems and standards necessary for accurate measurement. Such a program cannot, however, endorse each and every measurement nor the final product, any more than a spot check can vouch for every unchecked item. Care should be taken, therefore, not to imply such endorsement. The proper use of this Report is governed by section 200.114 of Title 15 of the Code of Federal Regulations. These regulations may be met if Reports are quoted only in their entirety. Excerpts out of context may be misleading.

NOTES

- (1) The uncertainty analysis methodology and nomenclature used for the reported uncertainties are based on uniform NIST guidelines and are compatible with those adopted by the principal international metrology standardization bodies [cf., B.N. Taylor and C.E. Kuyatt, *NIST Technical Note 1297* (1994)].
- (2) The combined standard uncertainty, $u_c = 0.23$ percent, is the quadratic combination of the standard deviation (or standard deviation of the mean where appropriate), or approximations thereof, for the following component uncertainties:
- | | |
|---|--------------|
| a) 20 measurements on each of 5 samples | 0.03 percent |
| b) gravimetric | 0.05 percent |
| c) dead time | 0.10 percent |
| d) background | 0.01 percent |
| e) detection efficiency | 0.20 percent |

The expanded uncertainty, $U = 0.46$ percent, is obtained by multiplying u_c by a coverage factor of $k = 2$ and is assumed to provide an uncertainty interval of approximately 95 percent confidence.

- (3) "Overall uncertainty" reported by EMSL.
- (4) The limits of detection, as a percentage of the 59.5-keV photons emitted in the decay of americium-241, are:
- 0.02 percent between 63.5 and 1900 keV,
- provided that the impurity photons are separated in energy by four keV or more from those emitted in the decay of americium-241.
- (5) Evaluated Nuclear Structure Data File (ENSDF), September 1996.
- (6) This result demonstrates the traceability of EMSL to NIST, for this measurement, to within five percent as specified in the appendix, Traceability Studies, of the EPA-NIST interagency agreement of April 1976, as amended.

For further information, please contact Jeffrey T. Cessna at 301-975-5539.

Source identification 94030-1



318
 Rec'd 6/24/97
 K. Yamamoto

Am-241 P1

Calibration Certificate

OFFICE OF
 RESEARCH AND DEVELOPMENT

Description

Principal Radionuclide.....	Americium-241
Total Mass of this Solution.....	Approx. 5 grams
Total Activity.....	Approx. 48 nanocuries
Half-life.....	432.7 ± 0.5 years
Activity Concentration.....	9.6 nanocuries/gram
Date and Time of Standardization.....	April 18, 1996 0400 hours PST
Solution Number.....	109,500-96 94030-1

Measurement

Method of Measurement:

The activity of the dilution was measured using liquid scintillation.

The activity of the primary solution was measured using a liquid scintillation counter.

Activity of daughter radionuclide:

The principal activity was accompanied at the quoted time by less than:

[] of the daughter nuclide..... []

Useful Life

We recommend that this solution should not be used after..... January, 2003

Am-241 P1 Rec'd 12/04/2001 in 1N HCl
 $5.0386 \text{ g} \times 9.6 \text{ nCi/g} \times 2220 \text{ dpm} \times \frac{1}{100 \text{ mL}} = 1074 \text{ dpm/mL} \pm 0.92\%$
 109,500-96
 R. Brenton 12/4/01
 K. Yamamoto 12/4/01
 NPDES - 1203

Purity:

The activities other than that of the principal nuclide and of its daughter nuclides were estimated to be:

- (1) None stated < of the principal activity
- (2) < of the principal activity
- (3) < of the principal activity

The activities of the impurities are not included in the quoted figures of the principal activity.

Random Errors:

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than $\pm 0.23\%$.

The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the Student t factor for the degree of freedom ($n-1$), and is calculated to be $\pm 0.75\%$.

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta, -\delta'$). These have been estimated not to exceed $\pm 2.0\%$.

The overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error [$t(sm)$] at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta, -\delta'$). The overall uncertainty is therefore calculated on the basis of $+ [t(sm) + \delta], - [t(sm) + \delta']$ and is $\pm 2.75\%$ of the quoted radioactive concentration.

Decay Schemes:

This standardization is based on the following assumptions of the principal nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Americium-241 decays 100 percent by alpha emission.

Chemical Composition of Solution:

Carrier content per gram of solution:

Other components:

Preservative: 1.0 M HCl

Remarks:

Date Certificate Prepared April 26, 1996

Approval Signature 



National Institute of Standards & Technology

Certificate

Sr⁹⁰Z1

Standard Reference Material 4919H Strontium-90 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive strontium-90 chloride, non-radioactive strontium chloride, non-radioactive yttrium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of beta-particle counting instruments and for the monitoring of radiochemical procedures.

Radiological Hazard

The SRM ampoule contains strontium-90 with a total activity of approximately 20 kBq. Strontium-90 decays by beta-particle emission to yttrium-90, which also decays by beta-particle emission. None of the beta particles escape from the SRM ampoule. The beta particles emitted from strontium-90 and yttrium-90 produce bremsstrahlung photons with energies up to 2 MeV. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 0.9 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 July 2005.

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
December 1995

Thomas E. Gills, Chief
Standard Reference Materials Program

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss. See also reference [4]*.

- [a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
- | | | | |
|---|----|------|-----|
| Distance from Ampoule (cm): | 1 | 30 | 100 |
| Approximate Dose Rate ($\mu\text{Sv/h}$): | 15 | <0.1 | - |

- [b] The stated uncertainty is two times the standard uncertainty.

- [c] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

- [d] The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.

The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial y / \partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .

The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain U , the **expanded uncertainty** of y .

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

For further information on the expression of uncertainties, see references [2] and [3].

- [e] The value of each standard uncertainty component, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the liquid-scintillation counting is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).

- [f] The estimated limit of detection for alpha-particle-emitting impurities is:
 $0.05 \alpha \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 3 and 12 MeV.

- [g] Estimated limits of detection for photon-emitting impurities are:
 $0.04 \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 40 and 507 keV and
 $0.004 \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 515 and 1900 keV.

- [h] The stated uncertainty is the standard uncertainty. See reference [5].

- [i] Relative standard uncertainty of the input quantity x_i .

- [j] 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 .

- [k] Relative component of combined standard uncertainty of output quantity y , rounded to two significant figures or less. The relative component of combined standard uncertainty of y is given by $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.
- [m] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.
- [n] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of Sr-90})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of Sr-90})\}$. 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.
- [p] 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.
- [q] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$, multiplied by other sensitivity factors where appropriate.
- [r] The relationship between the detection efficiency for Sr-90 and Y-90 and the detection efficiency for H-3 was computed using the CIEMAT/NIST method as embodied in the computer program EFFY4. See references [6, 7, 8]. The program computes the detection efficiency for each radionuclide based upon an assumed model. No estimate is made of the uncertainty associated with this model.

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), July 1995.
- [6] E. Garcia-Toraño and A. Grau Malonda, EFFY, A New Program to Compute the Counting Efficiency of Beta Particles in Liquid Scintillators, *Computer Phys. Comm.* **36** (1985) 307.
- [7] A. Grau Malonda, E. Garcia-Toraño, and J.M. Los Arcos, Liquid-Scintillation Counting Efficiency as a Function of the Figure of Merit for Pure Beta-Particle Emitters, *Int. J. Appl. Radiat. Isot.* **36** (1985) 157.
- [8] B.M. Coursey, W.B. Mann, A. Grau Malonda, E. Garcia-Toraño, J.M. Los Arcos, J.A.B. Gibson, and D. Reher, Standardization of Carbon-14 by $4\pi\beta$ Liquid Scintillation Efficiency Tracing with Hydrogen-3, *Appl. Radiat. Isot.* **37** (1986) 403.

PROPERTIES OF SRM 4919H
(Certified values are shown in bold type)

Sr⁹⁰Z1

Source identification number	NIST SRM 4919H		
Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall Thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution density	(1.014 ± 0.002) g·mL⁻¹ at 21.5 °C [b]*		
Solution mass	Approximately 5.0 grams		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O	54	0.96
	HCl	0.9	0.04
	SrCl ₂	0.001	0.0002
	YCl ₃	0.001	0.0002
	⁹⁰ SrCl ₂	9 × 10 ⁻⁹	1 × 10 ⁻⁹
Radiological Properties:			
Radionuclide	Strontium-90		
Reference time	1200 EST, 1 July 1995		
Massic activity of the solution [c]	4.010 kBq·g ⁻¹		
Relative expanded uncertainty (k=2)	0.74% [d] [e]		
Alpha-particle-emitting impurities	None detected [f]		
Photon-emitting impurities	None detected [g]		
Half lives used in the decay corrections	Hydrogen-3: (12.33 ± 0.06) a [h] Strontium-90: (28.78 ± 0.04) a [h] Yttrium-90: (64.10 ± 0.08) h [h]		
Beta-particle maximum energies used in the EFFY4 computations	Hydrogen-3: (18.594 ± 0.008) keV [h] Strontium-90: (546.0 ± 1.6) keV [h] Yttrium-90: (521 ± 3) keV [h] (2281.5 ± 2.5) keV [h]		
Calibration method	4πB liquid-scintillation counting. The Sr-90 plus Y-90 detection efficiency was calculated using the CIEMAT/NIST method with H-3 as the detection-efficiency monitor. [i]		

Sr⁹⁰Z1 in 1N HCL

$$4.9313 \text{ g} \times 4.010 \frac{\text{kBq}}{\text{g}} \times 1000 \times 60 \frac{\text{dpm}}{\text{Bq}} \times \frac{1}{100 \text{ ml}} = 1.18654 \text{ dpm/ml} \pm 0.37\% \text{ Sr}^{90}$$

@ 182,708 - 95

SRM 4919H, page 3 of 6

*Notes and references are on pages 5 and 6.

carrier content $\frac{0.132 \text{ mg/ml SrCO}_3 + 0.1107 \text{ mg/ml Y}_2\text{O}_3}{0.1907}$

K. Yamamoto 11/10/00

Counted 20.697- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.300 mg	18.300 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 109	GRB 109
Counts =	90.000	80370.000
Gross cpm =	0.900	803.700
Background =	0.037	1.019
Observed CPM =	0.863	802.681
Cross talk fac =	0.006	0.209
True CPM =	-4.096	803.538
Inst Std. Fac. =	1.163	1.014
Adjusted CPM =	-4.764	814.787
Eff (cpm/dpm) =	0.190	0.418
DFM of Aliquot =	-25.046	1950.059

pCi /smpl =	-11.3	878.
1 sigma % Err =	2.363	0.353
2 sigma % Err =	4.632	0.692

(1 sigma err) = 0.267 3.10

(2 sigma err) = 0.523 6.08

LTV (95 %) = 0.440 884.

MDA (3.00) = 0.283 0.538

MDA (2.71) = 0.276 0.535

CRITICAL LEVEL = 0.106 0.254

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.037	1.019	0.00
SF	20.633	0	1.163	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.738	17-JAN-03 9:42	GAW 109	(50)9025 1 \	100.0 min	0.75
17.986	17-JAN-03 15:39	GAW 109	BK \	3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 109	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.738	17-JAN-03 9:42	GRB 109	(50)9025 1 \	100.0 min	12.57
17.986	17-JAN-03 15:39	GRB 109	BK \	3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 109	SF \	10.0 min	0.00

CS
Counted 27.869- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.300 mg	18.300 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 114	GRB 114
Counts =	138.000	78303.000
Gross cpm =	1.380	783.030
Background =	0.037	2.057
Observed CPM =	1.343	780.973
Cross talk fac =	0.006	0.209
True CPM =	-3.482	781.701
Inst Std. Fac. =	1.045	1.012
Adjusted CPM =	-3.638	791.082
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	-19.128	1893.323

Count

pCi /smpl =	-8.62	853.
1 sigma % Err =	3.419	0.358
2 sigma % Err =	6.701	0.703

(1 sigma err) = 0.295 3.06

(2 sigma err) = 0.577 5.99

LTV (95 %) = 0.486 858.

MDA (3.00) = 0.283 0.751

MDA (2.71) = 0.276 0.748

CRITICAL LEVEL = 0.106 0.360

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	25.006	3	0.037	2.057	0.00
SF	27.619	0	1.045	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.620	27-JAN-03 6:52	GAW 114	SF	10.0 min	0.00
27.664	27-JAN-03 7:56	GAW 114	(93)2158 14	100.0 min	9.48
27.756	27-JAN-03 10:08	GAW 114	(93)7426 16	100.0 min	8.17

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.633	27-JAN-03 7:11	GRB 114	SF	10.0 min	0.00
27.664	27-JAN-03 7:56	GRB 114	(93)2158 14	100.0 min	25.28
27.756	27-JAN-03 10:08	GRB 114	(93)7426 16	100.0 min	21.12

CS
Counted 30.874- 3 on CI for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.300 mg	18.300 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 109	GRB 109
Counts =	142.000	80616.000
Gross cpm =	1.420	806.160
Background =	0.042	1.043
Observed CPM =	1.378	805.117
Cross talk fac =	0.006	0.209
True CPM =	-3.596	805.869
Inst Std. Fac. =	1.165	1.016
Adjusted CPM =	-4.189	818.763
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	-22.023	1959.574

2 counts done
(c)

pCi /smpl =	-9.92	883.
1 sigma % Err =	3.363	0.353
2 sigma % Err =	6.591	0.691

(1 sigma err) = 0.334 3.11

(2 sigma err) = 0.654 6.10

LTV (95 %) = 0.550 888.

MDA (3.00) = 0.297 0.544

MDA (2.71) = 0.290 0.541

CRITICAL LEVEL = 0.113 0.257

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.042	1.043	0.00
SF	30.616	0	1.165	1.016	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03 6:47	GAW 109	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GAW 109	(50)9035 1 \	100.0 min	0.82
30.867	30-JAN-03 12:48	GAW 109	(50)9035 1 \	6.0 min	0.73

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03 7:01	GRB 109	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GRB 109	(50)9035 1 \	100.0 min	20.30
30.867	30-JAN-03 12:48	GRB 109	(50)9035 1 \	6.0 min	24.17

CS
Counted 31.861- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.300 mg	18.300 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	29.000	80626.000
Gross cpm =	0.290	806.260
Background =	0.049	1.516
Observed CPM =	0.241	804.744
Cross talk fac =	0.006	0.209
True CPM =	-4.732	805.734
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	-4.898	820.237
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	-25.748	1963.102

2nd Count
Done
D

pCi /smpl =	-11.6	884.
1 sigma % Err =	1.230	0.353
2 sigma % Err =	2.412	0.691

(1 sigma err) = 0.143 3.12

(2 sigma err) = 0.280 6.11

LTV (95 %) = 0.235 889.

MDA (3.00) = 0.315 0.650

MDA (2.71) = 0.308 0.646

CRITICAL LEVEL = 0.122 0.309

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	30.966	3	0.049	1.516	0.00
SF	31.614	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.966	30-JAN-03 15:11	GAW 115	BK	929.7 min	0.00
31.614	31-JAN-03 6:44	GAW 115	SF	10.0 min	0.00
31.764	31-JAN-03 10:20	GAW 115	(80)1074	5 \ 100.0 min	194.10

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.966	30-JAN-03 15:11	GRB 115	BK	929.7 min	0.00
31.625	31-JAN-03 7:00	GRB 115	SF	10.0 min	0.00
31.764	31-JAN-03 10:20	GRB 115	(80)1074	5 \ 100.0 min	43.83

CS
Counted 20.697- 3 on C2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.400 mg	29.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 110	GRB 110
Counts =	217.000	81414.000
Gross cpm =	2.170	814.140
Background =	0.055	1.637
Observed CPM =	2.115	812.503
Cross talk fac =	0.006	0.215
True CPM =	-2.840	813.113
Inst Std. Fac. =	1.176	1.014
Adjusted CPM =	-3.340	824.496
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	-19.370	1989.682

pCi /smpl	=	-8.73	896.
1 sigma % Err	=	5.252	0.351
2 sigma % Err	=	10.293	0.688

(1 sigma err) = 0.458 3.15

(2 sigma err) = 0.898 6.17

LTV (95 %) = 0.756 901.

MDA (3.00) = 0.363 0.679

MDA (2.71) = 0.356 0.676

CRITICAL LEVEL = 0.143 0.324

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.055	1.637	0.00
SF	20.633	0	1.176	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.617	17-JAN-03 6:48	GAW 110	SF	\ 10.0 min	0.00
17.986	17-JAN-03 15:39	GAW 110	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 110	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.631	17-JAN-03 7:08	GRB 110	SF	\ 10.0 min	0.00
17.986	17-JAN-03 15:39	GRB 110	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 110	SF	\ 10.0 min	0.00

CS
Counted 27.869- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.400 mg	29.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	46.000	75955.000
Gross cpm =	0.460	759.550
Background =	0.070	1.746
Observed CPM =	0.390	757.804
Cross talk fac =	0.006	0.215
True CPM =	-4.234	758.713
Inst Std. Fac. =	1.037	1.016
Adjusted CPM =	-4.390	770.852
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	-25.460	1860.228

pCi /smpl =	-11.5	838.
1 sigma % Err =	1.720	0.364
2 sigma % Err =	3.370	0.713

(1 sigma err) = 0.197 3.05

(2 sigma err) = 0.387 5.97

LTV (95 %) = 0.325 843.

MDA (3.00) = 0.400 0.701

MDA (2.71) = 0.392 0.697

CRITICAL LEVEL = 0.161 0.335

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	25.006	3	0.070	1.746	0.00
SF	27.619	0	1.037	1.016	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.620	27-JAN-03 6:52	GAW 115	SF	10.0 min	0.00
27.664	27-JAN-03 7:56	GAW 115	(93)7426 15	100.0 min	1.59
27.756	27-JAN-03 10:08	GAW 115	(93)8035 4	100.0 min	4.05

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.633	27-JAN-03 7:11	GRB 115	SF	10.0 min	0.00
27.664	27-JAN-03 7:56	GRB 115	(93)7426 15	100.0 min	2.32
27.756	27-JAN-03 10:08	GRB 115	(93)8035 4	100.0 min	10.41

CS
Counted 28.807- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.400 mg	29.400 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 114	GRB 114
Counts =	159.000	80684.000
Gross cpm =	1.590	806.840
Background =	0.030	2.060
Observed CPM =	1.560	804.780
Cross talk fac =	0.006	0.215
True CPM =	-3.349	805.499
Inst Std. Fac. =	1.043	1.011
Adjusted CPM =	-3.493	814.360
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	-20.255	1965.220

2
Count.
dmc

D

pCi /smpl	=	-9.12	885.
1 sigma % Err	=	3.801	0.353
2 sigma % Err	=	7.449	0.692

(1 sigma err)	=	0.347	3.13
(2 sigma err)	=	0.680	6.13
LTV (95 %)	=	0.572	890.
MDA (3.00)	=	0.289	0.758
MDA (2.71)	=	0.281	0.755
CRITICAL LEVEL	=	0.105	0.364

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.030	2.060	0.00
SF	28.606	0	1.043	1.011	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.957	27-JAN-03 14:58	GAW 114	BK	927.7 min	0.00
28.606	28-JAN-03 6:32	GAW 114	SF	10.0 min	0.00
28.652	28-JAN-03 7:38	GAW 114	(88)9033 2	100.0 min	4.31

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.869	27-JAN-03 12:51	GRB 114	(80)1074 1	100.0 min	790.00
27.957	27-JAN-03 14:58	GRB 114	BK	927.7 min	0.00
28.616	28-JAN-03 6:47	GRB 114	SF	10.0 min	0.00

CS
Counted 30.874- 3 on C2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.400 mg	29.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 110	GRB 110
Counts =	224.000	80924.000
Gross cpm =	2.240	809.240
Background =	0.044	1.651
Observed CPM =	2.196	807.589
Cross talk fac =	0.006	0.215
True CPM =	-2.729	808.175
Inst Std. Fac. =	1.177	1.014
Adjusted CPM =	-3.212	819.489
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	-18.628	1977.599

2 Counts done

(C)

pCi /smpl =	-8.39	891.
1 sigma % Err =	9.938	0.352
2 sigma % Err =	10.854	0.691

(1 sigma err) = 0.465 3.14

(2 sigma err) = 0.911 6.15

LTV (95 %) = 0.767 896.

MDA (3.00) = 0.333 0.682

MDA (2.71) = 0.326 0.679

CRITICAL LEVEL = 0.128 0.325

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.044	1.651	0.00
SF	30.616	0	1.177	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03 6:47	GAW 110	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GAW 110	(50)9035	100.0 min	0.94
30.867	30-JAN-03 12:48	GAW 110	(50)9035	6.0 min	1.52

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03 7:01	GRB 110	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GRB 110	(50)9035	100.0 min	18.21
30.867	30-JAN-03 12:48	GRB 110	(50)9035	6.0 min	17.59

CS
Counted 20.697- 3 on CS for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	40.800 mg	40.800 mg
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 111	GRB 111
Counts =	75.000	81424.000
Gross cpm =	0.750	814.240
Background =	0.030	1.167
Observed CPM =	0.720	813.073
Cross talk fac =	0.006	0.220
True CPM =	-4.176	813.993
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	-4.744	816.435
Eff (cpm/dpm) =	0.157	0.411
DPM of Aliquot =	-30.289	1987.176

pCi /smpl =	-13.6	895.
1 sigma % Err =	2.115	0.351
2 sigma % Err =	4.145	0.688

(1 sigma err) = 0.289 3.14

(2 sigma err) = 0.566 6.15

LTV (95 %) = 0.476 900.

MDA (3.00) = 0.318 0.584

MDA (2.71) = 0.310 0.580

CRITICAL LEVEL = 0.116 0.276

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.030	1.167	0.00
SF	20.633	0	1.136	1.003	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GAW 111	(50)9025 3 \	24.0 min	0.40
17.986	17-JAN-03 15:39	GAW 111	BK \	3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 111	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GRB 111	(50)9025 3 \	24.0 min	6.18
17.986	17-JAN-03 15:39	GRB 111	BK \	3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 111	SF \	10.0 min	0.00

Counted 30.874- 3 on C3 for 100.00 min. Reviewed _____ Date _____

1.00	smpl	40.800 mg	40.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 111	GRB 111
Counts =	75.000	82078.000
Gross cpm =	0.750	820.780
Background =	0.031	1.187
Observed CPM =	0.719	819.593
Cross talk fac =	0.006	0.220
True CPM =	-4.216	820.522
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	-4.789	822.984
Eff (cpm/dpm) =	0.157	0.411
DPM of Aliquot =	-30.582	2003.115

2 counts done

@

pCi /smpl =	-13.8	902.
1 sigma % Err =	2.096	0.349
2 sigma % Err =	4.109	0.685

(1 sigma err) = 0.289 3.15

(2 sigma err) = 0.566 6.18

LTV (95 %) = 0.476 908.

MDA (3.00) = 0.322 0.588

MDA (2.71) = 0.313 0.585

CRITICAL LEVEL = 0.118 0.278

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.031	1.187	0.00
SF	30.616	0	1.136	1.003	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03 6:47	GAW 111	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GAW 111	(50)9035 3	100.0 min	0.67
30.867	30-JAN-03 12:48	GAW 111	(50)9035 3	6.0 min	1.10

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03 7:01	GRB 111	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GRB 111	(50)9035 3	100.0 min	17.98
30.867	30-JAN-03 12:48	GRB 111	(50)9035 3	6.0 min	17.04

CS
Counted 34.867- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00 smpl 40.800 mg 40.800 mg

Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	25.000	80936.000
Gross cpm =	0.250	809.360
Background =	0.067	1.540
Observed CPM =	0.183	807.820
Cross talk fac =	0.006	0.220
True CPM =	-4.682	808.852
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	-4.846	823.411
Eff (cpm/dpm) =	0.157	0.411
DPM of Aliquot =	-30.941	2004.155

2nd Count done
D

pCi /smpl	=	-13.9	903.
1 sigma % Err	=	1.203	0.352
2 sigma % Err	=	2.357	0.690

(1 sigma err) = 0.168 3.18

(2 sigma err) = 0.329 6.23

LTV (95 %) = 0.277 908.

MDA (3.00) = 0.432 0.666

MDA (2.71) = 0.424 0.662

CRITICAL LEVEL = 0.173 0.317

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	31.942	3	0.067	1.540	0.00
SF	34.615	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.615	3-FEB-03 6:45	GAW 115	SF	10.0 min	0.00
34.686	3-FEB-03 8:27	GAW 115	(80)1074	5 \ 100.0 min	192.99
34.762	3-FEB-03 10:17	GAW 115	(80)1074	6 \ 100.0 min	164.95

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.636	3-FEB-03 7:15	GRB 115	SF	10.0 min	0.00
34.686	3-FEB-03 8:27	GRB 115	(80)1074	5 \ 100.0 min	46.82
34.762	3-FEB-03 10:17	GRB 115	(80)1074	6 \ 100.0 min	38.59

CS
Counted 37.653- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	40.800 mg	40.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight
		ALPHA	BETA
		-----	-----
Instrument =	GAW 115	GRB 115	
Counts =	50.000	80909.000	
Gross cpm =	0.500	809.090	
Background =	0.054	1.510	
Observed CPM =	0.446	807.580	
Cross talk fac =	0.006	0.220	
True CPM =	-4.417	808.553	
Inst Std. Fac. =	1.036	1.017	
Adjusted CPM =	-4.576	822.299	
Eff (cpm/dpm) =	0.157	0.411	
DPM of Aliquot =	-29.219	2001.448	
pCi /smp1 =	-13.2	902.	
1 sigma % Err =	1.685	0.352	
2 sigma % Err =	3.303	0.690	
(1 sigma err) =	0.222	3.17	
(2 sigma err) =	0.435	6.22	
LTV (95 %) =	0.366	907.	
MDA (3.00) =	0.397	0.659	
MDA (2.71) =	0.389	0.656	
CRITICAL LEVEL =	0.156	0.314	

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	36.943	3	0.054	1.510	0.00
SF	37.605	0	1.036	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
36.943	5-FEB-03 14:37	GAW 115	BK	\ 949.8 min	0.00
37.605	6-FEB-03 6:31	GAW 115	SF	\ 10.0 min	0.00
37.648	6-FEB-03 7:33	GAW 115	(80)1074	7 \ 1.0 min	158.43

Previous 3 counts	Time	Detector	ID	Length	Cpm
36.943	5-FEB-03 14:37	GRB 115	BK	\ 949.8 min	0.00
37.618	6-FEB-03 6:49	GRB 115	SF	\ 10.0 min	0.00
37.648	6-FEB-03 7:33	GRB 115	(80)1074	7 \ 1.0 min	36.08

CS
Counted 20.697- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	53.500 mg	53.500 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 112	GRB 112
Counts =	74.000	81327.000
Gross cpm =	0.740	813.270
Background =	0.048	1.516
Observed CPM =	0.692	811.754
Cross talk fac =	0.006	0.227
True CPM =	-4.124	812.689
Inst Std. Fac. =	1.155	1.006
Adjusted CPM =	-4.763	817.565
Eff (cpm/dpm) =	0.141	0.407
DPM of Aliquot =	-33.695	2009.006

pCi /smpl =	-15.2	905.
1 sigma % Err =	2.153	0.351
2 sigma % Err =	4.219	0.685

(1 sigma err) = 0.327 3.18

(2 sigma err) = 0.640 6.23

LTV (95 %) = 0.539 910.

MDA (3.00) = 0.420 0.667

MDA (2.71) = 0.411 0.664

CRITICAL LEVEL = 0.163 0.318

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.048	1.516	0.00
SF	20.633	0	1.155	1.006	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GAW 112	(50)9025 4 \	24.0 min	0.52
17.986	17-JAN-03 15:39	GAW 112	BK \	3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 112	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GRB 112	(50)9025 4 \	24.0 min	5.72
17.986	17-JAN-03 15:39	GRB 112	BK \	3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 112	SF \	10.0 min	0.00

30-JAN-03
15:01:55

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 4 80
CALIBRATION Std.

CS
Counted 30.874- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00 smpl 53.500 mg 53.500 mg

Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 112	GRB 112
Counts =	75.000	82210.000
Gross cpm =	0.750	822.100
Background =	0.053	1.518
Observed CPM =	0.697	820.582
Cross talk fac =	0.006	0.227
True CPM =	-4.171	821.528
Inst Std. Fac. =	1.154	1.007
Adjusted CPM =	-4.813	827.278
Eff (cpm/dpm) =	0.141	0.407
DPM of Aliquot =	-34.052	2032.875

2 Counts done

pCi /smpl =	-15.3	916.
1 sigma % Err =	2.148	0.349
2 sigma % Err =	4.211	0.685

(1 sigma err) = 0.330 3.20

(2 sigma err) = 0.646 6.27

LTV (95 %) = 0.544 921.

MDA (3.00) = 0.437 0.667

MDA (2.71) = 0.428 0.664

CRITICAL LEVEL = 0.171 0.318

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.053	1.518	0.00
SF	30.616	0	1.154	1.007	0.00

Previous	3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03	6:47	GAW 112	SF	10.0 min	0.00
30.678	30-JAN-03	8:16	GAW 112	(50)9035 4	100.0 min	0.99
30.867	30-JAN-03	12:48	GAW 112	(50)9035 4	6.0 min	1.28

Previous	3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03	7:01	GRB 112	SF	10.0 min	0.00
30.678	30-JAN-03	8:16	GRB 112	(50)9035 4	100.0 min	17.23
30.867	30-JAN-03	12:48	GRB 112	(50)9035 4	6.0 min	14.25

06-FEB-03
13:49:44

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 4 80
CALIBRATION Std.

CS
Counted 35.753- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	53.500 mg	53.500 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 115	GRB 115
Counts =	25.000	79426.000
Gross cpm =	0.250	794.260
Background =	0.051	1.539
Observed CPM =	0.199	792.721
Cross talk fac =	0.006	0.227
True CPM =	-4.504	793.742
Inst Std. Fac. =	1.036	1.018
Adjusted CPM =	-4.666	808.030
Eff (cpm/dpm) =	0.141	0.407
DPM of Aliquot =	-33.014	1985.575

pCi /smp1	=	-14.9	894.
1 sigma % Err	=	1.218	0.355
2 sigma % Err	=	2.387	0.697

(1 sigma err) = 0.181 3.18

(2 sigma err) = 0.355 6.23

LTV (95 %) = 0.299 900.

MDA (3.00) = 0.430 0.672

MDA (2.71) = 0.421 0.669

CRITICAL LEVEL = 0.168 0.320

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	34.947	3	0.051	1.539	0.00
SF	35.623	0	1.036	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
35.623	4-FEB-03 6:57	GAW 115	SF	10.0 min	0.00
35.650	4-FEB-03 7:36	GAW 115	(80)1074 6	1.0 min	155.36
35.655	4-FEB-03 7:43	GAW 115	(80)9036 3	100.0 min	4.76

Previous 3 counts	Time	Detector	ID	Length	Cpm
35.633	4-FEB-03 7:11	GRB 115	SF	10.0 min	0.00
35.650	4-FEB-03 7:36	GRB 115	(80)1074 6	1.0 min	42.21
35.655	4-FEB-03 7:43	GRB 115	(80)9036 3	100.0 min	12.82

CS
Counted 37.849- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	53.500 mg	53.500 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

ALPHA

BETA

Instrument =	GAW 115	GRB 115
Counts =	36.000	80403.000
Gross cpm =	0.360	804.030
Background =	0.054	1.510
Observed CPM =	0.306	802.520
Cross talk fac =	0.006	0.227
True CPM =	-4.455	803.530
Inst Std. Fac. =	1.036	1.017
Adjusted CPM =	-4.616	817.190
Eff (cpm/dpm) =	0.141	0.407
DPM of Aliquot =	-32.654	2008.085

2nd Count done

pCi /smpl	=	-14.7	905.
1 sigma % Err	=	1.444	0.353
2 sigma % Err	=	2.831	0.692

(1 sigma err) = 0.212 3.19

(2 sigma err) = 0.416 6.26

LTV (95 %) = 0.351 910.

MDA (3.00) = 0.440 0.666

MDA (2.71) = 0.431 0.662

CRITICAL LEVEL = 0.173 0.317

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	36.943	3	0.054	1.510	0.00
SF	37.605	0	1.036	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
37.605	6-FEB-03 6:31	GAW 115	SF	10.0 min	0.00
37.648	6-FEB-03 7:33	GAW 115	(80)1074 7	1.0 min	158.43
37.654	6-FEB-03 7:41	GAW 115	(80)1074 3	100.0 min	0.46

Previous 3 counts	Time	Detector	ID	Length	Cpm
37.618	6-FEB-03 6:49	GRB 115	SF	10.0 min	0.00
37.648	6-FEB-03 7:33	GRB 115	(80)1074 7	1.0 min	36.08
37.654	6-FEB-03 7:41	GRB 115	(80)1074 3	100.0 min	821.08

CS
Counted 20.778- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.400 mg	18.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 109	GRB 109
Counts =	14270.000	3257.000
Gross cpm =	142.700	32.570
Background =	0.037	1.019
Observed CPM =	142.663	31.551
Cross talk fac =	0.006	0.209
True CPM =	142.652	1.708
Inst Std. Fac. =	1.163	1.014
Adjusted CPM =	165.905	1.732
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	873.036	4.146

pCi /smpl =	393.	1.87
1 sigma % Err =	0.838	33.930
2 sigma % Err =	1.642	66.503

(1 sigma err) = 3.29 0.634

(2 sigma err) = 6.46 1.24

LTV (95 %) = 399. 2.91

MDA (3.00) = 0.283 0.538

MDA (2.71) = 0.276 0.535

CRITICAL LEVEL = 0.106 0.254

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.037	1.019	0.00
SF	20.633	0	1.163	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 109	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 109	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 109	(80)1074 1	\ 100.0 min	1.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 109	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 109	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 109	(80)1074 1	\ 100.0 min	814.16

CS
Counted 28.807- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	18.400 mg	18.400 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 109	GRB 109
Counts =	14140.000	3417.000
Gross cpm =	141.400	34.170
Background =	0.028	1.053
Observed CPM =	141.372	33.117
Cross talk fac =	0.006	0.209
True CPM =	141.350	3.547
Inst Std. Fac. =	1.164	1.016
Adjusted CPM =	164.532	3.603
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	865.810	8.625

*2 Counts
dne*

(C)

pCi /smp1 =	390.	3.88
1 sigma % Err =	0.841	16.734
2 sigma % Err =	1.649	32.799

(1 sigma err) = 3.28 0.650

(2 sigma err) = 6.43 1.27

LTV (95 %) = 395. 4.96

MDA (3.00) = 0.256 0.547

MDA (2.71) = 0.249 0.544

CRITICAL LEVEL = 9.242E-02 0.258

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.028	1.053	0.00
SF	28.606	0	1.164	1.016	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GAW 109	(80) 903 16 \	10.0 min	1.35
27.957	27-JAN-03 14:58	GAW 109	BK \	927.5 min	0.00
28.606	28-JAN-03 6:32	GAW 109	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GRB 109	(80) 903 16 \	10.0 min	4.32
27.957	27-JAN-03 14:58	GRB 109	BK \	927.5 min	0.00
28.616	28-JAN-03 6:47	GRB 109	SF \	10.0 min	0.00

03-FEB-03
10:26:10

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 5 80
CALIBRATION Std.

CS
Counted 31.764- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.400 mg	18.400 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	18754.000	4458.000
Gross cpm =	187.540	44.580
Background =	0.049	1.516
Observed CPM =	187.491	43.064
Cross talk fac =	0.006	0.209
True CPM =	187.467	3.846
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	194.029	3.915
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	1021.031	9.371

1st count

pCi /smpl =	460.	4.22
1 sigma % Err =	0.731	17.654
2 sigma % Err =	1.432	34.601

(1 sigma err) = 3.36 0.745

(2 sigma err) = 6.59 1.46

LTV (95 %) = 465. 5.45

MDA (3.00) = 0.315 0.650

MDA (2.71) = 0.308 0.647

CRITICAL LEVEL = 0.122 0.309

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	30.966	3	0.049	1.516	0.00
SF	31.614	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.861	30-JAN-03 12:39	GAW 115	(80)1075	5 \ 100.0 min	191.94
30.966	30-JAN-03 15:11	GAW 115	BK	\ 929.7 min	0.00
31.614	31-JAN-03 6:44	GAW 115	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.861	30-JAN-03 12:39	GRB 115	(80)1075	5 \ 100.0 min	46.51
30.966	30-JAN-03 15:11	GRB 115	BK	\ 929.7 min	0.00
31.625	31-JAN-03 7:00	GRB 115	SF	\ 10.0 min	0.00

03-FEB-03
10:26:11

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 5 80
CALIBRATION Std.

CS
Counted 34.686- 3 on D3 for 100.00 min

Reviewed _____ Date _____

1.00	smpl	18.400 mg	18.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	18646.000	4753.000
Gross cpm =	186.460	47.530
Background =	0.067	1.540
Observed CPM =	186.393	45.990
Cross talk fac =	0.006	0.209
True CPM =	186.350	7.006
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	192.872	7.132
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	1014.943	17.070

2nd Count Done

pCi /smpl =	457.	7.69
1 sigma % Err =	0.733	9.999
2 sigma % Err =	1.436	19.598

(1 sigma err) = 3.35 0.769

(2 sigma err) = 6.57 1.51

LTV (95 %) = 463. 8.96

MDA (3.00) = 0.356 0.654

MDA (2.71) = 0.350 0.651

CRITICAL LEVEL = 0.143 0.312

GC Summary

GC	GMT	YR	ALPHA	BETA	TIME
BKG	31.942	3	0.067	1.540	0.00
SF	34.615	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.861	31-JAN-03 12:39	GAW 115	(80)1074	1 \ 100.0 min	0.25
31.942	31-JAN-03 14:36	GAW 115	BK	\ 3838.3 min	0.00
34.615	3-FEB-03 6:45	GAW 115	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.861	31-JAN-03 12:39	GRB 115	(80)1074	1 \ 100.0 min	819.14
31.942	31-JAN-03 14:36	GRB 115	BK	\ 3838.3 min	0.00
34.636	3-FEB-03 7:15	GRB 115	SF	\ 10.0 min	0.00

CS
Counted 20.778- 3 on C2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 110	GRB 110
Counts =	11696.000	2793.000
Gross cpm =	116.960	27.930
Background =	0.055	1.637
Observed CPM =	116.905	26.293
Cross talk fac =	0.006	0.215
True CPM =	116.898	1.172
Inst Std. Fac. =	1.176	1.014
Adjusted CPM =	137.472	1.188
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	800.120	2.868

pCi /smpl =	360.	1.29
1 sigma % Err =	0.925	46.409
2 sigma % Err =	1.814	90.962

(1 sigma err) = 3.34 0.600

(2 sigma err) = 6.54 1.18

LTV (95 %) = 366. 2.28

MDA (3.00) = 0.365 0.680

MDA (2.71) = 0.357 0.676

CRITICAL LEVEL = 0.143 0.324

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.055	1.637	0.00
SF	20.633	0	1.176	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 110	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 110	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 110	(80)1074 2	\ 100.0 min	2.49

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 110	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 110	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 110	(80)1074 2	\ 100.0 min	823.70

CS
Counted 28.807- 3 on C2 for 100.00 min. Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 110	GRB 110
Counts =	11671.000	2868.000
Gross cpm =	116.710	28.680
Background =	0.055	1.660
Observed CPM =	116.655	27.020
Cross talk fac =	0.006	0.215
True CPM =	116.643	1.953
Inst Std. Fac. =	1.177	1.014
Adjusted CPM =	137.289	1.981
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	799.056	4.781

2 counts done
C

pCi /smpl	=	360.	2.15
1 sigma % Err	=	0.926	28.198
2 sigma % Err	=	1.816	55.268

(1 sigma err)	=	3.33	0.607
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(2 sigma err)	=	6.54	1.19
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LTV (95 %)	=	365.	3.16
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MDA (3.00)	=	0.365	0.684
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MDA (2.71)	=	0.357	0.681
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CRITICAL LEVEL	=	0.143	0.326
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QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.055	1.660	0.00
SF	28.606	0	1.177	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GAW 110	(80) 903 17 \	10.0 min	0.35
27.957	27-JAN-03 14:58	GAW 110	BK \	927.5 min	0.00
28.606	28-JAN-03 6:32	GAW 110	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GRB 110	(80) 903 17 \	10.0 min	0.35
27.957	27-JAN-03 14:58	GRB 110	BK \	927.5 min	0.00
28.616	28-JAN-03 6:47	GRB 110	SF \	10.0 min	0.00

CS
Counted 34.762- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	15938.000	3945.000
Gross cpm =	159.380	39.450
Background =	0.067	1.540
Observed CPM =	159.313	37.910
Cross talk fac =	0.006	0.215
True CPM =	159.291	3.678
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	164.866	3.745
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	959.560	9.039

pCi /smpl =	432.	4.07
1 sigma % Err =	0.793	17.405
2 sigma % Err =	1.554	34.114

(1 sigma err) = 3.43 0.709

(2 sigma err) = 6.72 1.39

LTV (95 %) = 438. 5.24

MDA (3.00) = 0.394 0.660

MDA (2.71) = 0.387 0.657

CRITICAL LEVEL = 0.158 0.314

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	31.942	3	0.067	1.540	0.00
SF	34.615	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.942	31-JAN-03 14:36	GAW 115	BK	\ 3838.3 min	0.00
34.615	3-FEB-03 6:45	GAW 115	SF	\ 10.0 min	0.00
34.686	3-FEB-03 8:27	GAW 115	(80)1074	5 \ 100.0 min	192.99

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.942	31-JAN-03 14:36	GRB 115	BK	\ 3838.3 min	0.00
34.636	3-FEB-03 7:15	GRB 115	SF	\ 10.0 min	0.00
34.686	3-FEB-03 8:27	GRB 115	(80)1074	5 \ 100.0 min	46.82

04-FEB-03
08:15:15

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 6 80
CALIBRATION Std.

CS
Counted 35.650- 3 on D3 for 1.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 115	GRB 115
Counts =	150.000	43.000
Gross cpm =	150.000	43.000
Background =	0.051	1.539
Observed CPM =	149.949	41.461
Cross talk fac =	0.006	0.215
True CPM =	149.893	9.249
Inst Std. Fac. =	1.036	1.018
Adjusted CPM =	155.289	9.416
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	903.819	22.728

2nd Count
Done
D

pCi /smpl =	407.	10.2
1 sigma % Err =	8.172	72.156
2 sigma % Err =	16.018	141.426

(1 sigma err) = 33.3 7.39

(2 sigma err) = 65.2 14.5

LTV (95 %) = 462. 22.4

MDA (3.00) = 10.6 9.53

MDA (2.71) = 9.86 9.22

CRITICAL LEVEL = 1.38 3.14

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	34.947	3	0.051	1.539	0.00
SF	35.623	0	1.036	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.867	3-FEB-03 12:48	GAW 115	(80)1074	3 \ 100.0 min	0.19
34.947	3-FEB-03 14:43	GAW 115	BK	\ 953.9 min	0.00
35.623	4-FEB-03 6:57	GAW 115	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.867	3-FEB-03 12:48	GRB 115	(80)1074	3 \ 100.0 min	822.35
34.947	3-FEB-03 14:43	GRB 115	BK	\ 953.9 min	0.00
35.633	4-FEB-03 7:11	GRB 115	SF	\ 10.0 min	0.00

20-JAN-03
12:57:07

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 7 80
CALIBRATION Std.

CS
Counted 20.778- 3 on C3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 111	GRB 111
Counts =	10795.000	2813.000
Gross cpm =	107.950	28.130
Background =	0.030	1.167
Observed CPM =	107.920	26.963
Cross talk fac =	0.006	0.224
True CPM =	107.904	2.755
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	122.578	2.763
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	834.935	6.766

pCi /smpl =	376.	3.05
1 sigma % Err =	0.963	19.648
2 sigma % Err =	1.888	38.510

(1 sigma err) = 3.62 0.599

(2 sigma err) = 7.10 1.17

LTV (95 %) = 382. 4.04

MDA (3.00) = 0.339 0.587

MDA (2.71) = 0.330 0.584

CRITICAL LEVEL = 0.124 0.278

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.030	1.167	0.00
SF	20.633	0	1.136	1.003	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 111	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 111	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 111	(80)1074 3	\ 100.0 min	0.82

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 111	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 111	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 111	(80)1074 3	\ 100.0 min	815.46

CS
Counted 28.807- 3 on C3 for 100.00 min.

Reviewed _____ Date _____

1.00 smpl 48.700 mg 48.700 mg

Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 111	GRB 111
Counts =	10613.000	2795.000
Gross cpm =	106.130	27.950
Background =	0.029	1.189
Observed CPM =	106.101	26.761
Cross talk fac =	0.006	0.224
True CPM =	106.083	2.961
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	120.511	2.970
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	820.850	7.272
pCi /smpl =	370.	3.28
1 sigma % Err =	0.971	18.229
2 sigma % Err =	1.904	35.729
(1 sigma err) =	3.59	0.597
(2 sigma err) =	7.04	1.17
LTV (95 %) =	376.	4.26
MDA (3.00) =	0.335	0.592
MDA (2.71) =	0.326	0.589
CRITICAL LEVEL =	0.122	0.280

2 Counts Done

C

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.029	1.189	0.00
SF	28.606	0	1.136	1.003	0.00

Previous	3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03	11:09	GAW 111	(80) 903 18	10.0 min	0.42
27.957	27-JAN-03	14:58	GAW 111	BK	927.5 min	0.00
28.606	28-JAN-03	6:32	GAW 111	SF	10.0 min	0.00

Previous	3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03	11:09	GRB 111	(80) 903 18	10.0 min	0.42
27.957	27-JAN-03	14:58	GRB 111	BK	927.5 min	0.00
28.616	28-JAN-03	6:47	GRB 111	SF	10.0 min	0.00

CS
Counted 35.853- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
-----	-----	-----
Instrument =	GAW 115	GRB 115
Counts =	13796.000	3552.000
Gross cpm =	137.960	35.520
Background =	0.051	1.539
Observed CPM =	137.909	33.981
Cross talk fac =	0.006	0.224
True CPM =	137.891	3.045
Inst Std. Fac. =	1.036	1.018
Adjusted CPM =	142.855	3.100
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	973.047	7.591

pCi /smpl =	438.	3.42
1 sigma % Err =	0.852	19.991
2 sigma % Err =	1.670	39.182

(1 sigma err) = 3.73 0.684

(2 sigma err) = 7.32 1.34

LTV (95 %) = 444. 4.55

MDA (3.00) = 0.414 0.669

MDA (2.71) = 0.405 0.666

CRITICAL LEVEL = 0.161 0.319

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	34.947	3	0.051	1.539	0.00
SF	35.623	0	1.036	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
35.650	4-FEB-03 7:36	GAW 115	(80)1074 6 \	1.0 min	155.36
35.655	4-FEB-03 7:43	GAW 115	(80)9036 3 \	100.0 min	4.76
35.753	4-FEB-03 10:04	GAW 115	(80)1074 4 \	100.0 min	0.21

Previous 3 counts	Time	Detector	ID	Length	Cpm
35.650	4-FEB-03 7:36	GRB 115	(80)1074 6 \	1.0 min	42.21
35.655	4-FEB-03 7:43	GRB 115	(80)9036 3 \	100.0 min	12.82
35.753	4-FEB-03 10:04	GRB 115	(80)1074 4 \	100.0 min	807.07

CS
Counted 37.648- 3 on D3 for 1.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	153.000	37.000
Gross cpm =	153.000	37.000
Background =	0.054	1.510
Observed CPM =	152.946	35.490
Cross talk fac =	0.006	0.224
True CPM =	152.939	1.178
Inst Std. Fac. =	1.036	1.017
Adjusted CPM =	158.445	1.198
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	1079.236	2.934

2nd count done
D

pCi /smpl =	486.	1.32
1 sigma % Err =	8.089	526.731
2 sigma % Err =	15.855	1032.393

(1 sigma err) = 39.3 6.96

(2 sigma err) = 77.1 13.6

LTV (95 %) = 551. 12.8

MDA (3.00) = 12.5 9.61

MDA (2.71) = 11.6 9.29

CRITICAL LEVEL = 1.66 3.16

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	36.943	3	0.054	1.510	0.00
SF	37.605	0	1.036	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
36.614	5-FEB-03 6:44	GAW 115	SF	10.0 min	0.00
36.943	5-FEB-03 14:37	GAW 115	BK	949.8 min	0.00
37.605	6-FEB-03 6:31	GAW 115	SF	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
36.658	5-FEB-03 7:47	GRB 115	SF	10.0 min	0.00
36.943	5-FEB-03 14:37	GRB 115	BK	949.8 min	0.00
37.618	6-FEB-03 6:49	GRB 115	SF	10.0 min	0.00

13-FEB-03
10:20:13

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 7 80
CALIBRATION Std.

CS
Counted 44.652- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 115	GRB 115
Counts =	13939.000	3784.000
Gross cpm =	139.390	37.840
Background =	0.067	1.500
Observed CPM =	139.323	36.340
Cross talk fac =	0.006	0.224
True CPM =	139.293	5.090
Inst Std. Fac. =	1.039	1.017
Adjusted CPM =	144.725	5.176
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	985.785	12.674

pCi /smpl =	444.	5.71
1 sigma % Err =	0.848	12.323
2 sigma % Err =	1.662	24.154

(1 sigma err) = 3.76 0.704

(2 sigma err) = 7.38 1.38

LTV (95 %) = 450. 6.87

MDA (3.00) = 0.461 0.661

MDA (2.71) = 0.452 0.658

CRITICAL LEVEL = 0.185 0.315

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.067	1.500	0.00
SF	44.610	0	1.039	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
43.759	12-FEB-03 10:12	GAW 115	(93)8034 1 \	100.0 min	1.43
43.940	12-FEB-03 14:33	GAW 115	BK \	962.3 min	0.00
44.611	13-FEB-03 6:39	GAW 115	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
43.759	12-FEB-03 10:12	GRB 115	(93)8034 1 \	100.0 min	2.99
43.940	12-FEB-03 14:33	GRB 115	BK \	962.3 min	0.00
44.620	13-FEB-03 6:52	GRB 115	SF \	10.0 min	0.00

CS
Counted 20.778- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	52.800 mg	52.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 112	GRB 112
Counts =	8836.000	2500.000
Gross cpm =	88.360	25.000
Background =	0.048	1.516
Observed CPM =	88.312	23.484
Cross talk fac =	0.006	0.226
True CPM =	88.291	3.495
Inst Std. Fac. =	1.155	1.006
Adjusted CPM =	101.976	3.516
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	717.537	8.635

pCi /smpl =	323.	3.89
1 sigma % Err =	1.065	14.734
2 sigma % Err =	2.087	28.879

(1 sigma err) =	3.44	0.573
(2 sigma err) =	6.75	1.12
LTV (95 %) =	329.	4.84
MDA (3.00) =	0.418	0.667
MDA (2.71) =	0.409	0.663
CRITICAL LEVEL =	0.162	0.317

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.048	1.516	0.00
SF	20.633	0	1.155	1.006	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 112	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 112	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 112	(80)1074 4	\ 100.0 min	0.80

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 112	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 112	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 112	(80)1074 4	\ 100.0 min	816.62

CS
Counted 28.807- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	52.800 mg	52.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 112	GRB 112
Counts =	8662.000	2562.000
Gross cpm =	86.620	25.620
Background =	0.037	1.525
Observed CPM =	86.583	24.095
Cross talk fac =	0.006	0.226
True CPM =	86.556	4.499
Inst Std. Fac. =	1.156	1.007
Adjusted CPM =	100.059	4.530
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	704.047	11.126

pCi /smpl =	317.	5.01
1 sigma % Err =	1.075	11.581
2 sigma % Err =	2.108	22.700

(1 sigma err) = 3.41 0.580

(2 sigma err) = 6.69 1.14

LTV (95 %) = 323. 5.97

MDA (3.00) = 0.379 0.668

MDA (2.71) = 0.369 0.665

CRITICAL LEVEL = 0.142 0.318

2 Counts Done
(C)

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.037	1.525	0.00
SF	28.606	0	1.156	1.007	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GAW 112	(80) 903 19 \	10.0 min	0.41
27.957	27-JAN-03 14:58	GAW 112	BK \	927.5 min	0.00
28.606	28-JAN-03 6:32	GAW 112	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GRB 112	(80) 903 19 \	10.0 min	2.59
27.957	27-JAN-03 14:58	GRB 112	BK \	927.5 min	0.00
28.616	28-JAN-03 6:47	GRB 112	SF \	10.0 min	0.00

Reviewed _____ Date _____

Counted 37.920- 3 on D3 for 100.00 min.

1.00	smpl	52.800 mg	52.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 115	GRB 115
Counts =	11999.000	3189.000
Gross cpm =	119.990	31.890
Background =	0.054	1.510
Observed CPM =	119.936	30.380
Cross talk fac =	0.006	0.226
True CPM =	119.917	3.231
Inst Std. Fac. =	1.036	1.017
Adjusted CPM =	124.234	3.286
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	874.147	8.070

pCi /smpl =	394.	3.64
1 sigma % Err =	0.914	17.888
2 sigma % Err =	1.791	35.060

(1 sigma err) = 3.60 0.650

(2 sigma err) = 7.05 1.27

LTV (95 %) = 400. 4.71

MDA (3.00) = 0.438 0.665

MDA (2.71) = 0.428 0.662

CRITICAL LEVEL = 0.172 0.317

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	36.943	3	0.054	1.510	0.00
SF	37.605	0	1.036	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
37.648	6-FEB-03 7:33	GAW 115	(80)1074	7 \ 1.0 min	158.43
37.654	6-FEB-03 7:41	GAW 115	(80)1074	3 \ 100.0 min	0.46
37.849	6-FEB-03 12:22	GAW 115	(80)1074	4 \ 100.0 min	0.32

Previous 3 counts	Time	Detector	ID	Length	Cpm
37.648	6-FEB-03 7:33	GRB 115	(80)1074	7 \ 1.0 min	36.08
37.654	6-FEB-03 7:41	GRB 115	(80)1074	3 \ 100.0 min	821.08
37.849	6-FEB-03 12:22	GRB 115	(80)1074	4 \ 100.0 min	815.94

CS
Counted 38.748- 3 on D3 for 2.29 min. Reviewed _____ Date _____

1.00 smpl 52.800 mg 52.800 mg

Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	269.000	83.000
Gross cpm =	117.467	36.245
Background =	0.071	1.512
Observed CPM =	117.396	34.733
Cross talk fac =	0.006	0.226
True CPM =	117.348	8.165
Inst Std. Fac. =	1.037	1.018
Adjusted CPM =	121.690	8.312
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	856.246	20.414

2nd Count Done

D

pCi /smpl =	386.	9.20
1 sigma % Err =	6.105	49.730
2 sigma % Err =	11.966	97.472
(1 sigma err) =	23.5	4.57
(2 sigma err) =	46.2	8.96
LTV (95 %) =	425.	16.7
MDA (3.00) =	6.75	5.63
MDA (2.71) =	6.35	5.49
CRITICAL LEVEL =	1.30	2.09

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	38.133	3	0.071	1.512	0.00
SF	38.724	0	1.037	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
38.134	6-FEB-03 19:12	GAW 115	BK	685.8 min	0.00
38.612	7-FEB-03 6:41	GAW 115	SF	10.0 min	0.00
38.724	7-FEB-03 9:22	GAW 115	SF	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
38.624	7-FEB-03 6:58	GRB 115	SF	10.0 min	0.00
38.654	7-FEB-03 7:41	GRB 115	SF	10.0 min	0.00
38.688	7-FEB-03 8:30	GRB 115	SF	10.0 min	0.00

CS
Counted 44.756- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	52.800 mg	52.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 114	GRB 114
Counts =	11254.000	2895.000
Gross cpm =	112.540	28.950
Background =	0.052	2.440
Observed CPM =	112.488	26.510
Cross talk fac =	0.006	0.226
True CPM =	112.482	1.044
Inst Std. Fac. =	1.043	1.012
Adjusted CPM =	117.319	1.057
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	825.489	2.595

pCi /smpl =	372.	1.17
1 sigma % Err =	0.943	53.659
2 sigma % Err =	1.849	105.172

(1 sigma err) = 3.51 0.627

(2 sigma err) = 6.88 1.23

LTV (95 %) = 378. 2.20

MDA (3.00) = 0.431 0.837

MDA (2.71) = 0.422 0.834

CRITICAL LEVEL = 0.168 0.403

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.052	2.440	0.00
SF	44.610	0	1.043	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
44.611	13-FEB-03 6:39	GAW 114	SF	10.0 min	0.00
44.652	13-FEB-03 7:38	GAW 114	(93)1074	6 \ 100.0 min	158.39
44.652	13-FEB-03 7:38	GAW 114	(80)1074	6 \ 100.0 min	158.39

Previous 3 counts	Time	Detector	ID	Length	Cpm
44.620	13-FEB-03 6:52	GRB 114	SF	10.0 min	0.00
44.652	13-FEB-03 7:38	GRB 114	(93)1074	6 \ 100.0 min	34.61
44.652	13-FEB-03 7:38	GRB 114	(80)1074	6 \ 100.0 min	34.61

19-FEB-03
12:25:20

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- BR1 80
CALIBRATION Std.

CS
Counted 50.656- 3 on B1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	49.900 mg	49.900 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 105	GRB 105
Counts =	9377.000	2649.000
Gross cpm =	93.770	26.490
Background =	0.021	1.529
Observed CPM =	93.749	24.961
Cross talk fac =	0.006	0.225
True CPM =	93.726	3.877
Inst Std. Fac. =	1.147	1.024
Adjusted CPM =	107.504	3.970
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	739.751	9.731

pCi /smpl =	333.	4.38
1 sigma % Err =	1.033	13.652
2 sigma % Err =	2.025	26.758

(1 sigma err) =	3.44	0.598
(2 sigma err) =	6.75	1.17
LTV (95 %) =	339.	5.37
MDA (3.00) =	0.302	0.668
MDA (2.71) =	0.293	0.665
CRITICAL LEVEL =	0.105	0.318

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	49.916	3	0.021	1.529	0.00
SF	50.610	0	1.147	1.024	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.918	14-FEB-03 14:01	GAW 105	BK	\ 5342.8 min	0.00
49.916	18-FEB-03 13:59	GAW 105	BK	\ 995.9 min	0.00
50.610	19-FEB-03 6:38	GAW 105	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.918	14-FEB-03 14:01	GRB 105	BK	\ 5342.8 min	0.00
49.916	18-FEB-03 13:59	GRB 105	BK	\ 995.9 min	0.00
50.626	19-FEB-03 7:01	GRB 105	SF	\ 10.0 min	0.00

19-FEB-03
12:25:19

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- BR1 80
CALIBRATION Std.

CS
Counted 45.792- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	49.900 mg	49.900 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 114	GRB 114
Counts =	12507.000	3357.000
Gross cpm =	125.070	33.570
Background =	0.052	2.440
Observed CPM =	125.018	31.130
Cross talk fac =	0.006	0.225
True CPM =	125.000	3.011
Inst Std. Fac. =	1.044	1.012
Adjusted CPM =	130.500	3.047
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	897.994	7.468

pCi /smpl =	405.	3.36
1 sigma % Err =	0.895	19.928
2 sigma % Err =	1.754	39.059

(1 sigma err) = 3.62 0.670

(2 sigma err) = 7.09 1.31

LTV (95 %) = 410. 4.47

MDA (3.00) = 0.422 0.835

MDA (2.71) = 0.413 0.832

CRITICAL LEVEL = 0.165 0.402

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.052	2.440	0.00
SF	45.607	0	1.044	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.654	14-FEB-03 7:41	GAW 114	(93) 7437 5 \	100.0 min	8.50
45.751	14-FEB-03 10:01	GAW 114	(80) 903 44 \	10.0 min	0.36
45.783	14-FEB-03 10:47	GAW 114	(80) 903 53 \	10.0 min	0.15

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.654	14-FEB-03 7:41	GRB 114	(93) 7437 5 \	100.0 min	21.47
45.751	14-FEB-03 10:01	GRB 114	(80) 903 44 \	10.0 min	0.36
45.783	14-FEB-03 10:47	GRB 114	(80) 903 53 \	10.0 min	0.97

CS
Counted 45.792- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	49.900 mg	49.900 mg
----- Aliquot		----- Sample Weight	
		----- Counted Weight	

	ALPHA	BETA
Instrument =	GAW 114	GRB 114
Counts =	12507.000	3357.000
Gross cpm =	125.070	33.570
Background =	0.052	2.440
Observed CPM =	125.018	31.130
Cross talk fac =	0.006	0.225
True CPM =	125.000	3.011
Inst Std. Fac. =	1.044	1.012
Adjusted CPM =	130.500	3.047
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	897.994	7.468

pCi /smp1 =	405.	3.36
1 sigma % Err =	0.895	19.928
2 sigma % Err =	1.754	39.059

(1 sigma err) = 3.62 0.670

(2 sigma err) = 7.09 1.31

LTV (95 %) = 410. 4.47

MDA (3.00) = 0.422 0.835

MDA (2.71) = 0.413 0.832

CRITICAL LEVEL = 0.165 0.402

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.052	2.440	0.00
SF	45.607	0	1.044	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.654	14-FEB-03 7:41	GAW 114	(93)7437	5 \ 100.0 min	8.50
45.751	14-FEB-03 10:01	GAW 114	(80)903	44 \ 10.0 min	0.36
45.783	14-FEB-03 10:47	GAW 114	(80)903	53 \ 10.0 min	0.15

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.654	14-FEB-03 7:41	GRB 114	(93)7437	5 \ 100.0 min	21.47
45.751	14-FEB-03 10:01	GRB 114	(80)903	44 \ 10.0 min	0.36
45.783	14-FEB-03 10:47	GRB 114	(80)903	53 \ 10.0 min	0.97

CS
Counted 52.655- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	49.900 mg	49.900 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 109	GRB 109
Counts =	9219.000	2631.000
Gross cpm =	92.190	26.310
Background =	0.058	1.032
Observed CPM =	92.132	25.278
Cross talk fac =	0.006	0.225
True CPM =	92.105	4.559
Inst Std. Fac. =	1.168	1.018
Adjusted CPM =	107.578	4.641
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	740.267	11.374

pCi /smpl =	333.	5.12
1 sigma % Err =	1.043	11.470
2 sigma % Err =	2.044	22.480

(1 sigma err) =	3.48	0.588
(2 sigma err) =	6.82	1.15
LTV (95 %) =	339.	6.09
MDA (3.00) =	0.440	0.555
MDA (2.71) =	0.431	0.551
CRITICAL LEVEL =	0.174	0.261

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	52.114	3	0.058	1.032	0.00
SF	52.615	0	1.168	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
51.900	20-FEB-03 13:36	GAW 109	(93)2001 1 \	300.0 min	0.08
52.114	20-FEB-03 18:44	GAW 109	BK \	718.4 min	0.00
52.615	21-FEB-03 6:45	GAW 109	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
51.900	20-FEB-03 13:36	GRB 109	(93)2001 1 \	300.0 min	0.28
52.114	20-FEB-03 18:44	GRB 109	BK \	718.4 min	0.00
52.626	21-FEB-03 7:01	GRB 109	SF \	10.0 min	0.00

CS
Counted 52.892- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00 smpl 49.900 mg 49.900 mg

Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 114	GRB 114
Counts =	12027.000	3002.000
Gross cpm =	120.270	30.020
Background =	0.043	2.472
Observed CPM =	120.227	27.548
Cross talk fac =	0.006	0.225
True CPM =	120.224	0.504
Inst Std. Fac. =	1.044	1.009
Adjusted CPM =	125.514	0.508
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	863.683	1.245

pCi /smpl =	389.	0.561
1 sigma % Err =	0.912	113.186
2 sigma % Err =	1.788	221.845

(1 sigma err) =	3.55	0.635
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(2 sigma err) =	6.96	1.24
-----------------	------	------

LTV (95 %) =	395.	1.61
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MDA (3.00) =	0.392	0.840
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MDA (2.71) =	0.383	0.837
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CRITICAL LEVEL =	0.150	0.404
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QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	52.114	3	0.043	2.472	0.00
SF	52.617	0	1.044	1.009	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
52.114	20-FEB-03 18:44	GAW 114	BK	718.5 min	0.00
52.617	21-FEB-03 6:48	GAW 114	SF	10.0 min	0.00
52.656	21-FEB-03 7:44	GAW 114	(93)2000 4	300.0 min	4.38

Previous 3 counts	Time	Detector	ID	Length	Cpm
52.114	20-FEB-03 18:44	GRB 114	BK	718.5 min	0.00
52.626	21-FEB-03 7:01	GRB 114	SF	10.0 min	0.00
52.656	21-FEB-03 7:44	GRB 114	(93)2000 4	300.0 min	10.40

19-FEB-03
12:25:26

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 6 80
CALIBRATION Std.

CS
Counted 50.656- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00 smpl 29.800 mg 29.800 mg

Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 114	GRB 114
Counts =	15119.000	3552.000
Gross cpm =	151.190	35.520
Background =	0.055	2.486
Observed CPM =	151.135	33.034
Cross talk fac =	0.006	0.215
True CPM =	151.132	0.556
Inst Std. Fac. =	1.045	1.010
Adjusted CPM =	157.933	0.561
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	919.206	1.355

pCi /smpl =	414.	0.610
1 sigma % Err =	0.814	110.916
2 sigma % Err =	1.595	217.396

(1 sigma err) =	3.37	0.677
-----------------	------	-------

(2 sigma err) =	6.60	1.33
-----------------	------	------

LTV (95 %) =	420.	1.73
--------------	------	------

MDA (3.00) =	0.365	0.830
--------------	-------	-------

MDA (2.71) =	0.357	0.827
--------------	-------	-------

CRITICAL LEVEL =	0.143	0.399
------------------	-------	-------

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	49.916	3	0.055	2.486	0.00
SF	50.610	0	1.045	1.010	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.918	14-FEB-03 14:01	GAW 114	BK	\ 5342.9 min	0.00
49.916	18-FEB-03 13:59	GAW 114	BK	\ 995.9 min	0.00
50.610	19-FEB-03 6:38	GAW 114	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.918	14-FEB-03 14:01	GRB 114	BK	\ 5342.9 min	0.00
49.916	18-FEB-03 13:59	GRB 114	BK	\ 995.9 min	0.00
50.622	19-FEB-03 6:55	GRB 114	SF	\ 10.0 min	0.00

19-FEB-03
12:25:28

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 7 80
CALIBRATION Std.

CS
Counted 50.728- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 114	GRB 114
Counts =	13006.000	3332.000
Gross cpm =	130.060	33.320
Background =	0.055	2.486
Observed CPM =	130.005	30.834
Cross talk fac =	0.006	0.224
True CPM =	129.995	1.670
Inst Std. Fac. =	1.045	1.010
Adjusted CPM =	135.845	1.686
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	925.298	4.129

pCi /smpl =	417.	1.86
1 sigma % Err =	0.877	35.840
2 sigma % Err =	1.720	70.246

(1 sigma err) = 3.66 0.667

(2 sigma err) = 7.17 1.31

LTV (95 %) = 423. 2.96

MDA (3.00) = 0.427 0.842

MDA (2.71) = 0.418 0.839

CRITICAL LEVEL = 0.168 0.405

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	49.916	3	0.055	2.486	0.00
SF	50.610	0	1.045	1.010	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
49.916	18-FEB-03 13:59	GAW 114	BK	995.9 min	0.00
50.610	19-FEB-03 6:38	GAW 114	SF	10.0 min	0.00
50.656	19-FEB-03 7:44	GAW 114	(80)1074 6	100.0 min	157.90

Previous 3 counts	Time	Detector	ID	Length	Cpm
49.916	18-FEB-03 13:59	GRB 114	BK	995.9 min	0.00
50.622	19-FEB-03 6:55	GRB 114	SF	10.0 min	0.00
50.656	19-FEB-03 7:44	GRB 114	(80)1074 6	100.0 min	33.36

Notes on this Revision June 12, 1997

This revision incorporates the following changes:

- 1.) The data for the MEW counters shown in Table 6 was in error in the original document. It consisted of a duplicate of the LBG data by mistake. The correct data is shown in this revision. This is a documentation change only, as the correct data was placed in the computer files for actual data calculation.

- 2.) As noted in Section 6, a small change was made to the LBG efficiency in January of 1996. This change slightly affected the Y90/Sr90 efficiency ratio table shown in Table 5. The correct Y90/Sr90 Eff ratio data for this change was shown in the original version of this calibration, however the actual computer spline-fit file in use was not changed to incorporate this revision. The difference in the data used and the revised data is very small (1.4% or less), however for documentation purposes, this file was changed as of this revision to reflect exactly the data shown. From this date forward, the data will be calculated with the file data as shown in Table 5.

The Y90/Sr90 Efficiency Ratio spline table in use prior to this revision (9/27/95 to 6/12/97) is shown below:

LBG Y90/Sr90 Efficiency Ratio (27-SEP-95)

3.30	AREA
LBG	
mg/CM2	Y/Sr Eff Ratio
-----	-----
0.76	1.231
1.52	1.249
2.27	1.301
3.03	1.354
3.79	1.403
4.55	1.442
5.30	1.483
6.06	1.519
6.82	1.556
7.58	1.586
8.33	1.611
9.09	1.634
9.85	1.655
10.61	1.676
11.36	1.693
12.12	1.712
12.88	1.732
13.64	1.750
14.39	1.768
15.15	1.787
15.91	1.810

1.0 Introduction

This calibration was initiated to provide the primary calibration for ^{90}Sr counting on the LBG, MEW and LB4100 beta counter systems.

The calibration was performed to accomplish the following objectives:

- Determine the absolute counting efficiency for ^{90}Sr mounted as SrCO_3 on a 1" nylon planchet at the standard sample thickness of 6.0 mg/cm^2 .
- Determine the ^{90}Sr relative counting efficiency as a function of sample weight.
- Determine the ratio of ^{90}Y to ^{90}Sr counting efficiencies in the SrCO_3 mount.
- Compare the newly determined calibration data with the previous calibration.

2.0 Radioactivity Standards

A ^{90}Sr standard solution 2454-4 was obtained from the EPA-EMSL in February of 1994 (see calibration certificate in Appendix B. This vial contained 5.02 nCi/g of ^{89}Sr in 4.9652 grams for a total activity of 54,991.4 dpm of ^{90}Sr at the reference time of 04:00 PST February 11, 1994. The Sr and Y carrier contents were 100 ug/ml each. To prepare the dilute solution, the contents of the vial were transferred to a tared 25-ml volumetric flask with lid and weighed. 100 lambda of Sr carrier K-A1 (36.28 mg/ml SrCO_3) and 200 lambda of Yttrium carrier D-G1 (15.18 mg/ml Y_2O_3) were pipetted into the flask. The solution was brought up to the 25-ml mark with 0.1M HCl and transferred to a 1 ounce poly bottle. The activity at the reference time was calculated as follows:

$$4.9793\text{g} \times 5.02 \text{ nCi/g} \times 2220 \text{ dpm/nCi} \times 1/25 \text{ ml} = 2220 \text{ dpm } ^{90}\text{Sr/ml} \pm 0.8\%$$

The carrier concentration was calculated as follows:

$$[(4.9793\text{g} \times 0.1 \text{ mg Sr/g} \times 1.68489 \text{ SrCO}_3/\text{Sr}) + (0.1 \text{ ml} \times 36.28 \text{ mg SrCO}_3/\text{ml})] \times 1/25\text{ml} = 0.1787 \text{ mg/ml SrCO}_3.$$

$$[(4.9793\text{g} \times 0.1 \text{ mg Y/g} \times 1.26994 \text{ Y}_2\text{O}_3/\text{Y}) + (0.2 \text{ ml} \times 15.18 \text{ mg Y}_2\text{O}_3/\text{ml})] \times 1/25\text{ml} = 0.1467 \text{ mg/ml Y}_2\text{O}_3.$$

The resulting solution was designated U1.

3.0 Preparation of Counting Standards

Sixteen standards of various weights ranging from 1.57 mg to 50.44 mg were prepared by adding increasing amounts of Strontium carrier to 1 ml aliquots of the U1 stock solution. These samples were labeled group 1037, samples 1 to 16. The procedure for the preparation of the standards is detailed in the copy of the lab book sections shown in Appendix C.

4.0 Counting and Calculation

Each sample was counted sixteen times on each of the MEW, LBG and GRB counting systems over a period of three weeks. The MEW counts were identified as samples 101 through 116, the LBG counts were identified as 201 through 216, while the GRB readings were designated 301 through 316. All data was corrected for daily standard factor and instrument background.

The data from each sample was processed through the computer program TPBBI which is a modification of a program to reduce ^{210}Pb - ^{210}Bi decay/growth data. The program performs a linear least squares fit of the counting data, resolving an initial count rate at the separation time, which is due to ^{90}Sr only, and an equilibrium count rate, which is due to a combination of the ^{90}Sr plus the equilibrium ^{90}Y component. The output of the program is shown in Appendix A.

Tables 1, 2 and 3 show the summary of the counting data and the calculations of efficiencies and RCE (relative counting efficiency) values. The first five columns show the sample I.D., sample weight in mg, sample thickness in mg/cm^2 (assuming 3.3 cm^2 area), the Sr-Y separation time, and the gravimetric chemical yield. The next three columns are the computed Sr count rate at the separation time, the total equilibrium cpm and the net ^{90}Y cpm at separation time (computed as total equilibrium cpm minus the ^{90}Sr cpm at the separation time). The ^{90}Sr dpm at the separation time was calculated by decaying the certified activity from the reference time of the standard to the separation time with the ^{90}Sr half life. These values are shown in the next column headed " ^{90}Sr Dpm @ SepTme". The ^{90}Sr and ^{90}Y efficiencies are calculated as the respective count rates at separation time divided by the known activities at separation time and are shown in the next two columns. The 12th column is the ratio of the ^{90}Y to ^{90}Sr efficiencies.

