FINAL

INTERIM REMEDIAL ACTION BENCH SCALE TREATABILITY STUDY REPORT VOLUME II LABORATORY REPORTS RADIONUCLIDE ANALYSIS

903 Pad, Mound, and
East Trenches Areas
(South Walnut Creek)

Operable Unit No 2

Environmental Restoration Program

May 22, 1991

U S DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

REVIEWED FOR CLASSIFICATION/UCNI
By
Date June 30, 1992

22558/R7 TS 05 18-92/RPT/2

ADMIN RECORD

A-OU02-000363

FINAL

INTERIM REMEDIAL ACTION BENCH SCALE TREATABILITY STUDY REPORT
VOLUME II
LABORATORY REPORTS
RADIONUCLIDE ANALYSIS

903 Pad, Mound, and
East Trenches Areas
(South Walnut Creek)

Operable Unit No. 2

Environmental Restoration Program

May 22, 1991

U S DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

REVIEWED FOR CLASSIFICATION/UCNI
By
Date

22558/R7 TS 05 18-92/RPT/2

ADMIN RECORD

PROJECT 7488

WOODWARD-CLYDE FEDERAL SERVICES

WCC 22558E/WCFS 4020

GROSS ALPHA, BETA ANALYSIS

LAB CONTROL NUMBERS. K232-7,8 (02CWC1001, 02CWC1002)

CASE NARRATIVE.

ABNORMALITIES	N/A	OK	PROBLEM *
Instrumentation	—	✓	—
Procedural	—	✓	—
Sample Collection	—	—	✓
Sample Storage	—	✓	—
Sample Preservation	—	—	✓
Containers	—	✓	—
Holding Times	—	✓	—
Other _____	—	—	—

* If problem or abnormality, explain below

Analyst did not collect the samples Samples received were raw Acidified upon receipt

PREPARATION OF GROSS ALPHA, BETA CALIBRATION STANDARDS

11/5/90

Dissolve 30 grams of Na_2SO_4 in 1 liter of deionized water.

Pipet 0, .5, 1.0, 2.0, 3.0, and 5.0 ml of the solution into tared counting planchets and dry the solutions under the heat lamps.

Add 10 ml of Am-241 standard solution to each of the planchets and dry them again.

Ignite the planchets in the muffle furnace at 500 deg. C for 15 minutes. After cooling, weigh the planchets and determine the total milligrams of solids on each planchet.

Repeat the above procedure with a second set of planchets, but substituting the Sr-90/Y-90 standard solution for the Am-241 solution.

Count the Am-241 planchets for 15 min. at the alpha plateau of the NMC counter and at the beta plateau of the Canberra counter.

Count the Sr-90/Y-90 planchets for 15 min. at the beta plateau of the Canberra counter.

Record the data and submit it for computer processing to determine the calibration factors and instrument equivalency factors.

11/5/90

Preparation of Am-241
and Sr-90/Y-90
Gross α, β Standards
11/1/90

Starting Materials:

Am-241 4.9161 grams of 4.65×10^{-9} Ci/g = 22.86×10^{-9} Ci
= 22860 pCi total

5/24/88 Corrected for decay: $A = A_0 e^{-\lambda t}$
$A = 22860 (2.7183) \wedge (-1.6008 \times 10^{-3} \times 2.417 yr)$
[$t_{1/2}$ = 433 yrs · $\lambda = (.69315/433) = 1.6008 \times 10^{-3}$]

A = 22772 pCi

Dilute to 500 ml in 5% HNO_3 to get 45.54 pCi/ml
Use 10 ml per planchet = 455.4 pCi/planchet

4.9879 grams of $2(4.47 \times 10^{-9}$ Ci/g) = 44.59×10^{-9} Ci
= 44590 pCi total

1/9/89 Corrected for decay: $A = A_0 e^{-\lambda t}$
$A = 44590 (2.7183) \wedge (-.024236 \times 1.8333)$
[$t_{1/2}$ = 28.6 yrs : $\lambda = (69315/28.6) = .024236$]

A = 42652 pCi

Dilute to 500 ml in 5% HNO_3 to get 85.30 pCi/ml
Use 10 ml per planchet = 853.0 pCi/planchet

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide: AMERICIUM-241 Half life: 433±4 years

Nominal activity: 23.25 nano curies

Nominal volume: 5 ml in ampoule/bottle number: 2344-2

Measurement Activity of principal radionuclide

Activity per gram of this solution

4.65 nano curies of Americium-241

at 0400 hours PST on May 24, 1988

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

APPROX. 5.0 grams

Method of measurement

The activity of the primary solution was measured using four pi coincidence and anticoincidence counting.

The activity of the dilution was measured using liquid scintillation counting.

Useful Life

This radionuclide has decayed through 0.0 half lives since it was obtained by EMSL LV

We recommend that this solution should not be used after January 1995

U S Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide: STRONTIUM-90 Half life: 28.6 years

Nominal activity: 22.4 nano curies

Nominal volume: 5 ml in ampoule/bottle number: 2454-1

Measurement Activity of principal radionuclide

Activity per gram of this solution

4.47 nano curies of Strontium-90

at 0400 hours PST on January 9, 1989

Activity of daughter radionuclide

The principal activity was accompanied at the cited time by

4.47 nano curies Per gram

of the daughter nuclide Yttrium-90

Total mass of this solution

APPROX. 5.0 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.

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 [ ]

Bkg ccu[redacted] 82
Bkgnd ct. time, min. 480
Bkgnd counts 1111
Bkgnd ct., time, min. 500

GRC ALI[redacted]-BETA
Worksheet
System Calibration 11/5/90

Date 11/5/90[redacted]
Analyst [redacted]

HRI #	Samp #	plan wt full	plan wt empty	mgs	7) samp. ct. time	8) alpha count	9) beta count	10) V, mls	Net Cts α ~~pCi/l~~	Net cts β ~~Error~~	α pCi/l	β pCi/l Error
Am-241 -1	1	9.2736	9.2736	0.0	15 min	5070	3825	10	5069	3792	1.35	1.80
-2	2	9.1886	9.1237	14.7		2964	2680		2963	2647	2.30	2.59
-3	3	9.2130	9.1831	29.9		2577	2527		2576	2494	2.65	2.74
-4	4	9.2053	9.1450	60.3		2293	1646		2292	1613	2.98	4.23
-5	5	9.3862	9.2974	88.8		1764	1303		1763	1270	3.87	5.38
-6	6	10.3014	10.1565	144.9		1226	912		1225	879	5.58	7.77
Blank	7	—	—	—		1		—				
Sr 90/Y 90-1	8	9.1362	9.1362	0.0			10625	10		10592	1.21	
-2	9	9.3286	9.3140	14.6			10338			10305	1.24	
-3	10	9.4164	9.3870	29.4			10106			10073	1.27	
-4	11	9.2693	9.2084	60.9			9962			9929	1.29	
-5	12	9.3924	9.3023	90.1			9168			9135	1.40	
-6	13	9.3863	9.2416	144.7			9445			9412	1.36	
Blank	14	—	—				33	—				

Counting Conditions and Settings:

NMC #1 HV = 1147v Purge time = 100

Canberra HV = 1400 V

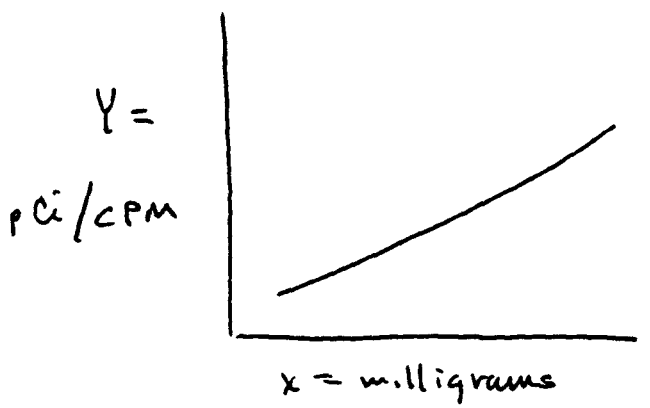
Sample Detector Amp: Coarse Gain = 16
Fine Gain = ϕ
Window = ϕ
Lower Level = 0.4

Guard Detector Amp: Coarse Gain = 16
Fine Gain = ϕ
Window = ϕ
Lower Level = 0.4

OK

Alpha Calibration
NMC #1
11/5/90

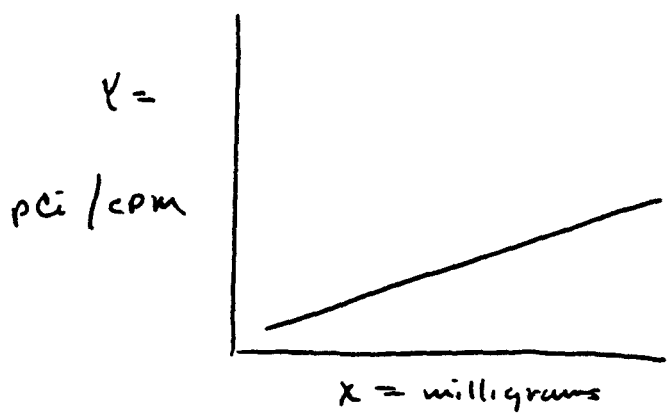
```
]RUN
  H-ORDER REGRESSION

DEGREE OF EQUATION?2
NUMBER OF KNOWN POINTS?6
X,Y OF POINT1?0,1.35
X,Y OF POINT2?14.9,2.30
X,Y OF POINT3?29.9,2.65
X,Y OF POINT4?60.3,2.98
X,Y OF POINT5?88.8,3.87
X,Y OF POINT6?144.9,5.58

                CONSTANT = 1.65416303
1DEGREE COEFFICIENT = .0243363531
2DEGREE COEFFICIENT = 1.66460348E-05


COEFFICIENT OF DETERMINATION (R^2) = .973354638
COEFFICIENT OF CORRELATION = .98658737
STANDARD ERROR OF ESTIMATE = .307699231

INTERPOLATION:(ENTER -9 TO END PROGRAM)
X= ?
0
Y= 1.65416303

  ?14.9
Y= 2.02047028

X= ?29.9
Y= 2.39670171

X= ?60.3
Y= 3.1821716

X= ?88.8
Y= 3.94649249

X= ?144.9
Y= 5.53000091

X= ?-9

]
```



OK

Beta Calibration
Canberra
11/5/90

```
RUN
NTH-ORDER REGRESSION

  .GREE OF EQUATION?2
NUMBER OF KNOWN POINTS?6
X,Y OF POINT1?0,1.21
X,Y OF POINT2?14.6,1.24
X,Y OF POINT3?29.4,1.27
X,Y OF POINT4?60.9,1.29
X,Y OF POINT5?90.1,1.4
X,Y OF POINT6?144.7,1.36

                CONSTANT = 1.20194501
1DEGREE COEFFICIENT = 2.72472385E-03
2DEGREE COEFFICIENT = -1.08520206E-05


COEFFICIENT OF DETERMINATION (R^2) = .876780441
COEFFICIENT OF CORRELATION = .936365549
STANDARD ERROR OF ESTIMATE = .0327729078

INTERPOLATION:(ENTER -9 TO END PROGRAM)
X= ?0
Y= 1.20194501

X= ?14.6
Y= 1.23941276

   ?29.4
Y= 1.27267184

X= ?60.9
Y= 1.32763261

X= ?90.1
Y= 1.35934582

X= ?144.7
Y= 1.36899197

X= ?-9

]
```

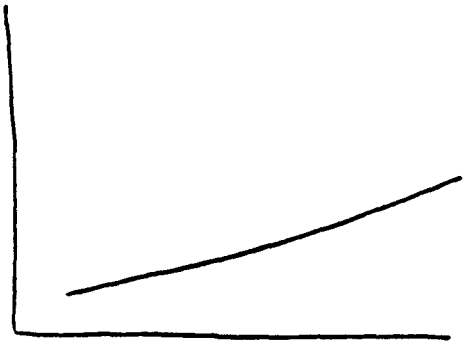


~~Alpha Calibration 11/5/90~~
~~UMC~~

Alpha on Beta Counter
Cross-talk Calibration
11/5/90

```
RUN
TH-ORDER REGRESSION

  GREE OF EQUATION?2
NUMBER OF KNOWN POINTS?6
X,Y OF POINT1?0,1.80
X,Y OF POINT2?14.9,2.58
X,Y OF POINT3?29.9,2.74
X,Y OF POINT4?60.3,4.23
X,Y OF POINT5?88.8,5.38
X,Y OF POINT6?144.9,7.77

                CONSTANT = 1.82960041
1DEGREE COEFFICIENT = .0373611964
2DEGREE COEFFICIENT = 2.57012399E-05


COEFFICIENT OF DETERMINATION (R^2) = .996216568
COEFFICIENT OF CORRELATION = .998106491
STANDARD ERROR OF ESTIMATE = .176038363

INTERPOLATION:(ENTER -9 TO END PROGRAM)
X= ?0
Y= 1.82960041

X= ?14.9
Y= 2.39198817

  ?29.9
Y= 2.96967735

X= ?60.3
Y= 4.17593258

X= ?88.8
Y= 5.34994024

X= ?144.9
Y= 7.78286126

X= ?-9

]
```

Y = pCi/cpm



X = milligrams

OK

Equivalency Factor Determination 11/5/90
Gross α, β

Solids on Planchet, mg	Am-241 pCi/CPM (NMC)	Am-241 pCi/CPM (Canberra)	Am-241 (Canberra) / Am-241 (NMC) Equivalency Factor
0 0	1.65	1.83	1.11
14.9	2.02	2.39	1.18
29.9	2.40	2.97	1.24
60.3	3.18	4.18	1.31
88.8	3.95	5.35	1.35
144.9	5.53	7.78	1.41

Interpolated values

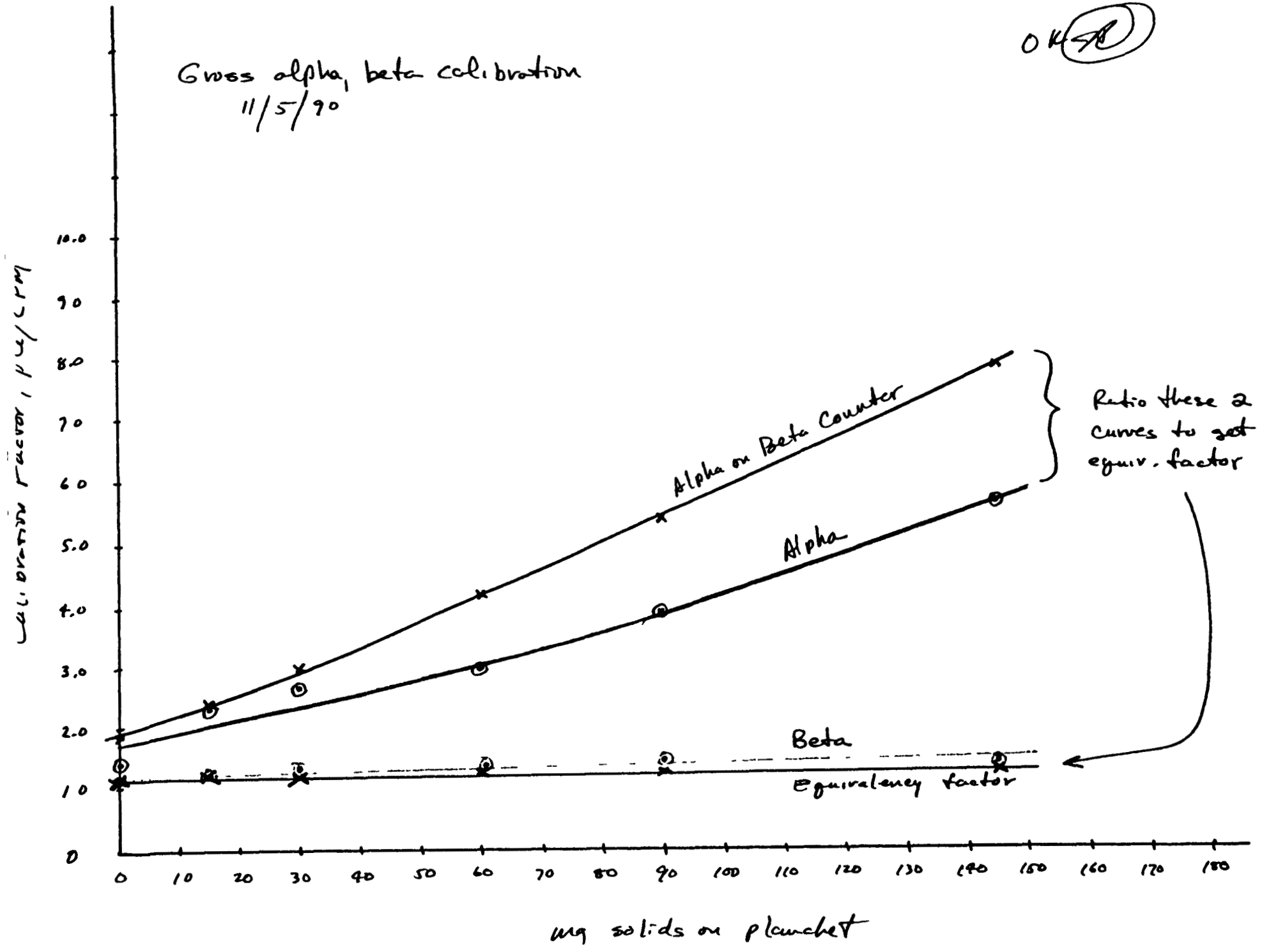
Equivalency Factor Curve
11/5/90

```
RUN
NTH-ORDER REGRESSION

DEGREE OF EQUATION?2
NUMBER OF KNOWN POINTS?6
X,Y OF POINT1?0,1.11
X,Y OF POINT2?14.9,1.18
X,Y OF POINT3?29.9,1.24
X,Y OF POINT4?60.3,1.31
X,Y OF POINT5?88.8,1.35
X,Y OF POINT6?144.9,1.41

              CONSTANT = 1.12058722
1DEGREE COEFFICIENT = 3.92873651E-03
2DEGREE COEFFICIENT = -1.35156447E-05

COEFFICIENT OF DETERMINATION (R^2) = .991826348
COEFFICIENT OF CORRELATION = .995904789
STANDARD ERROR OF ESTIMATE = .0130109728
```

OK 90

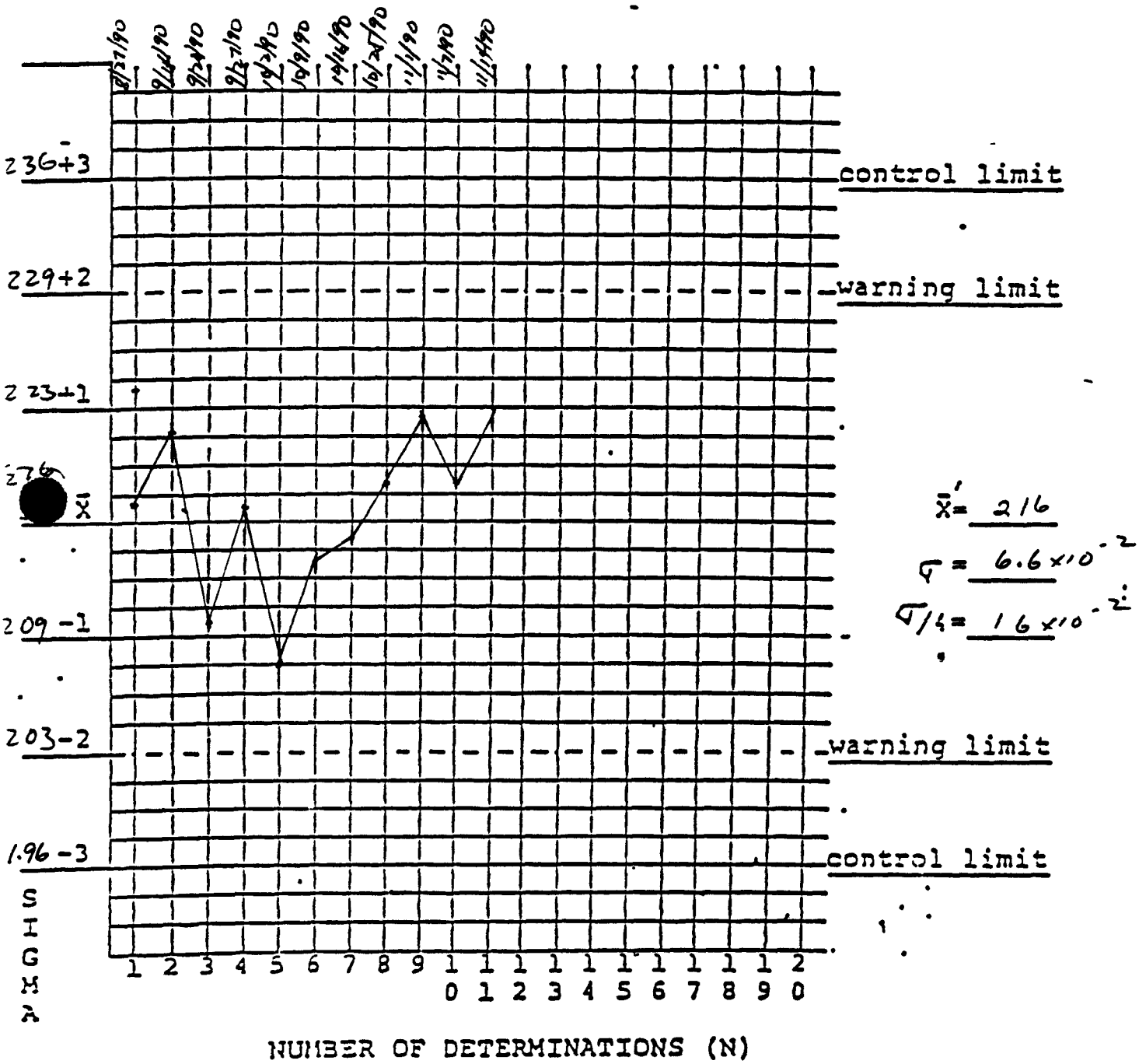
OK

Gross alpha, beta calibration
11/5/90



1085	2.17	10/9/90	1070	2.14	11/14/90	1112	2.22						
1107	2.21	10/16/90	1073	2.15									
1052	2.10	10/25/90	1092	2.18									
1084	2.17	11/1/90	1111	2.22									
1041	2.08	11/7/90	1090	2.18									