The ^{90}Sr efficiencies are graphically represented in Figures 1, 2 and 3 while the $^{90}\text{Y}/^{90}\text{Sr}$ efficiency ratios are plotted as a function of sample weight in Figures 4, 5 and 6. Smooth curves were drawn through the data points as shown and are defined by the data in Tables 4, 5 and 6. To calculate the standard efficiency at $6.0 \text{ mg}/\text{cm}^2$, the tabular data was interpolated between the $5.30 \text{ mg}/\text{cm}^2$ and the $6.06 \text{ mg}/\text{cm}^2$ values for the LBG system and between $4.55 \text{ mg}/\text{cm}^2$ and $6.06 \text{ mg}/\text{cm}^2$ for the MEW and GRB apparatus. The resulting ^{90}Sr efficiencies were 37.06% for the MEW counter, 36.52% for LBG detectors and 37.34% for the GRB system.

The compound data points for the RCE values in Tables 1, 2 and 3 were then derived by dividing the efficiency values by the standard efficiencies and are shown in columns 13 and 14. This RCE data was plotted as a function of sample thickness in Figures 7, 8 and 9. The smooth curves through these plots are defined in Tables 4, 5 and 6. A lookup table for ^{90}Sr RCE values is shown in Tables 7, 8 and 9.

5.0 Comparison to Previous Calibration

This was the initial Sr90 calibration for the LB4100 counters.

⁹⁰Sr efficiency - A calibration curve for ⁹⁰Sr was last produced in August of 1991. That testing was performed for LBG counters only. The standard efficiency for ⁹⁰Sr at 6.0 mg/cm² for LBG detectors was computed to be 39.13% in 1991. The new standard efficiency of 36.52% signifies a decrease of 6.7%. This downward shift in comparison with the previous calibration is approximately the same for all weights between 0 and 60 mg. This change is within the acceptance guidelines defined in RCP-00.

⁹⁰Y/⁹⁰Sr Efficiency ratio - The new ⁹⁰Y/⁹⁰Sr Efficiency ratio tended to run between 5 and 7 percent higher than the 1991 figures for the LBG detectors. This trend is true for all weights up to 60 mg with the exception of the region between 5 and 15 mg where the current results were equal to or 5 to 7 percent less than those of the previous calibration. The gap also substantially widened below 3.3 mg. This point represents a recovery of approximately 10% chemical yield based on a typical Sr carrier addition of 34 mg and the region below this point is out of the useful range of analysis. The new data is therefore in good agreement with the old data over the useful range.

6.0 Summary of Results

For ⁹⁰Sr mounted as SrCO₃ on a 1" nylon planchet, the following calibration results were obtained for the GRB, LBG and MEW beta counters:

1. The standard efficiencies are determined to be 37.06% for the MEW, 36.52% for the LBG counters and 37.34% for the GRB systems. The P-Factors are determined to be 2.698 for the MEW, 2.738 for the LBG and 2.678 for the GRB detectors.
2. A new relative counting efficiency curve has been generated.
3. New curves defining the ⁹⁰Y/⁹⁰Sr counting efficiency ratio for each system have been generated. The LBG data is in good agreement with the prior results.
4. The ⁹⁰Sr counting efficiency as a function of sample weight is nominally 5% lower than the data from the 1991 calibration.

Note: Between the dates 9/5/95 and 1/22/96, a value for the Sr90 efficiency for LBG was used as 37.04% (P-factor=2.700). On 1/22/96, a re-evaluation of the fit of the efficiency curve changed the efficiency by 1.4% to 36.52% (P=2.738). There was no significant impact on previously reported data based on this small change.

Table 1. Counting and Calculation Data - GRB Counters

CAL 1037 Sr90 8/15/95

Sr90 dpm @ Tz	2220	Y90	Sr90
Tz	11-Feb-94	Std Eff	Std Eff
Sr90 Lambda	6.863E-05	@6.0	@6.0
		-----	-----
		57.436	37.3398

GRB (counted as samples 301-316)

Sample	Weight	Mg/cm2	SepTme	Yield	Sr CPM@ SepTme	Total CPM@ Equilib	Y CPM@ Equilib	Sr90 Dpm @ SepTme	Sr90 %Eff	Y90 %Eff	Y/Sr Ratio	Y90 RCE	Sr90 RCE
301	1.57	0.48	27-Apr-95	0.7879	713.10	1616.34	903.24	2154.0	42.0	53.2	1.267	0.927	1.125
302	3.63	1.10	27-Apr-95	0.9536	805.97	1867.08	1061.11	2154.0	39.2	51.7	1.317	0.899	1.051
303	6.98	2.12	27-Apr-95	0.9388	824.63	1936.42	1111.79	2154.0	40.8	55.0	1.348	0.957	1.092
304	11.32	3.43	27-Apr-95	1.0233	856.50	2036.20	1179.70	2154.0	38.9	53.5	1.377	0.932	1.041
305	14.28	4.33	27-Apr-95	0.9720	807.61	1937.95	1130.34	2154.0	38.6	54.0	1.400	0.940	1.033
306	17.64	5.35	27-Apr-95	0.9630	767.28	1985.96	1218.68	2154.0	37.0	58.8	1.588	1.023	0.991
307	21.03	6.37	27-Apr-95	0.9582	769.80	1910.27	1140.47	2154.0	37.3	55.3	1.482	0.962	0.999
308	24.24	7.35	27-Apr-95	0.9478	739.69	1936.55	1196.86	2154.0	36.2	58.6	1.618	1.021	0.970
309	27.41	8.31	27-Apr-95	0.9386	738.57	1895.57	1157.00	2154.0	36.5	57.2	1.567	0.996	0.978
310	34.06	10.32	27-Apr-95	0.9342	700.68	1876.04	1175.36	2154.0	34.8	58.4	1.677	1.017	0.933
311	37.86	11.47	27-Apr-95	0.9445	686.31	1880.22	1193.91	2154.0	33.7	58.7	1.740	1.022	0.903
312	38.42	11.64	27-Apr-95	0.8789	670.85	1761.92	1091.07	2154.0	35.4	57.6	1.626	1.003	0.949
313	45.48	13.78	27-Apr-95	0.8923	572.66	1711.65	1138.99	2154.0	29.8	59.3	1.989	1.032	0.798
314	52.97	16.05	27-Apr-95	0.9097	619.78	1730.33	1110.55	2154.0	31.6	56.7	1.792	0.987	0.847
315	50.00	15.15	27-Apr-95	0.7636	562.70	1455.62	892.92	2154.0	34.2	54.3	1.587	0.945	0.916
316	50.44	15.28	27-Apr-95	0.6934	477.84	1303.78	825.94	2154.0	32.0	55.3	1.728	0.963	0.857

Table 2. Counting and Calculation Data - LBG Counters

CAL 1037 Sr90 8/1/95

Sr90 dpm @ Tz 2220
 Tz 11-Feb-94
 Sr90 Lambda 6.863E-05

Y90 Sr90
 Std Eff Std Eff
 @6.0 @6.0

 56.15 36.52

LBG (counted as samples 201-216)

Sample	Weight	Mg/cm2	SepTime	Yield	Sr CPM@ SepTime	Total CPM@ Equilib	Y CPM@ Equilib	Sr90 Dpm @ SepTime	Sr90 %Eff	Y90 %Eff	Y/Sr Ratio	Y90 RCE	Sr90 RCE
201	1.57	0.48	27-Apr-95	0.7879	687.28	1556.81	869.53	2154.0	40.5	51.2	1.265	0.912	1.109
202	3.63	1.10	27-Apr-95	0.9536	796.81	1781.62	984.81	2154.0	38.8	47.9	1.236	0.854	1.062
203	6.98	2.12	27-Apr-95	0.9388	802.04	1839.63	1037.59	2154.0	39.7	51.3	1.294	0.914	1.086
204	11.32	3.43	27-Apr-95	1.0233	805.51	1938.24	1132.73	2154.0	36.5	51.4	1.406	0.915	1.001
205	14.28	4.33	27-Apr-95	0.972	723.33	1878.05	1154.72	2154.0	34.5	55.2	1.596	0.982	0.946
206	17.64	5.35	27-Apr-95	0.963	737.43	1930.42	1192.99	2154.0	35.6	57.5	1.618	1.024	0.973
207	21.03	6.37	27-Apr-95	0.9582	731.63	1865.03	1133.40	2154.0	35.4	54.9	1.549	0.978	0.971
208	24.24	7.35	27-Apr-95	0.9478	746.63	1858.56	1111.93	2154.0	36.6	54.5	1.489	0.970	1.001
209	27.41	8.31	27-Apr-95	0.9386	678.91	1824.40	1145.49	2154.0	33.6	56.7	1.687	1.009	0.920
210	34.06	10.32	27-Apr-95	0.9342	639.39	1813.75	1174.36	2154.0	31.8	58.4	1.837	1.039	0.870
211	37.86	11.47	27-Apr-95	0.9445	691.39	1840.50	1149.11	2154.0	34.0	56.5	1.662	1.006	0.931
212	38.42	11.64	27-Apr-95	0.8789	662.89	1715.75	1052.86	2154.0	35.0	55.6	1.588	0.990	0.959
213	45.48	13.78	27-Apr-95	0.8923	566.70	1670.30	1103.60	2154.0	29.5	57.4	1.947	1.023	0.807
214	52.97	16.05	27-Apr-95	0.9097	607.17	1679.40	1072.23	2154.0	31.0	54.7	1.766	0.975	0.848
215	50.00	15.15	27-Apr-95	0.7636	545.14	1424.99	879.85	2154.0	33.1	53.5	1.614	0.953	0.908
216	50.44	15.28	27-Apr-95	0.6934	439.74	1275.42	835.68	2154.0	29.4	56.0	1.900	0.996	0.806

Table 3. Counting and Calculation Data - MEW Counter

CAL 1037 Sr90 8/15/95

Sr90 dpm @ Tz 2220
Tz 11-Feb-94
Sr90 Lambda 6.863E-05

Y90	Sr90
Std Eff	Std Eff
@6.0	@6.0
-----	-----
54.304	37.0557

MEW (counted as samples 101-116)

Sample	Weight	Mg/cm2	SepTme	Yield	Sr CPM@ SepTme	Total CPM@ Equilib	Y CPM@ Equilib	Sr90 Dpm @ SepTme	Sr90 %Eff	Y90 %Eff	Y/Sr Ratio	Y90 RCE	Sr90 RCE
101	1.57	0.48	27-Apr-95	0.7879	676.68	1605.54	928.86	2154.0	39.9	54.7	1.373	1.008	1.076
102	3.63	1.10	27-Apr-95	0.9536	798.22	1848.67	1050.45	2154.0	38.9	51.1	1.316	0.942	1.049
103	6.98	2.12	27-Apr-95	0.9388	776.24	1890.29	1114.05	2154.0	38.4	55.1	1.435	1.015	1.036
104	11.32	3.43	27-Apr-95	1.0233	887.02	1990.44	1103.42	2154.0	40.2	50.1	1.244	0.922	1.086
105	14.28	4.33	27-Apr-95	0.9720	792.02	1895.51	1103.49	2154.0	37.8	52.7	1.393	0.971	1.021
106	17.64	5.35	27-Apr-95	0.9630	774.12	1926.03	1151.91	2154.0	37.3	55.5	1.488	1.023	1.007
107	21.03	6.37	27-Apr-95	0.9582	774.91	1882.74	1107.83	2154.0	37.5	53.7	1.430	0.988	1.013
108	24.24	7.35	27-Apr-95	0.9478	740.65	1899.56	1158.91	2154.0	36.3	56.8	1.565	1.045	0.979
109	27.41	8.31	27-Apr-95	0.9386	680.34	1856.79	1176.45	2154.0	33.7	58.2	1.729	1.072	0.908
110	34.06	10.32	27-Apr-95	0.9342	661.42	1828.32	1166.90	2154.0	32.9	58.0	1.764	1.068	0.887
111	37.86	11.47	27-Apr-95	0.9445	640.79	1832.15	1191.36	2154.0	31.5	58.6	1.859	1.078	0.850
112	38.42	11.64	27-Apr-95	0.8789	601.63	1718.02	1116.39	2154.0	31.8	59.0	1.856	1.086	0.858
113	45.48	13.78	27-Apr-95	0.8923	610.63	1656.83	1046.20	2154.0	31.8	54.4	1.713	1.002	0.857
114	52.97	16.05	27-Apr-95	0.9097	569.82	1684.50	1114.68	2154.0	29.1	56.9	1.956	1.048	0.785
115	50.00	15.15	27-Apr-95	0.7636	528.80	1422.54	893.74	2154.0	32.2	54.3	1.690	1.001	0.868
116	50.44	15.28	27-Apr-95	0.6934	448.45	1270.59	822.14	2154.0	30.0	55.0	1.833	1.014	0.810

Table 4. ^{90}Sr and ^{90}Y Spline Data For Smooth Curve Definition - GRB Counters

mg/cm2	Y90 %Eff	Sr90 %Eff	Y90/ Sr90 Ratio	Y90 RCE	Sr90 RCE
0.30	51.7	41.20	1.255	0.9001	1.1034
0.61	52.0	41.00	1.268	0.9054	1.0980
0.91	52.3	40.80	1.282	0.9106	1.0927
1.21	52.6	40.60	1.296	0.9158	1.0873
1.52	53.0	40.40	1.312	0.9228	1.0820
1.82	53.3	40.20	1.326	0.9280	1.0766
2.12	53.6	40.00	1.340	0.9332	1.0712
2.42	54.0	39.80	1.357	0.9402	1.0659
2.73	54.4	39.60	1.374	0.9471	1.0605
3.03	54.7	39.40	1.388	0.9524	1.0552
3.33	55.1	39.20	1.406	0.9593	1.0498
3.64	55.4	39.00	1.421	0.9646	1.0445
3.94	55.8	38.80	1.438	0.9715	1.0391
4.24	56.2	38.60	1.456	0.9785	1.0337
4.55	56.5	38.30	1.475	0.9837	1.0257
6.06	57.4	37.30	1.539	0.9994	0.9989
9.09	58.1	35.50	1.637	1.0116	0.9507
12.12	57.5	33.30	1.727	1.0011	0.8918
15.15	56.8	31.30	1.815	0.9889	0.8382
18.18	56.0	29.40	1.905	0.9750	0.7874
21.21	55.2	27.50	2.007	0.9611	0.7365

Table 5. ⁹⁰Sr and ⁹⁰Y Spline Data For Smooth Curve Definition - LBG counters

mg/cm2	Y90 %Eff	Sr90 %Eff	Y90/ Sr90 Ratio	Y90 RCE	Sr90 RCE
0.76	48.0	39.73	1.208	0.8549	1.0878
1.52	49.6	39.26	1.263	0.8833	1.0751
2.27	51.4	38.80	1.325	0.9154	1.0625
3.03	52.8	38.34	1.377	0.9403	1.0498
3.79	54.0	37.88	1.426	0.9617	1.0371
4.55	54.8	37.41	1.465	0.9760	1.0244
5.30	55.6	36.95	1.505	0.9902	1.0118
6.00	56.1	36.52	1.536	0.9991	1.0001
6.06	56.2	36.49	1.540	1.0009	0.9991
6.82	56.8	36.02	1.577	1.0116	0.9864
8.33	57.2	35.10	1.630	1.0187	0.9610
9.09	57.2	34.63	1.652	1.0187	0.9484
9.85	57.1	34.17	1.671	1.0169	0.9357
10.61	57.0	33.71	1.691	1.0151	0.9230
11.36	56.7	33.25	1.706	1.0098	0.9103
12.12	56.5	32.78	1.723	1.0062	0.8977
12.88	56.3	32.32	1.742	1.0027	0.8850
13.64	56.0	31.86	1.758	0.9973	0.8723
14.39	55.7	31.39	1.774	0.9920	0.8596
15.15	55.4	30.93	1.791	0.9866	0.8469
15.91	55.2	30.47	1.812	0.9831	0.8343
16.67	55.0	30.00	1.833	0.9795	0.8216
17.42	54.8	29.54	1.855	0.9760	0.8089

Note: The Sr90 RCE table defines a straight line and is actually defined in the ASCII file used for calculations as:

mg/cm ²	Sr90 RCE
0.00	1.1000
17.42	0.8089

Table 6. ⁹⁰Sr and ⁹⁰Y Spline Data For Smooth Curve Definition - MEW Counter

mg/cm2	Y90 %Eff	Sr90 %Eff	Y90/ Sr90 Ratio	Y90 RCE	Sr90 RCE
0.30	46.0	38.00	1.211	0.8876	1.0255
0.61	50.0	38.30	1.305	0.9023	1.0336
0.91	52.0	38.60	1.347	0.9171	1.0417
1.21	52.8	38.90	1.357	0.9318	1.0498
1.52	53.1	39.10	1.358	0.9465	1.0552
1.82	53.3	39.20	1.360	0.9613	1.0579
2.12	53.4	39.30	1.359	0.9760	1.0606
2.42	53.6	39.40	1.360	0.9907	1.0633
2.73	53.7	39.50	1.359	1.0055	1.0660
3.03	53.8	39.50	1.362	1.0202	1.0660
3.33	53.9	39.45	1.366	1.0239	1.0646
3.64	54.0	39.30	1.374	1.0275	1.0606
3.94	54.1	39.10	1.384	1.0349	1.0552
4.24	54.2	38.80	1.397	1.0368	1.0471
4.55	54.3	38.40	1.414	1.0404	1.0363
6.06	54.4	37.00	1.470	1.0312	0.9985
9.09	58.8	34.50	1.704	1.0515	0.9310
12.12	57.2	32.10	1.782	1.0533	0.8663
15.15	55.4	29.80	1.859	1.0496	0.8042
18.18	54.2	27.90	1.943	1.0460	0.7529
21.21	53.7	25.80	2.081	1.0202	0.6962
24.24	53.3	23.60	2.258	0.9815	0.6369
27.27	52.9	21.40	2.472	0.9741	0.5775

Note - This page is revised from the original calibration document dated August, 1995. See Revision Note for details.

Table 7. **Lookup Table for New ⁹⁰Sr RCE Values - GRB counters**

Planchet area = 3.30 sq cm
 T = Sample thickness in mg/sq cm

T	PPT	T	PPT	T	PPT	T	PPT
0.00	1.1078	6.86	0.9854	13.71	0.8631	20.57	0.7468
0.15	1.1054	7.01	0.9830	13.86	0.8605	20.72	0.7442
0.30	1.1029	7.16	0.9806	14.02	0.8578	20.87	0.7417
0.46	1.1005	7.31	0.9781	14.17	0.8551	21.03	0.7391
0.61	1.0980	7.47	0.9757	14.32	0.8525	21.18	0.7365
0.76	1.0950	7.62	0.9733	14.47	0.8498	21.33	0.7340
0.91	1.0919	7.77	0.9709	14.63	0.8472	21.48	0.7314
1.07	1.0894	7.92	0.9685	14.78	0.8445	21.64	0.7288
1.22	1.0869	8.08	0.9661	14.93	0.8418	21.79	0.7263
1.37	1.0844	8.23	0.9637	15.08	0.8392	21.94	0.7237
1.52	1.0819	8.38	0.9612	15.24	0.8365	22.09	0.7211
1.68	1.0789	8.53	0.9588	15.39	0.8340	22.24	0.7186
1.83	1.0759	8.68	0.9564	15.54	0.8314	22.40	0.7160
1.98	1.0733	8.84	0.9540	15.69	0.8289	22.55	0.7135
2.13	1.0707	8.99	0.9516	15.85	0.8263	22.70	0.7109
2.29	1.0677	9.14	0.9490	16.00	0.8237	22.85	0.7083
2.44	1.0647	9.29	0.9460	16.15	0.8212	23.01	0.7058
2.59	1.0623	9.45	0.9431	16.30	0.8186	23.16	0.7032
2.74	1.0598	9.60	0.9401	16.46	0.8160	23.31	0.7006
2.89	1.0573	9.75	0.9371	16.61	0.8135	23.46	0.6981
3.05	1.0547	9.90	0.9342	16.76	0.8109	23.62	0.6955
3.20	1.0516	10.06	0.9312	16.91	0.8083	23.77	0.6929
3.35	1.0486	10.21	0.9282	17.06	0.8058	23.92	0.6904
3.50	1.0462	10.36	0.9253	17.22	0.8032	24.07	0.6878
3.66	1.0437	10.51	0.9223	17.37	0.8006	24.23	0.6852
3.81	1.0412	10.67	0.9193	17.52	0.7981	24.38	0.6827
3.96	1.0386	10.82	0.9164	17.67	0.7955	24.53	0.6801
4.11	1.0355	10.97	0.9134	17.83	0.7930	24.68	0.6776
4.27	1.0323	11.12	0.9104	17.98	0.7904	24.83	0.6750
4.42	1.0284	11.27	0.9075	18.13	0.7878	24.99	0.6724
4.57	1.0246	11.43	0.9045	18.28	0.7853	25.14	0.6699
4.72	1.0219	11.58	0.9015	18.44	0.7827	25.29	0.6673
4.88	1.0192	11.73	0.8986	18.59	0.7801	25.44	0.6647
5.03	1.0165	11.88	0.8956	18.74	0.7776	25.60	0.6622
5.18	1.0137	12.04	0.8926	18.89	0.7750	25.75	0.6596
5.33	1.0110	12.19	0.8898	19.05	0.7724	25.90	0.6570
5.49	1.0083	12.34	0.8871	19.20	0.7699	26.05	0.6545
5.64	1.0056	12.49	0.8845	19.35	0.7673	26.21	0.6519
5.79	1.0028	12.65	0.8818	19.50	0.7647	26.36	0.6493
5.94	1.0001	12.80	0.8791	19.65	0.7622	26.51	0.6468
6.09	0.9975	12.95	0.8765	19.81	0.7596	26.66	0.6442
6.25	0.9950	13.10	0.8738	19.96	0.7571	26.82	0.6416
6.40	0.9926	13.26	0.8711	20.11	0.7545	26.97	0.6391
6.55	0.9902	13.41	0.8685	20.26	0.7519	27.12	0.6365
6.70	0.9878	13.56	0.8658	20.42	0.7494	27.27	0.6340

Table 8. Lookup Table for New ⁹⁰Sr RCE Values - LBG counters

Planchet area = 3.30 sq cm
 T = Sample thickness in mg/sq cm

T	PPT	T	PPT	T	PPT	T	PPT
0.00	1.1000	4.57	1.0234	9.14	0.9468	13.71	0.8701
0.10	1.0983	4.67	1.0217	9.24	0.9451	13.81	0.8684
0.20	1.0966	4.77	1.0200	9.34	0.9434	13.92	0.8667
0.30	1.0949	4.88	1.0183	9.45	0.9417	14.02	0.8650
0.41	1.0932	4.98	1.0166	9.55	0.9400	14.12	0.8633
0.51	1.0915	5.08	1.0149	9.65	0.9383	14.22	0.8616
0.61	1.0898	5.18	1.0132	9.75	0.9365	14.32	0.8599
0.71	1.0881	5.28	1.0115	9.85	0.9348	14.42	0.8582
0.81	1.0864	5.38	1.0098	9.95	0.9331	14.53	0.8565
0.91	1.0847	5.49	1.0081	10.06	0.9314	14.63	0.8548
1.02	1.0830	5.59	1.0064	10.16	0.9297	14.73	0.8531
1.12	1.0813	5.69	1.0047	10.26	0.9280	14.83	0.8514
1.22	1.0796	5.79	1.0030	10.36	0.9263	14.93	0.8497
1.32	1.0779	5.89	1.0012	10.46	0.9246	15.03	0.8480
1.42	1.0762	5.99	0.9995	10.56	0.9229	15.13	0.8463
1.52	1.0745	6.09	0.9978	10.67	0.9212	15.24	0.8446
1.63	1.0728	6.20	0.9961	10.77	0.9195	15.34	0.8429
1.73	1.0711	6.30	0.9944	10.87	0.9178	15.44	0.8412
1.83	1.0694	6.40	0.9927	10.97	0.9161	15.54	0.8395
1.93	1.0677	6.50	0.9910	11.07	0.9144	15.64	0.8378
2.03	1.0659	6.60	0.9893	11.17	0.9127	15.74	0.8361
2.13	1.0642	6.70	0.9876	11.27	0.9110	15.85	0.8344
2.23	1.0625	6.81	0.9859	11.38	0.9093	15.95	0.8327
2.34	1.0608	6.91	0.9842	11.48	0.9076	16.05	0.8310
2.44	1.0591	7.01	0.9825	11.58	0.9059	16.15	0.8293
2.54	1.0574	7.11	0.9808	11.68	0.9042	16.25	0.8276
2.64	1.0557	7.21	0.9791	11.78	0.9025	16.35	0.8259
2.74	1.0540	7.31	0.9774	11.88	0.9008	16.46	0.8242
2.84	1.0523	7.41	0.9757	11.99	0.8991	16.56	0.8225
2.95	1.0506	7.52	0.9740	12.09	0.8974	16.66	0.8208
3.05	1.0489	7.62	0.9723	12.19	0.8957	16.76	0.8191
3.15	1.0472	7.72	0.9706	12.29	0.8940	16.86	0.8174
3.25	1.0455	7.82	0.9689	12.39	0.8923	16.96	0.8157
3.35	1.0438	7.92	0.9672	12.49	0.8906	17.06	0.8140
3.45	1.0421	8.02	0.9655	12.60	0.8889	17.17	0.8123
3.56	1.0404	8.13	0.9638	12.70	0.8872	17.27	0.8106
3.66	1.0387	8.23	0.9621	12.80	0.8855	17.37	0.8089
3.76	1.0370	8.33	0.9604	12.90	0.8838	17.47	0.8071
3.86	1.0353	8.43	0.9587	13.00	0.8821	17.57	0.8054
3.96	1.0336	8.53	0.9570	13.10	0.8804	17.67	0.8037
4.06	1.0319	8.63	0.9553	13.20	0.8787	17.78	0.8020
4.16	1.0302	8.74	0.9536	13.31	0.8770	17.88	0.8003
4.27	1.0285	8.84	0.9519	13.41	0.8753	17.98	0.7986
4.37	1.0268	8.94	0.9502	13.51	0.8736	18.08	0.7969
4.47	1.0251	9.04	0.9485	13.61	0.8718	18.18	0.7952

Table 9. Lookup Table for New ⁹⁰Sr RCE Values - MEW counter

Planchet area = 3.30 sq cm
T = Sample thickness in mg/sq cm

T	PPT	T	PPT	T	PPT	T	PPT
0.00	1.0173	6.86	0.9804	13.71	0.8334	20.57	0.7079
0.15	1.0212	7.01	0.9770	13.86	0.8303	20.72	0.7050
0.30	1.0251	7.16	0.9737	14.02	0.8272	20.87	0.7022
0.46	1.0291	7.31	0.9703	14.17	0.8241	21.03	0.6994
0.61	1.0330	7.47	0.9669	14.32	0.8209	21.18	0.6966
0.76	1.0401	7.62	0.9635	14.47	0.8178	21.33	0.6936
0.91	1.0470	7.77	0.9602	14.63	0.8147	21.48	0.6906
1.07	1.0480	7.92	0.9568	14.78	0.8116	21.64	0.6876
1.22	1.0492	8.08	0.9534	14.93	0.8085	21.79	0.6846
1.37	1.0521	8.23	0.9501	15.08	0.8054	21.94	0.6815
1.52	1.0550	8.38	0.9467	15.24	0.8025	22.09	0.6785
1.68	1.0560	8.53	0.9433	15.39	0.7999	22.24	0.6755
1.83	1.0571	8.68	0.9400	15.54	0.7973	22.40	0.6725
1.98	1.0586	8.84	0.9366	15.69	0.7947	22.55	0.6695
2.13	1.0601	8.99	0.9332	15.85	0.7921	22.70	0.6665
2.29	1.0617	9.14	0.9299	16.00	0.7894	22.85	0.6634
2.44	1.0632	9.29	0.9266	16.15	0.7868	23.01	0.6604
2.59	1.0646	9.45	0.9234	16.30	0.7842	23.16	0.6574
2.74	1.0660	9.60	0.9201	16.46	0.7816	23.31	0.6544
2.89	1.0660	9.75	0.9168	16.61	0.7790	23.46	0.6514
3.05	1.0659	9.90	0.9135	16.76	0.7764	23.62	0.6484
3.20	1.0649	10.06	0.9103	16.91	0.7738	23.77	0.6453
3.35	1.0637	10.21	0.9070	17.06	0.7711	23.92	0.6423
3.50	1.0618	10.36	0.9037	17.22	0.7685	24.07	0.6393
3.66	1.0597	10.51	0.9005	17.37	0.7659	24.23	0.6363
3.81	1.0572	10.67	0.8972	17.52	0.7633	24.38	0.6333
3.96	1.0544	10.82	0.8939	17.67	0.7607	24.53	0.6303
4.11	1.0504	10.97	0.8907	17.83	0.7581	24.68	0.6274
4.27	1.0461	11.12	0.8874	17.98	0.7555	24.83	0.6244
4.42	1.0407	11.27	0.8841	18.13	0.7528	24.99	0.6214
4.57	1.0355	11.43	0.8809	18.28	0.7501	25.14	0.6185
4.72	1.0316	11.58	0.8776	18.44	0.7473	25.29	0.6155
4.88	1.0278	11.73	0.8743	18.59	0.7445	25.44	0.6125
5.03	1.0240	11.88	0.8711	18.74	0.7416	25.60	0.6096
5.18	1.0201	12.04	0.8678	18.89	0.7388	25.75	0.6066
5.33	1.0163	12.19	0.8646	19.05	0.7360	25.90	0.6036
5.49	1.0125	12.34	0.8615	19.20	0.7332	26.05	0.6007
5.64	1.0086	12.49	0.8584	19.35	0.7304	26.21	0.5977
5.79	1.0048	12.65	0.8552	19.50	0.7276	26.36	0.5947
5.94	1.0010	12.80	0.8521	19.65	0.7247	26.51	0.5918
6.09	0.9972	12.95	0.8490	19.81	0.7219	26.66	0.5888
6.25	0.9939	13.10	0.8459	19.96	0.7191	26.82	0.5858
6.40	0.9905	13.26	0.8428	20.11	0.7163	26.97	0.5829
6.55	0.9871	13.41	0.8396	20.26	0.7135	27.12	0.5799
6.70	0.9838	13.56	0.8365	20.42	0.7107	27.27	0.5769

Figure 1. ⁹⁰Sr Efficiency - GRB counters

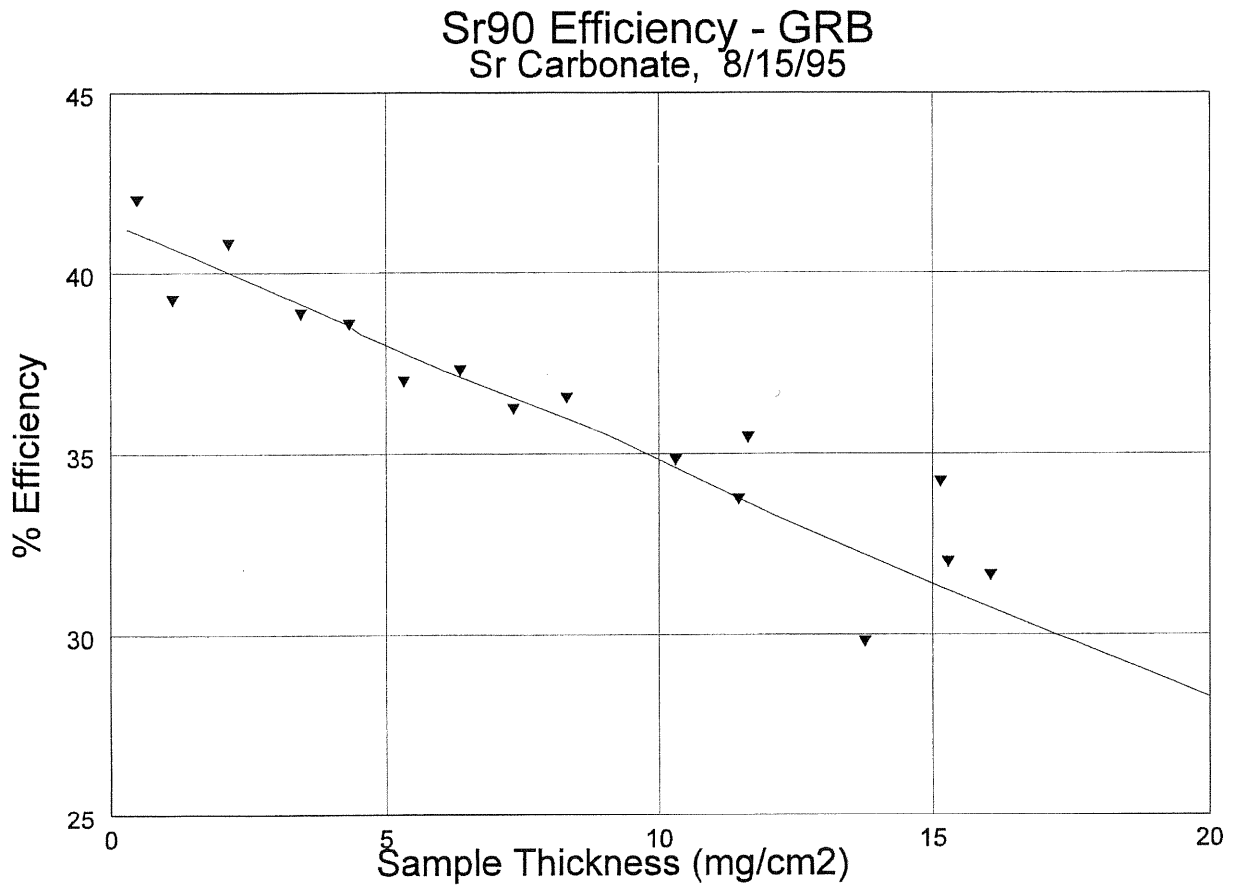


Figure 2. ⁹⁰Sr Efficiency - LBG counters

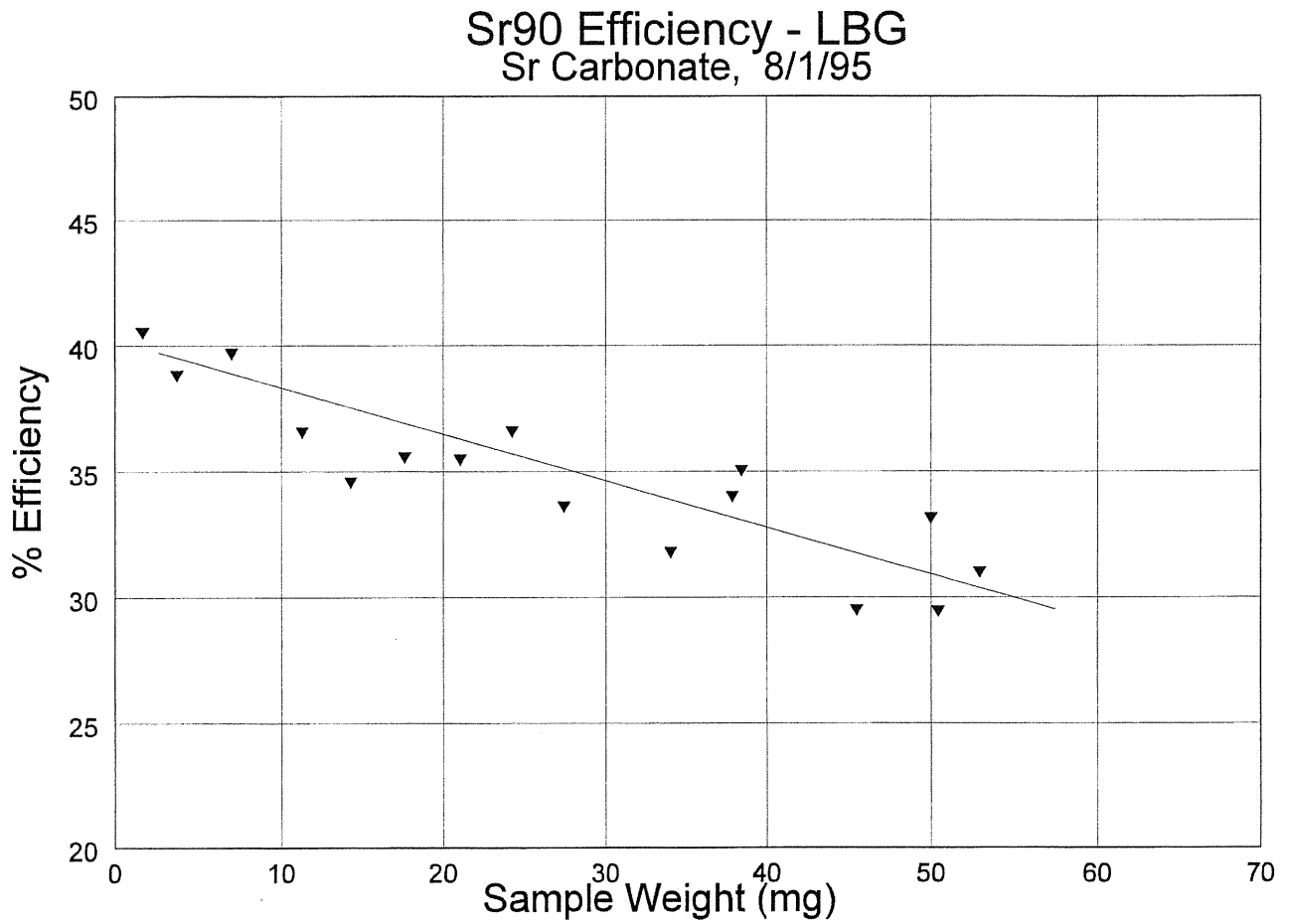


Figure 3. ⁹⁰Sr Efficiency - MEW counter

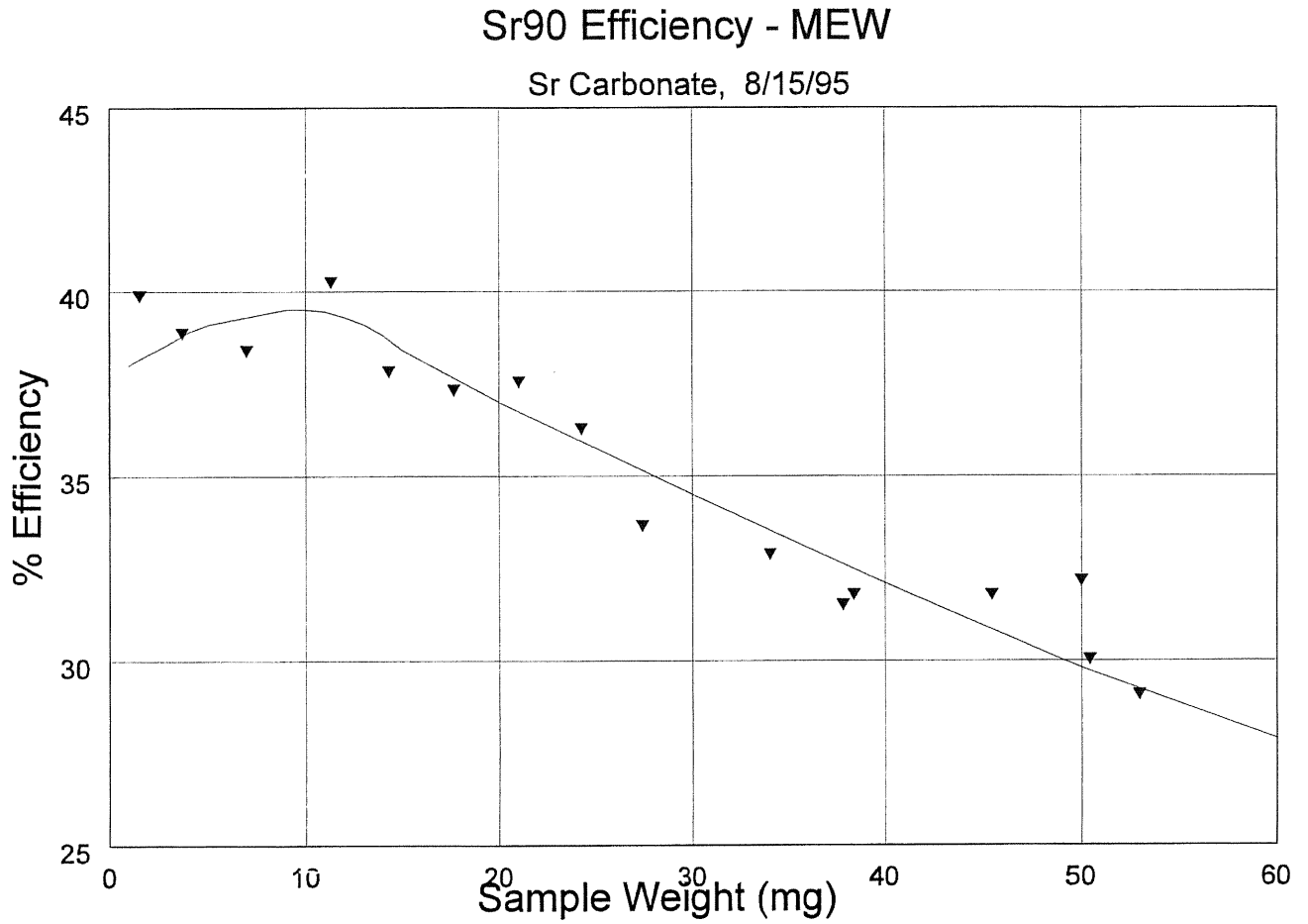


Figure 4. $^{90}\text{Y}/^{90}\text{Sr}$ Efficiency Ratio in Sr Carbonate - GRB counters

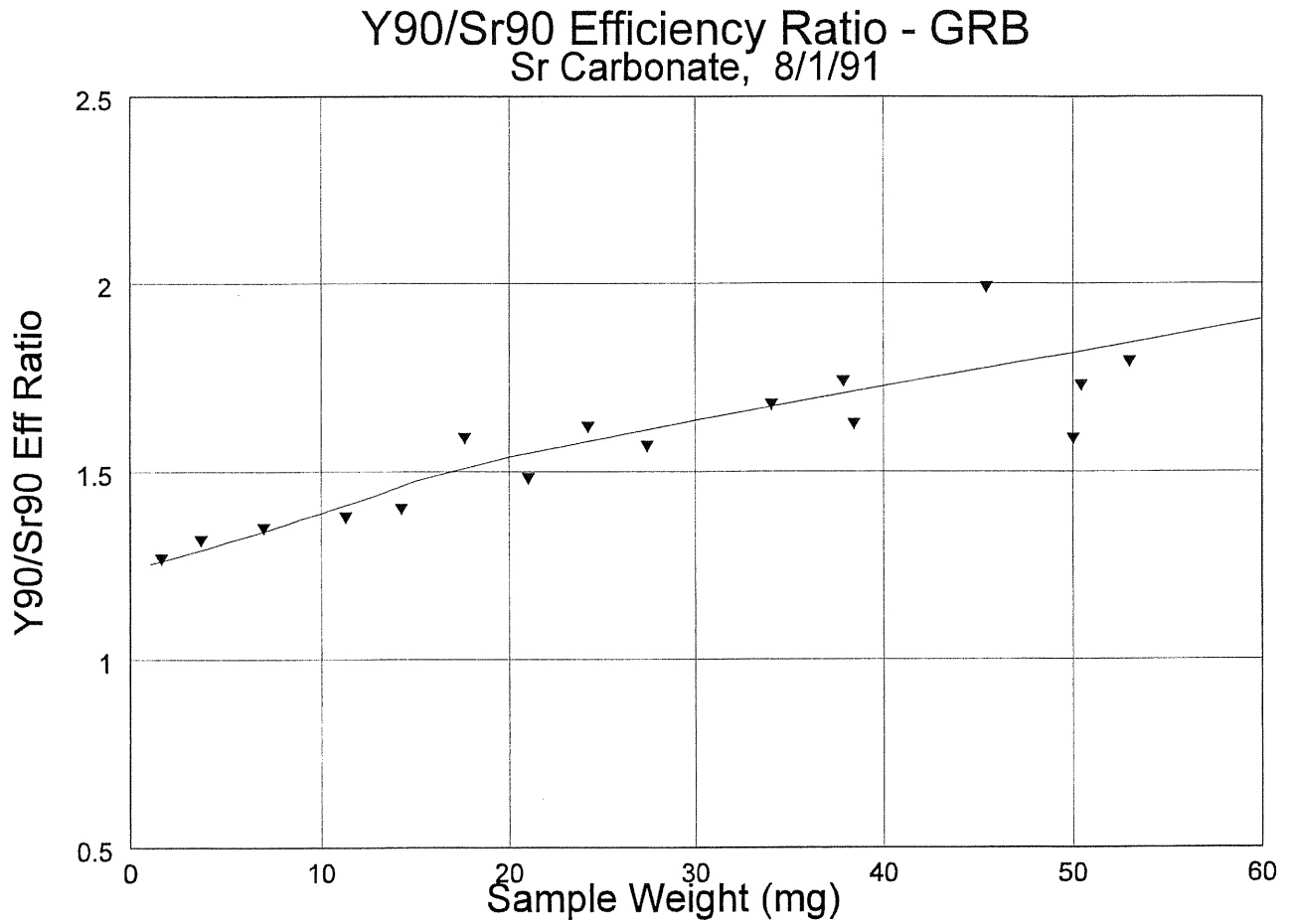


Figure 5. $^{90}\text{Y}/^{90}\text{Sr}$ Efficiency Ratio in Sr Carbonate - LBG counters

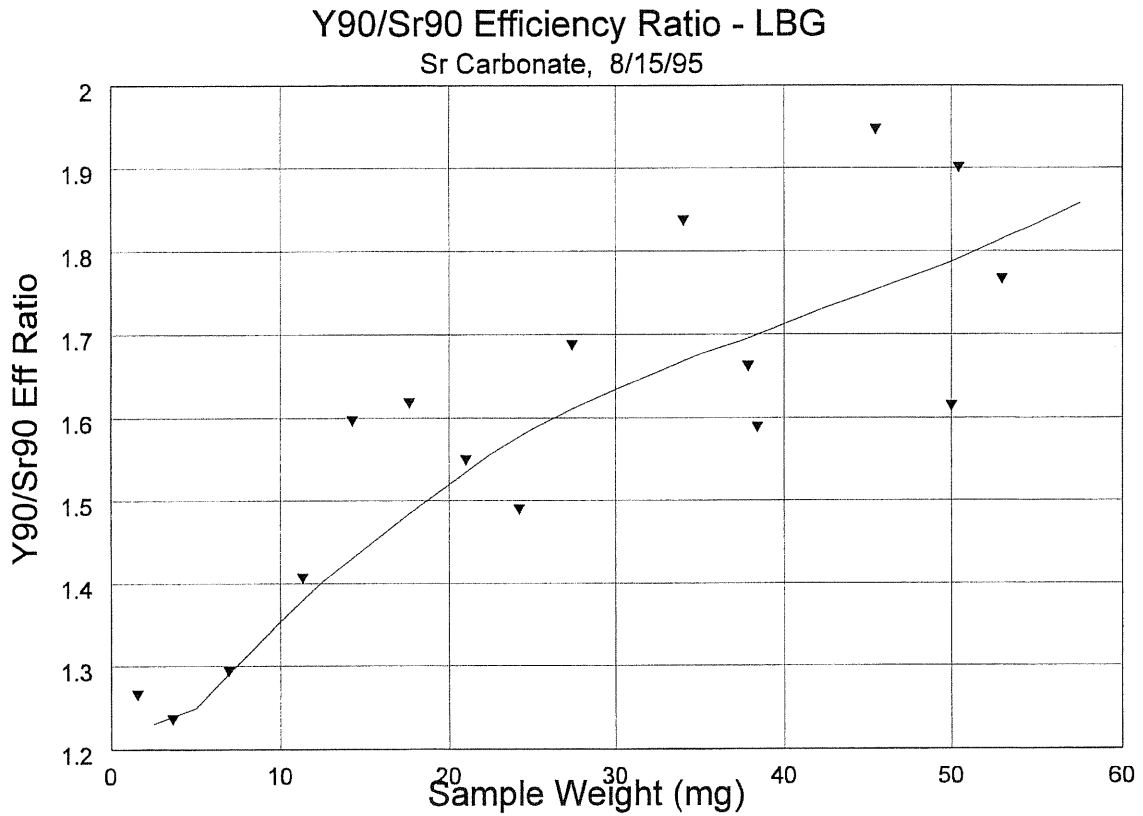


Figure 6. $^{90}\text{Y}/^{90}\text{Sr}$ Efficiency Ratio in Sr Carbonate - MEW counter

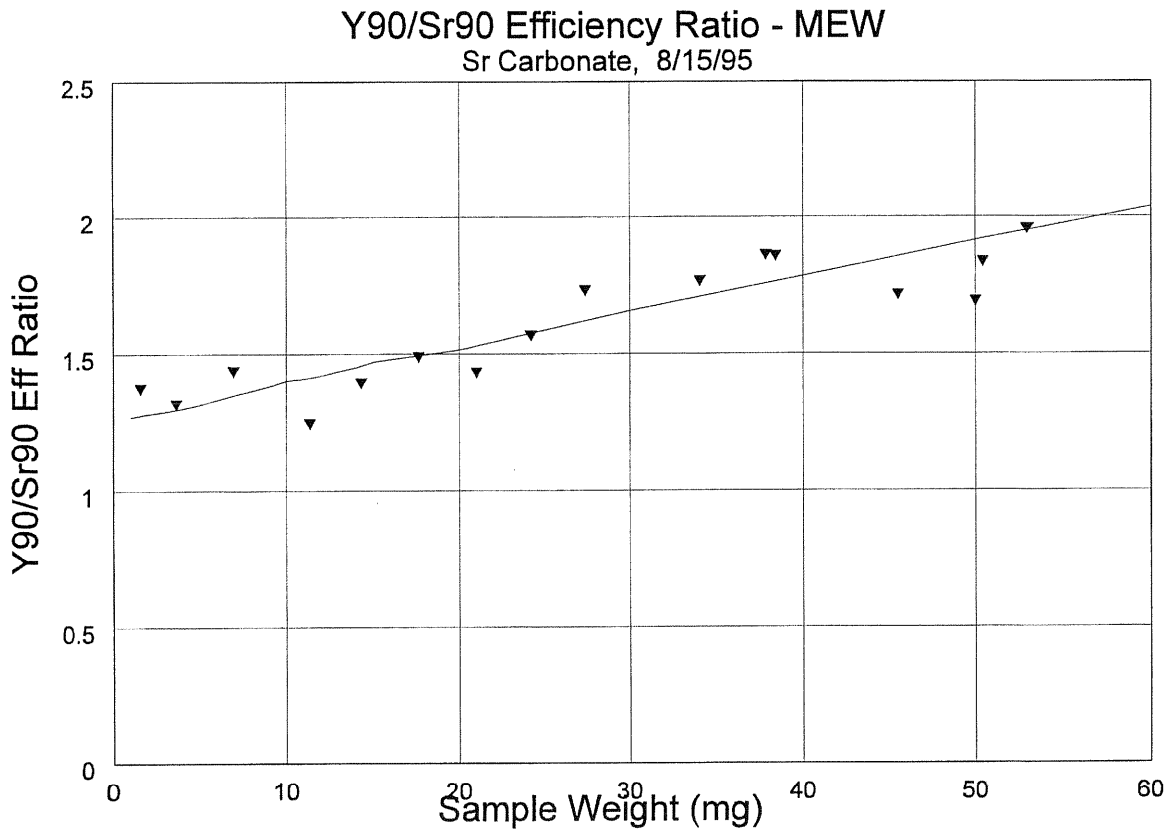


Figure 7. ⁹⁰Sr Relative Counting Efficiency - GRB counters

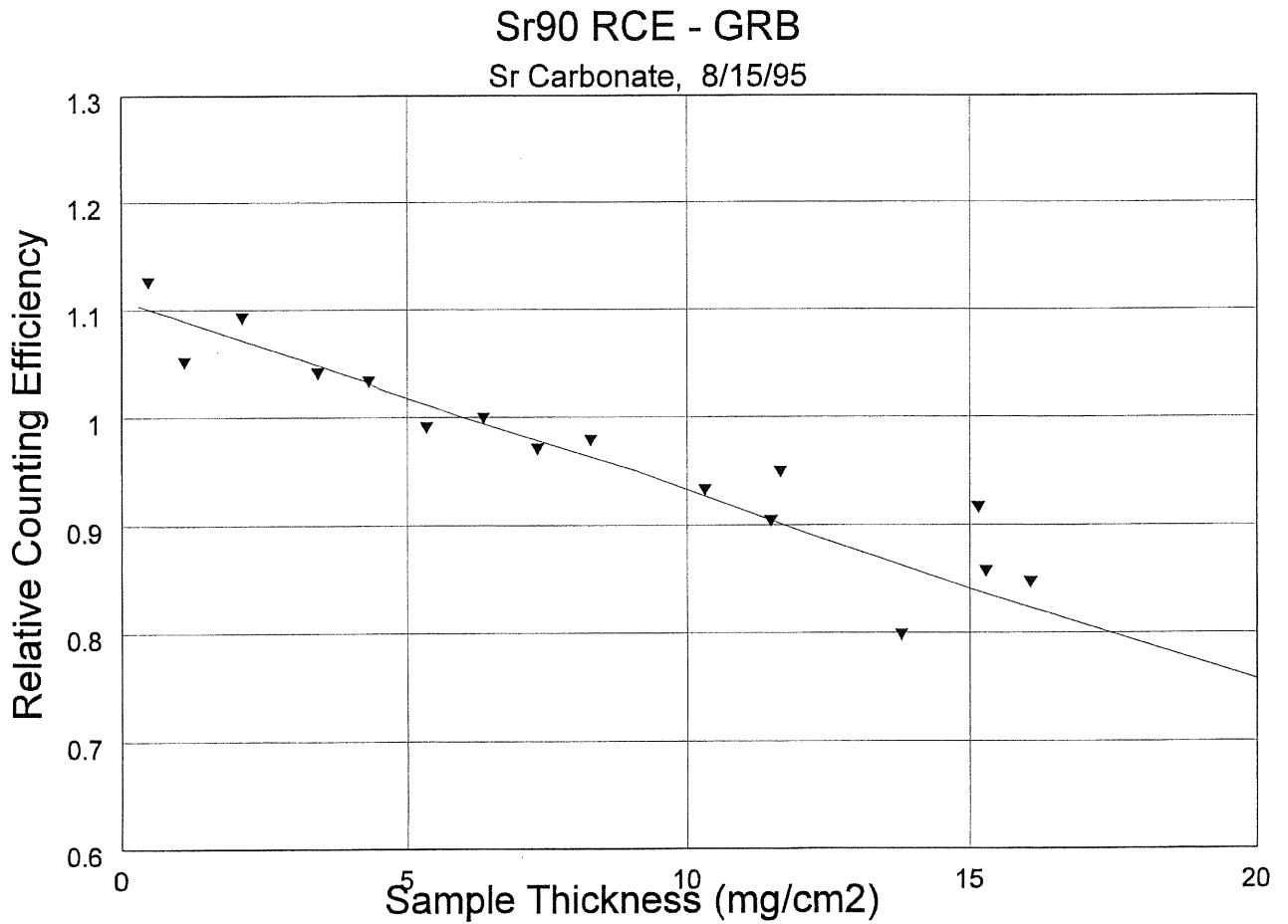


Figure 8. ⁹⁰Sr Relative Counting Efficiency - LBG counters

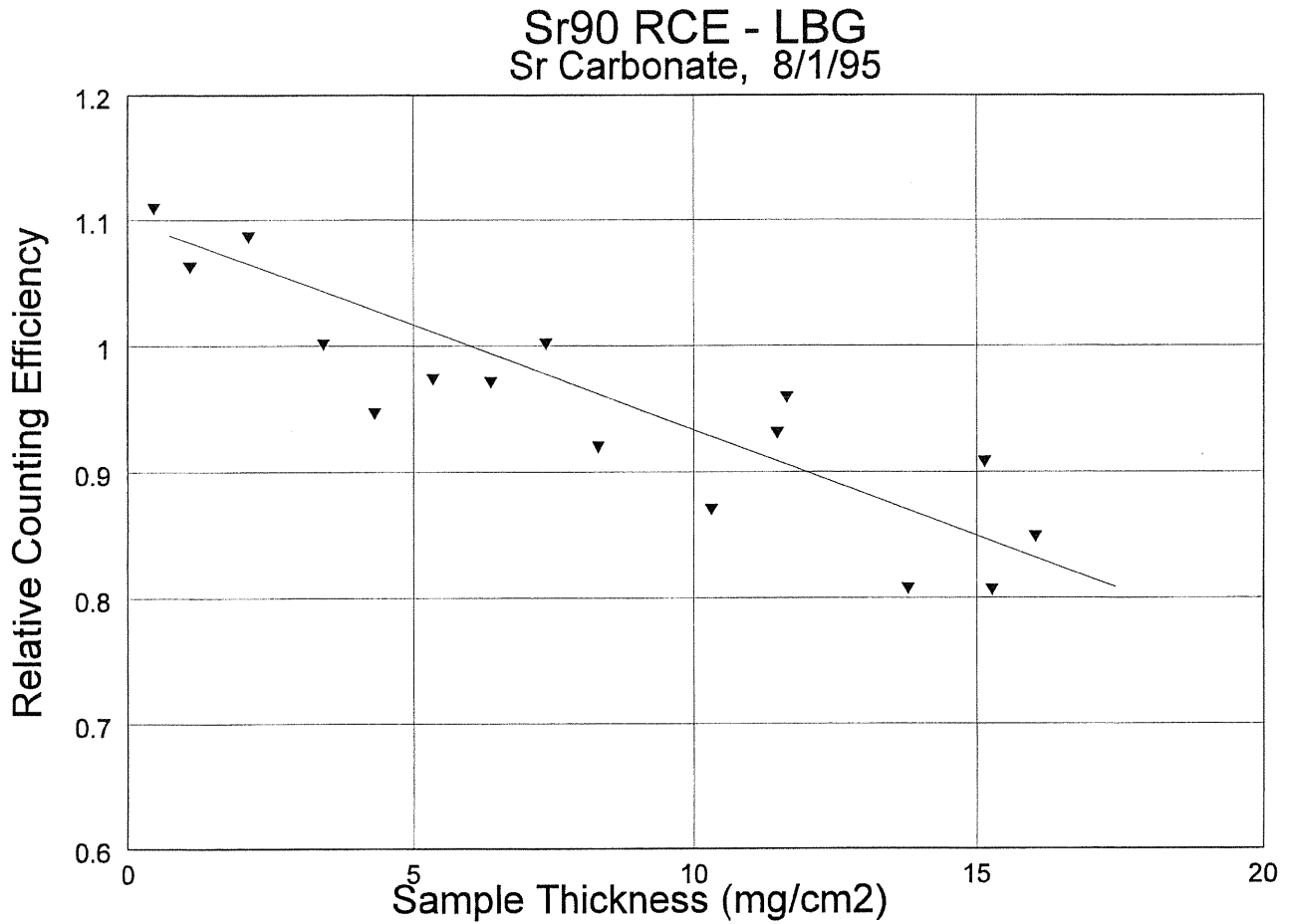
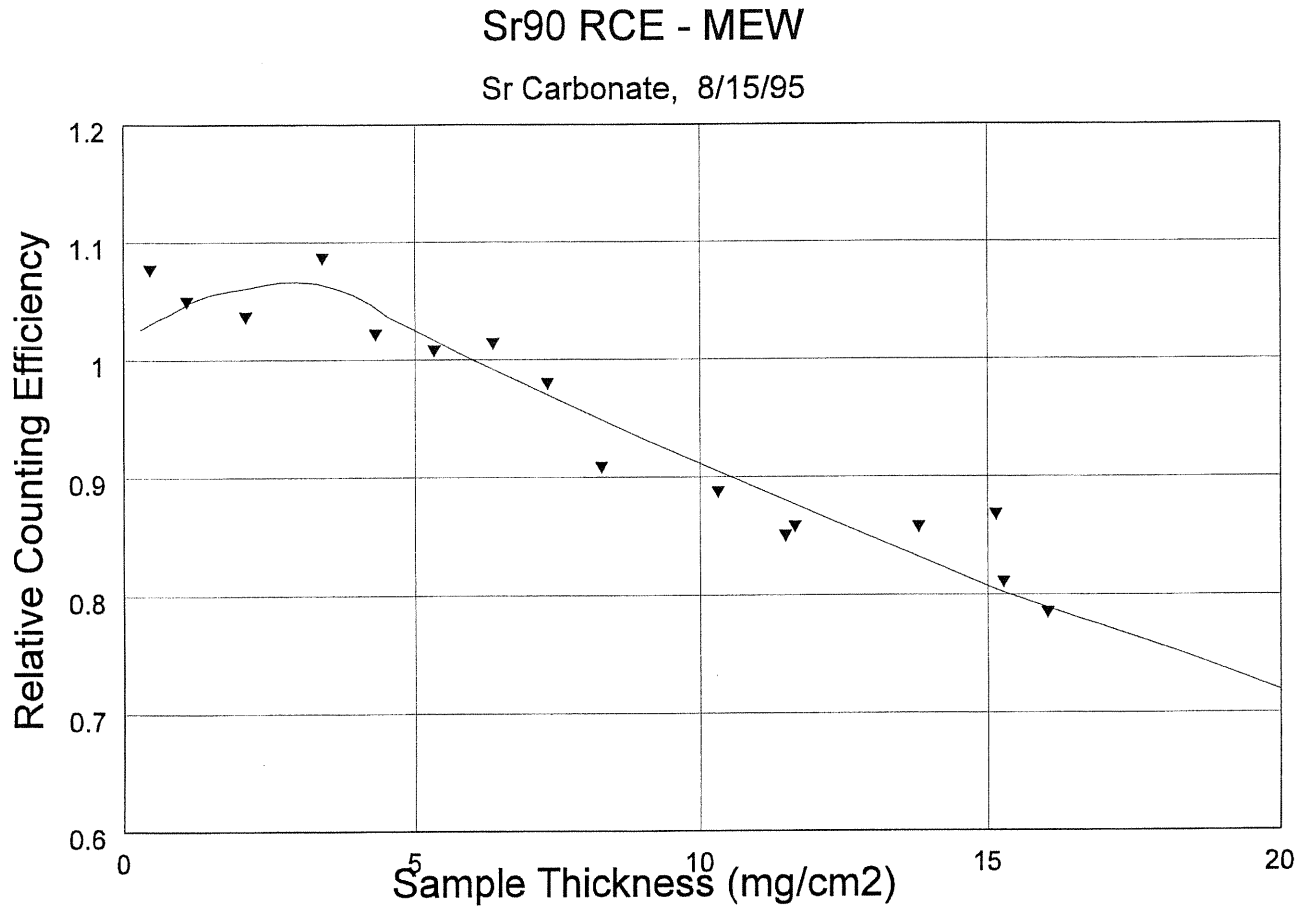


Figure 9. ⁹⁰Sr Relative Counting Efficiency - MEW counter



Appendix A. Counting/Calculation Data Sheets

26-JUN-95
15:52:43

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-201 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

OMT LBG
20 MIN

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.810 95

First fit
Equilibrium CPM= 1534.02 2.94 Percent Corr. coefficient= 0.990
CPM at sep time= 695.55 4.07 Percent Chi square prob.= 0.000

1 Points rejected
Equilibrium CPM= 1556.81 2.97 Percent Corr. coefficient= 0.987
CPM at sep time= 687.28 4.13 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.810	0.755	18006	21.96	15	842.23	843.46	-0.146	0.96	1.0000
124.142	6.087	13786	10.29	16	1386.07	1377.91	0.592	0.83	0.3441
127.096	9.041	16187	11.14	15	1491.61	1473.72	1.214	0.66	0.3096
130.208	12.153	17640	11.51	4	1527.44	1519.77	0.505	0.86	0.2975
131.252	13.197	15949	10.39	4	1529.89	1528.56	0.087	0.98	0.2883
132.226	14.171	17425	11.91	16	1519.54	1534.88	-0.999	0.71	0.3063
133.221	15.166	15810	10.30	4	1534.41	1539.87	-0.354	0.90	0.2864
133.927	15.872	15625	10.53	15	1530.65	1542.70	-0.781	0.78	0.2920
135.741	17.686	22346	16.29	3	1415.22	1548.01	-8.578	0.00	*****

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8655
PPT. correction (3) = 1.0561 (recovery = 1.570 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.799322E-01

C-zero P-factor dpm/smpl dpm error percent sigma
1.7692E+03 2.7470 4.8601E+03 1.4430E+02 2.97 %

LTV 5.0982E+03

9th point MDA 3.1901E+00

26-JUN-95
15:52:57

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-202 Sr
LBQ SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBQ

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.287 95

h

First fit
Equilibrium CPM= 1754.49 2.19 Percent
CPM at sep time= 804.47 2.39 Percent
Corr. coefficient= 0.977
Chi square prob.= 0.000

1 Points rejected
Equilibrium CPM= 1781.62 1.99 Percent
CPM at sep time= 796.81 2.43 Percent
Corr. coefficient= 0.970
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.287	0.232	11498	13.70	4	869.75	855.52	1.663	0.57	1.0000
118.810	0.755	20427	21.97	16	961.74	973.69	-1.227	0.64	0.9601
119.804	1.749	19115	17.12	15	1148.23	1157.17	-0.772	0.77	0.6602
123.022	4.967	19430	13.37	4	1509.36	1510.70	-0.089	0.97	0.3857
125.234	7.179	0	24.28	4	1626.35	1629.20	-0.175	0.94	0.3867
126.224	8.169	17685	10.93	15	1662.65	1663.60	-0.057	0.98	0.3084
127.096	9.041	18223	11.14	16	1694.14	1687.51	0.393	0.89	0.3006
131.252	13.197	17661	10.39	15	1746.72	1749.62	-0.166	0.95	0.2793
132.274	14.219	17928	10.71	16	1738.66	1757.08	-1.048	0.70	0.2846
133.252	15.197	19268	12.59	3	1577.43	1762.58	-10.505	0.00*****	
133.935	15.880	17313	10.20	16	1766.37	1765.67	0.039	0.99	0.2735
135.741	17.686	29295	16.30	4	1802.08	1771.65	1.718	0.51	0.2937

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 1.0006
PPT. correction (3) = 1.0498 (recovery = 3.630 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.011189E+00

C-zero 1.7619E+03
P-factor 2.7470
dpm/smpl 4.8400E+03
dpm error 9.6445E+01
percent sigma 1.99 %
1 sigma

LTV 4.9991E+03

12th point MDA 3.0897E+00

26-JUN-95
15:53:10

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-203 Sr
LBQ SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.287 95

First fit
Equilibrium CPM= 1824.37 1.94 Percent Corr. coefficient= 0.978
CPM at sep time= 806.24 2.45 Percent Chi square prob.= 0.000

1 Points rejected
Equilibrium CPM= 1839.63 1.97 Percent Corr. coefficient= 0.972
CPM at sep time= 802.04 2.47 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.287	0.232	11515	13.70	15	863.37	863.90	-0.061	0.98	1.0000
118.799	0.744	14246	14.88	15	983.52	985.42	-0.193	0.95	0.8216
119.804	1.749	19568	17.12	16	1182.43	1181.71	0.061	0.98	0.6223
123.151	5.096	16004	10.47	15	1572.21	1563.52	0.555	0.84	0.3325
124.142	6.087	16103	10.29	4	1625.38	1626.15	-0.047	0.99	0.3133
126.224	8.169	18582	10.93	16	1759.03	1715.29	2.550	0.36	0.2774
129.083	11.028	21509	12.87	15	1717.36	1780.45	-3.543	0.17	0.3011
130.219	12.164	19634	10.65	4	1837.50	1795.55	2.336	0.40	0.2529
131.252	13.197	18069	10.39	16	1801.11	1805.92	-0.266	0.92	0.2628
133.229	15.174	0	19.48	4	1832.67	1819.47	0.726	0.78	0.2932
133.896	15.841	10701	6.52	3	1693.34	1822.66	-7.095	0.01*****	
135.741	17.686	28476	16.30	15	1803.95	1829.13	-1.376	0.59	0.2922

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9620
PPT. correction (3) = 1.0396 (recovery = 6.980 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.627197E-01

C-zero 1.9109E+03 P-factor 2.7470 dpm/smpl 5.2492E+03 1 sigma dpm error 1.0365E+02 percent sigma 1.97 %

LTV 5.4202E+03

10th point MDA 3.0227E+00

26-JUN-95
15:53:23

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-204 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.287 95

H

	CPM	ERROR	
First fit	-----	-----	
Equilibrium CPM=	1919.76	1.91 Percent	Corr. coefficient= 0.980
CPM at sep time=	810.87	2.49 Percent	Chi square prob. = 0.000

	CPM	ERROR	
1 Points rejected	-----	-----	
Equilibrium CPM=	1938.24	1.95 Percent	Corr. coefficient= 0.974
CPM at sep time=	805.51	2.52 Percent	Chi square prob. = 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.287	0.232	11763	13.70	16	888.10	873.04	1.725	0.56	1.0000
118.799	0.744	14500	14.88	16	1008.00	1005.71	0.228	0.94	0.8261
119.804	1.749	19410	17.11	3	1175.97	1220.00	-3.609	0.16	0.6578
123.151	5.096	16871	10.47	16	1667.20	1636.81	1.856	0.51	0.3150
124.142	6.087	17463	10.29	15	1747.32	1705.18	2.471	0.38	0.2887
125.252	7.197	17900	10.81	4	1719.88	1763.54	-2.475	0.35	0.3014
127.096	9.041	19196	11.14	4	1788.07	1830.00	-2.291	0.38	0.2838
129.083	11.028	23718	12.87	16	1908.66	1873.63	1.870	0.48	0.2623
130.208	12.153	21368	11.51	15	1907.77	1889.98	0.941	0.73	0.2550
132.235	14.180	0	42.89	4	1916.34	1909.81	0.342	0.88	0.3254
133.221	15.166	19166	10.30	15	1914.06	1916.16	-0.110	0.97	0.2465
133.901	15.846	19250	11.13	3	1784.47	1919.74	-7.046	0.00	*****

Elapsed time (days) = 440.555
 Lambda = 8.626E-05 Reciprocal days
 exp(-lambda X t) (1) = 9.627E-01
 Chemical yield (2) = 1.0401
 PPT. correction (3) = 1.0263 (recovery = 11.32 mgs)
 Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.027612E+00

C-zero	P-factor	dpm/smpl	1 sigma
1.8862E+03	2.7470	5.1813E+03	dpm error percent sigma
			1.0091E+02 1.95 %

LTV 5.3478E+03

10th point MDA 1.8433E+00

26-JUN-95
15:53:36

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-205 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.826 95

H

First fit
Equilibrium CPM= 1844.42 3.12 Percent Corr. coefficient= 0.989
CPM at sep time= 738.11 3.87 Percent Chi square prob.= 0.000

1 Points rejected
Equilibrium CPM= 1878.05 2.62 Percent Corr. coefficient= 0.985
CPM at sep time= 723.33 3.98 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.826	0.771	10225	11.55	3	917.61	933.78	-1.731	0.55	1.0000
119.818	1.763	21675	19.01	16	1179.53	1148.65	2.688	0.32	0.7483
124.150	6.095	17539	11.21	4	1625.03	1640.98	-0.972	0.72	0.3742
127.104	9.049	23823	13.89	15	1760.75	1767.96	-0.408	0.88	0.3424
130.208	12.153	20505	11.52	16	1843.45	1828.86	0.798	0.77	0.3023
131.261	13.206	19154	10.37	4	1840.98	1840.62	0.019	0.99	0.2920
132.226	14.171	21180	11.91	15	1829.23	1848.92	-1.065	0.69	0.3085
133.221	15.166	18371	10.30	16	1852.58	1855.54	-0.160	0.95	0.2915
133.893	15.838	19350	10.38	4	1872.94	1859.15	0.742	0.79	0.2841
135.753	17.698	27687	17.07	3	1673.43	1866.39	-10.338	0.00	*****

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9840
PPT. correction (3) = 1.0173 (recovery = 14.28 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.636774E-01

C-zero P-factor dpm/smpl dpm error percent sigma
1.9488E+03 2.7470 5.3534E+03 1.4026E+02 2.62 %

LTV 5.5849E+03

10th point MDA 2.8321E+00

26-JUN-95

15:53:50

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-206 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.826 95.