DETECTOR I.D. Canberra Gross α/β STD. I.D. Background TIME 500



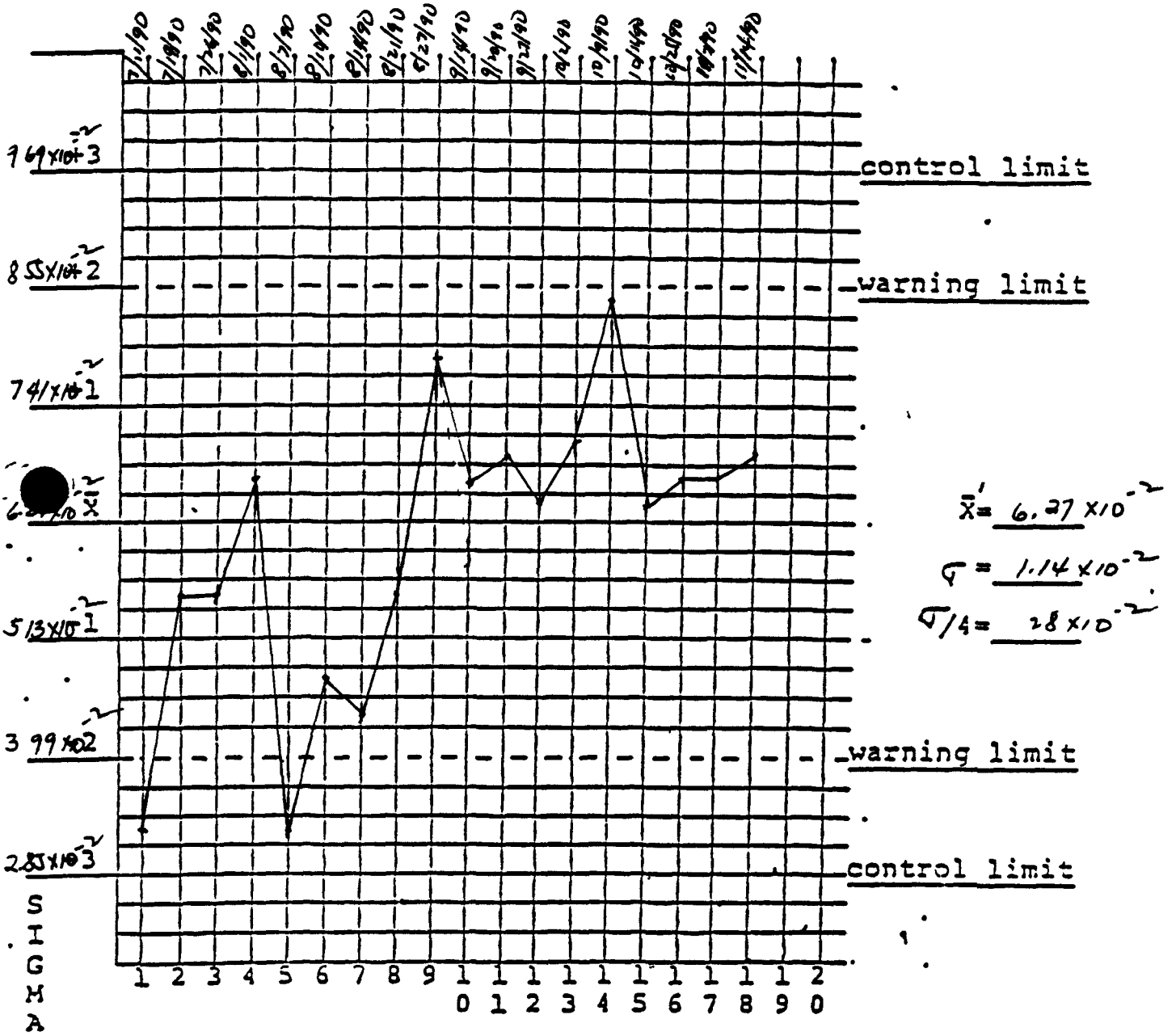
$\bar{X}' = 216$

$\sigma = 6.6 \times 10^{-2}$

$\sigma/4 = 16 \times 10^{-2}$

E	COUNT	CPM	DATE	COUNT	CPM	DATE	COUNT	CPM	DATE	COUNT	CPM	DATE	COUNT	C.
7/11	16	3.3	8/10/90	23	4.8	9/20/90	33	6.9	10/25/90	32	6.7			
7/19	30	6.2	8/14/90	21	4.4	9/27/90	31	6.5	11/7/90	32	6.2			
7/26	30	6.2	8/21/90	27	5.6	10/2/90	34	7.1	11/14/90	33	6.9			
8/5	32	6.7	8/27/90	38	7.9	10/9/90	40	8.3						
8/[illegible]	16	3.3	9/14/90	32	6.7	10/16/90	31	6.5						

DETECTOR I.D. NMC#1 STD. I.D. Background TIME 480 M



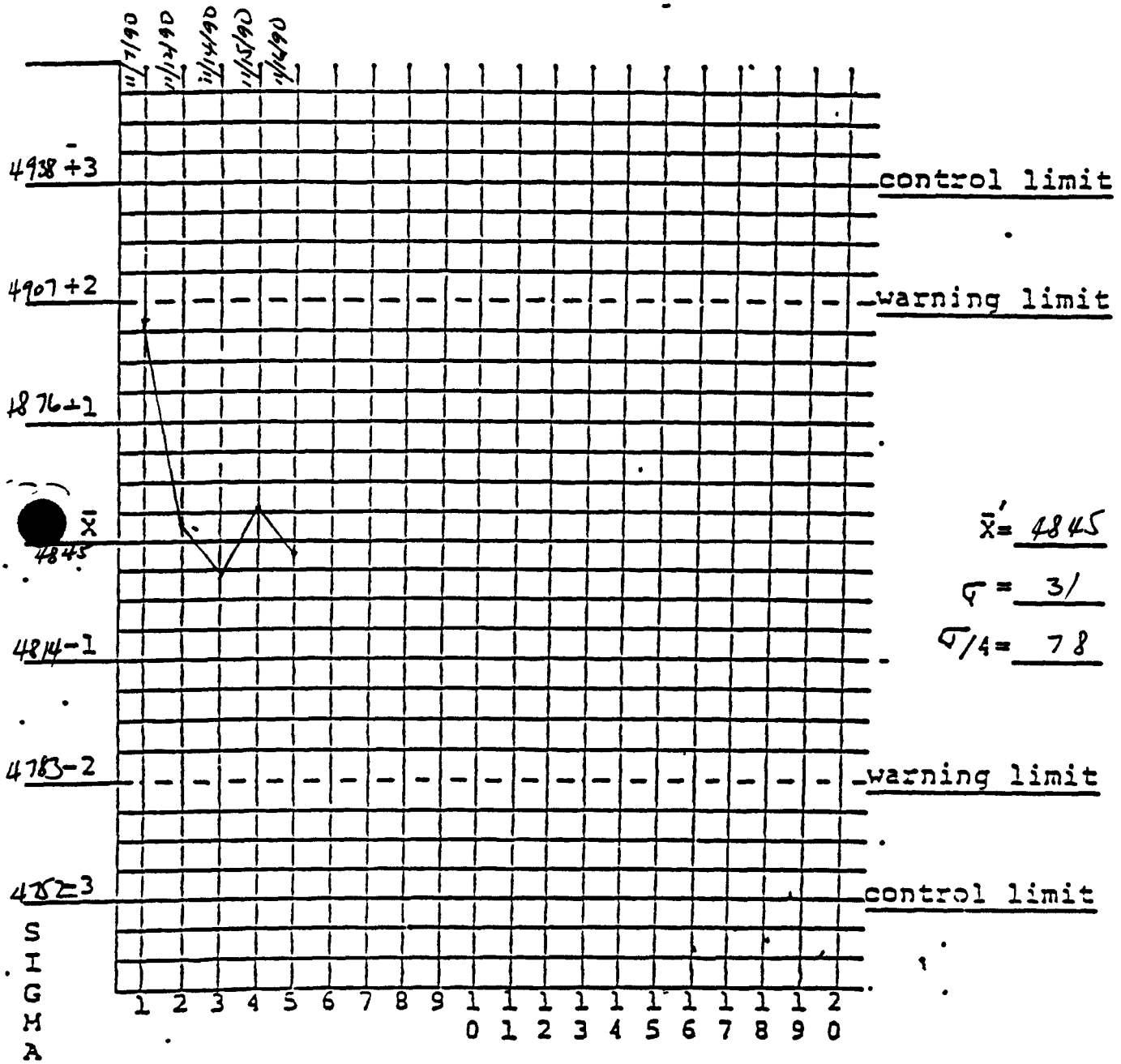
$\bar{X}' = 6.27 \times 10^{-2}$

$\sigma = 1.14 \times 10^{-2}$

$\sigma/4 = 28 \times 10^{-2}$

11/9	24510	4902											
11/12	24254	4851											
11/14	24184	4837											
11/15	24269	4854											
11/16	24208	4842											

DETECTOR I.D. Canberra Gross α/β STD. I.D. Sr Y 90 TIME 5



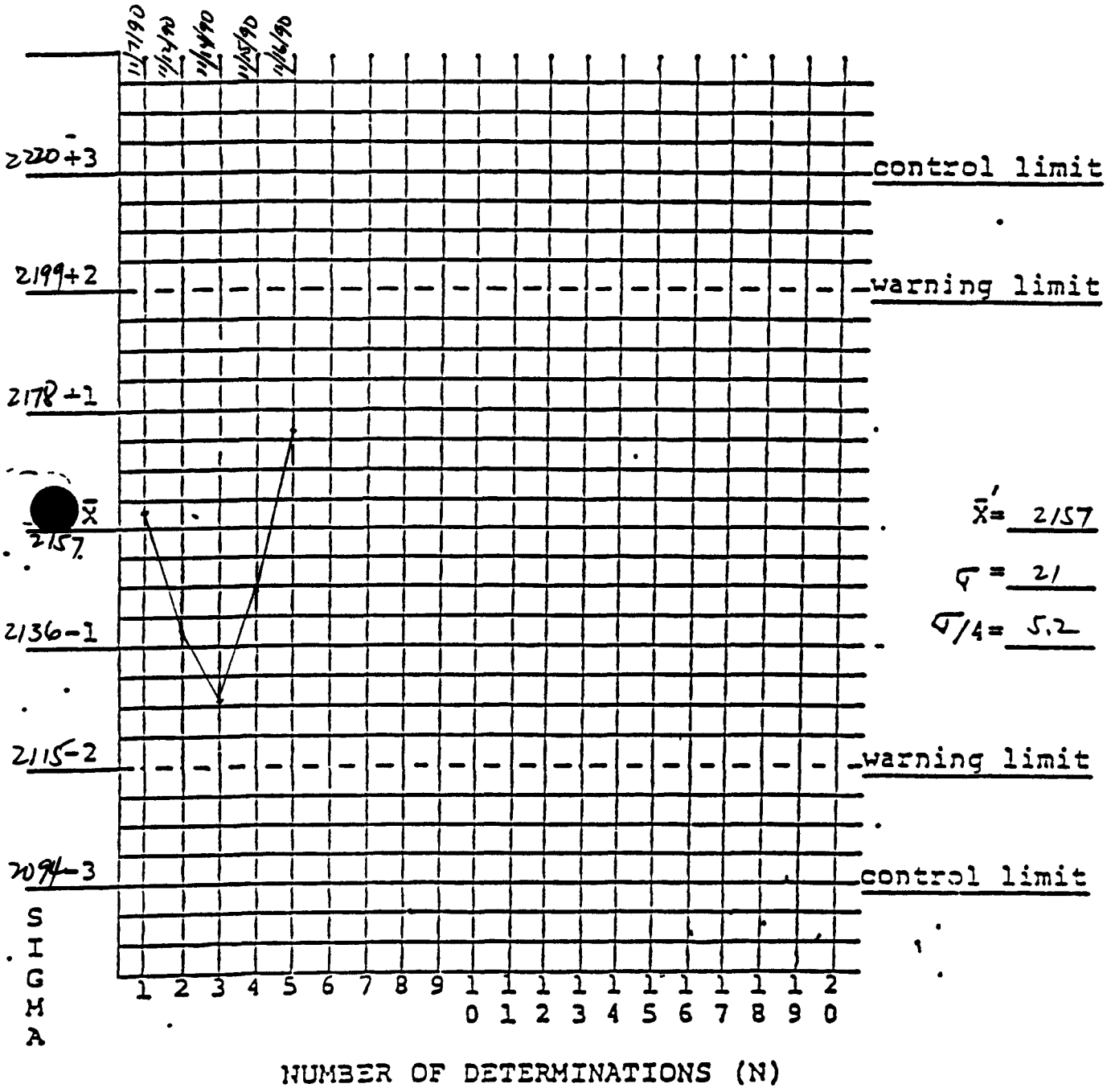
$\bar{X}' =$ 4845

$\sigma =$ 31

$\sigma/4 =$ 78

11/7	10801	2160											
11/8	10697	2139											
11/9	10631	2126											
11/13	10732	2146											
11/16	10868	2174											

DETECTOR I.D. NMC#1 STD. I.D. 7911 TIME 5



PROJECT 7488

WOODWARD-CLYDE FEDERAL SERVICES

WCC 22558E/WCFS 4020

GROSS ALPHA, BETA ANALYSIS

BLANKS DATA FOR THE NMC #1 GAS FLOW PROPORTIONAL COUNTER (ALPHA)

TYPE OF BLANK Empty planchet, wash 3 ml nitric acid into planchet with deionized water

Sample Control #'s	Date	Blank Count	Count Time	CPM	Detn Limit
K232-7 + 8	11/15/90	2	60	033	

PROJECT 7488

WOODWARD-CLYDE FEDERAL SERVICES

WCC 22558E/WCFS 4020

GROSS ALPHA, BETA ANALYSIS

BLANKS DATA FOR THE CANBERRA THIN WINDOW GAS FLOW PROPORTIONAL COUNTER (BETA)

TYPE OF BLANK Empty planchet, wash 3 ml nitric acid into planchet with deionized water

Sample Control #'s	Date	Blank Count	Count Time	CPM	Detn Limit
K 232-7 & 8	11/15/90	151	60	2 52	

PROJECT 7488

WOODWARD-CLYDE FEDERAL SERVICES

WCC 22558E/WCFS 4020

GROSS ALPHA, BETA ANALYSIS

LAB REPLICATES DATA

Sample Count times 60 minutes in each detector
Background Count times 500 min.-Canberra 480 min.- NMC #1
Acceptance Criteria No more than 5 out of 100 duplicate analyses should differ by more than the interval defined by the counting error calculation

		NMC #1 Gross Alpha			Canberra Gross Beta		
	Date	1st Run	2nd Run	Mean	1st Run	2nd Run	Mean
	~~11/15/90~~	~~K2327 & 8 no duplicate analyses made~~					
K2327	11/15/90	19±7	16±7	18±7	57±65	12±60	35±63
8		42±37	31±33	37±35	40±58	99±61	70±60

PROJECT 7488

WOODWARD-CLYDE FEDERAL SERVICES

WCC 22558E/WCFS 4020

GROSS ALPHA, BETA ANALYSIS

CONTROL SAMPLE ANALYSIS DATA

Gross Alpha detector NMC #1
Gross Beta Detector Canberra
Control Sample. EPA Am-241 std, ampuole no. 2344-2, and EPA Sr-90/Y-90 std, ampuole no 2464-1 See attached preparation procedure

Control Sample Known Activity 455 pCi/l gross alpha 4260 pCi/l gross beta. Acceptance criteria No more than 5 out of 100 analysis values should differ from the known value by more than the interval defined by the counting error calculation

Results

Date	Gross alpha Result,pCi/l	Gross beta Result,pCi/l	Acceptable (y/n)
11/6/90	607 ± 108		N
		3910 ± 196	Y
11/6/90	500 ± 99		Y
		4170 ± 200	Y
11/15/90	660 ± 113		N
		4082 ± 200	Y
11/15/90	534 ± 102		Y
		4079 ± 200	Y

11/6/90

Calculation of Detection Limit for Gross β Analysis

Background Count Data: (500 min counts)
Canberra system

Date	Counts	Date	Counts
8/27/90	1085	10/2/90	1041
9/14/90	1107	10/9/90	1070
9/20/90	1052	10/16/90	1073
9/27/90	1084	10/25/90	1092

Mean = 1076 = $\bar{x}$

Calculation of Standard Deviation:

$\lvert x_i - \bar{x} \rvert$ =			Δ^2
1085	−1076	= 9	81
1107	−1076	= 31	961
1052	−1076	= 24	576
1084	−1076	= 8	64
1041	−1076	= 35	1225
1070	−1076	= 6	36
1073	−1076	= 3	9
1092	−1076	= 16	256

$$\sum (\lvert x_i - \bar{x} \rvert)^2 = 3208$$

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{3208}{7}} = 21.4 \text{ counts}$$

$$S_b = \frac{21.4 \text{ counts}}{500 \text{ min.} \times 60 \text{ secs/min}} = \frac{21.4 \text{ counts}}{30{,}000 \text{ sec}} = 7.13 \times 10^{-4} \text{ CTS/SEC}$$

Calculation of LLD:

$$\text{LLD, } \mu Ci/ml = \frac{4.66 \times 7.13 \times 10^{-4}}{3.7 \times 10^{4} \times 0.3 \times 100 \text{ ml}}$$

$$= 29.9 \times 10^{-10} \mu Ci/ml$$

$$= 3.0 \text{ pCi/l}$$

John C. Jerin
11/6/90

11/6/90

Calculation of Detection Limit for Gross Alpha Analysis

Background Count Data: (~~500~~ 480 min. counts)
NMC #1 Counter

Date	Counts	Date	Counts
7/11/90	16	8/22/90	38
7/19/90	30	9/14/90	32
7/26/90	30	9/20/90	33
8/1/90	32	9/27/90	31
8/7/90	16	10/2/90	34
8/10/90	23	10/9/90	40
8/14/90	21	10/16/90	31
8/21/90	27	10/25/90	32

Mean = 29

Calculation of Standard Deviation:

$\lvert x_i - \bar{x} \rvert$ =			$\wedge 2$
16 - 29	=	13	169
30	=	1	1
30	=	1	1
32	=	3	9
16	=	13	169
23	=	6	36
21	=	8	64
27	=	2	4
38	=	9	81
32	=	3	9
33	=	4	8
31	=	2	4
34	=	5	25
40	=	11	121
31	=	2	4
32	=	3	9

$\Sigma (\lvert x_i - \bar{x} \rvert)^2 = 714$

$$S = \sqrt{\frac{\Sigma (x_i - \bar{x})^2}{n-1}}$$

$$S = \sqrt{\frac{714}{15}}$$

$S = 6.90$ counts

$$S_b = \frac{6.90 \text{ counts}}{480 \text{ min.} \times 60 \text{ secs/min}} = \frac{6.90}{28{,}800 \text{ sec}} = 2.40 \times 10^{-4} \text{ CTS/SEC}$$

Calculation of LLD:

$$\text{LLD, } \mu\text{Ci/ml} = \frac{4.66 \times 2.40 \times 10^{-4} \text{ CTS/SEC}}{37 \times 10^{4} \times 0.5 \times 100 \text{ ml}}$$

$$= 6.04 \times 10^{-10} \ \mu\text{Ci/ml}$$

$$= 0.6 \text{ pCi/l}$$

J. Farmer
11/6/90

ANALYSIS WORKSHEET

PRIORITY: RUSH
REQ.TYPE: NEW REQUEST
LAB GROUP: RAD
ALPHA/BETA COUNT
DIG
MTX
CODE 441 EPA 900.0

Calibration: Blanks:

	1
	10
	10^2
	10^3

GROSS ALPHA-BETA
11-14-1990 # 9,283 K232/90
WATER
FOR LYNCH
PROJECT 7488
CE: 4 @ $ 114 40 EA.
TAL PRICE: $ 228.80

ENTRY NUMBER 9283
COMPLETE 11-16-1990

Factor: _____

Sample Description	#	MATX.	EST.	I		BASIS->	REC.	DISS.	TOTAL	Result Pa/l α	Result β
02CWC1001										19±7	5.7±65
02CWC1002										4.2±37	40±5
				R7						16±7	12±60
				R8						3.1±33	9.9±61

Special Instructions: Please identify hazardous sample components:

AREA 7 H2O AREA 5 RAD TOTAL BASIS DUE BY: 11-15-90 4PM

) Alpha Bkgnd ct. time, min. 480
) Beta Bkgnd counts 1112
) Beta Bkgnd ct., time, min. 500

GROSS ALPHA-BETA Worksheet

Date 11/15/90
Analyst Eg

Control #	HRI #	Samp #	plan wt full	plan wt empty	mgs	7) samp. ct. time	8) alpha count	9) beta count	10) V, mls	α pCi/l	α Error	β pCi/l	β Error
	K232-7		93132	92314	818	60	34	199	100	18.7	7.2	5.7	6.5
	8		102066	101452	614		12	162	100	4.2	3.7	4.0	5.8
	Control Std #1		102197	101696	501		140	2176	10	660	113	4082	200
	#2		92574	92073	501		114	2141	10	534	10.2	4079	200
	Blank		91781	91781	0.0		2	151	100	0.0	0.9	4.0	5.1
	K232-R7		95080	94202	878	60	27	170	100	15.9	6.7	1.2	6.0
	R8		93553	92968	585	60	10	186	100	3.1	3.3	9.9	6.1

GROSS ALFHA,BETA CALCULATIONS

LFHA BACKGROUND [illegible]
LFHA BKGND TIME= [illegible]
E[illegible]ACKGROUND= [illegible]
ETA BKGND TIME= [illegible]

	ALFHA,FCI/L	+-	PRECISION
	BETA,FCI/L	+-	PRECISION
[illegible]	18.7030807	+-	[illegible]
	[illegible]	+-	[illegible]
[illegible]	4.21466052	+-	[illegible]
	4.0373043	+-	[illegible]
[illegible]	[illegible]	+-	[illegible]
	4082.46425	+-	200.52259
[illegible]	5[illegible].6488	+-	[illegible]
	4078.90457	+-	198.92519
[illegible]	-.5858625	+-	[illegible]
	[illegible]	+-	[illegible]
[illegible]	14.9420344	+-	[illegible]
	[illegible]	+-	[illegible]
[illegible]	[illegible]	+-	[illegible]
	9.9586598	+-	[illegible]

LFHA COEFFICIENTS: [illegible] A1=[illegible] A2=1.6646E-03
ETA COEFFICIENTS: Z0=1.2[illegible]19 Z1=2.7247E-03 Z2=-1.0832E-05

Woodward-Clyde Consultants
Stanford Place 3 Suite 1000 4582 South Ulster Street Parkway
Denver Colorado 80237 (303) 694 2770

Chain of Custody Record

COC # 004

PROJECT NO: 22558 Task 500

SAMPLERS (Signature): BR Clow

DATE	TIME	SAMPLE NUMBER	PH	Gross α, β	NUMBER OF CONTAINERS
11/14/90	1545	01GA01002	X		1
	1545	02GA01003	X		1
	1545	03GA01004	X		1
	1545	04GA01005	X		1
	1545	05GA01006	X		1
	1115	01GA01001	X		1
	1600	02CWC1001		X	1
	1600	02CWC1002		X	1

TOTAL NUMBER OF CONTAINERS: 8

REMARKS (Sample preservation handling procedures etc.)

For Hazen Research

Matrix – Water

~~All samples stored on ice~~ BRC 11/14/90

– 24-hour Turnaround

BR Clow 11/14/90

Contact personnel: Brian Clow or Peter Finch x205

RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)	RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)
BR Clow	11/14/90 1620	Vicki Hebel	Vicki Hebel	11/15 8 00	[illegible]

METHOD OF SHIPMENT	SHIPPED BY (Signature)	COURIER (Signature)	RECEIVED FOR LAB BY (Signature)	DATE/TIME
Personal Delivery				

TMA
Thermo Analytical Inc.

TMA/Norcal
2030 Wright Avenue
P O Box 4040
Richmond CA 94804-0040
(415) 235-2633 Fax No (415) 235-0438

RECEIVED
JUN 6 1991

SENT TO FAX NO. 303-740-2705

May 31, 1991

Ref Report No RF027-A
Woodward-Clyde Sub-contract No 1033
TMA/Norcal NO-00-000-525

Mr Steve Boca
Woodward-Clyde
Stanford Place 3, Suite 612
4582 South Ulster Street Parkway
Denver, CO 80237

Subject Radiological Analyses of Water Samples from Rocky Flats, Report RF027-A

Dear Mr Boca

Two water samples from the Bench Scale Project at Rocky Flats were analyzed for the radionuclides requested on each The ^{239}Pu analysis from No 03CWC1005 had a low yield and the results do not pass the MDA and yield requirements The analysis would have been repeated but, unfortunately, only a 1-gallon sample had been received We usually receive 3 gallons per sample for these analyses

The results for two gross alpha and beta analyses, two isotopic uranium, one ^{239}Pu and two ^{241}Am analysis are given in the attached table The data package, prepared according to GRAASP protocol, will be sent when it has been prepared for the other samples in the processing group

Please contact me if you have any questions

Thank you for allowing TMA/Norcal to be of service

Sincerely,

Robert A. Wessman

Robert A Wessman, Manager
Nuclear Projects

RAW/ss

Enclosures Data Table

TMA I D	0000-0525-003			0000-0525-004		
Cust I D	03 CWC 1005			04 CWC 1006		
Coll Date	28-NOV-90			07 DEC-90		
Analysis	pCi/L +/- 2 σ		MDA	pCi/L +/- 2 σ		MDA
Gross Alpha	2 653	3 216	3 9	1 881	3 369	4 7
Gross Beta	5 832	2 409	3 4	4 095	2 332	3 5
U-233,234	4 015	0 987	0 22	4 649	1 261	0 39
U-235	0 113	0 112	0 26	0 361	0 288	0 34
U-238	3 222	0 852	0 22	4 649	1 261	0 28
Pu-239,240				0 024	0 010	0 008
Am-241	0 031	0 015	0 014	0 012	0 004	0 003

TMA
Thermo Analytical Inc.

TMA/Norcal
2030 Wright Avenue
P O Box 4040
Richmond CA 94804-0040
(415) 235-2633 Fax No (415) 235-0438

FACSIMILE COVER SHEET

TO.

NAME Stacy Smith DATE: 3/6/92

COMPANY: Woodward Clyde FAX NO: 303-694-3946

ADDRESS: TELE NO:

FROM.

NAME Julie Wose COMPANY: TMA/NORCAL

FAX NO: (415) 235-0438 VERIFICATION NO (415) 235-2633

NO OF PAGES 2 (INCLUDING COVER SHEET)

COMMENTS.

Stacy -

Here is a revised result sheet for RF027 which includes MDAs. Call me if you need more than this.

Julie

TMA

Rocky Flats Analytical Report RF027	February 16, 1991
Pond Samples	TMA/Norcal

TMA I. D.	0000-0525-001			0000-0525-002		
Cust. I.D.	01 CWC 1001			02 CWC 1003		
Coll. Date	13-NOV-90			20-NOV-90		
Analysis	pCi/L	+/- 2sig	MDA	pCi/L	+/- 2sig	MDA
Gross Alpha	6.679	3.593	3.770	5.801	3.934	4.110
Gross Beta	3.542	1.198	1.570	5.382	2.330	3.270
U-233,234	3.826	0.984	0.220	3.067	1.053	0.318
U-235	0.171	0.225	0.266	0.083	0.162	0.384
U-238	2.645	0.742	0.220	3.339	1.073	0.318
Sr-89,90						
Pu-239,240	0.011	0.009	0.008	0.012	0.008	0.007
Am-241	-0.001	0.009	0.012	0.004	0.005	0.006
Cs-137						
Tritium						
Ra-226						
Cm-244						

TMA
Thermo Analytical Inc.

TMA/Norcal
2030 Wright Avenue
P O Box 4040
Richmond CA 94804-0040

(415) 235-2633 Fax No (415) 235-0438

RECEIVED
FEB 21 1991

February 16, 1991

Ref Report No RF027
Woodward-Clyde Sub-contract No 1033
TMA/Norcal NO-11-188-525

Mr Steve Boca
Woodward-Clyde
Stanford Place 3, Suite 612
4582 South Ulster Street Parkway
Denver, CO 80237

Subject Radiological Analyses of Water Samples from Rocky Flats, Report RF027

Dear Mr Brooman

Two water samples from the Bench Scale Project at Rocky Flats were analyzed for the radionuclides requested on each The data package has been prepared, according to the GRRASP protocol The document inventory and the data package are enclosed

Both copies of the electronic deliverable diskettes have been forwarded to EG&G

Please contact me if you have any questions

Thank you for allowing TMA/Norcal to be of service

Sincerely,

Robert A. Wessman

Robert A Wessman, Manager
Nuclear Projects

RAW/ss

Enclosures Data Package

EG&G/Rocky Flats Bench Scale

Radiological Report

Collection Dates 11/13/90 - 12/07/90

Document Inventory

SECTION 1	Case Narrative
SECTION 2	Data Reports
SECTION 3	Quality Control Summary
Appendix A	Chains of Custodies
Appendix B	Copies of laboratory notebook sections
Appendix C	Raw Data Sheets
Appendix D	Quality Control raw data sheets

1 Case Narrative

Table 1 contains a list of samples analyzed along with collection dates and analysis dates

GENERAL - The two samples, listed on the Chains-of-Custody for this report, were labelled TMA/Norcal group 525 The samples were processed with another group (No 582) of Rocky Flats water samples in order to satisfy GRRASP protocol requirements in the most expeditious manner

Sample 525-1 and 2, which are expedited gross alpha and beta samples, from the bench scale project at Rocky Flats, were processed with this group for U, Pu, and Am Samples 525-1 and 2 are the only samples in this process group for which gross alpha and beta results are required To satisfy GRRASP protocol, three QC samaples were processed alongside The results are being reported along with the applicable QC results

Curium-244 was requested on one sample in Group 582 It was processed by our TP procedure Americium-243 tracer is used and ^{241}Am is analyzed at the same time The analysis data are labelled TP (for Trans Plutoniums) To satisfy GRRASP protocol, three QC samples were processed as TP, i e, ^{241}Am, ^{244}Cm

The samples were processed concurrently through the radiochemistry procedures, etc The internal QC analyses applies to all samples analyzed This sample group was processed under the GRRASP protocol

CHAINS-OF-CUSTODY - The analyses reported herein were requested on the following Chain-of-Custody documents

WC-001
WC-005

SAMPLE VOLUME SHORTAGES - There were no shortages

MISSING SAMPLES - All samples were accounted for

LEAKING SAMPLE - There were no leaking or damaged sample notations

SAMPLE COLLECTION DATES - A discrepancy was found on 582-76 The collection date was 10/5/90 on the Chain-of-Custody but, 9/5/90 on the bottle label The date 10/5/90 was taken as the correct value It was consistent with the other samples for this group

SAMPLE PREPARATION - None of the samples were considered to have a significant amount of insoluble material, which required filtering before analysis

HOLDING TIMES - All collections were made on 11/13/90 and 12/07/90 Therefore all of the analyses have been made well within the 180-day maximum requirement

ANALYSIS, REANALYSES, REWORKS, ETC.

Matrix Problems - No particular problems were observed which could be attributed to sample matrix effects

Alpha, Beta Analyses - No abnormalities were observed, except as follows

Sample 525-2 was reanalyzed Smaller than standard 0 3 L aliquots were taken to reduce the heavy salt residues Even so, there were heavy solids on the counting planchet and, therefore, the required RDL could not be achieved in such cases

	Aliquot	Residue	MDA α	MDA β
525-2	0 150 L	144 mg	4	3

The following samples had heavy salt residues, greater than 150 mg but, the MDA's were greater than the RDL of 4 pCi α/L but <4 pCi β/L The following all had 0 3 L aliquots and greater than 150 mg residues but such low activity that analysis of smaller aliquots would have given less accuracy and the MDA would still exceed the RDL's

	Residue	MDA α	MDA β
525-1	272 mg	4	2
525-225	264 g (replicate of 525-1)	3	2

U Analyses - No abnormalities were observed The average yield for twenty seven analyses was 60 ± 12% (1 σ) The lowest was 35% and the highest 88%

Pu Analyses - The average yield for twenty-six analyses was 59 ± 15% (1 σ) The lowest was 32% and the highest was 84% The only abnormality applicable to the bench scale samples is as follows

582-222 Pu - This analysis had a low yield (4 %) Solutions from the analysis were combined and reprocessed A better yield (31 %) was obtained and the MDA was satisfactory (0 02 pCi/sample) for a LLCS

Am or TP Analyses - The ^{243}Am tracer yields of the twenty-two Am and 4 Am-Cm analyses averaged 59 ± 16% The lowest was 31 % and the highest 95 % The only abnormality applicable to the bench scale samples is as follows

582-222 TP - The ^{241}Am energy region on the alpha spectrum was not well resolved from the ^{243}Am tracer peak region The sample plate was recounted with an improved spectrum The results for ^{241}Am and ^{244}Cm on the original count, were, however, in good statistical agreement with the final count, which was reported This sample turned out to be a LLCS

TMA I D	0000-0525-001		0000-0525-002		
Cust I D	01 CWC 1001		02 CWC 1003		
Coll Date	13-NOV-90		20-NOV-90		
Analysis	pCi/L	+/- 2sig	pCi/L	+/- 2sig	pCi/L +/- 2sig
Gross Alpha	6 679	3 593	5 801	3 934	
Gross Beta	3 542	1 198	5 382	2 330	
U-233,234	3 826	0 984	3 067	1 053	
U-235	0 171	0 225	0 083	0 162	
U-238	2 645	0 742	3 339	1 073	
Sr-89,90					
Pu-239,240	0 011	0 009	0 012	0 008	
Am-241	-0 001	0 009	0 004	0 005	
Cs-137					
Tritium					
Ra-226					
Cm-244					

1	01 CWC 1001	13-NOV-90	525-	1	Pu239	6-DEC-90
1	01 CWC 1001	13-NOV-90	525-	1	Am241	12-DEC-90
1	01 CWC 1001	13-NOV-90	525-	1	U 233	2-DEC-90
					U 235	2-DEC-90
					U 238	2-DEC-90
1	01 CWC 1001	13-NOV-90	525-	1	GrAlph	30-NOV-90
					GrBeta	30-NOV-90
2	02 CWC 1003	20-NOV-90	525-	2	Pu239	6-DEC-90
2	02 CWC 1003	20-NOV-90	525-	2	Am241	12-DEC-90
2	02 CWC 1003	20-NOV-90	525-	2	U 233	3-DEC-90
					U 235	3-DEC-90
					U 238	3-DEC-90
2	02 CWC 1003	20-NOV-90	525-	2	GrAlph	3-DEC-90
					GrBeta	3-DEC-90

3 Quality Control Summary

The protocol for a group of nineteen sample analyses is to analyze one HLCS, one LLCS, one Reagent Blank and two Replicates for each of the designated analytes As noted in the introduction, there were only two gross alpha, beta analyses and, hence, only one Replicate The QC samples are prepared and labelled by the Quality Control Officer Copies of the QC Notebook pages are included in the data package

The internal quality control fulfills the requirement for 10% replicates and 5% each of high laboratory control samples (HLCS), low laboratory control samples (LLCS), and reagent blanks The LLCS and blank samples had a salt mixture added to 0 3 L of D I water This brings the solids level up to approximately 100 mg per planchet for gross alpha and beta The other QC samples are analyzed using the same volume of D I water as for the corresponding sample analysis The salt mixture is added proportionate to the water volume (1 0 L or 2 5 L) as required for the specific analysis

Table 3 shows the results of the QC samples The recovery ratios were determined by the QC Officer based upon the final data obtained for each The data for the blanks shows the resultant pCi/analysis of each The blanks were calculated with an aliquot of 1 000 and therefore the presented data can not be compared directly with the sample data To compare them directly, the blank data would need to be divided by the appropriate aliquot 0 3 liters This would also apply to an evaluation of the MDA's of the HLCS and the LLCS analyses Standard aliquots for the analyses are as follows

Gross alpha and beta	0 3 L
$^{89+90}Sr$ or ^{137}Cs	1 0 L
U Isotopic	0 5 L
^{239}Pu, or ^{241}Am or TP	2 5 L

<u>SUMMARY OF RESULTS</u> - The results for Gross Alpha, Gross Beta, ^{90}Sr, ^{137}Cs, ^{239}Pu, ^{241}Am and ^{238}U were satisfactory for all QC analyses, except as follows

<u>Gross Alpha HLSC</u> - The recovery ratio is low (0 78 ± 0 18, 2 σ) but, it is satisfactory when evaluated at the 2 σ level, wherein it overlaps unity

<u>^{244}Cm HLCS</u> - The recovery ratio is slightly low (0 84 ± 0 11, 2 σ) but, it is satisfactory when evaluated at the 3 σ level, wherein it overlaps unity

<u>Replicates</u> - The results for all replicates, except gross alpha and ^{238}U are below MDA's and meet the analytical objectives The gross alpha has a high MDA due to salts, as discussed in the introduction, so it is considered satisfactory The ^{238}U results are positive, above RDL and the

paired results check within statistical limits The ^{238}U MDA's are satisfactory so the uranium also meets analytical objectives

Blanks - The blanks are equal to or less than the RDL's for each and meet analytical objectives

Table 3 QUALITY CONTROL SAMPLE RESULTS
SPIKES AND BLANKS (b and d)

TMA/Norcal Number	Nuclide	pCi/sample Found	± error 2 σ) MDA (a)	Added	Recovery Ratio (a) Found ± 2 σ / Added
High Laboratory Control Samples (HLCS)					
582-224	Gross α	15 6 ± 3 6	0 4	19 9 ± 0 8	0 78 ± 0 18
	Gross β	52 5 ± 5 3	0 5	50 3 ± 2 0	1 04 ± 0 11
	^{238}U	22 8 ± 3 4	0 2	21 7 ± 0 9	1 05 ± 0 16
	^{239}Pu		1 94 ± 0 27	0 02	2 25 ± 0 09 0 86 ± 0 13 (d)
	^{241}Am		2 20 ± 0 18	0 01	2 26 ± 0 09 0 97 ± 0 09
	^{244}Cm		3 58 ± 0 43	0 01	4 26 ± 0 17 0 84 ± 0 11 (g)
Low Laboratory Control Samples (LLCS)					
582-222	Gross α	4 7 ± 0 5	0 5	5 4 ± 0 2	0 87 ± 0 25
	Gross β	8 6 ± 1 1	0 6	8 4 ± 0 3	1 03 ± 0 14
	^{238}U	5 46 ± 1 20	0 1	5 43 ± 0 22	1 01 ± 0 23
	^{239}Pu		0 41 ± 0 10	0 02	0 45 ± 0 02 0 91 ± 0 22
	^{241}Am		0 50 ± 0 10	0 04	0 45 ± 0 02 1 11 ± 0 22
	^{244}Cm		0 43 ± 0 10	0 04	0 43 ± 0 02 1 00 ± 0 22
Blanks					
582-223	Gross α	0 4 ± 0 5	0 6	0	Satisfactory
	Gross β	0 2 ± 0 3	0 5	0	Satisfactory
	^{238}U	0 ± 0 06	0 2	0	Satisfactory
	^{239}Pu		0 03 ± 0 02	0 02	0
Satisfactory					
	^{241}Am		0 02 ± 0 02	0 02	0
Satisfactory					
	^{244}Cm		0 03 ± 0 02	0 01	0
Satisfactory					

TABLE 3 (cont'd)

QUALITY CONTROL RESULTS
REPLICATES

Nuclide	pCi/L ± error 2 σ				RDL	Comment (g)
	No. 582-225		No. 525-1 (01WC1001)		(e)	
	Replicate	MDA	Original	MDA		
Gross α	5 3 ± 3 2	3 1	6 7 ± 3 7	3 8	2	MAO (g)
Gross β	3 0 ± 3 9	1 6	3 5 ± 1 6	1 6	4	MAO (g)

Nuclide	pCi/L ± error 2 σ				RDL	Comment (g)
	No. 582-221		No. 525-84(NP50193WC)		(e)	
	Replicate	MDA	Original	MDA		
^{238}U	1 17 ± 0 56	0 2	1 12 ± 0 51	0 2	0 6	MAO (g)
$^{239,240}Pu$	0 00 ± 0 01	0 01	0 01 ± 0 00	0 01	0 01	MAO
^{241}Am	0 01 ± 0 01	0 01	0 01 ± 0 01	0 01	0 01	MAO
^{244}Cm	0 00 ± 0 01	0 01	0 01 ± 0 01	0 01	1	MAO

Nuclide	pCi/L ± error 2 σ				RDL	Comment (g)
	No. 582-220		No. 525-63(NP50173WC)		(e)	
	Replicate	MDA	Original	MDA		
^{238}U	1 22 ± 0 49	0 2	1 07 ± 0 53	0 3	0 6	MAO (g)
$^{239\ 240}Pu$	0 01 ± 0 01	0 01	0 00 ± 0 01	0 01	0 01	MAO
^{241}Am (-)	0 01 ± 0 00	0 00	0 00 ± 0 01	0 00	0 01	MAO
^{244}Cm	0 00 ± 0 01	0 01	0 00 ± 0 00	0 01	1	MAO

NOTES TO QC TABLES

(a) The QC officer prepares the samples and determines the recovery ratios

(b) The gross alpha and gross beta are spiked with ^{241}Am and $^{90}Sr(^{90}Y)$

(c) A mixture of $^{90}Sr(^{90}Y)$ and ^{137}Cs is analyzed and reported as $^{89,90}Sr$ and ^{137}Cs, respectively

(d) A mixture of ^{239}Pu and ^{241}Am is analyzed and reported as $^{239\ 240}Pu$ and ^{241}Am, respectively When ^{244}Cm is required, ^{244}Cm spike is used and the Am and Cm are processed as a group

(e) The required Detection Limits (RDL's) from Table 18 in GRRASP are listed

(f) Meets Analytical Objectives (MAO) - The replicate results agree within 95% error limits or else the results and MDA's are equal to, or less than the required Detection Limits

(g) Please refer to the comment in the QC Summary of Results section

Appendix A Chain of Custodies

Enclosed are copies of the chains of custody and airbills of the samples included in this report

Fed Ex 7578275714

Woodward-Clyde Consultants
Stanford Place 3 Suite 1000 4582 South Ulster Street Parkway
Denver Colorado 80237 (303) 694 2770

Chain of Custody Record

COC #001

PROJECT NO. 22558 TASK 500

SAMPLERS. (Signature) BR Clow

DATE	TIME	SAMPLE NUMBER	ANALYSES: Rad. Suite	NUMBER OF CONTAINERS
11/13/90	1135	ØLCNC LØØL	2	2

REMARKS (Sample preservation handling procedures etc.)