First fit
Equilibrium CPM= 1930.42 2.54 Percent Corr. coefficient= 0.992
CPM at sep time= 737.43 3.98 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.826	0.771	10831	11.55	15	963.33	954.86	0.887	0.76	1.0000
119.818	1.763	21286	19.00	3	1161.34	1176.85	-1.318	0.62	0.8371
123.036	4.981	31345	20.39	4	1596.66	1603.63	-0.435	0.86	0.4847
124.150	6.095	18342	11.21	16	1692.92	1685.50	0.440	0.87	0.3789
125.260	7.205	22077	13.00	4	1763.89	1746.84	0.976	0.72	0.3665
126.233	8.178	18737	10.75	15	1791.10	1787.79	0.185	0.95	0.3392
127.104	9.049	24791	13.89	16	1848.49	1816.68	1.751	0.51	0.3427
129.092	11.037	21132	11.82	15	1837.19	1862.52	-1.360	0.61	0.3325
132.266	14.211	20400	10.57	4	1929.45	1900.63	1.516	0.58	0.2946
133.229	15.174	0	19.49	16	1880.93	1907.24	-1.379	0.58	0.3580
133.935	15.880	18746	10.19	15	1897.83	1911.10	-0.694	0.80	0.3027
135.753	17.698	32667	17.07	4	1918.90	1918.38	0.027	0.99	0.3335

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1)= 9.627E-01
Chemical yield (2)= 0.9724
PPT. correction (3)= 1.0070 (recovery = 17.64 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 9.427378E-01

1 sigma
C-zero P-factor dpm/smpl dpm error percent sigma
2.0477E+03 2.7470 5.6250E+03 1.4294E+02 2.54 %

LTV 5.8608E+03

10th point MDA 3.1119E+00

26-JUN-95
15:54:02

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-207 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.783 95

First fit
Equilibrium CPM= 1865.03 2.43 Percent Corr. coefficient= 0.989
CPM at sep time= 731.63 3.64 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.783	0.728	18273	20.42	15	919.24	928.53	-1.001	0.71	1.0000
119.818	1.763	21370	19.00	4	1168.03	1149.10	1.648	0.54	0.6483
123.158	5.103	22690	14.98	15	1557.93	1564.10	-0.394	0.88	0.3681
126.233	8.178	18111	10.75	16	1743.14	1729.52	0.787	0.77	0.2785
130.229	12.174	29136	15.73	4	1846.16	1817.03	1.603	0.54	0.2739
131.261	13.206	18372	10.37	14	1804.86	1828.29	0.359	0.90	0.2524
132.266	14.211	18512	10.57	15	1801.48	1836.73	-1.919	0.47	0.2615
133.243	15.188	21516	11.78	4	1825.94	1843.07	-0.929	0.73	0.2607
133.927	15.872	18732	10.54	16	1849.52	1846.64	0.156	0.95	0.2503
135.753	17.698	30590	17.08	15	1849.39	1853.59	-0.226	0.93	0.2803

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9661
PPT. correction (3) = 0.9967 (recovery = 21.03 mgs)
Aliquot (4) = 1.000 smpl.

Product (1X2X3X4) = 9.269671E-01

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
2.0120E+03	2.7470	5.5269E+03	1.3453E+02	2.43 %
	LTV	5.7489E+03		
	10th point MDA	3.5591E+00		

26-JUN-95
15:54:16

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-208 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.783 95

	CPM	ERROR	
First fit	-----	-----	
Equilibrium CPM=	1830.32	2.63 Percent	Corr. coefficient= 0.987
CPM at sep time=	760.63	3.59 Percent	Chi square prob.= 0.000

	CPM	ERROR	
1 Points rejected	-----	-----	
Equilibrium CPM=	1858.56	2.64 Percent	Corr. coefficient= 0.983
CPM at sep time=	746.63	3.70 Percent	Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.783	0.728	18610	20.50	16	939.01	939.80	-0.084	0.98	1.0000
119.818	1.763	21397	19.00	15	1158.14	1156.19	0.169	0.95	0.6792
123.158	5.103	22865	14.98	16	1579.22	1563.32	1.017	0.70	0.3724
124.150	6.095	17862	11.21	15	1640.52	1630.28	0.629	0.82	0.3233
125.269	7.214	16733	10.58	4	1642.68	1687.82	-2.674	0.32	0.3183
127.104	9.049	23131	13.89	4	1728.01	1752.55	-1.400	0.59	0.3124
129.092	11.037	20755	11.82	16	1818.56	1795.28	1.297	0.63	0.2744
131.261	13.206	18462	10.37	15	1829.49	1822.52	0.383	0.89	0.2620
133.252	15.197	23326	12.59	4	1852.20	1837.07	0.824	0.76	0.2675
133.909	15.854	16976	10.47	3	1672.84	1840.43	-9.106	0.00*****	

Elapsed time (days) = 440.555
 Lambda = 8.626E-05 Reciprocal days
 exp(-lambda X t) (1) = 9.627E-01
 Chemical yield (2) = 0.9545
 PPT. correction (3) = 0.9869 (recovery = 24.24 mgs)
 Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.068174E-01

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
2.0495E+03	2.7470	5.6301E+03	1.4878E+02	2.64 %

LTV 5.8756E+03

5th point MDA 4.1512E+00

26-JUN-95
15:54:28

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-209 Sr
LBO SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBO

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.826 95

First fit
Equilibrium CPM= 1824.40 2.61 Percent Corr. coefficient= 0.990
CPM at sep time= 678.91 4.14 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.826	0.771	10049	11.55	16	899.93	887.67	1.380	0.65	1.0000
119.833	1.778	14758	14.18	3	1078.84	1103.33	-2.220	0.42	0.7832
124.160	6.105	0	23.09	4	1612.74	1590.08	1.425	0.58	0.4349
127.115	9.060	21986	13.13	15	1719.02	1715.49	0.206	0.94	0.3412
130.219	12.164	18291	10.65	16	1778.72	1775.73	0.168	0.95	0.3054
131.269	13.214	19566	10.92	4	1785.84	1787.34	-0.084	0.98	0.3022
132.235	14.180	0	42.89	15	1787.75	1795.64	-0.440	0.85	0.4012
133.229	15.174	0	19.48	15	1804.93	1802.14	0.155	0.95	0.3424
133.901	15.846	19916	11.13	4	1797.80	1805.69	-0.437	0.87	0.3009

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9444
PPT. correction (3) = 0.9772 (recovery = 27.41 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.884331E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.0535E+03 2.7470 5.6410E+03 1.4698E+02 2.61 %

LTV 5.8835E+03

7th point MDA 2.3330E+00

26-JUN-95
15:54:43

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-210 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.908 95

	CPM	ERROR		
First fit	-----	-----		
Equilibrium CPM=	1789.10	3.10 Percent	Corr. coefficient=	0.992
CPM at sep time=	653.92	4.54 Percent	Chi square prob.=	0.000

	CPM	ERROR		
1 Points rejected	-----	-----		
Equilibrium CPM=	1813.75	2.56 Percent	Corr. coefficient=	0.989
CPM at sep time=	639.39	4.26 Percent	Chi square prob.=	0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.908	0.853	12678	15.34	3	856.62	873.95	-1.983	0.48	1.0000
119.833	1.778	15150	14.18	4	1109.50	1074.51	3.257	0.26	0.6285
123.051	4.996	17561	12.26	4	1487.67	1493.08	-0.362	0.89	0.3640
124.160	6.105	0	23.10	15	1582.13	1573.53	0.547	0.83	0.3781
125.277	7.222	29768	19.19	4	1611.15	1633.93	-1.394	0.58	0.3526
126.247	8.192	28376	17.18	15	1697.26	1673.93	1.393	0.59	0.3129
127.115	9.060	21946	13.13	16	1731.04	1702.10	1.700	0.53	0.2842
129.101	11.046	22459	13.51	15	1708.26	1747.08	-2.222	0.39	0.2924
130.229	12.174	27081	15.73	16	1783.02	1764.01	1.078	0.68	0.2815
133.243	15.188	20479	11.78	16	1805.68	1791.00	0.820	0.76	0.2571
133.943	15.888	30094	17.67	15	1756.93	1794.79	-2.109	0.40	0.2963
135.767	17.712	24762	15.70	3	1627.23	1801.94	-9.695	0.00	*****

Elapsed time (days) = 440.555
 Lambda = 8.626E-05 Reciprocal days
 exp(-lambda X t) (1) = 9.627E-01
 Chemical yield (2) = 0.9388
 PPT. correction (3) = 0.9569 (recovery = 34.06 mgs)
 Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.648351E-01

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
2.0972E+03	2.7470	5.7611E+03	1.4754E+02	2.56 %

LTV 6.0045E+03

12th point MDA 3.3172E+00

26-JUN-95
15:55:01

TMA Corporation
Pb210 Least Squares Analysis
PBEI V 1.04

1037-211 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.908 95

First fit
Equilibrium CPM= 1840.50 2.57 Percent
CPM at sep time= 691.39 4.09 Percent
Corr. coefficient= 0.992
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.908	0.853	13812	15.35	15	924.32	920.91	0.370	0.90	1.0000
119.833	1.778	15217	14.19	16	1109.34	1117.14	-0.698	0.80	0.7167
123.178	5.123	16313	10.82	15	1550.72	1536.86	0.902	0.75	0.3728
125.278	7.223	29545	18.30	15	1662.24	1664.58	-0.141	0.96	0.3759
126.247	8.192	28030	17.18	16	1688.09	1703.69	-0.916	0.72	0.3611
129.101	11.046	23239	13.51	16	1781.49	1775.26	0.350	0.89	0.3105
130.242	12.187	0	22.43	4	1815.75	1792.03	1.324	0.60	0.3326
131.269	13.214	18839	10.92	16	1786.72	1803.33	-0.921	0.73	0.2929
132.226	14.171	21501	11.91	4	1804.75	1811.51	-0.373	0.89	0.2917
133.909	15.854	18919	10.47	4	1815.46	1821.77	-0.346	0.90	0.2795
135.767	17.712	28775	15.71	4	1836.58	1828.94	0.418	0.87	0.3025

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9487
PPT. correction (3) = 0.9453 (recovery = 37.86 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.633354E-01

C-zero 2.1318E+03
P-factor 2.7470
dpm/smpl 5.8562E+03
dpm error 1.5036E+02
percent sigma 2.57 %
1 sigma

LTV 6.1043E+03

7th point MDA 3.3447E+00

26-JUN-95
15:55:15

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-212 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.908 95

First fit
Equilibrium CPM= 1715.75 2.59 Percent Corr. coefficient= 0.991
CPM at sep time= 662.89 4.04 Percent Chi square prob. = 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.908	0.853	12943	15.35	16	872.14	873.18	-0.120	0.97	1.0000
119.833	1.778	14464	14.19	15	1048.19	1052.98	-0.455	0.87	0.7128
123.178	5.123	15360	10.83	16	1467.36	1437.55	2.074	0.46	0.3713
125.278	7.223	27694	18.31	16	1564.88	1554.57	0.663	0.80	0.3787
127.115	9.060	20172	13.13	4	1594.14	1615.66	-1.332	0.61	0.3388
130.258	12.203	0	23.01	4	1687.12	1671.53	0.933	0.71	0.3449
131.269	13.214	17817	10.92	15	1676.60	1681.70	-0.303	0.91	0.2951
132.274	14.219	18270	10.70	4	1706.93	1689.52	1.031	0.71	0.2824
133.243	15.188	19301	11.78	15	1685.29	1695.35	-0.594	0.82	0.2984
133.943	15.888	28929	17.68	16	1702.77	1698.75	0.236	0.93	0.3238
135.767	17.712	25460	15.71	15	1673.41	1705.16	-1.862	0.47	0.3246

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8825
PPT. correction (3) = 0.9436 (recovery = 38.42 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.016442E-01

1 sigma

C-zero 2.1403E+03 P-factor 2.7470 dpm/smpl 5.8794E+03 dpm error 1.5228E+02 percent sigma 2.59 %

LTV 6.1306E+03

6th point MDA 3.5476E+00

26-JUN-95
15:55:29

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-213 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.920 95

First fit
Equilibrium CPM= 1670.30 2.58 Percent Corr. coefficient= 0.991
CPM at sep time= 566.70 4.53 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTC	CPM	CLC CPM	PCOFF	PROB	WT
118.920	0.865	10923	14.72	3	769.08	789.85	-2.629	0.36	1.0000
119.843	1.788	14094	14.40	4	1016.35	977.42	3.983	0.17	0.6192
124.182	6.127	19008	13.20	15	1482.52	1445.64	2.551	0.36	0.3144
127.125	9.070	19430	13.03	15	1530.76	1565.65	-2.229	0.40	0.2961
129.113	11.058	18789	11.83	15	1632.04	1607.84	1.505	0.58	0.2584
130.242	12.187	0	22.43	16	1634.76	1623.75	0.678	0.79	0.2994
131.279	13.224	0	28.53	4	1598.89	1634.75	-2.194	0.36	0.3243
132.235	14.180	0	42.89	16	1633.75	1642.60	-0.539	0.82	0.3369
133.252	15.197	20010	12.59	16	1650.77	1648.97	0.109	0.97	0.2581

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8954
PPT. correction (3) = 0.9220 (recovery = 45.48 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 7.948105E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.1015E+03 2.7470 5.7728E+03 1.4902E+02 2.58 %

LTV 6.0187E+03

8th point MDA 2.4045E+00

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.920 95

First fit
Equilibrium CPM= 1679.40 2.89 Percent Corr. coefficient= 0.995
CPM at sep time= 607.17 4.98 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.920	0.865	11902	14.74	15	829.39	823.96	0.660	0.82	1.0000
123.061	5.006	27608	21.44	4	1337.33	1387.62	-3.624	0.14	0.4836
124.182	6.127	18810	13.20	16	1474.31	1461.13	0.902	0.74	0.3619
125.292	7.237	0	23.79	4	1514.91	1515.93	-0.068	0.98	0.3959
126.260	8.205	18202	11.91	15	1570.41	1552.12	1.178	0.67	0.3151
127.125	9.070	20020	13.03	16	1591.20	1577.73	0.854	0.75	0.3159
129.113	11.058	18763	11.83	16	1642.58	1618.71	1.474	0.59	0.2915
131.279	13.224	0	28.54	16	1640.18	1644.87	-0.285	0.91	0.3552
133.252	15.197	20148	12.59	15	1646.04	1658.68	-0.762	0.77	0.2946
133.918	15.863	18276	11.10	4	1654.17	1661.97	-0.469	0.86	0.2809
135.780	17.725	0	63.17	15	1682.03	1668.70	0.799	0.73	0.3839

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9125
PPT. correction (3) = 0.8992 (recovery = 52.97 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 7.899066E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.1261E+03 2.7470 5.8403E+03 1.6899E+02 2.89 %

LTV 6.1192E+03

11th point MDA 2.0042E+00

26-JUN-95
15:55:57

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-215 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.920 95

First fit
Equilibrium CPM= 1399.34 2.99 Percent Corr. coefficient= 0.990
CPM at sep time= 560.35 4.14 Percent Chi square prob.= 0.000

1 Points rejected
Equilibrium CPM= 1424.99 2.84 Percent Corr. coefficient= 0.987
CPM at sep time= 545.14 4.32 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.920	0.865	10346	14.74	16	725.90	723.03	0.397	0.89	1.0000
119.843	1.788	12177	14.40	15	869.47	872.58	-0.356	0.90	0.7309
123.186	5.131	12609	10.91	15	1188.57	1192.98	-0.370	0.90	0.3954
124.182	6.127	15706	13.20	4	1235.68	1245.88	-0.818	0.77	0.3920
125.292	7.237	29706	23.79	15	1285.46	1290.85	-0.417	0.87	0.4224
126.260	8.205	15365	11.91	16	1334.68	1320.54	1.071	0.70	0.3333
129.121	11.066	18303	13.61	15	1381.79	1375.30	0.472	0.86	0.3249
130.297	12.242	18155	12.97	4	1395.03	1388.37	0.480	0.86	0.3129
132.266	14.211	14344	10.57	16	1409.40	1403.02	0.455	0.87	0.2938
133.918	15.863	14929	11.10	16	1399.52	1410.68	-0.791	0.77	0.3016
135.780	17.725	0	63.17	3	1289.85	1416.20	-8.922	0.00	*****

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.7656
PPT. correction (3) = 0.9082 (recovery = 50.00 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 6.694534E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.1286E+03 2.7470 5.8472E+03 1.6587E+02 2.84 %

LTV 6.1209E+03

11th point MDA 1.9215E+00

26-JUN-95
15:56:11

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-216 Sr
LBG SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on LBG

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.931 95

First fit
Equilibrium CPM= 1275.42 2.54 Percent
CPM at sep time= 439.74 4.42 Percent
Corr. coefficient= 0.993
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTA	CPM	CLC CPM	PCOFF	PROB	WT
118.931	0.876	11573	19.90	3	602.65	610.91	-1.353	0.64	1.0000
119.843	1.788	10613	14.40	15	762.24	750.74	1.532	0.61	0.6075
123.186	5.131	11299	10.92	16	1070.35	1055.06	1.450	0.62	0.3143
124.192	6.137	12606	11.75	4	1114.12	1105.72	0.759	0.79	0.3007
125.292	7.237	26689	23.79	16	1160.56	1148.02	1.092	0.68	0.3369
127.125	9.070	14930	13.03	4	1188.79	1196.18	-0.618	0.82	0.2773
129.121	11.066	16276	13.61	16	1238.36	1228.23	0.825	0.77	0.2615
130.219	12.164	12992	10.65	15	1253.38	1239.92	1.085	0.71	0.2382
131.279	13.224	0	28.54	15	1233.57	1248.51	-1.197	0.63	0.3140
132.274	14.219	12858	10.71	15	1234.69	1254.60	-1.587	0.57	0.2449
133.918	15.863	13498	11.10	15	1254.26	1261.83	-0.600	0.83	0.2412
135.780	17.725	0	63.17	4	1259.32	1267.08	-0.613	0.79	0.3468

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.6951
PPT. correction (3) = 0.9069 (recovery = 50.44 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 6.069112E-01

C-zero 2.1015E+03
P-factor 2.7470
dpm/smpl 5.7728E+03
dpm error 1.4688E+02
percent sigma 2.54 %
1 sigma

LTV 6.0152E+03

12th point MDA 2.3858E+00

26-JUN-95
15:57:45

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-316 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1303.78 2.65 Percent Corr. coefficient= 0.992
CPM at sep time= 477.84 4.29 Percent Chi square prob. = 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	13047	20.00	216	659.79	650.43	1.439	0.62	1.0000
119.987	1.932	16214	20.50	208	796.76	804.52	-0.964	0.73	0.7288
121.769	3.714	9761	10.00	201	983.47	989.13	-0.572	0.85	0.4094
122.740	4.685	15546	15.00	201	1044.25	1059.34	-1.424	0.61	0.4193
124.619	6.564	0	100.00	201	1142.24	1154.84	-1.091	0.63	0.5203
125.763	7.708	11920	10.00	203	1185.65	1192.21	-0.550	0.85	0.2981
126.975	8.920	18427	15.00	204	1228.05	1222.36	0.465	0.87	0.3164
129.062	11.007	12390	10.00	213	1254.64	1256.40	-0.140	0.96	0.2724
132.658	14.603	0	30.00	206	1278.92	1285.18	-0.487	0.85	0.3486
135.628	17.573	0	30.00	207	1288.39	1295.17	-0.524	0.83	0.3426
136.608	18.553	0	30.00	215	1348.27	1297.10	3.945	0.13	0.3159
136.983	18.928	0	30.00	210	1299.07	1297.72	0.104	0.97	0.3374

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.6951
PPT. correction (3) = 0.9069 (recovery = 50.44 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 6.069112E-01

1 sigma
C-zero 2.1482E+03 P-factor 0.0000 dpm/smpl 0.0000E-01 dpm error 0.0000E-01 percent sigma 2.65 %

LTV 0.0000E-01

5th point MDA 0.0000E-01

26-JUN-95
15:57:30

TMA Corporation
Pb210 Least Squares Analysis
PEBI V 1.04

1037-315 Sr
GRE SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1455.62 2.90 Percent Corr. coefficient= 0.994
CPM at sep time= 562.70 4.68 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	14925	20.00	215	750.33	749.28	0.140	0.96	1.0000
121.724	3.669	11019	10.00	216	1113.63	1111.46	0.196	0.95	0.4152
123.800	5.745	12289	10.00	201	1238.29	1254.85	-1.319	0.64	0.3469
124.619	6.564	0	100.00	202	1297.26	1294.61	0.205	0.93	0.5109
125.763	7.708	13352	10.00	202	1338.82	1335.01	0.286	0.92	0.3034
126.975	8.920	20353	15.00	203	1349.70	1367.61	-1.310	0.62	0.3346
129.062	11.007	14110	10.00	204	1410.58	1404.40	0.440	0.88	0.2774
129.633	11.578	0	30.00	206	1412.71	1411.54	0.083	0.97	0.3634
130.631	12.576	0	30.00	211	1432.71	1421.60	0.782	0.75	0.3524
132.606	14.551	0	30.00	212	1445.73	1435.25	0.731	0.77	0.3474
132.658	14.603	0	30.00	205	1432.24	1435.52	-0.228	0.93	0.3536
133.853	15.798	22436	15.69	210	1436.70	1440.86	-0.289	0.91	0.3042

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1)= 9.627E-01
Chemical yield (2)= 0.7656
PPT. correction (3)= 0.9082 (recovery = 50.00 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 6.694534E-01

1 sigma

C-zero 2.1743E+03 P-factor 0.0000 dpm/smpl 0.0000E-01 dpm error 0.0000E-01 percent sigma 2.90 %

LTV 0.0000E-01

4th point MDA 0.0000E-01

26-JUN-95
15:57:13

TMA Corporation
Pb210 Least Squares Analysis
PBEI V 1.04

1037-314 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1730.33 2.50 Percent Corr. coefficient= 0.993
CPM at sep time= 619.78 4.18 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	17087	20.00	214	859.03	851.84	0.843	0.76	1.0000
119.987	1.932	20808	20.50	206	1039.96	1059.03	-1.801	0.49	0.7259
121.724	3.669	13197	10.00	215	1325.91	1302.29	1.814	0.53	0.3894
123.800	5.745	14709	10.00	216	1488.17	1480.62	0.510	0.86	0.3205
124.619	6.564	0	100.00	203	1507.50	1530.07	-1.475	0.51	0.4853
126.975	8.920	24540	15.00	202	1642.16	1620.86	1.314	0.62	0.3002
128.739	10.684	0	30.00	208	1661.21	1661.17	0.003	1.00	0.3405
129.633	11.578	0	30.00	207	1664.57	1675.49	-0.652	0.79	0.3392
130.631	12.576	0	30.00	210	1698.76	1688.01	0.637	0.80	0.3271
131.629	13.574	0	30.00	212	1694.85	1697.67	-0.166	0.95	0.3287
132.606	14.551	0	30.00	211	1701.56	1704.98	-0.201	0.93	0.3254
132.658	14.603	0	30.00	204	1710.96	1705.32	0.331	0.89	0.3224

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1)= 9.627E-01
Chemical yield (2)= 0.9125
PPT. correction (3)= 0.8992 (recovery = 52.97 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 7.899066E-01

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
2.1905E+03	0.0000	0.0000E-01	0.0000E-01	2.50 %

LTV 0.0000E-01

5th point MDA 0.0000E-01

26-JUN-95
15:56:58

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-313 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 119.055 95
GMT at first count 119.987 95

First fit
Equilibrium CPM= 1711.65 4.07 Percent Corr. coefficient= 0.997
CPM at sep time= 572.66 7.63 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
119.987	1.932	20337	20.50	205	1013.53	1023.16	-0.942	0.72	1.0000
121.724	3.669	12691	10.00	214	1276.27	1272.65	0.284	0.92	0.5477
122.740	4.685	20737	15.00	214	1388.93	1374.57	1.045	0.70	0.5306
123.800	5.745	14767	10.00	215	1482.22	1455.55	1.832	0.52	0.4243
124.619	6.564	0	100.00	204	1510.66	1506.26	0.292	0.90	0.6375
125.763	7.708	15477	10.00	216	1567.43	1557.80	0.618	0.83	0.3866
126.975	8.920	23806	15.00	201	1597.74	1599.38	-0.103	0.97	0.4155
128.739	10.684	0	30.00	207	1619.50	1640.73	-1.294	0.59	0.4701
130.631	12.576	0	30.00	209	1687.85	1668.25	1.175	0.63	0.4370
131.629	13.574	0	30.00	211	1667.74	1678.16	-0.621	0.80	0.4449
132.606	14.551	0	30.00	210	1679.07	1685.66	-0.391	0.87	0.4402
132.658	14.603	0	30.00	203	1667.60	1686.01	-1.092	0.65	0.4447

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8954
PPT. correction (3) = 0.9220 (recovery = 45.48 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 7.948105E-01

C-zero 2.1535E+03
P-factor 0.0000
dpm/smpl 0.0000E-01
dpm error 0.0000E-01
percent sigma 4.07 %
1 sigma

LTV 0.0000E-01

5th point MDA 0.0000E-01

26-JUN-95
15:56:43

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-312 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1761.92 2.63 Percent Corr. coefficient= 0.991
CPM at sep time= 670.85 4.06 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	17846	20.00	212	902.58	898.84	0.417	0.88	1.0000
119.987	1.932	22339	20.43	204	1094.12	1102.39	-0.750	0.78	0.7174
121.724	3.669	13327	10.00	212	1348.27	1341.38	0.514	0.86	0.4124
122.740	4.685	21258	15.00	213	1428.07	1439.02	-0.761	0.77	0.4174
123.800	5.745	15132	10.00	214	1518.81	1516.59	0.146	0.96	0.3358
124.619	6.564	0	100.00	205	1570.80	1565.17	0.360	0.87	0.4898
125.763	7.708	16198	10.00	215	1630.75	1614.54	1.004	0.72	0.2975
128.739	10.684	0	30.00	206	1675.37	1693.98	-1.099	0.65	0.3658
129.751	11.696	16844	10.00	201	1697.45	1709.58	-0.710	0.80	0.2777
130.631	12.576	0	30.00	208	1722.88	1720.35	0.147	0.95	0.3466
131.629	13.574	0	30.00	210	1732.49	1729.83	0.154	0.95	0.3432
132.606	14.551	0	30.00	209	1748.81	1737.02	0.679	0.78	0.3379

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8825
PPT. correction (3) = 0.9436 (recovery = 38.42 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.016442E-01

C-zero 2.1979E+03 P-factor 0.0000 dpm/smpl 0.0000E-01
dpm error 0.0000E-01 percent sigma 2.63 %
1 sigma

LTV 0.0000E-01

6th point MDA 0.0000E-01

26-JUN-95
15:56:26

TMA Corporation
Pb210 Least Squares Analysis
PBEI V 1.04

1037-311 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1880.22 2.56 Percent Corr. coefficient= 0.992
CPM at sep time= 686.31 4.12 Percent Chi square prob. = 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	18798	20.00	211	938.42	935.79	0.281	0.92	1.0000
119.987	1.932	23754	20.42	203	1157.06	1158.52	-0.126	0.96	0.6971
121.724	3.669	13952	10.00	210	1407.35	1420.05	-0.894	0.75	0.4112
122.740	4.685	22845	15.00	212	1539.33	1526.89	0.815	0.76	0.3932
123.800	5.745	15964	10.00	213	1610.30	1611.77	-0.091	0.97	0.3265
124.619	6.564	0	100.00	206	1658.94	1664.93	-0.360	0.87	0.4744
125.763	7.708	17112	10.00	214	1719.31	1718.95	0.021	0.99	0.2914
128.739	10.684	0	30.00	205	1787.04	1805.87	-1.043	0.66	0.3487
129.633	11.578	0	30.00	204	1817.05	1821.27	-0.232	0.92	0.3372
130.631	12.576	0	30.00	207	1821.98	1834.73	-0.695	0.77	0.3359
131.629	13.574	0	30.00	209	1854.62	1845.11	0.516	0.83	0.3259
132.606	14.551	0	30.00	216	1888.18	1852.98	1.900	0.44	0.3152

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9487
PPT. correction (3) = 0.9453 (recovery = 37.86 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.633354E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.1779E+03 0.0000 0.0000E-01 0.0000E-01 2.56 %

LTV 0.0000E-01

6th point MDA 0.0000E-01

26-JUN-95
16:05:31

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-310 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1876.04 2.53 Percent Corr. coefficient= 0.992
CPM at sep time= 700.68 4.02 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	18747	20.00	210	945.38	946.29	-0.096	0.97	1.0000
119.987	1.932	23629	20.42	202	1160.24	1165.56	-0.456	0.86	0.7022
121.724	3.669	14161	10.00	209	1445.38	1423.02	1.572	0.58	0.3983
122.773	4.718	0	31.00	205	1533.31	1531.66	0.108	0.96	0.4685
123.800	5.745	25253	15.76	212	1619.55	1611.90	0.475	0.86	0.3676
124.619	6.564	0	100.00	207	1655.33	1664.09	-0.526	0.81	0.4804
128.739	10.684	0	30.00	204	1789.15	1802.85	-0.760	0.75	0.3504
129.633	11.578	0	30.00	203	1789.72	1818.01	-1.556	0.52	0.3499
130.631	12.576	0	30.00	206	1832.92	1831.25	0.091	0.97	0.3369
131.629	13.574	0	30.00	208	1825.72	1841.48	-0.855	0.72	0.3381
132.606	14.551	0	30.00	215	1900.76	1849.22	2.787	0.26	0.3141
133.853	15.798	28857	15.69	201	1855.31	1856.61	-0.070	0.98	0.2887

Elapsed time (days) = 440.555
Lambda ⇒ 8.626E-05 Reciprocal days
exp(-lambda X t) (1)= 9.627E-01
Chemical yield (2)= 0.9388
PPT. correction (3)= 0.9569 (recovery = 34.06 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 8.648351E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.1692E+03 0.0000 0.0000E-01 0.0000E-01 2.53 %

LTV 0.0000E-01

6th point MDA 0.0000E-01

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1895.57 2.61 Percent Corr. coefficient= 0.991
CPM at sep time= 738.57 3.96 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	19294	20.00	209	984.50	980.33	0.425	0.88	1.0000
119.987	1.932	24257	20.42	201	1196.97	1196.18	0.066	0.98	0.7120
121.724	3.669	14091	10.00	208	1419.87	1449.62	-2.052	0.46	0.4375
122.740	4.685	23179	15.00	210	1560.31	1553.16	0.461	0.86	0.4148
123.814	5.759	29389	18.00	204	1632.31	1636.54	-0.259	0.92	0.3989
124.619	6.564	0	100.00	208	1685.26	1686.93	-0.099	0.96	0.4967
125.763	7.708	17469	10.00	212	1767.44	1739.28	1.619	0.56	0.3008
128.739	10.684	0	30.00	203	1817.35	1823.52	-0.338	0.89	0.3639
129.633	11.578	0	30.00	202	1844.87	1838.44	0.350	0.89	0.3546
130.631	12.576	0	30.00	205	1838.11	1851.48	-0.722	0.76	0.3578
131.629	13.574	0	30.00	207	1862.78	1861.54	0.066	0.98	0.3485
132.606	14.551	0	30.00	214	1879.93	1869.16	0.576	0.81	0.3429

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1)= 9.627E-01
Chemical yield (2)= 0.9444
PPT. correction (3)= 0.9772 (recovery = 27.41 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 8.884331E-01

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
2.1336E+03	0.0000	0.0000E-01	0.0000E-01	2.61 %

LTV 0.0000E-01

6th point MDA 0.0000E-01

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1936.55 2.62 Percent Corr. coefficient= 0.991
CPM at sep time= 739.69 4.02 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	20086	20.00	208	1011.84	989.78	2.228	0.42	1.0000
119.948	1.893	24736	21.50	216	1162.78	1205.78	-3.567	0.16	0.7988
121.724	3.669	14610	10.00	207	1472.29	1475.24	-0.200	0.94	0.4328
122.740	4.685	23759	15.00	209	1615.16	1582.34	2.074	0.44	0.4118
123.800	5.745	26015	15.76	210	1666.81	1667.57	-0.046	0.99	0.3933
124.619	6.564	0	100.00	209	1720.89	1720.72	0.010	1.00	0.5030
125.763	7.708	17657	10.00	211	1761.62	1774.88	-0.747	0.78	0.3171
126.975	8.920	27269	15.00	212	1841.15	1818.57	1.241	0.64	0.3263
128.739	10.684	0	30.00	202	1873.21	1862.02	0.601	0.80	0.3630
129.633	11.578	0	30.00	201	1860.64	1877.45	-0.896	0.71	0.3677
130.631	12.576	0	30.00	204	1887.19	1890.94	-0.198	0.93	0.3578
131.629	13.574	0	30.00	206	1902.96	1901.35	0.085	0.97	0.3541

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1)= 9.627E-01
Chemical yield (2)= 0.9545
PPT. correction (3)= 0.9869 (recovery = 24.24 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 9.068174E-01

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
2.1355E+03	0.0000	0.0000E-01	0.0000E-01	2.62 %

LTV 0.0000E-01

6th point MDA 0.0000E-01

26-JUN-95
16:04:53

TMA Corporation
Pb210 Least Squares Analysis
PEBI V 1.04

1037-307 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1910.27 2.60 Percent Corr. coefficient= 0.991
CPM at sep time= 769.80 3.84 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	20230	20.00	207	1020.21	1008.11	1.200	0.66	1.0000
119.948	1.893	25513	21.50	215	1192.20	1213.93	-1.790	0.49	0.7741
121.724	3.667	14380	10.00	206	1473.51	1470.69	0.191	0.95	0.4404
122.740	4.685	23521	15.00	208	1581.68	1572.75	0.568	0.83	0.4321
124.619	6.564	0	100.00	210	1697.22	1704.61	-0.434	0.85	0.5231
125.763	7.708	17243	10.00	210	1737.70	1756.22	-1.055	0.70	0.3302
126.975	8.920	27340	15.00	211	1820.30	1797.85	1.248	0.64	0.3366
128.739	10.684	0	30.00	201	1824.32	1839.25	-0.812	0.74	0.3865
130.631	12.576	0	30.00	203	1873.57	1866.81	0.362	0.88	0.3674
131.629	13.574	0	30.00	205	1878.16	1876.73	0.076	0.97	0.3670
132.606	14.551	0	30.00	202	1891.02	1884.24	0.360	0.88	0.3617
132.660	14.605	0	30.00	212	1891.14	1884.61	0.347	0.89	0.3621

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9661
PPT. correction (3) = 0.9967 (recovery = 21.03 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.269671E-01

C-zero 2.0608E+03 P-factor 0.0000 dpm/smpl 0.0000E-01 dpm error 0.0000E-01 percent sigma 2.60 %
1 sigma

LTV 0.0000E-01

5th point MDA 0.0000E-01

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1985.96 2.58 Percent Corr. coefficient= 0.991
CPM at sep time= 767.28 3.93 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	20279	20.00	206	1038.87	1021.94	1.657	0.54	1.0000
119.948	1.893	25925	21.50	214	1212.60	1241.87	-2.357	0.36	0.7725
121.724	3.669	14577	10.00	205	1489.42	1516.24	-1.768	0.52	0.4441
122.740	4.685	24525	15.00	207	1649.32	1625.29	1.478	0.58	0.4127
123.801	5.746	17067	10.00	208	1721.56	1712.01	0.558	0.84	0.3450
125.763	7.708	18095	10.00	209	1843.43	1821.34	1.213	0.66	0.3074
126.975	8.920	27917	15.00	210	1875.62	1865.83	0.525	0.84	0.3288
129.062	11.007	19314	10.00	215	1946.47	1916.05	1.588	0.56	0.2789
129.633	11.578	0	30.00	212	1920.97	1925.79	-0.250	0.92	0.3619
130.631	12.576	0	30.00	202	1939.65	1939.52	0.007	1.00	0.3549
131.629	13.574	0	30.00	204	1938.96	1950.12	-0.572	0.81	0.3551
132.606	14.551	0	30.00	201	1934.46	1958.15	-1.210	0.61	0.3570

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8104
PPT. correction (3) = 1.0070 (recovery = 17.64 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 7.856148E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.5279E+03 0.0000 0.0000E-01 0.0000E-01 2.58 %

LTV 0.0000E-01

12th point MDA 0.0000E-01

26-JUN-95
16:04:28

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-305 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1937.95 2.93 Percent Corr. coefficient= 0.993
CPM at sep time= 807.61 4.33 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	20560	20.00	205	1051.29	1043.81	0.717	0.79	1.0000
121.724	3.669	14811	10.00	204	1482.16	1502.28	-1.339	0.63	0.4547
122.740	4.685	23080	15.00	206	1576.69	1603.43	-1.668	0.52	0.4580
123.801	5.746	16819	10.00	207	1696.64	1683.86	0.759	0.79	0.3614
124.619	6.564	0	100.00	212	1740.94	1734.12	0.393	0.86	0.5235
125.763	7.708	17645	10.00	208	1776.35	1785.27	-0.499	0.86	0.3337
126.975	8.920	26966	15.00	209	1831.43	1826.53	0.268	0.92	0.3512
129.062	11.007	18287	10.00	214	1842.89	1873.11	-1.613	0.55	0.3132
129.633	11.578	0	30.00	211	1880.40	1882.14	-0.093	0.97	0.3835
130.631	12.576	0	30.00	201	1885.84	1894.88	-0.477	0.84	0.3821
131.629	13.574	0	30.00	203	1912.70	1904.71	0.420	0.86	0.3715
132.658	14.603	0	30.00	215	1961.99	1912.50	2.588	0.30	0.3553

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t)^(1) = 9.627E-01
Chemical yield (2) = 0.9840
PPT. correction (3) = 1.0173 (recovery = 14.28 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.636774E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.0110E+03 0.0000 0.0000E-01 0.0000E-01 2.93 %

LTV 0.0000E-01

5th point MDA 0.0000E-01

26-JUN-95
16:04:16

TMA Corporation
Pb210 Least Squares Analysis
P8BI V 1.04

1037-304 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 2036.20 2.64 Percent Corr. coefficient= 0.990
CPM at sep time= 856.50 3.72 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	21960	20.00	204	1099.78	1103.01	-0.293	0.91	1.0000
119.948	1.893	28085	21.50	212	1321.54	1315.91	0.427	0.87	0.7382
121.724	3.669	15967	10.00	203	1588.33	1581.50	0.432	0.88	0.4386
122.740	4.685	24802	15.00	205	1689.50	1687.07	0.144	0.96	0.4408
123.801	5.746	17177	10.00	206	1761.92	1771.01	-0.514	0.85	0.3700
125.763	7.708	18437	10.00	207	1856.21	1876.85	-1.100	0.68	0.3363
126.976	8.921	28630	15.00	208	1921.52	1919.95	0.082	0.97	0.3499
129.062	11.007	19662	10.00	201	1979.53	1968.53	0.559	0.84	0.3008
129.633	11.578	0	30.00	210	2003.78	1977.96	1.305	0.59	0.3720
130.631	12.576	0	30.00	216	1939.61	1991.25	-2.594	0.27	0.3951
131.629	13.574	0	30.00	202	2011.16	2001.51	0.482	0.84	0.3691
132.658	14.603	0	30.00	214	2033.66	2009.64	1.195	0.62	0.3619

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t)^(1) = 9.627E-01
Chemical yield (2) = 1.0401
PPT. correction (3) = 1.0263 (recovery = 11.32 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.027612E+00

1 sigma

C-zero 1.9815E+03 P-factor 0.0000 dpm/smpl 0.0000E-01 dpm error 0.0000E-01 percent sigma 2.64 %

LTV 0.0000E-01

11th point MDA 0.0000E-01

26-JUN-95
16:04:03

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-303 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1936.42 2.91 Percent Corr. coefficient= 0.993
CPM at sep time= 824.63 4.25 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	21343	20.00	203	1061.43	1056.95	0.424	0.88	1.0000
121.724	3.669	15083	10.00	202	1512.44	1507.90	0.301	0.91	0.4501
122.740	4.685	24027	15.00	204	1599.78	1607.39	-0.473	0.86	0.4544
123.801	5.746	16165	10.00	205	1651.72	1686.50	-2.062	0.45	0.3890
125.763	7.708	17296	10.00	206	1770.67	1786.25	-0.872	0.75	0.3452
126.976	8.921	27106	15.00	207	1821.13	1826.86	-0.314	0.90	0.3624
129.062	11.007	18690	10.00	212	1892.88	1872.65	1.080	0.69	0.3066
129.633	11.578	0	30.00	209	1899.90	1881.53	0.976	0.69	0.3867
131.629	13.574	0	30.00	201	1873.27	1903.73	-1.600	0.50	0.3961
132.606	14.551	0	30.00	208	1903.57	1911.05	-0.391	0.87	0.3846
132.658	14.603	0	30.00	213	1934.43	1911.39	1.205	0.62	0.3738
133.853	15.798	30168	15.67	216	1951.77	1918.05	1.758	0.50	0.3241

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9620
PPT. correction (3) = 1.0396 (recovery = 6.980 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.627197E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.0114E+03 0.0000 0.0000E-01 0.0000E-01 2.91 %

LTV 0.0000E-01

9th point MDA 0.0000E-01

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1867.08 2.74 Percent Corr. coefficient= 0.989
CPM at sep time= 805.97 3.74 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	20491	20.00	202	1027.24	1027.70	-0.044	0.99	1.0000
119.948	1.893	26356	21.50	210	1236.48	1219.19	1.418	0.59	0.7365
121.724	3.669	14171	10.00	201	1428.00	1458.09	-2.063	0.46	0.4687
122.740	4.685	23676	15.00	203	1670.12	1553.04	1.100	0.68	0.4422
123.800	5.745	16236	10.00	204	1623.18	1628.48	-0.325	0.91	0.3755
124.619	6.564	0	100.00	215	1625.26	1675.73	-3.012	0.17	0.5751
125.763	7.708	17122	10.00	205	1744.39	1723.74	1.198	0.67	0.3335
126.976	8.921	25761	15.00	206	1759.89	1762.51	-0.148	0.95	0.3643
129.062	11.007	18304	10.00	211	1828.02	1806.20	1.208	0.66	0.3059
132.606	14.551	0	30.00	207	1844.78	1842.86	0.104	0.97	0.3838
132.658	14.603	0	30.00	208	1858.05	1843.18	0.806	0.74	0.3790
133.853	15.798	28971	15.67	213	1868.68	1849.53	1.035	0.69	0.3298

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 1.0006
PPT. correction (3) = 1.0498 (recovery = 3.630 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.011189E+00

1 sigma
C-zero P-factor dpm/smpl dpm error percent sigma
1.8464E+03 0.0000 0.0000E-01 0.0000E-01 2.74 %

LTV 0.0000E-01

6th point MDA 0.0000E-01

25-JUN-95
16:03:37

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-301 Sr
GRB SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 118.951 95

First fit
Equilibrium CPM= 1616.34 2.75 Percent
CPM at sep time= 713.10 2.71 Percent
Corr. coefficient= 0.989
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
118.951	0.896	17662	20.00	201	889.73	901.84	-1.343	0.62	1.0000
119.948	1.893	22935	21.50	209	1088.69	1064.85	2.239	0.41	0.7192
121.724	3.669	12512	10.00	213	1264.49	1268.20	-0.292	0.92	0.4489
122.740	4.685	19996	15.00	202	1336.68	1349.03	-0.915	0.73	0.4568
123.800	5.745	14271	10.00	203	1419.58	1413.24	0.448	0.88	0.3671
125.763	7.708	15203	10.00	204	1521.40	1494.33	1.812	0.53	0.3267
126.976	8.921	22571	15.00	205	1529.98	1527.33	0.173	0.95	0.3621
129.062	11.007	15824	10.00	210	1596.24	1564.52	2.027	0.48	0.3016
129.635	11.580	0	30.00	215	1528.79	1571.76	-2.734	0.25	0.4205
132.606	14.551	0	30.00	206	1583.39	1595.72	-0.773	0.75	0.3960
132.658	14.603	0	30.00	207	1596.27	1596.00	0.017	0.99	0.3887
133.853	15.798	25027	15.68	212	1611.65	1601.41	0.640	0.81	0.3335

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8655
PPT. correction (3) = 1.0561 (recovery = 1.570 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.799322E-01

C-zero 1.8369E+03 P-factor 0.0000
dpm/smpl 0.0000E-01
dpm error 0.0000E-01
percent sigma 2.75 %
1 sigma

LTV 0.0000E-01

11th point MDA 0.0000E-01

26-JUN-95
13:56:48

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-101 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 122.651 95

First fit
Equilibrium CPM= 1605.54 10.19 Percent Corr. coefficient= 0.999
CPM at sep time= 676.68 16.13 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
122.651	4.596	0	24.75	19	1315.21	1324.47	-0.699	0.78	1.0000
123.807	5.752	16167	10.78	19	1414.23	1397.08	1.228	0.67	0.7117
124.791	6.736	16349	10.65	19	1447.99	1444.07	0.272	0.92	0.6812
125.774	7.719	18829	12.04	19	1475.38	1480.45	-0.343	0.90	0.6832
126.724	8.669	17367	10.85	19	1510.41	1507.78	0.174	0.95	0.6373
128.828	10.773	17388	10.61	19	1546.76	1548.92	-0.140	0.96	0.6080
129.751	11.696	0	27.95	19	1561.30	1561.06	0.016	0.99	0.7547
130.767	12.712	16875	10.22	19	1558.59	1571.31	-0.810	0.77	0.5937
131.801	13.746	17022	10.02	19	1603.93	1579.37	1.555	0.59	0.5621
132.731	14.676	17638	10.54	19	1579.82	1584.99	-0.326	0.91	0.5853
134.015	15.960	16772	10.01	19	1581.79	1590.81	-0.567	0.84	0.5754
135.753	17.698	28331	16.77	19	1594.96	1596.17	-0.075	0.98	0.6500

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8655
PPT. correction (3) = 1.0561 (recovery = 1.570 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.797322E-01

C-zero 1.8246E+03 P-factor 2.7470 dpm/smpl 5.0122E+03 dpm error 5.1064E+02 percent sigma 10.19 %
1 sigma

LTV 5.8548E+03

7th point MDA 1.3247E+01

26-JUN-95
13:57:03

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-102 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.768 95

First fit
Equilibrium CPM= 1848.67 8.78 Percent Corr. coefficient= 0.999
CPM at sep time= 798.22 13.56 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.768	3.713	12353	8.04	19	1450.41	1448.31	0.145	0.96	1.0000
123.815	5.760	21075	12.37	19	1608.44	1613.44	-0.310	0.91	0.9517
124.799	6.744	21401	12.15	19	1663.41	1666.47	-0.183	0.95	0.8937
125.783	7.728	0	24.08	19	1712.91	1707.69	0.305	0.90	0.9951
126.731	8.676	19042	10.36	19	1736.40	1738.31	-0.110	0.97	0.7947
128.836	10.781	25498	13.49	19	1786.01	1784.79	0.068	0.98	0.8112
129.772	11.717	27961	14.65	19	1803.63	1798.58	0.281	0.92	0.8136
130.775	12.720	0	18.16	19	1815.86	1810.07	0.320	0.90	0.8447
131.809	13.754	0	18.40	19	1816.16	1819.16	-0.165	0.95	0.8469
132.738	14.683	20989	10.94	19	1813.18	1825.47	-0.673	0.80	0.7485
134.007	15.952	19853	10.24	19	1832.40	1831.98	0.023	0.99	0.7220
135.767	17.712	29390	15.08	19	1842.06	1838.11	0.215	0.93	0.7894

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 1.0006
PPT. correction (3) = 1.0498 (recovery = 3.630 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.011189E+00

C-zero 1.8282E+03 P-factor 2.7470 dpm/smpl 5.0221E+03
dpm error 4.4088E+02 percent sigma 8.78 %
1 sigma

LTV 5.7496E+03

9th point MDA 1.3471E+01

26-JUN-95
13:57:32

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-104 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.815 95

First fit
Equilibrium CPM= 1990.44 8.81 Percent Corr. coefficient= 0.998
CPM at sep time= 887.02 13.20 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.815	3.760	14031	8.40	19	1578.03	1575.01	0.192	0.95	1.0000
123.835	5.780	18565	10.02	19	1750.36	1744.57	0.331	0.91	0.8826
124.817	6.762	24306	12.89	19	1781.70	1799.95	-1.014	0.70	0.9153
125.813	7.758	32702	16.77	19	1843.01	1843.40	-0.022	0.99	0.9185
126.756	8.701	0	18.42	19	1875.04	1875.35	-0.017	0.99	0.9096
128.853	10.798	22858	11.15	19	1938.23	1923.62	0.760	0.78	0.7616
129.791	11.736	0	20.98	19	1948.40	1938.11	0.531	0.83	0.8727
130.797	12.742	0	27.45	19	1943.14	1950.16	-0.360	0.88	0.9235
131.892	13.837	28754	13.93	19	1951.77	1960.09	-0.425	0.87	0.7951
132.756	14.701	26268	12.65	19	1963.56	1966.18	-0.133	0.96	0.7686
133.994	15.939	16614	7.95	19	1976.19	1972.84	0.170	0.95	0.6712
135.909	17.854	0	20.48	19	1982.15	1979.75	0.121	0.96	0.8421

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 1.0401
PPT. correction (3) = 1.0263 (recovery = 11.32 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.027612E+00

C-zero 1.9370E+03 P-factor 2.7470
dpm/smpl 5.3208E+03
dpm error 4.6863E+02 percent sigma 8.81 %
1 sigma

LTV 6.0941E+03

Bth point MDA 1.1068E+01

26-JUN-95
13:57:46

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-105 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.821 95

First fit
Equilibrium CPM= 1895.51 7.70 Percent Corr. coefficient= 0.999
CPM at sep time= 792.02 12.19 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.821	3.766	0	60.59	19	1475.58	1482.64	-0.476	0.84	1.0000
123.890	5.835	27451	15.58	19	1663.86	1653.23	0.643	0.81	0.6206
124.826	6.771	30832	16.91	19	1722.34	1705.52	0.986	0.71	0.5954
125.869	7.814	0	23.13	19	1745.86	1750.67	-0.274	0.91	0.6222
126.769	8.714	30305	16.05	19	1784.12	1780.77	0.188	0.94	0.5527
128.862	10.807	19603	10.21	19	1814.41	1828.83	-0.789	0.77	0.4786
129.806	11.751	21842	11.13	19	1854.89	1843.33	0.627	0.82	0.4715
130.878	12.823	31724	16.25	19	1845.21	1856.02	-0.583	0.82	0.5223
131.902	13.847	0	21.14	19	1861.49	1865.25	-0.202	0.94	0.5444
132.774	14.719	23559	11.82	19	1884.19	1871.36	0.686	0.80	0.4661
133.986	15.931	20835	10.47	19	1881.15	1877.88	0.174	0.95	0.4528
135.924	17.869	19823	10.02	19	1870.05	1884.85	-0.785	0.77	0.4520

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9840
PPT. correction (3) = 1.0173 (recovery = 14.28 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.636774E-01

C-zero 1.9670E+03 P-factor 2.7470 dpm/smpl 5.4032E+03
1 sigma dpm error 4.1628E+02 percent sigma 7.70 %

LTV 6.0901E+03

9th point MDA 1.3123E+01

26-JUN-95
13:57:58

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-106 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.863 95

First fit
Equilibrium CPM= 1926.03 7.84 Percent Corr. coefficient= 0.999
CPM at sep time= 774.12 12.93 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.863	3.808	0	54.66	19	1501.17	1499.49	0.112	0.96	1.0000
123.901	5.846	17765	10.10	19	1660.98	1673.72	-0.761	0.78	0.5823
124.894	6.839	20009	10.83	19	1745.43	1731.07	0.830	0.76	0.5451
125.886	7.831	26542	14.09	19	1779.90	1775.37	0.255	0.92	0.5640
126.781	8.726	20561	10.80	19	1799.01	1806.57	-0.419	0.88	0.5170
128.907	10.852	0	19.67	19	1855.16	1857.29	-0.115	0.96	0.5656
129.814	11.759	25349	12.93	19	1853.02	1871.68	-0.997	0.71	0.5146
130.890	12.835	30993	15.48	19	1892.70	1884.93	0.412	0.87	0.5177
131.917	13.862	22104	10.91	19	1915.45	1894.54	1.104	0.69	0.4651
132.783	14.728	24051	12.03	19	1890.00	1900.88	-0.572	0.83	0.4882
133.978	15.923	20740	10.34	19	1896.22	1907.58	-0.596	0.83	0.4666
135.931	17.876	31682	15.53	19	1928.80	1914.92	0.724	0.78	0.5010

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9724
PPT. correction (3) = 1.0070 (recovery = 17.64 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.427378E-01

C-zero 2.0430E+03 P-factor 2.7470 dpm/smpl 5.6122E+03
1 sigma dpm error 4.3997E+02 percent sigma 7.84 %

LTV 6.3381E+03

12th point MDA 1.4666E+01

26-JUN-95
13:58:11

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-107 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.901 95

First fit
Equilibrium CPM= 1882.74 8.28 Percent Corr. coefficient= 0.999
CPM at sep time= 774.91 13.40 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.901	3.846	0	22.98	19	1470.01	1475.39	-0.365	0.89	1.0000
123.908	5.853	18081	10.31	19	1656.05	1640.53	0.946	0.74	0.6646
124.902	6.847	21429	12.00	19	1686.59	1695.65	-0.534	0.84	0.6713
125.896	7.841	0	24.11	19	1751.98	1738.35	0.784	0.76	0.7379
126.789	8.734	20137	10.79	19	1763.28	1768.09	-0.272	0.92	0.6041
128.921	10.866	19512	10.18	19	1811.29	1816.82	-0.304	0.91	0.5677
129.824	11.769	20975	10.82	19	1832.13	1830.60	0.084	0.98	0.5659
130.901	12.846	0	22.81	19	1834.95	1843.35	-0.456	0.85	0.6715
131.925	13.870	0	18.71	19	1869.60	1852.54	0.921	0.72	0.6231
132.792	14.737	0	18.10	19	1854.06	1858.62	-0.246	0.92	0.6279
133.971	15.916	21210	10.88	19	1842.57	1864.97	-1.201	0.66	0.5611
135.942	17.887	0	20.86	19	1882.82	1872.09	0.573	0.82	0.6296

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9661
PPT. correction (3) = 0.9967 (recovery = 21.03 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.269671E-01

C-zero 2.0311E+03 P-factor 2.7470 dpm/smpl 5.5794E+03 dpm error 4.6220E+02 percent sigma 8.28 %

LTV 6.3420E+03

12th point MDA 1.2794E+01

26-JUN-95
13:58:23

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-108 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.917 95

First fit

Equilibrium CPM= 1899.56 8.80 Percent Corr. coefficient= 0.999
CPM at sep time= 740.65 15.05 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.917	3.862	17775	11.34	19	1479.97	1474.76	0.354	0.90	1.0000
123.916	5.861	21818	12.46	19	1653.49	1646.76	0.409	0.88	0.8475
124.910	6.855	17985	10.03	19	1693.61	1704.21	-0.622	0.82	0.7663
125.913	7.858	24400	13.32	19	1730.48	1749.04	-1.061	0.69	0.7966
126.797	8.742	0	49.94	19	1779.40	1780.29	-0.050	0.98	0.9822
128.928	10.873	19380	10.01	19	1829.72	1830.72	-0.055	0.98	0.6706
129.831	11.776	21709	11.15	19	1840.18	1845.11	-0.267	0.92	0.6837
130.917	12.862	0	26.33	19	1869.55	1858.54	0.592	0.81	0.8062
131.938	13.883	28348	14.38	19	1863.39	1868.06	-0.250	0.92	0.7130
132.804	14.749	0	17.39	19	1884.75	1874.41	0.552	0.83	0.7301
133.964	15.909	20487	10.30	19	1880.25	1880.94	-0.037	0.99	0.6448
135.957	17.902	20268	10.11	19	1895.19	1888.46	0.356	0.90	0.6329

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9545
PPT. correction (3) = 0.9869 (recovery = 24.24 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.068174E-01

C-zero 2.0948E+03 P-factor 2.7470 dpm/smpl 5.7543E+03 dpm error 5.0628E+02 percent sigma 8.80 %
1 sigma

LTV 6.5896E+03

5th point MDA 1.0919E+01

26-JUN-95
13:58:35

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-109 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.926 95

First fit
Equilibrium CPM= 1856.79 8.52 Percent Corr. coefficient= 0.999
CPM at sep time= 680.34 15.47 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.926	3.871	23448	15.50	19	1427.86	1426.72	0.080	0.98	1.0000
123.925	5.870	22970	13.51	19	1605.11	1600.79	0.270	0.92	0.7872
124.918	6.863	28228	16.13	19	1652.59	1659.01	-0.387	0.88	0.7819
125.923	7.868	26024	14.46	19	1699.91	1704.40	-0.263	0.92	0.7246
126.832	8.777	19569	10.61	19	1742.45	1736.39	0.349	0.90	0.6403
128.935	10.880	32320	17.16	19	1779.64	1787.08	-0.417	0.87	0.6961
129.899	11.844	0	17.98	19	1799.20	1802.52	-0.184	0.94	0.6899
130.936	12.881	27478	14.36	19	1808.33	1815.31	-0.385	0.88	0.6490
131.953	13.898	20326	10.41	19	1845.49	1824.93	1.127	0.68	0.5769
132.817	14.762	24576	12.72	19	1826.05	1831.33	-0.288	0.91	0.6192
133.944	15.889	32150	16.53	19	1838.28	1837.80	0.027	0.99	0.6517
135.964	17.909	25665	13.11	19	1850.36	1845.54	0.261	0.92	0.6097

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9444
PPT. correction (3) = 0.9772 (recovery = 27.41 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.884331E-01

1 sigma
C-zero P-factor dpm/smpl dpm error percent sigma
2.0900E+03 2.7470 5.7411E+03 4.8896E+02 8.52 %

LTV 6.5479E+03

11th point MDA 1.5502E+01

26-JUN-95
15:29:24

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-110 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.954 95

First fit
Equilibrium CPM= 1828.32 8.54 Percent Corr. coefficient= 0.999
CPM at sep time= 661.42 15.71 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.954	3.899	26194	17.52	19	1411.00	1404.91	0.434	0.87	1.0000
123.935	5.880	18914	11.37	19	1570.15	1575.01	-0.309	0.91	0.7416
124.930	6.875	0	20.84	19	1637.03	1632.84	0.257	0.92	0.8007
125.933	7.878	21508	12.30	19	1651.26	1677.53	-1.566	0.56	0.6945
126.840	8.785	19320	10.65	19	1713.60	1709.15	0.260	0.93	0.6265
128.948	10.893	18640	10.01	19	1759.35	1759.37	-0.001	1.00	0.5886
129.953	11.898	26861	14.33	19	1771.12	1775.23	-0.231	0.93	0.6390
130.947	12.892	18919	10.04	19	1780.58	1787.29	-0.375	0.89	0.5770
131.961	13.906	20323	10.66	19	1801.63	1796.79	0.270	0.92	0.5748
132.872	14.817	0	22.96	19	1812.31	1803.46	0.491	0.85	0.6812
133.956	15.901	20054	10.38	19	1825.94	1809.53	0.907	0.74	0.5576
135.974	17.919	0	18.71	19	1814.34	1817.20	-0.157	0.95	0.6513

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9388
PPT. correction (3) = 0.9569 (recovery = 34.06 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 9.648351E-01

C-zero 2.1141E+03 P-factor 2.7470 dpm/smpl 5.8074E+03 dpm error 4.9584E+02 percent sigma 8.54 %
1 sigma

LTV 6.6255E+03

10th point MDA 1.3691E+01

26-JUN-95
15:29:43

TMA Corporation
Pb210 Least Squares Analysis
PBEI V 1.04

1037-111 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 122.668 95

First fit
Equilibrium CPM= 1832.15 9.82 Percent Corr. coefficient= 0.999
CPM at sep time= 640.79 18.76 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
122.668	4.613	0	26.59	19	1475.82	1473.29	0.172	0.95	1.0000
123.943	5.888	0	21.64	19	1570.05	1574.30	-0.270	0.92	0.8569
124.944	6.889	19625	11.30	19	1639.92	1633.12	0.416	0.88	0.6769
125.974	7.919	23712	13.37	19	1674.97	1679.85	-0.290	0.91	0.6823
126.847	8.792	19245	10.68	19	1702.06	1710.70	-0.505	0.85	0.6251
128.955	10.900	18775	10.06	19	1763.31	1761.89	0.081	0.98	0.5785
129.963	11.908	23785	12.57	19	1788.02	1778.08	0.559	0.84	0.5994
130.953	12.898	27550	14.59	19	1784.31	1790.34	-0.337	0.90	0.6243
131.969	13.914	0	27.99	19	1801.42	1800.07	0.075	0.98	0.7051
132.888	14.833	0	19.43	19	1800.95	1806.86	-0.327	0.90	0.6556
133.935	15.880	21466	11.11	19	1826.08	1812.87	0.729	0.79	0.5596
136.015	17.960	23455	12.20	19	1816.93	1820.91	-0.219	0.93	0.5784

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9487
PPT. correction (3) = 0.9453 (recovery = 37.86 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.633354E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.1222E+03 2.7470 5.8296E+03 5.7271E+02 9.82 %

LTV 6.7746E+03

9th point MDA 1.2650E+01

26-JUN-95
15:30:15

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-112 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 122.688 95

First fit
Equilibrium CPM= 1718.02 10.97 Percent
CPM at sep time= 601.63 21.02 Percent
Corr. coefficient= 0.999
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
122.688	4.633	10122	6.95	19	1374.28	1382.89	-0.622	0.84	0.9286
123.958	5.903	17143	10.89	19	1485.13	1477.10	0.544	0.85	0.9391
124.953	6.898	28335	17.39	19	1537.73	1532.05	0.371	0.89	1.0000
125.984	7.929	24923	14.95	19	1573.65	1575.69	-0.130	0.96	0.9254
126.870	8.815	18084	10.64	19	1604.63	1604.89	-0.016	1.00	0.8171
128.962	10.907	21012	12.07	19	1643.88	1652.30	-0.510	0.85	0.8115
129.972	11.917	31354	17.59	19	1683.57	1667.48	0.965	0.71	0.8547
130.964	12.909	22124	12.35	19	1692.10	1678.94	0.784	0.77	0.7765
131.988	13.933	25498	14.40	19	1672.37	1688.07	-0.930	0.72	0.8243
132.902	14.847	0	31.99	19	1694.21	1694.43	-0.013	1.00	0.9552
133.918	15.863	20693	11.59	19	1686.41	1699.87	-0.791	0.77	0.7680
136.024	17.969	18286	10.09	19	1711.97	1707.51	0.261	0.93	0.7204

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8825
PPT. correction (3) = 0.9436 (recovery = 38.42 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 8.016442E-01

C-zero 2.1431E+03
P-factor 2.7470
dpm/smpl 5.8871E+03
dpm error 6.4565E+02
percent sigma 10.97 %
1 sigma

LTV 6.9525E+03

10th point MDA 1.2439E+01

26-JUN-95
15:30:42

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-113 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 122.692 95

First fit
Equilibrium CPM= 1656.83 9.90 Percent Corr. coefficient= 0.999
CPM at sep time= 610.63 17.95 Percent Chi square prob. = 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
122.692	4.637	0	38.63	19	1340.73	1343.99	-0.242	0.92	1.0000
123.966	5.911	22154	14.47	19	1444.04	1431.60	0.869	0.75	0.7048
124.965	6.910	16592	10.70	19	1462.78	1482.99	-1.362	0.62	0.6341
125.994	7.939	16496	10.03	19	1552.30	1523.73	1.875	0.51	0.5623
126.878	8.823	29632	18.03	19	1551.19	1551.10	0.006	1.00	0.6568
128.971	10.916	18540	11.08	19	1579.56	1595.38	-0.992	0.72	0.5615
129.985	11.930	18266	10.79	19	1598.24	1609.60	-0.706	0.80	0.5462
130.973	12.918	20084	11.80	19	1607.01	1620.29	-0.820	0.76	0.5547
131.999	13.944	0	38.60	19	1629.26	1628.90	0.022	0.99	0.7010
132.924	14.869	0	33.12	19	1642.48	1634.85	0.467	0.85	0.6725
133.927	15.872	19428	11.12	19	1649.95	1639.86	0.616	0.82	0.5215
136.031	17.976	19182	10.96	19	1652.84	1647.00	0.355	0.90	0.5178

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.8954
PPT. correction (3) = 0.9220 (recovery = 45.48 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 7.948105E-01

C-zero P-factor dpm/smpl dpm error percent sigma
2.0846E+03 2.7470 5.7263E+03 5.6690E+02 9.90 %

LTV 6.6617E+03

9th point MDA 1.1638E+01

26-JUN-95
15:31:02

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-114 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 122.719 95

First fit
Equilibrium CPM= 1684.50 10.62 Percent Corr. coefficient= 0.999
CPM at sep time= 569.82 21.02 Percent Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
122.719	4.664	16139	11.32	19	1345.03	1352.70	-0.568	0.84	0.9352
123.976	5.921	18645	12.10	19	1453.44	1445.10	0.577	0.84	0.8346
124.973	6.918	0	35.78	19	1509.01	1500.08	0.595	0.81	1.0000
126.002	7.947	16437	10.09	19	1537.42	1542.99	-0.361	0.90	0.7198
126.891	8.836	0	31.92	19	1570.46	1572.37	-0.122	0.96	0.9108
128.979	10.924	21872	12.76	19	1618.42	1619.18	-0.047	0.99	0.7034
129.992	11.937	19273	11.16	19	1630.72	1634.28	-0.218	0.94	0.6696
130.981	12.926	28321	16.26	19	1644.82	1645.67	-0.051	0.98	0.7267
132.026	13.971	28668	16.38	19	1652.84	1654.89	-0.124	0.96	0.7218
132.948	14.893	0	26.44	19	1665.07	1661.22	0.232	0.93	0.7904
133.909	15.854	19526	11.07	19	1665.89	1666.33	-0.026	0.99	0.6440
136.040	17.985	17855	10.08	19	1672.97	1674.05	-0.064	0.98	0.6228

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.9125
PPT. correction (3) = 0.8992 (recovery = 52.97 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 7.899066E-01

C-zero 2.1325E+03 P-factor 2.7470 dpm/smpl 5.8581E+03 1 sigma dpm error 6.2199E+02 percent sigma 10.62 %

LTV 6.8843E+03

10th point MDA 1.3914E+01

26-JUN-95
15:31:24

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-115 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 122.728 95

First fit
Equilibrium CPM= 1422.54 11.28 Percent
CPM at sep time= 528.80 20.36 Percent
Corr. coefficient= 0.999
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
122.728	4.673	12439	10.12	19	1157.71	1157.10	0.053	0.99	1.0000
123.985	5.930	13030	10.01	19	1225.71	1231.00	-0.430	0.88	0.9053
124.998	6.943	15094	11.13	19	1277.62	1275.31	0.181	0.95	0.8723
126.157	8.102	27680	19.72	19	1322.85	1313.65	0.700	0.79	0.9592
126.914	8.859	14290	10.09	19	1334.87	1333.00	0.140	0.96	0.7861
128.988	10.933	16663	11.55	19	1360.03	1370.29	-0.749	0.79	0.7930
130.001	11.946	20058	13.76	19	1374.37	1382.38	-0.579	0.83	0.8183
130.993	12.938	26813	18.28	19	1383.06	1391.51	-0.607	0.82	0.8710
132.038	13.983	14990	10.00	19	1413.72	1398.87	1.062	0.71	0.7114
132.966	14.911	18500	12.43	19	1403.61	1403.94	-0.024	0.99	0.7673
133.901	15.846	16125	10.77	19	1412.04	1407.95	0.291	0.92	0.7288
136.047	17.992	20992	13.99	19	1415.14	1414.18	0.068	0.98	0.7815

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.7656
PPT. correction (3) = 0.9082 (recovery = 50.00 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 6.694534E-01

C-zero 2.1249E+03
P-factor 2.7470
dpm/smpl 5.8372E+03
dpm error 6.5846E+02
percent sigma 11.28 %
1 sigma

LTV 6.9237E+03

8th point MDA 2.0853E+01

26-JUN-95
15:31:48

TMA Corporation
Pb210 Least Squares Analysis
PBEI V 1.04

1037-116 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.938 95

First fit
Equilibrium CPM= 1270.59 7.85 Percent
CPM at sep time= 448.45 14.58 Percent
Corr. coefficient= 0.999
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.938	3.883	24598	23.81	19	970.72	971.20	-0.049	0.99	1.0000
122.756	4.701	15821	14.43	19	1031.19	1028.27	0.284	0.92	0.7854
123.993	5.938	0	53.45	19	1094.31	1095.44	-0.104	0.97	0.9589
125.006	6.951	20518	17.08	19	1130.19	1135.50	-0.468	0.86	0.7040
126.186	8.131	13517	10.85	19	1172.58	1171.09	0.128	0.97	0.5792
126.921	8.866	0	38.94	19	1193.66	1188.58	0.427	0.86	0.7727
128.997	10.942	15058	11.67	19	1214.97	1222.63	-0.626	0.83	0.5578
130.010	11.955	0	50.76	19	1236.86	1233.85	0.244	0.92	0.7601
131.006	12.951	0	49.08	19	1240.35	1242.21	-0.150	0.95	0.7518
132.045	13.990	31075	23.41	19	1250.38	1248.87	0.121	0.96	0.6386
132.975	14.920	22244	16.67	19	1257.04	1253.52	0.281	0.92	0.5819
133.893	15.838	14955	11.23	19	1254.47	1257.13	-0.211	0.94	0.5223

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1) = 9.627E-01
Chemical yield (2) = 0.6951
PPT. correction (3) = 0.9069 (recovery = 50.44 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 6.069112E-01

C-zero 2.0935E+03
P-factor 2.7470
dpm/smpl 5.7509E+03
dpm error 4.5117E+02
percent sigma 7.85 %
1 sigma

LTV 6.4953E+03

9th point MDA 1.3821E+01

1037 Raw Counting Data, page 1

1037-101		Sr							PRFD
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.122.651	MEW	19	24.75	34512	1315.49	0.5%	14.3470	0.9532	0
2.123.807	MEW	19	10.78	16167	1413.81	0.8%	14.1859	0.9517	0
3.124.791	MEW	19	10.65	16349	1447.56	0.8%	14.1176	0.9517	0
4.125.774	MEW	19	12.04	18829	1474.96	0.7%	14.0997	0.9517	0
5.126.724	MEW	19	10.85	17367	1510.40	0.8%	14.0840	0.9520	0
6.128.828	MEW	19	10.61	17388	1546.67	0.8%	14.0838	0.9519	0
7.129.751	MEW	19	27.95	46231	1561.21	0.5%	14.0348	0.9519	0
8.130.767	MEW	19	10.22	16875	1558.50	0.8%	14.0031	0.9519	0
9.131.801	MEW	19	10.02	17022	1603.54	0.8%	14.0027	0.9518	0
10.132.731	MEW	19	10.54	17638	1579.44	0.8%	13.9554	0.9518	0
11.134.015	MEW	19	10.01	16772	1581.41	0.8%	13.9776	0.9518	0
12.135.753	MEW	19	16.77	28331	1594.78	0.6%	14.0064	0.9519	0

1037-102		Sr							PRFD
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.121.768	MEW	19	8.04	12353	1450.71	0.9%	14.5005	0.9532	0
2.123.815	MEW	19	12.37	21075	1607.96	0.7%	14.1859	0.9517	0
3.124.799	MEW	19	12.15	21401	1662.92	0.7%	14.1176	0.9517	0
4.125.783	MEW	19	24.08	43666	1712.41	0.5%	14.0997	0.9517	0
5.126.731	MEW	19	10.36	19042	1736.39	0.7%	14.0840	0.9520	0
6.128.836	MEW	19	13.49	25498	1785.90	0.6%	14.0838	0.9519	0
7.129.772	MEW	19	14.65	27961	1803.52	0.6%	14.0348	0.9519	0
8.130.775	MEW	19	18.16	34893	1815.76	0.5%	14.0031	0.9519	0
9.131.809	MEW	19	18.40	35360	1815.73	0.5%	14.0027	0.9518	0
10.132.738	MEW	19	10.94	20989	1812.74	0.7%	13.9554	0.9518	0
11.134.007	MEW	19	10.24	19853	1831.96	0.7%	13.9776	0.9518	0
12.135.767	MEW	19	15.08	29390	1841.85	0.6%	14.0064	0.9519	0

1037-103		Sr							PRFD
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.121.774	MEW	19	57.40	89430	1471.28	0.3%	14.5005	0.9532	0
2.123.824	MEW	19	14.61	25260	1631.98	0.6%	14.1859	0.9517	0
3.124.808	MEW	19	13.13	23411	1683.49	0.7%	14.1176	0.9517	0
4.125.800	MEW	19	17.80	33164	1759.79	0.6%	14.0997	0.9517	0
5.126.739	MEW	19	24.23	45382	1769.65	0.5%	14.0840	0.9520	0
6.128.846	MEW	19	10.84	21111	1840.51	0.7%	14.0838	0.9519	0
7.129.782	MEW	19	13.12	25466	1834.37	0.6%	14.0348	0.9519	0
8.130.788	MEW	19	11.70	22819	1843.29	0.7%	14.0031	0.9519	0
9.131.823	MEW	19	21.27	41994	1865.78	0.5%	14.0027	0.9518	0
10.132.746	MEW	19	12.99	25563	1859.71	0.6%	13.9554	0.9518	0
11.134.000	MEW	19	10.00	19912	1881.86	0.7%	13.9776	0.9518	0
12.135.898	MEW	19	15.84	31254	1864.85	0.6%	14.0064	0.9519	0

1037-104		Sr							PRFD
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.121.815	MEW	19	8.40	14031	1578.36	0.9%	14.5005	0.9532	0
2.123.835	MEW	19	10.02	18565	1749.84	0.7%	14.1859	0.9517	0
3.124.817	MEW	19	12.89	24306	1781.17	0.6%	14.1176	0.9517	0
4.125.813	MEW	19	16.77	32702	1842.47	0.6%	14.0997	0.9517	0
5.126.756	MEW	19	18.42	36539	1875.03	0.5%	14.0840	0.9520	0
6.128.853	MEW	19	11.15	22858	1938.12	0.7%	14.0838	0.9519	0
7.129.791	MEW	19	20.98	43233	1948.29	0.5%	14.0348	0.9519	0
8.130.797	MEW	19	27.45	56413	1943.03	0.4%	14.0031	0.9519	0
9.131.892	MEW	19	13.93	28754	1951.30	0.6%	14.0027	0.9518	0
10.132.756	MEW	19	12.65	26268	1963.09	0.6%	13.9554	0.9518	0
11.133.994	MEW	19	7.95	16614	1975.72	0.8%	13.9776	0.9518	0
12.135.909	MEW	19	20.48	42928	1981.93	0.5%	14.0064	0.9519	0

1037-105		Sr							PRFD
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.121.821	MEW	19	60.59	94693	1475.88	0.3%	14.5005	0.9532	0
2.123.890	MEW	19	15.58	27451	1663.37	0.6%	14.1859	0.9517	0
3.124.826	MEW	19	16.91	30832	1721.83	0.6%	14.1176	0.9517	0
4.125.869	MEW	19	23.13	42744	1745.36	0.5%	14.0997	0.9517	0
5.126.769	MEW	19	16.05	30305	1784.11	0.6%	14.0840	0.9520	0
6.128.862	MEW	19	10.21	19603	1814.31	0.7%	14.0838	0.9519	0

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7.129.806	MEW	19	11.13	21842	1854.78	0.7%	14.0348	0.9519	0
8.130.878	MEW	19	16.25	31724	1845.10	0.6%	14.0031	0.9519	0
9.131.902	MEW	19	21.14	41632	1861.04	0.5%	14.0027	0.9518	0
10.132.774	MEW	19	11.82	23559	1883.74	0.7%	13.9554	0.9518	0
11.133.986	MEW	19	10.47	20835	1880.69	0.7%	13.9776	0.9518	0
12.135.924	MEW	19	10.02	19823	1869.84	0.7%	14.0064	0.9519	0

1037-106									
GMT	Sr	Det	Min.	Counts	CPM	Error	BKG	SF	PRFD CF
1.121.863	MEW	19	54.66	86893	1501.48	0.3%	14.5005	0.9532	0
2.123.901	MEW	19	10.10	17765	1660.49	0.8%	14.1859	0.9517	0
3.124.894	MEW	19	10.83	20009	1744.91	0.7%	14.1176	0.9517	0
4.125.886	MEW	19	14.09	26542	1779.39	0.6%	14.0997	0.9517	0
5.126.781	MEW	19	10.80	20561	1799.00	0.7%	14.0840	0.9520	0
6.128.907	MEW	19	19.67	38608	1855.06	0.5%	14.0838	0.9519	0
7.129.814	MEW	19	12.93	25349	1852.91	0.6%	14.0348	0.9519	0
8.130.890	MEW	19	15.48	30993	1892.59	0.6%	14.0031	0.9519	0
9.131.917	MEW	19	10.91	22104	1914.99	0.7%	14.0027	0.9518	0
10.132.783	MEW	19	12.03	24051	1889.55	0.7%	13.9554	0.9518	0
11.133.978	MEW	19	10.34	20740	1895.76	0.7%	13.9776	0.9518	0
12.135.931	MEW	19	15.53	31682	1928.58	0.6%	14.0064	0.9519	0

1037-107									
GMT	Sr	Det	Min.	Counts	CPM	Error	BKG	SF	PRFD CF
1.121.901	MEW	19	22.98	35780	1470.31	0.5%	14.5005	0.9532	0
2.123.908	MEW	19	10.31	18081	1655.56	0.8%	14.1859	0.9517	0
3.124.902	MEW	19	12.00	21429	1686.10	0.7%	14.1176	0.9517	0
4.125.896	MEW	19	24.11	44710	1751.48	0.5%	14.0997	0.9517	0
5.126.789	MEW	19	10.79	20137	1763.27	0.7%	14.0840	0.9520	0
6.128.921	MEW	19	10.18	19512	1811.18	0.7%	14.0838	0.9519	0
7.129.824	MEW	19	10.82	20975	1832.02	0.7%	14.0348	0.9519	0
8.130.901	MEW	19	22.81	44285	1834.84	0.5%	14.0031	0.9519	0
9.131.925	MEW	19	18.71	37006	1869.15	0.5%	14.0027	0.9518	0
10.132.792	MEW	19	18.10	35503	1853.61	0.5%	13.9554	0.9518	0
11.133.971	MEW	19	10.88	21210	1842.12	0.7%	13.9776	0.9518	0
12.135.942	MEW	19	20.86	41548	1882.61	0.5%	14.0064	0.9519	0

1037-108									
GMT	Sr	Det	Min.	Counts	CPM	Error	BKG	SF	PRFD CF
1.121.917	MEW	19	11.34	17775	1480.28	0.8%	14.5005	0.9532	0
2.123.916	MEW	19	12.46	21818	1653.00	0.7%	14.1859	0.9517	0
3.124.910	MEW	19	10.03	17985	1693.11	0.8%	14.1176	0.9517	0
4.125.913	MEW	19	13.32	24400	1729.98	0.6%	14.0997	0.9517	0
5.126.797	MEW	19	49.94	94047	1779.39	0.3%	14.0840	0.9520	0
6.128.928	MEW	19	10.01	19380	1829.62	0.7%	14.0838	0.9519	0
7.129.831	MEW	19	11.15	21709	1840.07	0.7%	14.0348	0.9519	0
8.130.917	MEW	19	26.33	52076	1869.44	0.4%	14.0031	0.9519	0
9.131.938	MEW	19	14.38	28348	1862.94	0.6%	14.0027	0.9518	0
10.132.804	MEW	19	17.39	34671	1884.29	0.5%	13.9554	0.9518	0
11.133.964	MEW	19	10.30	20487	1879.80	0.7%	13.9776	0.9518	0
12.135.957	MEW	19	10.11	20268	1894.97	0.7%	14.0064	0.9519	0

1037-109									
GMT	Sr	Det	Min.	Counts	CPM	Error	BKG	SF	PRFD CF
1.121.926	MEW	19	15.50	23448	1428.15	0.7%	14.5005	0.9532	0
2.123.925	MEW	19	13.51	22970	1604.63	0.7%	14.1859	0.9517	0
3.124.918	MEW	19	16.13	28228	1652.10	0.6%	14.1176	0.9517	0
4.125.923	MEW	19	14.46	26024	1699.42	0.6%	14.0997	0.9517	0
5.126.832	MEW	19	10.61	19569	1742.45	0.7%	14.0840	0.9520	0
6.128.935	MEW	19	17.16	32320	1779.53	0.6%	14.0838	0.9519	0
7.129.899	MEW	19	17.98	34233	1799.09	0.5%	14.0348	0.9519	0
8.130.936	MEW	19	14.36	27478	1808.23	0.6%	14.0031	0.9519	0
9.131.953	MEW	19	10.41	20326	1845.05	0.7%	14.0027	0.9518	0
10.132.817	MEW	19	12.72	24576	1825.61	0.6%	13.9554	0.9518	0
11.133.944	MEW	19	16.53	32150	1837.84	0.6%	13.9776	0.9518	0
12.135.964	MEW	19	13.11	25665	1850.16	0.6%	14.0064	0.9519	0

1037-110									
GMT	Sr	Det	Min.	Counts	CPM	Error	BKG	SF	PRFD CF

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1.121.954	MEW	19	17.52	26194	1411.30	0.6%	14.5005	0.9532	0
2.123.935	MEW	19	11.37	18914	1569.68	0.7%	14.1859	0.9517	0
3.124.930	MEW	19	20.84	36130	1636.54	0.5%	14.1176	0.9517	0
4.125.933	MEW	19	12.30	21508	1650.79	0.7%	14.0997	0.9517	0
5.126.840	MEW	19	10.65	19320	1713.59	0.7%	14.0840	0.9520	0
6.128.948	MEW	19	10.01	18640	1759.25	0.7%	14.0838	0.9519	0
7.129.953	MEW	19	14.33	26861	1771.02	0.6%	14.0348	0.9519	0
8.130.947	MEW	19	10.04	18919	1780.48	0.7%	14.0031	0.9519	0
9.131.961	MEW	19	10.66	20323	1801.20	0.7%	14.0027	0.9518	0
10.132.872	MEW	19	22.96	44029	1811.87	0.5%	13.9554	0.9518	0
11.133.956	MEW	19	10.38	20054	1825.50	0.7%	13.9776	0.9518	0
12.135.974	MEW	19	18.71	35920	1814.14	0.5%	14.0064	0.9519	0

1037-111		Sr	PRFD						
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.122.668	MEW	19	26.59	41559	1476.13	0.5%	14.3470	0.9532	0
2.123.943	MEW	19	21.64	35996	1569.59	0.5%	14.1859	0.9517	0
3.124.944	MEW	19	11.30	19625	1639.44	0.7%	14.1176	0.9517	0
4.125.974	MEW	19	13.37	23712	1674.49	0.7%	14.0997	0.9517	0
5.126.847	MEW	19	10.68	19245	1702.06	0.7%	14.0840	0.9520	0
6.128.955	MEW	19	10.06	18775	1763.21	0.7%	14.0838	0.9519	0
7.129.963	MEW	19	12.57	23785	1787.91	0.7%	14.0348	0.9519	0
8.130.953	MEW	19	14.59	27550	1784.21	0.6%	14.0031	0.9519	0
9.131.969	MEW	19	27.99	53356	1800.99	0.4%	14.0027	0.9518	0
10.132.888	MEW	19	19.43	37028	1800.52	0.5%	13.9554	0.9518	0
11.133.935	MEW	19	11.11	21466	1825.64	0.7%	13.9776	0.9518	0
12.136.015	MEW	19	12.20	23455	1816.72	0.7%	14.0064	0.9519	0

1037-112		Sr	PRFD						
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.122.688	MEW	19	6.95	10122	1374.57	1.0%	14.3470	0.9532	0
2.123.958	MEW	19	10.89	17143	1484.69	0.8%	14.1859	0.9517	0
3.124.953	MEW	19	17.39	28335	1537.28	0.6%	14.1176	0.9517	0
4.125.984	MEW	19	14.95	24923	1573.19	0.6%	14.0997	0.9517	0
5.126.870	MEW	19	10.64	18084	1604.63	0.8%	14.0840	0.9520	0
6.128.962	MEW	19	12.07	21012	1643.78	0.7%	14.0838	0.9519	0
7.129.972	MEW	19	17.59	31354	1683.47	0.6%	14.0348	0.9519	0
8.130.964	MEW	19	12.35	22124	1692.00	0.7%	14.0031	0.9519	0
9.131.988	MEW	19	14.40	25498	1671.97	0.6%	14.0027	0.9518	0
10.132.902	MEW	19	31.99	57377	1693.81	0.4%	13.9554	0.9518	0
11.133.918	MEW	19	11.59	20693	1686.01	0.7%	13.9776	0.9518	0
12.136.024	MEW	19	10.09	18286	1711.77	0.7%	14.0064	0.9519	0

1037-113		Sr	PRFD						
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.122.692	MEW	19	38.63	54901	1341.01	0.4%	14.3470	0.9532	0
2.123.966	MEW	19	14.47	22154	1443.61	0.7%	14.1859	0.9517	0
3.124.965	MEW	19	10.70	16592	1462.35	0.8%	14.1176	0.9517	0
4.125.994	MEW	19	10.03	16496	1551.85	0.8%	14.0997	0.9517	0
5.126.878	MEW	19	18.03	29632	1551.18	0.6%	14.0840	0.9520	0
6.128.971	MEW	19	11.08	18540	1579.47	0.7%	14.0838	0.9519	0
7.129.985	MEW	19	10.79	18266	1598.15	0.7%	14.0348	0.9519	0
8.130.973	MEW	19	11.80	20084	1606.91	0.7%	14.0031	0.9519	0
9.131.999	MEW	19	38.60	66601	1628.87	0.4%	14.0027	0.9518	0
10.132.924	MEW	19	33.12	57604	1642.09	0.4%	13.9554	0.9518	0
11.133.927	MEW	19	11.12	19428	1649.56	0.7%	13.9776	0.9518	0
12.136.031	MEW	19	10.96	19182	1652.66	0.7%	14.0064	0.9519	0

1037-114		Sr	PRFD						
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.122.719	MEW	19	11.32	16139	1345.31	0.8%	14.3470	0.9532	0
2.123.976	MEW	19	12.10	18645	1453.01	0.7%	14.1859	0.9517	0
3.124.973	MEW	19	35.78	57220	1508.57	0.4%	14.1176	0.9517	0
4.126.002	MEW	19	10.09	16437	1536.98	0.8%	14.0997	0.9517	0
5.126.891	MEW	19	31.92	53106	1570.45	0.4%	14.0840	0.9520	0
6.128.979	MEW	19	12.76	21872	1618.33	0.7%	14.0838	0.9519	0
7.129.992	MEW	19	11.16	19273	1630.62	0.7%	14.0348	0.9519	0
8.130.981	MEW	19	16.26	28321	1644.73	0.6%	14.0031	0.9519	0

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9.132.026	MEW	19	16.38	28668	1652.45	0.6%	14.0027	0.9518	0
10.132.948	MEW	19	26.44	46613	1664.66	0.5%	13.9554	0.9518	0
11.133.909	MEW	19	11.07	19526	1665.49	0.7%	13.9776	0.9518	0
12.136.040	MEW	19	10.08	17855	1672.78	0.8%	14.0064	0.9519	0

1037-115		Sr	Min.	Counts	CPM	Error	BKG	PRFD	
GMT	Det							SF	CF
1.122.728	MEW	19	10.12	12439	1157.95	0.9%	14.3470	0.9532	0
2.123.985	MEW	19	10.01	13030	1225.35	0.9%	14.1859	0.9517	0
3.124.998	MEW	19	11.13	15094	1277.24	0.8%	14.1176	0.9517	0
4.126.157	MEW	19	19.72	27680	1322.47	0.6%	14.0997	0.9517	0
5.126.914	MEW	19	10.09	14290	1334.86	0.8%	14.0840	0.9520	0
6.128.988	MEW	19	11.55	16663	1359.95	0.8%	14.0838	0.9519	0
7.130.001	MEW	19	13.76	20058	1374.29	0.7%	14.0348	0.9519	0
8.130.993	MEW	19	18.28	26813	1382.98	0.6%	14.0031	0.9519	0
9.132.038	MEW	19	10.00	14990	1413.38	0.8%	14.0027	0.9518	0
10.132.966	MEW	19	12.43	18500	1403.27	0.7%	13.9554	0.9518	0
11.133.901	MEW	19	10.77	16125	1411.70	0.8%	13.9776	0.9518	0
12.136.047	MEW	19	13.99	20992	1414.98	0.7%	14.0064	0.9519	0

1037-116		Sr	Min.	Counts	CPM	Error	BKG	PRFD	
GMT	Det							SF	CF
1.121.938	MEW	19	23.81	24598	970.92	0.7%	14.5005	0.9532	0
2.122.756	MEW	19	14.43	15821	1031.41	0.8%	14.3470	0.9532	0
3.123.993	MEW	19	53.45	62198	1093.98	0.4%	14.1859	0.9517	0
4.125.006	MEW	19	17.08	20518	1129.85	0.7%	14.1176	0.9517	0
5.126.186	MEW	19	10.85	13517	1172.25	0.9%	14.0997	0.9517	0
6.126.921	MEW	19	38.94	49373	1193.65	0.5%	14.0840	0.9520	0
7.128.997	MEW	19	11.67	15058	1214.90	0.8%	14.0838	0.9519	0
8.130.010	MEW	19	50.76	66661	1236.79	0.4%	14.0348	0.9519	0
9.131.006	MEW	19	49.08	64633	1240.28	0.4%	14.0031	0.9519	0
10.132.045	MEW	19	23.41	31075	1250.08	0.6%	14.0027	0.9518	0
11.132.975	MEW	19	16.67	22244	1256.73	0.7%	13.9554	0.9518	0
12.133.893	MEW	19	11.23	14955	1254.17	0.8%	13.9776	0.9518	0
13.136.058	MEW	19	11.49	15593	1278.48	0.8%	14.0064	0.9519	0

1037-201		Sr	Min.	Counts	CPM	Error	BKG	PRFD	
GMT	Det							SF	CF
1.118.287	LBG	3	13.69	9009	682.02	1.1%	0.4134	1.0370	0 *HELD*
2.118.810	LBG	15	21.96	18006	842.29	0.7%	0.6587	1.0281	0
3.123.022	LBG	3	13.37	15926	1234.75	0.8%	0.4134	1.0369	0 *HELD*
4.124.142	LBG	16	10.29	13786	1385.58	0.9%	0.5480	1.0346	0
5.125.234	LBG	3	24.28	30939	1319.10	0.6%	0.4134	1.0355	0 *HELD*
6.127.096	LBG	15	11.14	16187	1491.65	0.8%	0.6587	1.0270	0
7.129.072	LBG	3	14.13	19081	1391.51	0.7%	0.4212	1.0308	0 *HELD*
8.130.208	LBG	4	11.51	17640	1526.95	0.8%	0.5420	0.9967	0
9.131.252	LBG	4	10.39	15949	1529.40	0.8%	0.5420	0.9967	0
10.132.226	LBG	16	11.91	17425	1518.90	0.8%	0.5530	1.0386	0
11.133.221	LBG	4	10.30	15810	1533.76	0.8%	0.5420	0.9996	0
12.133.927	LBG	15	10.53	15625	1531.18	0.8%	0.6643	1.0324	0
13.135.741	LBG	3	16.29	22346	1415.71	0.7%	0.4228	1.0324	0

1037-202		Sr	Min.	Counts	CPM	Error	BKG	PRFD	
GMT	Det							SF	CF
1.118.287	LBG	4	13.70	11498	869.65	0.9%	0.5561	1.0369	0
2.118.810	LBG	16	21.97	20427	961.65	0.7%	0.5480	1.0349	0
3.119.804	LBG	15	17.12	19115	1148.75	0.7%	0.6587	1.0295	0
4.123.022	LBG	4	13.37	19430	1508.74	0.7%	0.5498	1.0386	0
5.124.142	LBG	3	10.29	14462	1454.94	0.8%	0.4134	1.0355	0 *HELD*
6.125.234	LBG	4	24.28	38019	1625.85	0.5%	0.5498	1.0387	0
7.126.224	LBG	15	10.93	17685	1662.80	0.8%	0.6587	1.0281	0
8.127.096	LBG	16	11.14	18223	1694.60	0.7%	0.5480	1.0363	0
9.129.083	LBG	3	12.86	20079	1608.97	0.7%	0.4212	1.0308	0 *HELD*
10.130.208	LBG	3	11.51	17877	1597.95	0.7%	0.4212	1.0291	0 *HELD*
11.131.252	LBG	15	10.39	17661	1746.96	0.8%	0.6643	1.0281	0
12.132.274	LBG	16	10.71	17928	1737.93	0.7%	0.5530	1.0386	0
13.133.252	LBG	3	12.59	19268	1577.05	0.7%	0.4212	1.0308	0
14.133.935	LBG	16	10.20	17313	1766.09	0.8%	0.5530	1.0408	0
15.135.741	LBG	4	16.30	29295	1801.78	0.6%	0.5509	1.0028	0

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1037-203		Sr						PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.118.287	LBG	15	13.70	11515	863.05	0.9%	0.6587	1.0276	0
2.118.799	LBG	15	14.88	14246	983.60	0.8%	0.6587	1.0281	0
3.119.804	LBG	16	17.12	19568	1182.96	0.7%	0.5480	1.0355	0
4.123.151	LBG	15	10.47	16004	1572.92	0.8%	0.6587	1.0295	0
5.124.142	LBG	4	10.29	16103	1624.87	0.8%	0.5498	1.0387	0
6.125.252	LBG	3	10.81	16506	1580.74	0.8%	0.4134	1.0355	0 *HELD*
7.126.224	LBG	16	10.93	18582	1759.71	0.7%	0.5480	1.0354	0
8.127.096	LBG	3	11.13	17515	1625.32	0.8%	0.4134	1.0331	0 *HELD*
9.129.083	LBG	15	12.87	21509	1717.60	0.7%	0.6643	1.0281	0
10.130.219	LBG	4	10.65	19634	1836.91	0.7%	0.5420	0.9967	0
11.131.252	LBG	16	10.39	18069	1800.91	0.7%	0.5530	1.0359	0
12.132.226	LBG	3	11.92	19393	1676.53	0.7%	0.4212	1.0308	0 *HELD*
13.133.229	LBG	4	19.48	35711	1831.90	0.5%	0.5420	0.9996	0
14.133.896	LBG	3	6.52	10701	1693.48	1.0%	0.4212	1.0321	0
15.135.741	LBG	15	16.30	28476	1804.57	0.6%	0.6713	1.0334	0

1037-204		Sr						PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.118.287	LBG	16	13.70	11763	887.76	0.9%	0.5480	1.0346	0
2.118.799	LBG	16	14.88	14500	1007.90	0.8%	0.5480	1.0349	0
3.119.804	LBG	3	17.11	19410	1175.90	0.7%	0.4134	1.0369	0
4.123.151	LBG	16	10.47	16871	1667.95	0.8%	0.5480	1.0355	0
5.124.142	LBG	15	10.29	17463	1748.16	0.8%	0.6587	1.0305	0
6.125.252	LBG	4	10.81	17900	1719.35	0.7%	0.5498	1.0387	0
7.126.224	LBG	3	10.92	16874	1598.59	0.8%	0.4134	1.0348	0 *HELD*
8.127.096	LBG	4	11.14	19196	1787.27	0.7%	0.5498	1.0375	0
9.129.083	LBG	16	12.87	23718	1908.45	0.6%	0.5530	1.0359	0
10.130.208	LBG	15	11.51	21368	1908.04	0.7%	0.6643	1.0281	0
11.131.252	LBG	3	10.39	16869	1670.41	0.8%	0.4212	1.0291	0 *HELD*
12.132.235	LBG	4	42.89	82215	1915.53	0.3%	0.5420	0.9996	0
13.133.221	LBG	15	10.30	19166	1914.81	0.7%	0.6643	1.0294	0
14.133.901	LBG	3	11.13	19250	1784.62	0.7%	0.4212	1.0321	0

1037-205		Sr						PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.118.826	LBG	3	11.55	10225	917.70	1.0%	0.4134	1.0371	0
2.119.818	LBG	16	19.01	21675	1180.06	0.7%	0.5480	1.0355	0
3.123.036	LBG	3	20.38	28376	1443.35	0.6%	0.4134	1.0369	0 *HELD*
4.124.150	LBG	4	11.21	17539	1624.53	0.8%	0.5498	1.0387	0
5.125.260	LBG	3	12.98	19514	1556.37	0.7%	0.4134	1.0355	0 *HELD*
6.127.104	LBG	15	13.89	23823	1760.80	0.6%	0.6587	1.0270	0
7.129.092	LBG	3	11.82	18660	1626.83	0.7%	0.4212	1.0308	0 *HELD*
8.130.208	LBG	16	11.52	20505	1843.25	0.7%	0.5530	1.0359	0
9.131.261	LBG	4	10.37	19154	1840.39	0.7%	0.5420	0.9967	0
10.132.226	LBG	15	11.91	21180	1829.94	0.7%	0.6643	1.0294	0
11.133.221	LBG	16	10.30	18371	1851.80	0.7%	0.5530	1.0386	0
12.133.893	LBG	4	10.38	19350	1872.43	0.7%	0.5420	1.0047	0
13.135.753	LBG	3	17.07	27687	1674.01	0.6%	0.4228	1.0324	0

1037-206		Sr						PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.118.826	LBG	15	11.55	10831	963.40	1.0%	0.6587	1.0281	0
2.119.818	LBG	3	19.00	21286	1161.28	0.7%	0.4134	1.0369	0
3.123.036	LBG	4	20.39	31345	1596.00	0.6%	0.5498	1.0386	0
4.124.150	LBG	16	11.21	18342	1692.32	0.7%	0.5480	1.0346	0
5.125.260	LBG	4	13.00	22077	1763.34	0.7%	0.5498	1.0387	0
6.126.233	LBG	15	10.75	18737	1791.26	0.7%	0.6587	1.0281	0
7.127.104	LBG	16	13.89	24791	1849.00	0.6%	0.5480	1.0363	0
8.129.092	LBG	15	11.82	21132	1837.45	0.7%	0.6643	1.0281	0
9.130.219	LBG	3	10.65	17713	1711.17	0.8%	0.4212	1.0291	0 *HELD*
10.131.261	LBG	3	10.37	16878	1674.52	0.8%	0.4212	1.0291	0 *HELD*
11.132.266	LBG	4	10.57	20400	1928.63	0.7%	0.5420	0.9996	0
12.133.229	LBG	16	19.49	35294	1880.14	0.5%	0.5530	1.0386	0
13.133.935	LBG	15	10.19	18746	1898.48	0.7%	0.6643	1.0324	0
14.135.753	LBG	4	17.07	32667	1918.58	0.6%	0.5509	1.0028	0

1037-207 Sr PRFD

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GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF
1.118.783	LBG	15	18273	919.31	0.7%	0.6587	1.0281	0
2.119.818	LBG	4	21370	1167.55	0.7%	0.5498	1.0386	0
3.123.158	LBG	15	22690	1558.64	0.7%	0.6587	1.0295	0
4.124.150	LBG	3	11.20	16311	1507.65	0.8%	0.4134	1.0355 0 *HELD*
5.125.269	LBG	3	10.58	16317	1596.61	0.8%	0.4134	1.0355 0 *HELD*
6.126.233	LBG	16	10.75	18111	1743.82	0.7%	0.5480	1.0354 0
7.127.104	LBG	3	13.89	22065	1640.69	0.7%	0.4134	1.0331 0 *HELD*
8.129.062	LBG	3	14.65	23338	1641.63	0.7%	0.4212	1.0308 0 *HELD*
9.130.229	LBG	4	15.73	29136	1845.57	0.6%	0.5420	0.9967 0
10.131.261	LBG	16	10.37	18372	1834.65	0.7%	0.5530	1.0359 0
11.132.266	LBG	15	10.57	18512	1802.19	0.7%	0.6643	1.0294 0
12.133.243	LBG	4	11.78	21516	1825.17	0.7%	0.5420	0.9996 0
13.133.927	LBG	16	10.54	18732	1849.23	0.7%	0.5530	1.0408 0
14.135.753	LBG	15	17.08	30590	1850.03	0.6%	0.6713	1.0334 0

1037-208		Sr							PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.783	LBG	16	20.50	18610	938.92	0.7%	0.5480	1.0349 0		
2.119.818	LBG	15	19.00	21397	1158.66	0.7%	0.6587	1.0295 0		
3.123.158	LBG	16	14.98	22865	1579.94	0.7%	0.5480	1.0355 0		
4.124.150	LBG	15	11.21	17862	1641.31	0.7%	0.6587	1.0305 0		
5.125.269	LBG	4	10.58	16733	1642.17	0.8%	0.5498	1.0387 0		
6.126.233	LBG	3	10.75	16789	1615.69	0.8%	0.4134	1.0348 0 *HELD*		
7.127.104	LBG	4	13.89	23131	1727.23	0.7%	0.5498	1.0375 0		
8.129.092	LBG	16	11.82	20755	1818.36	0.7%	0.5530	1.0359 0		
9.130.229	LBG	3	15.73	24944	1631.49	0.6%	0.4212	1.0291 0 *HELD*		
10.131.261	LBG	15	10.37	18462	1829.75	0.7%	0.6643	1.0281 0		
11.132.235	LBG	3	42.88	68890	1655.55	0.4%	0.4212	1.0308 0 *HELD*		
12.133.252	LBG	4	12.59	23326	1851.41	0.7%	0.5420	0.9996 0		
13.133.909	LBG	3	10.47	16976	1672.98	0.8%	0.4212	1.0321 0		

1037-209		Sr							PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.826	LBG	16	11.55	10049	899.84	1.0%	0.5480	1.0349 0		
2.119.833	LBG	3	14.18	14758	1078.78	0.8%	0.4134	1.0369 0		
3.123.051	LBG	3	12.26	16506	1395.64	0.8%	0.4134	1.0369 0 *HELD*		
4.124.160	LBG	4	23.09	35853	1612.24	0.5%	0.5498	1.0387 0		
5.125.277	LBG	3	19.18	27763	1498.49	0.6%	0.4134	1.0355 0 *HELD*		
6.127.115	LBG	15	13.13	21986	1719.07	0.7%	0.6587	1.0270 0		
7.129.101	LBG	3	13.51	21303	1624.92	0.7%	0.4212	1.0308 0 *HELD*		
8.130.219	LBG	16	10.65	18291	1778.53	0.7%	0.5530	1.0359 0		
9.131.269	LBG	4	10.92	19566	1785.27	0.7%	0.5420	0.9967 0		
10.132.235	LBG	15	42.89	74544	1788.45	0.4%	0.6643	1.0294 0		
11.133.229	LBG	15	19.48	34182	1805.64	0.5%	0.6643	1.0294 0		
12.133.901	LBG	4	11.13	19916	1797.32	0.7%	0.5420	1.0047 0		

1037-210		Sr							PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.908	LBG	3	15.34	12678	856.70	0.9%	0.4134	1.0371 0		
2.119.833	LBC	4	14.18	15150	1109.04	0.8%	0.5498	1.0386 0		
3.123.051	LBG	4	12.26	17561	1487.06	0.8%	0.5498	1.0386 0		
4.124.160	LBG	15	23.10	35498	1582.89	0.5%	0.6587	1.0305 0		
5.125.277	LBG	4	19.19	29768	1610.65	0.6%	0.5498	1.0387 0		
6.126.247	LBG	15	17.18	28376	1697.41	0.6%	0.6587	1.0281 0		
7.127.115	LBG	16	13.13	21946	1731.51	0.7%	0.5480	1.0363 0		
8.129.101	LBG	15	13.51	22459	1708.50	0.7%	0.6643	1.0281 0		
9.130.229	LBG	16	15.73	27081	1782.82	0.6%	0.5530	1.0359 0		
10.131.269	LBG	3	10.92	17059	1607.22	0.8%	0.4212	1.0291 0 *HELD*		
11.132.266	LBG	3	10.57	16552	1613.66	0.8%	0.4212	1.0308 0 *HELD*		
12.133.243	LBG	16	11.78	20479	1804.92	0.7%	0.5530	1.0386 0		
13.133.943	LBG	15	17.67	30094	1757.53	0.6%	0.6643	1.0324 0		
14.135.767	LBG	3	15.70	24762	1627.79	0.6%	0.4228	1.0324 0		

1037-211		Sr							PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.908	LBG	15	15.35	13812	924.39	0.9%	0.6587	1.0281 0		
2.119.833	LBG	16	14.19	15217	1109.84	0.8%	0.5480	1.0355 0		

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3.123.178	LBG	15	10.82	16313	1551.42	0.8%	0.6587	1.0295	0	
4.124.160	LBG	3	23.09	32916	1475.77	0.6%	0.4134	1.0355	0	*HELD*
5.125.278	LBG	15	18.30	29545	1663.04	0.6%	0.6587	1.0305	0	
6.126.247	LBG	16	17.18	28030	1688.74	0.6%	0.5480	1.0354	0	
7.127.115	LBG	3	13.12	20343	1601.42	0.7%	0.4134	1.0331	0	*HELD*
8.129.101	LBG	16	13.51	23239	1781.29	0.7%	0.5530	1.0359	0	
9.130.242	LBG	4	22.43	40862	1815.17	0.5%	0.5420	0.9967	0	
10.131.269	LBG	16	10.92	18839	1786.52	0.7%	0.5530	1.0359	0	
11.132.226	LBG	4	11.91	21501	1803.98	0.7%	0.5420	0.9996	0	
12.133.221	LBG	3	10.30	16832	1683.99	0.8%	0.4212	1.0308	0	*HELD*
13.133.909	LBG	4	10.47	18919	1814.97	0.7%	0.5420	1.0047	0	
14.135.767	LBG	4	15.71	28775	1836.27	0.6%	0.5509	1.0028	0	

1037-212		Sr	PRFD							
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.908	LBG	16	15.35	12943	872.05	0.9%	0.5480	1.0349	0	
2.119.833	LBG	15	14.19	14464	1048.67	0.8%	0.6587	1.0295	0	
3.123.178	LBG	16	10.83	15360	1468.02	0.8%	0.5480	1.0355	0	
4.124.182	LBG	3	13.19	17780	1395.45	0.8%	0.4134	1.0355	0	*HELD*
5.125.278	LBG	16	18.31	27694	1564.33	0.6%	0.5480	1.0346	0	
6.126.247	LBG	3	16.89	23945	1466.61	0.6%	0.4134	1.0348	0	*HELD*
7.127.115	LBG	4	13.13	20172	1593.42	0.7%	0.5498	1.0375	0	
8.129.113	LBG	3	11.82	17684	1541.72	0.8%	0.4212	1.0308	0	*HELD*
9.130.258	LBG	4	23.01	38950	1686.58	0.5%	0.5420	0.9967	0	
10.131.269	LBG	15	10.92	17817	1676.83	0.7%	0.6643	1.0281	0	
11.132.274	LBG	4	10.70	18270	1706.21	0.7%	0.5420	0.9996	0	
12.133.243	LBG	15	11.78	19301	1685.95	0.7%	0.6643	1.0294	0	
13.133.943	LBG	16	17.68	28929	1702.50	0.6%	0.5530	1.0408	0	
14.135.767	LBG	15	15.71	25460	1673.99	0.6%	0.6713	1.0334	0	

1037-213		Sr	PRFD							
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.920	LBG	3	14.72	10923	769.15	1.0%	0.4134	1.0371	0	
2.119.843	LBG	4	14.40	14094	1015.93	0.8%	0.5498	1.0386	0	
3.123.061	LBG	3	21.44	24787	1198.39	0.6%	0.4134	1.0369	0	*HELD*
4.124.182	LBG	15	13.20	19008	1483.23	0.7%	0.6587	1.0305	0	
5.125.292	LBG	3	23.79	31907	1388.41	0.6%	0.4134	1.0355	0	*HELD*
6.127.125	LBG	15	13.03	19430	1530.80	0.7%	0.6587	1.0270	0	
7.129.113	LBG	15	11.83	18789	1632.27	0.7%	0.6643	1.0281	0	
8.130.242	LBG	16	22.43	35406	1634.59	0.5%	0.5530	1.0359	0	
9.131.279	LBG	4	28.53	45769	1598.38	0.5%	0.5420	0.9967	0	
10.132.235	LBG	16	42.89	67465	1633.06	0.4%	0.5530	1.0386	0	
11.133.252	LBG	16	12.59	20010	1650.07	0.7%	0.5530	1.0386	0	
12.133.918	LBG	3	11.10	16681	1550.58	0.8%	0.4212	1.0321	0	*HELD*

1037-214		Sr	PRFD							
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.920	LBG	15	14.74	11902	829.46	0.9%	0.6587	1.0281	0	
2.119.843	LBG	3	14.40	13442	967.53	0.9%	0.4134	1.0369	0	*HELD*
3.123.061	LBG	4	21.44	27608	1336.78	0.6%	0.5498	1.0386	0	
4.124.182	LBG	16	13.20	18810	1473.79	0.7%	0.5480	1.0346	0	
5.125.292	LEC	4	23.79	34700	1514.44	0.5%	0.5498	1.0387	0	
6.126.260	LBG	15	11.91	18202	1570.55	0.7%	0.6587	1.0281	0	
7.127.125	LBG	16	13.03	20020	1591.63	0.7%	0.5480	1.0363	0	
8.129.113	LBG	16	11.83	18763	1642.40	0.7%	0.5530	1.0359	0	
9.130.242	LBG	3	22.41	32174	1477.06	0.6%	0.4212	1.0291	0	*HELD*
10.131.279	LBG	16	28.54	45200	1640.00	0.5%	0.5530	1.0359	0	
11.132.274	LBG	3	10.70	15150	1458.99	0.8%	0.4212	1.0308	0	*HELD*
12.133.252	LBG	15	12.59	20148	1646.69	0.7%	0.6643	1.0294	0	
13.133.918	LBG	4	11.10	18276	1653.73	0.7%	0.5420	1.0047	0	
14.135.780	LBG	15	63.17	102902	1682.61	0.3%	0.6713	1.0334	0	

1037-215		Sr	PRFD							
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.920	LBG	16	14.74	10346	725.83	1.0%	0.5480	1.0349	0	
2.119.843	LBG	15	14.40	12177	869.86	0.9%	0.6587	1.0295	0	
3.123.186	LBG	15	10.91	12609	1189.11	0.9%	0.6587	1.0295	0	
4.124.182	LBG	4	13.20	15706	1235.30	0.8%	0.5498	1.0387	0	
5.125.292	LBG	15	23.79	29706	1286.08	0.6%	0.6587	1.0305	0	

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6.126.260	LBG	16	11.91	15365	1335.20	0.8%	0.5480	1.0354	0	
7.127.125	LBG	3	13.03	15555	1232.86	0.8%	0.4134	1.0331	0	*HELD*
8.129.121	LBG	15	13.61	18303	1381.99	0.7%	0.6643	1.0281	0	
9.130.297	LBG	4	12.97	18155	1394.58	0.7%	0.5420	0.9967	0	
10.131.279	LBG	3	28.50	34750	1254.36	0.5%	0.4212	1.0291	0	*HELD*
11.132.266	LBG	16	10.57	14344	1408.81	0.8%	0.5530	1.0386	0	
12.133.229	LBG	3	19.48	24191	1279.59	0.6%	0.4212	1.0308	0	*HELD*
13.133.918	LBG	16	11.10	14929	1399.30	0.8%	0.5530	1.0408	0	
14.135.780	LBG	3	63.17	78980	1290.29	0.4%	0.4228	1.0324	0	

1037-216		Sr						PRFD		
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.931	LBG	3	19.90	11573	602.71	0.9%	0.4134	1.0371	0	
2.119.843	LBG	16	14.40	10613	762.59	1.0%	0.5480	1.0355	0	
3.123.186	LBG	16	10.92	11299	1070.84	0.9%	0.5480	1.0355	0	
4.124.192	LBG	4	11.75	12606	1113.78	0.9%	0.5498	1.0387	0	
5.125.292	LBG	16	23.79	26689	1160.15	0.6%	0.5480	1.0346	0	
6.126.260	LBG	3	11.90	12043	1046.81	0.9%	0.4134	1.0348	0	*HELD*
7.127.125	LBG	4	13.03	14930	1188.25	0.8%	0.5498	1.0375	0	
8.129.121	LBG	16	13.61	16276	1238.23	0.8%	0.5530	1.0359	0	
9.130.219	LBG	15	10.65	12992	1253.56	0.9%	0.6643	1.0281	0	
10.131.279	LBG	15	28.54	34266	1233.74	0.5%	0.6643	1.0281	0	
11.132.274	LBG	15	10.71	12858	1235.18	0.9%	0.6643	1.0294	0	
12.133.243	LBG	3	11.78	13222	1156.49	0.9%	0.4212	1.0308	0	*HELD*
13.133.918	LBG	15	11.10	13498	1254.70	0.9%	0.6643	1.0324	0	
14.135.780	LBG	4	63.17	79348	1259.11	0.4%	0.5509	1.0028	0	

1037-301		Sr						PRFD		
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.951	GRB	201	20.00	17662	889.92	0.8%	0.4304	1.0082	0	
2.119.948	GRB	209	21.50	22935	1088.37	0.7%	0.4447	1.0207	0	
3.121.724	GRB	213	10.00	12512	1264.69	0.9%	0.4671	1.0112	0	
4.122.740	GRB	202	15.00	19996	1336.93	0.7%	0.3807	1.0032	0	
5.123.800	GRB	203	10.00	14271	1419.83	0.8%	0.3894	0.9952	0	
6.124.619	GRB	216	100.00	135515	1371.57	0.3%	0.3776	1.0124	0	*HELD*
7.125.763	GRB	204	10.00	15203	1520.73	0.8%	0.4161	1.0006	0	
8.126.976	GRB	205	15.00	22571	1529.31	0.7%	0.3323	1.0166	0	
9.129.062	GRB	210	10.00	15824	1595.52	0.8%	0.3974	1.0085	0	
10.129.635	GRB	215	30.00	45511	1528.81	0.5%	0.3792	1.0080	0	
11.130.631	GRB	213	30.00	42302	1426.77	0.5%	0.4653	1.0122	0	*HELD*
12.132.606	GRB	206	30.00	46266	1583.05	0.5%	0.4345	1.0268	0	
13.132.658	GRB	207	30.00	47614	1595.77	0.5%	0.3881	1.0057	0	
14.133.853	GRB	212	15.68	25027	1611.73	0.6%	0.4189	1.0101	0	
15.136.610	GRB	211	30.00	48928	1625.33	0.5%	0.5621	0.9969	0	
16.136.984	GRB	214	30.00	48517	1633.93	0.5%	0.4480	1.0106	0	
17.137.651	GRB	208	30.00	48564	1629.13	0.5%	0.4979	1.0067	0	

1037-302		Sr						PRFD		
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.951	GRB	202	20.00	20491	1027.44	0.7%	0.3803	1.0032	0	
2.119.948	GRB	210	21.50	26356	1236.61	0.6%	0.4049	1.0091	0	
3.121.724	GRB	201	10.00	14171	1428.04	0.8%	0.4332	1.0080	0	
4.122.740	GRB	203	15.00	23676	1570.35	0.7%	0.3894	0.9951	0	
5.123.800	GRB	204	10.00	16236	1623.47	0.8%	0.4161	1.0002	0	
6.124.619	GRB	215	100.00	161917	1626.05	0.2%	0.3840	1.0045	0	
7.125.763	GRB	205	10.00	17122	1743.92	0.8%	0.3307	1.0187	0	
8.126.976	GRB	206	15.00	25761	1759.64	0.6%	0.4307	1.0249	0	
9.129.062	GRB	211	10.00	18304	1827.82	0.7%	0.5523	0.9989	0	
10.129.635	GRB	216	30.00	51442	1736.72	0.4%	0.3860	1.0131	0	*HELD*
11.130.631	GRB	214	30.00	48566	1630.37	0.5%	0.4404	1.0074	0	*HELD*
12.132.606	GRB	207	30.00	55025	1844.21	0.4%	0.3881	1.0057	0	
13.132.658	GRB	208	30.00	55314	1857.71	0.4%	0.4996	1.0078	0	
14.133.853	GRB	213	15.67	28971	1869.47	0.6%	0.4720	1.0114	0	
15.135.628	GRB	209	30.00	55653	1885.53	0.4%	0.4661	1.0167	0	
16.136.610	GRB	212	30.00	55728	1873.18	0.4%	0.4215	1.0086	0	

1037-303		Sr						PRFD		
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF		
1.118.951	GRB	203	20.00	21343	1061.28	0.7%	0.3891	0.9949	0	

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2.121.724	GRB	202	10.00	15083	1512.81	0.8%	0.3807	1.0032	0
3.122.740	GRB	204	15.00	24027	1600.38	0.6%	0.4161	0.9994	0
4.123.801	GRB	205	10.00	16165	1652.36	0.8%	0.3307	1.0224	0
5.124.619	GRB	214	100.00	158202	1588.24	0.3%	0.4449	1.0042	0 *HELD*
6.125.763	GRB	206	10.00	17296	1771.34	0.8%	0.4295	1.0244	0
7.126.976	GRB	207	15.00	27106	1821.91	0.6%	0.3889	1.0084	0
8.129.062	GRB	212	10.00	18690	1891.96	0.7%	0.4135	1.0125	0
9.129.633	GRB	209	30.00	55948	1900.54	0.4%	0.4570	1.0193	0
10.130.631	GRB	215	30.00	54208	1821.03	0.4%	0.3792	1.0080	0 *HELD*
11.131.629	GRB	201	30.00	55765	1873.89	0.4%	0.4258	1.0083	0
12.132.606	GRB	208	30.00	56669	1903.23	0.4%	0.4996	1.0078	0
13.132.658	GRB	213	30.00	57302	1933.99	0.4%	0.4653	1.0128	0
14.133.853	GRB	216	15.67	30168	1952.65	0.6%	0.3891	1.0145	0
15.135.628	GRB	210	30.00	57325	1920.85	0.4%	0.4048	1.0055	0
16.137.651	GRB	211	30.00	57975	1927.39	0.4%	0.5621	0.9976	0

1037-304		Sr	Min.	Counts	CPM	Error	BKG	SF	PRFD CF
GMT	Det								
1.118.951	GRB	204	20.00	21960	1099.64	0.7%	0.4154	1.0019	0
2.119.948	GRB	212	21.50	28085	1321.10	0.6%	0.4141	1.0117	0
3.121.724	GRB	203	10.00	15967	1588.05	0.8%	0.3894	0.9948	0
4.122.740	GRB	205	15.00	24802	1689.81	0.6%	0.3366	1.0222	0
5.123.801	GRB	206	10.00	17177	1761.31	0.8%	0.4295	1.0256	0
6.124.619	GRB	213	100.00	160095	1614.18	0.3%	0.4652	1.0086	0 *HELD*
7.125.763	GRB	207	10.00	18437	1857.11	0.7%	0.3899	1.0075	0
8.126.976	GRB	208	15.00	28630	1921.47	0.6%	0.4997	1.0070	0
9.129.062	GRB	201	10.00	19662	1980.19	0.7%	0.4297	1.0073	0
10.129.633	GRB	210	30.00	59589	2002.87	0.4%	0.3971	1.0085	0
11.130.631	GRB	216	30.00	57453	1940.23	0.4%	0.3860	1.0133	0
12.131.629	GRB	202	30.00	60166	2010.35	0.4%	0.3837	1.0026	0
13.132.658	GRB	214	30.00	60599	2034.01	0.4%	0.4404	1.0072	0
14.133.853	GRB	215	15.67	33277	2143.67	0.5%	0.3759	1.0096	0
15.135.628	GRB	211	30.00	60934	2024.82	0.4%	0.5642	0.9972	0
16.136.610	GRB	209	30.00	60510	2048.82	0.4%	0.4684	1.0160	0

1037-305		Sr	Min.	Counts	CPM	Error	BKG	SF	PRFD CF
GMT	Det								
1.118.951	GRB	205	20.00	20560	1051.30	0.7%	0.3436	1.0230	0
2.119.948	GRB	213	21.50	24566	1154.88	0.6%	0.4630	1.0112	0 *HELD*
3.121.724	GRB	204	10.00	14811	1482.70	0.8%	0.4161	1.0014	0
4.122.740	GRB	206	15.00	23080	1577.34	0.7%	0.4311	1.0254	0
5.123.801	GRB	207	10.00	16819	1697.31	0.8%	0.3899	1.0094	0
6.124.619	GRB	212	100.00	172241	1741.53	0.2%	0.4153	1.0113	0
7.125.763	GRB	208	10.00	17645	1776.48	0.8%	0.4958	1.0071	0
8.126.975	GRB	209	15.00	26966	1830.80	0.6%	0.4525	1.0187	0
9.129.062	GRB	214	10.00	18287	1842.14	0.7%	0.4402	1.0076	0
10.129.633	GRB	211	30.00	56485	1880.19	0.4%	0.5565	0.9989	0
11.130.631	GRB	201	30.00	56139	1885.49	0.4%	0.4258	1.0078	0
12.131.629	GRB	203	30.00	57681	1911.78	0.4%	0.3850	0.9945	0
13.132.658	GRB	215	30.00	58520	1962.17	0.4%	0.3792	1.0061	0
14.133.853	GRB	202	15.69	30506	1948.13	0.6%	0.3880	1.0022	0
15.135.628	GRB	212	30.00	57929	1949.96	0.4%	0.4161	1.0101	0
16.136.608	GRB	216	30.00	58331	1970.88	0.4%	0.3892	1.0138	0
17.137.651	GRB	210	30.00	58064	1943.71	0.4%	0.4022	1.0045	0

1037-306		Sr	Min.	Counts	CPM	Error	BKG	SF	PRFD CF
GMT	Det								
1.118.951	GRB	206	20.00	20279	1038.74	0.7%	0.4208	1.0249	0
2.119.948	GRB	214	21.50	25925	1212.82	0.6%	0.4474	1.0062	0
3.121.724	GRB	205	10.00	14577	1489.65	0.8%	0.3366	1.0222	0
4.122.740	GRB	207	15.00	24525	1649.16	0.6%	0.3914	1.0089	0
5.123.801	GRB	208	10.00	17067	1721.58	0.8%	0.4958	1.0090	0
6.124.619	GRB	211	100.00	175234	1750.32	0.2%	0.5486	0.9992	0 *HELD*
7.125.763	GRB	209	10.00	18095	1843.47	0.7%	0.4448	1.0190	0
8.126.975	GRB	210	15.00	27917	1875.24	0.6%	0.3954	1.0078	0
9.129.062	GRB	215	10.00	19314	1946.50	0.7%	0.3815	1.0080	0
10.129.633	GRB	212	30.00	56902	1920.04	0.4%	0.4155	1.0125	0
11.130.631	GRB	202	30.00	58085	1940.46	0.4%	0.3837	1.0024	0
12.131.629	GRB	204	30.00	58123	1939.02	0.4%	0.4112	1.0010	0
13.132.606	GRB	201	30.00	57586	1934.18	0.4%	0.4258	1.0079	0

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14.132.658	GRB	216	30.00	58994	1993.97	0.4%	0.3860	1.0142	0
15.133.853	GRB	203	15.69	30927	1961.92	0.6%	0.3868	0.9955	0

1037-307									
GMT	Sr Det	Min.	Counts	CPM	Error	BKG	SF	CF	PRFD
1.118.951	GRB 207	20.00	20230	1020.46	0.7%	0.3855	1.0092	0	
2.119.948	GRB 215	21.50	25513	1192.16	0.6%	0.3855	1.0050	0	
3.121.724	GRB 206	10.00	14380	1473.87	0.8%	0.4311	1.0252	0	
4.122.740	GRB 208	15.00	23521	1581.95	0.7%	0.4961	1.0092	0	
5.123.800	GRB 209	15.76	26405	1709.33	0.6%	0.4448	1.0205	0	*HELD*
6.124.619	GRB 210	100.00	168081	1696.84	0.2%	0.3958	1.0098	0	
7.125.763	GRB 210	10.00	17243	1737.73	0.8%	0.3958	1.0080	0	
8.126.975	GRB 211	15.00	27340	1819.43	0.6%	0.5470	0.9985	0	
9.128.739	GRB 201	30.00	54362	1824.33	0.4%	0.4297	1.0070	0	
10.129.635	GRB 214	30.00	51962	1744.77	0.4%	0.4404	1.0076	0	*HELD*
11.130.631	GRB 203	30.00	56501	1872.73	0.4%	0.3850	0.9946	0	
12.131.629	GRB 205	30.00	55577	1877.32	0.4%	0.3352	1.0135	0	
13.132.606	GRB 202	30.00	56629	1891.60	0.4%	0.3837	1.0023	0	
14.132.660	GRB 212	30.00	56185	1891.72	0.4%	0.4155	1.0103	0	
15.133.853	GRB 204	15.69	29593	1891.31	0.6%	0.4061	1.0030	0	
16.135.628	GRB 213	30.00	54978	1853.07	0.4%	0.4730	1.0114	0	
17.136.984	GRB 216	30.00	58198	1970.76	0.4%	0.3892	1.0161	0	

1037-308									
GMT	Sr Det	Min.	Counts	CPM	Error	BKG	SF	CF	PRFD
1.118.951	GRB 208	20.00	20086	1011.98	0.7%	0.4904	1.0081	0	
2.119.948	GRB 216	21.50	24736	1163.05	0.6%	0.3870	1.0112	0	
3.121.724	GRB 207	10.00	14610	1472.43	0.8%	0.3914	1.0081	0	
4.122.740	GRB 209	15.00	23759	1615.94	0.6%	0.4448	1.0205	0	
5.123.800	GRB 210	15.76	26015	1666.43	0.6%	0.3958	1.0098	0	
6.124.619	GRB 209	100.00	168759	1721.72	0.2%	0.4448	1.0205	0	
7.125.763	GRB 211	10.00	17657	1762.25	0.8%	0.5486	0.9984	0	
8.126.975	GRB 212	15.00	27269	1840.57	0.6%	0.4127	1.0127	0	
9.128.739	GRB 202	30.00	55984	1872.43	0.4%	0.3837	1.0036	0	
10.129.633	GRB 201	30.00	55444	1861.26	0.4%	0.4258	1.0073	0	
11.130.631	GRB 204	30.00	56685	1887.25	0.4%	0.4166	0.9990	0	
12.131.629	GRB 206	30.00	55601	1903.67	0.4%	0.4345	1.0274	0	
13.132.606	GRB 203	30.00	57389	1903.50	0.4%	0.3850	0.9952	0	
14.135.628	GRB 214	30.00	56953	1912.18	0.4%	0.4480	1.0075	0	
15.136.610	GRB 205	30.00	56935	1925.93	0.4%	0.3364	1.0150	0	
16.136.984	GRB 215	30.00	59405	2006.53	0.4%	0.3768	1.0135	0	

1037-309									
GMT	Sr Det	Min.	Counts	CPM	Error	BKG	SF	CF	PRFD
1.118.951	GRB 209	20.00	19294	984.66	0.7%	0.4470	1.0212	0	
2.119.987	GRB 201	20.42	24257	1197.01	0.6%	0.4338	1.0080	0	
3.121.724	GRB 208	10.00	14091	1420.44	0.8%	0.4961	1.0084	0	
4.122.740	GRB 210	15.00	23179	1559.96	0.7%	0.4035	1.0098	0	
5.123.814	GRB 204	18.00	29389	1632.60	0.6%	0.4161	1.0002	0	
6.124.619	GRB 208	100.00	167072	1685.28	0.2%	0.4958	1.0090	0	
7.125.763	GRB 212	10.00	17469	1766.91	0.8%	0.4153	1.0117	0	
8.126.975	GRB 213	15.00	24354	1640.35	0.6%	0.4568	1.0106	0	*HELD*
9.128.739	GRB 203	30.00	54806	1817.63	0.4%	0.3869	0.9952	0	
10.129.633	GRB 202	30.00	55192	1844.95	0.4%	0.3837	1.0030	0	
11.130.631	GRB 205	30.00	54285	1837.65	0.4%	0.3352	1.0157	0	
12.131.629	GRB 207	30.00	55617	1863.36	0.4%	0.3881	1.0053	0	
13.132.606	GRB 214	30.00	56019	1880.25	0.4%	0.4404	1.0072	0	
14.132.660	GRB 211	30.00	56083	1863.39	0.4%	0.5565	0.9971	0	
15.135.628	GRB 215	30.00	56212	1891.38	0.4%	0.3768	1.0096	0	
16.136.610	GRB 206	30.00	55390	1894.65	0.4%	0.4347	1.0264	0	
17.137.651	GRB 216	30.00	57044	1931.67	0.4%	0.3892	1.0161	0	

1037-310									
GMT	Sr Det	Min.	Counts	CPM	Error	BKG	SF	CF	PRFD
1.118.951	GRB 210	20.00	18747	945.32	0.7%	0.4021	1.0089	0	
2.119.987	GRB 202	20.42	23629	1160.52	0.7%	0.3791	1.0032	0	
3.121.724	GRB 209	10.00	14161	1444.95	0.8%	0.4448	1.0207	0	
4.122.773	GRB 205	31.00	46520	1533.59	0.5%	0.3366	1.0222	0	
5.123.800	GRB 212	15.76	25253	1620.10	0.6%	0.4153	1.0113	0	

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6.124.619	GRB	207	100.00	164096	1655.99	0.2%	0.3899	1.0094	0	
7.125.763	GRB	213	10.00	16465	1662.23	0.8%	0.4568	1.0098	0	*HELD*
8.126.975	GRB	214	15.00	24056	1612.44	0.6%	0.4436	1.0057	0	*HELD*
9.128.739	GRB	204	30.00	53687	1789.78	0.4%	0.4163	1.0004	0	
10.129.633	GRB	203	30.00	53973	1789.99	0.4%	0.3850	0.9952	0	
11.130.631	GRB	206	30.00	53555	1832.71	0.4%	0.4345	1.0269	0	
12.131.629	GRB	208	30.00	54406	1825.33	0.4%	0.4996	1.0068	0	
13.132.606	GRB	215	30.00	56694	1900.93	0.4%	0.3792	1.0061	0	
14.133.853	GRB	201	15.69	28857	1855.46	0.6%	0.4322	1.0091	0	
15.135.628	GRB	216	30.00	55656	1881.63	0.4%	0.3892	1.0145	0	

1037-311		Sr	Min.	Counts	CPM	Error	BKG	PRFD		
GMT	Det							SF	CF	
1.118.951	GRB	211	20.00	18798	938.64	0.7%	0.5420	0.9992	0	
2.119.987	GRB	203	20.42	23754	1156.86	0.6%	0.3917	0.9948	0	
3.121.724	GRB	210	10.00	13952	1407.50	0.8%	0.4035	1.0091	0	
4.122.740	GRB	212	15.00	22845	1539.86	0.7%	0.4153	1.0113	0	
5.123.800	GRB	213	10.00	15964	1609.59	0.8%	0.4652	1.0086	0	
6.124.619	GRB	206	100.00	161733	1658.37	0.2%	0.4295	1.0256	0	
7.125.763	GRB	214	10.00	17112	1719.63	0.8%	0.4436	1.0052	0	
8.126.975	GRB	215	15.00	25267	1695.71	0.6%	0.3840	1.0069	0	*HELD*
9.128.739	GRB	205	30.00	52725	1786.27	0.4%	0.3308	1.0166	0	
10.129.633	GRB	204	30.00	54524	1817.08	0.4%	0.4166	1.0000	0	
11.130.631	GRB	207	30.00	54345	1821.15	0.4%	0.3881	1.0055	0	
12.131.629	GRB	209	30.00	54615	1854.54	0.4%	0.4570	1.0190	0	
13.132.606	GRB	216	30.00	55875	1888.53	0.4%	0.3860	1.0142	0	
14.132.658	GRB	201	30.00	54554	1832.32	0.4%	0.4258	1.0079	0	
15.133.866	GRB	201	10.10	18401	1837.99	0.7%	0.4322	1.0091	0	
16.135.628	GRB	202	30.00	55893	1866.76	0.4%	0.3904	1.0022	0	
17.136.610	GRB	208	30.00	55473	1860.72	0.4%	0.4979	1.0066	0	

1037-312		Sr	Min.	Counts	CPM	Error	BKG	PRFD		
GMT	Det							SF	CF	
1.118.951	GRB	212	20.00	17846	902.32	0.7%	0.4177	1.0117	0	
2.119.987	GRB	204	20.43	22339	1094.52	0.7%	0.4154	1.0014	0	
3.121.724	GRB	212	10.00	13327	1347.83	0.9%	0.4153	1.0117	0	
4.122.740	GRB	213	15.00	21258	1427.97	0.7%	0.4671	1.0079	0	
5.123.800	GRB	214	10.00	15132	1519.13	0.8%	0.4449	1.0042	0	
6.124.619	GRB	205	100.00	153732	1571.41	0.3%	0.3307	1.0224	0	
7.125.763	GRB	215	10.00	16198	1630.98	0.8%	0.3840	1.0071	0	
8.126.975	GRB	216	15.00	23772	1604.63	0.6%	0.3805	1.0128	0	*HELD*
9.128.739	GRB	206	30.00	49048	1675.12	0.5%	0.4286	1.0249	0	
10.129.751	GRB	201	10.00	16844	1697.13	0.8%	0.4258	1.0078	0	
11.130.631	GRB	208	30.00	51342	1722.20	0.4%	0.4996	1.0066	0	
12.131.629	GRB	210	30.00	51523	1732.61	0.4%	0.3971	1.0091	0	
13.132.606	GRB	209	30.00	51601	1748.90	0.4%	0.4570	1.0171	0	
14.132.658	GRB	202	30.00	51505	1720.41	0.4%	0.3837	1.0023	0	
15.135.628	GRB	203	30.00	52333	1736.24	0.4%	0.3896	0.9955	0	
16.136.610	GRB	207	30.00	51111	1713.66	0.4%	0.3998	1.0061	0	
17.136.983	GRB	211	30.00	52246	1736.87	0.4%	0.5621	0.9976	0	

1037-313		Sr	Min.	Counts	CPM	Error	BKG	PRFD		
GMT	Det							SF	CF	
1.118.951	GRB	213	20.00	16724	844.55	0.8%	0.4589	1.0105	0	*HELD*
2.119.987	GRB	205	20.50	20337	1013.68	0.7%	0.3400	1.0222	0	
3.121.724	GRB	214	10.00	12691	1276.50	0.9%	0.4457	1.0062	0	
4.122.740	GRB	214	15.00	20737	1388.91	0.7%	0.4457	1.0050	0	
5.123.800	GRB	215	10.00	14767	1482.94	0.8%	0.3840	1.0045	0	
6.124.619	GRB	204	100.00	151108	1510.93	0.3%	0.4161	1.0002	0	
7.125.763	GRB	216	10.00	15477	1566.68	0.8%	0.3805	1.0125	0	
8.126.975	GRB	201	15.00	23806	1597.75	0.6%	0.4332	1.0070	0	
9.128.739	GRB	207	30.00	48211	1620.20	0.5%	0.3880	1.0084	0	
10.130.631	GRB	209	30.00	49705	1687.98	0.4%	0.4570	1.0191	0	
11.131.629	GRB	211	30.00	50149	1668.37	0.4%	0.5565	0.9984	0	
12.132.606	GRB	210	30.00	50034	1678.96	0.4%	0.3971	1.0069	0	
13.132.658	GRB	203	30.00	50291	1668.02	0.4%	0.3850	0.9952	0	
14.133.853	GRB	208	15.67	26445	1698.46	0.6%	0.4988	1.0067	0	
15.135.628	GRB	206	30.00	49693	1700.18	0.4%	0.4329	1.0267	0	
16.136.612	GRB	202	30.00	50976	1702.08	0.4%	0.3904	1.0019	0	
17.136.983	GRB	212	30.00	50633	1700.79	0.4%	0.4215	1.0080	0	

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1037-314		Sr						PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.118.951	GRB 214	20.00	17087	859.34	0.8%	0.4483	1.0064	0	
2.119.987	GRB 206	20.50	20808	1040.21	0.7%	0.4282	1.0252	0	
3.121.724	GRB 215	10.00	13197	1325.87	0.9%	0.3835	1.0050	0	
4.122.740	GRB 215	15.00	21516	1441.34	0.7%	0.3835	1.0051	0 *HELD*	
5.123.800	GRB 216	10.00	14709	1488.76	0.8%	0.3776	1.0124	0	
6.124.619	GRB 203	100.00	151546	1507.76	0.3%	0.3894	0.9952	0	
7.125.763	GRB 201	10.00	15338	1545.18	0.8%	0.4332	1.0077	0 *HELD*	
8.126.975	GRB 202	15.00	24540	1641.48	0.6%	0.3807	1.0036	0	
9.128.739	GRB 208	30.00	49505	1661.17	0.4%	0.5008	1.0070	0	
10.129.633	GRB 207	30.00	49651	1663.77	0.4%	0.3881	1.0055	0	
11.130.631	GRB 210	30.00	50520	1698.12	0.4%	0.3971	1.0086	0	
12.131.629	GRB 212	30.00	50255	1694.05	0.4%	0.4155	1.0115	0	
13.132.606	GRB 211	30.00	51217	1701.67	0.4%	0.5565	0.9971	0	
14.132.658	GRB 204	30.00	51290	1710.90	0.4%	0.4112	1.0010	0	
15.133.853	GRB 209	15.69	26512	1717.41	0.6%	0.4655	1.0167	0	
16.135.628	GRB 205	30.00	50298	1700.42	0.4%	0.3370	1.0144	0	
17.136.608	GRB 213	30.00	49931	1682.96	0.4%	0.4730	1.0115	0	
18.137.651	GRB 214	30.00	52039	1752.58	0.4%	0.4480	1.0106	0	

1037-315		Sr						PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.118.951	GRB 215	20.00	14925	750.52	0.8%	0.3940	1.0063	0	
2.119.987	GRB 207	20.50	18013	885.40	0.7%	0.3914	1.0081	0 *HELD*	
3.121.724	GRB 216	10.00	11019	1113.90	1.0%	0.3822	1.0112	0	
4.122.740	GRB 216	15.00	18062	1218.35	0.7%	0.3822	1.0121	0 *HELD*	
5.123.800	GRB 201	10.00	12289	1237.97	0.9%	0.4332	1.0077	0	
6.124.619	GRB 202	100.00	129376	1297.03	0.3%	0.3807	1.0028	0	
7.125.763	GRB 202	10.00	13352	1339.07	0.9%	0.3807	1.0032	0	
8.126.975	GRB 203	15.00	20353	1349.91	0.7%	0.3894	0.9952	0	
9.129.062	GRB 204	10.00	14110	1410.60	0.8%	0.4163	1.0000	0	
10.129.633	GRB 206	30.00	41280	1413.22	0.5%	0.4345	1.0274	0	
11.130.631	GRB 211	30.00	43041	1432.37	0.5%	0.5565	0.9988	0	
12.132.606	GRB 212	30.00	42955	1446.17	0.5%	0.4155	1.0103	0	
13.132.658	GRB 205	30.00	42384	1431.70	0.5%	0.3352	1.0136	0	
14.133.853	GRB 210	15.69	22436	1437.35	0.7%	0.4039	1.0055	0	
15.135.628	GRB 208	30.00	43075	1444.98	0.5%	0.4966	1.0067	0	
16.136.608	GRB 214	30.00	43349	1455.49	0.5%	0.4480	1.0076	0	
17.136.983	GRB 209	30.00	43372	1468.29	0.5%	0.4684	1.0159	0	

1037-316		Sr						PRFD	
GMT	Det	Min.	Counts	CPM	Error	BKG	SF	CF	
1.118.951	GRB 216	20.00	13047	659.55	0.9%	0.3879	1.0116	0	
2.119.987	GRB 208	20.50	16214	797.08	0.8%	0.4860	1.0084	0	
3.121.769	GRB 201	10.00	9761	983.50	1.0%	0.4332	1.0080	0	
4.122.740	GRB 201	15.00	15546	1043.92	0.8%	0.4332	1.0077	0	
5.123.800	GRB 202	10.00	10974	1100.11	1.0%	0.3807	1.0028	0 *HELD*	
6.124.619	GRB 201	100.00	113361	1141.94	0.3%	0.4332	1.0077	0	
7.125.763	GRB 203	10.00	11920	1185.80	0.9%	0.3894	0.9951	0	
8.126.975	GRB 204	15.00	18427	1228.48	0.7%	0.4161	1.0004	0	
9.129.062	GRB 213	10.00	12390	1254.50	0.9%	0.4615	1.0129	0	
10.130.631	GRB 212	30.00	37999	1281.46	0.5%	0.4155	1.0120	0 *HELD*	
11.132.658	GRB 206	30.00	37372	1278.65	0.5%	0.4345	1.0268	0	
12.135.628	GRB 207	30.00	38433	1287.90	0.5%	0.3936	1.0056	0	
13.136.608	GRB 215	30.00	40059	1347.96	0.5%	0.3768	1.0098	0	
14.136.983	GRB 210	30.00	38829	1299.68	0.5%	0.4022	1.0045	0	
15.137.651	GRB 205	30.00	38007	1283.89	0.5%	0.3364	1.0137	0	

Appendix B. Calibration Certificate for Standard Solution

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U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Sr⁹⁰ U1

Calibration Certificate

Description

Principal radionuclide: Half-life:

Nominal activity: curies

Nominal volume: ml in ampoule/bottle number:

Measurement Activity of principal radionuclide

Activity per gram of this solution

curies of

at 0400 hours PST on

042.500-94

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

curies Per gram

of the daughter nuclide

Total mass of this solution

grams

Method of measurement

The activity of the primary solution was measured by four pi efficiency tracing.

The activity of the dilution was measured by liquid scintillation counting.

Rec'd 10/24/94 RP

Useful Life This radionuclide has decayed through half lives since it was obtained by EMSL-LV

We recommend that this solution should not be used after

Sr⁹⁰ in .1M HCl

$$4.9793 \text{ g} \times \frac{5.02 \text{ nCi}}{\text{g}} \times \frac{2220 \text{ dpm}}{\text{nCi}} \times \frac{1}{25 \text{ ml}} = 2220 \text{ dpm/ml} \pm 0.8\% @ 042.500-94$$

R. Preston 4/27/95

carrier content .1787 mg/ml SrCO₃, .1467 mg/ml Y₂O₃

Calculations checked K. Y. Yamamoto 4/27/95

Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be:

- (1) others less than ~~equal to~~ 0.01 % of the principal activity
- (2) less than equal to % of the principal activity
- (3) less than equal to % of the principal activity

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than \pm 0.2 % (The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the student t factor for the degree of freedom (n-1)).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta - \delta'$). These have been estimated not to exceed

+ 2.1 % or - 2.1 %

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error $[t(sm)]$ at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta, -\delta'$)

The overall uncertainty is therefore calculated on the basis of $+[t(sm) + \delta], -[t(sm) + \delta]$ and is + 2.5 %, - 2.5 % of the quoted radioactive concentration.

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Strontium-90 decays 100 percent by beta emission to yttrium-90. Yttrium-90 decays also by beta emission.

Chemical Composition of Solution

Carrier content per gram of solution:	Other components:
100 micrograms strontium	0.1 <u>M</u> HCl
100 micrograms yttrium	
Preservative:	

Remarks

Date Certificate Prepared February 14, 1994

Approval Signature George Wilbeck

Appendix C. Preparation of Standards

Sr⁹⁰ Primary calibration

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4/27/95

GROUP # 1037

Cmpl #	ml of Carrier added	RECOVERY			SEP. TIME
		GWT (mg)	TWT (mg)	NWT (mg)	
1037 - 1	0.5 ml K-A1-B	42.09	40.52	1.57	118.055.95
2	1.0	42.81	39.18	3.63	
3	2.0	46.37	39.39	6.98	
4	3.0	51.12	39.80	11.32	
5	4.0	54.60	40.32	14.28	
6	5.0	56.75	39.11	17.64	
7	0.6 ml K-A1-(2)	61.15	40.12	21.03	
8	0.7	62.97	38.73	24.24	
9	0.8	68.02	40.61	27.41	
10	1.0	73.63	39.57	34.06	
11	1.1	78.11	40.25	37.86	
12	1.2	77.77	39.85	38.42	
13	1.4	83.50	38.02	45.48	
14	1.6	92.40	39.43	52.97	
15	1.8	89.20	39.20	50.00	
16	2.0	88.83	38.39	50.44	

mg/ml of SrCO₃ in U1 Sr⁹⁰ Activity is 0.1787 mg

Carriers - K-A1-B, 36.28 mg/ml SrCO₃ ± 0.26% 333.000.94

K-A1-(2) 36.28 mg/ml SrCO₃ ± 0.13% 333.000.94

Pipet used for pipetting - Carrier

LSC-3 - calibra, 200 ul capacity. calibrated on 4/4/95

DST-2 calibra, 1000 ul capacity. " " "

4/27/95
RPPrep of Sr⁹⁰ LI

Gross wt. 26.5818 g
 Tare wt 21.6025
 4.9793 g

Balance A
 Met. H10

Tared a 25ml vol. flask + top. Opened EPA vial, Sr⁹⁰ 2454-1, 5.02 nCi/g @ 0400 PST Feb. 11, 1994. Transferred Sr⁹⁰ solution into the flask. Weighed Sr⁹⁰ soln. flask and top. Pippetted 100ml Sr carrier K-Al 36.28 mg/ml SrCO₃ and 200ml Y carrier D-G 15.18 mg/ml $\frac{1}{2}$ D₃ into the same flask. Diluted to mark with 1M HCl. Transferred to a 102. P.B..

$$4.9793g \times \frac{5.02 \text{ nCi}}{g} \times \frac{2220 \text{ dpm}}{\text{nCi}} \times \frac{1}{25 \text{ ml}} = 2220 \text{ dpm/ml} \pm .8\%$$

Carrier content

$$\left[\left(4.9793g \times \frac{1 \text{ mg Sr}}{g} \times 1.68489 \frac{\text{SrCO}_3}{\text{Sr}} \right) + \left(1 \text{ ml} \times \frac{36.28 \text{ mg SrCO}_3}{\text{ml}} \right) \right] \times \frac{1}{25 \text{ ml}} = .1787 \text{ mg/ml SrCO}_3$$

$$\left[\left(4.9793g \times \frac{1 \text{ mg Y}}{g} \times 1.26994 \frac{\text{Y}_2\text{O}_3}{\text{Y}} \right) + \left(2 \text{ ml} \times \frac{15.18 \text{ mg Y}_2\text{O}_3}{\text{ml}} \right) \right] \times \frac{1}{25 \text{ ml}} = .1467 \text{ mg/ml Y}_2\text{O}_3$$

R Prentiss

Calculations checked. K. Yamamoto 4/27/95

3/23/95
RP

Nb carrier prep for sample

Pipetted 1ml Nb DI, 14.31 mg/ml Nb₂O₅
into a 50ml poly tube, for sample
3954-1, gave to E. Bandoma.