For TMA/Norcal

Matrix – Water

All samples stored on ice

*Rad Suite:
Gross α, β
$U^{233,234,235,238}$
$Pu^{239,240}$
Am^{241}

– preserved with HNO_3 to pH<2

Contact personnel

BR Clow 11/14/90

TOTAL NUMBER OF CONTAINERS 2

RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)	RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)
BR Clow	11/14/90 1700				

METHOD OF SHIPMENT	SHIPPED BY (Signature)	COURIER (Signature)	RECEIVED FOR LAB BY (Signature)	DATE/TIME
Fed Ex			Kermit Blum	11-15-90 1030

PM DHS

Woodward-Clyde Consultants

Stanford Place 3 Suite 1000 4582 South Ulster Street Parkway
Denver Colorado 80237 (303) 694 2770

Chain of Custody Record

COC # 005

PROJECT NO: 22558 Task 500

SAMPLERS (Signature): BR Clow

DATE	TIME	SAMPLE NUMBER	ANALYSES: Rad. Suite*						NUMBER OF CONTAINERS
11/20/90	1100	02CWC1003	2						2

BR Clow 11/20/90

REMARKS (Sample preservation handling procedures etc.)

For TMA/Norcal

Matrix – Water

~~All samples stored on ice.~~ BRC 11/20

*Rad Suite:
Gross α, β
$U^{233,234,235,238}$
$Pu^{239,240}$
Am^{241}
– Preserved w/ HNO_3 to pH<2

Contact personnel: Brian Clow (303) 279-4501 x 205

TOTAL NUMBER OF CONTAINERS: 2

RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)	RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)
BR Clow	11/20/90 1700				

METHOD OF SHIPMENT	SHIPPED BY (Signature)	COURIER (Signature)	RECEIVED FOR LAB BY (Signature)	DATE/TIME
Fed Ex.			Kermit Blum	10-21-90 1020

9727723235

Appendix B Copies of Laboratory Notebooks

Enclosed are copies of the lab book used for processing these samples Also included are copies of the QC notebook which was used in the preparation of the LCS and blank samples for analysis

2

582, 522, 525

THA #	CUST. ID	T°	ALIQUOTS Pu, Am	Cs, Sr	U	Th	Np
582- 60	SW00348WCWC	9-26-90	2.5L	1.0L	0.5L		
		9-27-90					
63	Np50173WC		Pu, Tp			0.2L	0.2L
64	Np50173WC						
analysis stopped 65	Np50173WC		—	—	—	—	—
67	Np50178WC	9-28-90	2.5	1.0L	0.5L		
70	Np50181WC	10-01-90					
71	Np50183WC						
73	Np50185WC	10-02-90		—			
74	Np50184WC			1.0L			
* 76	Np50189WC	9-05-90					*
80	Np50192WC	10-09-90					
81	Np50195WC						
82	Np50196WC	10-11-90					
84	Np50[illegible]						

582, 522, 525

TMA #	CUST ID	T°	ALIQUOTS Pu, Am	Cs, Sr	U	Th	Np	80 N/A
582- 92	Np80056 WC	10-18-90	2.5L	1.0L	0.5L			
93	Np80057 WC	↓	↓	↓	↓			↓
analysis stopped 94	Np50204 WC	10-22-90	Pu, Tp	—	—	—	—	
95	Np50204 WC	↓	Pu, Tp 2.5L	1.0L	0.5L	0.2L	0.2L	
522- 23	Np50227 WC	11-07-90		↓				
525- 1	01CWC 1001	11-13-90		—				0.3 L ↓
2	02 CWC 1003	11-20-90	↓	—				
582-220	Split # 63	9-27-90	Pu, Tp 2.5L	1.0L				N/A ↓
221	Split # 84	10-11-90	↓	↓	↓			
222	QC		Pu, Tp 1.0 ampl	1.0 sample	1.0 ampl	1.0 ampl	1.0 ampl	1.0 ampl
223	QC		1.0 ampl	↓	↓	↓	↓	↓
224	QC		1.0 ampl	↓	↓	↓	↓	
225	Split # 525-1	11-13-90	1.0 ampl —	—	—	—	—	0.3L

582, 522, 525

Carriers / Tracers Used

582- 90, 222, 223, 224
525- 1 + 2
522 -23
} 1 mL U^{232} F-F1-A-(13) TC 11/29/90

582- 60, 63, 64, 65, 67, 70, 71, 73, 74, 76, 80, 81, 82, 84, 89, 220, 221
} 1 mL U^{232} E-F1-A-(13) KS. 11/29/90

582- 51, 52, 179 1 mL Th^{227} B-C1-B-(3) 10 drops Y scavenge.
} see p. 41

582- 60, 63, 64, 67, 70, 71, 73, 74, 76, 80, 81, 82, 84, 89, 90, 91, 92, 93, 95, 522-23, 525-1, 2, 582-220, 221, 222, 223, 224
} 1 mL Sr H-01-(5) 1 mL Cs B B1-(4) KA 11/30/90

582- 60, 63, 64, 67, 70, 71, 73, 74, 76, 80, 81, 82, 84, 89, 90, 91, 92, 93, 95, 220, 221, 222, 223, 224
525- 23
525- 1, 2
} 1 mL Y scav 1 mL Am^{243} H-E1-A-(5) 1 mL Pu^{242} G4-D2-A-(2) TC 12/3/90

Np- 582- 63, 95, 220, 223, 224 - 1 mL Am^{243} H-E1-C-(3) TC 1/11/91

6"	QC #	TMA/Sample #	Date	Analysis	Liquor/Prep. Meth.	Key'd By		SPIKE INFORMATION: Volume	Spike Tracer (I)	Activity/Gram	% Error	Activity/Aliquot	% Error (I)	Matrix	Contains	Remarks	ANALYSIS RESULTS: Date Run	Form	Nuclide	OK	Re	CAL #	Recount By	Remarks
3	3849	582-224	23 Dec 90	$U^{232,234,238}$	TC/ARW	Key	✓	100λ	Th^{232} C1	46.15	2.0	4.0-90	0.10	20 ml 1N HNO_3	100 ml Beaker									
3	3850	-224	"	Np-237	"	Key	✓	5 ml	Np^{237} F-G2-A	45.45	"	"	5.50	20 ml 6N HCl	" "									
3	3851	440-12	30 Nov 90	U-234,5,8	HCS/ARW	Key	✓	300λ	U^{238} E1-B	7.23	"	"	0.21	20 ml 0.5N HNO_3	100 ml Beaker									
3	3852	-13	"	"	"	Key	✓	—	—	—	—	—	—	"	" "									
3	3853	5102-57	3 Dec 90	Sr-90	SCS/Acetate	Key	✓	1 ml	Sr^{90} M1-A	13.39	2.0	4.0-90	1.01	20 ml 0.1N HCl	100 ml Beaker	Mass Spec	12 Dec 90	DPK	Sr^{90}	✓	—	—	Key	Corrected data rec 12/14/90 Key ok
3	3854	582-222	5 Dec 90	Type 90 Gross α	TC/ARW	Key	✓	300λ	Am^{241} F1-B	12.033	2.0	3440-90	0.30	20 ml 0.1N HNO_3	50 ml Beaker									
				" β		Key	✓	500λ	Sr^{90} M1-B	β = 18.612	"	"	0.51											
3	3855	-223	"	Type 90 Gross α	"	Key	✓	—	—	—	—	—	—	"	" "									
				" β				—	—	—	—	—	—											
3	3856	-224	"	Type 90 Gross α	"	Key	✓	1.1 ml	Am^{241} F1-B	44.121	2.0	3440-90	1.11	" "	" "									
				" β		Key	✓	3 ml	Sr^{90} M1-B	β = 111.7	"	"	3.00											
3	3857	587-101	5 Dec 90	Type 90 Gross α	LA/ARW	Key	✓	300λ	Am^{241} E1-B	12.033	"	"	0.30	0.1 ml 0.1N HNO_3	" "		9 Jan 91	DJ	Gross α	✓	—	—	Key	
				" β		Key	✓	500λ	Sr^{90} M1-B	β = 18.612	"	"	0.50				"	"	" β	✓	—	—	Key	
3	3858	-102	"	Type 90 Gross α	"	Key	✓	—	—	—	—	—	—	"	" "		"	"	" α	✓	—	—	Key	
				" β				—	—	—	—	—	—				"	"	" β	✓	—	—	Key	
	3859	-103	"	Type 90 Gross α	"	Key	✓	1 ml	Am^{241} F1-B	β = 40.110	2.0	3440-90	1.00	"	" "									
				" β		Key	✓	3 ml	Sr^{90} M1-B	β = 111.7	"	"	3.00											
3	3860	588-101	"	Type 90 Gross α	"	Key	✓	—	—	—	—	—	—	"	" "									
				" β				—	—	—	—	—	—											
3	3861	-102	"	Type 90 Gross α	"	Key	✓	1.1 ml	Am^{241} F1-B	44.121	2.0	3440-90	1.11	"	" "									
				" β		Key	✓	3.5 ml	Sr^{90} M1-B	β = 130.3	"	"	3.50											
3	3862	-103	"	Type 90 Gross α	"	Key	✓	300λ	Am^{241} F1-B	12.033	"	"	0.30	"	" "									
				Gross β		Key	✓	600λ	Sr^{90} M1-B	β = 22.334	"	"	0.60											
3	3863	589-101	"	Type 90 Gross α	"	Key	✓	1.1 ml	Am^{241} F1-B	44.121	"	"	1.11	"	" "									
				" β		Key	✓	3.2 ml	Sr^{90} M1-B	β = 119.1	"	"	3.20											
3	3864	-102	"	Type 90 Gross α	"	Key	✓	400λ	Am^{241} F1-B	16.044	"	"	0.40	"	" "									
				" β		Key	✓	600λ	Sr^{90} M1-B	β = 22.334	"	"	0.60											
3	3865	-103	"	Type 90 Gross α,β	"	Key	✓	—	—	—	—	—	—											

QC#	Tank/Barrel #	Date	Analysis	Equipment/Procedure	Rec'd By	✓	SPIKE INFORMATION: Volume	Spike Tracer & ID	Activity/Amount	Spike Conc.	Activity Date	Sp. Wt. (g)	Matrix	Container	Remarks	ANALYSIS RESULTS: Date Rec'd	Form	Nuclide	OK	NI	UNCR	Reported By	Remarks
3830	136-16-06	29 Nov 90	Ra-226	AG/RAW	Ky	✓	3 ml	Ra^{226} F1-B	20.49	2.0	1.0-90	2.02	5 ml 0.05 N HNO_3	100 ml Beaker		—	—	—	—	—	—	—	
3831	-07	"	"	"	Ky	✓	3 ml	"	20.49	"	"	2.02	" "	" "		—	—	—	—	—	—	—	
3832	-08	"	"	"	Ky	✓	3 ml	"	20.49	"	"	2.02	" "	" "		—	—	—	—	—	—	—	Not QC Samp
3833	516-221	29 Nov 90	Ra-226	AG/RAW	Ky	✓	~~1 ml~~ No activity added	Ra^{226} F1-B	~~6.93~~	~~2.0~~	~~1.0-90~~		5 ml 0.05 N HNO_3	150 ml Beaker	Blank								
3834	-281	"	Ra-226	"	Ky	✓	1 ml	Ra^{226} F1-B	6.93	2.0	1.0-90	1.00	" "	100 ml Beaker									
3835	-291	"	Ra-226	"	Ky	✓	100 λ	Ra^{226} F1-B	0.693	"	"	0.10	" "	" "									
3836	582-222	29 Nov 90	Pu-239	TC/RAW	Ky	✓	500 λ	Pu^{239} H1 A-A	1.0002	20	1.0-90	0.57	4 N HNO_3 } + 18 ml		Excludes Pu^{240} from Cm^{244}								
			Am-241		Ky	✓	1 ml	Am^{241} F1-D	1.005	"	"	1.00	0.1 N HCl } 2 N HNO_3	100 ml Beaker									
			Cm-244		Ky	✓	100 λ	Cm^{244} J1-A	0.9460	"	"	0.10	1 N HNO_3 }										
3837	-222	"	Sr-90	"	Ky	✓	2 ml	Sr^{90} M1-A	26.78	"	"	2.01	20 ml 0.1 N HCl	" "									
			Cs-137		Ky	✓	500 λ	Cs^{137} F1-B	24.52	"	"	0.50											
3838	-222	"	U-234,5,8	"	Ky	✓	500 λ	U^{238} E1-B	12.05	"	"	0.51	20 ml 0.5 N HNO_3	" "									
3839	-222	"	Th-232,230	"	Ky	✓	2 ml	Th^{232} C1-A	9.250	"	"	2.05	20 ml 1 N HNO_3	" "									
3840	-222	"	Np-237	"	Ky	✓	1 ml	Np^{237} F-G3 A	9.090	"	"	1.10	20 ml 6 N HCl	" "									
3841	-223	"	Pu-239	"			—	—	—	—	—	—											
			Am-241		Ky	✓	—	—	—	—	—	—	20 ml 3 N HNO_3	" "									
			Cm-244				—	—	—	—	—	—											
3842	-223	"	Sr-90	"	Ky	✓	—	—	—	—	—	—	20 ml 0.1 N HCl	" "									
~~3843~~	~~Rec 11/27/90 223~~		Cs-137				—	—	—	—	—	—											
3843 ~~3844~~	-223 Rec 11/27/90	"	U-234,5,8	"	Ky	✓	—	—	—	—	—	—	20 ml 0.5 N HNO_3	" "									
3844	-223	"	Th-232,230	"	Ky	✓	—	—	—	—	—	—	20 ml 1 N HNO_3	" "									
3845	-223	"	Np-237	"	Ky	✓	—	—	—	—	—	—	20 ml 6 N HCl	" "									
3846	-224	"	Pu-239	"	Ky	✓	25 ml	H1-A-A, Pu^{239}	5.002	2.0	1.0-90	2.24	4 N HNO_3 } 15 ml		Excludes Pu^{240} from Cm^{244}								
			Am-241		Ky	✓	1 ml	Am^{241} F1-C	6.022	"	"	1.00	0.1 N HCl } 2 N HNO_3	" "									
			Cm-244		Ky	✓	1 ml	Cm^{244} J1-A	9.460	"	"	1.04	1 N HNO_3 }										
3847	-224	"	Sr-90	"	Ky	✓	200 λ	Sr^{90} M1	95.90	"	"	0.20	20 ml 0.1 N HCl	" "									
			Cs-137		Ky	✓	2 ml	Cs^{137} F1-B	98.08	"	"	2.00											
3848	-224	"	U-234,5,8	"	Ky	✓	2 ml	U^{238} E1-B	48.20	"	"	2.03	20 ml 0.5 N HNO_3	" "									

Appendix C Raw Data Sheets

Enclosed are copies of the raw data sheets for all analyses

04-DEC-90 TMA Corporation 525- 2A1 80
13 02 00 Gross Alpha, Gross Beta Analysis 02 CWC 1003
AB4000 V 1 01

Reviewed Date 12/4/90

Counted 338 668-90 (B1 1470 volts)

0 150 1	143 500 mg	143 500 mg
Aliquot	Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 105	GRB 105
Counts =	19 000	166 000
Time =	100 000	100 000
Gross cpm =	0 190	1 660
Background =	0 046	0 889
Observed CPM =	0 144	0 771
Cross talk fac =	0 006	0 343
True CPM =	0 140	0 723
Eff (cpm/dpm) =	0 073	0 403
DPM of Aliquot =	1 932	1 792
pCi /l =	5 80	5 38
1 sigma % Err =	34 603	22 090
(1 sigma err) =	2 01	1 19
(2 sigma err) =	4 01	2 38
LTV (95 %) =	9 11	7 34
MDA =	4 11	3 27

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	335 996	90	0 046	0 889	2394 29
SF	338 616	90	0 993	1 016	10 00

LOG FILE information (File name NP [50,1]GAW 105 LOG)

Time of count	GMT	Planchet Identification	A-cpm	B-cpm	Time
15 54 1-DEC-90	335 996	BK	0	1	2394 29
7 59 3-DEC-90	337 666	SF	753	1271	10 00
6 47 4-DEC-90	338 616	SF	755	1296	10 00

04-DEC-90 TMA Corporation 525- 1 U
22 50 39 Alpha Spectroscopy 01 CWC 1001
ASPEC V 2 09

W 12/5

Reviewed [illegible] Date 12/5/90

Counted on	SS 5	126 20 minutes
GMT	339 153 90	
Zero time	317 333 90	
GMT of std	338 995 90	
Sep time	0 000 0	

Chemical yield 0 5602

Tracer - U 232 (F-F1-A-(13) 240 738-89)
11 41 Dpm X 0 9879 = 11 27 Corr tracer DPM

Channels	104-128	
Bkg CPM	0 00452	(on 335 978 90 for 2433 53 Min
Gross cnts	216	
Background	1	
Net counts	215	7 0%
Divisor	1 9075E+01	(net counts / corr tracer DPM)
Det Eff	0 2698	
Yield	0 5602	(net counts) / (eff x corr tracer DPM X time)

	U 238		U 235		U 233 /4		U 234	
Channels	21- 41		43- 61		64- 94		70- 88	
Bkg CPM	0 00123		0 00000		0 00041		0 00000	
Gross cnts	56		3		81		80	
Background	0		0		0		0	
Tracer cts	0	0	0	0	0	0	0	0
U235 cnts	0		0		0		0	
Net counts	56	7	3	2	81	9	80	9
Lambda	(4 2266E-13)		(2 6729E-12)		(1 1714E-08)		(7 6520E-09)	
Decay corr	1 0000		1 0000		1 0000		1 0000	
Brnch ratio	1 0000		0 8260		1 0000		1 0000	
DPM of aliq	2 9358E+00		1 9041E-01		4 2465E+00		4 1940E+00	
Aliquot	5 0000E-01		5 0000E-01		5 0000E-01		5 0000E-01	
Dpm/l	5 8717E+00		3 8081E-01		8 4929E+00		8 3881E+00	
pCi /l	2 645E+00		1 715E-01		3 826E+00		3 778E+00	
1 sigma Err	14 3%		67 0%		13 1%		13 2%	
pCi Err	3 786E-01		1 150E-01		5 019E-01		5 002E-01	
2 sigma Err	28 6%		134 1%		26 2%		26 5%	
pCi Err	7 572E-01		2 300E-01		1 004E+00		1 000E+00	
Limitng Vlu	< 3 27E+00		< 3 61E-01		< 4 65E+00		< 4 60E+00	
MDA	2 20E-01		2 66E-01		2 20E-01		2 20E-01	

P (F)

02

525 1 U 339 153 126 20 MIN SS 5

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	643	0	156	575	0	-104	507	0	-52	440	0
0	0	0	207	641	0	155	574	0	103	506	0	-51	438	0
0	0	0	206	640	0	154	572	0	102	505	0	-50	437	2
0	0	0	205	639	0	153	571	0	101	503	0	-49	436	0
256	705	0	204	637	0	152	570	0	100	502	0	-48	434	0
255	704	0	203	636	0	151	568	0	99	501	0	-47	433	0
254	702	0	202	635	0	150	567	0	98	499	0	-46	432	0
253	701	0	201	633	0	149	566	0	97	498	0	-45	430	0
252	700	0	200	632	0	148	564	0	96	497	0	-44	429	0
251	699	0	199	631	0	147	563	0	95	495	1	-43	428	0
250	697	0	198	630	0	146	562	0	-94	494	0	42	427	0
249	696	0	197	628	0	145	561	0	-93	493	0	-41	425	2
248	695	0	196	627	0	144	559	0	-92	492	0	-40	424	3
247	693	0	195	626	0	143	558	0	-91	490	0	-39	423	5
246	692	0	194	624	0	142	557	0	-90	489	0	-38	421	5
245	691	0	193	623	0	141	555	0	-89	488	0	-37	420	9
244	689	0	192	622	0	140	554	0	-88	486	0	-36	419	5
243	688	0	191	620	0	139	553	0	-87	485	2	-35	417	4
242	687	0	190	619	0	138	551	0	-86	484	1	-34	416	7
241	686	0	189	618	0	137	550	0	-85	482	0	-33	415	6
240	684	0	188	617	0	136	549	0	-84	481	3	-32	413	4
239	683	0	187	615	0	135	548	0	-83	480	8	-31	412	2
238	682	0	186	614	0	134	546	0	-82	479	15	-30	411	4
237	680	0	185	613	0	133	545	0	-81	477	12	-29	410	0
236	679	0	184	611	0	132	544	0	-80	476	12	-28	408	0
235	678	0	183	610	1	131	542	0	-79	475	5	-27	407	0
234	676	0	182	609	0	130	541	0	-78	473	9	-26	406	0
233	675	0	181	607	1	129	540	0	-77	472	3	-25	404	0
232	674	0	180	606	0	-128	538	1	-76	471	2	-24	403	0
231	673	0	179	605	0	-127	537	1	-75	469	4	-23	402	0
230	671	0	178	604	0	-126	536	12	-74	468	1	-22	400	0
229	670	0	177	602	0	-125	535	25	-73	467	2	-21	399	0
228	669	0	176	601	0	-124	533	40	-72	466	1	20	398	0
227	667	0	175	600	0	-123	532	29	-71	464	0	19	397	0
226	666	0	174	598	0	-122	531	31	-70	463	0	18	395	0
225	665	0	173	597	0	-121	529	23	-69	462	0	17	394	0
224	663	0	172	596	0	-120	528	23	-68	460	1	16	393	0
223	662	0	171	594	0	-119	527	9	-67	459	0	15	391	0
222	661	0	170	593	0	-118	525	11	-66	458	0	14	390	0
221	660	0	169	592	0	-117	524	6	-65	456	0	13	389	0
220	658	0	168	591	0	-116	523	0	-64	455	0	12	387	0
219	657	0	167	589	0	-115	522	2	63	454	0	11	386	0
218	656	0	166	588	0	-114	520	1	62	453	0	10	385	0
217	654	0	165	587	0	-113	519	1	-61	451	0	9	384	0
216	653	0	164	585	0	-112	518	0	-60	450	0	8	382	0
215	652	0	163	584	0	-111	516	0	-59	449	1	7	381	0
214	650	0	162	583	0	-110	515	1	-58	447	0	6	380	0
213	649	0	161	581	0	-109	514	0	-57	446	0	5	378	0
212	648	0	160	580	0	-108	512	0	-56	445	0	4	377	0
211	646	0	159	579	0	-107	511	0	-55	443	0	3	376	0
210	645	0	158	578	0	-106	510	0	-54	442	0	2	374	0
209	644	0	157	576	0	-105	509	0	-53	441	0	1	373	0