R. Prenton

4/10/95 Prep. Sr carrier K-AI-(2)
RP

Transferred ~50mls of Sr K-AI into
a 202 P.B.,

36.28 mg/ml SrCO₃ ± .13% @ 333,000-94

R. Prenton

~~4/10/95 RP
Prep of K-AI-BI~~

4/10/95 Prep of Sr carrier K-AI-B
RP

~~4/10/95 RP~~
Pipetted 5mls of Sr carrier K-AI
into a 50ml vol. flask. Diluted to
mark with .1N HNO₃. Transfer to
a 202 P.B.,

3.628 mg/ml SrCO₃ ± .12.26% @ 333,000-94

R. Prenton

Log Book Entry No.	TMA/Inch. No.	Date	Nuclide	Prep. Method	Vol. & I.D. of Tracer Added	Total Activity (cps)	% of Error	Activity Date	Sp. Wt. (g)	Matrix	Container	Additional Information or Comment
41	1037-9	4/27/95	Sr-90	CS RP	✓ 1m / Sr-90 4/1	2220.	0.9	42,500-94	1.00	1NHCl	50ml Poly Tube	Sr-90 Prim, Calif. Carrier content Total
42	10	"	Sr-90	" RP	✓ 1m / Sr-90 4/1	2220.	0.9	"	1.01	"	"	.1787mg Sr-90
43	11	"	Sr-90	" RP	✓ 1m / Sr-90 4/1	2220. 2200. 4/1/95	0.9	"	1.00	"	"	.1467mg Y-203
44	12	"	Sr-90	" RP	✓ 1m / Sr-90 4/1	2220.	0.9	"	1.00	"	"	
45	13	"	Sr-90	" RP	✓ 1m / Sr-90 4/1	2220.	0.9	"	1.00	"	"	
46	14	"	Sr-90	" RP	✓ 1m / Sr-90 4/1	2220.	0.9	"	1.00	"	"	
47	15	"	Sr-90	" RP	✓ 1m / Sr-90 4/1	2220.	0.9	"	1.00	"	"	
48	16	"	Sr-90	" RP	✓ 1m / Sr-90 4/1	2220.	0.9	"	1.00	"	"	

3 L bk 58-

26

Log Book Entry No.	TMA/Reimbursement Number	Date	Nuclide	Prep. Method	Volume and I.D. of Tracer Added	Total Activity (cpm)	% Error	Activity Date	Sp. Count (CP)	Matrix	Container	Given to	Additional Information or Comment
22	410195 RP 1037	4/10/95	Sr 90	CS	4 ml Sr 90 T1	2220	1.0	400-440 42500-94	4.00	.1N HCl	50 ml Poly Tube	CS	Sr 90 Primary Calibration carrier content total .7508 mg Sr 90 1.6328 mg Y2O3
23		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	4.00	"	"	"	"
24		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	4.00	"	"	"	"
25		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	4.00	"	"	"	"
26		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	4.00	"	"	"	"
27		"	Sr 90	RP	4 ml Sr 90 T1	2220	0.8	"	3.99	"	40 ml GLASS	"	Used 4 ml glass pipet appended taken out of service
28		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	3.99	"	"	"	"
29		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	3.99	"	"	"	"
30		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	4.00	"	"	"	"
31		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	4.00	"	"	"	"
32		"	Sr 90	RP	4 ml Sr 90 T1	2220	"	"	4.00	"	"	"	"
Los Book entries 17-32 Problems in chemistry replaced with the next entries													
33	1037-1	4/27/95	Sr 90	CS	1 ml Sr 90 U1	2220	0.9	42500-94	1.01	.1N HCl	50 ml Poly Tube	CS	Sr 90 Prim. Calib carrier content total .1787 mg Sr 90 1.1467 mg Y2O3
34		"	Sr 90	RP	1 ml Sr 90 U1	2220	0.9	"	1.01	"	"	"	"
35		"	Sr 90	RP	1 ml Sr 90 U1	2220	0.9	"	1.01	"	"	"	"
36		"	Sr 90	RP	1 ml Sr 90 U1	2220	0.9	"	1.01	"	"	"	"
37		"	Sr 90	RP	1 ml Sr 90 U1	2220	0.9	"	1.00	"	"	"	"
38		"	Sr 90	RP	1 ml Sr 90 U1	2220	0.9	"	1.00	"	"	"	"
39		"	Sr 90	RP	1 ml Sr 90 U1	2220	0.9	"	1.01	"	"	"	"
40		"	Sr 90	RP	1 ml Sr 90 U1	2220	0.9	"	1.00	"	"	"	"

26-JUN-95
13:57:17

TMA Corporation
Pb210 Least Squares Analysis
PBBI V 1.04

1037-103 Sr
MEW SR90 PRIMARY CAL

CS

Reviewed _____ Date _____

** NOTE - This is actually Sr-Y data for cpm only **

Counted on MEW

Zero time 42.500 94
Separation time 118.055 95
GMT at first count 121.774 95

First fit
Equilibrium CPM= 1890.29 7.60 Percent
CPM at sep time= 776.24 12.23 Percent
Corr. coefficient= 0.999
Chi square prob.= 0.000

GMT	ET	CTS	CTTM	CTR	CPM	CLC CPM	PCOFF	PROB	WT
121.774	3.719	0	57.40	19	1470.97	1468.23	0.186	0.94	1.0000
123.824	5.769	25260	14.61	19	1632.46	1641.45	-0.548	0.84	0.6330
124.808	6.753	23411	13.13	19	1683.99	1697.52	-0.797	0.77	0.5836
125.800	7.745	0	17.80	19	1760.29	1741.35	1.088	0.68	0.5809
126.739	8.684	0	24.23	19	1769.66	1773.64	-0.224	0.93	0.6143
128.846	10.791	21111	10.84	19	1840.62	1822.70	0.983	0.72	0.4756
129.782	11.727	25466	13.12	19	1834.48	1837.30	-0.153	0.95	0.5025
130.788	12.733	22819	11.70	19	1843.39	1849.47	-0.329	0.90	0.4840
131.823	13.768	0	21.27	19	1866.23	1859.12	0.383	0.88	0.5439
132.746	14.691	25563	12.99	19	1860.15	1865.74	-0.299	0.91	0.4892
134.000	15.945	19912	10.00	19	1882.32	1872.56	0.521	0.85	0.4477
135.898	17.843	31254	15.84	19	1865.06	1879.46	-0.766	0.77	0.5107

Elapsed time (days) = 440.555
Lambda = 8.626E-05 Reciprocal days
exp(-lambda X t) (1)= 9.627E-01
Chemical yield (2)= 0.9620
PPT. correction (3)= 1.0396 (recovery = 6.980 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 9.627197E-01

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
1.9635E+03	2.7470	5.3937E+03	4.0976E+02	7.60 %

LTV 6.0698E+03

9th point MDA 1.3120E+01

Reviewed _____ Date _____

Decay Constants

Rn222 - 1.8129E-01
Ra226 - 1.1700E-06

De-emanation Times

1st - 206.704 6
2nd - 265.696 6

GMT	YR	Det	Cnts	Min.	Bkg	Net CPM	Decay during cntg	CPM	(1 sig) %	
265.881	6	RN	13	4698	81.5	0.161	57.476	0.995	57.771	1.5

Rn-222 decay from 2nd De-em to Count time = 0.9670
 CPM @ 2nd De-emanation time = 59.7418
 Rn-222 growth from 1st to 2nd De-em time = 1.0000
 Ra-226 decay (tracer date to 2nd De-em) = 0.9942

```

=====
|               Efficiency Determination for Cell #29               |
|-----|
|                               |
|                               |
|                               |
|      Tracer used :   Ra226   M1-A-(06)   |
|      Amount used :   1.0 mLs   |
|      DPM per mL  :   26.42 +/- 1.8 %   |
|      Standardization Date :   1.500 93   |
|                               |
|      Cell #29 Efficiency = 2.275 +/- 0.053   |
|      @ 265.881 6   |
|-----|
=====
    
```

Quality Control Summary

Detector	Continuing Calibr:	Date (GMT)	Gross Cnts	Time (min)	Value	Control Limits	New Avg	Norm dev
RN	13 BK BK	265.022	104	922.5	0.113	0.059 - 0.125	0.093	1.9
RN	13 EF SF	265.676	10042	3.6	1.018	0.991 - 1.059	1.026	-0.6
RN	13 BK BK29	264.765	23	142.8	0.161	0.061 - 0.340	0.197	-0.8
RN	13 EF EF29	265.881	4698	81.5	2.275	2.100 - 2.652	2.339	-0.9

Previous 3 counts	Time	Detector	ID	Length	Cpm
265.022	21-SEP-06 17:31	RN 13 BK		922.5 min	0.00
265.676	22-SEP-06 9:13	RN 13 SF		3.6 min	0.00
265.772	22-SEP-06 11:31	RN 13 BK		123.5 min	0.00

Reviewed _____ Date _____

Decay Constants		De-emanation Times	
Rn222 -	1.8124E-01	1st -	228.669 6
Ra226 -	1.1700E-06	2nd -	268.729 6

GMT	YR	Det	Cnts	Min.	Bkg	Net CPM	Decay durng cntg	CPM	(1 sig) %	
268.917	6	RN	9	4206	72.9	0.256	57.463	0.995	57.727	1.6

Rn-222 decay from 2nd De-em to Count time = 0.9665
 CPM @ 2nd De-emanation time = 59.7283
 Rn-222 growth from 1st to 2nd De-em time = 0.9993
 Ra-226 decay (tracer date to 2nd De-em) = 0.9941

```

=====
|
|           Efficiency Determination for Cell # 1
|-----|
|
|           Tracer used : Ra226   M1-A--(06)
|           Amount used : 1.0 mLs
|           DPM per mL  : 26.42 +/- 1.8 %
|           Standardization Date : 1.500 93
|
|           Cell # 1 Efficiency = 2.276 +/- 0.054
|           @ 268.917 6
|-----|
|
|=====
    
```

Quality Control Summary

Detector	Continuing Calibr:	Date (GMT)	Gross Cnts	Time (min)	Value	Control Limits	New Avg	Norm dev
RN	9 BK BK	265.022	167	922.5	0.181	0.137 - 0.249	0.192	-0.6
RN	9 EF SF	268.676	10051	3.6	1.004	0.975 - 1.035	1.005	-0.1
RN	9 BK BK1	223.645	31	120.9	0.256	0.217 - 0.500	0.380	-2.3
RN	9 EF EF1	268.917	4206	72.9	2.276	2.100 - 2.616	2.310	-0.6

Previous 3 counts	Time	Detector	ID	Length	Cpm
265.772	22-SEP-06 11:31	RN	9 BK	123.5 min	0.00
265.881	22-SEP-06 14:08	RN	9 Ra	81.5 min	134.98
268.676	25-SEP-06 9:13	RN	9 SF	3.6 min	0.00

13-NOV-06
15:41:01

TMA Corporation
Ra226 calculation
RADTUM V 1.03

137-795

Ra

Reviewed: ### Date: #####

Decay Constants

De-emanation Times

Rn222 - 1.8129E-01
Ra226 - 1.1700E-06

1st - 270.697 6
2nd - 317.765 6

GMT	YR	Det	Cnts	Min.	Bkg	Net CPM	Decay during cntg	CPM	(i sig) %
317.938	6	RN	10	4050	69.0	0.111	58.593	0.996	58.848 1.6

Rn-222 decay from 2nd De-em to Count time = 0.9691
 CPM @ 2nd De-emanation time = 60.7227
 Rn-222 growth from 1st to 2nd De-em time = 0.9998
 Ra-226 decay (tracer date to 2nd De-em) = 0.9941

Efficiency Determination for Cell #66

Tracer used : Ra226 M1-A-(06)
 Amount used : 1.0 mLs
 DPM per mL : 26.42 +/- 1.8 %
 Standardization Date : 1.500 93

Cell #66 Efficiency = 2.312 +/- 0.055
 @ 317.938 6

Quality Control Summary

Detector	Continuing Calibr:	Date (GMT)	Gross Cnts	Time (min)	Value	Control Limits	New Avg	Norm dev
RN	10 BK BK	314.056	55	869.2	0.063	0.033 - 0.100	0.066	-0.3
RN	10 EF SF	317.697	10046	3.7	1.069	1.026 - 1.070	1.057	2.8
RN	10 BK BK66	311.728	14	126.4	0.111	0.000 - 0.280	0.116	-0.3
RN	10 EF EF66	317.938	4050	69.0	2.312	2.100 - 2.800	2.349	-0.6

Previous	3 counts	Time	Detector	ID	Length	Cpm
314.663	10-NOV-06	7:54	RN	10 SF	3.7 min	0.00
314.886	10-NOV-06	13:15	RN	10 Ra	70.1 min	128.24
317.697	13-NOV-06	8:43	RN	10 SF	3.7 min	0.00

Reviewed _____ Date _____

Decay Constants

De-emanation Times

Rn222 - 1.8129E-01
Ra226 - 1.1700E-06

1st - 324.770 6
2nd - 339.740 6

GMT	YR	Det	Cnts	Min.	Bkg	Net CPM	Decay during cntg	CPM	(1 sig) %	
339.924	6	RN	11	4870	80.5	0.140	60.387	0.995	60.693	1.4

Rn-222 decay from 2nd De-em to Count time = 0.9672
 CPM @ 2nd De-emanation time = 62.7521
 Rn-222 growth from 1st to 2nd De-em time = 0.9337
 Ra-226 decay (tracer date to 2nd De-em) = 0.9941

```

=====
|           Efficiency Determination for Cell #43           |
|-----|
|           Tracer used : Ra226 M1-A-(06)                 |
|           Amount used : 1.0 mLs                         |
|           DPM per mL  : 26.42 +/- 1.8 %                 |
|           Standardization Date : 1.500 93               |
|
|           Cell #43 Efficiency = 2.559 +/- 0.059         |
|           @ 339.924 6                                     |
|-----|
=====
    
```

Quality Control Summary

Detector	Continuing Calibr:	Date (GMT)	Gross Cnts	Time (min)	Value	Control Limits	New Avg	Norm dev
RN	11 BK BK	339.051	44	937.2	0.047	0.026 - 0.081	0.052	-0.7
RN	11 EF SF	339.708	10011	3.7	1.058	1.031 - 1.070	1.061	-0.3
RN	11 BK BK43	314.693	17	121.4	0.140	0.000 - 0.284	0.131	0.0
RN	11 EF EF43	339.924	4870	80.5	2.559	2.100 - 2.635	2.357	2.2

Previous	3 counts	Time	Detector	ID	Length	Cpm
339.051	4-DEC-06	17:13	RN	11 BK	937.2 min	0.00
339.708	5-DEC-06	8:59	RN	11 SF	3.7 min	0.00
339.747	5-DEC-06	9:55	RN	11 BK	122.0 min	0.00

Reviewed _____ Date _____

Decay Constants

De-emanation Times

Rn222 - 1.8129E-01
Ra226 - 1.1700E-06

1st - 314.714 6
2nd - 324.795 6

GMT	YR	Det	Cnts	Min.	Bkg	Net CPM	Decay during cntg	CPM	(1 sig) %
325.006	6	RN	12	4094	83.7	0.238	48.698	0.995	48.955 1.6

Rn-222 decay from 2nd De-em to Count time = 0.9625
 CPM @ 2nd De-emanation time = 50.8639
 Rn-222 growth from 1st to 2nd De-em time = 0.8392
 Ra-226 decay (tracer date to 2nd De-em) = 0.9941

Efficiency Determination for Cell #52

Tracer used : Ra226 M1-A-(06)
 Amount used : 1.0 mLs
 DPM per mL : 26.42 +/- 1.8 %
 Standardization Date : 1.500 93

Cell #52 Efficiency = 2.308 +/- 0.055
 @ 325.006 6

Quality Control Summary

Detector	Continuing Calibr:	Date (GMT)	Gross Cnts	Time (min)	Value	Control Limits	New Avg	Norm dev
RN	12 BK BK	321.047	86	931.1	0.092	0.062 - 0.110	0.086	0.8
RN	12 EF SF	324.715	10067	3.7	1.061	1.012 - 1.080	1.059	0.1
RN	12 BK BK52	321.744	43	180.5	0.238	0.000 - 0.350	0.183	1.1
RN	12 EF EF52	325.006	4094	83.7	2.308	2.100 - 2.528	2.272	0.5

Previous 3 counts	Time	Detector	ID	Length	Cpm
324.738	20-NOV-06 9:42	RN 12	BK	120.6 min	0.00
324.824	20-NOV-06 11:46	RN 12	BK	128.5 min	0.00
324.949	20-NOV-06 14:46	RN 12	Ra 137 803	79.4 min	118.54

EBERLINE SERVICES

ANALYTICAL SERVICES GROUP

Richmond, CA Laboratory

Implementation of Primary Calibration

Ra228/5

Nuclide Ac 228

Date 7/7/01

Calibration Title AC228PGRB0701

Detectors GRB 201-232

Place P-factor(s) in Constants file

Date:

By:

7-7-1

wt

List P-Factor(s) 3.175

Create RCE Curve File(s)

7-7-1

wt

List File name(s): AC228GRB.PPT

Other (list)

Place Documentation in Calibration files

06.12.03

LGJ

Update Calibration Log

06.12.03

LGJ

Comments:

Ac-228 Primary Calibration

00-May-2001

AC228PGRB0701

A primary calibration for Ac-228 was performed in early 2001 by taking 16 aliquots of Ra-228 (stock # R1-A and adding various amounts of Y oxalate with 9 hydrates (stock # E-A2-(07)) so as to generate an efficiency curve between 1 and 75 mgs. (see attachment 1; 'planchet Log-In sheet').

Each planchet produced by following procedure XX-000 was counted on several of the beta counters in the Eberline Services LB4110 Gross Beta detector system over a 24 hour period. (see attachment 2: 'raw counting data').

The results of the counting produced a series of results (table 1) that was used to generate a relative efficiency curve (figure I). These results were normalized to 12.00 mg/cm² assuming an area of 3.30 cm². (see table 2) to produce a PPT curve (see figure II) with a normalized efficiency of 0.315.

In keeping with the practice at Eberline Services of using P-factors one was calculated $(1.0 / 0.315) = 3.175$.

Using the results of table 2 a table of PPT vs correction factors was generated. These were placed into the DEC data base to be used by Eberline Services Spline table lookup routines (see table 3).

The above P-factor and Spline table were put into effect on 07-July-2001.

The following attachments are attached at the end of this summary:

- A. Copy of QA departments notebooks for standardizations of Ra-228 stock # R1-A and Y stock # E-A2-(07).
- B. Copy of Laboratory planchet Log_in sheets about the preparation of the planchets.
- C. Raw counting data.
- D. Copy of spread sheets used to generate the Spline table.

GROUP	SAMPLE	ELM	TYPE	GEO	AMOUNT COUNTED	AMOUNT RECOV.	1ST SEP TIME	FINAL SEP TIME	ALIQUOT & UNITS	Carrier/Tracer	
										#mLs. Elm.	Iso. I.D.
1067	25	Ac			3.98		29.733	31.774	1.0 sample	0.20	E-A2-(07)
	26				7.56					0.30	
	27				11.78					0.40	
	28				15.23					0.50	
	29				19.54					0.60	
	30				24.15					0.70	
	31				29.09					0.80	
	32				31.40					0.90	
	33				31.98					1.0	
	34				40.66					1.2	
	35				51.84					1.4	
	36				58.92					1.6	
	37				66.78					1.8	
↓	38				75.68		↓	↓	↓	2.0	↓

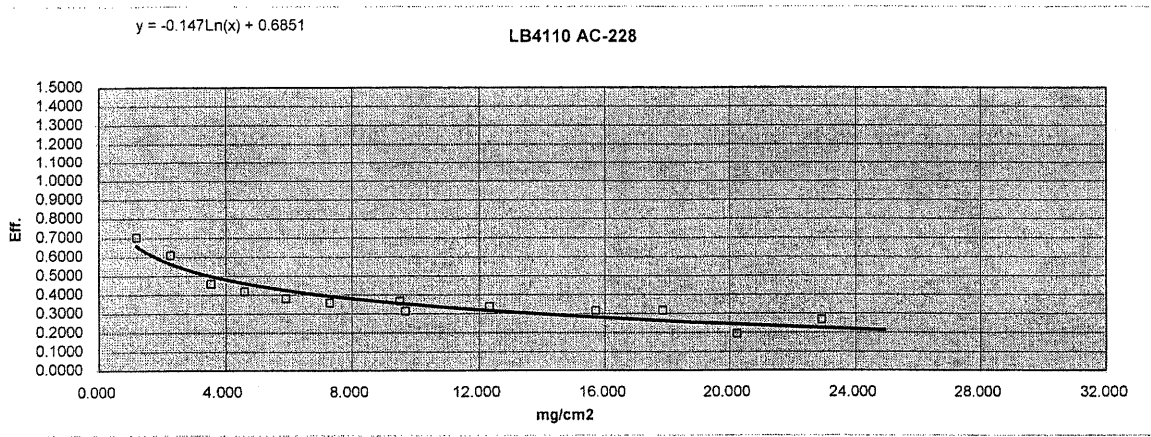
295

LB4110 1" Nylon Planchet with yttrium oxalate mount

TRACER:

Ra-228; R1-A-14
 Tzero = 189.708 2000
 DPM/ML 71.01 LAMBDA = 3.30E-04 (5.75 YEARS)
 MG/ML 40.15

Gram Rcvd	mG/cm2	mL carrier	SAMPLE	Tc	CPM	DELTA	DECAY	Yield	CZERO	EFF	PPT
3.98	1.206	0.200	25	31.774	23.070	208.066	0.93363	0.49564	49.9	0.7021	
7.56	2.291	0.300	26	31.774	25.274	208.066	0.93363	0.62765	43.1	0.6074	
11.78	3.570	0.400	27	31.774	22.300	208.066	0.93363	0.73350	32.6	0.4586	1.467454
15.23	4.615	0.500	28	31.774	21.010	208.066	0.93363	0.75866	29.7	0.4177	1.336672
19.54	5.921	0.600	29	31.774	20.435	208.066	0.93363	0.81112	27.0	0.3800	1.216007
24.15	7.318	0.700	30	31.774	20.324	208.066	0.93363	0.85928	25.3	0.3568	1.141651
31.40	9.515	0.900	32	31.774	20.980	208.066	0.93363	0.86896	25.9	0.3642	1.165375
31.98	9.691	1.000	33	31.774	16.503	208.066	0.93363	0.79651	22.2	0.3125	1.000072
40.66	12.321	1.200	34	31.774	18.841	208.066	0.93363	0.84392	23.9	0.3367	1.077576
51.84	15.709	1.400	35	31.774	19.194	208.066	0.93363	0.92226	22.3	0.3139	1.004546
58.92	17.855	1.600	36	31.774	19.229	208.066	0.93363	0.91719	22.5	0.3162	1.011947
66.78	20.236	1.800	37	31.774	11.833	208.066	0.93363	0.92403	13.7	0.1932	
75.68	22.933	2.000	38	31.774	16.647	208.066	0.93363	0.94247	18.9	0.2664	



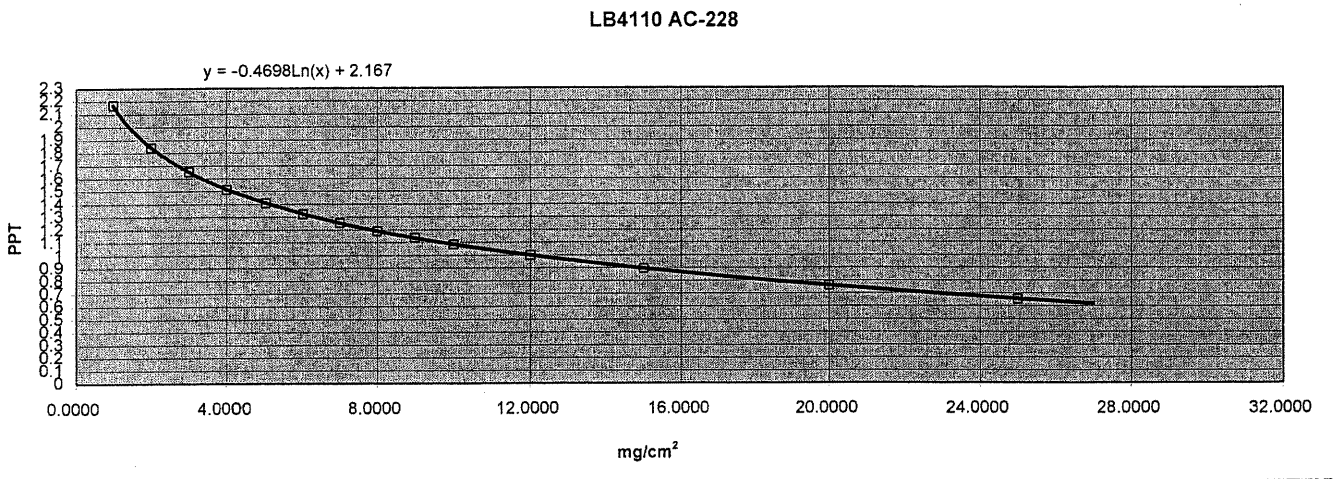
79

78

Log Book Entry	Group & Sample Number	Date	Assay / Size / Reg	Prep By	Volume	Std. Solution	Total Activity	% Error	Activity Date	Std WTS	Matrix	Container	Other Comments
	10-67-35	1/24/01	Ac. 228	CS RP	1.0 ml	RFA (4)	71.01	1.8	1/29/02-00	1.01	- 1M HCl	50ml Poly Tube	
	10-67-36	"	"	" RP	"	"	71.01	"	"	1.01	"	"	
	10-67-37	"	"	" RP	"	"	71.01	"	"	1.01	"	"	
	10-67-38	"	"	" RP	"	"	71.01	"	"	1.01	"	"	

Log Book Entry	Group & Sample Number	Date	Assay / Size / Reg	Prep By	Volume	Std. Solution	Total Activity	% Error	Activity Date	Std WTS	Matrix	Container	Other Comments
	10-67-35	1/24/01	Ac. 228	CS RP	1.0 ml	RFA (4)	71.01	1.8	1/29/02-00	1.01	- 1M HCl	50ml Poly Tube	
	10-67-36	"	"	" RP	"	"	71.01	"	"	1.01	"	"	
	10-67-37	"	"	" RP	"	"	71.01	"	"	1.01	"	"	
	10-67-38	"	"	" RP	"	"	71.01	"	"	1.01	"	"	

mg/cm2	PPT	Eff.
0.0000		
1.0000	2.168	0.683
2.0000	1.841	0.58
3.0000	1.651	0.52
4.0000	1.514	0.477
5.0000	1.41	0.444
6.0000	1.323	0.417
7.0000	1.254	0.395
8.0000	1.19	0.375
9.0000	1.137	0.358
10.0000	1.086	0.342
12.0000	1	0.315
15.0000	0.895	0.282
20.0000	0.759	0.239
25.0000	0.654	0.206



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TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 25

Ac

Reviewed AK Date 2-2-01

Ac 228

Counter GRB 217
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.136	0.	0.0	0.00	0.000	0.00		8.64	8.64

CPM corrected for decay to Sept. Time. : 23.0697

Elapsed time (days) = 0.000
 Lambda = 3.300E-04 Reciprocal days
 exp(-lambda X t) (1)= 1.000E+00
 Chemical yield (2)= 1.3258
 PPT. correction (3)= 0.9700 (recovery = 3.980 mgs)
 Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 1.285977E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
1.7939E+01	1.8280	3.2793E+01	9.7470E-01	2.97 %

LTV 3.4401E+01

1st point MDA 1.3384E+00

DPM OF ALIQUOT 3.279E+01

Saved answer = 3.279E+01 2.97% (DPM of aliquot) (28516)

1067 - 25 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM @ 32.136	Error	
32.136	GRB	217	838	100.0	0.37	1.021	8.97	8.97	3.7%
32.208	GRB	217	381	60.0	0.37	1.021	6.45	7.84	5.5%
32.258	GRB	217	381	60.0	0.37	1.021	6.45	8.98	5.5%
32.740	GRB	217	182	100.0	0.37	1.021	1.62	8.34	9.8%
32.828	GRB	221	160	100.0	0.38	1.014	1.35	8.84	11.1%
Weighted average							8.64	3.0%	

Error shown is 1.2 times that expected from counting statistics.

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR
8.9675E+00 8.9675E+00 3.2818E-01 8.6369E+00 2.5671E-01 2.9723E+00
8.9675E+00 8.9675E+00 3.2818E-01 8.6369E+00 2.5671E-01 2.9723E+00

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302
TMA Beta Counting Data
AUTOB V 2.07

1067-26

Ac

Reviewed AK Date 2-6-01

Ac 228

Counter GRB 218
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.136	0.	0.0	0.00	0.000	0.00		9.46	9.46

CPM corrected for decay to Sept. Time. : 25.2742

Elapsed time (days) = 0.000
Lambda = 3.300E-04 Reciprocal days
exp(-lambda X t) (1) = 1.000E+00
Chemical yield (2) = 1.6789
PPT. correction (3) = 0.9965 (recovery = 7.560 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.672989E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
1.5107E+01	1.8280	2.7616E+01	6.5148E-01	2.36 %

LTV 2.8691E+01

1st point MDA 9.8384E-01

DPM OF ALIQUOT 2.762E+01

Saved answer = 2.762E+01 2.36% (DPM of aliquot) (29365)

1067 - 26 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM @ 32.136	Error
32.136	GRB 218	901	100.0	0.35	1.005	9.55	9.55	3.5%
32.208	GRB 218	463	60.0	0.35	1.005	7.83	9.52	4.9%
32.258	GRB 218	409	60.0	0.35	1.005	6.87	9.57	5.3%
32.740	GRB 218	207	100.0	0.35	1.005	1.90	9.76	8.7%
32.828	GRB 222	144	100.0	0.35	1.006	1.21	7.89	11.6%
Weighted average							9.46	2.4%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

9.5481E+00 9.5481E+00 3.3423E-01 9.4623E+00 2.2322E-01 2.3591E+00
 9.5481E+00 9.5481E+00 3.3423E-01 9.4623E+00 2.2322E-01 2.3591E+00

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304
TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 27

Ac

Reviewed AK Date 2-2-01

Ac 228

Counter GRB 219
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.136	0.	0.0	0.00	0.000	0.00		8.35	8.35

CPM corrected for decay to Sept. Time. : 22.3003

Elapsed time (days) = 0.000
Lambda = 3.300E-04 Reciprocal days
exp(-lambda X t) (1) = 1.000E+00
Chemical yield (2) = 1.9620
PPT. correction (3) = 1.0050 (recovery = 11.78 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.971835E+00

C-zero	P-factor	dpm/smpl	dpm error	1 sigma percent sigma
1.1309E+01	1.8280	2.0674E+01	5.2447E-01	2.54 %

LTV 2.1539E+01

1st point MDA 8.5999E-01

DPM OF ALIQUOT 2.067E+01

Saved answer = 2.067E+01 2.54% (DPM of aliquot) (28159)

(P)

1067 - 27 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM @ 32.136	Error
32.136	GRB 219	803	100.0	0.37	1.012	8.51	8.51	3.7%
32.208	GRB 219	410	60.0	0.37	1.012	6.92	8.41	5.3%
32.258	GRB 219	343	60.0	0.37	1.012	5.72	7.97	5.8%
32.740	GRB 219	172	100.0	0.37	1.012	1.50	7.73	10.2%
32.856	GRB 207	156	100.0	0.36	1.047	1.38	9.74	11.0%
33.210	GRB 231	74	100.0	0.41	1.026	0.37	6.91	29.7%
Weighted average							8.35	2.5%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

8.5065E+00 8.5065E+00 3.1846E-01 8.3489E+00 2.1180E-01 2.5369E+00
8.5065E+00 8.5065E+00 3.1846E-01 8.3489E+00 2.1180E-01 2.5369E+00

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306
TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 28 Ac

Reviewed AK Date 2-2-1

Ac 228

Counter GRB 220
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.136	0.	0.0	0.00	0.000	0.00		7.87	7.87

CPM corrected for decay to Sept. Time. : 21.0095

Elapsed time (days) = 0.000
Lambda = 3.300E-04 Reciprocal days
exp(-lambda X t) (1) = 1.000E+00
Chemical yield (2) = 2.0293
PPT. correction (3) = 1.0032 (recovery = 15.23 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 2.035715E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
1.0320E+01	1.8280	1.8866E+01	4.9387E-01	2.62 %

LTV 1.9681E+01

1st point MDA 8.0734E-01

DPM OF ALIQUOT 1.887E+01

Saved answer = 1.887E+01 2.62% (DPM of aliquot) (28160)

1067 - 28 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM	
							@ 32.136	Error
32.136	GRB	220	782	100.0	0.35	1.007	8.25	3.8%
32.208	GRB	220	367	60.0	0.35	1.007	6.14	5.6%
32.258	GRB	220	343	60.0	0.35	1.007	5.72	5.8%
32.740	GRB	220	164	100.0	0.35	1.007	1.43	10.4%
32.856	GRB	208	134	100.0	0.47	1.037	0.99	14.9%
33.210	GRB	232	67	100.0	0.36	1.024	0.34	30.3%
Weighted average							7.87	2.6%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

8.2545E+00 8.2545E+00 3.1242E-01 7.8656E+00 2.0591E-01 2.6178E+00
 8.2545E+00 8.2545E+00 3.1242E-01 7.8656E+00 2.0591E-01 2.6178E+00

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TMA Corporation
Beta Counting Data
AUTOB V 2 07

1067- 29

Ac

Reviewed _____ Date _____

Ac 228

Counter GRB 221
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.113	0.	0.0	0.00	0.000	0.00		8.14	8.14

CPM corrected for decay to Sept. Time. : 20.4348

Elapsed time (days) = 0.000
 Lambda = 3.300E-04 Reciprocal days
 exp(-lambda X t) (1)= 1.000E+00
 Chemical yield (2)= 2.1697
 PPT. correction (3)= 1.0002 (recovery = 19.54 mgs)
 Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 2.170007E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
9.4169E+00	1.8280	1.7214E+01	4.6224E-01	2.69 %

LTV 1.7977E+01

1st point MDA 7.4959E-01

DPM OF ALIQUOT 1.721E+01

Saved answer = 1.721E+01 2.69% (DPM of aliquot) (28161)

1067 - 29 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM	
							@ 32.113	Error
32.113	GRB 221	771	100.0	0.38	1.014	8.15	8.15	3.8%
32.208	GRB 221	357	60.0	0.38	1.014	5.97	7.72	5.7%
32.257	GRB 221	347	60.0	0.38	1.014	5.79	8.56	5.8%
32.741	GRB 221	185	100.0	0.38	1.014	1.63	8.96	9.8%
33.213	GRB 202	60	100.0	0.36	1.039	0.27	5.35	37.5%
33.783	GRB 217	31	60.0	0.38	1.021	0.15	13.72	75.7%
Weighted average							8.14	2.7%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

8.1495E+00 8.1495E+00 3.1317E-01 8.1433E+00 2.1867E-01 2.6853E+00
 8.1495E+00 8.1495E+00 3.1317E-01 8.1433E+00 2.1867E-01 2.6853E+00

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310
TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 30 Ac

Reviewed _____ Date _____

Ac 228

Counter GRB 222
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.113	0.	0.0	0.00	0.000	0.00		8.10	8.10

CPM corrected for decay to Sept. Time. : 20.3242

Elapsed time (days) = 0.000
Lambda = 3.300E-04 Reciprocal days
exp(-lambda X t) (1) = 1.000E+00
Chemical yield (2) = 2.2985
PPT. correction (3) = 0.9960 (recovery = 24.15 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 2.289378E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
8.8776E+00	1.8280	1.6228E+01	4.3225E-01	2.66 %

LTV 1.6941E+01

1st point MDA 6.7203E-01

DPM OF ALIQUOT 1.623E+01

Saved answer = 1.623E+01 2.66% (DPM of aliquot) (28162)

1067 - 30 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM	
							@ 32.113	Error
32.113	GRB	222	761	100.0	0.35	1.006	8.02	3.8%
32.208	GRB	222	368	60.0	0.35	1.006	6.16	5.6%
32.257	GRB	222	343	60.0	0.35	1.006	5.71	5.8%
32.741	GRB	222	166	100.0	0.35	1.006	1.45	10.3%
33.213	GRB	203	78	100.0	0.34	1.039	0.50	22.3%
33.783	GRB	218	23	60.0	0.36	1.005	0.03	373.2%
Weighted average							8.10	2.7%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

8.0167E+00 8.0167E+00 3.0794E-01 8.0992E+00 2.1573E-01 2.6636E+00
 8.0167E+00 8.0167E+00 3.0794E-01 8.0992E+00 2.1573E-01 2.6636E+00

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TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 31

Ac

Reviewed _____ Date _____

Ac 228

Counter GRB 223
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.113	0.	0.0	0.00	0.000	0.00		7.25	7.25

CPM corrected for decay to Sept. Time. : 18.2036

Elapsed time (days) = 0.000
 Lambda = 3.300E-04 Reciprocal days
 exp(-lambda X t) (1) = 1.000E+00
 Chemical yield (2) = 2.4226
 PPT. correction (3) = 0.9875 (recovery = 29.09 mgs)
 Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 2.392218E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
7.6095E+00	1.8280	1.3910E+01	3.9871E-01	2.87 %

LTV 1.4568E+01

1st point MDA 6.7919E-01

DPM OF ALIQUOT 1.391E+01

Saved answer = 1.391E+01 2.87% (DPM of aliquot) (28173)

1067 - 31 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM @ 32.113	Error
32.113	GRB	223	703	100.0	0.39	1.012	7.38	4.1%
32.208	GRB	223	354	60.0	0.39	1.012	5.90	5.7%
32.257	GRB	223	278	60.0	0.39	1.012	4.55	6.6%
32.741	GRB	223	162	100.0	0.39	1.012	1.37	11.0%
33.213	GRB	204	58	100.0	0.42	1.040	0.18	56.7%
33.783	GRB	219	17	60.0	0.36	1.012	-0.09	100.9%
Weighted average							7.25	2.9%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

7.3772E+00 7.3772E+00 2.9886E-01 7.2542E+00 2.0793E-01 2.8663E+00
7.3772E+00 7.3772E+00 2.9886E-01 7.2542E+00 2.0793E-01 2.8663E+00

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TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 32

Ac

Reviewed _____ Date _____

Ac 228

Counter ORB 224
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.113	0.	0.0	0.00	0.000	0.00		8.36	8.36

CPM corrected for decay to Sept. Time. : 20.9804

Elapsed time (days) = 0.000
 Lambda = 3.300E-04 Reciprocal days
 exp(-lambda X t) (1) = 1.000E+00
 Chemical yield (2) = 2.3244
 PPT. correction (3) = 0.9808 (recovery = 31.40 mgs)
 Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 2.279861E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
9.2025E+00	1.8280	1.6822E+01	4.4022E-01	2.62 %

LTV 1.7548E+01

1st point MDA 6.8591E-01

DPM OF ALIQUOT 1.682E+01

Saved answer = 1.682E+01 2.62% (DPM of aliquot) (28174)

1067 - 32 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S.F.	CPM	CPM	
							@ 32.113	Error
32.113	GRB	224	783	100.0	0.36	1.000	8.19	3.8%
32.208	GRB	224	396	60.0	0.36	1.000	8.54	5.4%
32.257	GRB	224	346	60.0	0.36	1.000	8.45	5.8%
32.741	GRB	224	179	100.0	0.36	1.000	8.60	9.9%
33.337	GRB	203	226	400.0	0.34	1.039	9.10	25.1%
33.758	GRB	221	34	60.0	0.38	1.014	16.93	59.2%
Weighted average							8.36	2.6%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

8.1917E+00 8.1917E+00 3.1074E-01 8.3607E+00 2.1879E-01 2.6169E+00
8.1917E+00 8.1917E+00 3.1074E-01 8.3607E+00 2.1879E-01 2.6169E+00

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316
TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 33

Ac

Reviewed AK Date 2-2-1

Ac 228

Counter GRB 229
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.112	0.	0.0	0.00	0.000	0.00		6.59	6.59

CPM corrected for decay to Sept. Time. : 16.5033

Elapsed time (days) = 0.000
Lambda = 3.300E-04 Reciprocal days
exp(-lambda X t) (1)= 1.000E+00
Chemical yield (2)= 2.1306
PPT. correction (3)= 0.9791 (recovery = 31.98 mgs)
Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 2.086031E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
7.9113E+00	1.8280	1.4462E+01	4.2415E-01	2.93 %

LTV 1.5162E+01

1st point MDA 7.9542E-01

DPM OF ALIQUOT 1.446E+01

Saved answer = 1.446E+01 2.93% (DPM of aliquot) (28175)

1067 - 33 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S.F.	CPM	CPM @ 32.112	Error
32.112	GRB	229	635	100.0	0.40	1.025	6.70	4.3%
32.208	GRB	229	297	60.0	0.40	1.025	4.94	6.4%
32.257	GRB	229	266	60.0	0.40	1.025	4.38	6.8%
32.740	GRB	229	143	100.0	0.40	1.025	1.16	12.5%
32.829	GRB	217	123	100.0	0.37	1.021	0.96	14.0%
32.852	GRB	229	127	100.0	0.40	1.025	0.98	14.1%
Weighted average							6.59	2.9%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

6.6960E+00 6.6960E+00 2.8839E-01 6.5945E+00 1.9340E-01 2.9328E+00
6.6960E+00 6.6960E+00 2.8839E-01 6.5945E+00 1.9340E-01 2.9328E+00

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ACC

318
TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 34

Ac

Reviewed AK Date 2-2-1

Ac 228

Counter GRB 230
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.112	0.	0.0	0.00	0.000	0.00		7.53	7.53

CPM corrected for decay to Sept. Time. : 18.8406

Elapsed time (days) = 0.000
Lambda = 3.300E-04 Reciprocal days
exp(-lambda X t) (1) = 1.000E+00
Chemical yield (2) = 2.2574
PPT. correction (3) = 0.9349 (recovery = 40.66 mgs)
Aliquot (4) = 1.000 μ mpl

Product (1X2X3X4) = 2.110421E+00

C-zero	F-factor	dpm/ μ mpl	dpm error	percent sigma
8.9274E+00	1.8280	1.6319E+01	5.5090E-01	3.38 %

LTV 1.7228E+01

1st point MDA 7.3940E-01

DPM OF ALIQUOT 1.632E+01

Saved answer = 1.632E+01 3.38% (DPM of aliquot) (28191)

1067 - 34 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM	
							@ 32.112	Error
32.112	GRB	230	744	100.0	0.36	1.011	7.86	3.9%
32.208	GRB	230	317	60.0	0.36	1.011	5.27	6.1%
32.257	GRB	230	332	60.0	0.36	1.011	5.54	5.9%
32.740	GRB	230	147	100.0	0.35	1.011	1.24	11.5%
32.829	GRB	218	130	100.0	0.35	1.005	1.05	12.8%
32.852	GRB	230	115	100.0	0.35	1.011	0.89	14.4%
Weighted average							7.53	3.4%

Error shown is 1.3 times that expected from counting statistics.

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

7.8580E+00 7.8580E+00 3.0626E-01 7.5284E+00 2.5414E-01 3.3758E+00
7.8580E+00 7.8580E+00 3.0626E-01 7.5284E+00 2.5414E-01 3.3758E+00

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19:15:47
R011183
ACC

320
TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067-35 Ac

Reviewed AK Date 2-2-1

Ac 228

Counter GRB 231
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.112	0.	0.0	0.00	0.000	0.00		7.67	7.67

CPM corrected for decay to Sept. Time. : 19.1941

Elapsed time (days) = 0.000
Lambda = 3.300E-04 Reciprocal days
exp(-lambda X t) (1) = 1.000E+00
Chemical yield (2) = 2.4669
PPT. correction (3) = 0.8705 (recovery = 51.84 mgs)
Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 2.147527E+00

C-zero	F-factor	dpm/smpl	dpm error	percent sigma
8.9378E+00	1.8280	1.6338E+01	4.4208E-01	2.71 %

LTV 1.7068E+01

1st point MDA 7.8925E-01

DPM OF ALIQUOT 1.634E+01

Saved answer = 1.634E+01 2.71% (DPM of aliquot) (28192)

1067 - 35 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM @ 32.112	Error
32.112	GRB 231	727	100.0	0.41	1.026	7.72	7.72	4.0%
32.208	GRB 231	358	60.0	0.41	1.026	6.03	7.82	5.7%
32.257	GRB 231	321	60.0	0.41	1.026	5.36	7.94	6.1%
32.740	GRB 231	147	100.0	0.41	1.026	1.20	6.58	12.3%
32.829	GRB 219	148	100.0	0.37	1.012	1.23	8.64	11.7%
32.852	GRB 231	113	100.0	0.41	1.026	0.81	6.06	16.2%
Weighted average							7.67	2.7%

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

7.7179E+00 7.7179E+00 3.0864E-01 7.6697E+00 2.0753E-01 2.7058E+00
7.7179E+00 7.7179E+00 3.0864E-01 7.6697E+00 2.0753E-01 2.7058E+00

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19:16:30
R011183
ACC

TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 36

Ac

Reviewed AK Date 2-2-1

Ac 228

Counter GRB 232
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.112	0.	0.0	0.00	0.000	0.00		7.68	7.68

CPM corrected for decay to Sept. Time. : 19.2292

Elapsed time (days) = 0.000
 Lambda = 3.300E-04 Reciprocal days
 exp(-lambda X t) (1) = 1.000E+00
 Chemical yield (2) = 2.4534
 PPT. correction (3) = 0.8298 (recovery = 58.92 mgs)
 Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 2.035712E+00

C-zero	P-factor	dpm/smpl	dpm error	percent sigma
9.4459E+00	1.8280	1.7267E+01	4.6107E-01	2.67 %

LTV 1.8028E+01

1st point MDA 7.8451E-01

DPM OF ALIQUOT 1.727E+01

Saved answer = 1.727E+01 2.67% (DPM of aliquot) (28193)

(P)

1067 - 36 Ac

Ac228 (lambda = 2.714E+00)
Corrected for decay during counting

GMT	Det	Cnts	Min.	Bkg	S. F.	CPM	CPM e 32.112	Error	
32.112	GRB	232	734	100.0	0.36	1.024	7.84	7.84	3.9%
32.208	GRB	232	364	60.0	0.36	1.024	6.18	8.01	5.6%
32.257	GRB	232	290	60.0	0.36	1.024	4.84	7.17	6.4%
32.740	GRB	232	140	100.0	0.36	1.024	1.16	6.40	12.2%
32.829	GRB	220	134	100.0	0.35	1.007	1.09	7.66	12.4%
32.852	GRB	232	146	100.0	0.36	1.024	1.23	9.18	11.7%
Weighted average							7.68	2.7%	

CRATE1, DCPM1, ERR1, AVCPM, AVERR, AVPERR

7.8377E+00 7.8377E+00 3.0832E-01 7.6837E+00 2.0517E-01 2.6702E+00
7.8377E+00 7.8377E+00 3.0832E-01 7.6837E+00 2.0517E-01 2.6702E+00

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08:07:14
R011183
ACC

TMA Corporation
Data Counting Data
AUTOB V 2.07

1067- 37

Ac

Reviewed AK Date 2-2-01

Ac 228

Counter GRB 207
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	ADJUSTED CPM	CORRECTED CPM
32.122	0.	0.0	0.00	0.000	0.00	4.60	4.60

CPM corrected for decay to Sept. Time. : 11.8328

Elapsed time (days) = 0.000
 Lambda = 3.300E-04 Reciprocal days
 exp(-lambda X t) (1)= 1.000E+00
 Chemical yield (2)= 2.4717
 PPT. correction (3)= 0.7845 (recovery = 66.78 mgs)
 Aliquot (4)= 1.000 smpl

Product (1X2X3X4) = 1.939060E+00

C-zero	P-factor	dpm/smpl	dpm error	1 sigma percent sigma
6.1023E+00	1.8280	1.1155E+01	4.1194E-01	3.69 %

LTV 1.1835E+01

1st point MDA 8.5695E-01

DPM OF ALIQUOT 1.116E+01

Saved answer = 1.116E+01 3.69% (DPM of aliquot) (28194)

02-FEB-01
08:08:14
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ACC

TMA Corporation
Beta Counting Data
AUTOB V 2.07

1067- 38

Ac

Reviewed AK Date 2-2-01

Ac 228

Counter GRB 208
Length of count 0.0 Min.
Gross counts = 0.

Zero time 31.774 1
Separation time 31.774 1

GMT TIME	GROSS COUNT	COUNTING TIME	TOTAL CPM	BKGD	NET CPM	CPM	ADJUSTED CPM	CORRECTED CPM
32.122	0.	0.0	0.00	0.000	0.00		6.47	6.47

CPM corrected for decay to Sept. Time. : 16.6470

Elapsed time (days) = 0.000
 Lambda = 3.300E-04 Reciprocal days
 exp(-lambda X t) (1) = 1.000E+00
 Chemical yield (2) = 2.5210
 PPT. correction (3) = 0.7333 (recovery = 75.68 mgs)
 Aliquot (4) = 1.000 smpl

Product (1X2X3X4) = 1.848555E+00

C-zero	F-factor	dpm/smpl	dpm error	percent sigma
9.0054E+00	1.8280	1.6462E+01	5.1993E-01	3.16 %

LTV 1.7320E+01

1st point MDA 1.0136E+00

DPM OF ALIQUOT 1.646E+01

Saved answer = 1.646E+01 3.16% (DPM of aliquot) (28195)

APPENDIX G

Section 19

EBERLINE SERVICES REPORT

April 18, 2007



EBERLINE

SERVICES

April 18, 2007

Ms. Michele Chamberlin
Test America, Inc.
17461 Derian Avenue, Suite 100
Irvine, CA 92614

Reference: Test America Project No. IQB2023
Eberline Services NELAP Cert #01120CA (exp. 01/31/08)
Eberline Services Report R702123-8658
R704053-8658

Dear Ms. Chamberlin:

Enclosed are updated results from the analyses of one water sample received at Eberline Services on February 21, 2007. Results for gross alpha/gross beta were originally reported on March 23. This report includes results for Ra-226 (EPA903.1), Ra-228 (EPA 904.0), and gamma spectroscopy (EPA901.1). The sample was not filtered prior to analysis; the gross alpha/gross beta fraction was prepared for analysis within 5 days of collection. Quality control samples consisted of an LCS, blank analysis, duplicate analysis, and matrix spike. The gross alpha/gross beta QC samples are 8657-002, 003, 004, and 005. The Ra-226, Ra-228, and gamma spec QC samples are 8658-002, 003, 004, and 005. All QC sample results were within the limits defined in Eberline Services Quality Control Procedures Manual.

Please call me if you have any questions concerning this report.

Regards,

For Melissa Mannion
Senior Program Manager

MCM/njv

Enclosure: Report

Analytical Services
2030 Wright Avenue
P.O. Box 4040
Richmond, California 94804-0040
(510) 235-2633 Fax (510) 235-0438
Toll Free (800) 841-5487
www.eberlineservices.com
NPDES - 1384

Eberline Services

ANALYSIS RESULTS

SDG <u>8658</u>	Client <u>TA IRVINE</u>
Work Order <u>R702123-01</u>	Contract <u>PROJECT# IQB2023</u>
Received Date <u>02/21/07</u>	Matrix <u>WATER</u>

Client	Lab						
<u>Sample ID</u>	<u>Sample ID</u>	<u>Collected</u>	<u>Analyzed</u>	<u>Nuclide</u>	<u>Results + 2σ</u>	<u>Units</u>	<u>MDA</u>
IQB2023-01	8658-001	02/19/07	03/08/07	GrossAlpha	-0.901 ± 1.5	pCi/L	2.5
			03/08/07	Gross Beta	63.8 ± 2.8	pCi/L	2.2
		04/16/07	04/17/07	Ra-228	0.053 ± 0.19	pCi/L	0.52
			04/16/07	K-40 (G)	U	pCi/L	168
			04/16/07	Cs-137 (G)	U	pCi/L	8.51
			04/16/07	Tl-208 (G)	U	pCi/L	9.24
			04/16/07	Pb-210 (G)	U	pCi/L	1950
			04/16/07	Bi-212 (G)	U	pCi/L	62.4
			04/16/07	Pb-212 (G)	U	pCi/L	14.2
			04/16/07	Bi-214 (G)	U	pCi/L	17.9
			04/16/07	Pb-214 (G)	U	pCi/L	16.4
			04/16/07	Ra-226 (G)	U	pCi/L	144
			04/16/07	Ac-228 (G)	U	pCi/L	37.6
			04/16/07	Th-234 (G)	U	pCi/L	258
			04/16/07	U-235 (G)	U	pCi/L	52.1
			04/16/07	U-238 (G)	U	pCi/L	1070
04/17/07	Ra-226	0.240 ± 0.49	pCi/L	0.85			

Certified by
Report Date <u>04/18/07</u>
Page 1

Eberline Services

QC RESULTS

SDG <u>8658</u>	Client <u>TA IRVINE</u>
Work Order <u>R702123-01</u>	Contract <u>PROJECT# IQB2023</u>
Received Date <u>02/21/07</u>	Matrix <u>WATER</u>

Lab	Sample ID	Nuclide	Results	Units	Amount Added	MDA	Evaluation
<u>LCS</u>							
	8657-002	GrossAlpha	8.17 ± 0.65	pCi/Smpl	10.1	0.318	81% recovery
		Gross Beta	9.76 ± 0.37	pCi/Smpl	9.60	0.277	102% recovery
		Ra-228	9.35 ± 0.51	pCi/Smpl	8.84	0.85	106% recovery
		Ra-226	5.19 ± 0.24	pCi/Smpl	5.02	0.087	103% recovery
<u>BLANK</u>							
	8657-003	GrossAlpha	-0.364 ± 0.15	pCi/Smpl	NA	0.348	<MDA
		Gross Beta	-0.091 ± 0.15	pCi/Smpl	NA	0.269	<MDA
		Ra-228	-0.372 ± 0.28	pCi/Smpl	NA	0.771	<MDA
		Ra-226	0.007 ± 0.040	pCi/Smpl	NA	0.077	<MDA
<u>LCS</u>							
	8658-002	Ra-228	12.4 ± 0.68	pCi/Smpl	10.9	0.840	114% recovery
		Cs-137 (G)	309 ± 9.7	pCi/Smpl	288	7.27	107% recovery
		Ra-226	5.30 ± 0.26	pCi/Smpl	5.02	0.095	106% recovery
<u>BLANK</u>							
	8658-003	Ra-228	-0.270 ± 0.28	pCi/Smpl	NA	0.83	<MDA
		K-40 (G)	U	pCi/Smpl	NA	121	<MDA
		Cs-137 (G)	U	pCi/Smpl	NA	5.58	<MDA
		Tl-208 (G)	U	pCi/Smpl	NA	5.73	<MDA
		Pb-210 (G)	U	pCi/Smpl	NA	750	<MDA
		Bi-212 (G)	U	pCi/Smpl	NA	41.0	<MDA
		Pb-212 (G)	U	pCi/Smpl	NA	9.09	<MDA
		Bi-214 (G)	U	pCi/Smpl	NA	12.5	<MDA
		Pb-214 (G)	U	pCi/Smpl	NA	12.0	<MDA
		Ra-226 (G)	U	pCi/Smpl	NA	85.9	<MDA
		Ac-228 (G)	U	pCi/Smpl	NA	24.5	<MDA
		Th-234 (G)	U	pCi/Smpl	NA	124	<MDA
		U-235 (G)	U	pCi/Smpl	NA	32.0	<MDA
		U-238 (G)	U	pCi/Smpl	NA	703	<MDA
		Ra-226	-0.016 ± 0.033	pCi/Smpl	NA	0.075	<MDA

DUPLICATES				ORIGINALS				
Sample ID	Nuclide	Results + 2σ	MDA	Sample ID	Results + 2σ	MDA	RPD (Tot)	Eval
8657-004	GrossAlpha	-0.302 ± 0.53	0.882	8657-001	-0.192 ± 0.44	0.698	-	0 satis.

Certified by _____ *ngv*

Report Date 04/18/07

Page 2

Eberline Services

SDG <u>8658</u>	Client <u>TA IRVINE</u>
Work Order <u>R702123-01</u>	Contract <u>PROJECT# IOB2023</u>
Received Date <u>02/21/07</u>	Matrix <u>WATER</u>

<table style="width: 100%; border-collapse: collapse;"> <tr> <td>Gross Beta</td> <td>27.3 ± 1.3</td> <td>1.47</td> </tr> <tr> <td>Ra-228</td> <td>-0.024 ± 0.21</td> <td>0.426</td> </tr> <tr> <td>Ra-226</td> <td>-0.021 ± 0.38</td> <td>0.756</td> </tr> <tr> <td>8658-004 Ra-228</td> <td>0.038 ± 0.18</td> <td>0.49</td> </tr> <tr> <td>K-40 (G)</td> <td>U</td> <td>357</td> </tr> <tr> <td>Cs-137 (G)</td> <td>U</td> <td>13.4</td> </tr> <tr> <td>Tl-208 (G)</td> <td>U</td> <td>14.0</td> </tr> <tr> <td>Pb-210 (G)</td> <td>U</td> <td>363</td> </tr> <tr> <td>Bi-212 (G)</td> <td>U</td> <td>103</td> </tr> <tr> <td>Pb-212 (G)</td> <td>U</td> <td>20.2</td> </tr> <tr> <td>Bi-214 (G)</td> <td>U</td> <td>29.4</td> </tr> <tr> <td>Pb-214 (G)</td> <td>U</td> <td>27.4</td> </tr> <tr> <td>Ra-226 (G)</td> <td>U</td> <td>192</td> </tr> <tr> <td>Ac-228 (G)</td> <td>U</td> <td>57.4</td> </tr> <tr> <td>Th-234 (G)</td> <td>U</td> <td>215</td> </tr> <tr> <td>U-235 (G)</td> <td>U</td> <td>71.9</td> </tr> <tr> <td>U-238 (G)</td> <td>U</td> <td>1570</td> </tr> <tr> <td>Ra-226</td> <td>-0.234 ± 0.40</td> <td>0.87</td> </tr> </table>	Gross Beta	27.3 ± 1.3	1.47	Ra-228	-0.024 ± 0.21	0.426	Ra-226	-0.021 ± 0.38	0.756	8658-004 Ra-228	0.038 ± 0.18	0.49	K-40 (G)	U	357	Cs-137 (G)	U	13.4	Tl-208 (G)	U	14.0	Pb-210 (G)	U	363	Bi-212 (G)	U	103	Pb-212 (G)	U	20.2	Bi-214 (G)	U	29.4	Pb-214 (G)	U	27.4	Ra-226 (G)	U	192	Ac-228 (G)	U	57.4	Th-234 (G)	U	215	U-235 (G)	U	71.9	U-238 (G)	U	1570	Ra-226	-0.234 ± 0.40	0.87		<table style="width: 100%; border-collapse: collapse;"> <tr> <td>24.3 ± 1.1</td> <td>1.04</td> <td>12</td> <td>44</td> <td>satis.</td> </tr> <tr> <td>0.051 ± 0.15</td> <td>0.413</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>-0.200 ± 0.41</td> <td>0.878</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>8658-001 0.053 ± 0.19</td> <td>0.52</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>168</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>8.51</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>9.24</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>1950</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>62.4</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>14.2</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>17.9</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>16.4</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>144</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>37.6</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>258</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>52.1</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>U</td> <td>1070</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> <tr> <td>0.240 ± 0.49</td> <td>0.85</td> <td>-</td> <td>0</td> <td>satis.</td> </tr> </table>	24.3 ± 1.1	1.04	12	44	satis.	0.051 ± 0.15	0.413	-	0	satis.	-0.200 ± 0.41	0.878	-	0	satis.	8658-001 0.053 ± 0.19	0.52	-	0	satis.	U	168	-	0	satis.	U	8.51	-	0	satis.	U	9.24	-	0	satis.	U	1950	-	0	satis.	U	62.4	-	0	satis.	U	14.2	-	0	satis.	U	17.9	-	0	satis.	U	16.4	-	0	satis.	U	144	-	0	satis.	U	37.6	-	0	satis.	U	258	-	0	satis.	U	52.1	-	0	satis.	U	1070	-	0	satis.	0.240 ± 0.49	0.85	-	0	satis.
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U	9.24	-	0	satis.																																																																																																																																														
U	1950	-	0	satis.																																																																																																																																														
U	62.4	-	0	satis.																																																																																																																																														
U	14.2	-	0	satis.																																																																																																																																														
U	17.9	-	0	satis.																																																																																																																																														
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U	144	-	0	satis.																																																																																																																																														
U	37.6	-	0	satis.																																																																																																																																														
U	258	-	0	satis.																																																																																																																																														
U	52.1	-	0	satis.																																																																																																																																														
U	1070	-	0	satis.																																																																																																																																														
0.240 ± 0.49	0.85	-	0	satis.																																																																																																																																														

SPIKED SAMPLE

Sample ID	Nuclide	Results ± 2σ	MDA
8657-005	GrossAlpha	77.4 ± 6.8	1.9
	Gross Beta	95.0 ± 4.0	2.0
	Ra-226	105 ± 4.4	0.863
8658-005	Ra-226	111 ± 4.6	0.920

ORIGINAL SAMPLE

Sample ID	Results ± 2σ	MDA	Added	%Recv
8657-001	-0.192 ± 0.44	0.698	70.8	110
	24.3 ± 1.1	1.04	70.4	100
	-0.200 ± 0.41	0.878	112	94
8658-001	0.240 ± 0.49	0.85	112	99

Certified by
Report Date <u>04/18/07</u>
Page 3

Gross Beta Reanalysis

Eberline Services

ANALYSIS RESULTS

SDG <u>8658</u>	Client <u>TA IRVINE</u>
Work Order <u>R704053-01</u>	Contract <u>PROJECT# IQB2023</u>
Received Date <u>04/10/07</u>	Matrix <u>WATER</u>

<u>Client</u>	<u>Lab</u>	<u>Collected</u>	<u>Analyzed</u>	<u>Nuclide</u>	<u>Results ± 2σ</u>	<u>Units</u>	<u>MDA</u>
<u>Sample ID</u>	<u>Sample ID</u>						
IQB2023-01	8658-001	02/19/07	04/12/07	Gross Beta	66.2 ± 3.8	pCi/L	2.47

Certified by <u><i>Mel Mann</i></u>
Report Date <u>04/13/07</u>
Page 1

Eberline Services

QC RESULTS

SDG <u>8658</u>	Client <u>TA IRVINE</u>
Work Order <u>R704053-01</u>	Contract <u>PROJECT# IQB2023</u>
Received Date <u>04/10/07</u>	Matrix <u>WATER</u>

Lab	<u>Sample ID</u>	<u>Nuclide</u>	<u>Results</u>	<u>Units</u>	<u>Amount Added</u>	<u>MDA</u>	<u>Evaluation</u>
<u>LCS</u>	8658-002	Gross Beta	11.2 ± 0.76	pCi/Smpl	11.5	0.555	97% recovery
<u>BLANK</u>	8658-003	Gross Beta	-0.102 ± 0.30	pCi/Smpl	NA	0.563	<MDA

<u>DUPLICATES</u>				<u>ORIGINALS</u>				
<u>Sample ID</u>	<u>Nuclide</u>	<u>Results ± 2σ</u>	<u>MDA</u>	<u>Sample ID</u>	<u>Results ± 2σ</u>	<u>MDA</u>	<u>RPD (Tot)</u>	<u>Eval</u>
8658-004	Gross Beta	70.6 ± 4.3	3.94	8658-001	66.2 ± 3.8	2.47	6 44	satis.

<u>SPIKED SAMPLE</u>				<u>ORIGINAL SAMPLE</u>				
<u>Sample ID</u>	<u>Nuclide</u>	<u>Results ± 2σ</u>	<u>MDA</u>	<u>Sample ID</u>	<u>Results ± 2σ</u>	<u>MDA</u>	<u>Added</u>	<u>%Recv</u>
8658-005	Gross Beta	153 ± 5.8	3.82	8658-001	66.2 ± 3.8	2.47	84.3	103

Certified by <u><i>Mer Mann</i></u> Report Date <u>04/13/07</u> Page 2
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APPENDIX G

Section 19

EBERLINE SERVICES REPORT

April 23, 2007



EBERLINE SERVICES

April 23, 2007

Ms. Michele Chamberlin
Test America, Inc.
17461 Derian Avenue, Suite 100
Irvine, CA 92614

Reference: Test America Project No. IQA2793
Eberline Services NELAP Cert #01120CA (exp. 01/31/08)
Eberline Services Report R703151-8655

Dear Ms. Chamberlin:

Enclosed is a Level IV data report (on CD) for the results of one water sample received at Eberline Services on January 31, 2007. The sample was originally analyzed according to the accompanying Test America Subcontract Order Form; results were reported on February 23, 2007. The originally requested analyses were gross alpha/gross beta (EPA900.0), tritium (H-3, EPA906.0), and strontium-90 (Sr-90, EPA905.0), Ra-226 (EPA903.1), and Ra-228 (EPA904.0). This report contains the additionally requested gross beta (EPA900.0) and gamma spectroscopic (EPA901.1) results. Quality control samples consisted of LCS's, blank analyses, duplicate analyses, and matrix spikes (gross beta only). All QC sample results were within the limits defined in Eberline Services Quality Control Procedures Manual.

Please call me if you have any questions concerning this report.

Regards,

Melissa Mannion
Senior Program Manager

MCM/njv

Enclosure: CD Report

Analytical Services
2030 Wright Avenue
P.O. Box 4040
Richmond, California 94804-0040
(510) 235-2633 Fax (510) 235-0438
Toll Free (800) 841-5487
www.eberlineservices.com
NPDES - 1392

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Sample Analysis Raw Data
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Preparation Logs & Standards Certification
for Quality Control Samples

Section 3

Instrument Calibration Information

Section 1

Chain-of-Custody & Sample Receipt Information

Analysis Results

Sample Analysis Raw Data

Aliquot Information

SUBCONTRACT ORDER - PROJECT # IQA2793

SENDING LABORATORY:

TestAmerica - Irvine, CA
 17461 Derian Avenue, Suite 100
 Irvine, CA 92614
 Phone: (949) 261-1022
 Fax: (949) 260-3297
 Project Manager: Michele Chamberlin

RECEIVING LABORATORY:

Eberline Services
 2030 Wright Avenue
 Richmond, CA 94804
 Phone : (510) 235-2633
 Fax: (510) 235-0438

8655

Standard TAT is requested unless specific due date is requested => Due Date: _____ Initials: _____

Analysis	Expiration	Comments
Sample ID: IQA2793-01 Water	Sampled: 01/28/07 10:40	
Gross Alpha-O	07/27/07 10:40	EPA 900.0, DONT FILTER, 5 day HT!, sub to Eberline
Gross Beta-O	07/27/07 10:40	EPA 900.0, DONT FILTER, 5 day HT!, sub to Eberline
Level 4 + EDD-OUT	02/25/07 10:40	**LEVEL IV QC, ACCESS 7 EDD**
Radium, Combined-O	01/28/08 10:40	EPA 903.1 & 904.0, DONT FILTER, sub to Eberline
Strontium 90-O	01/28/08 10:40	EPA 905.0, DONT FILTER, 5 day HT!, sub to Eberline
Tritium-O	01/28/08 10:40	EPA 906.0, DONT FILTER, sub to Eberline

Containers Supplied:

- 1 gal Poly (IQA2793-01L)
- 1 gal Poly (IQA2793-01M)
- 1 gal Poly (IQA2793-01N)
- 40 ml Amber Voa Vial (IQA2793-01O)
- 40 ml Amber Voa Vial (IQA2793-01P)
- 40 ml Amber Voa Vial (IQA2793-01Q)

SAMPLE INTEGRITY:

All containers intact: Yes No
 Sample labels/COC agree: Yes No
 Samples Received On Ice:: Yes No
 Custody Seals Present: Yes No
 Samples Preserved Properly: Yes No
 Samples Received at (temp): _____

Released By: Va Bank Date: 1/30/07 Time: _____ Received By: [Signature] Date: 01/31/07 Time: 9:15

Released By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____

Client: TEST AMERICA City: IRVINE State: CA
 Date/Time received: 01/31/07 9:15 CoC No.: 10A2793 JFK 1/31/07
 Container I.D. No.: ICE GTEST Requested TAT (Days): 1 P.O. Received Yes [] No []

INSPECTION

1. Custody seals on shipping container intact? Yes [X] No [] N/A []
2. Custody seals on shipping container dated & signed? Yes [X] No [] N/A []
3. Custody seals on sample containers intact? Yes [] No [] N/A [X]
4. Custody seals on sample containers dated & signed? Yes [] No [] N/A [X]
5. Packing material is: Wet [] Dry [X]
6. Number of samples in shipping container: 1 Sample Matrix: W
7. Number of containers per sample: 6 (Or see CoC _____)
8. Samples are in correct container Yes [X] No []
9. Paperwork agrees with samples? Yes [X] No []
10. Samples have: Tape [] Hazard labels [] Rad labels [] Appropriate sample labels [X]
11. Samples are: In good condition [X] Leaking [] Broken Container [] Missing []
12. Samples are: Preserved [] Not preserved [X] pH _____ Preservative _____
13. Describe any anomalies:

14. Was P.M. notified of any anomalies? Yes [] No [] Date: _____
 15. Inspected by: JFK Date: 01/31/07 Time: 9:35

Customer Sample No.	cpm	mR/hr	Wide	Customer Sample No.	cpm	mR/hr	Wide


Ion Chamber Ser. No. _____ Calibration date _____
 Alpha Meter Ser. No. _____ Calibration date _____
 Beta/Gamma Meter Ser. No. _____ Calibration date _____

Eberline Services

ANALYSIS RESULTS

SDG <u>8655</u> Work Order <u>R703151-01</u> Received Date <u>03/22/07</u>	Client <u>TA IRVINE</u> Contract <u>PROJECT# IQA2793</u> Matrix <u>WATER</u>
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Client	Lab						
<u>Sample ID</u>	<u>Sample ID</u>	<u>Collected</u>	<u>Analyzed</u>	<u>Nuclide</u>	<u>Results ± 2σ</u>	<u>Units</u>	<u>MDA</u>
IQA2793-01	8655-001	01/28/07	03/28/07	Gross Beta	57.8 ± 3.2	pCi/L	1.90
			03/28/07	K-40 (G)	U	pCi/L	350
			03/28/07	Mn-54 (G)	U	pCi/L	13.1
			03/28/07	Co-58 (G)	U	pCi/L	19.0
			03/28/07	Co-60 (G)	U	pCi/L	13.4
			03/28/07	Cs-137 (G)	U	pCi/L	13.1
			03/28/07	Eu-152 (G)	U	pCi/L	36.6
			03/28/07	Eu-154 (G)	U	pCi/L	42.6
			03/28/07	Ra-226 (G)	U	pCi/L	27.9
			03/28/07	Th-228 (G)	U	pCi/L	21.7
			03/28/07	Th-232 (G)	U	pCi/L	59.2
			03/28/07	U-238 (G)	U	pCi/L	1520
			03/28/07	Am-241 (G)	U	pCi/L	17.5
			03/28/07	Am-243 (G)	U	pCi/L	140

Certified by <u></u> Report Date <u>04/19/07</u> Page 1
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Eberline Services

QC RESULTS

SDG <u>8655</u>	Client <u>TA IRVINE</u>
Work Order <u>R703151-01</u>	Contract <u>PROJECT# IQA2793</u>
Received Date <u>03/22/07</u>	Matrix <u>WATER</u>

Lab	Sample ID	Nuclide	Results	Units	Amount Added	MDA	Evaluation
<u>LCS</u>							
	8655-006	Gross Beta	10.9 ± 0.79	pCi/Smpl	11.5	0.638	95% recovery
		Co-60 (G)	256 ± 12	pCi/Smpl	253	6.67	101% recovery
		Cs-137 (G)	245 ± 10	pCi/Smpl	241	7.22	102% recovery
<u>BLANK</u>							
	8655-007	Gross Beta	-0.179 ± 0.30	pCi/Smpl	NA	0.550	<MDA
		K-40 (G)	U	pCi/Smpl	NA	109	<MDA
		Mn-54 (G)	U	pCi/Smpl	NA	3.86	<MDA
		Co-58 (G)	U	pCi/Smpl	NA	3.80	<MDA
		Co-60 (G)	U	pCi/Smpl	NA	4.37	<MDA
		Cs-137 (G)	U	pCi/Smpl	NA	4.50	<MDA
		Eu-152 (G)	U	pCi/Smpl	NA	12.6	<MDA
		Eu-154 (G)	U	pCi/Smpl	NA	13.1	<MDA
		Ra-226 (G)	U	pCi/Smpl	NA	9.23	<MDA
		Th-228 (G)	U	pCi/Smpl	NA	6.94	<MDA
		Th-232 (G)	U	pCi/Smpl	NA	19.5	<MDA
		U-238 (G)	U	pCi/Smpl	NA	520	<MDA
		Am-241 (G)	U	pCi/Smpl	NA	5.64	<MDA
		Am-243 (G)	U	pCi/Smpl	NA	68.5	<MDA

<u>DUPLICATES</u>			
Sample ID	Nuclide	Results + 2σ	MDA
8655-008	Gross Beta	59.4 ± 3.3	1.90
	K-40 (G)	U	189
	Mn-54 (G)	U	9.48
	Co-58 (G)	U	15.1
	Co-60 (G)	U	9.60
	Cs-137 (G)	U	9.95
	Eu-152 (G)	U	24.6
	Eu-154 (G)	U	27.9
	Ra-226 (G)	U	18.1
	Th-228 (G)	U	14.5
	Th-232 (G)	U	37.5
	U-238 (G)	U	986
	Am-241 (G)	U	49.8
	Am-243 (G)	U	164


<u>ORIGINALS</u>						
Sample ID	Results + 2σ	MDA	3σ			
			RPD	(Tot)	Eval	
8655-001	57.8 ± 3.2	1.90	3	44	satis.	
	U	350	-	0	satis.	
	U	13.1	-	0	satis.	
	U	19.0	-	0	satis.	
	U	13.4	-	0	satis.	
	U	13.1	-	0	satis.	
	U	36.6	-	0	satis.	
	U	42.6	-	0	satis.	
	U	27.9	-	0	satis.	
	U	21.7	-	0	satis.	
	U	59.2	-	0	satis.	
	U	1520	-	0	satis.	
	U	17.5	-	0	satis.	
	U	140	-	0	satis.	

Certified by <u></u>
Report Date <u>04/19/07</u>
Page 2

Eberline Services

SDG <u>8655</u>	Client <u>TA IRVINE</u>
Work Order <u>R703151-01</u>	Contract <u>PROJECT# IQA2793</u>
Received Date <u>03/22/07</u>	Matrix <u>WATER</u>

8655-009 Gross Beta 131 ± 4.7 2.24 | 8655-001 57.8 ± 3.2 1.90 70.3 104

Certified by <u></u>
Report Date <u>04/19/07</u>

28-MAR-07

13:03:37

R701193

MCM

Counted 87.740- 7 on C1 for 100.00 min.