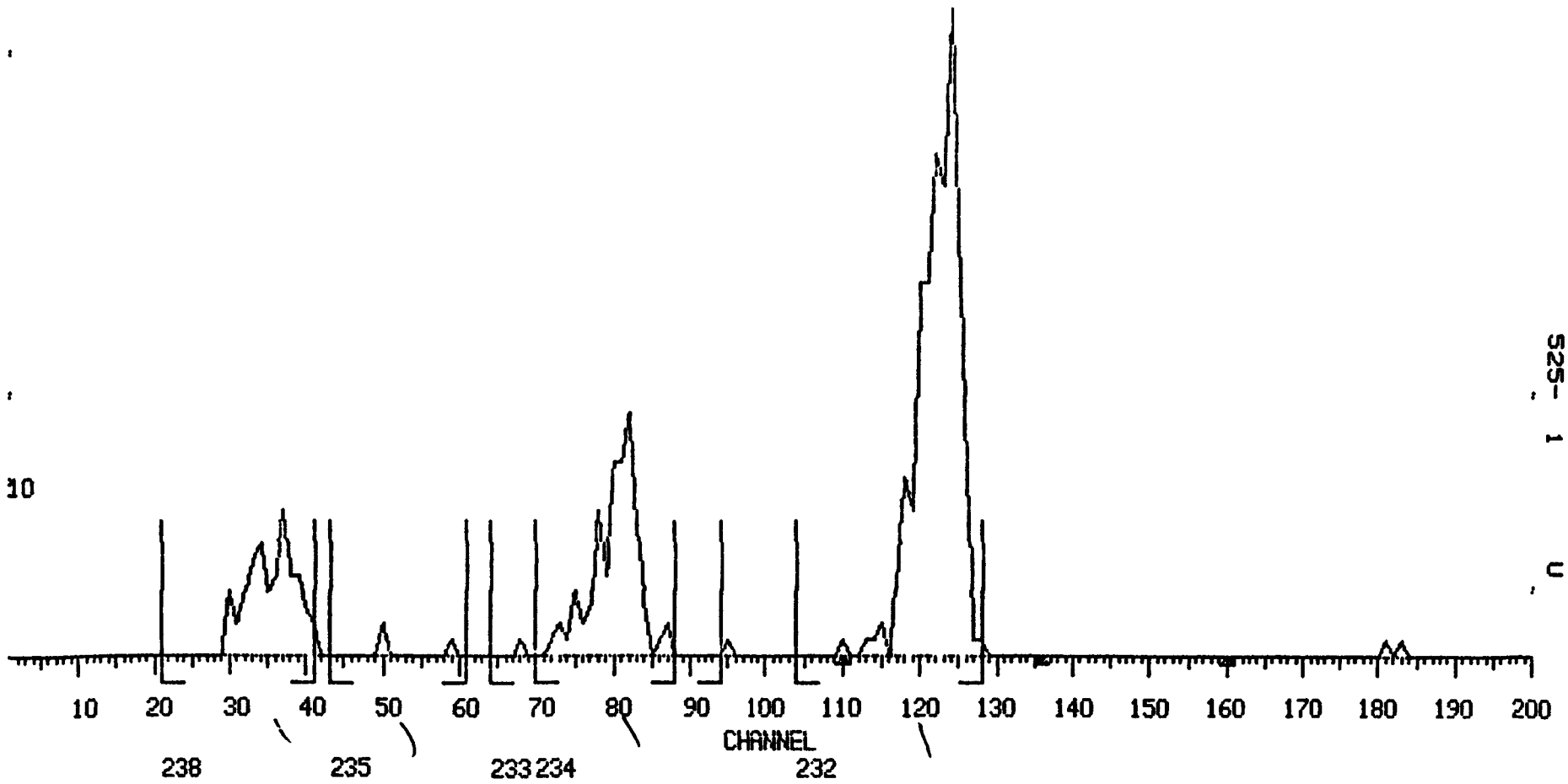
238 235 233 234 232

21- 41 43- 61 64- 94 70- 88 104- 128

525- 1 U SS 5 339 153 90 126 20 MIN PLAWT V 1 00

3 8 3 9 4 0 4 1 4 2 4 3 4 4 4 5 4 6 4 7 4 8 4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8 5 9 6 0 6 1 6 2 6 3

MEV



525- 1 U

04

05-DEC-90 TMA Corporation 525- 2 U
20 33 00 Alpha Spectroscopy 02 CWC 1003
ASPEC V 2 09

Reviewed Date 12/4/90

Counted on SS 3 122 62 minutes
GMT 340 099 90
Zero time 324 333 90

GMT of std 340 084 90
Sep time 0 000 0 Chemical yield 0 3730

Tracer - U 232 (F-F1-A-(13) 240 738-89)
11 41 Dpm X 0 9878 = 11 27 Corr tracer DPM

Channels 106-130
Bkg CPM 0 00904 (on 335 978 90 for 2433 53 Min

Gross cnts 150
Background 1
Net counts 149 8 1%

Divisor 1 3220E+01 (net counts / corr tracer DPM)
Det Eff 0 2890
Yield 0 3730 (net counts) / (eff x corr tracer DPM X time)

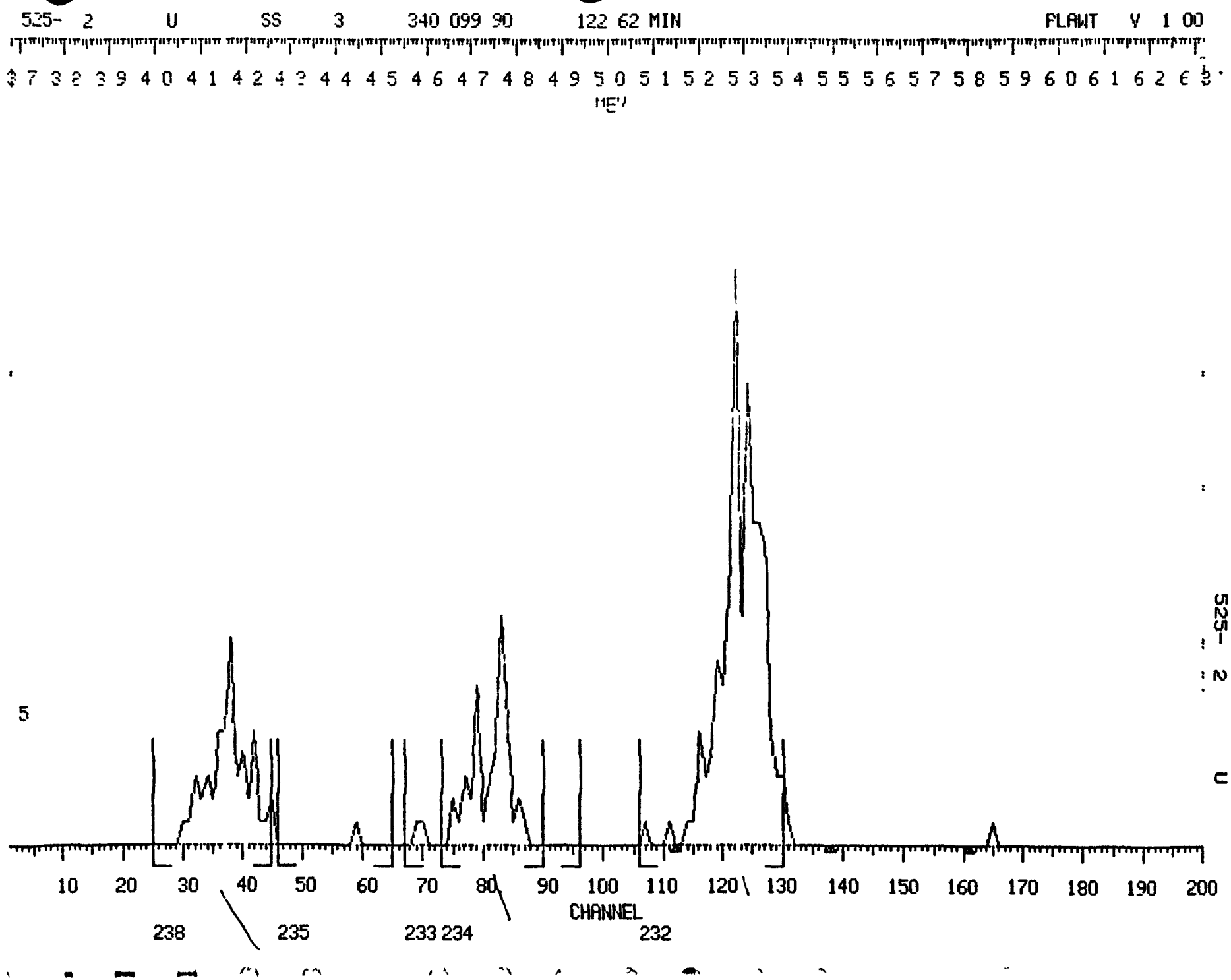
	U 238		U 235		U 233/4		U 234	
Channels	25- 45		46- 65		67- 96		73- 90	
Bkg CPM	0 00082		0 00082		0 00370		0 00205	
Gross cnts	49		1		45		43	
Background	0		0		0		0	
Tracer cts	0	0	0	0	0	0	0	0
U235 cnts	0		0		0		0	
Net counts	49	7	1	1	45	7	43	7
Lambda	(4 2266E-13)		(2 6729E-12)		(1 1714E-08)		(7 6520E-09)	
Decay corr	1 0000		1 0000		1 0000		1 0000	
Brnch ratio	1 0000		0 8260		1 0000		1 0000	
DPM of aliq	3 7066E+00		9 1581E-02		3 4041E+00		3 2528E+00	
Aliquot	5 0000E-01		5 0000E-01		5 0000E-01		5 0000E-01	
Dpm/l	7 4133E+00		1 8316E-01		6 8081E+00		6 5055E+00	
pCi /l	3 339E+00		8 251E-02		3 067E+00		2 930E+00	
1 sigma Err	16 4%		100 3%		17 5%		18 2%	
pCi Err	5 476E-01		8 277E-02		5 372E-01		5 322E-01	
2 sigma Err	32 8%		200 6%		35 0%		36 3%	
pCi Err	1 095E+00		1 655E-01		1 074E+00		1 064E+00	
Limitng Vlu	< 4 24E+00		< 2 19E-01		< 3 95E+00		< 3 81E+00	
MDA	3 18E-01		3 84E-01		3 18E-01		3 18E-01	

P (F)

525 2 U 340 099 122 62 MIN SS 3

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	642	0	156	573	0	104	504	0	-52	435	0
0	0	0	207	641	0	155	572	0	103	503	0	-51	434	0
0	0	0	206	640	0	154	571	0	102	502	0	-50	433	0
0	0	0	205	638	0	153	569	0	101	500	0	-49	431	0
256	706	0	204	637	0	152	568	0	100	499	0	-48	430	0
255	705	0	203	636	0	151	567	0	99	498	0	-47	429	0
254	703	0	202	634	0	150	565	0	98	496	0	-46	427	0
253	702	0	201	633	0	149	564	0	97	495	0	-45	426	2
252	701	0	200	632	0	148	563	0	-96	494	0	-44	425	1
251	699	0	199	630	0	147	561	0	-95	492	0	-43	423	1
250	698	0	198	629	0	146	560	0	-94	491	0	-42	422	5
249	697	0	197	628	0	145	559	0	-93	490	0	-41	421	2
248	695	0	196	626	0	144	557	0	-92	488	0	-40	419	4
247	694	0	195	625	0	143	556	0	-91	487	0	-39	418	3
246	693	0	194	624	0	142	555	0	-90	486	0	-38	417	9
245	691	0	193	622	0	141	553	0	-89	484	0	-37	415	5
244	690	0	192	621	0	140	552	0	-88	483	0	-36	414	5
243	689	0	191	620	0	139	551	0	-87	482	1	-35	413	2
242	687	0	190	618	0	138	549	0	-86	480	2	-34	411	3
241	686	0	189	617	0	137	548	0	-85	479	1	-33	410	2
240	685	0	188	616	0	136	547	0	-84	478	6	-32	409	3
239	683	0	187	614	0	135	545	0	-83	476	10	-31	407	1
238	682	0	186	613	0	134	544	0	-82	475	4	-30	406	1
237	681	0	185	612	0	133	543	0	-81	474	3	-29	405	0
236	679	0	184	610	0	132	541	0	-80	472	1	-28	403	0
235	678	0	183	609	0	131	540	1	-79	471	7	-27	402	0
234	677	0	182	608	0	-130	539	3	-78	470	2	-26	401	0
233	675	0	181	606	0	-129	537	3	-77	468	3	-25	399	0
232	674	0	180	605	0	-128	536	5	-76	467	1	24	398	0
231	673	0	179	604	0	-127	535	13	-75	466	2	23	397	0
230	671	0	178	602	0	-126	533	14	-74	464	0	22	395	0
229	670	0	177	601	0	-125	532	14	-73	463	0	21	394	0
228	669	0	176	600	0	-124	531	20	-72	462	0	20	393	0
227	667	0	175	598	0	-123	529	10	-71	460	0	19	391	0
226	666	0	174	597	0	-122	528	25	-70	459	1	18	390	0
225	665	0	173	596	0	-121	527	12	-69	458	1	17	389	0
224	663	0	172	594	0	-120	525	7	-68	456	0	16	387	0
223	662	0	171	593	0	-119	524	8	-67	455	0	15	386	0
222	661	0	170	592	0	-118	523	4	66	454	0	14	385	0
221	660	0	169	590	0	-117	521	3	-65	452	0	13	383	0
220	658	0	168	589	0	-116	520	5	-64	451	0	12	382	0
219	657	0	167	588	0	-115	519	1	-63	450	0	11	381	0
218	656	0	166	586	0	-114	517	1	-62	448	0	10	379	0
217	654	0	165	585	1	-113	516	0	-61	447	0	9	378	0
216	653	0	164	584	0	-112	515	0	-60	446	0	8	377	0
215	652	0	163	583	0	-111	513	1	-59	444	1	7	375	0
214	650	0	162	581	0	-110	512	0	-58	443	0	6	374	0
213	649	0	161	580	0	-109	511	0	-57	442	0	5	373	0
212	648	0	160	579	0	-108	510	0	-56	440	0	4	371	0
211	646	0	159	577	0	-107	508	1	-55	439	0	3	370	0
210	645	0	158	576	0	-106	507	0	-54	438	0	2	369	0
209	644	0	157	575	0	105	506	0	-53	436	0	1	367	0

238	235	233	234	232
25- 45	46- 65	67- 96	73- 90	106- 130


525- 2 U SS 3 340 099 90 122 62 MIN PLAWT V 1 00
MEV
5
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
CHANNEL
238
235
233 234
232
525- 2 U

08-DEC-90 TMI Corporation 525- 1 Pu
17 16 13 Alpha Spectroscopy 01 CWC 1001
ASPEC V 2 09

Reviewed Date 12/10/90

Counted on SS 23 1013 55 minutes
GMT 342 251 90
Zero time 317 333 90

GMT of std 342 106 90
Sep time 0 000 0

Chemical yield 0 4606

Tracer - Pu242 (G4-D2-A-(2) 160 269-90)
5 96 Dpm X 1 0000 = 5 96 Corr tracer DPM
Channels 84-102 Drift correction -1 4
Bkg CPM 0 00287 (on 335 978 90 for 2434 98 Min

Gross cnts 893
Background 3
Net counts 890 3 4%

Divisor 1 4928E+02 (net counts / corr tracer DPM)
Det Eff 0 3197
Yield 0 4606 (net counts) / (eff x corr tracer DPM X time)

	Pu239		Pu238		Pu236	
Channels	103-119		122 144		148-164	
Bkg CPM	0 00203		0 00164		0 00041	
Gross cnts	11		1		3	
Background	2		2		0	
Tracer cts	0	0	0	0	0	0
Net counts	9	4	-1	2	3	2
Lambda	(7 7775E-08)		(2 2005E-05)		(6 6560E-04)	
Decay corr	1 0000		0 9995		0 9836	
Branch ratio	1 0000		1 0000		1 0000	
DPM of aliq	6 0790E-02		-6 7025E-03		2 0433E-02	
Aliquot	2 5000E+00		2 5000E+00		2 5000E+00	
Dpm/l	2 4116E-02		-2 6810E 03		8 1731E-03	
pCi /l	1 086E-02		-1 208E-03		3 682E-03	
1 sigma Err	44 6%		200 0%		66 8%	
pCi Err	4 829E-03		2 416E-03		2 458E-03	
2 sigma Err	89 1%		400 1%		133 5%	
pCi Err	9 687E-03		4 831E-03		4 915E-03	
Limiting Vlu	< 1 807E-02		< 3 99E-03		< 7 74E-03	
MDA	7 95E-03		7 96E-03		5 72E-03	