TMA Corporation

Gross Alpha, Gross Beta Analysis

ABCALC V 1.05

8655- 1

82

IGA2793-01

Reviewed Beu Date 3-28-07

0.300	1	124.800 mg	124.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 109	GRB 109
Counts =	8.000	1558.000
Gross cpm =	0.080	15.580
Background =	0.065	0.967
Observed CPM =	0.015	14.613
Cross talk fac =	0.005	0.262
True CPM =	-0.064	14.630
Inst Std. Fac. =	1.060	1.014
Adjusted CPM =	-0.068	14.835
Eff (cpm/dpm) =	0.076	0.386
DPM of Aliquot =	-0.901	38.461
pCi /l =	-1.35	57.7
1 sigma % Err =	59.140	2.780
2 sigma % Err =	115.914	5.450
(1 sigma err) =	0.800	1.61
(2 sigma err) =	1.57	3.15
LTV (95 %) =	1.32	60.4
MDA (3.00) =	2.94	1.90
MDA (2.71) =	2.89	1.89
CRITICAL LEVEL =	1.18	0.892

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	86.995	7	0.065	0.967	0.00
SF	82.661	0	1.060	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.995	27-MAR-07 16:52	GAW 109	BK	801.1 min	0.00
87.645	28-MAR-07 8:28	GAW 109		10.0 min	0.00
87.682	28-MAR-07 9:22	GAW 109		10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.770	27-MAR-07 11:28	GRB 109	(82)9027 10	100.0 min	0.02
86.995	27-MAR-07 16:52	GRB 109	BK	801.1 min	0.00
87.682	28-MAR-07 9:22	GRB 109		10.0 min	0.00

kes
3/29/07

Status: PASS

Source	LCS
Sample No.	6
Analyte	GrBeta
Geometry	ST
Reference Date	
Separation Date #1	
Separation Date #2	
Count Date	87.740-07
Aliquot	1
Aliquot Units	SMPL
Yield	1
Result	10.875
Error @ 2s (abs.)	0.773
Error @ 2s (%)	7.1
MDA	0.63763
Result Units	PCI/SMPL
Nuclide	Sr 90
Standard ID	AA1-B-(15)
Qty (ml)	0.6
Activity (dpm)	27.31
Calib. Date	306.500-1996
Half Life (days)	10580
Decay Date	87.740-07
Added (pCi)	11.51
Added Error @ 2s (%)	4
F/A Ratio	0.945
F/A Ratio Error @ 2s (%)	8
LCL	0.80
LWL	0.87
UWL	1.13
UCL	1.20
Status	PASS
Flag	

(K)

Initials/Date LES
3/28/07

60753

28-MAR-07

13:03:38

R701193

MCM

Counted 87.740- 7 on C2 for 100.00 min.

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.05

8655- 6

82

QC-LCS #60753

Reviewed EW Date 3-28-07

1.00	smp1	59.100 mg	59.100 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 110	GRB 110
Counts =	2.000	1107.000
Gross cpm =	0.020	11.070
Background =	0.062	1.367
Observed CPM =	-0.042	9.703
Cross talk fac =	0.006	0.230
True CPM =	-0.099	9.726
Inst Std. Fac. =	1.053	1.006
Adjusted CPM =	-0.105	9.784
Eff (cpm/dpm) =	0.119	0.405
DPM of Aliquot =	-0.878	24.142

pCi /smp1 = -0.396 10.9

9

1 sigma % Err =	28.852	3.626
2 sigma % Err =	56.551	7.107
(1 sigma err) =	0.114	0.394
(2 sigma err) =	0.224	0.773
LTV (95 %) =	0.188	11.5
MDA (3.00) =	0.552	0.638
MDA (2.71) =	0.541	0.634
CRITICAL LEVEL =	0.220	0.303

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	86.995	7	0.062	1.367	0.00
SF	82.661	0	1.053	1.006	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.995	27-MAR-07 16:52	GAW 110	BK	801.1 min	0.00
87.645	28-MAR-07 8:28	GAW 110		10.0 min	0.00
87.682	28-MAR-07 9:22	GAW 110		10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.770	27-MAR-07 11:28	GRB 110	(82)9027 6	100.0 min	1.69
86.995	27-MAR-07 16:52	GRB 110	BK	801.1 min	0.00
87.682	28-MAR-07 9:22	GRB 110		10.0 min	0.00

(es)
3/28/07

Status: PASS

Source	BLANK
Sample No.	7
Analyte	GrBeta
Geometry	ST
Reference Date	
Separation Date #1	
Separation Date #2	
Count Date	87.740-07
Aliquot	1
Aliquot Units	SMPL
Yield	1
Result	-0.17869
Error @ 2s (abs.)	0.295
Error @ 2s (%)	165.1
MDA	0.55031
Result Units	PCI/SMPL
Status	PASS
Flag	

Initials/Date fes
3/28/07

60754

28-MAR-07
 13:03:39
 R701193
 MCM
 Counted 87.740- 7 on C3 for 100.00 min.

TMA Corporation
 Gross Alpha, Gross Beta Analysis
 ABCALC V 1.05

8655- 7 82
 QC-BLANK #60754
 Reviewed BEV Date 3/28/07

1.00	smpl	59.400 mg	59.400 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight
		ALPHA	BETA
		-----	-----
Instrument =	GAW 111	GRB 111	
Counts =	0.000	83.000	
Gross cpm =	0.000	0.830	
Background =	0.042	1.000	
Observed CPM =	-0.042	-0.170	
Cross talk fac =	0.006	0.230	
True CPM =	-0.041	-0.161	
Inst Std. Fac. =	1.050	1.001	
Adjusted CPM =	-0.043	-0.161	
Eff (cpm/dpm) =	0.119	0.405	
DPM of Aliquot =	-0.363	-0.397	
pCi /smpl =	-0.164	-0.179	(e)
1 sigma % Err =	49.918	84.248	
2 sigma % Err =	97.839	165.127	
(1 sigma err) =	8.167E-02	0.151	
(2 sigma err) =	0.160	0.295	
LTV (95 %) =	0.135	0.248	
MDA (3.00) =	0.476	0.550	
MDA (2.71) =	0.465	0.547	
CRITICAL LEVEL =	0.181	0.259	

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	86.995	7	0.042	1.000	0.00
SF	82.661	0	1.050	1.001	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.995	27-MAR-07 16:52	GAW 111	BK	\ 801.1 min	0.00
87.645	28-MAR-07 8:28	GAW 111		\ 10.0 min	0.00
87.682	28-MAR-07 9:22	GAW 111		\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.770	27-MAR-07 11:28	GRB 111	(93)8471 11	\ 100.0 min	0.28
86.995	27-MAR-07 16:52	GRB 111	BK	\ 801.1 min	0.00
87.682	28-MAR-07 9:22	GRB 111		\ 10.0 min	0.00

(e)
 3/28/07

Status: PASS

Source	DUP	ORIGINAL
Sample No.	8	1
Analyte	GrBeta	GrBeta
Reference Date	28.778-7	28.778-7
Separation Date #1		
Separation Date #2		
Count Date	87.824-07	87.740-07
Aliquot	0.3	0.3
Aliquot Units	L	L
Yield	1	1
Result	59.443	57.749
Error @ 2s (abs.)	3.189	3.147
Error @ 2s (%)	5.4	5.4
MDA	1.8988	1.8968
Result Units	PCI/L	PCI/L
RPD	3	
UCL	30.00	
RER		
Criterion		
Status	PASS	
Flag		

✓

(Handwritten signature)

Initials/Date LES
3/29/05

60755

28-MAR-07
 15:35:09
 R701193
 MCM

TMA Corporation
 Gross Alpha, Gross Beta Analysis
 ABCALC V 1.05

8655- 8 82
 QC-DUP#1 60755

Reviewed Bev Date 3/28/07

Counted 87.824- 7 on C1 for 100.00 min.

0.300 1 126.200 mg 126.200 mg

 Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 109	GRB 109
Counts =	7.000	1599.000
Gross cpm =	0.070	15.990
Background =	0.065	0.967
Observed CPM =	0.005	15.023
Cross talk fac =	0.005	0.263
True CPM =	-0.076	15.043
Inst Std. Fac. =	1.060	1.014
Adjusted CPM =	-0.081	15.254
Eff (cpm/dpm) =	0.075	0.385
DPM of Aliquot =	-1.079	39.589

pCi /l =	-1.62	59.4
1 sigma % Err =	48.040	2.737
2 sigma % Err =	94.159	5.365
(1 sigma err) =	0.778	1.63
(2 sigma err) =	1.53	3.19
LTV (95 %) =	1.28	62.1
MDA (3.00) =	2.97	1.90
MDA (2.71) =	2.91	1.89
CRITICAL LEVEL =	1.19	0.893

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	86.995	7	0.065	0.967	0.00
SF	82.661	0	1.060	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
87.645	28-MAR-07 8:28	GAW 109		10.0 min	0.00
87.682	28-MAR-07 9:22	GAW 109		10.0 min	0.00
87.740	28-MAR-07 10:45	GAW 109	(82)8655 1	100.0 min	0.02

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.995	27-MAR-07 16:52	GRB 109	BK	801.1 min	0.00
87.682	28-MAR-07 9:22	GRB 109		10.0 min	0.00
87.740	28-MAR-07 10:45	GRB 109	(82)8655 1	100.0 min	14.82

f (e)
 3/29/07

Status: PASS

Source	MS	ORIGINAL
Sample No.	9	1
Analyte	GrBeta	GrBeta
Reference Date	28.778-7	28.778-7
Separation Date #1		
Separation Date #2		
Count Date	87.824-07	87.740-07
Aliquot	0.3	0.3
Aliquot Units	L	L
Yield	1	1
Result	130.91	57.749
Error @ 2s (abs.)	4.620	3.147
Error @ 2s (%)	3.5	5.4
MDA	2.2381	1.8968
Result Units	PCI/L	PCI/L
Nuclide	Sr 90	
Standard ID	AA1-B-(15)	
Qty (ml)	1.1	
Activity (dpm)	27.31	
Calib. Date	306.500-1996	
Half Life (days)	10580	
Decay Date	87.824-07	
Added (pCi)	21.10	
Added Error @ 2s (%)	4	
Spike Activity	39.273	
Original Activity	17.325	
Activity Difference	21.948	
Error Difference	7.641	
F/A Ratio	1.040	
F/A Ratio Error @ 2s (%)	8.624	
LCL	0.80	
LWL	0.87	
UWL	1.13	
UCL	1.20	
Status	PASS	
Flag		

(F)

Initials/Date fes
3/29/07

60756

28-MAR-07

15:35:10

R701193

MCM

Counted 87.824- 7 on C2 for 100.00 min.

TMA Corporation

Gross Alpha, Gross Beta Analysis

ABCALC V 1.05

8655- 9

82

QC-MS#1 60756

Reviewed BV Date 3-28-07

0.300 1

127.700 mg

127.700 mg

Aliquot

Sample Weight

Counted Weight

ALPHA

BETA

Instrument =	GAW 110	GRB 110
Counts =	16.000	3470.000
Gross cpm =	0.160	34.700
Background =	0.062	1.367
Observed CPM =	0.098	33.333
Cross talk fac =	0.005	0.264
True CPM =	-0.082	33.355
Inst Std. Fac. =	1.053	1.006
Adjusted CPM =	-0.087	33.555
Eff (cpm/dpm) =	0.074	0.385
DPM of Aliquot =	-1.164	87.186

pCi /l = -1.75 131.

1 sigma % Err =	57.237	1.801
2 sigma % Err =	112.184	3.529
(1 sigma err) =	1.00	2.36
(2 sigma err) =	1.96	4.62
LTV (95 %) =	1.65	135.

MDA (3.00) = 2.94 2.24

MDA (2.71) = 2.88 2.23

CRITICAL LEVEL = 1.17 1.06

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	86.995	7	0.062	1.367	0.00
SF	82.661	0	1.053	1.006	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
87.645	28-MAR-07 8:28	GAW 110		10.0 min	0.00
87.682	28-MAR-07 9:22	GAW 110		10.0 min	0.00
87.740	28-MAR-07 10:45	GAW 110	(82)8655 6	100.0 min	-0.04

Previous 3 counts	Time	Detector	ID	Length	Cpm
86.995	27-MAR-07 16:52	GRB 110	BK	801.1 min	0.00
87.682	28-MAR-07 9:22	GRB 110		10.0 min	0.00
87.740	28-MAR-07 10:45	GRB 110	(82)8655 6	100.0 min	9.76

ks
3/29/07

P M 4.10.07

NUCLIDE	MDA	PCI	+/- ACT ERR 2 sigma	%ERR 2 sigma
IQA2793-01	00046952		TMA # (GLY) 8655	1
TZERO = 28.778 2007			0.5000 L	Aliquot
K 40	3.499E+02	<	3.499E+02	DET LIM
Mn 54	1.312E+01	<	1.312E+01	DET LIM
Co 58	1.901E+01	<	1.901E+01	DET LIM
Co 60	1.336E+01	<	1.336E+01	DET LIM
Cs137	1.309E+01	<	1.309E+01	DET LIM
Eu152	3.661E+01	<	3.661E+01	DET LIM
Eu154	4.257E+01	<	4.257E+01	DET LIM
Pb210	2.641E+02	<	4.018E+02	DET LIM
Ra226	2.787E+01	<	2.787E+01	DET LIM
Th228	2.167E+01	<	2.167E+01	DET LIM
Th232	5.924E+01	<	5.924E+01	DET LIM
U 238	1.524E+03	<	1.524E+03	DET LIM
Am241	1.752E+01	<	1.752E+01	DET LIM
Am243	1.623E+01	<	1.403E+02	DET LIM

MB

NUCLIDE	MDA	PCI	+/- ACT ERR 2 sigma	%ERR 2 sigma
QC-LCS #60753	00046953		TMA # (GLY) 8655	6
TZERO = 87.014 2007			1.0000 SMPL	Aliquot
K 40	4.610E+01	<	9.664E+01	DET LIM
Mn 54	6.300E+00	<	6.300E+00	DET LIM
Co 58	6.179E+00	<	6.179E+00	DET LIM
Co 60	6.668E+00		(2.565 +/- 0.122) E+02	4.8%
Cs137	7.220E+00		(2.450 +/- 0.101) E+02	4.1%
Eu152	1.566E+01	<	1.566E+01	DET LIM
Eu154	1.571E+01	<	1.571E+01	DET LIM
Ra226	1.051E+01	<	1.051E+01	DET LIM
Th228	8.667E+00	<	8.667E+00	DET LIM
Th232	3.015E+01	<	3.015E+01	DET LIM
U 238	9.175E+02	<	9.174E+02	DET LIM
Am241	4.495E+01	<	4.495E+01	DET LIM
Am243	9.534E+00	<	9.534E+00	DET LIM

*BL
4/10/07*

10-APR-07

PAGE 2

NUCLIDE	MDA	PCI	+/- ACT ERR 2 sigma	%ERR 2 sigma
QC-BLANK #60754		00046954	TMA # (GLY) 8655	7
TZERO = 87.014 2007			1.0000 SMPL	Aliquot
K 40	1.090E+02	<	1.090E+02	DET LIM
Mn 54	3.865E+00	<	3.865E+00	DET LIM
Co 58	3.800E+00	<	3.800E+00	DET LIM
Co 60	4.369E+00	<	4.368E+00	DET LIM
Cs137	4.498E+00	<	4.498E+00	DET LIM
Eu152	1.265E+01	<	1.265E+01	DET LIM
Eu154	1.306E+01	<	1.306E+01	DET LIM
Pb210	7.481E+01	<	1.620E+02	DET LIM
Ra226	9.230E+00	<	9.230E+00	DET LIM
Th228	6.935E+00	<	6.935E+00	DET LIM
Th232	1.947E+01	<	1.947E+01	DET LIM
U 238	5.202E+02	<	5.202E+02	DET LIM
Am241	5.637E+00	<	5.637E+00	DET LIM
Am243	5.362E+00	<	6.854E+01	DET LIM

QC-DUP#1 60755		00046955	TMA # (GLY) 8655	8
TZERO = 28.778 2007			0.5000 L	Aliquot
K 40	1.890E+02	<	1.890E+02	DET LIM
Mn 54	9.475E+00	<	9.475E+00	DET LIM
Co 58	1.509E+01	<	1.509E+01	DET LIM
Co 60	9.605E+00	<	9.605E+00	DET LIM
Cs137	9.951E+00	<	9.951E+00	DET LIM
Eu152	2.464E+01	<	2.464E+01	DET LIM
Eu154	2.793E+01	<	2.793E+01	DET LIM
Ra226	1.812E+01	<	1.812E+01	DET LIM
Th228	1.452E+01	<	1.452E+01	DET LIM
Th232	3.749E+01	<	3.749E+01	DET LIM
U 238	9.864E+02	<	9.864E+02	DET LIM
Am241	4.983E+01	<	4.983E+01	DET LIM
Am243	1.968E+01	<	1.641E+02	DET LIM

Status: PASS

Source	LCS	LCS
Sample No.	6	6
Analyte	Co 60	Cs137
Geometry	MB	MB
Reference Date		
Separation Date #1		
Separation Date #2		
Count Date	87.014-07	87.014-07
Aliquot	1	1
Aliquot Units	SMPL	SMPL
Yield	1	1
Result	256.5	245
Error @ 2s (abs.)	12.200	10.100
Error @ 2s (%)	4.8	4.1
MDA	6.668	7.22
Result Units	PCI/SMPL	PCI/SMPL
Nuclide	Co 60	Cs137
Standard ID	K1-F-(03)	Q1-A-(03)
Qty (ml)	0.3	0.25
Activity (dpm)	9340	2200
Calib. Date	001.708-1995	353.708-2005
Half Life (days)	1925	11020
Decay Date	87.014-07	87.014-07
Added (pCi)	252.6	240.6
Added Error @ 2s (%)	4	4
F/A Ratio	1.016	1.018
F/A Ratio Error @ 2s (%)	6	6
LCL	0.80	0.80
LWL	0.87	0.87
UWL	1.13	1.13
UCL	1.20	1.20
Status	PASS	PASS
Flag		



Bw
4-11-07

60753

Status: PASS

Source	BLANK
Sample No.	7
Analyte	Cs137
Geometry	MB
Reference Date	
Separation Date #1	
Separation Date #2	
Count Date	87.014-07
Aliquot	1
Aliquot Units	SMPL
Yield	
Result	< 4.498
Error @ 2s (abs.)	0.000
Error @ 2s (%)	0.0
MDA	4.498
Result Units	PCI/SMPL
Status	PASS
Flag	



BW
4-11-07

60754

Status: PASS

Source	DUP	ORIGINAL
Sample No.	8	1
Analyte	Cs137	Cs137
Reference Date	28.778-7	28.778-7
Separation Date #1		
Separation Date #2		
Count Date	95.985-07	87.565-07
Aliquot	0.5	0.5
Aliquot Units	L	L
Yield		
Result	9.951	13.09
Error @ 2s (abs.)	0.000	0.000
Error @ 2s (%)	0.0	0.0
MDA	9.951	13.09
Result Units	PCI/L	PCI/L
RPD		
UCL	20	
RER		
Criterion	N	
Status	PASS	
Flag		

BN
4-11-07

60755

136-8

 8655 GLY 1 G-6 MB 87.566 7 402.72 MIN 0.50000 L 070

LIBR=LLL REF TIME= 28.778 7

W 4.1007

SPECIAL ANALYSIS

PK-ENERGY-GAMMA KEY	BRANCH FRAC	EFFICIENCY FRAC	CPM CORR CNTG DECAY	DPM NDW	ERROR PCT	PCI/L AT TZERO
K 40	4.602E+11 DAYS	LAMBDA= 1.506E-12	DECAY= 1.000E+00	10		
**** (1460.85)	0.110000	0.00928	0.396	3.884E+02 s	< 3.499E+02	
Cr 51	2.772E+01 DAYS	LAMBDA= 2.501E-02	DECAY= 2.299E-01	10		
**** (320.03)	0.102000	0.03285	0.296	8.825E+01 s	< 3.458E+02	
Mn 54	3.125E+02 DAYS	LAMBDA= 2.218E-03	DECAY= 8.777E-01	20		
**** (834.83)	1.000000	0.01516	0.194	1.278E+01 s	< 1.312E+01	
Co 57	2.700E+02 DAYS	LAMBDA= 2.567E-03	DECAY= 8.599E-01	100		
**** (122.06)	0.852000	0.06160	0.425	8.089E+00 s	< 8.475E+00	
**** (136.47)	0.111000	0.05832	0.412	6.365E+01 s	< 6.669E+01	
Co 58	7.130E+01 DAYS	LAMBDA= 9.722E-03	DECAY= 5.647E-01	40		
**** (810.76)	0.990000	0.01554	0.183	1.191E+01 s	< 1.901E+01	
Co 60	1.921E+03 DAYS	LAMBDA= 3.608E-04	DECAY= 9.790E-01	40		
**** (1173.21)	0.999200	0.01128	0.182	1.610E+01 s	< 1.482E+01	
**** (1332.48)	1.000000	0.01008	0.146	1.452E+01 s	< 1.336E+01	
Sr 85	6.520E+01 DAYS	LAMBDA= 1.063E-02	DECAY= 5.353E-01	40		
**** (513.98)	1.000000	0.02266	0.336	1.482E+01 s	< 2.494E+01	
Y 88	1.066E+02 DAYS	LAMBDA= 6.501E-03	DECAY= 6.824E-01	70		
**** (898.00)	0.920000	0.01425	0.181	1.384E+01 s	< 1.827E+01	
**** (1836.10)	1.000000	0.00752	0.101	1.349E+01 s	< 1.781E+01	
Cd109	3.530E+02 DAYS	LAMBDA= 1.964E-03	DECAY= 8.910E-01	10		
**** (88.03)	0.039000	0.06859	0.402	1.503E+02 s	< 1.520E+02	
Sn113	1.150E+02 DAYS	LAMBDA= 6.027E-03	DECAY= 7.016E-01	40		
**** (391.40)	0.642000	0.02809	0.269	1.494E+01 s	< 1.918E+01	
Te123M	1.197E+02 DAYS	LAMBDA= 5.791E-03	DECAY= 7.115E-01	20		
**** (159.00)	0.841000	0.05345	0.390	8.680E+00 s	< 1.099E+01	
I 131	8.040E+00 DAYS	LAMBDA= 8.621E-02	DECAY= 6.293E-03	90		
**** (364.50)	0.820000	0.02969	0.292	1.200E+01 s	< 1.718E+03	
Cs137	1.102E+04 DAYS	LAMBDA= 6.290E-05	DECAY= 9.963E-01	30		
**** (661.64)	0.851000	0.01843	0.227	1.448E+01 s	< 1.309E+01	
Eu152	4.821E+03 DAYS	LAMBDA= 1.438E-04	DECAY= 9.916E-01	480		
**** (121.78)	0.254000	0.06166	0.424	2.710E+01 s	< 2.462E+01	
**** (344.31)	0.245000	0.03104	0.306	4.029E+01 s	< 3.661E+01	
**** (778.87)	0.120000	0.01608	0.211	1.092E+02 s	< 9.924E+01	
**** (963.36)	0.132000	0.01342	0.192	1.081E+02 s	< 9.826E+01	
**** (1112.04)	0.124000	0.01183	0.191	1.303E+02 s	< 1.184E+02	
**** (1408.02)	0.198000	0.00959	0.141	7.420E+01 s	< 6.741E+01	
Eu154	3.105E+03 DAYS	LAMBDA= 2.232E-04	DECAY= 9.870E-01	480		
**** (123.07)	0.390000	0.	23	1.756E+01 s	< 1.603E+01	

****	(723. 26)	0. 202000	0. 01713	0. 224	6. 487E+01 s	<	5. 921E+01
****	(873. 16)	0. 117000	0. 01459	0. 198	1. 160E+02 s	<	1. 059E+02
****	(1004. 75)	0. 170000	0. 01295	0. 178	8. 092E+01 s	<	7. 386E+01
****	(1274. 49)	0. 336000	0. 01048	0. 164	4. 664E+01 s	<	4. 257E+01

Pb210 7. 451E+03 DAYS LAMBDA= 9. 303E-05 DECAY= 9. 945E-01 1G
 46 (46. 50) 0. 040000 0. 04912 0. 546 2. 776E+02 s 36. 21% 2. 515E+02

Ra226 5. 851E+05 DAYS LAMBDA= 1. 185E-06 DECAY= 9. 999E-01 48G
 **** (186. 10) 0. 040000 0. 04843 0. 448 2. 315E+02 s <r 2. 086E+02
 **** (242. 00) 0. 078000 0. 04042 0. 384 1. 219E+02 s < 1. 098E+02
 **** (351. 96) 0. 393000 0. 03052 0. 329 2. 746E+01 s <r 2. 474E+01
 **** (609. 32) 0. 484000 0. 01971 0. 295 3. 093E+01 s <r 2. 787E+01

Th228 6. 987E+02 DAYS LAMBDA= 9. 921E-04 DECAY= 9. 433E-01 31G
 85 (84. 37) 0. 004480 0. 06906 2. 315 7. 481E+03 10. 24% 7. 144E+03
 **** (238. 62) 0. 448000 0. 04083 0. 415 2. 269E+01 s <r 2. 167E+01
 **** (583. 17) 0. 287000 0. 02043 0. 270 4. 608E+01 s <r 4. 401E+01

Th232 5. 113E+12 DAYS LAMBDA= 1. 356E-13 DECAY= 1. 000E+00 41G
 **** (338. 40) 0. 104000 0. 03146 0. 316 9. 660E+01 s < 8. 702E+01
 **** (911. 10) 0. 250000 0. 01407 0. 231 6. 576E+01 s <r 5. 924E+01
 **** (968. 90) 0. 150000 0. 01335 0. 220 1. 099E+02 s <r 9. 897E+01

U 235 2. 571E+11 DAYS LAMBDA= 2. 696E-12 DECAY= 1. 000E+00 34G
 74 (72. 81) 0. 004000 0. 06956 6. 473 2. 326E+04 6. 37% 2. 096E+04
 85 (84. 24) 0. 051000 0. 06908 2. 314 6. 569E+02 10. 24% 5. 918E+02
 **** (143. 78) 0. 132600 0. 05667 0. 414 5. 510E+01 s < 4. 964E+01
 **** (185. 72) 0. 540000 0. 04850 0. 407 1. 556E+01 s <r 1. 402E+01
 **** (205. 31) 0. 050000 0. 04536 0. 387 1. 708E+02 s < 1. 539E+02

U 238 1. 633E+12 DAYS LAMBDA= 4. 245E-13 DECAY= 1. 000E+00 1G
 **** (1001. 10) 0. 008280 0. 01299 0. 182 1. 692E+03 s < 1. 524E+03

Am241 1. 582E+05 DAYS LAMBDA= 4. 381E-06 DECAY= 9. 997E-01 41G
 **** (59. 54) 0. 359000 0. 06689 0. 467 1. 944E+01 s < 1. 752E+01

Am243 2. 904E+06 DAYS LAMBDA= 2. 387E-07 DECAY= 1. 000E+00 12G
 74 (74. 67) 0. 660000 0. 06961 6. 473 1. 409E+02 s 6. 37% 1. 269E+02

 8655 GLY 1 G-6 MB 87.566 7 402.72 MIN 0.50000 L 070

LIBR=LLL REF TIME= 28.778 7

 * Group..... 8655 * Time of count 87.566 2007 *
 * Sample..... 1 * Reference GMT..... 28.778 2007 *
 * Element..... * Elapsed Live Tm..... 402.7167 *
 * Type code..... GLY * Dead Time Pct..... 0.020688 *
 * ID..... IQA2793-01 * Background GMT..... 83.001 2007 *
 * Geometry, detector..... MB-6 * Standard GMT..... 81.753 2007 *
 * Aliquot..... 0.5 * Days since TO..... 58.78761 *
 * Unit of Aliquot..... L * Time on..... 6:35 PDT 28-MAR *
 * Data Sheet Units..... PCI /L * Time off..... 13:18 PDT 28-MAR *
 * Library..... LLL * Calc Time..... 01:25 29-MAR-07 *

 * Slope..... 1.00378 * Width slope..... 0.009611 *
 * Intercept..... -.2939 * Width offset..... -.044159 *
 * X**2 TERM..... -0.14895948E-05 * Sensitivity..... 4. *
 NP: [7,67]070. GSP 25 PEAKS

PK	IT	ENRG	LEFT	WD	BKGD	FWHM	AREA	CHAN	CPM	ERR	EFF	K	FIT
1	0	15.3	14	6	1277	1.65	275	15.6	6.83E-01	22.40	0.029	0	0.00
2	0	25.7	23	8	5836	1.89	16995	25.9	4.22E+01	1.10	0.135	0	0.00
3	0	46.2	44	6	2397	1.87	220	46.3	5.46E-01	36.20	0.789	0	0.00
4	0	63.9	62	5	1927	1.36	253	63.9	6.27E-01	27.2	6.82	0	0.00
5	0	73.7	70	13	5044	3.16	2607	73.7	6.47E+00	6.4	6.94	0	0.00
6	0	85.2	82	8	2665	2.09	932	85.2	2.31E+00	10.2	6.88	0	0.00
7	0	92.1	90	6	1930	2.77	207	92.0	5.14E-01	35.0	6.79	0	0.00
8	0	186.0	182	8	1994	1.78	201	185.7	4.99E-01	38.9	4.85	0	0.00
9	0	199.2	197	6	1363	1.34	118	198.8	2.92E-01	50.8	4.64	0	0.00
10	0	239.4	234	11	1956	2.00	439	238.9	1.09E+00	20.6	4.08	0	0.00
11	0	294.5	291	7	929	1.91	135	293.8	3.35E-01	39.0	3.50	0	0.00
12	0	351.7	347	9	891	1.76	294	350.8	7.31E-01	19.5	3.11	0	0.00
13	0	510.9	503	13	740	3.23	942	509.6	2.34E+00	7.0	2.28	0	0.00
14	0	582.5	577	11	580	2.81	165	581.1	4.11E-01	29.8	2.07	0	0.00
15	0	608.9	603	9	474	2.14	253	607.5	6.28E-01	17.0	2.00	0	0.00
16	0	727.2	722	7	273	2.66	78	725.6	1.93E-01	37.9	1.71	0	0.00
17	0	910.9	905	10	310	3.05	122	909.0	3.04E-01	28.5	1.42	0	0.00
18	0	968.5	962	10	304	3.11	90	966.5	2.24E-01	39.4	1.34	0	0.00
19	0	1119.6	1113	9	228	2.41	109	1117.5	2.71E-01	27.3	1.19	0	0.00
PK	IT	ENRG	LEFT	WD	BKGD	FWHM	AREA	CHAN	CPM	ERR	EFF	K	FIT
20	0	1300.9	1294	10	138	4.54	50	1298.8	1.24E-01	49.8	1.04	0	0.00
21	0	1351.3	1347	5	62	2.44	22	1349.2	5.34E-02	61.5	1.00	0	0.00
22	0	1461.0	1450	20	174	4.13	1093	1459.0	2.71E+00	4.50	0.933	0	0.00
23	0	1728.9	1719	14	63	2.96	41	1727.2	1.03E-01	48.20	0.806	0	0.00
24	0	1764.1	1755	14	69	3.82	138	1762.3	3.43E-01	16.20	0.791	0	0.00
25	0	1831.6	1825	10	50	1.81	23	1829.9	5.83E-02	63.60	0.762	0	0.00

FWHM=SQRT(4.06643E+00 + 4.39335E-03 *E)

 BACKGROUND INFO 8655 GLY 1 87.566 7 G-6 BG DATE 83.001 7

v-----PEAK-----v			v-----BACKGROUND-----v			v-----NET-----v	
ENERGY	CPM	%ERROR	ENERGY	CPM	%ERROR	CPM	%ERROR
63.86	0.6273	27.18	62.00	0.6050	52.27	0.0223	*****R
92.08	0.5143	35.00	92.00	0.8395	17.48	-0.3252	71.41R
186.05	0.4989	38.91	25	3.16		0.0006	*****R

199.22	0.2919	50.77	198.00	0.1368	8.40	0.1551	95.84R
239.44	1.0893	20.65	238.60	1.0927	24.66	-0.0034	*****R
294.45	0.3352	38.97	295.20	0.4484	23.71	-0.1132	148.73R
351.66	0.7309	19.55	351.90	0.9939	16.09	-0.2630	81.54R
510.88	2.3392	6.96	511.00	2.5557	9.91	-0.2165	139.08R
582.51	0.4106	29.82	583.10	0.6196	24.95	-0.2090	94.37R
608.93	0.6279	17.01	609.30	1.1349	15.11	-0.5070	39.85R
727.24	0.1929	37.93	727.20	0.1475	31.25	0.0454	190.47R
910.88	0.3038	28.47	911.10	0.4874	24.25	-0.1836	79.78R
968.50	0.2236	39.36	968.90	0.3678	40.79	-0.1441	120.66R
1119.62	0.2714	27.27	1120.30	0.4106	11.71	-0.1391	63.45R
1461.01	2.7136	4.52	1461.00	3.6125	20.00	-0.8989	81.52R
1728.95	0.1028	48.21	1729.60	0.0779	22.85	0.0249	211.73R
1764.06	0.3427	16.22	1764.50	0.4181	12.56	-0.0753	101.52R

17 PEAKS REJECTED BY BACKGROUND

 INTERFERING ISOTOPE ANALYSIS 8655 GLY 1 87.566 7 G- 6

 NONE FOUND

BACKGROUND FOR GELI DETECTOR 6 OF 83.001/2007 3687.6 MIN

ENERGY	CPM	ERROR	ENERGY	CPM	ERROR	ENERGY	CPM	ERROR
62.0	0.6050	52.27	511.0	2.5557	9.91	1120.3	0.4106	11.71
92.0	0.8395	17.48	583.1	0.6196	24.95	1173.2	0.0362	32.09
143.0	0.1067	0.00	609.3	1.1349	15.11	1238.1	0.1865	21.93
186.0	0.4983	13.16	661.6	0.1018	50.78	1332.5	0.0574	26.83
198.0	0.1368	8.40	727.2	0.1475	31.25	1337.7	0.0000	0.00
238.6	1.0927	24.66	846.0	0.0625	0.00	1461.0	3.6125	20.00
279.0	0.1035	0.00	860.4	0.1051	26.65	1586.0	0.0773	0.00
295.2	0.4484	23.71	911.1	0.4874	24.25	1591.0	0.1319	29.72
338.4	0.1999	34.31	968.9	0.3678	40.79	1729.6	0.0779	22.85
351.9	0.9939	16.09	1001.0	0.0475	26.11	1764.5	0.4181	12.56

GELI STANDARD EFFICIENCY QC FOR DETECTOR G- 6 ON 3/29/ 7

HIGH RADIUM STANDARD

LOW RADIUM STANDARD

HIGH RADIUM STANDARD				LOW RADIUM STANDARD					
GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES	GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES		
5.755	7	1.4354	12.275	24. NG	4.652	7	1.3440	13.744	26.
20.762	7	1.4106	11.030	21. NG	20.778	7	1.3707	13.413	21. NG
26.607	7	1.4487	13.714	22. NG	29.886	7	1.3666	12.322	68. NG
34.893	7	1.4070	11.890	23. NG	34.911	7	1.3575	14.031	26. NG
47.974	7	1.4316	12.505	25.	47.994	7	1.3550	14.222	23. NG
55.959	7	1.3986	10.685	22.	55.939	7	1.3656	13.681	27. NG
61.903	7	1.3933	11.019	20.	61.811	7	1.3744	14.949	20. NG
69.881	7	1.4140	11.728	31.	69.906	7	1.3635	14.524	20.
76.856	7	1.4175	11.605	29.	76.810	7	1.3438	13.154	35.
81.753	7	1.4002	11.462	21.	81.696	7	1.3658	13.879	25.
AVERAGE		1.4092	0.014		AVERAGE		1.3607	0.010	

CALIBRATION LINE FROM STANDARD FOR G- 6 OF 81.753 7
 ENERGY= -0.293900 + 1.0037800*CH + -1.489595E-06*CH**2
 FWHM =SQRT(-0.0442 + 0.009611*ENERGY) (CO60= 3.573)

EFFICIENCIES FOR GEOMETRY MB 6 CALIBRATED 26.000 2007

ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY
50.0	6.107200	100.0	6.645700	300.0	3.450500	0.0	0.000000
55.0	6.465200	110.0	6.429700	500.0	2.317600	0.0	0.000000
60.0	6.706800	130.0	5.979700	700.0	1.760600	0.0	0.000000
65.0	6.856800	150.0	5.530600	1000.0	1.300000	0.0	0.000000
70.0	6.935900	170.0	5.131300	1400.0	0.964500		
80.0	6.944800	190.0	4.777700	2000.0	0.695400		
90.0	6.828800	250.0	3.948100	3000.0	0.479200		

PK	ENERGY	CPM	%ERR	COMMENT
1	15.3	0.68	22.4	.....
2	25.7	42.20	1.1	.....
3	46.2	0.55	36.2	..... Pb210s
5	73.7	6.47	6.4	..... Am243s
6	85.2	2.31	10.2	NO GEN. Cs136
20	1300.9	0.12	49.8	.....
21	1351.3	0.05	61.5	.....
25	1831.6	0.06	63.6	.....

REJECTED PEAKS

B 4	63.9	0.02	99.9	.....
B 7	92.1	-0.33	71.4	.....
B 8	186.0	0.00	99.9	..... Cs136 U 235s Ra226s
B 9	199.2	0.16	95.8	Ac228
B 10	239.4	0.00	99.9	Th228
B 11	294.5	-0.11	99.9	Ra226
B 12	351.7	-0.26	81.5	..... Ra226s
B 13	510.9	-0.22	99.9	Ac228 Th228
B 14	582.5	-0.21	94.4	..... Th228s
B 15	608.9	-0.51	39.9	..... Ru103 Ra226s
B 16	727.2	0.05	99.9	Ac228 Th228
B 17	910.9	-0.18	79.8	Ac228
B 18	968.5	-0.14	99.9	Ac228
B 19	1119.6	-0.14	63.4	Ra226
B 22	1461.0	-0.90	81.5	..... K 40s
B 23	1728.9	0.02	99.9	Ra226
B 24	1764.1	-0.08	99.9	Ra226

8655 GLY 6 G-5 MB 87.014 7 784.88 MIN 1.00000 SM 777

LIBR=LLL REF TIME= 87.014 7 1098-1

Wp. 1007

SPECIAL ANALYSIS

PK-ENERGY-GAMMA KEV	BRANCH FRAC	EFFICIENCY FRAC	CPM CORR CNTG DECAY	DPM NDW	ERROR PCT	PCI/SMPL AT TZERO	
K 40 1461 (1460.85)	4.602E+11 DAYS 0.110000	LAMBDA= 1.506E-12 0.00478	DECAY= 1.000E+00 0.049	1G 9.347E+01	78.50%	4.211E+01	
Cr 51 **** (320.03)	2.772E+01 DAYS 0.102000	LAMBDA= 2.501E-02 0.01865	DECAY= 1.000E+00 0.158	1G 8.308E+01	<	3.742E+01	
Mn 54 **** (834.83)	3.125E+02 DAYS 1.000000	LAMBDA= 2.218E-03 0.00810	DECAY= 1.000E+00 0.113	2G 1.399E+01	<	6.300E+00	
Co 57 **** (122.06) **** (136.47)	2.700E+02 DAYS 0.852000 0.111000	LAMBDA= 2.567E-03 0.03201 0.03254	DECAY= 1.000E+00 0.199 0.227	10G 7.315E+00 6.297E+01	< <	3.295E+00 2.836E+01	
Co 58 **** (810.76)	7.130E+01 DAYS 0.990000	LAMBDA= 9.722E-03 0.00831	DECAY= 1.000E+00 0.113	4G 1.372E+01	<	6.179E+00	
Co 60 1173 (1173.21) 1333 (1332.48)	1.921E+03 DAYS 0.999200 1.000000	LAMBDA= 3.608E-04 0.00594 0.00524	DECAY= 1.000E+00 3.254 2.986	4G 5.486E+02 5.694E+02	s 2.38% s 2.38%	2.471E+02 2.565E+02	
Sr 85 **** (513.98)	6.520E+01 DAYS 1.000000	LAMBDA= 1.063E-02 0.01229	DECAY= 1.000E+00 0.164	4G 1.337E+01	<	6.024E+00	
Y 88 **** (898.00) **** (1836.10)	1.066E+02 DAYS 0.920000 1.000000	LAMBDA= 6.501E-03 0.00760 0.00378	DECAY= 1.000E+00 0.116 0.041	7G 1.655E+01 1.074E+01	< <	7.453E+00 4.837E+00	
Cd109 **** (88.03)	3.530E+02 DAYS 0.039000	LAMBDA= 1.964E-03 0.02265	DECAY= 1.000E+00 0.192	1G 2.169E+02	<	9.770E+01	
Sn113 **** (391.40)	1.150E+02 DAYS 0.642000	LAMBDA= 6.027E-03 0.01557	DECAY= 1.000E+00 0.160	4G 1.605E+01	<	7.229E+00	
Te123M **** (159.00)	1.197E+02 DAYS 0.841000	LAMBDA= 5.791E-03 0.03151	DECAY= 1.000E+00 0.217	2G 8.183E+00	<	3.686E+00	
I 131 **** (364.50)	8.040E+00 DAYS 0.820000	LAMBDA= 8.621E-02 0.01659	DECAY= 1.000E+00 0.168	9G 1.233E+01	<	5.555E+00	
Cs137 662 (661.64)	1.102E+04 DAYS 0.851000	LAMBDA= 6.290E-05 0.00990	DECAY= 1.000E+00 4.584	3G 5.439E+02	s 2.05%	2.450E+02	
Eu152 **** (121.78) **** (344.31) **** (778.87) **** (963.36) **** (1112.04) **** (1408.02)	4.821E+03 DAYS 0.254000 0.245000 0.120000 0.132000 0.124000 0.198000	LAMBDA= 1.438E-04 0.03198 0.01747 0.00861 0.00714 0.00625 0.00497	DECAY= 1.000E+00 0.226 0.149 0.112 0.124 0.111 0.052	48G 2.778E+01 3.477E+01 1.080E+02 1.318E+02 1.432E+02 5.249E+01	s s s s s s	< < < < < <	1.251E+01 1.566E+01 4.866E+01 5.936E+01 6.451E+01 2.364E+01
Eu154 **** (123.07)	3.105E+03 DAYS 0.390000	LAMBDA= 2.232E-04 0.	DECAY= 1.000E+00 29)	48G 1.596E+01	s	< 7.188E+00 NPDES - 1420	

583	(582.03)	0.008000	0.01103	0.095	1.081E+03	65.76%	4.871E+02
****	(723.26)	0.202000	0.00919	0.105	5.681E+01 s	<	2.559E+01
****	(873.16)	0.117000	0.00779	0.111	1.223E+02 s	<	5.511E+01
****	(1004.75)	0.170000	0.00688	0.111	9.491E+01 s	<	4.275E+01
****	(1274.49)	0.336000	0.00548	0.064	3.488E+01 s	<	1.571E+01
Pb210	7.451E+03 DAYS	LAMBDA= 9.303E-05	DECAY= 1.000E+00	1G			
****	(46.50)	0.040000	0.00153	0.212	3.475E+03 s	<	1.565E+03
Ra226	5.851E+05 DAYS	LAMBDA= 1.185E-06	DECAY= 1.000E+00	48G			
****	(186.10)	0.040000	0.02907	0.227	1.956E+02 s	<r	8.811E+01
****	(242.00)	0.078000	0.02387	0.198	1.065E+02 s	<	4.796E+01
****	(351.96)	0.393000	0.01712	0.155	2.309E+01 s	<	1.040E+01
****	(609.32)	0.484000	0.01061	0.120	2.333E+01 s	<	1.051E+01
Th228	6.987E+02 DAYS	LAMBDA= 9.921E-04	DECAY= 1.000E+00	31G			
****	(238.62)	0.448000	0.02416	0.208	1.924E+01 s	<r	8.667E+00
583	(583.17)	0.287000	0.01101	0.095	3.020E+01 s	65.76%	1.360E+01
Th232	5.113E+12 DAYS	LAMBDA= 1.356E-13	DECAY= 1.000E+00	41G			
****	(338.40)	0.104000	0.01774	0.171	9.268E+01 s	<	4.175E+01
****	(911.10)	0.250000	0.00750	0.126	6.693E+01 s	<	3.015E+01
****	(968.90)	0.150000	0.00710	0.118	1.109E+02 s	<	4.998E+01
U 235	2.571E+11 DAYS	LAMBDA= 2.696E-12	DECAY= 1.000E+00	34G			
****	(143.78)	0.132600	0.03239	0.226	5.259E+01 s	<	2.369E+01
****	(185.72)	0.540000	0.02911	0.227	1.447E+01 s	<r	6.519E+00
****	(205.31)	0.050000	0.02721	0.207	1.520E+02 s	<	6.848E+01
U 238	1.633E+12 DAYS	LAMBDA= 4.245E-13	DECAY= 1.000E+00	1G			
****	(1001.10)	0.008280	0.00690	0.116	2.037E+03 s	<	9.174E+02
Am241	1.582E+05 DAYS	LAMBDA= 4.381E-06	DECAY= 1.000E+00	41G			
****	(59.54)	0.359000	0.00581	0.208	9.978E+01 s	<	4.495E+01
Am243	2.904E+06 DAYS	LAMBDA= 2.387E-07	DECAY= 1.000E+00	12G			
****	(74.67)	0.660000	0.01499	0.209	2.117E+01 s	<	9.534E+00

 8655 GLY 6 G-5 MB 87.014 7 784.88 MIN 1.00000 SM 777

LIBR=LLL REF TIME= 87.014 7 1098-1

 * Group..... 8655 * Time of count 87.014 2007 *
 * Sample..... 6 * Reference GMT..... 87.014 2007 *
 * Element..... * Elapsed Live Tm..... 784.8834 *
 * Type code..... GLY * Dead Time Pct..... 0.004246 *
 * ID..... QC-LCS #60753 * Background GMT..... 69.979 2007 *
 * Geometry, detector..... MB-5 * Standard GMT..... 81.670 2007 *
 * Aliquot..... 1. * Days since T0..... 0.0 *
 * Unit of Aliquot..... SMPL * Time on..... 17:20 PDT 27-MAR *
 * Data Sheet Units..... PCI /SMPL * Time off..... 6:24 PDT 28-MAR *
 * Library..... LLL * Calc Time..... 06:48 28-MAR-07 *

 * Slope..... 1.002937 * Width slope..... 0.006479 *
 * Intercept..... 0.303856 * Width offset..... 0.955129 *
 * X**2 TERM..... -0.14367683E-05 * Sensitivity..... 4. *
 NP: [7,67]777. GSP 11 PEAKS

PK	IT	ENRG	LEFT	WD	BKGD	FWHM	AREA	CHAN	CPM	ERR	EFF	K	FIT
1	10	27.4	24	11	304	3.73	999	27.0	1.27E+00	4.40	165	0	122.00
2	10	31.5	24	11	1565	3.73	390	31.1	4.97E-01	19.70	249	0	0.00
3	0	92.3	89	7	1800	1.69	237	91.7	3.02E-01	30.5	2.45	0	0.00
4	0	185.4	182	6	1467	1.46	191	184.6	2.43E-01	32.9	2.91	0	0.00
5	0	239.4	235	8	1656	2.28	171	238.5	2.18E-01	42.5	2.41	0	0.00
6	0	511.5	504	12	896	2.47	460	510.0	5.86E-01	13.8	1.24	0	0.00
7	0	583.2	577	10	523	2.65	141	581.7	1.80E-01	32.2	1.12	0	0.00
8	0	661.6	654	10	491	2.43	3616	660.0	4.61E+00	2.0	1.00	0	0.00
9	0	1173.5	1164	13	278	2.79	2579	1171.7	3.29E+00	2.40	600	0	0.00
10	0	1332.8	1323	14	155	2.98	2359	1331.2	3.01E+00	2.40	527	0	0.00
11	0	1461.5	1452	15	71	2.77	233	1459.9	2.97E-01	11.40	481	0	0.00

FWHM=SQRT(7.51412E+00 + -2.02052E-04 *E)

 BACKGROUND INFO 8655 GLY 6 87.014 7 G-5 BG DATE 69.979 7

v-----PEAK-----v			v-----BACKGROUND-----v			v-----NET-----v	
ENERGY	CPM	%ERROR	ENERGY	CPM	%ERROR	CPM	%ERROR
92.31	0.3020	30.50	92.00	0.3558	10.74	-0.0538	185.33R
185.41	0.2429	32.90	186.00	0.2567	20.26	-0.0137	693.97R
239.42	0.2176	42.47	238.60	0.2449	12.98	-0.0273	358.10R
511.45	0.5864	13.82	511.00	0.6210	4.72	-0.0346	248.81R
583.19	0.1797	32.16	583.10	0.0843	28.93	0.0954	65.76
661.61	4.6073	2.04	661.60	0.0238	0.00	4.5835	2.05
1173.49	3.2857	2.36	1173.20	0.0319	0.00	3.2538	2.38
1332.85	3.0053	2.36	1332.50	0.0195	0.00	2.9858	2.38
1461.46	0.2965	11.35	1460.80	0.2473	7.64	0.0492	78.50

4 PEAKS REJECTED BY BACKGROUND

 INTERFERING ISOTOPE ANALYSIS 8655 GLY 6 87.014 7 G-5

 NONE FOUND

BACKGROUND FOR GELI DETECTOR 5 OF 69.979/2007 2253.0 MIN

ENERGY	CPM	ERROR	ENERGY	CPM	ERROR	ENERGY	CPM	ERROR
62.0	0.0664	32.82	511.0	0.6210	4.72	1120.3	0.0447	83.60
92.0	0.3558	10.74	583.1	0.0843	28.93	1173.2	0.0319	0.00
143.0	0.0760	0.00	609.3	0.0634	42.90	1238.1	0.0135	0.00
186.0	0.2567	20.26	661.6	0.0238	0.00	1332.5	0.0195	0.00
198.0	0.1075	38.22	727.2	0.0228	6.13	1377.7	0.0257	0.00
238.6	0.2449	12.98	846.0	0.0451	19.31	1460.8	0.2473	7.64
279.0	0.0510	0.00	860.4	0.0351	0.00	1586.0	0.0131	0.00
295.2	0.0386	21.00	911.1	0.0755	29.39	1591.3	0.0321	0.00
338.4	0.0542	21.60	968.9	0.0469	46.92	1729.6	0.0145	0.00
351.9	0.0656	53.07	1001.0	0.0243	52.32	1764.5	0.0280	42.90

GELI STANDARD EFFICIENCY QC FOR DETECTOR G- 5 ON 3/28/ 7

HIGH RADIUM STANDARD

LOW RADIUM STANDARD

HIGH RADIUM STANDARD				LOW RADIUM STANDARD					
GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES	GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES		
5.722	7	0.9263	11.701	22.	113.737	5	1.0563	5.691	26.
20.820	7	0.9496	10.432	35.	115.895	5	1.0268	6.707	21.
26.974	7	0.9532	10.394	34.	120.831	5	1.0112	5.396	22.
34.875	7	0.9302	10.832	21.	123.895	5	1.0173	6.576	33.
47.951	7	0.9344	10.954	27.	127.778	5	0.9253	8.428	21.
55.923	7	0.9310	10.143	20.	163.023	5	1.0185	6.233	33.
61.927	7	0.9529	11.244	25.	262.653	5	0.8772	2.731	23.
69.956	7	0.9615	10.491	28.	361.604	5	0.9753	4.215	14.
76.810	7	0.9501	9.859	33.	120.933	6	0.9544	3.970	23.
81.670	7	0.9362	11.417	23.	130.842	6	1.0028	5.576	21.
AVERAGE		0.9425	0.012		AVERAGE		0.9987	0.040	

CALIBRATION LINE FROM STANDARD FOR G- 5 OF 81.670 7
 ENERGY= 0.303857 + 1.0029370*CH + -1.436768E-06*CH**2
 FWHM =SQRT(0.9551 + 0.006480*ENERGY) (CO60= 3.097)

EFFICIENCIES FOR GEOMETRY MB 5 CALIBRATED 68.000 2007

ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY
50.0	0.190020	100.0	2.758490	300.0	1.976590	0.0	0.000000
55.0	0.366930	110.0	3.024350	500.0	1.258780	0.0	0.000000
60.0	0.605530	130.0	3.243550	700.0	0.945520	0.0	0.000000
65.0	0.890520	150.0	3.208910	1000.0	0.690860	0.0	0.000000
70.0	1.201490	170.0	3.058700	1400.0	0.499470		
80.0	1.823920	190.0	2.867890	2000.0	0.345950		
90.0	2.358930	250.0	2.320410	3000.0	0.240430		

	PK	ENERGY	CPM	%ERR	COMMENT
	1	27.4	1.27	4.4	.....
	2	31.5	0.50	19.7	.....
b	7	583.2	0.10	65.8	..... Th228s
b	8	661.6	4.58	2.1	..... Cs137s
b	9	1173.5	3.25	2.4	..... Cs134+ Co 60s
b	10	1332.8	2.99	2.4	..... Ag110 Co 60s
b	11	1461.5	0.05	78.5	..... K 40s

REJECTED PEAKS

B	3	92.3	-0.05	99.9	.....
B	4	185.4	-0.01	99.9	..... Cs137c U 235s Ra226s
B	5	239.4	-0.03	99.9	Th228 Th228s
B	6	511.5	-0.03	99.9	Th228 La140 Ru106 Na 22

 8655 GLY 7 G-6 MB 87.014 7 785.02 MIN 1.00000 SM 778
 LIBR=LLL REF TIME= 87.014 7

M4.10² ↑

SPECIAL ANALYSIS

PK-ENERGY-GAMMA KEV	BRANCH FRAC	EFFICIENCY FRAC	CPM CORR CNTG DECA	DPM NOW	ERROR PCT	PCI/SMPL AT TZERO
K 40	4.602E+11 DAYS	LAMBDA= 1.506E-12	DECAY= 1.000E+00	1G		
**** (1460.85)	0.110000	0.00928	0.247	2.420E+02 s	<	1.090E+02
Cr 51	2.772E+01 DAYS	LAMBDA= 2.501E-02	DECAY= 1.000E+00	1G		
**** (320.03)	0.102000	0.03285	0.208	6.219E+01 s	<	2.801E+01
Mn 54	3.125E+02 DAYS	LAMBDA= 2.218E-03	DECAY= 1.000E+00	2G		
**** (834.83)	1.000000	0.01516	0.130	8.581E+00 s	<	3.865E+00
Co 57	2.700E+02 DAYS	LAMBDA= 2.567E-03	DECAY= 1.000E+00	10G		
**** (122.06)	0.852000	0.06160	0.298	5.681E+00 s	<	2.559E+00
**** (136.47)	0.111000	0.05832	0.294	4.538E+01 s	<	2.044E+01
Co 58	7.130E+01 DAYS	LAMBDA= 9.722E-03	DECAY= 1.000E+00	4G		
**** (810.76)	0.990000	0.01554	0.130	8.435E+00 s	<	3.800E+00
Co 60	1.921E+03 DAYS	LAMBDA= 3.608E-04	DECAY= 1.000E+00	4G		
**** (1173.21)	0.999200	0.01128	0.120	1.066E+01 s	<	4.802E+00
**** (1332.48)	1.000000	0.01008	0.098	9.698E+00 s	<	4.368E+00
Sr 85	6.520E+01 DAYS	LAMBDA= 1.063E-02	DECAY= 1.000E+00	4G		
**** (513.98)	1.000000	0.02266	0.238	1.050E+01 s	<	4.728E+00
Y 88	1.066E+02 DAYS	LAMBDA= 6.501E-03	DECAY= 1.000E+00	7G		
**** (898.00)	0.920000	0.01425	0.131	9.968E+00 s	<	4.490E+00
**** (1836.10)	1.000000	0.00752	0.065	8.592E+00 s	<	3.870E+00
Cd109	3.530E+02 DAYS	LAMBDA= 1.964E-03	DECAY= 1.000E+00	1G		
**** (88.03)	0.039000	0.06859	0.281	1.052E+02 s	<	4.738E+01
Sn113	1.150E+02 DAYS	LAMBDA= 6.027E-03	DECAY= 1.000E+00	4G		
**** (391.40)	0.642000	0.02809	0.188	1.043E+01 s	<	4.698E+00
Te123M	1.197E+02 DAYS	LAMBDA= 5.791E-03	DECAY= 1.000E+00	2G		
**** (159.00)	0.841000	0.05345	0.279	6.200E+00 s	<	2.793E+00
I 131	8.040E+00 DAYS	LAMBDA= 8.621E-02	DECAY= 1.000E+00	9G		
**** (364.50)	0.820000	0.02969	0.203	8.352E+00 s	<	3.762E+00
Cs137	1.102E+04 DAYS	LAMBDA= 6.290E-05	DECAY= 1.000E+00	3G		
**** (661.64)	0.851000	0.01843	0.157	9.986E+00 s	<	4.498E+00
Eu152	4.821E+03 DAYS	LAMBDA= 1.438E-04	DECAY= 1.000E+00	48G		
**** (121.78)	0.254000	0.06166	0.298	1.902E+01 s	<	8.569E+00
**** (344.31)	0.245000	0.03104	0.214	2.809E+01 s	<	1.265E+01
**** (778.87)	0.120000	0.01608	0.129	6.701E+01 s	<	3.018E+01
**** (963.36)	0.132000	0.01342	0.129	7.292E+01 s	<	3.285E+01
**** (1112.04)	0.124000	0.01183	0.121	8.252E+01 s	<	3.717E+01
**** (1408.02)	0.198000	0.00959	0.095	5.005E+01 s	<	2.254E+01
Eu154	3.105E+03 DAYS	LAMBDA= 2.232E-04	DECAY= 1.000E+00	48G		
**** (123.07)	0.390000	0.	5	1.239E+01 s	<	5.579E+00

****	(723. 26)	0. 202000	0. 01713	0. 150	4. 345E+01 s	<	1. 957E+01
****	(873. 16)	0. 117000	0. 01459	0. 132	7. 753E+01 s	<	3. 492E+01
****	(1004. 75)	0. 170000	0. 01295	0. 118	5. 365E+01 s	<	2. 417E+01
****	(1274. 49)	0. 336000	0. 01048	0. 102	2. 898E+01 s	<	1. 306E+01

Pb210 7. 451E+03 DAYS LAMBDA= 9. 303E-05 DECAY= 1. 000E+00 1G
 46 (46. 50) 0. 040000 0. 04912 0. 520 2. 648E+02 s 21. 70% 1. 193E+02

Ra226 5. 851E+05 DAYS LAMBDA= 1. 185E-06 DECAY= 1. 000E+00 48G
 **** (186. 10) 0. 040000 0. 04843 0. 313 1. 614E+02 s <r 7. 272E+01
 **** (242. 00) 0. 078000 0. 04042 0. 261 8. 279E+01 s < 3. 729E+01
 **** (351. 96) 0. 393000 0. 03052 0. 217 1. 812E+01 s <r 8. 162E+00
 **** (609. 32) 0. 484000 0. 01971 0. 195 2. 049E+01 s <r 9. 230E+00
 1378 (1377. 60) 0. 041800 0. 00978 0. 060 1. 473E+02 62. 92% 6. 635E+01

Th228 6. 987E+02 DAYS LAMBDA= 9. 921E-04 DECAY= 1. 000E+00 31G
 85 (84. 37) 0. 004480 0. 06906 2. 480 8. 017E+03 8. 15% 3. 611E+03
 **** (238. 62) 0. 448000 0. 04083 0. 282 1. 540E+01 s <r 6. 935E+00
 **** (583. 17) 0. 287000 0. 02043 0. 185 3. 150E+01 s <r 1. 419E+01

Th232 5. 113E+12 DAYS LAMBDA= 1. 356E-13 DECAY= 1. 000E+00 41G
 **** (338. 40) 0. 104000 0. 03146 0. 226 6. 909E+01 s < 3. 112E+01
 **** (911. 10) 0. 250000 0. 01407 0. 152 4. 323E+01 s <r 1. 947E+01
 **** (968. 90) 0. 150000 0. 01335 0. 137 6. 854E+01 s < 3. 087E+01

U 235 2. 571E+11 DAYS LAMBDA= 2. 696E-12 DECAY= 1. 000E+00 34G
 85 (84. 24) 0. 051000 0. 06908 2. 480 7. 039E+02 8. 15% 3. 171E+02
 **** (143. 78) 0. 132600 0. 05667 0. 297 3. 949E+01 s < 1. 779E+01
 **** (185. 72) 0. 540000 0. 04850 0. 285 1. 090E+01 s <r 4. 910E+00
 **** (205. 31) 0. 050000 0. 04536 0. 278 1. 228E+02 s < 5. 530E+01

U 238 1. 633E+12 DAYS LAMBDA= 4. 245E-13 DECAY= 1. 000E+00 1G
 **** (1001. 10) 0. 008280 0. 01299 0. 124 1. 155E+03 s < 5. 202E+02

Am241 1. 582E+05 DAYS LAMBDA= 4. 381E-06 DECAY= 1. 000E+00 41G
 **** (59. 54) 0. 359000 0. 06689 0. 300 1. 251E+01 s < 5. 637E+00

Am243 2. 904E+06 DAYS LAMBDA= 2. 387E-07 DECAY= 1. 000E+00 12G
 74 (74. 67) 0. 660000 0. 06961 6. 569 1. 430E+02 s 3. 89% 6. 440E+01

8655 GLY 7 G-6 MB 87.014 7 785.02 MIN 1.00000 SM 778

LIBR=LLL REF TIME= 87.014 7

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* Group..... 8655 * Time of count      87.014 2007 *
* Sample..... 7 * Reference GMT..... 87.014 2007 *
* Element..... * Elapsed Live Tm..... 785.0167 *
* Type code.... GLY * Dead Time Pct..... 0.002123 *
* ID..... 4 QC-BLANK #60754 * Background GMT..... 83.001 2007 *
* Geometry, detector..... MB-6 * Standard GMT..... 81.753 2007 *
* Aliquot..... 1. * Days since TO..... 0.0 *
* Unit of Aliquot..... SMPL * Time on..... 17:20 PDT 27-MAR *
* Data Sheet Units..... PCI /SMPL * Time off..... 6:24 PDT 28-MAR *
* Library..... LLL * Calc Time..... 06:48 28-MAR-07 *

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* Slope..... 1.00378 * Width slope..... 0.009611 *
* Intercept..... -.2939 * Width offset..... -.044159 *
* X**2 TERM..... -0.14895948E-05 * Sensitivity..... 4. *

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NP: [7,67]778. GSP 22 PEAKS

PK	IT	ENRG	LEFT	WD	BKGND	FWHM	AREA	CHAN	CPM	ERR	EFF	K	FIT
1	0	25.6	23	7	1746	1.73	27482	25.8	3.50E+01	0.60	134	0	0.00
2	0	46.4	44	6	2965	1.98	408	46.6	5.20E-01	21.70	802	0	0.00
3	0	63.4	61	5	3270	1.89	445	63.4	5.67E-01	20.1	6.81	0	0.00
4	0	73.9	70	12	8405	2.94	5157	74.0	6.57E+00	3.9	6.94	0	0.00
5	0	85.0	81	10	6192	1.98	1947	85.0	2.48E+00	8.2	6.89	0	0.00
6	0	92.6	90	6	3471	2.11	612	92.5	7.79E-01	16.1	6.78	0	0.00
7	0	185.9	183	7	3175	1.93	425	185.5	5.42E-01	22.7	4.85	0	0.00
8	0	238.2	233	9	3331	1.46	352	237.7	4.48E-01	29.7	4.10	0	0.00
9	0	295.4	291	8	2057	2.32	242	294.8	3.08E-01	33.3	3.49	0	0.00
10	0	352.3	347	9	1755	2.17	381	351.4	4.86E-01	20.5	3.11	0	0.00
11	0	510.7	502	15	1677	3.17	1767	509.5	2.25E+00	5.7	2.28	0	0.00
12	0	583.2	576	12	1050	2.70	399	581.8	5.08E-01	17.8	2.07	0	0.00
13	0	609.3	605	7	593	2.65	457	607.9	5.82E-01	10.3	1.99	0	0.00
14	0	647.8	644	5	383	2.46	67	646.3	8.53E-02	47.1	1.89	0	0.00
15	0	911.0	905	9	498	2.62	186	909.0	2.36E-01	23.3	1.42	0	0.00
16	0	967.3	959	12	596	1.92	143	965.4	1.82E-01	33.4	1.34	0	0.00
17	0	1120.8	1114	12	481	2.64	247	1118.7	3.15E-01	19.0	1.19	0	0.00
18	0	1378.4	1371	10	232	3.00	47	1376.3	6.02E-02	62.90	980	0	0.00
19	0	1460.8	1449	20	339	3.93	1600	1458.8	2.04E+00	3.80	933	0	0.00
PK	IT	ENRG	LEFT	WD	BKGND	FWHM	AREA	CHAN	CPM	ERR	EFF	K	FIT
20	0	1763.4	1754	16	165	4.07	223	1761.6	2.85E-01	14.20	791	0	0.00
21	0	1844.8	1838	17	168	7.90	35	1843.2	4.50E-02	89.40	757	0	0.00
22	0	1923.6	1919	7	45	1.58	32	1922.1	4.08E-02	42.10	725	0	0.00

FWHM=SQRT(1.72746E+00 + 1.04997E-02 *E)

BACKGROUND INFO 8655 GLY 7 87.014 7 G-6 BG DATE 83.001 7

v-----PEAK-----v			v-----BACKGROUND-----v			v-----NET-----v	
ENERGY	CPM	%ERROR	ENERGY	CPM	%ERROR	CPM	%ERROR
63.36	0.5666	20.05	62.00	0.6050	52.27	-0.0384875	05R
92.59	0.7793	16.14	92.00	0.8395	17.48	-0.0601321	29R
185.89	0.5419	22.72	186.00	0.4983	13.16	0.0435320	53R
238.22	0.4484	29.70	238.60	1.0927	24.66	-0.6443	46.66R
295.45	0.3083	33.33	295.20	0.4484	23.71	-0.1401105	54R
352.25	0.4855	20.47	36		5.09	-0.5084	37.03R

510.71	2.2513	5.73	511.00	2.5557	9.91	-0.3044	93.34R
583.16	0.5078	17.79	583.10	0.6196	24.95	-0.1118	160.23R
609.33	0.5818	10.31	609.30	1.1349	15.11	-0.5531	32.85R
910.96	0.2363	23.27	911.10	0.4874	24.25	-0.2511	51.92R
967.34	0.1821	33.39	968.90	0.3678	40.79	-0.1857	87.16R
1120.78	0.3150	19.03	1120.30	0.4106	11.71	-0.0956	80.35R
1460.83	2.0382	3.82	1461.00	3.6125	20.00	-1.5743	46.15R
1763.36	0.2846	14.24	1764.50	0.4181	12.56	-0.1334	49.70R

14 PEAKS REJECTED BY BACKGROUND

 INTERFERING ISOTOPE ANALYSIS 8655 GLY 7 87.014 7 G- 6

 NONE FOUND

BACKGROUND FOR GELI DETECTOR 6 OF 83.001/2007 3687.6 MIN

ENERGY	CPM	ERROR	ENERGY	CPM	ERROR	ENERGY	CPM	ERROR
62.0	0.6050	52.27	511.0	2.5557	9.91	1120.3	0.4106	11.71
92.0	0.8395	17.48	583.1	0.6196	24.95	1173.2	0.0362	32.09
143.0	0.1067	0.00	609.3	1.1349	15.11	1238.1	0.1865	21.93
186.0	0.4983	13.16	661.6	0.1018	50.78	1332.5	0.0574	26.83
198.0	0.1368	8.40	727.2	0.1475	31.25	1337.7	0.0000	0.00
238.6	1.0927	24.66	846.0	0.0625	0.00	1461.0	3.6125	20.00
279.0	0.1035	0.00	860.4	0.1051	26.65	1586.0	0.0773	0.00
295.2	0.4484	23.71	911.1	0.4874	24.25	1591.0	0.1319	29.72
338.4	0.1999	34.31	968.9	0.3678	40.79	1729.6	0.0779	22.85
351.9	0.9939	16.09	1001.0	0.0475	26.11	1764.5	0.4181	12.56

GELI STANDARD EFFICIENCY QC FOR DETECTOR G- 6 ON 3/28/ 7

HIGH RADIUM STANDARD

LOW RADIUM STANDARD

HIGH RADIUM STANDARD				LOW RADIUM STANDARD					
GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES	GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES		
5.755	7	1.4354	12.275	24. NG	4.652	7	1.3440	13.744	26.
20.762	7	1.4106	11.030	21. NG	20.778	7	1.3707	13.413	21. NG
26.607	7	1.4487	13.714	22. NG	29.886	7	1.3666	12.322	68. NG
34.893	7	1.4070	11.890	23. NG	34.911	7	1.3575	14.031	26. NG
47.974	7	1.4316	12.505	25.	47.994	7	1.3550	14.222	23. NG
55.959	7	1.3986	10.685	22.	55.939	7	1.3656	13.681	27. NG
61.903	7	1.3933	11.019	20.	61.811	7	1.3744	14.949	20. NG
69.881	7	1.4140	11.728	31.	69.906	7	1.3635	14.524	20.
76.856	7	1.4175	11.605	29.	76.810	7	1.3438	13.154	35.
81.753	7	1.4002	11.462	21.	81.696	7	1.3658	13.879	25.
AVERAGE		1.4092	0.014		AVERAGE		1.3607	0.010	

CALIBRATION LINE FROM STANDARD FOR G- 6 OF 81.753 7
 ENERGY= -0.293900 + 1.0037800*CH + -1.489595E-06*CH**2
 FWHM =SQRT(-0.0442 + 0.009611*ENERGY) (CO60= 3.573)

EFFICIENCIES FOR GEOMETRY MB 6 CALIBRATED 26.000 2007

ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY
50.0	6.107200	100.0	6.645700	300.0	3.450500	0.0	0.000000
55.0	6.465200	110.0	6.429700	500.0	2.317600	0.0	0.000000
60.0	6.706800	130.0	5.979700	700.0	1.760600	0.0	0.000000
65.0	6.856800	150.0	5.530600	1000.0	1.300000	0.0	0.000000
70.0	6.935900	170.0	5.131300	1400.0	0.964500		
80.0	6.944800	190.0	4.777700	2000.0	0.695400		
90.0	6.828800	250.0	3.948100	3000.0	0.479200		

PK	ENERGY	CPM	%ERR	COMMENT
1	25.6	35.01	0.6	.....
2	46.4	0.52	21.7	..... Pb210s
4	73.9	6.57	3.9	..... Am243s
5	85.0	2.48	8.2	NO GEN. Cs136
14	647.8	0.09	47.1	.....
18	1378.4	0.06	62.9	Ra226
22	1923.6	0.04	42.1	.....
REJECTED PEAKS				
B 3	63.4	-0.04	99.9	.....
B 6	92.6	-0.06	99.9	.....
B 7	185.9	0.04	99.9	..... Cs136 U 235s Ra226s
B 8	238.2	-0.64	46.7	..... Th228s
B 9	295.4	-0.14	99.9	Ra226 Ru103 Ir192s
B 10	352.3	-0.51	37.0	..... Ra226s
B 11	510.7	-0.30	93.3	Ac228 Th228 La140 Ru106 Na 22
B 12	583.2	-0.11	99.9	..... Th228s
B 13	609.3	-0.55	32.8	..... Ru103 Ra226s
B 15	911.0	-0.25	51.9	Ac228 Th232s
B 16	967.3	-0.19	87.2	..... Sb124
B 17	1120.8	-0.10	80.4	Ra226
B 19	1460.8	-1.57	46.2	..... K 40s
B 20	1763.4	-0.13	49.7	Ra226
B 21	1844.8	0.05	89.4	.....