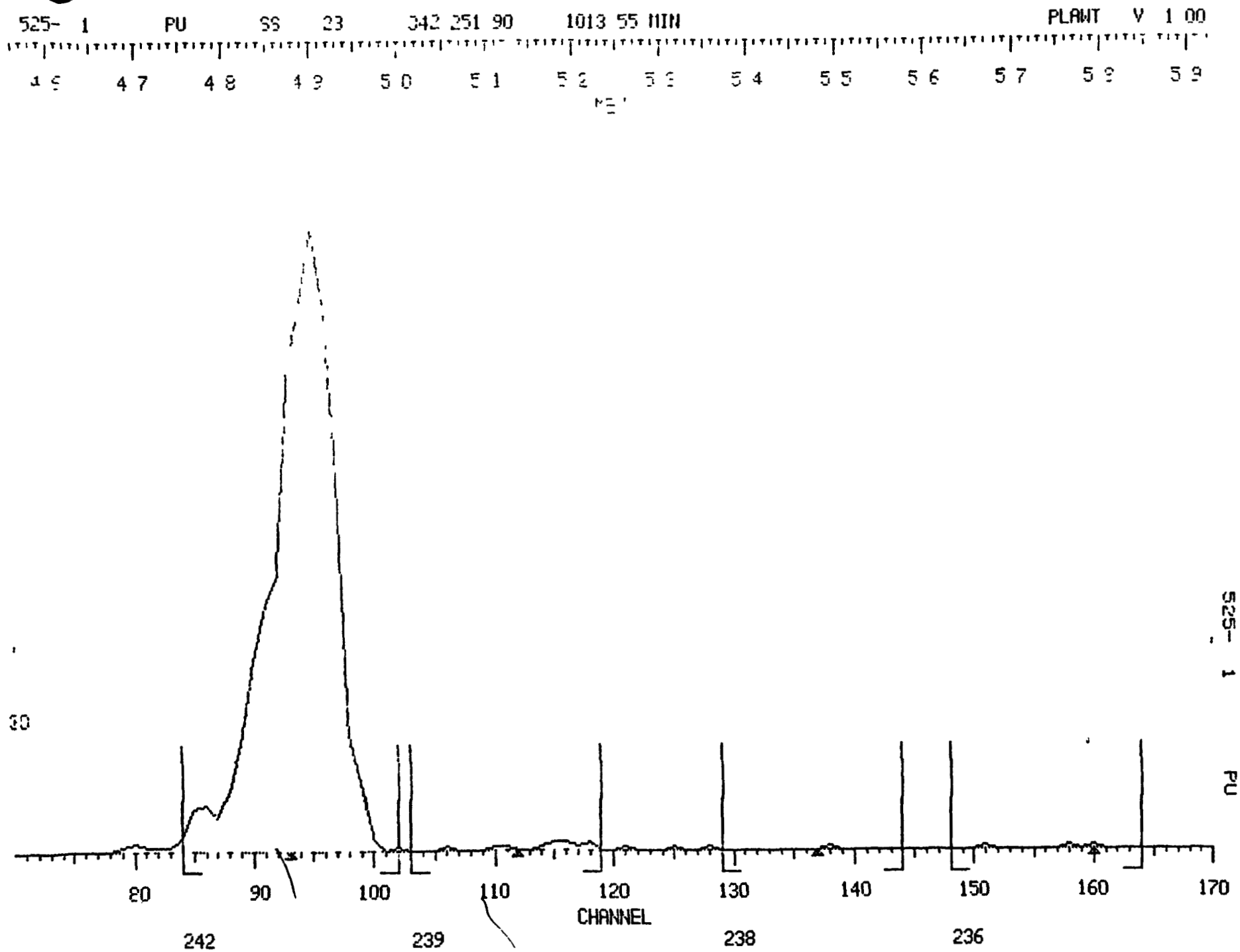
525 1 Pu 34 251 1013 55 MIN SS 23

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	642	0	-156	573	0	-104	502	0	52	431	0
0	0	0	207	643	0	-155	572	0	-103	501	0	51	430	0
0	0	0	206	641	0	-154	570	0	-102	499	1	50	428	0
0	0	0	205	640	0	-153	569	0	-101	498	0	49	427	0
256	709	0	204	638	0	-152	567	0	-100	496	3	48	425	0
255	708	0	203	637	0	-151	566	1	-99	495	15	47	424	0
254	707	0	202	636	0	-150	565	0	-98	494	28	46	423	0
253	705	0	201	634	0	-149	563	0	-97	492	89	45	421	0
252	704	0	200	633	0	-148	562	0	-96	491	129	44	420	0
251	703	0	199	632	0	147	561	0	-95	490	146	43	419	0
250	701	0	198	630	0	146	559	0	-94	488	128	42	417	0
249	700	0	197	629	0	145	558	0	-93	487	113	41	416	0
248	698	0	196	627	0	-144	556	0	-92	485	65	40	414	0
247	697	0	195	626	0	-143	555	0	-91	484	58	39	413	0
246	696	0	194	625	0	-142	554	0	-90	483	45	38	412	0
245	694	0	193	623	0	-141	552	0	-89	481	26	37	410	0
244	693	0	192	622	0	-140	551	0	-88	480	15	36	409	0
243	692	0	191	621	0	-139	550	0	-87	479	8	35	408	0
242	690	0	190	619	0	-138	548	1	-86	477	11	34	406	0
241	689	0	189	618	0	-137	547	0	-85	476	10	33	405	0
240	688	0	188	617	0	-136	546	0	-84	475	3	32	404	0
239	686	0	187	615	0	-135	544	0	83	473	1	31	402	1
238	685	0	186	614	0	-134	543	0	82	472	1	30	401	1
237	683	0	185	612	0	-133	541	0	81	470	1	29	399	0
236	682	0	184	611	0	-132	540	0	80	469	2	28	398	0
235	681	0	183	610	1	-131	539	0	79	468	1	27	397	0
234	679	0	182	608	0	-130	537	0	78	466	0	26	395	0
233	678	0	181	607	0	-129	536	0	77	465	0	25	394	0
232	677	0	180	606	0	128	535	1	76	464	0	24	393	0
231	675	0	179	604	0	127	533	0	75	462	0	23	391	0
230	674	0	178	603	0	126	532	0	74	461	0	22	390	0
229	673	0	177	602	0	125	531	1	73	460	0	21	389	0
228	671	0	176	600	0	124	529	0	72	458	0	20	387	0
227	670	0	175	599	0	123	528	0	71	457	0	19	386	0
226	668	0	174	597	0	122	526	0	70	455	0	18	384	0
225	667	0	173	596	0	121	525	1	69	454	0	17	383	0
224	666	0	172	595	0	120	524	0	68	453	0	16	382	0
223	664	0	171	593	0	119	522	0	67	451	0	15	380	0
222	663	0	170	592	0	-118	521	2	66	450	0	14	379	0
221	662	0	169	591	0	-117	520	1	65	449	0	13	378	0
220	660	0	168	589	0	-116	518	2	64	447	0	12	376	0
219	659	0	167	588	0	-115	517	2	63	446	0	11	375	0
218	658	0	166	587	0	-114	516	1	62	445	0	10	374	0
217	656	0	165	585	0	-113	514	0	61	443	0	9	372	0
216	655	0	-164	584	0	-112	513	0	60	442	0	8	371	0
215	653	0	-163	582	0	-111	511	1	59	440	0	7	369	0
214	652	0	-162	581	0	-110	510	1	58	439	0	6	368	0
213	651	0	-161	580	0	-109	509	0	57	438	1	5	367	0
212	649	0	-160	578	1	-108	507	0	56	436	0	4	365	0
211	648	0	-159	577	0	-107	506	0	55	435	0	3	364	0
210	647	0	-158	576	1	-106	505	1	54	434	0	2	363	0
209	645	0	-157	574	0	-105	503	0	53	432	0	1	361	0

239 238 236 0 242

103- 119 129- 144 148- 164 0- 0 84- 102

09


525- 1 PU SS 23 342 251 90 1013 55 MIN PLAWT V 1 00
4 7 4 8 4 9 5 0 5 1 5 2 5 4 5 5 5 6 5 7 5 9
30
80 90 100 110 120 130 140 150 160 170
CHANNEL
242 239 238 236
525- 1 PU

10

07-DEC-90 TMA Corporation 525- 2 Pu
16 50 32 Alpha Spectroscopy 02 CWC 1003
ASPEC V 2 09

W 12/17 Reviewed [signature] Date 12/[illegible]/90

Counted on	SS 11	1183 27 minutes
GMT	341 202 90	
Zero time	324 333 90	
GMT of std	341 149 90	
Sep time	0 000 0	

Chemical yield 0 5240

Tracer - Pu242 (G4-D2-A-(2) 160 269-90)
5 96 Dpm X 1 0000 = 5 96 Corr tracer DPM

Channels	87-105	
Bkg CPM	0 00329	(on 335 978 90 for 2434 98 Min
Gross cnts	1006	
Background	4	
Net counts	1002	3 2%
Divisor	1 6806E+02	(net counts / corr tracer DPM)
Det Eff	0 2711	
Yield	0 5240	(net counts) / (eff x corr tracer DPM X time)

	Pu239		Pu238		Pu236	
Channels	106-123		132-148		152-168	
Bkg CPM	0 00205		0 00246		0 00082	
Gross cnts	13		11		12	
Background	2		3		1	
Tracer cts	0	0	0	0	0	0
Net counts	11	4	8	4	11	4
Lambda	(7 7775E-08)		(2 2005E-05)		(6 6560E-04)	
Decay corr	1 0000		0 9996		0 9888	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	6 5451E-02		4 7618E-02		6 6190E-02	
Aliquot	2 5000E+00		2 5000E+00		2 5000E+00	
Dpm/l	2 6180E-02		1 9047E-02		2 6476E-02	
pCi /l	1 179E-02		8 580E-03		1 193E-02	
1 sigma Err	36 5%		50 1%		36 5%	
pCi Err	4 305E-03		4 299E-03		4 353E-03	
2 sigma Err	73 0%		100 2%		73 0%	
pCi Err	8 610E-03		8 597E-03		8 707E-03	
Limitng Vlu	< 1 89E-02		< 1 57E-02		< 1 91E-02	
MDA	7 07E-03		8 66E-03		5 05E-03	

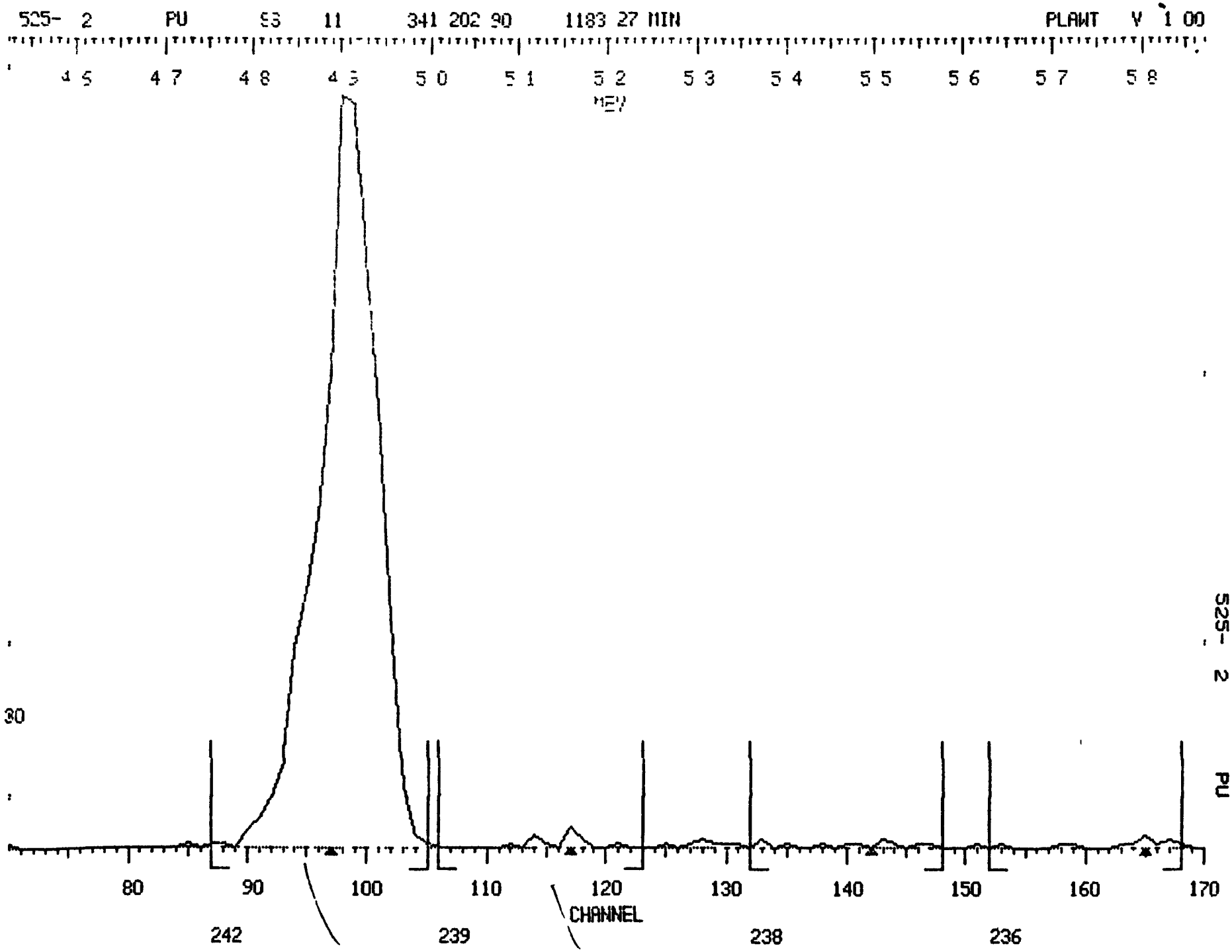
P

525 2 Pu 341 202 1183 27 MIN SS 11

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	638	0	-156	568	0	-104	498	3	52	428	0
0	0	0	207	637	0	-155	566	0	-103	496	15	51	426	0
0	0	0	206	635	0	-154	565	0	-102	495	53	50	425	0
0	0	0	205	634	0	-153	564	1	-101	494	102	49	424	0
256	703	0	204	633	0	-152	562	0	-100	492	137	48	422	0
255	701	0	203	631	0	151	561	1	-99	491	175	47	421	0
254	700	0	202	630	0	150	560	0	-98	490	177	46	420	2
253	699	0	201	629	0	149	558	0	-97	488	111	45	418	1
252	697	0	200	627	0	-148	557	0	-96	487	78	44	417	0
251	696	0	199	626	0	-147	556	1	-95	486	61	43	415	0
250	695	0	198	624	0	-146	554	1	-94	484	48	42	414	0
249	693	0	197	623	0	-145	553	0	-93	483	20	41	413	0
248	692	0	196	622	0	-144	552	1	-92	482	12	40	411	0
247	691	0	195	620	0	-143	550	2	-91	480	7	39	410	0
246	689	0	194	619	0	-142	549	0	-90	479	4	38	409	0
245	688	0	193	618	0	-141	548	1	-89	478	0	37	407	0
244	686	0	192	616	0	-140	546	1	-88	476	1	36	406	0
243	685	0	191	615	1	-139	545	0	-87	475	1	35	405	0
242	684	0	190	614	1	-138	544	1	86	473	0	34	403	0
241	682	0	189	612	1	-137	542	0	85	472	1	33	402	0
240	681	0	188	611	0	-136	541	0	84	471	0	32	401	1
239	680	0	187	610	0	-135	540	1	83	469	0	31	399	0
238	678	0	186	608	0	-134	538	0	82	468	0	30	398	0
237	677	0	185	607	1	-133	537	2	81	467	0	29	397	0
236	676	0	184	606	0	-132	535	0	80	465	0	28	395	0
235	674	0	183	604	0	131	534	1	79	464	0	27	394	0
234	673	0	182	603	0	130	533	1	78	463	0	26	393	0
233	672	0	181	602	0	129	531	1	77	461	0	25	391	0
232	670	0	180	600	0	128	530	2	76	460	0	24	390	0
231	669	0	179	599	0	127	529	1	75	459	0	23	389	0
230	668	0	178	597	0	126	527	0	74	457	0	22	387	0
229	666	0	177	596	0	125	526	1	73	456	0	21	386	0
228	665	0	176	595	0	124	525	0	72	455	0	20	384	0
227	664	0	175	593	0	-123	523	0	71	453	0	19	383	0
226	662	0	174	592	0	-122	522	0	70	452	1	18	382	0
225	661	0	173	591	0	-121	521	1	69	451	0	17	380	0
224	660	0	172	589	0	-120	519	0	68	449	0	16	379	0
223	658	0	171	588	1	-119	518	0	67	448	1	15	378	0
222	657	0	170	587	0	-118	517	2	66	447	0	14	376	0
221	655	0	169	585	0	-117	515	5	65	445	1	13	375	0
220	654	0	-168	584	1	-116	514	0	64	444	0	12	374	0
219	653	0	-167	583	2	-115	513	1	63	442	0	11	372	0
218	651	0	-166	581	1	-114	511	3	62	441	0	10	371	0
217	650	0	-165	580	3	-113	510	0	61	440	0	9	370	0
216	649	0	-164	579	1	-112	509	1	60	438	0	8	368	0
215	647	0	-163	577	1	-111	507	0	59	437	0	7	367	0
214	646	0	-162	576	0	-110	506	0	58	436	0	6	366	0
213	645	0	-161	575	0	-109	504	0	57	434	0	5	364	0
212	643	0	-160	573	0	-108	503	0	56	433	0	4	363	0
211	642	0	-159	572	1	-107	502	0	55	432	0	3	362	0
210	641	0	-158	571	1	-106	500	0	54	430	0	2	360	0
209	639	0	-157	569	0	-105	499	1	53	429	0	1	359	0

239 238 236 0 242

106- 123 132- 148 152- 168 0- 0 87- 105


525- 2 PU 53 11 341 202 90 1183 27 MIN PLAWT V 1 00
45 47 48 49 50 51 52 53 54 55 56 57 58
MEV
30
80 90 100 110 120 130 140 150 160 170
CHANNEL
242 239 238 236
525- 2
PU

17-DEC-90 TMA Corporation 525- 1 Am
11 43 58 Alpha Spectroscopy 01 CWC 1001
ASPEC V 2 09

Reviewed Date 12/17/90

Counted on SS 13 1041 53 minutes
GMT 348 203 90
Zero time 317 333 90

GMT of std 348 118 90
Sep. time 0.000 0

****
** RECALCULATED DATA **
****

Chemical yield 0 4563

Tracer - Am243 (H-E1-A-(5) 263 950-89)
9 77 Dpm X 0 9999 = 9 77 Corr. tracer DPM

Channels 115-135*
Bkg CPM 0 00579 (on 343 006 90 for 2416 00 Min

Gross cnts 1186
Background 6
Net counts 1180 3 0%

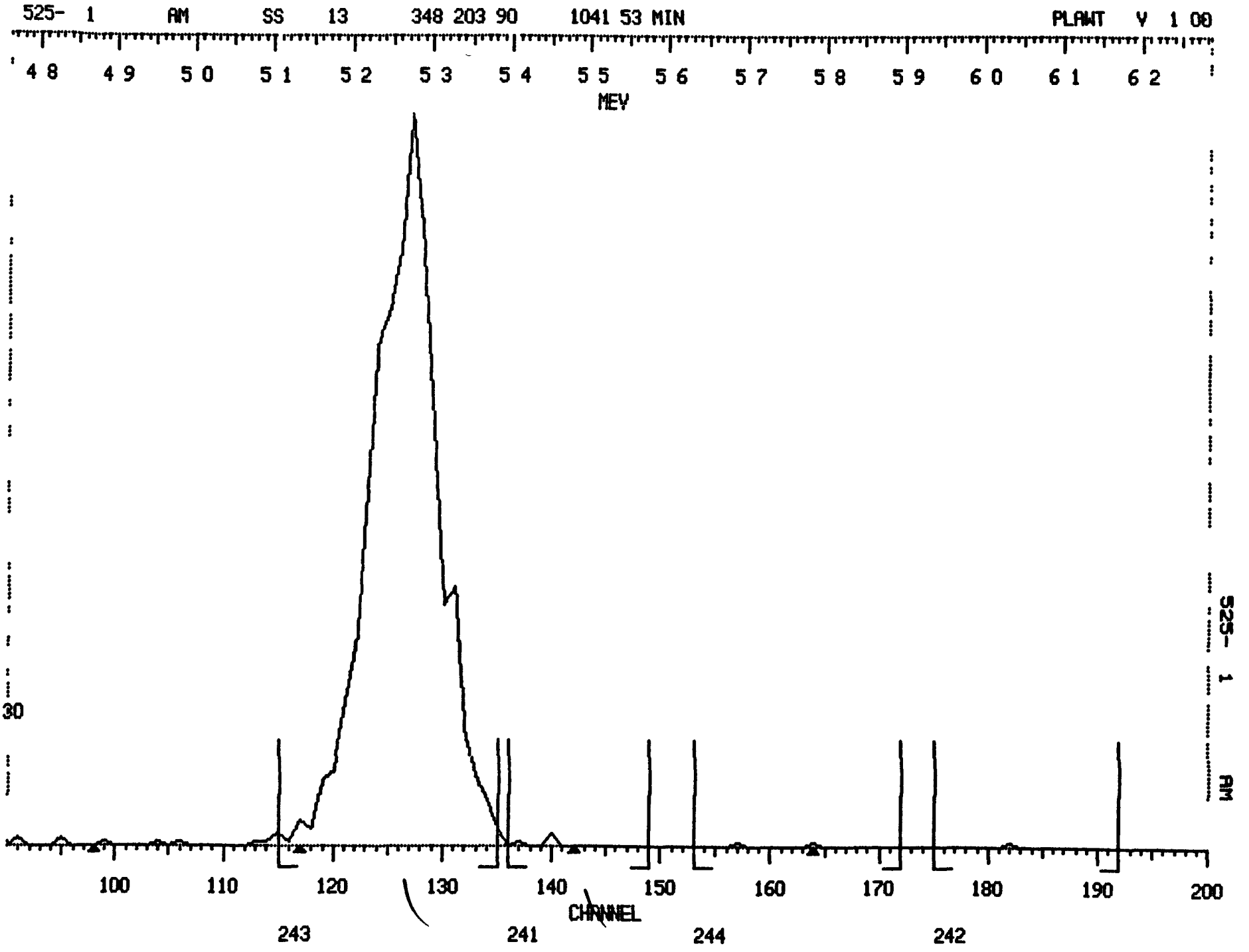
Divisor 1 2083E+02 (net counts / corr tracer DPM)
Det Eff 0 2542
Yield 0 4563 (net counts) / (eff x corr tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	136-149*		175-192		153-172	
Bkg CPM	0 00248		0 00000		0 00166	
Gross cnts	4		1		2	
Background	3		0		2	
Tracer cts	2	0	0	0	1	0
Net counts	-1	3	1	1	-1	2
Lambda	(4 0291E-06)		(4 2525E-03)		(1 0632E-04)	
Decay corr	0 9999		0 8770		0 9967	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	-8 2772E-03		9 4372E-03		-8 3034E-03	
Aliquot	2 5000E+00		2 5000E+00		2 5000E+00	
Dpm/l	-3 3109E-03		3 7749E-03		-3 3214E-03	
pCi /l	-1 491E-03		1 700E-03		-1 496E-03	
1 sigma Err	300 0%		100 0%		200 0%	
pCi Err	4 474E-03		1 701E-03		2.993E-03	
2 sigma Err	600 0%		200 1%		400 0%	
pCi Err	8 949E-03		3 402E-03		5 985E-03	
Limitng Vlu	< 7 38E-03		< 4 51E-03		< 4 94E-03	
MDA	1 20E-02		7 92E-03		9 86E-03	

525 . 1 Am 348 203 1041 53 MIN SS 13

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	639	0	-156	567	0	104	495	1	52	423	0
0	0	0	207	638	0	-155	566	0	103	494	0	51	422	0
0	0	0	206	636	0	-154	564	0	102	492	0	50	420	0
0	0	0	205	635	0	-153	563	0	101	491	0	49	419	0
256	706	0	204	634	0	152	562	0	100	490	0	48	418	0
255	704	0	203	632	0	151	560	0	99	488	1	47	416	0
254	703	0	202	631	0	150	559	0	98	487	0	46	415	0
253	701	0	201	629	0	-149	557	0	97	486	0	45	414	0
252	700	0	200	628	0	-148	556	0	96	484	0	44	412	0
251	699	0	199	627	0	-147	555	0	95	483	2	43	411	0
250	697	0	198	625	0	-146	553	0	94	481	0	42	409	0
249	696	0	197	624	0	-145	552	0	93	480	0	41	408	0
248	694	0	196	623	0	-144	551	0	92	479	0	40	407	0
247	693	0	195	621	0	-143	549	0	91	477	2	39	405	0
246	692	0	194	620	0	-142	548	0	90	476	0	38	404	0
245	690	0	193	618	0	-141	546	0	89	474	0	37	402	0
244	689	0	-192	617	0	-140	545	3	88	473	0	36	401	0
243	688	0	-191	616	0	-139	544	0	87	472	0	35	400	0
242	686	0	-190	614	0	-138	542	0	86	470	1	34	398	0
241	685	0	-189	613	0	-137	541	1	85	469	0	33	397	0
240	683	0	-188	611	0	-136	539	0	84	468	1	32	396	0
239	682	0	-187	610	0	-135	538	4	83	466	0	31	394	0
238	681	0	-186	609	0	-134	537	11	82	465	0	30	393	0
237	679	0	-185	607	0	-133	535	16	81	463	0	29	391	0
236	678	0	-184	606	0	-132	534	27	80	462	0	28	390	0
235	676	0	-183	605	0	-131	533	61	79	461	0	27	389	0
234	675	0	-182	603	1	-130	531	57	78	459	0	26	387	0
233	674	0	-181	602	0	-129	530	101	77	458	0	25	386	0
232	672	0	-180	600	0	-128	528	143	76	456	0	24	385	0
231	671	0	-179	599	0	-127	527	172	75	455	0	23	383	0
230	670	0	-178	598	0	-126	526	140	74	454	0	22	382	0
229	668	0	-177	596	0	-125	524	126	73	452	0	21	380	0
228	667	0	-176	595	0	-124	523	119	72	451	0	20	379	0
227	665	0	-175	593	0	-123	522	80	71	450	0	19	378	0
226	664	0	174	592	0	-122	520	47	70	448	0	18	376	0
225	663	0	173	591	0	-121	519	34	69	447	0	17	375	0
224	661	0	-172	589	0	-120	517	18	68	445	0	16	373	0
223	660	0	-171	588	0	-119	516	16	67	444	0	15	372	0
222	659	0	-170	587	0	-118	515	4	66	443	0	14	371	0
221	657	0	-169	585	0	-117	513	6	65	441	0	13	369	0
220	656	0	-168	584	0	-116	512	1	64	440	1	12	368	0
219	654	0	-167	582	0	-115	510	3	63	438	0	11	367	0
218	653	0	-166	581	0	114	509	1	62	437	0	10	365	0
217	652	0	-165	580	0	113	508	1	61	436	0	9	364	0
216	650	0	-164	578	1	112	506	0	60	434	0	8	362	1
215	649	0	-163	577	0	111	505	0	59	433	0	7	361	0
214	647	0	-162	575	0	110	504	0	58	432	0	6	360	0
213	646	0	-161	574	0	109	502	0	57	430	0	5	358	0
212	645	0	-160	573	0	108	501	0	56	429	0	4	357	0
211	643	0	-159	571	0	107	499	0	55	427	0	3	355	0
210	642	0	-158	570	0	106	498	1	54	426	0	2	354	0
209	641	0	-157	569	1	105	497	0	53	425	0	1	353	0

241	242	244	0	243
136- 149	175- 192	153- 172	0- 0	115- 135


525- 1 AM SS 13 348 203 90 1041 53 MIN PLANT V 1 00
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
MEV
30
100 110 120 130 140 150 160 170 180 190 200
CHANNEL
243 241 244 242
525- 1 AM

17-DEC-90 TMA Corporation 525- 2 Am
11 43 25 Alpha Spectroscopy 02 CWC 1003
ASPEC V 2 09

Reviewed Date 12/17/90

Counted on SS 14 1041 53 minutes
GMT 348 203 90
Zero time 324 333 90

GMT of std 348 118 90
Sep time 0 000 0

****
** RECALCULATED DATA **
****

Chemical yield 0 7001

Tracer - Am243 (H-E1-A-(5) 263 950-89)
9 77 Dpm X 0 9999 = 9 77 Corr tracer DPM

Channels 113-134*
Bkg CPM 0 00331 (on 343 006 90 for 2416 00 Min

Gross cnts 1949
Background 3
Net counts 1946 2 3%

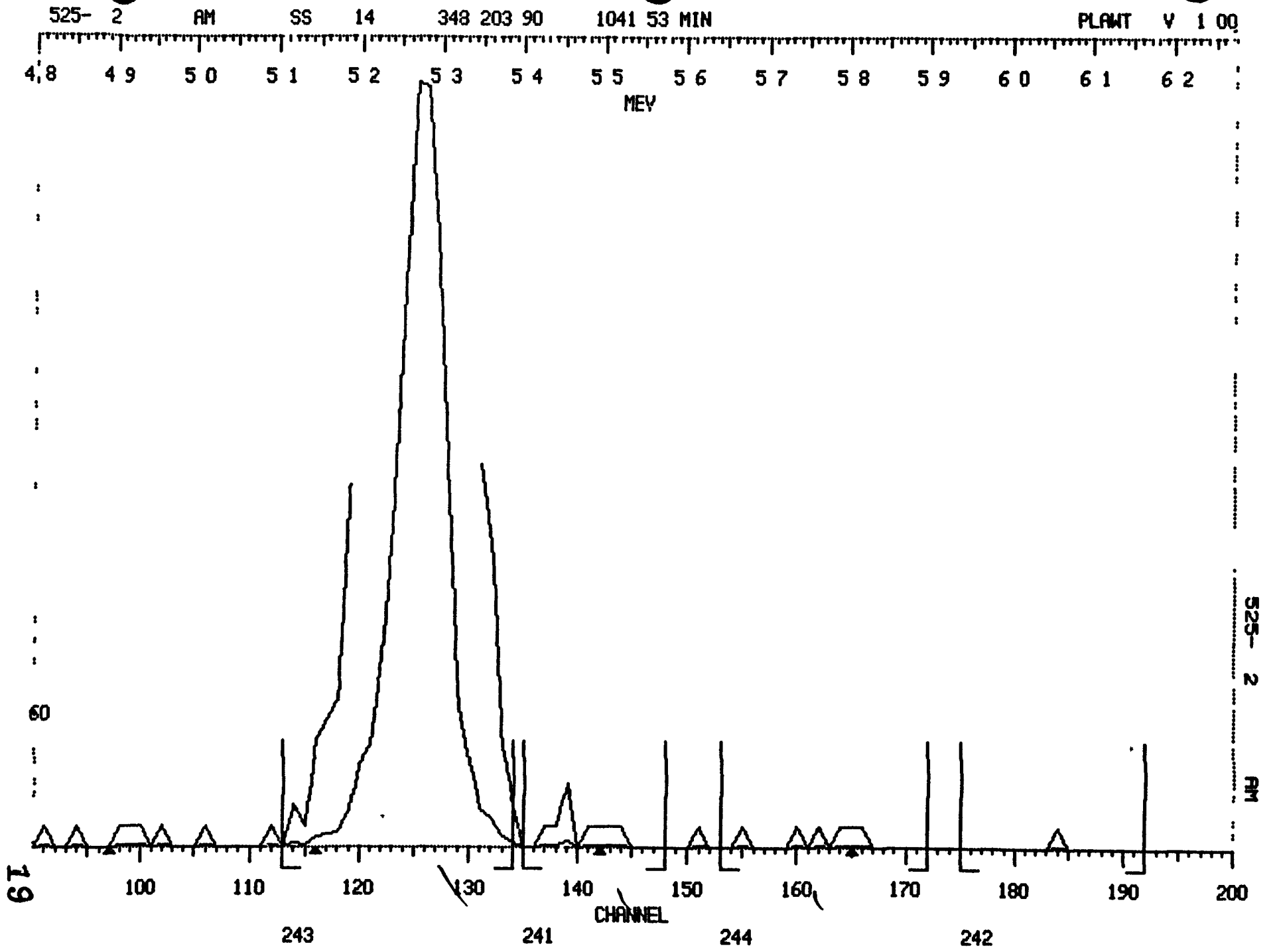
Divisor 1 9926E+02 (net counts / corr tracer DPM)
Det Eff 0 2733
Yield 0 7001 (net counts) / (eff x corr tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	135-148*		175-192		153-172	
Bkg CPM	0 00166		0 00041		0 00083	
Gross cnts	9		1		6	
Background	2		0		1	
Tracer cts	3	0	0	0	2	0
Net counts	4	3	1	1	3	3
Lambda	(4 0291E-06)		(4 2525E-03)		(1 0632E-04)	
Decay corr	0 9999		0 9035		0 9975	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	2 0076E-02		5 5546E-03		1 5094E-02	
Aliquot	2 5000E+00		2 5000E+00		2 5000E+00	
Dpm/l	8 0303E-03		2 2218E-03		6 0374E-03	
pCi /l	3 617E-03		1 001E-03		2 720E-03	
1 sigma Err	75 0%		100 0%		100 0%	
pCi Err	2 714E-03		1 001E-03		2 720E-03	
2 sigma Err	150 1%		200 1%		200 1%	
pCi Err	5 428E-03		2 002E-03		5 441E-03	
Limitng Vlu	< 8 10E-03		< 2 65E-03		< 7 21E-03	
MDA	5 96E-03		4 66E-03		4 22E-03	

525 · 2 Am 348 203 1041 53 MIN SS 14

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	638	0	-156	568	0	104	498	0	52	429	0
0	0	0	207	636	0	-155	567	1	103	497	0	51	427	0
0	0	0	206	635	0	-154	565	0	102	496	1	50	426	0
0	0	0	205	634	0	-153	564	0	101	494	0	49	424	1
256	702	0	204	632	0	152	563	0	100	493	1	48	423	0
255	701	0	203	631	0	151	561	1	99	492	1	47	422	0
254	699	0	202	630	1	150	560	0	98	490	1	46	420	0
253	698	0	201	628	0	149	559	0	97	489	0	45	419	0
252	697	0	200	627	0	-148	557	0	96	488	0	44	418	0
251	695	0	199	626	0	-147	556	0	95	486	0	43	416	0
250	694	0	198	624	0	-146	555	0	94	485	1	42	415	1
249	693	0	197	623	0	-145	553	0	93	484	0	41	414	0
248	691	0	196	622	0	-144	552	1	92	482	0	40	412	0
247	690	0	195	620	0	-143	551	1	91	481	1	39	411	0
246	689	0	194	619	0	-142	549	1	90	479	0	38	410	0
245	687	0	193	618	0	-141	548	1	89	478	0	37	408	0
244	686	0	-192	616	0	-140	547	0	88	477	0	36	407	0
243	685	0	-191	615	0	-139	545	3	87	475	0	35	406	0
242	683	0	-190	614	0	-138	544	1	86	474	0	34	404	0
241	682	0	-189	612	0	-137	543	1	85	473	0	33	403	0
240	681	0	-188	611	0	-136	541	0	84	471	1	32	402	0
239	679	0	-187	610	0	-135	540	0	83	470	0	31	400	0
238	678	0	-186	608	0	-134	538	2	82	469	1	30	399	0
237	677	0	-185	607	0	-133	537	5	81	467	0	29	398	0
236	675	0	-184	606	1	-132	536	14	80	466	0	28	396	0
235	674	0	-183	604	0	-131	534	18	79	465	0	27	395	1
234	673	0	-182	603	0	-130	533	41	78	463	0	26	394	0
233	671	0	-181	602	0	-129	532	67	77	462	0	25	392	0
232	670	0	-180	600	0	-128	530	173	76	461	0	24	391	0
231	669	0	-179	599	0	-127	529	284	75	459	0	23	390	0
230	667	0	-178	597	0	-126	528	357	74	458	0	22	388	0
229	666	0	-177	596	0	-125	526	359	73	457	0	21	387	0
228	665	0	-176	595	0	-124	525	256	72	455	0	20	386	0
227	663	0	-175	593	0	-123	524	156	71	454	0	19	384	0
226	662	0	174	592	0	-122	522	91	70	453	0	18	383	0
225	661	0	173	591	0	-121	521	48	69	451	0	17	382	0
224	659	0	-172	589	0	-120	520	40	68	450	0	16	380	0
223	658	0	-171	588	0	-119	518	17	67	449	0	15	379	0
222	657	0	-170	587	0	-118	517	7	66	447	1	14	378	0
221	655	0	-169	585	0	-117	516	6	65	446	0	13	376	0
220	654	0	-168	584	0	-116	514	5	64	445	0	12	375	0
219	652	0	-167	583	0	-115	513	1	63	443	0	11	374	0
218	651	0	-166	581	1	-114	512	2	62	442	0	10	372	0
217	650	0	-165	580	1	-113	510	0	61	441	0	9	371	0
216	648	0	-164	579	1	112	509	1	60	439	0	8	370	0
215	647	0	-163	577	0	111	508	0	59	438	0	7	368	0
214	646	0	-162	576	1	110	506	0	58	437	0	6	367	0
213	644	0	-161	575	0	109	505	0	57	435	1	5	365	0
212	643	0	-160	573	1	108	504	0	56	434	1	4	364	0
211	642	0	-159	572	0	107	502	0	55	433	0	3	363	1
210	640	0	-158	571	0	106	501	1	54	431	0	2	361	0
209	639	0	-157	569	0	105	500	0	53	430	0	1	360	0

241	242	244	0	243
135- 148	175- 192	153- 172	0- 0	113- 134


525- 2 AM SS 14 348 203 90 1041 53 MIN PLAWT V 1 00
4.8 4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8 5 9 6 0 6 1 6 2
MEV
60
100 110 120 130 140 150 160 170 180 190 200
CHANNEL
243 241 244 242
525- 2 AM

Appendix D Quality Control Raw Data Sheets

Enclosed are the raw data sheets for the QC samples presented in the previous section

08-DEC-90 TMA Corporation 582-222 80
12 07 09 Gross Alpha, Gross Beta Analysis QC 3836-40, 54
AB4000 V 1 01

W 12/10 Reviewed [illegible] Date 12/10/90

Counted 342 091-90 (C4 1470 volts)

1 00 smpl	99 900 mg	99 900 mg
Aliquot	Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 112	GRB 112
Counts =	110 000	931 000
Time =	100 000	100 000
Gross cpm =	1 100	9 310
Background =	0 055	1 213
Observed CPM =	1 045	8 097
Cross talk fac =	0 006	0 302
True CPM =	0 998	7 796
Eff (cpm/dpm) =	0 095	0 410
DPM of Aliquot =	10 490	19 013
pCi /smpl =	4 73	8 56
1 sigma % Err =	10 774	4 161
(1 sigma err) =	0 509	0 356
(2 sigma err) =	1 02	0 713
LTV (95 %) =	5 57	9 15
MDA =	0 519	0 564

pCi/smpl ± tot er 2σ 4.7 ± ~~0.7~~ 1.4 ~~± 15%~~ ±29% 8.6 ± 1.1 ± 13% W 12/10

QC Summary

QC	CNT	YR	ALPHA	BETA	TIME
BKG	341 255	90	0 055	1 213	578 51
SF	342 049	90	1 009	0 965	10 00

LOG FILE information (File name NP [50,1]GAW 112 LOG)

Time of count		CNT	Planchet Identification	A-cpm	B-cpm	Time
18 22	6-DEC-90	341 099	(80)8147 3	0	0	100 00
22 07	6-DEC-90	341 255	BK	0	1	578 51
17 10	7-DEC-90	342 049	SF	647	1454	10 00

01

08-DEC-90 TMA Corporation 582-223 80
12 07 41 Gross Alpha, Gross Beta Analysis GC 3841-45,55
AB4000 V 1 01 W 12/10 Reviewed [illegible] Date 12/10/90

Counted 342 091-90 (D1 1470 volts)

1 00 smpl	93 000 mg	93 000 mg
Aliquot	Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 113	GRB 113
Counts =	17 000	108 000
Time =	100 000	100.000
Gross cpm =	0 170	1 080
Background =	0 088	0 857
Observed CPM =	0 082	0 223
Cross talk fac =	0 006	0 296
True CPM =	0 081	0 199
Eff (cpm/dpm) =	0 102	0 412
DPM of Aliquot =	0 791	0 483
pCi /smpl =	0 356	0 218
1 sigma % Err =	63 009	69 910
	± 126 % 2σ	± 140 % 2σ W 12/10
(1 sigma err) =	0 224	0 152
(2 sigma err) =	0 449	0 304
LTV (95 %) =	0 726	0 469
MDA =	0 611	0 472

pCi/smpl ± tot err 2σ 0.36 ± 0.45 0.22 ± 0.31 W 12/10

QC Summary

GC	GMT	YR	ALPHA	BETA	TIME
BKG	341 254	90	0 088	0 857	578 54
SF	342 049	90	0 988	1 035	10 00

LOG FILE information (File name NP [50,1]GAW 113 LOG)

Time of count	GMT	Planchet Identification	A-cpm	B-cpm	Time
18 22 6-DEC-90	341 099	(88)8147 4	0	0	100 00
22 05 6-DEC-90	341 254	BK	0	1	578 54
17 10 7-DEC-90	342 049	SF	934	1320	10 00

08-DEC-90 TMA Corporation 582-224 80
12 08 17 Gross Alpha, Gross Beta Analysis GC 3846-50,56
AB4000 V 1 01

Reviewed [illegible] Date 12/10/90.

Counted 342 091-90 (D2 1470 volts)

1 00 smpl	83 900 mg	83 900 mg
Aliquot	Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 114	GRB 114
Counts =	409 000	5049 000
Time =	100 000	100 000
Gross cpm =	4 090	50 490
Background =	0 047	1 161
Observed CPM =	4 043	49 329
Cross talk fac =	0 006	0 287
True CPM =	3 748	48 252
Eff (cpm/dpm) =	0 108	0 414
DPM of Aliquot =	34 690	116 489
pCi /smpl =	15 6	52 5
1 sigma % Err =	5 426	1 489
(1 sigma err) =	0 848	0 782
(2 sigma err) =	1 70	1 56
LTV (95 %) =	17 0	53 8
MDA =	0 420	0 546
pCi/smpl ± total err, 2σ	15.6 ± 3.6 ±23%	52.5 ± 5.3 ±10%

P

W 12/10

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	341 254	90	0 047	1 161	578 54
SF	342 049	90	0 999	1 009	10 00

LOG FILE information (File name NP [50,1]GAW 114 LOG)

Time of count	GMT	Planchet Identification	A-cpm	B-cpm	Time
18 22 6-DEC-90	341 099	(80)8132 1	0	0	100 00
22 05 6-DEC-90	341 254	BK	0	1	578 54
17 10 7-DEC-90	342 049	SF	1064	1443	10 00

03

08-DEC-90 TMA Corporation 582-225 80
12 08 44 Gross Alpha, Gross Beta Analysis SPLIT 525-1 01WC1001
AB4000 V 1.01

Reviewed [illegible] Date 12/10/90

Counted 342 091-90 (D3 1470 volts)

0 300 1	263 900 mg	263 900 mg
Aliquot	Sample Weight	Counted Weight

	ALPHA	BETA
Instrument =	GAW 115	GRB 115
Counts =	23 000	166 000
Time =	100 000	100 000
Gross cpm =	0 230	1 660
Background =	0 048	0 786
Observed CPM =	0 182	0.874
Cross talk fac =	0 005	0 465
True CPM =	0 177	0 792
Eff (cpm/dpm) =	0 050	0 400
DPM of Aliquot =	3 547	1 979
pCi /l =	5 33	2 97
1 sigma % Err =	29 750	19 754
(1 sigma err) =	1 58	0 587
(2 sigma err) =	3 17	1 17
LTV (95 %) =	7 94	3 94
MDA =	3 08	1 55

pCi

GC Summary

GC	GMT	YR	ALPHA	BETA	TIME
BKG	341 254	90	0 048	0 786	578 54
SF	342 049	90	1 004	0 995	10 00

LOG FILE information (File name NP [50,1]GAW 115 LOG)

Time of count		GMT	Planchet Identification	A-cpm	B-cpm	Time
17 56	6-DEC-90	341 081	SF	1030.	1519	10 00
22 05	6-DEC-90	341 254	BK	0	1	578 54
17 10	7-DEC-90	342 049	SF	1056	1552	10 00

01-DEC-90 TMA Corporation 525- 1 80
00 05 11 Gross Alpha, Gross Beta Analysis 01 CWC 1001
AB4000 V 1 01

Reviewed Date 12/3/90

Counted 335 227-90 (A2 1470 volts)

Aliquot	Sample Weight	Counted Weight
0 300 1	272 000 mg	272 000 mg

	ALPHA	BETA
Instrument =	GAW 102	GRB 102
Counts =	30 000	185 000
Time =	100 000	100 000
Gross cpm =	0 300	1 850
Background =	0 073	0 803
Observed CPM =	0 227	1 047
Cross talk fac =	0 005	0 465
True CPM =	0 222	0 944
Eff (cpm/dpm) =	0 050	0 400
DPM of Aliquot =	4 448	2 359
pCi /l =	6 68	3 54
1 sigma % Err =	27 443	17 261
(1 sigma err) =	1 83	0 611
(2 sigma err) =	3 67	1 22
LTV (95 %) =	9 70	4 55
MDA =	3 77	1 57

QC Summary

QC	GMT	YR	ALPHA	BETA	TIME
BKG	334 302	90	0 073	0 803	551 46
SF	334 691	90	1 020	0 994	10 00

Error reading log file ****

04-DEC-90 TMA Corporation 582-220 U
22 49 35 Alpha Spectroscopy SPLIT 63 NP50173WC
ASPEC V 2 09

Reviewed Date 12/5/90

Counted on SS 2 126 20 minutes
GMT 339 153 90
Zero time 270 292 90

GMT of std 338 995 90
Sep time 0 000 0 Chemical yield 0 6239

Tracer - U 232 (F-F1-A-(13) 240 738-89)
11 41 Dpm X 0 9879 = 11 27 Corr. tracer DPM
Channels 109-133
Bkg CPM 0 00657 (on 335 978 90 for 2433 53 Min.