 8655 GLY B G-B MB 95.985 7 921.87 MIN 0.50000 L 450
 LIBR=LLL REF TIME= 28.778 7 500 mLs in Marinelli Be

in 41007

SPECIAL ANALYSIS

PK-ENERGY-GAMMA KEV	BRANCH FRAC	EFFICIENCY FRAC	CPM CORR CNTG DECAY	DPM NOW	ERROR PCT	PCI/L AT TZERO
K 40	4.602E+11 DAYS	LAMBDA= 1.506E-12	DECAY= 1.000E+00	1G		
**** (1460.85)	0.110000	0.00996	0.230	2.098E+02 s	<	1.890E+02
Cr 51	2.772E+01 DAYS	LAMBDA= 2.501E-02	DECAY= 1.863E-01	1G		
**** (320.03)	0.102000	0.03365	0.226	6.577E+01 s	<	3.181E+02
Mn 54	3.125E+02 DAYS	LAMBDA= 2.218E-03	DECAY= 8.615E-01	2G		
**** (834.83)	1.000000	0.01579	0.143	9.061E+00 s	<	9.475E+00
Co 57	2.700E+02 DAYS	LAMBDA= 2.567E-03	DECAY= 8.415E-01	10G		
**** (122.06)	0.852000	0.04792	0.268	6.564E+00 s	<	7.027E+00
**** (136.47)	0.111000	0.04931	0.295	5.385E+01 s	<	5.765E+01
Co 58	7.130E+01 DAYS	LAMBDA= 9.722E-03	DECAY= 5.203E-01	4G		
**** (810.76)	0.990000	0.01617	0.139	8.713E+00 s	<	1.509E+01
Co 60	1.921E+03 DAYS	LAMBDA= 3.608E-04	DECAY= 9.760E-01	4G		
**** (1173.21)	0.999200	0.01198	0.126	1.056E+01 s	<	9.748E+00
**** (1332.48)	1.000000	0.01078	0.112	1.041E+01 s	<	9.604E+00
Sr 85	6.520E+01 DAYS	LAMBDA= 1.063E-02	DECAY= 4.894E-01	4G		
**** (513.98)	1.000000	0.02323	0.278	1.198E+01 s	<	2.205E+01
Y 88	1.066E+02 DAYS	LAMBDA= 6.501E-03	DECAY= 6.460E-01	7G		
**** (898.00)	0.920000	0.01490	0.128	9.357E+00 s	<	1.305E+01
**** (1836.10)	1.000000	0.00812	0.070	8.577E+00 s	<	1.196E+01
Cd109	3.530E+02 DAYS	LAMBDA= 1.964E-03	DECAY= 8.764E-01	1G		
**** (88.03)	0.039000	0.03550	0.278	2.006E+02 s	<	2.062E+02
Sn113	1.150E+02 DAYS	LAMBDA= 6.027E-03	DECAY= 6.669E-01	4G		
**** (391.40)	0.642000	0.02886	0.195	1.052E+01 s	<	1.422E+01
Te123M	1.197E+02 DAYS	LAMBDA= 5.791E-03	DECAY= 6.776E-01	2G		
**** (159.00)	0.841000	0.04909	0.289	6.997E+00 s	<	9.303E+00
I 131	8.040E+00 DAYS	LAMBDA= 8.621E-02	DECAY= 3.045E-03	9G		
**** (364.50)	0.820000	0.03050	0.219	8.743E+00 s	<	2.586E+03
Cs137	1.102E+04 DAYS	LAMBDA= 6.290E-05	DECAY= 9.958E-01	3G		
**** (661.64)	0.851000	0.01901	0.178	1.100E+01 s	<	9.951E+00
Eu152	4.821E+03 DAYS	LAMBDA= 1.438E-04	DECAY= 9.904E-01	48G		
**** (121.78)	0.254000	0.04788	0.289	2.376E+01 s	<	2.162E+01
**** (344.31)	0.245000	0.03186	0.211	2.709E+01 s	<	2.464E+01
**** (778.87)	0.120000	0.01669	0.147	7.343E+01 s	<	6.680E+01
**** (963.36)	0.132000	0.01409	0.145	7.788E+01 s	<	7.084E+01
**** (1112.04)	0.124000	0.01253	0.126	8.105E+01 s	<	7.373E+01
**** (1408.02)	0.198000	0.01029	0.100	4.897E+01 s	<	4.455E+01
Eu154	3.105E+03 DAYS	LAMBDA= 2.232E-04	DECAY= 9.851E-01	48G		
**** (123.07)	0.390000	0.01127	0.213	1.427E+01 s	<	1.305E+01

****	(723. 26)	0. 202000	0. 01772	0. 152	4. 234E+01 s	<	3. 872E+01
****	(873. 16)	0. 117000	0. 01524	0. 141	7. 908E+01 s	<	7. 232E+01
****	(1004. 75)	0. 170000	0. 01363	0. 123	5. 322E+01 s	<	4. 867E+01
****	(1274. 49)	0. 336000	0. 01118	0. 115	3. 054E+01 s	<	2. 793E+01
Pb210	7. 451E+03 DAYS	LAMBDA= 9. 303E-05	DECAY= 9. 938E-01	1G			
****	(46. 50)	0. 040000	0. 00494	0. 249	1. 260E+03 s	<	1. 142E+03
Ra226	5. 851E+05 DAYS	LAMBDA= 1. 185E-06	DECAY= 9. 999E-01	48G			
****	(186. 10)	0. 040000	0. 04693	0. 293	1. 560E+02 s	<r	1. 406E+02
****	(242. 00)	0. 078000	0. 04091	0. 282	8. 839E+01 s	<	7. 964E+01
****	(351. 96)	0. 393000	0. 03133	0. 228	1. 855E+01 s	<r	1. 671E+01
****	(609. 32)	0. 484000	0. 02028	0. 197	2. 011E+01 s	<r	1. 812E+01
Th228	6. 987E+02 DAYS	LAMBDA= 9. 921E-04	DECAY= 9. 355E-01	31G			
85	(84. 37)	0. 004480	0. 03315	1. 180	7. 947E+03	10. 81%	7. 653E+03
****	(238. 62)	0. 448000	0. 04128	0. 279	1. 507E+01 s	<r	1. 452E+01
****	(583. 17)	0. 287000	0. 02100	0. 176	2. 927E+01 s	<r	2. 819E+01
Th232	5. 113E+12 DAYS	LAMBDA= 1. 356E-13	DECAY= 1. 000E+00	41G			
****	(338. 40)	0. 104000	0. 03228	0. 218	6. 503E+01 s	<	5. 859E+01
****	(911. 10)	0. 250000	0. 01473	0. 153	4. 161E+01 s	<r	3. 749E+01
****	(968. 90)	0. 150000	0. 01403	0. 147	6. 994E+01 s	<r	6. 301E+01
U 235	2. 571E+11 DAYS	LAMBDA= 2. 696E-12	DECAY= 1. 000E+00	34G			
74	(72. 81)	0. 004000	0. 02442	2. 837	2. 905E+04	5. 99%	2. 617E+04
85	(84. 24)	0. 051000	0. 03306	1. 180	6. 997E+02	10. 81%	6. 304E+02
****	(143. 78)	0. 132600	0. 04949	0. 289	4. 409E+01 s	<	3. 972E+01
****	(185. 72)	0. 540000	0. 04697	0. 293	1. 155E+01 s	<r	1. 040E+01
****	(205. 31)	0. 050000	0. 04494	0. 261	1. 163E+02 s	<	1. 048E+02
U 238	1. 633E+12 DAYS	LAMBDA= 4. 245E-13	DECAY= 1. 000E+00	1G			
****	(1001. 10)	0. 008280	0. 01367	0. 124	1. 095E+03 s	<	9. 864E+02
Am241	1. 582E+05 DAYS	LAMBDA= 4. 381E-06	DECAY= 9. 997E-01	41G			
****	(59. 54)	0. 359000	0. 01318	0. 262	5. 530E+01 s	<	4. 983E+01
Am243	2. 904E+06 DAYS	LAMBDA= 2. 387E-07	DECAY= 1. 000E+00	12G			
74	(74. 67)	0. 660000	0. 02594	2. 837	1. 657E+02 s	5. 99%	1. 493E+02

8655 GLY 8 G-8 MB 95.985 7 921.87 MIN 0.50000 L 450

LIBR=LLL REF TIME= 28.778 7 500 mLs in Marinelli Be

* Group..... 8655 * Time of count 95.985 2007 *
* Sample..... 8 * Reference GMT..... 28.778 2007 *
* Element..... * Elapsed Live Tm..... 921.8666 *
* Type code..... GLY * Dead Time Pct..... 0.005423 *
* ID..... QC-DUP#1 60755 * Background GMT..... 89.979 2007 *
* Geometry, detector..... MB-8 * Standard GMT..... 92.670 2007 *
* Aliquot..... 0.5 * Days since TO..... 67.20735 *
* Unit of Aliquot..... L * Time on..... 16:38 PDT 5-APR *
* Data Sheet Units..... PCI /L * Time off..... 8:00 PDT 6-APR *
* Library..... LLL * Calc Time..... 08:05 06-APR-07 *
* Slope..... 1.009779 * Width slope..... 0.018078 *
* Intercept..... -2.56617 * Width offset..... 3.308945 *
* X**2 TERM..... -0.33945587E-05 * Sensitivity..... 4. *
NP: [7,67]450. GSP 23 PEAKS

Table with 13 columns: PK, IT, ENRG, LEFT, WD, BKGD, FWHM, AREA, CHAN, CPM, ERR, EFF, K, FIT. Contains 23 rows of peak data.

FWHM=SQRT(3.39898E+00 + 3.11875E-02 *E)

BACKGROUND INFO 8655 GLY 8 95.985 7 G- 8 BG DATE 89.979 7

Table with 6 columns: ENERGY, CPM, %ERROR for PEAK, BACKGROUND, and NET. Contains 4 rows of data.

294.91	0.2887	30.06	295.20	0.3436	30.04	-0.0549245.62R
351.60	0.2797	34.14	351.90	0.7723	18.44	-0.4926 34.80R
511.00	2.4066	4.84	511.00	2.8275	7.95	-0.4209 60.17R
584.22	0.3178	19.90	583.10	0.5690	23.80	-0.2512 59.50R
609.58	0.4913	15.97	609.30	0.9577	18.67	-0.4664 41.86R
662.42	0.3625	20.21	661.60	0.3497	17.85	0.0128750.69R
910.65	0.3374	21.65	911.10	0.5203	18.58	-0.1829 66.24R
968.06	0.2290	29.53	968.90	0.4298	21.27	-0.2008 56.61R
1459.44	2.0630	4.29	1460.80	3.4576	21.91	-1.3946 54.70R
1764.15	0.2350	19.59	1764.50	0.3667	30.98	-0.1317 93.09R

15 PEAKS REJECTED BY BACKGROUND

 INTERFERING ISOTOPE ANALYSIS B655 GLY 8 95.985 7 G- 8

 NONE FOUND

BACKGROUND FOR GELI DETECTOR 8 OF 89.979/2007 1895.8 MIN

ENERGY	CPM	ERROR	ENERGY	CPM	ERROR	ENERGY	CPM	ERROR
62.0	0.2449	57.94	511.0	2.8275	7.95	1173.2	0.1297	11.18
92.0	0.6321	7.97	583.1	0.5690	23.80	1238.1	0.1633	39.26
143.0	0.1433	0.00	609.3	0.9577	18.67	1332.5	0.1415	0.00
186.0	0.5031	14.35	661.6	0.3497	17.85	1377.7	0.0949	43.09
198.0	0.1310	14.96	727.2	0.1319	51.70	1460.8	3.4576	21.91
238.5	1.0778	24.73	860.0	0.1019	25.61	1586.0	0.1242	50.66
279.0	0.1166	0.00	911.1	0.5203	18.58	1591.0	0.1983	5.04
295.2	0.3436	30.04	968.9	0.4298	21.27	1729.6	0.0424	0.00
338.4	0.2513	32.39	1001.0	0.1562	0.00	1764.5	0.3667	30.98
351.9	0.7723	18.44	1120.3	0.3700	17.11	0.0	0.0000	0.00

GELI STANDARD EFFICIENCY QC FOR DETECTOR G- 8 ON 4/ 6/ 7

HIGH RADIUM STANDARD

LOW RADIUM STANDARD

GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES	GMT YEAR	NORMALISED CPM	% ERROR	LENGTH IN MINUTES		
62.718	3	0.9679	16.683	80.	47.974	7	0.8285	11.214	26.
76.719	3	0.9279	15.753	61.	50.941	7	0.8308	14.344	22.
322.765	5	0.8833	18.759	31.	50.959	7	0.8133	14.108	22.
322.789	5	0.8727	17.160	43.	53.696	7	0.8334	12.601	46.
322.825	5	0.8755	17.370	41.	55.907	7	0.8497	13.966	22. NG
352.103	5	0.8703	18.548	21.	61.951	7	0.8381	12.615	42. NG
355.939	5	0.8663	19.048	20.	69.881	7	0.8217	10.936	33.
58.691	6	0.9079	17.307	83.	76.788	7	0.8444	12.015	30.
312.732	6	0.8798	18.209	22.	81.924	7	0.8275	10.834	33. NG
4.921	7	0.8151	17.364	39.	92.670	7	0.8012	11.271	24.
AVERAGE		0.8867	0.041		AVERAGE		0.8309	0.016	

CALIBRATION LINE FROM STANDARD FOR G- 8 OF 92.670 7

ENERGY= -2.566167 + 1.0097787*CH + -3.394559E-06*CH**2
 FWHM =SQRT(3.3089 + 0.018078*ENERGY) (CO60= 5.234)

EFFICIENCIES FOR GEOMETRY MB 8 CALIBRATED 242.000 2006

ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY	ENERGY	% EFFCY
50.0	0.613700	100.0	4.170500	300.0	3.528100	0.0	0.000000
55.0	0.959100	110.0	4.524900	500.0	2.374600	0.0	0.000000
60.0	1.355900	130.0	4.885300	700.0	1.819400	0.0	0.000000
65.0	1.779200	150.0	4.941900	1000.0	1.368500	0.0	0.000000
70.0	2.206300	170.0	4.836300	1400.0	1.033900		
80.0	3.004900	190.0	4.652800	2000.0	0.751800		
90.0	3.667300	250.0	4.004400	3000.0	0.512400		

PK	ENERGY	CPM	%ERR	COMMENT
1	24.3	1.78	4.4	
2	27.5	0.91	10.5	
3	30.5	0.55	17.0	
4	52.8	0.25	33.7	
6	73.7	2.84	6.0	Am243s
7	84.6	1.18	10.8	NO GEN.
20	1022.8	0.12	46.1	
22	1756.0	0.21	13.0	
REJECTED PEAKS				
B 5	63.6	0.00	99.9	
B 8	92.1	0.05	99.9	
B 9	185.7	-0.08	99.9	Cs137c U 235s Ra226s
B 10	198.2	-0.01	99.9	Ac228
B 11	238.7	-0.29	99.9	Th228s
B 12	294.9	-0.05	99.9	Ra226 Ru103 Ir192s
B 13	351.6	-0.49	34.8	Ra226s
B 14	511.0	-0.42	60.2	Ac228 Th228 La140 Ru106 Na 22
B 15	584.2	-0.25	59.5	Th228s
B 16	609.6	-0.47	41.9	Ru103 Ra226s
B 17	662.4	0.01	99.9	Cs137s
B 18	910.7	-0.18	66.2	Ac228 Th232s
B 19	968.1	-0.20	56.6	Ac228 Sb124 Th232s
B 21	1459.4	-1.39	54.7	Ac228 K 40s
B 23	1764.1	-0.13	93.1	Ra226

LOG-IN VERIFICATION

All samples

All planchets

RT
4-2-7

CB# 6100 P. 158
PB# 6107 P. 6

R701193 TA_IRVINE
TestAmerica - Irvin
17461 Derian Avenue

Pr Mgr.... MCM Rcvd... 01/31/07
Charge.... 00-000 Due.... 05-APR-07
Chemist... Value... 0.
Created... 31-JAN-07 Billed... 0.
Billing status.. open
Calc. units..... PCI /Unit alq Min Pri
0

PROJECT# IGA2793

Re # 7124 M. 89

smpl	elm	typ	mg rec	dpm rec Ash wgt	1st sep	2nd sep	aliquot	carr/ trac
1	Ac		31.71	0.0000	0.000	0	46.764-7	1.800- 1 # 1
	82		124.80	0.0000	0.000	0	0.000 0	0.3000- 1 # 0
	H DST		0.00	0.0000	0.000	0	0.000 0	1.0000E-021- 1 # 2
	Ra		0.00	0.0000	38.925-	7	47.731-7	0.1000- 1 # 0
	Sr		14.29	0.0000	0.000	0	40.698-7	0.5000- 1 # 3
	80		87.50	0.0000	0.000	0	0.000 0	0.2200- 1 # 0
	GLY		0.00	0.0000	0.000	0	0.000 0	0.5000- 1 # 0
2	Ac		29.98	0.0000	0.000	0	46.764-7	1.000- smpl # 1
	H DST		10.00	100.0	0.000	0	0.000 0	1.000- smpl # 2
	Ra		0.00	0.0000	38.925-	7	47.731-7	1.000- smpl # 0
	Sr		14.51	0.0000	0.000	0	40.698-7	1.000- smpl # 3
	80		62.50	0.0000	0.000	0	0.000 0	1.000- smpl # 0
3	Ac		31.31	0.0000	0.000	0	46.764-7	1.000- smpl # 1
	H DST		10.00	100.0	0.000	0	0.000 0	1.000- smpl # 2
	Ra		0.00	0.0000	38.925-	7	47.731-7	1.000- smpl # 0
	Sr		14.89	0.0000	0.000	0	40.698-7	1.000- smpl # 3
	80		63.10	0.0000	0.000	0	0.000 0	1.000- smpl # 0
4	Ac		31.59	0.0000	0.000	0	46.764-7	1.800- 1 # 1
	H DST		0.00	0.0000	0.000	0	0.000 0	1.0000E-021- 1 # 2
	Ra		0.00	0.0000	38.925-	7	47.731-7	0.1000- 1 # 0
	Sr		15.77	0.0000	0.000	0	40.698-7	0.5000- 1 # 3
	80		88.40	0.0000	0.000	0	0.000 0	0.2200- 1 # 0
5	H DST		10.00	40.10	0.000	0	0.000 0	4.0000E-021- 1 # 2
	Ra		0.00	0.0000	38.925-	7	47.731-7	0.1000- 1 # 0
	80		88.40	0.0000	0.000	0	0.000 0	0.2200- 1 # 0
6	82		59.10	0.0000	0.000	0	0.000 0	1.000- smpl # 0
	GLY		0.00	0.0000	0.000	0	0.000 0	1.000- smpl # 0
7	82		59.40	0.0000	0.000	0	0.000 0	1.000- smpl # 0
	GLY		0.00	0.0000	0.000	0	0.000 0	1.000- smpl # 0

8	82	126.20	0.0000	0.000	0	0.000	0	0.3000	-	1	# 0
	GLY	0.00	0.0000	0.000	0	0.000	0	0.5000	-	1	# 0
9	82	127.70	0.0000	0.000	0	0.000	0	0.3000	-	1	# 0

Carriers/Tracers used -----

# 1	1.000	mls of	Y	0	E-D1-(03)DXAL9	@	40.74	mg/ml
# 2	0.1000	mls of	H	3	AF1-A-(07)-	@	1.3240E+05	dpm/ml
# 3	1.000	mls of	Sr	0	M-A1-(06)-	@	17.90	mg/ml

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701193

8655

WORK RECORD

2-01-07

Date	Analysis	Proc. / Steps	Sample	Analyst	Remarks
1.31.07	VOL. RSU PH	DWP-007 ALL	1	AK	
- 1 -	[80]	DWP-121 7.1-7.2	1,4	AK	
- 11 -	SO, SR ALIB	DWP-062 ALL	1,4,5	AK	
"	FILTR'N	DWP-050	1	LS	Aliquots for Ar and La analysis have been filtered, filters digested and added to filtrate. LS 01/31.
02.08.07	[80]	DWP 121 → 7.2 → END	1-5	DWP	
03.26.07	GLY	DWP 150	1,8	Fun	
"	[82]	DWP-121 7.1 → 7.2	1,8,9	LS	
03.27.07	[82]	DWP 121 → 7.2 → END	1,6-9	DWP	

8655-

ALIB GLY (L)	ALIB 82 (L)
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8655- 1	0.50	03
- 6	1.0 sample	1.0 sample
- 7	1.0 sample	1.0 sample
- 8	0.50	03
- 9	-	03

Fun 03/26	LS 3/26
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8655-

8655-

701193

TEST AMERICA

7

2.01.07 8655

WATER

Rec'd: 01.31.07
DUE: 02.21.07

[SR],[SO],[RA],[AC],

UP DWP

	FRAG	VOLUME RSV (L)	PH	AUR SR(L)	AUR AC(L)	AUR RA(L)	AUR SO(L)
Cust. ID To							
8655-1 IQA 2793-01 01.28.07 10:40	3	11.0	~6	0.5L	1.8	0.1	0.220
- 2 LCS							1.0 Sample
- 3 BLANK							1.0 Sample
- 4 Dup. #1 1.28.07 10:40				0.5L	1.8	0.1	0.220
- 5 MS #1 1.28.07 10:40				-	-	0.1	0.220
DONE BY:		1/31 AK			LS 1/31		1/31 AK

2 ea
filtered,
nd added
01/31

Recovery:

[80]

	G	T	N	DONE BY	CD
8655-1	19.2888	19.2013	87.5	DWP 02.08.07	CD 02.08.07
2	19.3258	19.2633	62.5		
3	19.3524	19.2893	63.1		
4	19.3303	19.2419	88.4		
5	19.2910	19.2026	88.4		

[82]

8655-1	19.4088	19.2840	124.8	DWP 03.27.07	CD 03.27.07
6	19.2765	19.2174	59.1		
7	19.3587	19.2993	59.4		
8	19.3203	19.1941	126.2		
9	19.3729	19.2452	127.7		

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DC
2/1/07

8655

DUE: 2-21-07

TA IRVINE (Water)

[HDST, Sr, Ac, Ra]

#	CUST ID	TO	
1	IQA 2793-01	01-28-07	10:40
2	LES Sr ^{AK} 2-7-07 #60250 [Ra] ^{EM} 02-07-07		H (DST) 2-12-07 - IQA
3	Blank		
4	Dup #1		
5	MS #1 #60253 [Ra] ^{EM} 02-07-07		

8655

Tracers / Carrier

1-4 Sr Carrier 1.0 ml M-A1-(06)

ML/TAC
02-07-07

1-4 2.0 ml Ba^o TAC 2.8.07

1-4 1.0 ml Y E-D1-(03) EXAL 9

TACTM 2.9.7
2.9.07

spiked 8655- 1 → 5 HDST 0.1 ml H³AF1-A-(07) JAC 2/16/07

8655

Recovery
SV

	G	T	N	SEPTIME	DONE BY	CHECKED BY
1	56.27	41.98	14.28	040698	MW 02-09-07	TAC 02-09-07
2	55.66	41.15	14.51	↓	↓	↓
3	56.17	41.28	14.89	↓	↓	↓
4	57.16	41.39	15.77	↓	↓	↓

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H
(DST)

	FRACT.	VOLUME RECD (ML)	DISTILL (ML)	DISTILLATE (ML)	COUNT (ML)	ALIQ (L)	BAL	DONE BY	CHK BY	P
8655	1	195.0	40.0	20.0	10.0	0.010L	↓	WJA 3-12-07	BM 02-12-07	7
	2		100.0			1.0 SNAP	↓			
	3		↓			↓				
	4		40.0			0.010L	↓			
	5		40.1	↓	↓	0.010L	↓	↓	↓	

~~NEED~~ Pico Floor wt. TRACER 0.1ML H-3 API-A-(27)

8655
Recovery
[AC]

	G	T	N	sep Time	Done by	Checked by
8655-1	74.43	42.72	31.71	046.764	TAE 2.11.07	BM 2.11.07
2	73.94	43.96	29.98	↓	↓	↓
3	73.07	41.76	31.31	↓	↓	↓
4	75.35	43.76	31.19	↓	↓	↓

BM	7
202.12.07	
↓	

SAMPLE #	FIRST DM	SECOND DM	GMT ON	COUNT TIME	AUCRT UNLT	CELL #	BKG (cpm)	SYS #	RN #	GROSS (cpm)
02-02-07										
8528-4	033.955	043.735	043.903	87.05		20	0.15	4	12	17.07
13	↓	↓	↓	↓		29	0.12	5	13	15.43
14	↓	↓	↓	107.26		62	0.22	6	14	17.23
LCS-17	↓	↓	↓	168.46	1.0 SMPL	33	0.36	1	9	23.71
BLK-18	↓	↓	↓	87.05	↓	58	0.14	2	10	0.12
02-02-07										
2152-1	033.997	045.715	045.885	112.22		53	0.22	5	13	0.31
2	↓	↓	↓	↓		6	0.23	6	14	0.26
LCS-3	↓	↓	↓	146.23	1.0 SMPL	41	0.33	1	9	24.51
BLK-4	↓	↓	↓	70.26	↓	74	0.11	2	10	0.07
DUP#1-5	↓	↓	↓	↓		35	0.10	3	11	0.21
MS#2-6	↓	↓	↓	↓		28	0.11	4	12	51.83
2153-1	↓	↓	↓	70.26		23	0.13	7	15	0.56
2	↓	045.735	045.957	94.23		42	0.18	2	10	0.24
2154-1	033.973	↓	↓	↓		67	0.17	3	11	1.60
2	↓	↓	↓	103.08		4	0.23	4	12	0.21
3	↓	↓	↓	83.47		18	0.18	5	13	0.37
2155-1	↓	↓	045.937	94.23		47	0.17	7	15	0.31
02-05-07										
7602-1	036.917	046.733	046.900	90.48		12	0.26	4	12	0.21
2	↓	↓	↓	↓		37	0.21	5	13	0.17
3	↓	↓	↓	↓		62	0.27	6	14	0.19
4	↓	↓	↓	↓		34	0.22	7	15	0.22
LCS-5	↓	↓	↓	↓	1.0 SMPL	1	0.38	1	9	47.92
BLK-6	↓	↓	↓	48.01	↓	10	0.11	2	10	0.25
DUP#1-7	↓	↓	↓	90.48		43	0.24	3	11	0.24
02-07-07										
8655-1	038.925	047.731	047.905	62.32		5	0.23	5	13	0.34
LCS-2	↓	↓	↓	87.73	1.0 SMPL	25	0.34	1	9	23.14
BLK-3	↓	↓	↓	52.10	↓	66	0.15	2	10	0.17
DUP#1-4	↓	↓	↓	62.32		35	0.18	3	11	0.16
MS#1-5	↓	↓	↓	↓		20	0.19	4	12	48.72

Section 2
Standards Certification &
Preparation Logs for Quality Control Samples

#372 Rec'd 4/2/2001 R Brenton P.O. 8555



Certificate of calibration of absolutely
standardised radioactive solutions

Sr⁹⁰AA1

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

ISSUED FOR: AEA Technology plc
Isotrak
329 Harwell
Didcot
Oxfordshire
OX11 0QJ

Sr⁹⁰ 13653 dpm/ml ± 0.4% @ 306,500-96 5/7/01 R Brenton
in 1N HCl carrier content 0.1899 SrCO₃ mg/ml + D1.580 mg/ml Y₂O₃

Description Principal radionuclide: Strontium-90
Daughter radionuclide: Yttrium-90

Product code: SIZ24
Solution number: S6/11/196

K. Yamamoto
5/7/01

Measurement Reference time:

1200 GMT on 1 November 1996 306,500-96

Radioactive concentration of strontium-90:

4.557 kilobecquerels per gram of solution

which is equivalent to:

123.2 nanocuries per gram of solution

Mass of solution:

5.0309 grams

Total activity of strontium-90:

22.93 kilobecquerels

which is equivalent to:

620 nanocuries

Method of measurement used:

4π efficiency tracing using a liquid scintillation counter.

Calibration date(s): 17 November 1996 to 30 November 1996

The calibration date is provided for added information only, and must not be confused with the reference date. It is the reference date that must be used in all calculations relating to the values of activity.

Uncertainty Expanded uncertainty in the radioactive concentration quoted above: ± 0.88 %

Combined Type A uncertainty: ± 0.09 %

Combined Type B uncertainty: ± 0.43 %

Approved Signatory

D A Tattam

Date of issue

20 March 2001

D A Tattam

Page 1 of 2 pages

Nycomed
Amersham

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

#372 Rec'd 4/2/00, Princeton Po 8555

Certificate of calibration of absolutely standardised radioactive solution

UKAS ACCREDITED CALIBRATION LABORATORY No. 0146

Radionuclidic Purity 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.

Other radionuclides 0.002(1) %

Chemical Composition 0.1M HCl containing 100 micrograms of strontium and 100 micrograms of yttrium per ml.

Physical Data Recommended half life: 29.12 ± 0.24 years (1 year = 365.25 days)

Strontium-90: 100% beta particle emission.

Yttrium-90: 100% beta particle emission. Half life 2.670 ± 0.004 days.

The activity of the yttrium-90 is equal to the activity of the strontium-90.

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

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

Tests made over a period of 2 years on standardised solutions of strontium-90 stored in glass ampoules have shown that loss of strontium-90 from solution is negligible other than by radioactive decay.

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

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

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

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

10/27/06
RP

Prep of Sr⁹⁰ AA1-B-(15) QC 1B

Procedure CT-T04 Rev 03 6/16/06

Pipetted 0.5 mL = 0.50g of Sr⁹⁰ AA1
13653 dpm/mL \pm 0.4% into a 250 mL vol. flask.

Added 1 mL Sr M-A1 carrier 17.90 mg/mL +
1 mL Y E-D1 " 15.23 "

into same vol. flask.

Diluted to mark with 0.1N HCl. Transferred to
a 8oz WM PB.

27.31 dpm/mL \pm 0.5% @ 306,500 96

R. Prenton

10/27/06
RP

Prep of Am²⁴¹ RI-A QC 1B

Procedure CT-T04 Rev 03 6/16/06

Pipetted 2.5 mL (2x1000 mL + 500 mL) = 2.55g
of Am²⁴¹ RI 2249 dpm/mL \pm 1.0%

into a 250 mL vol. flask. Diluted to
mark with 1N HCl. Transferred
into 8oz WM PB.

22.49 dpm/mL \pm 1.1% @ 353,708 05

R. Prenton

Key 11/2/06

361



National Institute of Standards & Technology

Certificate

Co⁶⁰K1

Standard Reference Material 4915E Cobalt-60 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive cobalt-60 chloride, non-radioactive cobalt chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of ionization chambers and solid-state gamma-ray spectrometry systems.

Radiological Hazard

The SRM ampoule contains cobalt-60 with a total activity of approximately 400 kBq. Cobalt-60 decays by beta-particle emission. None of the beta particles escape from the SRM ampoule. During the decay process X-rays and gamma rays with energies from 8 to 2500 keV are emitted. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 1 mole per liter of water. The solution is corrosive and represents a health hazard if it comes in contact with eyes or skin. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2. The ampoule should be opened only by persons qualified to handle both radioactive material and strong acid solution.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least January 2005.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) both because of the radioactivity and because of the strong acid.

Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, J.M.R. Hutchinson, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas of the Radioactivity Group and D.B. Golas, Nuclear Energy Institute Research Associate.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, Maryland 20899
April 1995 (Text only revised November 1997)

Thomas E. Gills, Chief
Standard Reference Materials Program

SRM 4915E, page 1 of 6

Rec'd 5/5/00 L. Prenter

*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 an acid concentration and a carrier concentration 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]*.

#361

PROPERTIES OF SRM 4915E
(Certified values are shown in bold type)

Co⁶⁰KI

Source identification number	NIST SRM 4915E		
Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall Thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution density	(1.016 ± 0.002) g·mL ⁻¹ at 22.1 °C [b]*		
Solution mass	(5.063 ± 0.002) g [b]		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O	54	0.96
	HCl	1.0	0.04
	CoCl ₂	1 × 10 ⁻³	1 × 10 ⁻⁴
	⁶⁰ CoCl ₂	3 × 10 ⁻⁸	4 × 10 ⁻⁹
Radiological Properties:			
Radionuclide	Cobalt-60		
Reference time	1200 EST, 1 January 1995		
Massic activity of the solution [c] (Activity per unit mass of solution)	75.55 kBq·g ⁻¹		
Relative expanded uncertainty (k=2)	0.54% [d]		
Photon-emitting impurities	None detected [e]		
Half lives used	Cobalt-60: (5.2714 ± 0.0005) a [f] Radium-226: (1600 ± 7) a [f]		
Measuring instrument	Pressurized "4π"γ ionization chamber A calibrated using a cobalt-60 solution whose activity was determined by 4πβ-γ-coincidence and anticoincidence counting		

Co⁶⁰KI prep. in 1N HCl.

7/1/00 RP
5.06

$$5.0262g \times 75.55 \frac{kBq}{g} \times 60 \frac{dpm}{Bq} \times 1000 \times \frac{L}{100ml} = 2.278 E 5 dpm/ml \pm 0.28$$

carrier content: 0.1104 mol/ml Co⁰

© 001-833-95 7/1/00
001-708-95
K. Yamamoto 7/1/00

*Notes and references are on pages 5 and 6.

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [g]	Relative Sensitivity Factor, $|\partial y/\partial x_i| \cdot$ (x_i/y) [h]	Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [i]
PIC A net response per gram of SRM 4915E, measured relative to RRS10 [j]	Standard deviation of the mean for 350 repeated measurements (A)	0.02	1.0	0.02
PIC A background response, measured relative to RRS10	Standard deviation of the mean for >250 repeated measurements (A)	0.25	0.001 [k]	0.0003
PIC A net response for RRS100, measured relative to RRS10	Standard deviation of the mean for >100 repeated measurements (A)	0.06	1.0	0.06
PIC A net response per Bq of cobalt-60 in solution, measured relative to RRS100.	Standard deviation of the mean for 720 repeated measurements (A)	0.02	1.0	0.02
Gravimetric measurements	Estimated (B)	0.01	1.0	0.01
Half life of cobalt-60 Half life of radium-226	Standard uncertainty of the half life (A)	0.01 [m] 0.44 [m]	0.03 [n] 0.006 [n]	0.0003 0.003
Activity used to calibrate PIC A net response per Bq of cobalt-60 in solution	Standard uncertainty of the activity determined by $4\pi\beta$ - γ - coincidence and anticoincidence counting (B)	0.20	1.0	0.20
Live-time [p]	Estimated (B)	0.10	1.0	0.10
PIC A charge collection	Estimated (B)	0.05	1.0	0.05
Source Positioning	Estimated (B)	0.05	1.0	0.05
Photon-emitting impurities	Limit of detection (B) [q]	100.	0.001	0.10
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.27
Coverage Factor, k				<u>x 2</u>
Relative Expanded Uncertainty of the Output Quantity, U/y , (%)				0.54

- [j] The response of pressurized ionization chamber A (PIC A) is determined from measurement of the time required to collect a given amount of charge on a stable fixed capacitor. All of the response measurements in the NIST pressurized ionization chambers are made relative to the response of one or more artifact standards. These artifact standards consist of microgram quantities of aged radium-226 in small welded stainless-steel capsules. These capsules are encapsulated in plastic rods whose dimensions are similar to those of the standard NIST ampoule. The artifact standards are called **Radium Reference Sources** and are designated as RRSx, where x is the nominal mass (in micrograms) of radium-226 in the capsule.
- [k] $|\partial y/\partial x_i| \cdot (x_i/y) = (\text{average background response})/(\text{average net sample response})$
- [m] 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.
- [n] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of Co-60})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of Co-60})\}$. 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), January 1995.

361

Co⁶⁰K1

NOTES

- [a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
 Distance from Ampoule (cm): 1 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): 300 2 0.3

- [b] The stated uncertainty is two times the standard uncertainty.

- [c] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

- [d] The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.

 The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial y/\partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .

 The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

 The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain U , the **expanded uncertainty** of y .

 Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

 For further information on the expression of uncertainties, see references [2] and [3].

- [e] Estimated limits of detection for photon-emitting impurities are:
 $76 \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 90 and 1169 keV,
 $24 \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 1177 and 1328 keV, and
 $8 \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 1336 and 1900 keV, provided that the photons are separated in energy by 4 keV or more from photons emitted in the decay of cobalt-60.

- [f] The stated uncertainty is the standard uncertainty. See reference [5].

- [g] Relative standard uncertainty of the input quantity x_i .

- [h] 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 .

- [i] Relative component of combined standard uncertainty of output quantity y , rounded to two significant figures or less. The relative component of combined standard uncertainty of y is given by $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.

7/7/00 RP Prep of Co^{60} KI

Gross 84.3604 g
Tare 79.3342 g
Net 5.0262 g

Balance used #2
Satorius Model 1702

Tared a 100 ml. vol. flask and top.
Opened Co^{60} NIST 4915E, 10g #361, 75.55 kBq/g
@ 1200 EST, 1 Jan 1995. Transferred
 Co^{60} solution into a tared vol. flask.
Weighed Co^{60} solution, flask and top.
Pipetted 1 ml of Co PI carrier (10.81 mg/ml Co^{60})
into the flask. Diluted to mark with
1N HCl. Transfer to 4oz P.B.

$$5.0262 \text{ g} \times 75.55 \text{ kBq/g} \times \frac{\text{dem}}{1000} \times 1 - 2.278 \text{ ES/dpm/ml}$$

100 ml $\pm 0.28\%$

@ 001.708-95 @ 001.833-95
7/7/00 RP 001.833-95

Co^{60} carrier content

$$\left[(5.0262 \text{ g} \times \frac{10.81 \text{ mg CoCl}_2}{1000 \text{ g}} \times 0.4539 \text{ Co}^{60}) + 10.81 \text{ mg Co}^{60} \right] \times \frac{1}{100 \text{ ml}}$$

$$= 0.1104 \text{ mg/ml Co}^{60}$$

Calculations checked, K. Yamamoto 7/10/00
K. Prenter

12/2/05
RP

Verification of Cs¹³⁷ NI

1501 451-453

In triplicate; Pipetted 0.1 mL Cs-137 NI into 3 ea Geli jars.
Contd Procedure CT-VE-1, Rev 02, 4/15/02

R Brenton

12/2/05
RP

Prep of Cs¹³⁷ NI-E (2)

1B QC

Pipetted 0.3 mL (0.3 g) ^{↑ x 10⁴} into a 100 mL vol. flask of Cs¹³⁷ NI 1.567 dpm/mL ± 0.5%
Added 500 μL Cs D-A6 carrier into the flask.
Diluted to mark with 0.1N HCl.
Transferred to 4oz WM PB

47.01 dpm/mL ± 0.7% @ 245.500 00

R Brenton

12/2/05

Prep of Co⁶⁰ KI-F

1B QC

Procedure CT-T04, Rev 02 4/15/02 ~~12/2/05 RP~~

Pipetted 4.1 mL (4.18 g) of Co⁶⁰ KI 2.278 ES dpm/mL ± 0.3% into a 100 mL vol. flask.
Diluted to mark with 1N HCl.
Transferred to 4oz WM PB

9340 dpm/mL ± 0.7% @ 001.708 95

R Brenton

104 12/7/05

11/13/06
RPPrep of Co^{60} KI-F-(03) IB

11/13/06 RP

Procedure CT-T04, Rev 03 6/16/06
 Pipetted 4.1 mL (4x100mL+100mL) ~4.18 g
 of Co^{60} KI 2.278 ES dpm/mL $\pm 0.3\%$
 into a 100mL vol flask, Diluted to mark
 with INHCL. Transferred to a 4oz
 WMPB.

9340 dpm/mL $\pm 0.7\%$ @ ADI. 708 95

Shenton

11/13/06
RPPrep of Cs^{137} QI-A-(03) IB

Procedure CT-T04 Rev 03, 6/16/06

Pipetted 10mL ~10.00 g of Cs^{137} QI
 22000 dpm/mL $\pm 0.9\%$ into a 100mL vol flask,
 Diluted to mark with D. INHCL. Transferred to
 a 4oz WMPB

2200 dpm/mL $\pm 0.9\%$ @ 353.708 05

Shenton

RP 11/14/06

409 Rec'd 12/21/05 R. Prentice

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

72016-207

Cs¹³⁷ Q1

Cs-137 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with 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:	Cs-137
ACTIVITY (dps):	3.690 E4
HALF-LIFE:	3.007 E1 years
CALIBRATION DATE:	December 19, 2005 12:00 EST 353.708 DS
RELATIVE EXPANDED UNCERTAINTY (k=2):	1.7%

Impurities: γ -impurities <0.1%

5.01264 grams 0.1M HCl solution with 30 μ g/g Cs carrier.

P O NUMBER: 00003035, Item 2

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

Q A APPROVED: [Signature] 12-20-2005

Cs-137 Q1 pred 11/01/06 IN HCL

$$4.9808g \times \frac{36900 \text{ dps}}{5.01264g} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{1}{100 \text{ mL}} = 2.200E4 \text{ dps/mL} \pm 0.9\% @ 353.708 \text{ DS}$$

0.0546 mg/mL Cs₂PTCl₆ carrier content

R. Prentice 11/01/06
✓ K. Gammeter 11/2/06

1/10/06
RP

Prep of Cs¹³⁷ Q1

1A QC

Gross wt. 76.0174g
Tare wt ~~71.~~ 71.0366g
Net wt 4.9808g

Balance Used
#36

Procedure CT-T03, Rev 2, 4/15/02

Tared a 100mL vol. flask + top. Opened
Cs-137 vial Analytics 78 72016-307,
Log 409 3.690E4 dps in 5.01267g on
Dec. 19, 2005 12:00 EST. Transferred
Cs-137 sol. into the tared vol. flask.
Tared Cs-137 sol. vol. flask + top.
Added 100μL Cs D-Ab carrier 50.77
mg/mL Cs₂PTCl₆ to the same flask.
Diluted to mark with 0.1M HCL.
Transferred to 4oz PB.

$$\frac{4.9808g \times 36900dps \times 60sec \times L}{5.01267g \text{ min } 100mL} = 2.200E4 dp/mL \pm 0.9\% @ 353.70805$$

carrier content
0.0546 mg/mL Cs₂PTCl₆

R. Brenton

✓ K. Yamamoto 1/12/06

6/27/05 Standardization of Cs D-A6 carrier

RP

Procedure CI-CES, Rev 02. 4/15/02
 7.2 Standardization, Balance 2 Model 11702 Sartorius
 2 mL a/g from Cs D-A5
 Prep. see C-3 pg 39

6/27/05 RP	21	22	23	1
Tare wt	12.4876 g	12.5112 g	12.4712 g	12.5446 g
"	12.4876 ^{6/27/05}	<u>12.5112</u>	<u>12.4712</u>	<u>12.5446</u>
"	<u>12.4876</u>			
Avg wt	12.4876 g	12.5112 g	12.4712 g	12.5446 g

Gross wt	12.5893 g	12.6126 g	12.5732 g	12.6458 g
"	<u>12.5893</u>	<u>12.6127</u>	<u>12.5730</u>	<u>12.6456</u>
Avg "	12.5893 g	12.61265 g	12.5731 g	12.6457 g
Avg Tarent	<u>12.4876</u>	<u>12.5112</u>	<u>12.4712</u>	<u>12.5446</u>
	<u>0.1017 g</u>	<u>0.10145 g</u>	<u>0.1019 g</u>	<u>0.1011 g</u>

mean $\frac{101.54 \text{ mg}}{2 \text{ mL}} = 50.77 \text{ mg/mL Cs}_2\text{PtCl}_6 \pm 0.17\% @ 180 \text{ } ^\circ\text{C}$

R. Trenton

K. Yamamoto 6/29/05

11/13/06
RP

Verification of Cs¹³⁷ Q1

1501 454-456

In triplicate; Pipetted 0.1 mL Cs¹³⁷ Q1 into three each Gel jars.

Contd Procedure CT-VG-1, Rev 02 4/15/02

R Prenton

11/13/06
RP

~~Prep~~
11/13/06 RP

Prep of Cs¹³⁷ Q1-A

1B

Procedure CT-T04, Rev 02, 4/15/02

Pipetted 10 mL (2 x 5 mL) - 10.01 g of Cs¹³⁷ Q1
22000 dpm/mL 1 mL ± 0.9% into a 100 mL vol.
flask, ^{11/13/06 RP} Diluted to mark with 0.1 N HCl.
Transferred to a 4oz WM PB.

25

2200 dpm/mL ± 1.0% @ 353.708-05

R Prenton

KY 1/20/06

11/13/06
RPPrep of Co^{60} KI-F-(03) IB

Procedure CT-T04, Rev 03 6/16/06

Pipetted 4.1 mL (4x1000mL+100mL) ~4.18 g
of Co^{60} KI 2.278E5 dpm/mL $\pm 0.3\%$ into a 100mL vol flask, Diluted to mark
with 1N HCL. Transferred to a 4oz
WMPB.9340 dpm/mL $\pm 0.7\%$ @ ADI. 708 95

Arenton

11/13/06
RPPrep of Cs^{137} QI-A-(03) IB

Procedure CT-T04 Rev 03, 6/16/06

Pipetted 10mL ~10.00 g of Cs^{137} QI22000 dpm/mL $\pm 0.9\%$ into a 100mL vol flask.Diluted to mark with 0.1N HCL. Transferred to
a 4oz WMPB.2200 dpm/mL $\pm 0.9\%$ @ 353.708 OS

Arenton

KJ 11/14/06

Section 3

Instrument Calibration Information

Richmond, CA Laboratory

Verification of Primary Calibration

Analysis Gross A/B Detector system LB4000 Date 2-26-03

Type: 80/93
TLW No. of Primary calibration being verified: _____ Date: _____

Standard Solution used: <u>Sr 90 Zr Am 241 Pl</u>	Prepared by: <u>RP</u>
Reference Date: <u>102 + 708 - 95 109 + 500 - 96</u>	Date: <u>11-10-00</u>

Preparation of secondary Solution(s):

Sample Preparation:

Counting Results:

Sample	Count GMT	Calculated Dpm ± 2σ error	Known Dpm	Ratio Found Dpm/ Known Dpm
See attached Summary: For Gross Alpha, only the results from D drawers were used in the calculation. Data from sample # B and BR were not used, (unreliable data). QAP-11 has a control limit of: 0.70 - 1.30 for GRA 0.80 - 1.20 for GRB The results of the verification is within the warning limits. CS 2-26-03				
Average Found/known ratio				$\frac{0.912}{0.90} \quad \frac{0.998}{0.93}$
Acceptance limits (from RCP-00, section 7.5)				$\frac{1.10}{1.07}$

Attach all raw data sheets Verification: outside limits within limits

Prepared by: <u>[Signature]</u> Signature	Date: <u>2-26-03</u>	Q.A. Review: <u>[Signature]</u> Signature	Date: <u>02-26-03</u>
---	----------------------	---	-----------------------

Gross Alpha / Beta Verification

										ALPHA		BETA
										WTSmg	AVG	AVG
SAMPLE	INST.ID	REGION	GMT	YR	DPM	DELTA	DECAY	DPM@TZ	F/A			
					Am-241 = 1074	DPM @ 109.500	1996		lambda(-d) =			4.0291E-06
					Sr-90 = 1186	DPM @ 182.708	1995		lambda(-d) =			6.8630E-05
1074-1	C1	BETA	20.697	2003	1950.06	2467.947	0.84419	1976.80	0.986	18.300		
1074-1	D2	BETA	27.869	2003	1893.32	2475.119	0.84378	1976.80	0.958	18.300		
1074-1	C1	BETA	30.874	2003	1959.57	2478.124	0.84360	1976.80	0.991	18.300		
1074-1	D3	BETA	31.861	2003	1963.10	2479.111	0.84419	1976.80	0.993	18.300		0.981
1074-2	C2	BETA	20.697	2003	1989.68	2467.947	0.99008	1976.80	1.007	29.400		
1074-2	D3	BETA	27.869	2003	1860.23	2475.119	0.99007	1976.80	0.941	29.400		
1074-2	D2	BETA	28.807	2003	1965.22	2476.057	0.99007	1976.80	0.994	29.400		
1074-2	C2	BETA	30.874	2003	1977.60	2478.124	1.00000	1976.80	1.000	29.400		0.985
1074-3	C3	BETA	20.697	2003	1987.18	2467.947	0.84419	1976.80	1.005	40.800		
1074-3	C3	BETA	30.874	2003	2003.12	2478.124	0.84360	1976.80	1.013	40.800		
1074-3	D3	BETA	34.867	2003	2004.16	2482.117	0.84337	1976.80	1.014	40.800		
1074-3	D3	BETA	37.653	2003	2001.45	2484.903	0.84321	1976.80	1.012	40.800		1.011
1074-4	C4	BETA	20.697	2003	2009.01	2467.947	0.84419	1976.80	1.016	53.500		
1074-4	C4	BETA	30.874	2003	2032.88	2478.124	0.84360	1976.80	1.028	53.500		
1074-4	D3	BETA	35.753	2003	1985.58	2483.003	0.84332	1976.80	1.004	53.500		
1074-4	D3	BETA	37.849	2003	2008.09	2485.099	0.84320	1976.80	1.016	53.500		
1074-5	C1	ALPHA	20.778	2003	865.81	2468.028	0.99011	1074.00	0.806	18.400		
1074-5	C1	ALPHA	28.807	2003	865.81	2476.057	0.99007	1074.00	0.806	18.400	0.806	
1074-5	D3	ALPHA	31.764	2003	1021.03	2479.014	0.99006	1074.00	0.951	18.400		
1074-5	D3	ALPHA	34.686	2003	1014.95	2481.936	0.99005	1074.00	0.945	18.400	0.948 *	
1074-6	C2	ALPHA	20.778	2003	800.12	2468.028	0.99011	1074.00	0.745	29.800		
1074-6	C2	ALPHA	28.807	2003	799.06	2476.057	0.99007	1074.00	0.744	29.800	0.745	
1074-6	D3	ALPHA	34.768	2003	959.56	2482.018	0.99005	1074.00	0.893	29.800		
1074-6	D2	ALPHA	44.652	2003	921.68	2491.902	0.99001	1074.00	0.858	29.800	0.876 *	
1074-7	C3	ALPHA	20.778	2003	834.94	2468.028	0.99011	1074.00	0.777	48.700		
1074-7	C3	ALPHA	28.807	2003	820.85	2476.057	0.99007	1074.00	0.764	48.700	0.771	
1074-7	D3	ALPHA	35.853	2003	973.05	2483.103	0.99005	1074.00	0.906	48.700		
1074-7	D3	ALPHA	44.652	2003	985.79	2491.902	0.99001	1074.00	0.918	48.700	0.912 *	
1074-8	C4	ALPHA	20.778	2003	717.54	2468.028	0.84419	1074.00	0.668	58.200		
1074-8	C4	ALPHA	28.807	2003	704.05	2476.057	0.84372	1074.00	0.656	58.200	0.662	
1074-8	D3	ALPHA	37.920	2003	874.15	2485.170	0.84320	1074.00	0.814	58.200		
1074-8	D2	ALPHA	44.756	2003	825.49	2492.006	0.84280	1074.00	0.769	58.200	0.791	
1074-8	B1	ALPHA	45.792	2003	739.75	2493.042	0.84274	1074.00	0.689	49.900		
1074-8	D2	ALPHA	52.655	2003	740.27	2499.905	0.84234	1074.00	0.689	49.900	0.689	
1074-8	C1	ALPHA	50.656	2003	897.94	2497.906	0.84246	1074.00	0.836	49.900		
1074-8	D2	ALPHA	52.892	2003	863.68	2500.142	0.84233	1074.00	0.804	49.900	0.82	

1.016
 Ave. 0.998 ± 1.8%
 CN
 2/26/03

0.912 *
 Ave. 0.912 ± 3.6% *
 CN
 2/26/03

GROSS ALPHA/BETA VERIFICATION CALIBRATION - 2/2003

SAMPLE NO.	INST. ID	WTS. MG	SR-90 ADDED	BETA CPM	ALPHA CPM	BETA EFF.	ALPHA FR BETA	EFF USED	F/A-EFF
1074-1	C1	18.3	1976.8	802.681	0.860	0.4061	0.0011	0.418	0.9714
1074-1	D2	18.3	1976.8	780.973	1.343	0.3951	0.0017	0.418	0.9451
1074-1	C1	18.3	1976.8	805.117	1.378	0.4073	0.0017	0.418	0.9744
1074-1	D3	18.3	1976.8	804.744	0.241	0.4071	0.0003	0.418	0.9739
1074-2	C2	29.4	1976.8	812.030	2.115	0.4108	0.0026	0.414	0.9922
1074-2	D3	29.4	1976.8	757.040	0.390	0.3830	0.0005	0.414	0.9250
1074-2	D2	29.4	1976.8	804.780	1.560	0.4071	0.0019	0.414	0.9834
1074-2	C2	29.4	1976.8	807.589	2.196	0.4085	0.0027	0.414	0.9868
1074-3	C3	40.8	1976.8	813.073	0.720	0.4113	0.0009	0.411	1.0007
1074-3	C3	40.8	1976.8	819.593	0.719	0.4146	0.0009	0.411	1.0088
1074-3	D3	40.8	1976.8	807.820	0.183	0.4087	0.0002	0.411	0.9943
1074-3	D3	40.8	1976.8	807.580	0.446	0.4085	0.0006	0.411	0.9940
1074-4	C4	53.5	1976.8	811.754	0.692	0.4106	0.0009	0.407	1.0089
1074-4	C4	53.5	1976.8	820.582	0.697	0.4151	0.0008	0.407	1.0199
1074-4	D3	53.5	1976.8	792.721	0.199	0.4010	0.0003	0.407	0.9853
1074-4	D3	53.5	1976.8	802.520	0.306	0.4060	0.0004	0.407	0.9975

SAMPLE NO	INST. ID	WTS mg	Am-241 ADDED	ALPHA CPM	BETA CPM	ALPHA EFF	BETA FR. ALPHA	EFF. USED	F/A - EFF
1074-5	C1	18.4	1062	142.663	31.510	0.1343	0.2209	0.190	0.7070
1074-5	C1	18.4	1062	141.372	33.117	0.1331	0.2343	0.190	0.7006
1074-5	D3	18.4	1062	187.491	43.064	0.1765	0.2297	0.190	0.9292
1074-5	D3	18.4	1062	183.393	45.990	0.1727	0.2508	0.190	0.9089
1074-6	C2	29.8	1062	116.905	26.293	0.1101	0.2249	0.172	0.6400
1074-6	C2	29.8	1062	116.655	27.020	0.1098	0.2316	0.172	0.6386
1074-6	D3	29.8	1062	159.313	37.910	0.1500	0.2380	0.172	0.8722
1074-6	D2	29.8	1062	151.838	34.190	0.1430	0.2252	0.172	0.8312
1074-7	C3	48.7	1062	107.920	26.693	0.1016	0.2473	0.147	0.6913
1074-7	C3	48.7	1062	106.101	26.761	0.0999	0.2522	0.147	0.6796
1074-7	D3	48.7	1062	137.309	33.981	0.1293	0.2475	0.147	0.8795
1074-7	D3	48.7	1062	139.323	36.340	0.1312	0.2608	0.147	0.8924
1074-8	C4	58.2	1062	88.312	23.488	0.0832	0.2660	0.142	0.5856
1074-8	C4	58.2	1062	86.853	24.095	0.0818	0.2774	0.142	0.5759
1074-8	D3	58.2	1062	119.936	30.380	0.1129	0.2533	0.142	0.7953
1074-8	D2	58.2	1062	112.488	26.510	0.1059	0.2357	0.142	0.7459
1074-8R	B1	49.9	1062	93.749	24.961	0.0883	0.2663	0.145	0.6088
1074-8R	D2	49.9	1062	125.018	31.130	0.1177	0.2490	0.145	0.8119
1074-8R	C1	49.9	1062	92.132	25.278	0.0868	0.2744	0.145	0.5983
1074-8R	D2	49.9	1062	120.227	27.548	0.1132	0.2291	0.145	0.7807

Date: 1-13-03

To: Ruby Prenton/ Kats Yamamoto

From: Cesar Sangalang *CS*

Subj: Request for preparation of Calibration Standards of Group 1074 Gross Alpha/Beta

1074

Please prepare four (4) tubes each with about 1000 dpm of Sr-90 (soln. Sr-90 Z1) and another for tubes each with about 1000 dpm of Am-241 (soln. Am-241 P1).

Sample Nos. will be 1074-1 to 4 type "80" for Sr and 1074- 5 to 8 type "80" for Am .

I need to start with this work tomorrow, 1-14-03 with a projected finish date of 2-07-03

Thank you

Cesar

Verification
Book 2583 pg 86
565-572
Radiometrics Prep

Page 101, BK # 2775 Calibration

B efficiency -

counted in 2 diff. drawer C- Aluminized mylar
D- (Amidized) Gold in mylar.

2 counts on each drawer
4 count per samples.

α efficiency -

β efficiency -

α from beta -

β from alpha -

Added 1186 dpm of Sr 90 Z1

1074 dpm of Am²⁴¹ P1

Log Book Group's Sample Entry #	DATE	ANALYSIS	Reg. Sample ID	Volume & ID of TRACER ADDED	TOTAL ACTIVITY (CPM)	ACTIVITY DATE	STANDARD WT. (g)	MATRIX	CONTAINER	Event ID	Additional Information on Comment
564	10/18/02	Pu241	MUT RP	350uL Pu ²⁴¹ M1	2849.7	336.708-95	0.39	1.6542 ON HANDS + 18 mL U ²³⁵ MA Gold AB	LSC VIAL	MUT	Pu-241 Calib. check 10/18/02 K-gamma meter 2/14/03
565	1074-1	Type 80CS	RP	0.1 mL Sr ⁹⁰ Z1	1186	182.708-95	0.5	10m L/MNHCl	50mL Poly Tube	CS	GRB Verification 1/13/03 K-gamma meter
566	2	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
567	3	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
568	4	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
569	5	"	RP	0.1 mL Am ²⁴¹ PI	1074	109.500-96	0.92	2/15/03 RP	"	"	"
70	6	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	1.0	"	"	"	"
71	7	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
72	8	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
3	1075-1	Rn ²²²	CS RP	6.0 mL Rn ²²² N1-A	149.7	252.708-91	0.13	6m L/MNHCl + 4mL H ₂ O	LSC VIAL	CS	Rn ²²² Verification 1/21/03 K-gamma meter 2/14/03
4	2	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
575	3	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
576	1076-1	Sr ⁹⁰	CS RP	200uL Sr ⁹⁰ Z1	2372	182.708-95	0.21	0.1 N HANDS	50mL Poly Tube	CS	Sr ⁹⁰ Verification 2/14/03 K-gamma meter 2/14/03
577	2	"	RP	"	"	"	0.21	"	"	"	"
578	3	"	RP	"	"	"	0.21	"	"	"	"
579	4	"	RP	"	"	"	0.21	"	"	"	"
580	5	"	RP	"	"	"	0.21	"	"	"	"
581	6	"	RP	"	"	"	0.21	"	"	"	"

Log Book Group's Sample Entry #	DATE	ANALYSIS	Reg. Sample ID	Volume & ID of TRACER ADDED	TOTAL ACTIVITY (CPM)	ACTIVITY DATE	STANDARD WT. (g)	MATRIX	CONTAINER	Event ID	Additional Information on Comment
564	10/18/02	Pu241	MUT RP	350uL Pu ²⁴¹ M1	2849.7	336.708-95	0.39	1.6542 ON HANDS + 18 mL U ²³⁵ MA Gold AB	LSC VIAL	MUT	Pu-241 Calib. check 10/18/02 K-gamma meter 2/14/03
565	1074-1	Type 80CS	RP	0.1 mL Sr ⁹⁰ Z1	1186	182.708-95	0.5	10m L/MNHCl	50mL Poly Tube	CS	GRB Verification 1/13/03 K-gamma meter
566	2	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
567	3	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
568	4	"	RP	0.1 mL Sr ⁹⁰ Z1	1186	"	"	"	"	"	"
569	5	"	RP	0.1 mL Am ²⁴¹ PI	1074	109.500-96	0.92	2/15/03 RP	"	"	"
70	6	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	1.0	"	"	"	"
71	7	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
72	8	"	RP	0.1 mL Am ²⁴¹ PI	1074	"	"	"	"	"	"
3	1075-1	Rn ²²²	CS RP	6.0 mL Rn ²²² N1-A	149.7	252.708-91	0.13	6m L/MNHCl + 4mL H ₂ O	LSC VIAL	CS	Rn ²²² Verification 1/21/03 K-gamma meter 2/14/03
4	2	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
575	3	"	RP	6.0 mL Rn ²²² N1-A	149.7	"	0.13	"	"	"	"
576	1076-1	Sr ⁹⁰	CS RP	200uL Sr ⁹⁰ Z1	2372	182.708-95	0.21	0.1 N HANDS	50mL Poly Tube	CS	Sr ⁹⁰ Verification 2/14/03 K-gamma meter 2/14/03
577	2	"	RP	"	"	"	0.21	"	"	"	"
578	3	"	RP	"	"	"	0.21	"	"	"	"
579	4	"	RP	"	"	"	0.21	"	"	"	"
580	5	"	RP	"	"	"	0.21	"	"	"	"
581	6	"	RP	"	"	"	0.21	"	"	"	"



U.S. DEPARTMENT OF COMMERCE
National Institute of Standards & Technology
Gaithersburg, MD 20899

REPORT OF TRACEABILITY *Am-241 P1*

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada

Radionuclide Americium-241
Source identification 94030-1, prepared by EMSL
Source description Liquid in 5-mL flame-sealed glass ampoule
Source mass Approximately 5.0 grams
Source composition Americium-241 in 0.1 mol·L⁻¹ HCl
Reference time 0700 EST April 18, 1996

NIST DATA

EMSL DATA

Radioactivity concentration	3.574 x 10 ² Bq·g ⁻¹	9.6 nanocuries/gram
Expanded uncertainty	0.46 percent ^{(1,2)*}	±2.75 percent ⁽³⁾
Photon-emitting impurities	None observed ⁽⁴⁾	None reported
Measuring instrument	2π α liquid-scintillation counter	Liquid-scintillation counter
Half life	432.2 ± 0.7 years ⁽⁵⁾	
Difference from NIST		+0.06 percent ⁽⁶⁾

For the Director,

J.M. Robin Hutchinson, Group Leader
Radioactivity Group
Physics Laboratory

*Notes on next page

(over)

Gaithersburg, MD 20899
November 1996

As guidance for the proper use of this Report, it should be emphasized that the National Institute of Standards and Technology is concerned only with fostering good measurements capability and consistency with the national measurements system. The assurance of the proper application of that capability to the ultimate consumer products is the responsibility of each manufacturer of these products and of the Federal regulatory agencies.

A continuing traceability program in radioactivity demonstrates, to the degree established by the periodic assays of calibrated radioactivity samples, a continuing competence to maintain the instrument systems and standards necessary for accurate measurement. Such a program cannot, however, endorse each and every measurement nor the final product, any more than a spot check can vouch for every unchecked item. Care should be taken, therefore, not to imply such endorsement. The proper use of this Report is governed by section 200.114 of Title 15 of the Code of Federal Regulations. These regulations may be met if Reports are quoted only in their entirety. Excerpts out of context may be misleading.

NOTES

(1) The uncertainty analysis methodology and nomenclature used for the reported uncertainties are based on uniform NIST guidelines and are compatible with those adopted by the principal international metrology standardization bodies [cf., B.N. Taylor and C.E. Kuyatt, *NIST Technical Note 1297* (1994)].

(2) The combined standard uncertainty, $u_c = 0.23$ percent, is the quadratic combination of the standard deviation (or standard deviation of the mean where appropriate), or approximations thereof, for the following component uncertainties:

a)	20 measurements on each of 5 samples	0.03 percent
b)	gravimetric	0.05 percent
c)	dead time	0.10 percent
d)	background	0.01 percent
e)	detection efficiency	0.20 percent

The expanded uncertainty, $U = 0.46$ percent, is obtained by multiplying u_c by a coverage factor of $k = 2$ and is assumed to provide an uncertainty interval of approximately 95 percent confidence.

(3) "Overall uncertainty" reported by EMSL.

(4) The limits of detection, as a percentage of the 59.5-keV photons emitted in the decay of americium-241, are:

0.02 percent between 63.5 and 1900 keV,

provided that the impurity photons are separated in energy by four keV or more from those emitted in the decay of americium-241.

(5) Evaluated Nuclear Structure Data File (ENSDF), September 1996.

(6) This result demonstrates the traceability of EMSL to NIST, for this measurement, to within five percent as specified in the appendix, Traceability Studies, of the EPA-NIST interagency agreement of April 1976, as amended.

For further information, please contact Jeffrey T. Cessna at 301-975-5539.

Source identification 94030-1



318
 Rec'd 6/24/97
 K. Yamamoto

Am-241 P1

Calibration Certificate

OFFICE OF
 RESEARCH AND DEVELOPMENT

Description

Principal Radionuclide.....	Americium-241
Total Mass of this Solution.....	Approx. 5 grams
Total Activity.....	Approx. 48 nanocuries
Half-life.....	432.7 ± 0.5 years
Activity Concentration.....	9.6 nanocuries/gram
Date and Time of Standardization.....	April 18, 1996 0400 hours PST
Solution Number.....	109,500-96 94030-1

Measurement

Method of Measurement:

The activity of the dilution was measured using liquid scintillation.

The activity of the primary solution was measured using a liquid scintillation counter.

Activity of daughter radionuclide:

The principal activity was accompanied at the quoted time by less than:

[] of the daughter nuclide..... []

Useful Life

We recommend that this solution should not be used after..... January, 2003

Am-241 P1 Rec'd 12/04/2001 in 1M HCl
 $5.0386 \text{ g} \times 9.6 \text{ nCi/g} \times 2220 \text{ dpm/nCi} \times \frac{1}{100 \text{ mL}} = 1074 \text{ dpm/mL} \pm 0.92\%$
 109,500-96
 R. Prentice 12/4/01
 K. Yamamoto 12/4/01
 NPDES - 1474

Purity:

The activities other than that of the principal nuclide and of its daughter nuclides were estimated to be:

- (1) None stated < of the principal activity
- (2) < of the principal activity
- (3) < of the principal activity

The activities of the impurities are not included in the quoted figures of the principal activity.

Random Errors:

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than $\pm 0.23\%$.

The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the Student t factor for the degree of freedom ($n-1$), and is calculated to be $\pm 0.75\%$.

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta, -\delta'$). These have been estimated not to exceed $\pm 2.0\%$.

The overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error [$t(sm)$] at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta, -\delta'$). The overall uncertainty is therefore calculated on the basis of $+ [t(sm) + \delta], - [t(sm) + \delta']$ and is $\pm 2.75\%$ of the quoted radioactive concentration.

Decay Schemes:

This standardization is based on the following assumptions of the principal nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Americium-241 decays 100 percent by alpha emission.

Chemical Composition of Solution:

Carrier content per gram of solution:

Other components:

Preservative: 1.0 M HCl

Remarks:

Date Certificate Prepared April 26, 1996

Approval Signature *J. L. Mills*



National Institute of Standards & Technology

Certificate

Sr⁹⁰Z1

Standard Reference Material 4919H Strontium-90 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive strontium-90 chloride, non-radioactive strontium chloride, non-radioactive yttrium chloride, and hydrochloric acid dissolved in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of beta-particle counting instruments and for the monitoring of radiochemical procedures.

Radiological Hazard

The SRM ampoule contains strontium-90 with a total activity of approximately 20 kBq. Strontium-90 decays by beta-particle emission to yttrium-90, which also decays by beta-particle emission. None of the beta particles escape from the SRM ampoule. The beta particles emitted from strontium-90 and yttrium-90 produce bremsstrahlung photons with energies up to 2 MeV. Most of these photons escape from the SRM ampoule and can represent a radiation hazard. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. Appropriate shielding and/or distance should be used to minimize personnel exposure. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains hydrochloric acid (HCl) with a concentration of 0.9 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 July 2005.

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
December 1995

Thomas E. Gills, Chief
Standard Reference Materials Program

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood. In addition to the radioactive material, the solution contains strong acid and is corrosive.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss. See also reference [4]*.

- [a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
- | | | | |
|---|----|------|-----|
| Distance from Ampoule (cm): | 1 | 30 | 100 |
| Approximate Dose Rate ($\mu\text{Sv/h}$): | 15 | <0.1 | - |

- [b] The stated uncertainty is two times the standard uncertainty.

- [c] **Massic activity** is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].

- [d] The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.

The value, x_i , used for each input quantity i has a **standard uncertainty**, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) \equiv |\partial y / \partial x_i| \cdot u(x_i)$, called a **component of combined standard uncertainty** of y .

The **combined standard uncertainty** of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.

The combined standard uncertainty is multiplied by a **coverage factor** of $k = 2$ to obtain U , the **expanded uncertainty** of y .

Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.

For further information on the expression of uncertainties, see references [2] and [3].

- [e] The value of each standard uncertainty component, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the liquid-scintillation counting is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).

- [f] The estimated limit of detection for alpha-particle-emitting impurities is:
 $0.05 \alpha \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 3 and 12 MeV.

- [g] Estimated limits of detection for photon-emitting impurities are:
 $0.04 \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 40 and 507 keV and
 $0.004 \gamma \cdot \text{s}^{-1} \cdot \text{g}^{-1}$ for energies between 515 and 1900 keV.

- [h] The stated uncertainty is the standard uncertainty. See reference [5].

- [i] Relative standard uncertainty of the input quantity x_i .

- [j] 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 .

- [k] Relative component of combined standard uncertainty of output quantity y , rounded to two significant figures or less. The relative component of combined standard uncertainty of y is given by $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.
- [m] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.
- [n] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of Sr-90})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of Sr-90})\}$. 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.
- [p] 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.
- [q] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$, multiplied by other sensitivity factors where appropriate.
- [r] The relationship between the detection efficiency for Sr-90 and Y-90 and the detection efficiency for H-3 was computed using the CIEMAT/NIST method as embodied in the computer program EFFY4. See references [6, 7, 8]. The program computes the detection efficiency for each radionuclide based upon an assumed model. No estimate is made of the uncertainty associated with this model.

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), July 1995.
- [6] E. Garcia-Toraño and A. Grau Malonda, EFFY, A New Program to Compute the Counting Efficiency of Beta Particles in Liquid Scintillators, *Computer Phys. Comm.* **36** (1985) 307.
- [7] A. Grau Malonda, E. Garcia-Toraño, and J.M. Los Arcos, Liquid-Scintillation Counting Efficiency as a Function of the Figure of Merit for Pure Beta-Particle Emitters, *Int. J. Appl. Radiat. Isot.* **36** (1985) 157.
- [8] B.M. Coursey, W.B. Mann, A. Grau Malonda, E. Garcia-Toraño, J.M. Los Arcos, J.A.B. Gibson, and D. Reher, Standardization of Carbon-14 by $4\pi\beta$ Liquid Scintillation Efficiency Tracing with Hydrogen-3, *Appl. Radiat. Isot.* **37** (1986) 403.

PROPERTIES OF SRM 4919H
(Certified values are shown in bold type)

Sr⁹⁰Z1

Source identification number	NIST SRM 4919H		
Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall Thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution density	(1.014 ± 0.002) g·mL⁻¹ at 21.5 °C [b]*		
Solution mass	Approximately 5.0 grams		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O	54	0.96
	HCl	0.9	0.04
	SrCl ₂	0.001	0.0002
	YCl ₃	0.001	0.0002
	⁹⁰ SrCl ₂	9 × 10 ⁻⁹	1 × 10 ⁻⁹
Radiological Properties:			
Radionuclide	Strontium-90		
Reference time	1200 EST, 1 July 1995		
Massic activity of the solution [c]	4.010 kBq·g ⁻¹		
Relative expanded uncertainty (k=2)	0.74% [d] [e]		
Alpha-particle-emitting impurities	None detected [f]		
Photon-emitting impurities	None detected [g]		
Half lives used in the decay corrections	Hydrogen-3: (12.33 ± 0.06) a [h] Strontium-90: (28.78 ± 0.04) a [h] Yttrium-90: (64.10 ± 0.08) h [h]		
Beta-particle maximum energies used in the EFFY4 computations	Hydrogen-3: (18.594 ± 0.008) keV [h] Strontium-90: (546.0 ± 1.6) keV [h] Yttrium-90: (521 ± 3) keV [h] (2281.5 ± 2.5) keV [h]		
Calibration method	4πB liquid-scintillation counting. The Sr-90 plus Y-90 detection efficiency was calculated using the CIEMAT/NIST method with H-3 as the detection-efficiency monitor. [r]		

Sr⁹⁰Z1 in 1N HCL
 $4.9313 \text{ g} \times 4.010 \frac{\text{kBq}}{\text{g}} \times 1000 \times 60 \frac{\text{dpm}}{\text{Bq}} \times \frac{1}{100 \text{ ml}} = 1.18654 \text{ dpm/ml} \pm 0.37\% \text{ Sr}^{90}$
 SRM 4919H, page 3 of 6
Carrier content 0.132 mg/ml SrCO₃ + 0.1107 mg/ml Y₂O₃
 11/10/00 P.38
 @ 182.708 - 95
 *Notes and references are on pages 5 and 6.
 K. Yamamoto
 NPDES 1480

Counted 20.697- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	18.300 mg	18.300 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 109	GRB 109
Counts =	90.000	80370.000
Gross cpm =	0.900	803.700
Background =	0.037	1.019
Observed CPM =	0.863	802.681
Cross talk fac =	0.006	0.209
True CPM =	-4.096	803.538
Inst Std. Fac. =	1.163	1.014
Adjusted CPM =	-4.764	814.787
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	-25.046	1950.059

pCi /smp1 =	-11.3	878.
1 sigma % Err =	2.363	0.353
2 sigma % Err =	4.632	0.692

(1 sigma err) = 0.267 3.10

(2 sigma err) = 0.523 6.08

LTV (95 %) = 0.440 884.

MDA (3.00) = 0.283 0.538

MDA (2.71) = 0.276 0.535

CRITICAL LEVEL = 0.106 0.254

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.037	1.019	0.00
SF	20.633	0	1.163	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.738	17-JAN-03 9:42	GAW 109	(50)9025 1	100.0 min	0.75
17.986	17-JAN-03 15:39	GAW 109	BK	3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 109	SF	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.738	17-JAN-03 9:42	GRB 109	(50)9025 1	100.0 min	12.57
17.986	17-JAN-03 15:39	GRB 109	BK	3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 109	SF	10.0 min	0.00

CS
Counted 27.869- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.300 mg	18.300 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 114	GRB 114
Counts =	138.000	78303.000
Gross cpm =	1.380	783.030
Background =	0.037	2.057
Observed CPM =	1.343	780.973
Cross talk fac =	0.006	0.209
True CPM =	-3.482	781.701
Inst Std. Fac. =	1.045	1.012
Adjusted CPM =	-3.638	791.082
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	-19.128	1893.323

Count

pCi /smpl =	-8.62	853.
1 sigma % Err =	3.419	0.358
2 sigma % Err =	6.701	0.703

(1 sigma err) = 0.295 3.06

(2 sigma err) = 0.577 5.99

LTV (95 %) = 0.486 858.

MDA (3.00) = 0.283 0.751

MDA (2.71) = 0.276 0.748

CRITICAL LEVEL = 0.106 0.360

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	25.006	3	0.037	2.057	0.00
SF	27.619	0	1.045	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.620	27-JAN-03 6:52	GAW 114	SF	10.0 min	0.00
27.664	27-JAN-03 7:56	GAW 114	(93)2158 14	100.0 min	9.48
27.756	27-JAN-03 10:08	GAW 114	(93)7426 16	100.0 min	8.17

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.633	27-JAN-03 7:11	GRB 114	SF	10.0 min	0.00
27.664	27-JAN-03 7:56	GRB 114	(93)2158 14	100.0 min	25.28
27.756	27-JAN-03 10:08	GRB 114	(93)7426 16	100.0 min	21.12

CS
Counted 30.874- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.300 mg	18.300 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 109	GRB 109
Counts =	142.000	80616.000
Gross cpm =	1.420	806.160
Background =	0.042	1.043
Observed CPM =	1.378	805.117
Cross talk fac =	0.006	0.209
True CPM =	-3.596	805.869
Inst Std. Fac. =	1.165	1.016
Adjusted CPM =	-4.189	818.763
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	-22.023	1959.574

2 counts done
(c)

pCi /smpl =	-9.92	883.
1 sigma % Err =	3.363	0.353
2 sigma % Err =	6.591	0.691

(1 sigma err) = 0.334 3.11

(2 sigma err) = 0.654 6.10

LTV (95 %) = 0.550 888.

MDA (3.00) = 0.297 0.544

MDA (2.71) = 0.290 0.541

CRITICAL LEVEL = 0.113 0.257

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.042	1.043	0.00
SF	30.616	0	1.165	1.016	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03 6:47	GAW 109	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GAW 109	(50)9035 1 \	100.0 min	0.82
30.867	30-JAN-03 12:48	GAW 109	(50)9035 1 \	6.0 min	0.73

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03 7:01	GRB 109	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GRB 109	(50)9035 1 \	100.0 min	20.30
30.867	30-JAN-03 12:48	GRB 109	(50)9035 1 \	6.0 min	24.17

CS
Counted 31.861- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.300 mg	18.300 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	29.000	80626.000
Gross cpm =	0.290	806.260
Background =	0.049	1.516
Observed CPM =	0.241	804.744
Cross talk fac =	0.006	0.209
True CPM =	-4.732	805.734
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	-4.898	820.237
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	-25.748	1963.102

2nd Count
Done
D

pCi /smpl =	-11.6	884.
1 sigma % Err =	1.230	0.353
2 sigma % Err =	2.412	0.691

(1 sigma err) = 0.143 3.12

(2 sigma err) = 0.280 6.11

LTV (95 %) = 0.235 889.

MDA (3.00) = 0.315 0.650

MDA (2.71) = 0.308 0.646

CRITICAL LEVEL = 0.122 0.309

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	30.966	3	0.049	1.516	0.00
SF	31.614	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.966	30-JAN-03 15:11	GAW 115	BK	929.7 min	0.00
31.614	31-JAN-03 6:44	GAW 115	SF	10.0 min	0.00
31.764	31-JAN-03 10:20	GAW 115	(80)1074	5 \ 100.0 min	194.10

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.966	30-JAN-03 15:11	GRB 115	BK	929.7 min	0.00
31.625	31-JAN-03 7:00	GRB 115	SF	10.0 min	0.00
31.764	31-JAN-03 10:20	GRB 115	(80)1074	5 \ 100.0 min	43.83

CS
Counted 20.697- 3 on C2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.400 mg	29.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 110	GRB 110
Counts =	217.000	81414.000
Gross cpm =	2.170	814.140
Background =	0.055	1.637
Observed CPM =	2.115	812.503
Cross talk fac =	0.006	0.215
True CPM =	-2.840	813.113
Inst Std. Fac. =	1.176	1.014
Adjusted CPM =	-3.340	824.496
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	-19.370	1989.682

pCi /smpl =	-8.73	896.
1 sigma % Err =	5.252	0.351
2 sigma % Err =	10.293	0.688

(1 sigma err) = 0.458 3.15

(2 sigma err) = 0.898 6.17

LTV (95 %) = 0.756 901.

MDA (3.00) = 0.363 0.679

MDA (2.71) = 0.356 0.676

CRITICAL LEVEL = 0.143 0.324

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.055	1.637	0.00
SF	20.633	0	1.176	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.617	17-JAN-03 6:48	GAW 110	SF	\ 10.0 min	0.00
17.986	17-JAN-03 15:39	GAW 110	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 110	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.631	17-JAN-03 7:08	GRB 110	SF	\ 10.0 min	0.00
17.986	17-JAN-03 15:39	GRB 110	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 110	SF	\ 10.0 min	0.00

CS
Counted 28.807- 3 on D2 for 100.00 min. Reviewed _____ Date _____

1.00	smpl	29.400 mg	29.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 114	GRB 114
Counts =	159.000	80684.000
Gross cpm =	1.590	806.840
Background =	0.030	2.060
Observed CPM =	1.560	804.780
Cross talk fac =	0.006	0.215
True CPM =	-3.349	805.499
Inst Std. Fac. =	1.043	1.011
Adjusted CPM =	-3.493	814.360
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	-20.255	1965.220

2
Count.
dmc

(D)

pCi /smpl =	-9.12	885.
1 sigma % Err =	3.801	0.353
2 sigma % Err =	7.449	0.692

(1 sigma err) =	0.347	3.13
(2 sigma err) =	0.680	6.13
LTV (95 %) =	0.572	890.
MDA (3.00) =	0.289	0.758
MDA (2.71) =	0.281	0.755
CRITICAL LEVEL =	0.105	0.364

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.030	2.060	0.00
SF	28.606	0	1.043	1.011	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.957	27-JAN-03 14:58	GAW 114	BK	927.7 min	0.00
28.606	28-JAN-03 6:32	GAW 114	SF	10.0 min	0.00
28.652	28-JAN-03 7:38	GAW 114	(88)9033 2	100.0 min	4.31

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.869	27-JAN-03 12:51	GRB 114	(80)1074 1	100.0 min	790.00
27.957	27-JAN-03 14:58	GRB 114	BK	927.7 min	0.00
28.616	28-JAN-03 6:47	GRB 114	SF	10.0 min	0.00

CS
Counted 30.874- 3 on C2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.400 mg	29.400 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 110	GRB 110
Counts =	224.000	80924.000
Gross cpm =	2.240	809.240
Background =	0.044	1.651
Observed CPM =	2.196	807.589
Cross talk fac =	0.006	0.215
True CPM =	-2.729	808.175
Inst Std. Fac. =	1.177	1.014
Adjusted CPM =	-3.212	819.489
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	-18.628	1977.599

2 Counts done

(C)

pCi /smpl =	-8.39	891.
1 sigma % Err =	9.938	0.352
2 sigma % Err =	10.854	0.691

(1 sigma err) = 0.465 3.14

(2 sigma err) = 0.911 6.15

LTV (95 %) = 0.767 896.

MDA (3.00) = 0.333 0.682

MDA (2.71) = 0.326 0.679

CRITICAL LEVEL = 0.128 0.325

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.044	1.651	0.00
SF	30.616	0	1.177	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03 6:47	GAW 110	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GAW 110	(50)9035	2 \ 100.0 min	0.94
30.867	30-JAN-03 12:48	GAW 110	(50)9035	2 \ 6.0 min	1.52

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03 7:01	GRB 110	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GRB 110	(50)9035	2 \ 100.0 min	18.21
30.867	30-JAN-03 12:48	GRB 110	(50)9035	2 \ 6.0 min	17.59

CS
Counted 20.697- 3 on CS for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	40.800 mg	40.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 111	GRB 111
Counts =	75.000	81424.000
Gross cpm =	0.750	814.240
Background =	0.030	1.167
Observed CPM =	0.720	813.073
Cross talk fac =	0.006	0.220
True CPM =	-4.176	813.993
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	-4.744	816.435
Eff (cpm/dpm) =	0.157	0.411
DPM of Aliquot =	-30.289	1987.176

pCi /smpl =	-13.6	895.
1 sigma % Err =	2.115	0.351
2 sigma % Err =	4.145	0.688

(1 sigma err) = 0.289 3.14

(2 sigma err) = 0.566 6.15

LTV (95 %) = 0.476 900.

MDA (3.00) = 0.318 0.584

MDA (2.71) = 0.310 0.580

CRITICAL LEVEL = 0.116 0.276

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.030	1.167	0.00
SF	20.633	0	1.136	1.003	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GAW 111	(50)9025 3 \	24.0 min	0.40
17.986	17-JAN-03 15:39	GAW 111	BK \	3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 111	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GRB 111	(50)9025 3 \	24.0 min	6.18
17.986	17-JAN-03 15:39	GRB 111	BK \	3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 111	SF \	10.0 min	0.00

CS
Counted 30.874- 3 on C3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	40.800 mg	40.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 111	GRB 111
Counts =	75.000	82078.000
Gross cpm =	0.750	820.780
Background =	0.031	1.187
Observed CPM =	0.719	819.593
Cross talk fac =	0.006	0.220
True CPM =	-4.216	820.522
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	-4.789	822.984
Eff (cpm/dpm) =	0.157	0.411
DPM of Aliquot =	-30.582	2003.115

2 counts done

@

pCi /smpl =	-13.8	902.
1 sigma % Err =	2.096	0.349
2 sigma % Err =	4.109	0.685

(1 sigma err) = 0.289 3.15

(2 sigma err) = 0.566 6.18

LTV (95 %) = 0.476 908.

MDA (3.00) = 0.322 0.588

MDA (2.71) = 0.313 0.585

CRITICAL LEVEL = 0.118 0.278

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.031	1.187	0.00
SF	30.616	0	1.136	1.003	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03 6:47	GAW 111	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GAW 111	(50)9035 3	100.0 min	0.67
30.867	30-JAN-03 12:48	GAW 111	(50)9035 3	6.0 min	1.10

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03 7:01	GRB 111	SF	10.0 min	0.00
30.678	30-JAN-03 8:16	GRB 111	(50)9035 3	100.0 min	17.98
30.867	30-JAN-03 12:48	GRB 111	(50)9035 3	6.0 min	17.04

CS
Counted 34.867- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	40.800 mg	40.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	25.000	80936.000
Gross cpm =	0.250	809.360
Background =	0.067	1.540
Observed CPM =	0.183	807.820
Cross talk fac =	0.006	0.220
True CPM =	-4.682	808.852
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	-4.846	823.411
Eff (cpm/dpm) =	0.157	0.411
DPM of Aliquot =	-30.941	2004.155

2nd Count done

D

pCi /smpl =	-13.9	903.
1 sigma % Err =	1.203	0.352
2 sigma % Err =	2.357	0.690

(1 sigma err) = 0.168 3.18

(2 sigma err) = 0.329 6.23

LTV (95 %) = 0.277 908.

MDA (3.00) = 0.432 0.666

MDA (2.71) = 0.424 0.662

CRITICAL LEVEL = 0.173 0.317

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	31.942	3	0.067	1.540	0.00
SF	34.615	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.615	3-FEB-03 6:45	GAW 115	SF	10.0 min	0.00
34.686	3-FEB-03 8:27	GAW 115	(80)1074	5 \ 100.0 min	192.99
34.762	3-FEB-03 10:17	GAW 115	(80)1074	6 \ 100.0 min	164.95

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.636	3-FEB-03 7:15	GRB 115	SF	10.0 min	0.00
34.686	3-FEB-03 8:27	GRB 115	(80)1074	5 \ 100.0 min	46.82
34.762	3-FEB-03 10:17	GRB 115	(80)1074	6 \ 100.0 min	38.59

CS
Counted 37.653- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	40.800 mg	40.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight
		ALPHA	BETA
		-----	-----
Instrument =	GAW 115	GRB 115	
Counts =	50.000	80909.000	
Gross cpm =	0.500	809.090	
Background =	0.054	1.510	
Observed CPM =	0.446	807.580	
Cross talk fac =	0.006	0.220	
True CPM =	-4.417	808.553	
Inst Std. Fac. =	1.036	1.017	
Adjusted CPM =	-4.576	822.299	
Eff (cpm/dpm) =	0.157	0.411	
DPM of Aliquot =	-29.219	2001.448	
pCi /smp1 =	-13.2	902.	
1 sigma % Err =	1.685	0.352	
2 sigma % Err =	3.303	0.690	
(1 sigma err) =	0.222	3.17	
(2 sigma err) =	0.435	6.22	
LTV (95 %) =	0.366	907.	
MDA (3.00) =	0.397	0.659	
MDA (2.71) =	0.389	0.656	
CRITICAL LEVEL =	0.156	0.314	

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	36.943	3	0.054	1.510	0.00
SF	37.605	0	1.036	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
36.943	5-FEB-03 14:37	GAW 115	BK	\ 949.8 min	0.00
37.605	6-FEB-03 6:31	GAW 115	SF	\ 10.0 min	0.00
37.648	6-FEB-03 7:33	GAW 115	(80)1074	7 \ 1.0 min	158.43

Previous 3 counts	Time	Detector	ID	Length	Cpm
36.943	5-FEB-03 14:37	GRB 115	BK	\ 949.8 min	0.00
37.618	6-FEB-03 6:49	GRB 115	SF	\ 10.0 min	0.00
37.648	6-FEB-03 7:33	GRB 115	(80)1074	7 \ 1.0 min	36.08

CS
Counted 20.697- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	53.500 mg	53.500 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 112	GRB 112
Counts =	74,000	81327,000
Gross cpm =	0.740	813.270
Background =	0.048	1.516
Observed CPM =	0.692	811.754
Cross talk fac =	0.006	0.227
True CPM =	-4.124	812.689
Inst Std. Fac. =	1.155	1.006
Adjusted CPM =	-4.763	817.565
Eff (cpm/dpm) =	0.141	0.407
DPM of Aliquot =	-33.695	2009.006

pCi /smpl =	-15.2	905.
1 sigma % Err =	2.153	0.351
2 sigma % Err =	4.219	0.685

(1 sigma err) = 0.327 3.18

(2 sigma err) = 0.640 6.23

LTV (95 %) = 0.539 910.

MDA (3.00) = 0.420 0.667

MDA (2.71) = 0.411 0.664

CRITICAL LEVEL = 0.163 0.318

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.048	1.516	0.00
SF	20.633	0	1.155	1.006	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GAW 112	(50)9025 4 \	24.0 min	0.52
17.986	17-JAN-03 15:39	GAW 112	BK \	3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 112	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.836	17-JAN-03 12:03	GRB 112	(50)9025 4 \	24.0 min	5.72
17.986	17-JAN-03 15:39	GRB 112	BK \	3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 112	SF \	10.0 min	0.00

30-JAN-03
15:01:55

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 4 80
CALIBRATION Std.

CS
Counted 30.874- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	53.500 mg	53.500 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 112	GRB 112
Counts =	75.000	82210.000
Gross cpm =	0.750	822.100
Background =	0.053	1.518
Observed CPM =	0.697	820.582
Cross talk fac =	0.006	0.227
True CPM =	-4.171	821.528
Inst Std. Fac. =	1.154	1.007
Adjusted CPM =	-4.813	827.278
Eff (cpm/dpm) =	0.141	0.407
DPM of Aliquot =	-34.052	2032.875

2 Counts done

pCi /smpl =	-15.3	916.
1 sigma % Err =	2.148	0.349
2 sigma % Err =	4.211	0.685

(1 sigma err) = 0.330 3.20

(2 sigma err) = 0.646 6.27

LTV (95 %) = 0.544 921.

MDA (3.00) = 0.437 0.667

MDA (2.71) = 0.428 0.664

CRITICAL LEVEL = 0.171 0.318

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	29.937	3	0.053	1.518	0.00
SF	30.616	0	1.154	1.007	0.00

Previous	3 counts	Time	Detector	ID	Length	Cpm
30.616	30-JAN-03	6:47	GAW 112	SF	10.0 min	0.00
30.678	30-JAN-03	8:16	GAW 112	(50)9035 4	100.0 min	0.99
30.867	30-JAN-03	12:48	GAW 112	(50)9035 4	6.0 min	1.28

Previous	3 counts	Time	Detector	ID	Length	Cpm
30.626	30-JAN-03	7:01	GRB 112	SF	10.0 min	0.00
30.678	30-JAN-03	8:16	GRB 112	(50)9035 4	100.0 min	17.23
30.867	30-JAN-03	12:48	GRB 112	(50)9035 4	6.0 min	14.25

06-FEB-03
13:49:44

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 4 80
CALIBRATION Std.

CS
Counted 35.753- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	53.500 mg	53.500 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 115	GRB 115
Counts =	25.000	79426.000
Gross cpm =	0.250	794.260
Background =	0.051	1.539
Observed CPM =	0.199	792.721
Cross talk fac =	0.006	0.227
True CPM =	-4.504	793.742
Inst Std. Fac. =	1.036	1.018
Adjusted CPM =	-4.666	808.030
Eff (cpm/dpm) =	0.141	0.407
DPM of Aliquot =	-33.014	1985.575

pCi /smp1	=	-14.9	894.
1 sigma % Err	=	1.218	0.355
2 sigma % Err	=	2.387	0.697

(1 sigma err) = 0.181 3.18

(2 sigma err) = 0.355 6.23

LTV (95 %) = 0.299 900.

MDA (3.00) = 0.430 0.672

MDA (2.71) = 0.421 0.669

CRITICAL LEVEL = 0.168 0.320

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	34.947	3	0.051	1.539	0.00
SF	35.623	0	1.036	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
35.623	4-FEB-03 6:57	GAW 115	SF	10.0 min	0.00
35.650	4-FEB-03 7:36	GAW 115	(80)1074 6	1.0 min	155.36
35.655	4-FEB-03 7:43	GAW 115	(80)9036 3	100.0 min	4.76

Previous 3 counts	Time	Detector	ID	Length	Cpm
35.633	4-FEB-03 7:11	GRB 115	SF	10.0 min	0.00
35.650	4-FEB-03 7:36	GRB 115	(80)1074 6	1.0 min	42.21
35.655	4-FEB-03 7:43	GRB 115	(80)9036 3	100.0 min	12.82

CS
Counted 20.778- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	18.400 mg	18.400 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 109	GRB 109
Counts =	14270.000	3257.000
Gross cpm =	142.700	32.570
Background =	0.037	1.019
Observed CPM =	142.663	31.551
Cross talk fac =	0.006	0.209
True CPM =	142.652	1.708
Inst Std. Fac. =	1.163	1.014
Adjusted CPM =	165.905	1.732
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	873.036	4.146

pCi /smpl =	393.	1.87
1 sigma % Err =	0.838	33.930
2 sigma % Err =	1.642	66.503

(1 sigma err) = 3.29 0.634

(2 sigma err) = 6.46 1.24

LTV (95 %) = 399. 2.91

MDA (3.00) = 0.283 0.538

MDA (2.71) = 0.276 0.535

CRITICAL LEVEL = 0.106 0.254

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.037	1.019	0.00
SF	20.633	0	1.163	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 109	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 109	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 109	(80)1074 1	\ 100.0 min	1.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 109	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 109	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 109	(80)1074 1	\ 100.0 min	814.16

CS
Counted 28.807- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smp1	18.400 mg	18.400 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 109	GRB 109
Counts =	14140.000	3417.000
Gross cpm =	141.400	34.170
Background =	0.028	1.053
Observed CPM =	141.372	33.117
Cross talk fac =	0.006	0.209
True CPM =	141.350	3.547
Inst Std. Fac. =	1.164	1.016
Adjusted CPM =	164.532	3.603
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	865.810	8.625

*2 Counts
dne*

(C)

pCi /smp1 =	390.	3.88
1 sigma % Err =	0.841	16.734
2 sigma % Err =	1.649	32.799

(1 sigma err) = 3.28 0.650

(2 sigma err) = 6.43 1.27

LTV (95 %) = 395. 4.96

MDA (3.00) = 0.256 0.547

MDA (2.71) = 0.249 0.544

CRITICAL LEVEL = 9.242E-02 0.258

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.028	1.053	0.00
SF	28.606	0	1.164	1.016	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GAW 109	(80) 903	16 \ 10.0 min	1.35
27.957	27-JAN-03 14:58	GAW 109	BK	\ 927.5 min	0.00
28.606	28-JAN-03 6:32	GAW 109	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GRB 109	(80) 903	16 \ 10.0 min	4.32
27.957	27-JAN-03 14:58	GRB 109	BK	\ 927.5 min	0.00
28.616	28-JAN-03 6:47	GRB 109	SF	\ 10.0 min	0.00

CS

Reviewed _____ Date _____

Counted 31.764- 3 on D3 for 100.00 min.

1.00	smpl	18.400 mg	18.400 mg
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	18754.000	4458.000
Gross cpm =	187.540	44.580
Background =	0.049	1.516
Observed CPM =	187.491	43.064
Cross talk fac =	0.006	0.209
True CPM =	187.467	3.846
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	194.029	3.915
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	1021.031	9.371

1st count

pCi /smpl =	460.	4.22
1 sigma % Err =	0.731	17.654
2 sigma % Err =	1.432	34.601

(1 sigma err) = 3.36 0.745

(2 sigma err) = 6.59 1.46

LTV (95 %) = 465. 5.45

MDA (3.00) = 0.315 0.650

MDA (2.71) = 0.308 0.647

CRITICAL LEVEL = 0.122 0.309

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	30.966	3	0.049	1.516	0.00
SF	31.614	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.861	30-JAN-03 12:39	GAW 115	(80)1075	5 \ 100.0 min	191.94
30.966	30-JAN-03 15:11	GAW 115	BK	\ 929.7 min	0.00
31.614	31-JAN-03 6:44	GAW 115	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
30.861	30-JAN-03 12:39	GRB 115	(80)1075	5 \ 100.0 min	46.51
30.966	30-JAN-03 15:11	GRB 115	BK	\ 929.7 min	0.00
31.625	31-JAN-03 7:00	GRB 115	SF	\ 10.0 min	0.00

03-FEB-03
10:26:11

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 5 80
CALIBRATION Std.

CS
Counted 34.686- 3 on D3 for 100.00 min

Reviewed _____ Date _____

1.00	smpl	18.400 mg	18.400 mg
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	18646.000	4753.000
Gross cpm =	186.460	47.530
Background =	0.067	1.540
Observed CPM =	186.393	45.990
Cross talk fac =	0.006	0.209
True CPM =	186.350	7.006
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	192.872	7.132
Eff (cpm/dpm) =	0.190	0.418
DPM of Aliquot =	1014.943	17.070

2nd Count Done

pCi /smpl =	457.	7.69
1 sigma % Err =	0.733	9.999
2 sigma % Err =	1.436	19.598
(1 sigma err) =	3.35	0.769
(2 sigma err) =	6.57	1.51
LTV (95 %) =	463.	8.96
MDA (3.00) =	0.356	0.654
MDA (2.71) =	0.350	0.651
CRITICAL LEVEL =	0.143	0.312

GC Summary

GC	GMT	YR	ALPHA	BETA	TIME
BKG	31.942	3	0.067	1.540	0.00
SF	34.615	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.861	31-JAN-03 12:39	GAW 115	(80)1074	1 \ 100.0 min	0.25
31.942	31-JAN-03 14:36	GAW 115	BK	\ 3838.3 min	0.00
34.615	3-FEB-03 6:45	GAW 115	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.861	31-JAN-03 12:39	GRB 115	(80)1074	1 \ 100.0 min	819.14
31.942	31-JAN-03 14:36	GRB 115	BK	\ 3838.3 min	0.00
34.636	3-FEB-03 7:15	GRB 115	SF	\ 10.0 min	0.00

CS
Counted 20.778- 3 on C2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
Aliquot		Sample Weight	Counted Weight
		ALPHA	BETA
Instrument =	GAW 110	GRB 110	
Counts =	11696.000	2793.000	
Gross cpm =	116.960	27.930	
Background =	0.055	1.637	
Observed CPM =	116.905	26.293	
Cross talk fac =	0.006	0.215	
True CPM =	116.898	1.172	
Inst Std. Fac. =	1.176	1.014	
Adjusted CPM =	137.472	1.188	
Eff (cpm/dpm) =	0.172	0.414	
DPM of Aliquot =	800.120	2.868	
pCi /smpl =	360.	1.29	
1 sigma % Err =	0.925	46.409	
2 sigma % Err =	1.814	90.962	
(1 sigma err) =	3.34	0.600	
(2 sigma err) =	6.54	1.18	
LTV (95 %) =	366.	2.28	
MDA (3.00) =	0.365	0.680	
MDA (2.71) =	0.357	0.676	
CRITICAL LEVEL =	0.143	0.324	

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.055	1.637	0.00
SF	20.633	0	1.176	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 110	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 110	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 110	(80)1074 2	\ 100.0 min	2.49

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 110	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 110	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 110	(80)1074 2	\ 100.0 min	823.70

CS
Counted 28.807- 3 on C2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 110	GRB 110
Counts =	11671.000	2868.000
Gross cpm =	116.710	28.680
Background =	0.055	1.660
Observed CPM =	116.655	27.020
Cross talk fac =	0.006	0.215
True CPM =	116.643	1.953
Inst Std. Fac. =	1.177	1.014
Adjusted CPM =	137.289	1.981
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	799.056	4.781

2 counts done

C

pCi /smpl =	360.	2.15
1 sigma % Err =	0.926	28.198
2 sigma % Err =	1.816	55.268

(1 sigma err) = 3.33 0.607

(2 sigma err) = 6.54 1.19

LTV (95 %) = 365. 3.16

MDA (3.00) = 0.365 0.684

MDA (2.71) = 0.357 0.681

CRITICAL LEVEL = 0.143 0.326

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.055	1.660	0.00
SF	28.606	0	1.177	1.014	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GAW 110	(80) 903 17 \	10.0 min	0.35
27.957	27-JAN-03 14:58	GAW 110	BK \	927.5 min	0.00
28.606	28-JAN-03 6:32	GAW 110	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GRB 110	(80) 903 17 \	10.0 min	0.35
27.957	27-JAN-03 14:58	GRB 110	BK \	927.5 min	0.00
28.616	28-JAN-03 6:47	GRB 110	SF \	10.0 min	0.00

CS
Counted 34.762- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	15938.000	3945.000
Gross cpm =	159.380	39.450
Background =	0.067	1.540
Observed CPM =	159.313	37.910
Cross talk fac =	0.006	0.215
True CPM =	159.291	3.678
Inst Std. Fac. =	1.035	1.018
Adjusted CPM =	164.866	3.745
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	959.560	9.039

pCi /smpl =	432.	4.07
1 sigma % Err =	0.793	17.405
2 sigma % Err =	1.554	34.114

(1 sigma err) = 3.43 0.709

(2 sigma err) = 6.72 1.39

LTV (95 %) = 438. 5.24

MDA (3.00) = 0.394 0.660

MDA (2.71) = 0.387 0.657

CRITICAL LEVEL = 0.158 0.314

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	31.942	3	0.067	1.540	0.00
SF	34.615	0	1.035	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.942	31-JAN-03 14:36	GAW 115	BK	\ 3838.3 min	0.00
34.615	3-FEB-03 6:45	GAW 115	SF	\ 10.0 min	0.00
34.686	3-FEB-03 8:27	GAW 115	(80)1074	5 \ 100.0 min	192.99

Previous 3 counts	Time	Detector	ID	Length	Cpm
31.942	31-JAN-03 14:36	GRB 115	BK	\ 3838.3 min	0.00
34.636	3-FEB-03 7:15	GRB 115	SF	\ 10.0 min	0.00
34.686	3-FEB-03 8:27	GRB 115	(80)1074	5 \ 100.0 min	46.82

04-FEB-03
08:15:15

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 6 80
CALIBRATION Std.

CS
Counted 35.650- 3 on D3 for 1.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 115	GRB 115
Counts =	150.000	43.000
Gross cpm =	150.000	43.000
Background =	0.051	1.539
Observed CPM =	149.949	41.461
Cross talk fac =	0.006	0.215
True CPM =	149.893	9.249
Inst Std. Fac. =	1.036	1.018
Adjusted CPM =	155.289	9.416
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	903.819	22.728

2nd Count
Done
D

pCi /smpl =	407.	10.2
1 sigma % Err =	8.172	72.156
2 sigma % Err =	16.018	141.426

(1 sigma err) = 33.3 7.39

(2 sigma err) = 65.2 14.5

LTV (95 %) = 462. 22.4

MDA (3.00) = 10.6 9.53

MDA (2.71) = 9.86 9.22

CRITICAL LEVEL = 1.38 3.14

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	34.947	3	0.051	1.539	0.00
SF	35.623	0	1.036	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.867	3-FEB-03 12:48	GAW 115	(80)1074	3 \ 100.0 min	0.19
34.947	3-FEB-03 14:43	GAW 115	BK	\ 953.9 min	0.00
35.623	4-FEB-03 6:57	GAW 115	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
34.867	3-FEB-03 12:48	GRB 115	(80)1074	3 \ 100.0 min	822.35
34.947	3-FEB-03 14:43	GRB 115	BK	\ 953.9 min	0.00
35.633	4-FEB-03 7:11	GRB 115	SF	\ 10.0 min	0.00

CS
Counted 44.652- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	29.800 mg	29.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 114	GRB 114
Counts =	15189.000	3663.000
Gross cpm =	151.890	36.630
Background =	0.052	2.440
Observed CPM =	151.838	34.190
Cross talk fac =	0.006	0.215
True CPM =	151.828	1.562
Inst Std. Fac. =	1.043	1.012
Adjusted CPM =	158.357	1.581
Eff (cpm/dpm) =	0.172	0.414
DPM of Aliquot =	921.678	3.816

pCi /smpl =	415.	1.72
1 sigma % Err =	0.812	40.015
2 sigma % Err =	1.591	78.430

(1 sigma err) = 3.37 0.688

(2 sigma err) = 6.61 1.35

LTV (95 %) = 421. 2.85

MDA (3.00) = 0.357 0.822

MDA (2.71) = 0.349 0.819

CRITICAL LEVEL = 0.139 0.396

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.052	2.440	0.00
SF	44.610	0	1.043	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
43.622	12-FEB-03 6:55	GAW 114	SF	10.0 min	0.00
43.940	12-FEB-03 14:33	GAW 114	BK	962.3 min	0.00
44.611	13-FEB-03 6:39	GAW 114	SF	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
43.640	12-FEB-03 7:21	GRB 114	SF	10.0 min	0.00
43.940	12-FEB-03 14:33	GRB 114	BK	962.3 min	0.00
44.620	13-FEB-03 6:52	GRB 114	SF	10.0 min	0.00

20-JAN-03
12:57:07

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 7 80
CALIBRATION Std.

CS
Counted 20.778- 3 on C3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 111	GRB 111
Counts =	10795.000	2813.000
Gross cpm =	107.950	28.130
Background =	0.030	1.167
Observed CPM =	107.920	26.963
Cross talk fac =	0.006	0.224
True CPM =	107.904	2.755
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	122.578	2.763
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	834.935	6.766

pCi /smpl =	376.	3.05
1 sigma % Err =	0.963	19.648
2 sigma % Err =	1.888	38.510

(1 sigma err) = 3.62 0.599

(2 sigma err) = 7.10 1.17

LTV (95 %) = 382. 4.04

MDA (3.00) = 0.339 0.587

MDA (2.71) = 0.330 0.584

CRITICAL LEVEL = 0.124 0.278

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.030	1.167	0.00
SF	20.633	0	1.136	1.003	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 111	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 111	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 111	(80)1074	3 \ 100.0 min	0.82

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 111	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 111	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 111	(80)1074	3 \ 100.0 min	815.46

CS
Counted 28.807- 3 on C3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 111	GRB 111
Counts =	10613.000	2795.000
Gross cpm =	106.130	27.950
Background =	0.029	1.189
Observed CPM =	106.101	26.761
Cross talk fac =	0.006	0.224
True CPM =	106.083	2.961
Inst Std. Fac. =	1.136	1.003
Adjusted CPM =	120.511	2.970
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	820.850	7.272

2 Counts Done

(C)

pCi /smpl =	370.	3.28
1 sigma % Err =	0.971	18.229
2 sigma % Err =	1.904	35.729

(1 sigma err) = 3.59 0.597

(2 sigma err) = 7.04 1.17

LTV (95 %) = 376. 4.26

MDA (3.00) = 0.335 0.592

MDA (2.71) = 0.326 0.589

CRITICAL LEVEL = 0.122 0.260

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.029	1.189	0.00
SF	28.606	0	1.136	1.003	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GAW 111	(80) 903 18 \	10.0 min	0.42
27.957	27-JAN-03 14:58	GAW 111	BK \	927.5 min	0.00
28.606	28-JAN-03 6:32	GAW 111	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GRB 111	(80) 903 18 \	10.0 min	0.42
27.957	27-JAN-03 14:58	GRB 111	BK \	927.5 min	0.00
28.616	28-JAN-03 6:47	GRB 111	SF \	10.0 min	0.00

13-FEB-03
10:20:13

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- 7 80
CALIBRATION Std.

CS
Counted 44.652- 3 on D3 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 115	GRB 115
Counts =	13939.000	3784.000
Gross cpm =	139.390	37.840
Background =	0.067	1.500
Observed CPM =	139.323	36.340
Cross talk fac =	0.006	0.224
True CPM =	139.293	5.090
Inst Std. Fac. =	1.039	1.017
Adjusted CPM =	144.725	5.176
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	985.785	12.674

pCi /smpl =	444.	5.71
1 sigma % Err =	0.848	12.323
2 sigma % Err =	1.662	24.154

(1 sigma err) = 3.76 0.704

(2 sigma err) = 7.38 1.38

LTV (95 %) = 450. 6.87

MDA (3.00) = 0.461 0.661

MDA (2.71) = 0.452 0.658

CRITICAL LEVEL = 0.185 0.315

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.067	1.500	0.00
SF	44.610	0	1.039	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
43.759	12-FEB-03 10:12	GAW 115	(93)8034 1 \	100.0 min	1.43
43.940	12-FEB-03 14:33	GAW 115	BK \	962.3 min	0.00
44.611	13-FEB-03 6:39	GAW 115	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
43.759	12-FEB-03 10:12	GRB 115	(93)8034 1 \	100.0 min	2.99
43.940	12-FEB-03 14:33	GRB 115	BK \	962.3 min	0.00
44.620	13-FEB-03 6:52	GRB 115	SF \	10.0 min	0.00

CS
Counted 20.778- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	52.800 mg	52.800 mg
-----		-----	-----
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 112	GRB 112
Counts =	8836.000	2500.000
Gross cpm =	88.360	25.000
Background =	0.048	1.516
Observed CPM =	88.312	23.484
Cross talk fac =	0.006	0.226
True CPM =	88.291	3.495
Inst Std. Fac. =	1.155	1.006
Adjusted CPM =	101.976	3.516
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	717.537	8.635

pCi /smpl =	323.	3.89
1 sigma % Err =	1.065	14.734
2 sigma % Err =	2.087	28.879

(1 sigma err) =	3.44	0.573
(2 sigma err) =	6.75	1.12
LTV (95 %) =	329.	4.84
MDA (3.00) =	0.418	0.667
MDA (2.71) =	0.409	0.663
CRITICAL LEVEL =	0.162	0.317

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	17.986	3	0.048	1.516	0.00
SF	20.633	0	1.155	1.006	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GAW 112	BK	\ 3774.4 min	0.00
20.633	20-JAN-03 7:11	GAW 112	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GAW 112	(80)1074 4	\ 100.0 min	0.80

Previous 3 counts	Time	Detector	ID	Length	Cpm
17.986	17-JAN-03 15:39	GRB 112	BK	\ 3774.4 min	0.00
20.648	20-JAN-03 7:33	GRB 112	SF	\ 10.0 min	0.00
20.697	20-JAN-03 8:43	GRB 112	(80)1074 4	\ 100.0 min	816.62

CS
Counted 28.807- 3 on C4 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	52.800 mg	52.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 112	GRB 112
Counts =	8662.000	2562.000
Gross cpm =	86.620	25.620
Background =	0.037	1.525
Observed CPM =	86.583	24.095
Cross talk fac =	0.006	0.226
True CPM =	86.556	4.499
Inst Std. Fac. =	1.156	1.007
Adjusted CPM =	100.059	4.530
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	704.047	11.126

2 Counts Done
C

pCi /smpl =	317.	5.01
1 sigma % Err =	1.075	11.581
2 sigma % Err =	2.108	22.700

(1 sigma err) = 3.41 0.580

(2 sigma err) = 6.69 1.14

LTV (95 %) = 323. 5.97

MDA (3.00) = 0.379 0.668

MDA (2.71) = 0.369 0.665

CRITICAL LEVEL = 0.142 0.318

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	27.957	3	0.037	1.525	0.00
SF	28.606	0	1.156	1.007	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GAW 112	(80) 903 19 \	10.0 min	0.41
27.957	27-JAN-03 14:58	GAW 112	BK \	927.5 min	0.00
28.606	28-JAN-03 6:32	GAW 112	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
27.798	27-JAN-03 11:09	GRB 112	(80) 903 19 \	10.0 min	2.59
27.957	27-JAN-03 14:58	GRB 112	BK \	927.5 min	0.00
28.616	28-JAN-03 6:47	GRB 112	SF \	10.0 min	0.00

Reviewed _____ Date _____

Counted 37.920- 3 on D3 for 100.00 min.

1.00	smpl	52.800 mg	52.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 115	GRB 115
Counts =	11999.000	3189.000
Gross cpm =	119.990	31.890
Background =	0.054	1.510
Observed CPM =	119.936	30.380
Cross talk fac =	0.006	0.226
True CPM =	119.917	3.231
Inst Std. Fac. =	1.036	1.017
Adjusted CPM =	124.234	3.286
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	874.147	8.070

pCi /smpl =	394.	3.64
1 sigma % Err =	0.914	17.888
2 sigma % Err =	1.791	35.060

(1 sigma err) = 3.60 0.650

(2 sigma err) = 7.05 1.27

LTV (95 %) = 400. 4.71

MDA (3.00) = 0.438 0.665

MDA (2.71) = 0.428 0.662

CRITICAL LEVEL = 0.172 0.317

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	36.943	3	0.054	1.510	0.00
SF	37.605	0	1.036	1.017	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
37.648	6-FEB-03 7:33	GAW 115	(80)1074 7 \	1.0 min	158.43
37.654	6-FEB-03 7:41	GAW 115	(80)1074 3 \	100.0 min	0.46
37.849	6-FEB-03 12:22	GAW 115	(80)1074 4 \	100.0 min	0.32

Previous 3 counts	Time	Detector	ID	Length	Cpm
37.648	6-FEB-03 7:33	GRB 115	(80)1074 7 \	1.0 min	36.08
37.654	6-FEB-03 7:41	GRB 115	(80)1074 3 \	100.0 min	821.08
37.849	6-FEB-03 12:22	GRB 115	(80)1074 4 \	100.0 min	815.94

CS
Counted 38.748- 3 on D3 for 2.29 min. Reviewed _____ Date _____

1.00 smpl 52.800 mg 52.800 mg

Aliquot Sample Weight Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	269.000	83.000
Gross cpm =	117.467	36.245
Background =	0.071	1.512
Observed CPM =	117.396	34.733
Cross talk fac =	0.006	0.226
True CPM =	117.348	8.165
Inst Std. Fac. =	1.037	1.018
Adjusted CPM =	121.690	8.312
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	856.246	20.414

2nd Count Done

D

pCi /smpl =	386.	9.20
1 sigma % Err =	6.105	49.730
2 sigma % Err =	11.966	97.472

(1 sigma err) = 23.5 4.57

(2 sigma err) = 46.2 8.96

LTV (95 %) = 425. 16.7

MDA (3.00) = 6.75 5.63

MDA (2.71) = 6.35 5.49

CRITICAL LEVEL = 1.30 2.09

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	38.133	3	0.071	1.512	0.00
SF	38.724	0	1.037	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
38.134	6-FEB-03 19:12	GAW 115	BK	685.8 min	0.00
38.612	7-FEB-03 6:41	GAW 115	SF	10.0 min	0.00
38.724	7-FEB-03 9:22	GAW 115	SF	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
38.624	7-FEB-03 6:58	GRB 115	SF	10.0 min	0.00
38.654	7-FEB-03 7:41	GRB 115	SF	10.0 min	0.00
38.688	7-FEB-03 8:30	GRB 115	SF	10.0 min	0.00

CS
Counted 44.756- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	52.800 mg	52.800 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 114	GRB 114
Counts =	11254.000	2895.000
Gross cpm =	112.540	28.950
Background =	0.052	2.440
Observed CPM =	112.488	26.510
Cross talk fac =	0.006	0.226
True CPM =	112.482	1.044
Inst Std. Fac. =	1.043	1.012
Adjusted CPM =	117.319	1.057
Eff (cpm/dpm) =	0.142	0.407
DPM of Aliquot =	825.489	2.595

pCi /smpl =	372.	1.17
1 sigma % Err =	0.943	53.659
2 sigma % Err =	1.849	105.172

(1 sigma err) = 3.51 0.627

(2 sigma err) = 6.88 1.23

LTV (95 %) = 378. 2.20

MDA (3.00) = 0.431 0.837

MDA (2.71) = 0.422 0.834

CRITICAL LEVEL = 0.168 0.403

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.052	2.440	0.00
SF	44.610	0	1.043	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
44.611	13-FEB-03 6:39	GAW 114	SF	10.0 min	0.00
44.652	13-FEB-03 7:38	GAW 114	(93)1074	6 \ 100.0 min	158.39
44.652	13-FEB-03 7:38	GAW 114	(80)1074	6 \ 100.0 min	158.39

Previous 3 counts	Time	Detector	ID	Length	Cpm
44.620	13-FEB-03 6:52	GRB 114	SF	10.0 min	0.00
44.652	13-FEB-03 7:38	GRB 114	(93)1074	6 \ 100.0 min	34.61
44.652	13-FEB-03 7:38	GRB 114	(80)1074	6 \ 100.0 min	34.61

19-FEB-03
12:25:20

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- BR1 80
CALIBRATION Std.

CS
Counted 50.656- 3 on B1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	49.900 mg	49.900 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 105	GRB 105
Counts =	9377.000	2649.000
Gross cpm =	93.770	26.490
Background =	0.021	1.529
Observed CPM =	93.749	24.961
Cross talk fac =	0.006	0.225
True CPM =	93.726	3.877
Inst Std. Fac. =	1.147	1.024
Adjusted CPM =	107.504	3.970
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	739.751	9.731

pCi /smpl =	333.	4.38
1 sigma % Err =	1.033	13.652
2 sigma % Err =	2.025	26.758

(1 sigma err) =	3.44	0.598
(2 sigma err) =	6.75	1.17
LTV (95 %) =	339.	5.37
MDA (3.00) =	0.302	0.668
MDA (2.71) =	0.293	0.665
CRITICAL LEVEL =	0.105	0.318

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	49.916	3	0.021	1.529	0.00
SF	50.610	0	1.147	1.024	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.918	14-FEB-03 14:01	GAW 105	BK	\ 5342.8 min	0.00
49.916	18-FEB-03 13:59	GAW 105	BK	\ 995.9 min	0.00
50.610	19-FEB-03 6:38	GAW 105	SF	\ 10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.918	14-FEB-03 14:01	GRB 105	BK	\ 5342.8 min	0.00
49.916	18-FEB-03 13:59	GRB 105	BK	\ 995.9 min	0.00
50.626	19-FEB-03 7:01	GRB 105	SF	\ 10.0 min	0.00

19-FEB-03
12:25:19

TMA Corporation
Gross Alpha, Gross Beta Analysis
ABCALC V 1.04

1074- BR1 80
CALIBRATION Std.

CS
Counted 45.792- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	49.900 mg	49.900 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 114	GRB 114
Counts =	12507.000	3357.000
Gross cpm =	125.070	33.570
Background =	0.052	2.440
Observed CPM =	125.018	31.130
Cross talk fac =	0.006	0.225
True CPM =	125.000	3.011
Inst Std. Fac. =	1.044	1.012
Adjusted CPM =	130.500	3.047
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	897.994	7.468

pCi /smpl =	405.	3.36
1 sigma % Err =	0.895	19.928
2 sigma % Err =	1.754	39.059

(1 sigma err) = 3.62 0.670

(2 sigma err) = 7.09 1.31

LTV (95 %) = 410. 4.47

MDA (3.00) = 0.422 0.835

MDA (2.71) = 0.413 0.832

CRITICAL LEVEL = 0.165 0.402

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	43.940	3	0.052	2.440	0.00
SF	45.607	0	1.044	1.012	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.654	14-FEB-03 7:41	GAW 114	(93) 7437 5 \	100.0 min	8.50
45.751	14-FEB-03 10:01	GAW 114	(80) 903 44 \	10.0 min	0.36
45.783	14-FEB-03 10:47	GAW 114	(80) 903 53 \	10.0 min	0.15

Previous 3 counts	Time	Detector	ID	Length	Cpm
45.654	14-FEB-03 7:41	GRB 114	(93) 7437 5 \	100.0 min	21.47
45.751	14-FEB-03 10:01	GRB 114	(80) 903 44 \	10.0 min	0.36
45.783	14-FEB-03 10:47	GRB 114	(80) 903 53 \	10.0 min	0.97

CS
Counted 52.655- 3 on C1 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	49.900 mg	49.900 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA
	-----	-----
Instrument =	GAW 109	GRB 109
Counts =	9219.000	2631.000
Gross cpm =	92.190	26.310
Background =	0.058	1.032
Observed CPM =	92.132	25.278
Cross talk fac =	0.006	0.225
True CPM =	92.105	4.559
Inst Std. Fac. =	1.168	1.018
Adjusted CPM =	107.578	4.641
Eff (cpm/dpm) =	0.145	0.408
DPM of Aliquot =	740.267	11.374

pCi /smpl =	333.	5.12
1 sigma % Err =	1.043	11.470
2 sigma % Err =	2.044	22.480

(1 sigma err) =	3.48	0.588
(2 sigma err) =	6.82	1.15
LTV (95 %) =	339.	6.09
MDA (3.00) =	0.440	0.555
MDA (2.71) =	0.431	0.551
CRITICAL LEVEL =	0.174	0.261

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	52.114	3	0.058	1.032	0.00
SF	52.615	0	1.168	1.018	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
51.900	20-FEB-03 13:36	GAW 109	(93)2001 1 \	300.0 min	0.08
52.114	20-FEB-03 18:44	GAW 109	BK \	718.4 min	0.00
52.615	21-FEB-03 6:45	GAW 109	SF \	10.0 min	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
51.900	20-FEB-03 13:36	GRB 109	(93)2001 1 \	300.0 min	0.28
52.114	20-FEB-03 18:44	GRB 109	BK \	718.4 min	0.00
52.626	21-FEB-03 7:01	GRB 109	SF \	10.0 min	0.00

CS
Counted 50.728- 3 on D2 for 100.00 min.

Reviewed _____ Date _____

1.00	smpl	48.700 mg	48.700 mg
-----		-----	
Aliquot		Sample Weight	Counted Weight

	ALPHA	BETA

Instrument =	GAW 114	GRB 114
Counts =	13006.000	3332.000
Gross cpm =	130.060	33.320
Background =	0.055	2.486
Observed CPM =	130.005	30.834
Cross talk fac =	0.006	0.224
True CPM =	129.995	1.670
Inst Std. Fac. =	1.045	1.010
Adjusted CPM =	135.845	1.686
Eff (cpm/dpm) =	0.147	0.408
DPM of Aliquot =	925.298	4.129

pCi /smpl =	417.	1.86
1 sigma % Err =	0.877	35.840
2 sigma % Err =	1.720	70.246

(1 sigma err) = 3.66 0.667

(2 sigma err) = 7.17 1.31

LTV (95 %) = 423. 2.96

MDA (3.00) = 0.427 0.842

MDA (2.71) = 0.418 0.839

CRITICAL LEVEL = 0.168 0.405

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	49.916	3	0.055	2.486	0.00
SF	50.610	0	1.045	1.010	0.00

Previous 3 counts	Time	Detector	ID	Length	Cpm
49.916	18-FEB-03 13:59	GAW 114	BK	995.9 min	0.00
50.610	19-FEB-03 6:38	GAW 114	SF	10.0 min	0.00
50.656	19-FEB-03 7:44	GAW 114	(80)1074 6	100.0 min	157.90

Previous 3 counts	Time	Detector	ID	Length	Cpm
49.916	18-FEB-03 13:59	GRB 114	BK	995.9 min	0.00
50.622	19-FEB-03 6:55	GRB 114	SF	10.0 min	0.00
50.656	19-FEB-03 7:44	GRB 114	(80)1074 6	100.0 min	33.36

Gamma Spectrometer Efficiency Calculation

G5.XLS

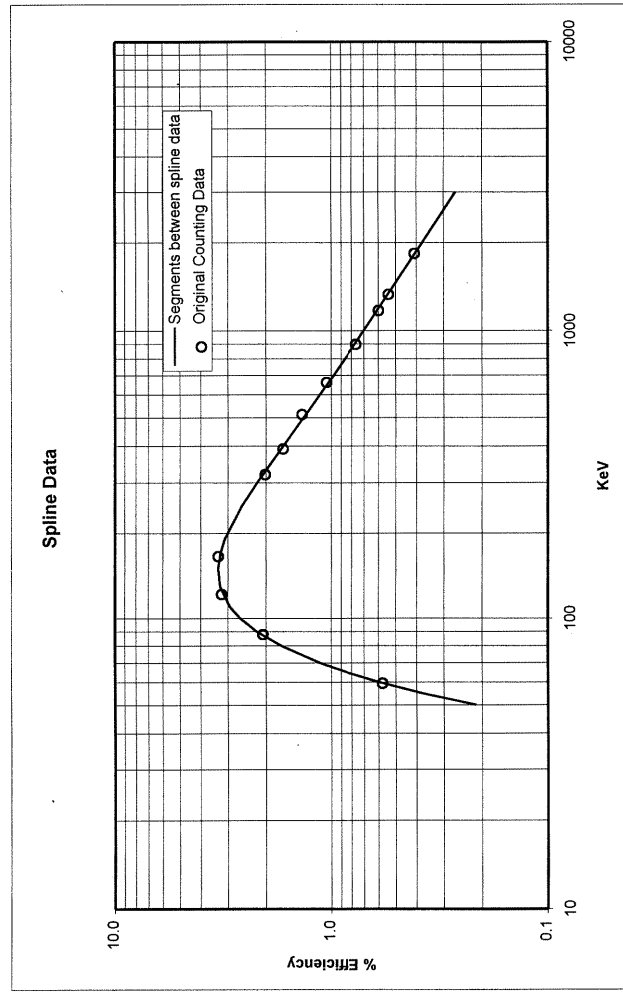
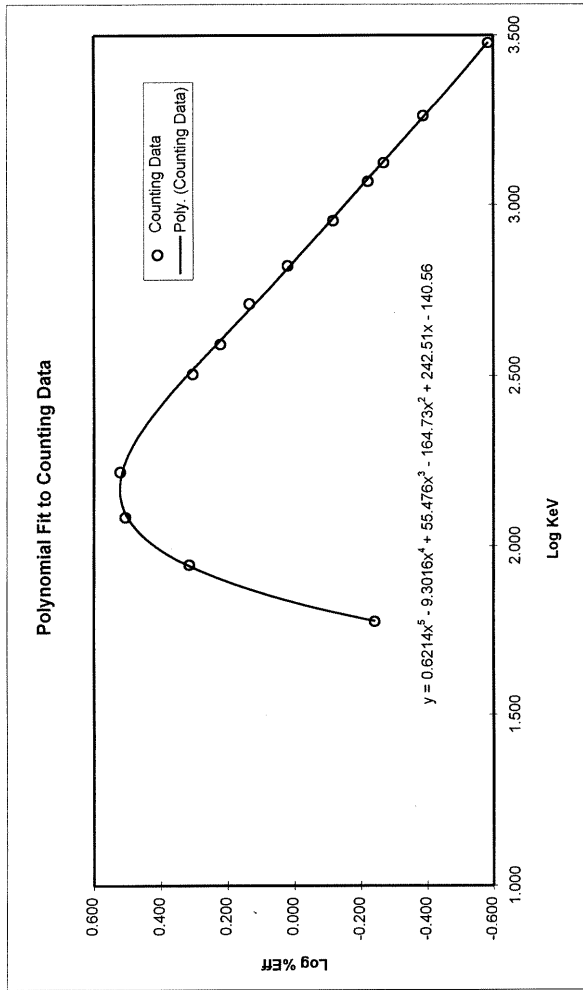
Detector Geometry	G5 500 mL Marinelli beaker
Std I.D.	MB Shelf 0
Filename	1057-4 [25.4] G-FLI05MB0.EFF

Line KeV	%Eff 1st Cnt	%Eff 2nd Cnt	Avg %Eff	%SD	LogKeV	Log%Eff	%Dev from Spline
59.5	0.59700	0.55650	0.57375	4	1.775	-0.241	0
88	1.97600	2.15200	2.06400	6	1.944	0.315	-2
122	3.2060	3.2010	3.20350	0	2.086	0.506	1
166	3.3380	3.32050	3.32950	1	2.220	0.521	2
320	2.04000	1.98400	2.01200	2	2.505	0.304	-3
392	1.67800	1.65000	1.66400	1	2.593	0.221	-2
514	1.37700	1.35400	1.36250	1	2.711	0.134	5
662	1.05600	1.03800	1.04700	1	2.821	0.020	2
898	0.76390	0.76780	0.76285	0	2.953	-0.118	-1
1173	0.59940	0.59930	0.59935	0	3.069	-0.222	-1
1332	0.54370	0.53270	0.53790	1	3.125	-0.269	0
1836	0.41400	0.40420	0.40910	2	3.264	-0.388	1
3000	(artificial data)	0.26000	0.26000		3.477	-0.585	-1
							0

(shaded cells are manual entry, all others are calculated)

Generation of Spline Points from Polynomial Equation

Spline Values keV	%Eff	LogkeV	Log%Eff	%Eff		Ratio New/Old
				Prev	Calib	
50	0.21376	1.699	-0.670			
55	0.38172	1.740	-0.418			
60	0.59913	1.778	-0.222			#DIV/0!
65	0.85410	1.813	-0.068			
70	1.13176	1.845	0.054			
80	1.69823	1.903	0.230			
90	2.20993	1.954	0.344			
100	2.62301	2.000	0.419			#DIV/0!
110	2.92779	2.041	0.467			
130	3.25632	2.114	0.513			
150	3.32367	2.176	0.522			
170	3.24605	2.230	0.511			
190	3.09843	2.279	0.491			
250	2.57081	2.398	0.410			
300	2.19270	2.477	0.341			#DIV/0!
500	1.33824	2.699	0.127			
700	0.97023	2.845	-0.013			
1000	0.69944	3.000	-0.155			#DIV/0!
1400	0.51685	3.146	-0.287			
2000	0.37498	3.301	-0.426			
3000	0.26327	3.477	-0.580			



Polynomial Coefficients
 x5 = 0.62145
 x4 = -9.3016
 x3 = 55.476
 x2 = -164.73
 x1 = 242.51
 x0 = -140.55

Det ... GELI 5
 Geo ... MB - Marinelli beaker
 Shlf ... 0
 Ref ... 1057 - 4

Date ... 01-SEP-99 Page 1
 Version ... 1.01
 File ... ND:[25,4]GELI05MBO.EFF

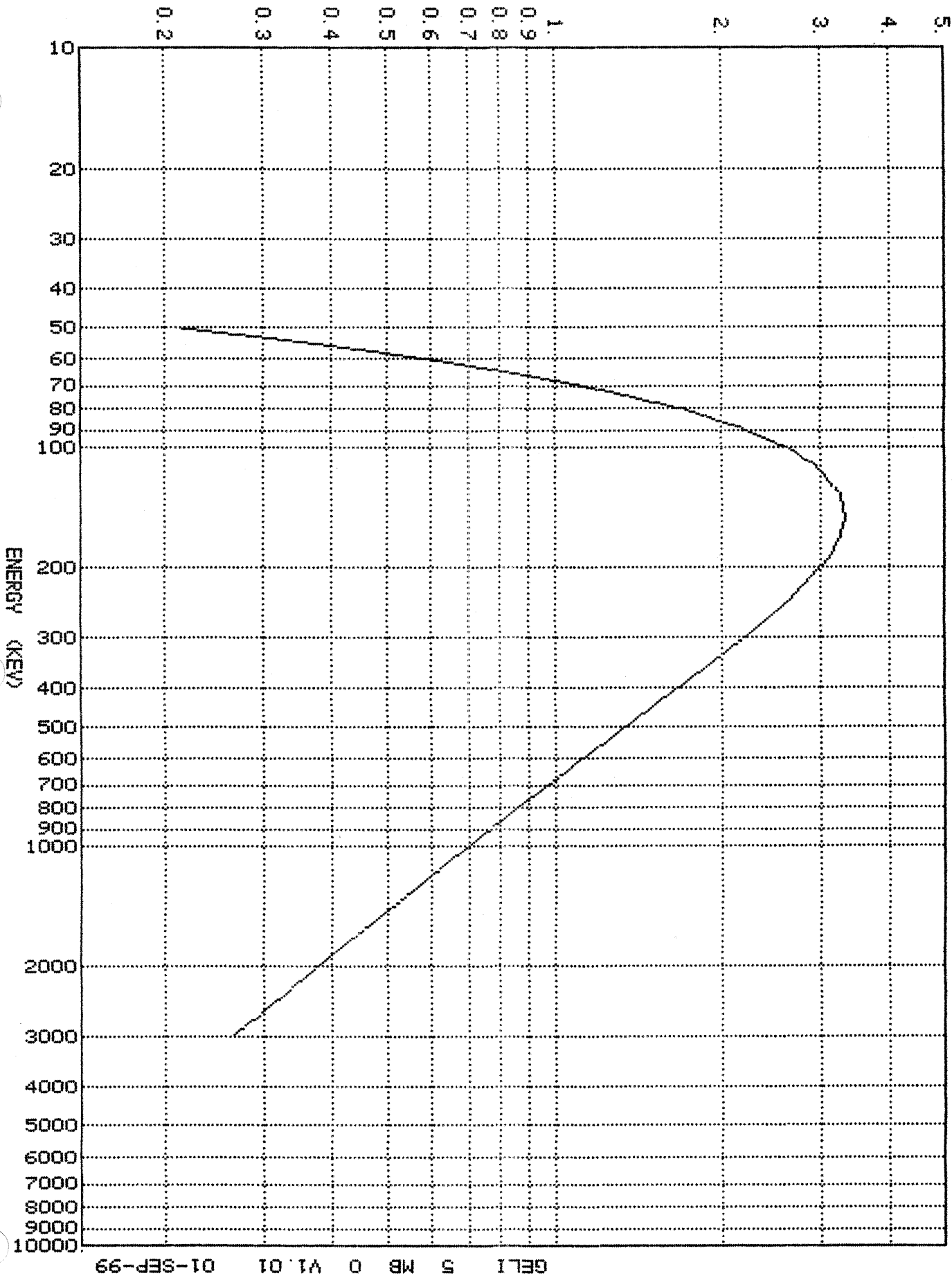
KEV	EFF.	KEV	EFF.	KEV	EFF.	KEV	EFF.	KEV	EFF.
50	0.21376	108	2.86648	216	2.83958	324	2.03550	432	1.54135
51	0.24113	110	2.92779	218	2.82183	326	2.02343	434	1.53448
52	0.27136	112	2.96157	220	2.80436	328	2.01150	436	1.52768
53	0.30470	114	2.99513	222	2.78715	330	1.99971	438	1.52094
54	0.34140	116	3.02847	224	2.77020	332	1.98807	440	1.51425
55	0.38172	118	3.06161	226	2.75350	334	1.97656	442	1.50763
56	0.41907	120	3.09455	228	2.73705	336	1.96519	444	1.50106
57	0.45931	122	3.12728	230	2.72083	338	1.95395	446	1.49456
58	0.50262	124	3.15982	232	2.70486	340	1.94283	448	1.48811
59	0.54917	126	3.19217	234	2.68911	342	1.93185	450	1.48171
60	0.59913	128	3.22434	236	2.67359	344	1.92099	452	1.47538
61	0.64464	130	3.25632	238	2.65828	346	1.91026	454	1.46909
62	0.69279	132	3.26365	240	2.64320	348	1.89964	456	1.46286
63	0.74368	134	3.27088	242	2.62832	350	1.88915	458	1.45669
64	0.79741	136	3.27802	244	2.61364	352	1.87877	460	1.45057
65	0.85410	138	3.28507	246	2.59917	354	1.86851	462	1.44450
66	0.90509	140	3.29203	248	2.58490	356	1.85837	464	1.43848
67	0.95830	142	3.29891	250	2.57081	358	1.84833	466	1.43251
68	1.01377	144	3.30571	252	2.55300	360	1.83840	468	1.42659
69	1.07157	146	3.31243	254	2.53545	362	1.82858	470	1.42072
70	1.13176	148	3.31907	256	2.51816	364	1.81887	472	1.41490
71	1.18162	150	3.32563	258	2.50112	366	1.80926	474	1.40913
72	1.23292	152	3.31712	260	2.48432	368	1.79976	476	1.40341
73	1.28571	154	3.30874	262	2.46776	370	1.79035	478	1.39773
74	1.33998	156	3.30049	264	2.45144	372	1.78105	480	1.39210
75	1.39577	158	3.29236	266	2.43535	374	1.77184	482	1.38652
76	1.45310	160	3.28436	268	2.41949	376	1.76273	484	1.38098
77	1.51199	162	3.27647	270	2.40384	378	1.75371	486	1.37549
78	1.57247	164	3.26870	272	2.38841	380	1.74479	488	1.37004
79	1.63454	166	3.26104	274	2.37319	382	1.73596	490	1.36463
80	1.69823	168	3.25349	276	2.35818	384	1.72722	492	1.35927
81	1.74606	170	3.24605	278	2.34337	386	1.71857	494	1.35395
82	1.79463	172	3.23020	280	2.32876	388	1.71000	496	1.34867
83	1.84394	174	3.21461	282	2.31434	390	1.70153	498	1.34343
84	1.89399	176	3.19928	284	2.30011	392	1.69313	500	1.33824
85	1.94478	178	3.18418	286	2.28607	394	1.68482	502	1.33314
86	1.99631	180	3.16933	288	2.27221	396	1.67660	504	1.32809
87	2.04859	182	3.15471	290	2.25853	398	1.66845	506	1.32307
88	2.10162	184	3.14032	292	2.24503	400	1.66039	508	1.31809
89	2.15540	186	3.12614	294	2.23170	402	1.65240	510	1.31315
90	2.20993	188	3.11218	296	2.21853	404	1.64450	512	1.30825
91	2.25001	190	3.09843	298	2.20554	406	1.63666	514	1.30338
92	2.29036	192	3.07644	300	2.19270	408	1.62891	516	1.29855
93	2.33099	194	3.05483	302	2.17866	410	1.62123	518	1.29376
94	2.37189	196	3.03359	304	2.16481	412	1.61362	520	1.28901
95	2.41306	198	3.01272	306	2.15113	414	1.60608	522	1.28429
96	2.45451	200	2.99219	308	2.13762	416	1.59862	524	1.27960
97	2.49623	202	2.97201	310	2.12429	418	1.59123	526	1.27495
98	2.53822	204	2.95216	312	2.11113	420	1.58390	528	1.27033
99	2.58048	206	2.93263	314	2.09813	422	1.57664	530	1.26575
100	2.62301	208	2.91342	316	2.08529	424	1.56945	532	1.26120
102	2.68361	210	2.89452	318	2.07261	426	1.56233	534	1.25669
104	2.74439	212	2.87591	320	2.06009	428	1.55527	536	1.25221
106	2.80535	214	2.85760	322	2.04772	430	1.54828	538	1.24776

Det ... GELI 5
 Geo ... MB - Marinelli beaker
 Shlf ... 0
 Ref ... 1057 - 4

Date 01-SEP-99
 Version ... 1.01
 File ND:[25,4]GELI05MBO.EFF
 Page 2

KEV	EFF.	KEV	EFF.	KEV	EFF.	KEV	EFF.	KEV	EFF.
540	1.24334	660	1.02635	930	0.74760	1260	0.56821	1800	0.41226
542	1.23895	665	1.01898	935	0.74393	1270	0.56418	1810	0.41021
544	1.23460	670	1.01171	940	0.74030	1280	0.56022	1820	0.40818
546	1.23028	675	1.00455	945	0.73670	1290	0.55631	1830	0.40618
548	1.22599	680	0.99749	950	0.73314	1300	0.55246	1840	0.40419
550	1.22173	685	0.99053	955	0.72962	1310	0.54867	1850	0.40222
552	1.21749	690	0.98366	960	0.72613	1320	0.54493	1860	0.40028
554	1.21329	695	0.97690	965	0.72268	1330	0.54124	1870	0.39835
556	1.20912	700	0.97023	970	0.71926	1340	0.53761	1880	0.39645
558	1.20498	705	0.96391	975	0.71588	1350	0.53403	1890	0.39456
560	1.20087	710	0.95768	980	0.71253	1360	0.53050	1900	0.39269
562	1.19678	715	0.95154	985	0.70921	1370	0.52701	1925	0.38810
564	1.19273	720	0.94547	990	0.70592	1380	0.52358	1950	0.38362
566	1.18870	725	0.93949	995	0.70266	1390	0.52019	1975	0.37925
568	1.18470	730	0.93358	1000	0.69944	1400	0.51685	2000	0.37498
570	1.18072	735	0.92775	1005	0.69631	1410	0.51355	2025	0.37094
572	1.17678	740	0.92200	1010	0.69321	1420	0.51030	2050	0.36699
574	1.17286	745	0.91632	1015	0.69014	1430	0.50708	2075	0.36313
576	1.16897	750	0.91072	1020	0.68710	1440	0.50392	2100	0.35936
578	1.16510	755	0.90518	1025	0.68408	1450	0.50079	2125	0.35566
580	1.16126	760	0.89972	1030	0.68110	1460	0.49770	2150	0.35205
582	1.15745	765	0.89432	1035	0.67814	1470	0.49465	2175	0.34852
584	1.15366	770	0.88899	1040	0.67520	1480	0.49165	2200	0.34506
586	1.14989	775	0.88373	1045	0.67230	1490	0.48868	2225	0.34168
588	1.14615	780	0.87853	1050	0.66942	1500	0.48574	2250	0.33837
590	1.14244	785	0.87339	1055	0.66657	1510	0.48285	2275	0.33512
592	1.13875	790	0.86832	1060	0.66374	1520	0.47999	2300	0.33194
594	1.13509	795	0.86331	1065	0.66094	1530	0.47717	2325	0.32883
596	1.13145	800	0.85835	1070	0.65816	1540	0.47438	2350	0.32577
598	1.12783	805	0.85346	1075	0.65541	1550	0.47163	2375	0.32278
600	1.12424	810	0.84863	1080	0.65268	1560	0.46890	2400	0.31984
602	1.12067	815	0.84385	1085	0.64997	1570	0.46622	2425	0.31697
604	1.11712	820	0.83913	1090	0.64729	1580	0.46356	2450	0.31414
606	1.11360	825	0.83446	1095	0.64463	1590	0.46094	2475	0.31137
608	1.11010	830	0.82985	1100	0.64200	1600	0.45834	2500	0.30865
610	1.10662	835	0.82528	1105	0.63939	1610	0.45578	2525	0.30599
612	1.10316	840	0.82078	1110	0.63680	1620	0.45325	2550	0.30337
614	1.09973	845	0.81632	1115	0.63423	1630	0.45075	2575	0.30080
616	1.09631	850	0.81191	1120	0.63168	1640	0.44828	2600	0.29827
618	1.09292	855	0.80755	1125	0.62916	1650	0.44583	2625	0.29579
620	1.08955	860	0.80325	1130	0.62665	1660	0.44341	2650	0.29336
622	1.08620	865	0.79899	1135	0.62417	1670	0.44102	2675	0.29096
624	1.08288	870	0.79477	1140	0.62171	1680	0.43866	2700	0.28861
626	1.07957	875	0.79060	1150	0.61684	1690	0.43633	2725	0.28630
628	1.07628	880	0.78648	1160	0.61206	1700	0.43402	2750	0.28403
630	1.07302	885	0.78240	1170	0.60736	1710	0.43173	2775	0.28180
632	1.06977	890	0.77837	1180	0.60273	1720	0.42947	2800	0.27960
634	1.06655	895	0.77438	1190	0.59817	1730	0.42724	2825	0.27744
636	1.06334	900	0.77043	1200	0.59369	1740	0.42503	2850	0.27532
638	1.06015	905	0.76652	1210	0.58927	1750	0.42284	2875	0.27323
640	1.05699	910	0.76266	1220	0.58493	1760	0.42068	2900	0.27117
645	1.04916	915	0.75883	1230	0.58065	1770	0.41854	2925	0.26915
650	1.04144	920	0.75505	1240	0.57644	1780	0.41643	2950	0.26716
655	1.03384	925	0.75130	1250	0.57229	1790	0.41433	2975	0.26520

PERCENT EFFICIENCY



GELI 5 MB 0 V1.01 01-SEP-99

Gamma Spectrometer Calibration Counting Results

Detector: 65
 Geometry: MB Descr: 500 ml in Marinelli Beaker
 Standard I.D.: 1057-4

Gamma KeV	% Efficiency			
	GMT=182.204	GMT=198.089	GMT=205.200	GMT=
59.5 (Am241)	0.5910	0.5565	0.5380	
88 (Cd109)	1.976	2.152	2.147	
122 (Co57)	3.206	3.201	3.197	
166 (Ce139)	3.338	3.303	3.278	
320 (Cr51)	2.040	1.984	2.027	
392 (Sn113)	1.678	1.650	1.641	
514 (Sr85)	1.371	1.354	1.361	
662 (Cs137)	1.056	1.038	1.040	
898 (Y88)	0.7639	0.7618	0.7626	
1173 (Co60)	0.5994	0.7 0.5993	0.6011	
1332 (Co60)	0.5431	0.5327	0.5319	
1836 (Y88)	0.4140	0.4042	0.4084	

761

146

302

NO EFFICIENCIES

 1057 GLY 4 G-5 XX 182.204 98 146.50 MIN 2.00000 ML 761
 LIBR=C981 REF TIME= 121.500 98 Calibration 1234

SPECIAL ANALYSIS

PK-ENERGY-GAMMA KEV	BRANCH FRAC	EFFICIENCY FRAC	CPM CORR CNTG DECAY	DPM NOW	ERROR PCT	DPM/ML AT TZERO
Am241 59 (59.54)	1.582E+05 DAYS 0.073342	LAMBDA= 4.381E-06 1.00000	DECAY= 9.997E-01 41G 86.662	1.182E+03	2.66%	5.910E+02
Cd109 88 (88.03)	4.530E+02 DAYS 0.041771	LAMBDA= 1.530E-03 1.00000	DECAY= 9.113E-01 1G 150.413	3.601E+03	1.51%	1.976E+03
Co 57 122 (122.06) 136 (136.47)	2.700E+02 DAYS 0.038133 0.111000	LAMBDA= 2.567E-03 1.00000 1.00000	DECAY= 8.557E-01 10G 209.218 25.461	5.487E+03 2.294E+02	1.23% 7.95%	3.206E+03 1.340E+02
Ce139 166 (165.80)	1.372E+02 DAYS 0.063273	LAMBDA= 5.052E-03 1.00000	DECAY= 7.359E-01 2G 310.800	4.912E+03	0.91%	3.338E+03
Cr 51 320 (320.03)	2.772E+01 DAYS 0.186701	LAMBDA= 2.501E-02 1.00000	DECAY= 2.192E-01 1G 166.965	8.943E+02	1.31%	2.040E+03
Sn113 392 (391.40)	1.150E+02 DAYS 0.134211	LAMBDA= 6.027E-03 1.00000	DECAY= 6.936E-01 4G 312.417	2.328E+03	0.69%	1.678E+03
85 514 (513.98)	6.520E+01 DAYS 0.248480	LAMBDA= 1.063E-02 1.00000	DECAY= 5.245E-01 4G 357.369	1.438E+03	0.63%	1.371E+03
Cs137 662 (661.64)	1.102E+04 DAYS 0.157793	LAMBDA= 6.290E-05 1.00000	DECAY= 9.962E-01 3G 332.047	2.104E+03	0.66%	1.056E+03
Y 88 898 (898.00) 1836 (1836.10)	1.066E+02 DAYS 0.394059 0.416536	LAMBDA= 6.502E-03 1.00000 1.00000	DECAY= 6.739E-01 7G 405.708 232.409	1.030E+03 5.580E+02	0.53% 0.59%	7.639E+02 4.140E+02
Co 60 1173 (1173.21) 1332 (1332.48)	1.921E+03 DAYS 0.221390 0.221520	LAMBDA= 3.608E-04 1.00000 1.00000	DECAY= 9.783E-01 4G 259.652 235.412	1.173E+03 1.063E+03	0.65% 0.60%	5.994E+02 5.431E+02

NP: [7,67]761.GSP

19 PEAKS

PK	IT	ENRG	LEFT	WD	BKGND	FWHM	AREA	CHAN	CPM	ERR	EFF	K	FIT
1	0	11.7	8	10	36730	3.37	35157	11.8	2.40E+02	1.20	0.10	0	0.00
2	0	59.2	55	8	33334	1.86	12696	59.2	8.67E+01	2.7	100.	0	0.00
3	0	70.1	68	5	21455	1.26	743	70.0	5.07E+00	29.8	100.	0	0.00
4	0	87.8	84	7	33484	1.36	22034	87.7	1.50E+02	1.5	100.	0	0.00
5	0	121.9	118	8	36856	1.56	30646	121.7	2.09E+02	1.2	100.	0	0.00
6	0	136.4	133	7	30453	1.29	3729	136.2	2.55E+01	7.9	100.	0	0.00
7	0	165.7	161	9	38917	1.93	45520	165.4	3.11E+02	0.9	100.	0	0.00
8	0	254.8	252	7	20978	1.96	2033	254.4	1.39E+01	12.1	100.	0	0.00
9	0	319.9	315	10	22375	2.01	24429	319.4	1.67E+02	1.3	100.	0	0.00
10	0	391.6	386	10	15967	1.65	45755	391.0	3.12E+02	0.7	100.	0	0.00
11	0	513.9	507	12	13843	2.08	52326	513.2	3.57E+02	0.6	100.	0	0.00
12	0	661.6	655	12	13470	2.14	48645	660.8	3.32E+02	0.7	100.	0	0.00
13	0	813.7	809	9	6000	2.58	1199	812.9	8.18E+00	12.1	100.	0	0.00