Gross cnts 260
Background 1
Net counts 259 6 2%

Divisor 2 2978E+01 (net counts / corr tracer DPM)
Det Eff 0 2919
Yield 0 6239 (net counts) / (eff x corr tracer DPM X time)

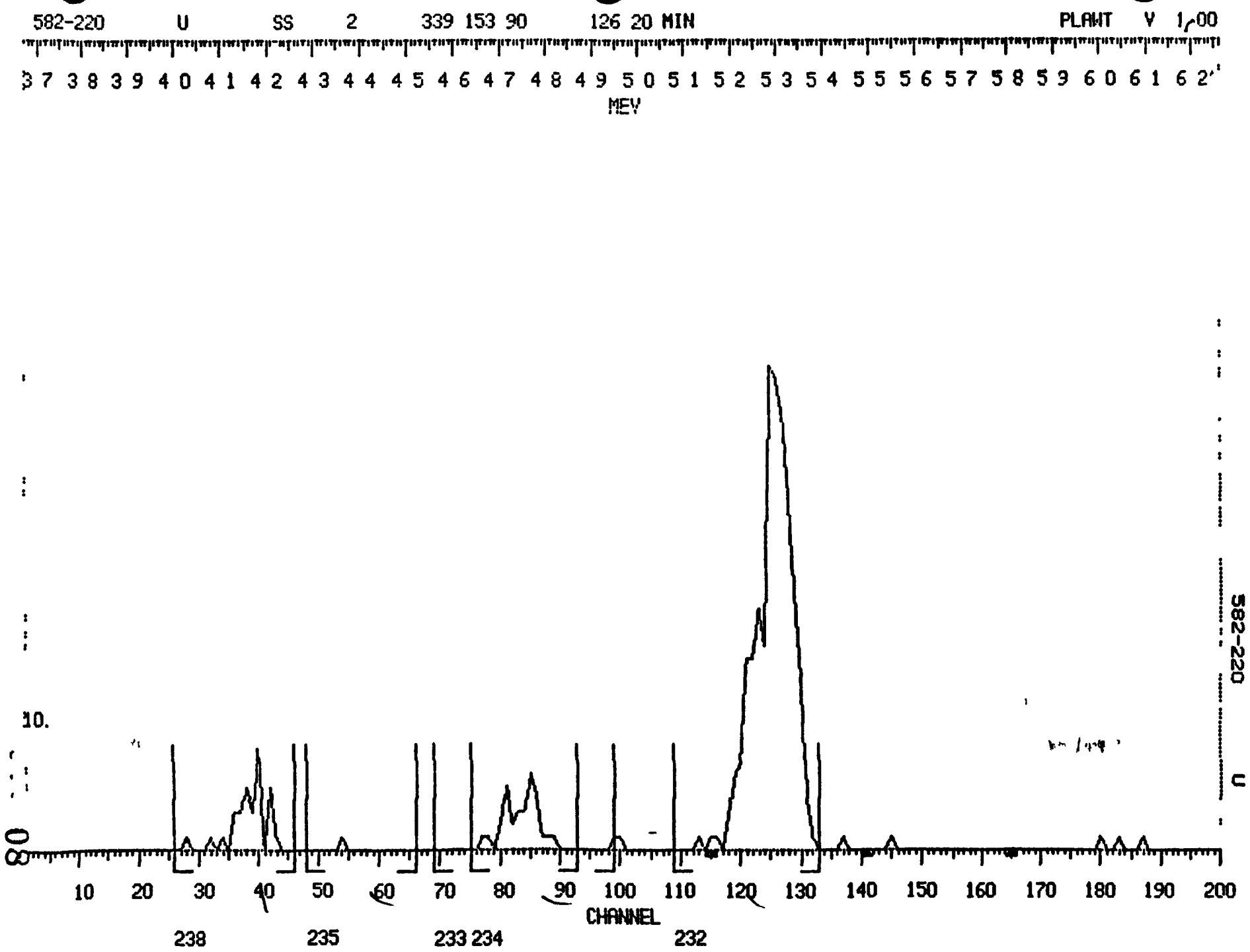
	U 238		U 235		U 233 /4		U 234	
Channels	26- 46		48- 66		69- 99		75- 93	
Bkg CPM	0 00000		0 00247		0 00657		0 00370	
Gross cnts	31		1		31		30	
Background	0		0		1		0	
Tracer cts	0	0	0	0	0	0	0	0
U235 cnts	0		0		0		0	
Net counts	31	6	1	1	30	6	30	5
Lambda	(4 2266E-13)		(2 6729E-12)		(1 1714E-08)		(7 6520E-09)	
Decay corr	1 0000		1 0000		1 0000		1 0000	
Brnch ratio	1 0000		0 8260		1 0000		1 0000	
DPM of aliq	1 3491E+00		5 2687E-02		1 3056E+00		1 3056E+00	
Aliquot	5 0000E-01		5 0000E-01		5 0000E-01		5 0000E-01	
Dpm/l	2 6982E+00		1 0537E-01		2 6112E+00		2 6112E+00	
pCi /l	1 215E+00		4 747E-02		1 176E+00		1 176E+00	
1 sigma Err	20 3%		100 2%		20 9%		17 8%	
pCi Err	2 469E-01		4 756E-02		2 462E-01		2 091E-01	
2 sigma Err	40 6%		200 4%		41 9%		35 5%	
pCi Err	4 939E-01		9 511E-02		4 924E-01		4 181E-01	
Limitng Vlu	< 1 62E+00		< 1 26E-01		< 1 58E+00		< 1 52E+00	
MDA	1 83E-01		2 21E-01		1 83E-01		1 83E-01	

582 220 U 339 153 126 20 MIN SS 2

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	636	0	156	568	0	104	501	0	-52	433	0
0	0	0	207	635	0	155	567	0	103	499	0	-51	432	0
0	0	0	206	633	0	154	566	0	102	498	0	-50	430	0
0	0	0	205	632	0	153	564	0	101	497	0	-49	429	0
256	699	0	204	631	0	152	563	0	100	495	1	-48	428	0
255	697	0	203	630	0	151	562	0	-99	494	1	47	427	0
254	696	0	202	628	0	150	561	0	-98	493	0	-46	425	0
253	695	0	201	627	0	149	559	0	-97	492	0	-45	424	0
252	693	0	200	626	0	148	558	0	-96	490	0	-44	423	0
251	692	0	199	624	0	147	557	0	-95	489	0	-43	421	1
250	691	0	198	623	0	146	555	0	-94	488	0	-42	420	5
249	689	0	197	622	0	145	554	1	-93	486	0	-41	419	0
248	688	0	196	620	0	144	553	0	-92	485	0	-40	417	8
247	687	0	195	619	0	143	551	0	-91	484	0	-39	416	3
246	686	0	194	618	0	142	550	0	-90	482	0	-38	415	5
245	684	0	193	617	0	141	549	0	-89	481	1	-37	413	3
244	683	0	192	615	0	140	548	0	-88	480	1	-36	412	3
243	682	0	191	614	0	139	546	0	-87	479	1	-35	411	0
242	680	0	190	613	0	138	545	0	-86	477	4	-34	410	1
241	679	0	189	611	0	137	544	1	-85	476	6	-33	408	0
240	678	0	188	610	0	136	542	0	-84	475	3	-32	407	1
239	676	0	187	609	1	135	541	0	-83	473	3	-31	406	0
238	675	0	186	607	0	134	540	0	-82	472	2	-30	404	0
237	674	0	185	606	0	-133	538	0	-81	471	5	-29	403	0
236	673	0	184	605	0	-132	537	1	-80	469	2	-28	402	1
235	671	0	183	604	1	-131	536	4	-79	468	0	-27	400	0
234	670	0	182	602	0	-130	535	14	-78	467	1	-26	399	0
233	669	0	181	601	0	-129	533	20	-77	466	1	25	398	0
232	667	0	180	600	1	-128	532	28	-76	464	0	24	397	0
231	666	0	179	598	0	-127	531	34	-75	463	0	23	395	0
230	665	0	178	597	0	-126	529	37	-74	462	0	22	394	0
229	663	0	177	596	0	-125	528	38	-73	460	0	21	393	0
228	662	0	176	594	0	-124	527	16	-72	459	0	20	391	0
227	661	0	175	593	0	-123	525	19	-71	458	0	19	390	0
226	660	0	174	592	0	-122	524	15	-70	456	0	18	389	0
225	658	0	173	591	0	-121	523	15	-69	455	0	17	387	0
224	657	0	172	589	0	-120	522	7	68	454	0	16	386	0
223	656	0	171	588	0	-119	520	6	67	453	0	15	385	0
222	654	0	170	587	0	-118	519	3	-66	451	0	14	384	0
221	653	0	169	585	0	-117	518	0	-65	450	0	13	382	0
220	652	0	168	584	0	-116	516	1	-64	449	0	12	381	0
219	650	0	167	583	0	-115	515	1	-63	447	0	11	380	0
218	649	0	166	581	0	-114	514	0	-62	446	0	10	378	0
217	648	0	165	580	0	-113	512	1	-61	445	0	9	377	0
216	646	0	164	579	0	-112	511	0	-60	443	0	8	376	0
215	645	0	163	578	0	-111	510	0	-59	442	0	7	374	0
214	644	0	162	576	0	-110	509	0	-58	441	0	6	373	0
213	643	0	161	575	0	-109	507	0	-57	440	0	5	372	0
212	641	0	160	574	0	108	506	0	-56	438	0	4	371	0
211	640	0	159	572	0	107	505	0	-55	437	0	3	369	0
210	639	0	158	571	0	106	503	0	-54	436	1	2	368	0
209	637	0	157	570	0	105	502	0	-53	434	0	1	367	0

238 26- 46 235 48- 66 233 69- 99 234 75- 93 232 109- 133

07


582-220 U SS 2 339 153 90 126 20 MIN PLANT V 1.00
3 7 3 8 3 9 4 0 4 1 4 2 4 3 4 4 4 5 4 6 4 7 4 8 4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8 5 9 6 0 6 1 6 2
MEV
582-220
U
10.
0.
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
CHANNEL
238
235
233 234
232

04-DEC-90 TMA Corporation 582-221 U
22 50 07 Alpha Spectroscopy SPLIT 84 NP50193WC
ASPEC V 2 09

Reviewed Date 12/5/90

Counted on SS 3 126 20 minutes
GMT 339 153 90
Zero time 284 292 90

GMT of std 338 995 90
Sep time 0 000 0 Chemical yield 0 4671

Tracer - U 232 (F-F1-A-(13) 240 738-89)
11 41 Dpm X 0 9879 = 11 27 Corr. tracer DPM
Channels 107-131
Bkg CPM 0 00904 (on 335 978 90 for 2433 53 Min

Gross cnts 192
Background 1
Net counts 191 7 3%

Divisor 1 6945E+01 (net counts / corr tracer DPM)
Det Eff 0 2874
Yield 0 4671 (net counts) / (eff x corr tracer DPM X time)

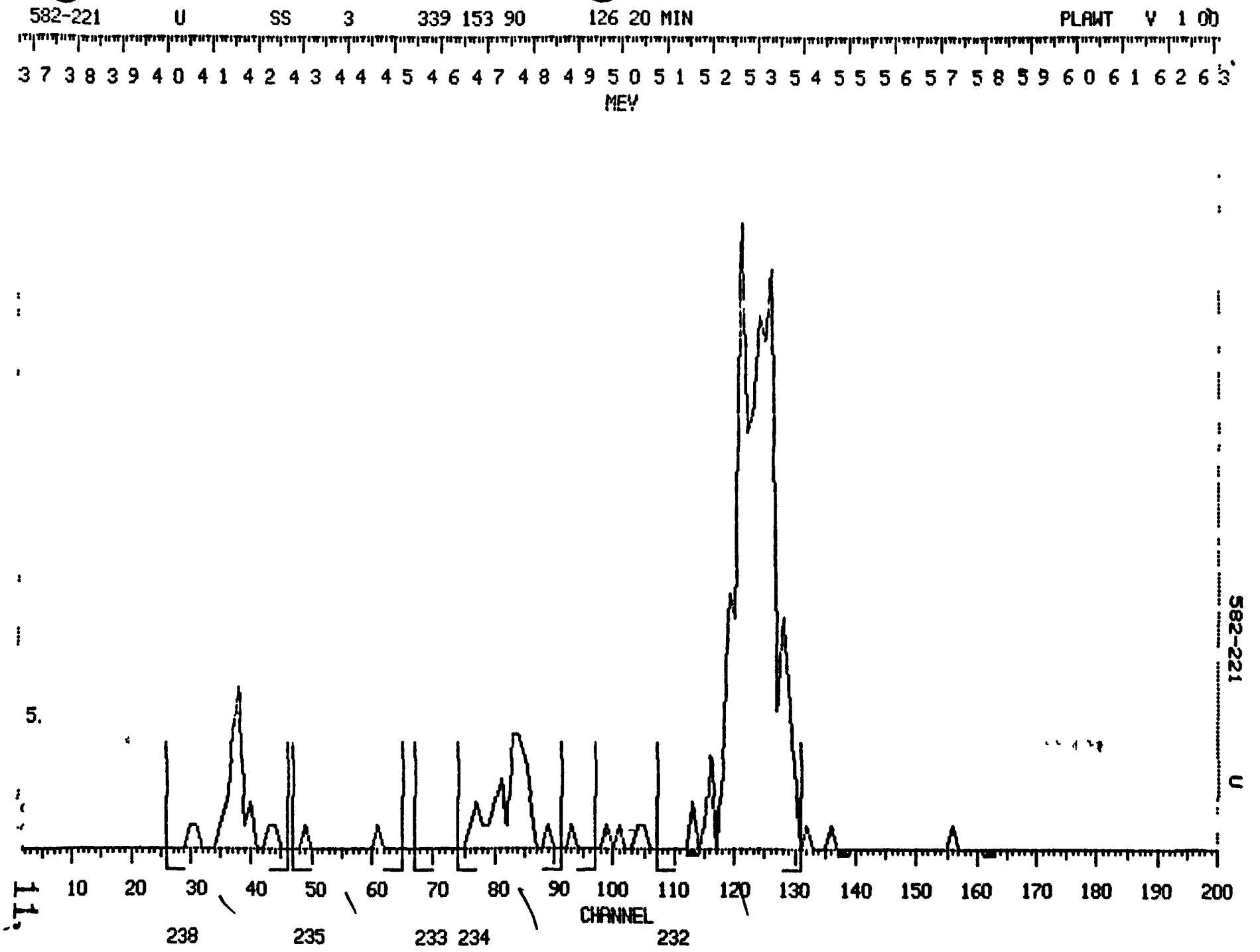
	U 238		U 235		U 233		U 234	
Channels	26- 46		47- 65		67- 97		74- 91	
Bkg CPM	0 00082		0 00082		0 00370		0 00205	
Gross cnts	22		2		29		28	
Background	0		0		0		0	
Tracer cts	0	0	0	0	0	0	0	0
U235 cnts	0		0		0		0	
Net counts	22	5	2	1	29	5	28	5
Lambda	(4 2266E-13)		(2 6729E-12)		(1 1714E-08)		(7 6520E-09)	
Decay corr	1 0000		1 0000		1 0000		1 0000	
Brnch ratio	1 0000		0 8260		1 0000		1 0000	
DPM of aliq	1 2983E+00		1 4289E-01		1 7114E+00		1 6524E+00	
Aliquot	5 0000E-01		5 0000E-01		5 0000E-01		5 0000E-01	
Dpm/l	2 5966E+00		2 8578E-01		3 4228E+00		3 3047E+00	
pCi /l	1 170E+00		1 287E-01		1 542E+00		1 489E+00	
1 sigma Err	23 9%		50 5%		18 7%		19 3%	
pCi Err	2 793E-01		6 505E-02		2 888E-01		2 873E-01	
2 sigma Err	47 8%		101 1%		37 5%		38 6%	
pCi Err	5 586E-01		1 301E-01		5 777E-01		5 747E-01	
Limitng Vlu	< 1 63E+00		< 2 36E-01		< 2 02E+00		< 1 96E+00	
MDA	2 48E-01		3 00E-01		2 48E-01		2 48E-01	

582 221 U 339 153 126 20 MIN SS 3

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	641	0	156	572	1	104	503	1	-52	434	0
0	0	0	207	640	0	155	571	0	103	502	0	-51	433	0
0	0	0	206	639	0	154	570	0	102	501	0	-50	432	0
0	0	0	205	637	0	153	568	0	101	499	1	-49	430	1
256	705	0	204	636	0	152	567	0	100	498	0	-48	429	0
255	704	0	203	635	0	151	566	0	99	497	1	-47	428	0
254	703	0	202	633	0	150	564	0	98	495	0	-46	426	0
253	701	0	201	632	0	149	563	0	-97	494	0	-45	425	0
252	700	0	200	631	0	148	562	0	-96	493	0	-44	424	1
251	699	0	199	629	0	147	560	0	-95	491	0	-43	422	1
250	697	0	198	628	0	146	559	0	-94	490	0	-42	421	0
249	696	0	197	627	0	145	558	0	-93	489	1	-41	420	0
248	695	0	196	626	0	144	556	0	-92	487	0	-40	418	2
247	693	0	195	624	0	143	555	0	-91	486	0	-39	417	1
246	692	0	194	623	0	142	554	0	-90	485	0	-38	416	7
245	691	0	193	622	0	141	552	0	-89	483	1	-37	414	5
244	689	0	192	620	0	140	551	0	-88	482	0	-36	413	2
243	688	0	191	619	0	139	550	0	-87	481	0	-35	412	1
242	687	0	190	618	0	138	548	0	-86	479	2	-34	410	0
241	685	0	189	616	0	137	547	0	-85	478	4	-33	409	0
240	684	0	188	615	0	136	546	1	-84	477	5	-32	408	0
239	683	0	187	614	0	135	544	0	-83	475	5	-31	406	1
238	681	0	186	612	0	134	543	0	-82	474	1	-30	405	1
237	680	1	185	611	0	133	542	0	-81	473	3	-29	404	0
236	679	0	184	610	0	132	540	1	-80	471	2	-28	402	0
235	677	0	183	608	0	-131	539	0	-79	470	1	-27	401	0
234	676	0	182	607	0	-130	538	3	-78	469	1	-26	400	0
233	675	0	181	606	0	-129	536	7	-77	467	2	25	398	0
232	673	0	180	604	0	-128	535	10	-76	466	1	24	397	0
231	672	0	179	603	0	-127	534	6	-75	465	0	23	396	0
230	671	0	178	602	0	-126	533	25	-74	463	0	22	394	0
229	669	0	177	600	0	-125	531	22	-73	462	0	21	393	0
228	668	0	176	599	0	-124	530	23	-72	461	0	20	392	0
227	667	0	175	598	0	-123	529	19	-71	459	0	19	390	0
226	665	0	174	596	0	-122	527	18	-70	458	0	18	389	0
225	664	0	173	595	0	-121	526	27	-69	457	0	17	388	0
224	663	0	172	594	0	-120	525	10	-68	455	0	16	386	0
223	661	0	171	592	0	-119	523	11	-67	454	0	15	385	0
222	660	0	170	591	0	-118	522	4	66	453	0	14	384	0
221	659	0	169	590	0	-117	521	0	-65	451	0	13	382	0
220	657	0	168	588	0	-116	519	4	-64	450	0	12	381	0
219	656	0	167	587	0	-115	518	1	-63	449	0	11	380	0
218	655	0	166	586	0	-114	517	0	-62	447	0	10	378	0
217	653	0	165	584	0	-113	515	2	-61	446	1	9	377	0
216	652	0	164	583	0	-112	514	0	-60	445	0	8	376	0
215	651	0	163	582	0	-111	513	0	-59	443	0	7	374	0
214	649	0	162	580	0	-110	511	0	-58	442	0	6	373	0
213	648	0	161	579	0	-109	510	0	-57	441	0	5	372	0
212	647	0	160	578	0	-108	509	0	-56	439	0	4	370	0
211	645	0	159	576	0	-107	507	0	-55	438	0	3	369	0
210	644	0	158	575	0	106	506	0	-54	437	0	2	368	0
209	643	0	157	574	0	105	505	1	-53	436	0	1	366	0

238 235 233 234 232

26- 46 47- 65 67- 97 74- 91 107- 131


582-221 U SS 3 339 153 90 126 20 MIN PLAWT V 1 00
3 7 3 8 3 9 4 0 4 1 4 2 4 3 4 4 4 5 4 6 4 7 4 8 4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8 5 9 6 0 6 1 6 2 6 3
MEV
582-221
U
5.
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
CHANNEL
238
235
233 234
232

05-DEC-90 TMA Corporation 582-222 U
00 17 10 Alpha Spectroscopy GC 3836-3840
ASPEC V 2 09 Reviewed Date 12/5/90

Counted on SS 8 89 48 minutes
GMT 339 250 90
Zero time 1 000 90

GMT of std 338 995 90
Sep time 0 000 0 Chemical yield 0 5943

Tracer - U 232 (F-F1-A-(13) 240 738-89)
11 41 Dpm X 0 9879 = 11 27 Corr. tracer DPM
Channels 108-133
Bkg CPM 0 01027 (on 335 978 90 for 2433 53 Min

Gross cnts 172
Background 1
Net counts 171 7 6%

Divisor 1 5171E+01 (net counts / corr tracer DPM)
Det Eff 0 2853
Yield 0 5943 (net counts) / (eff x corr tracer DPM X time)

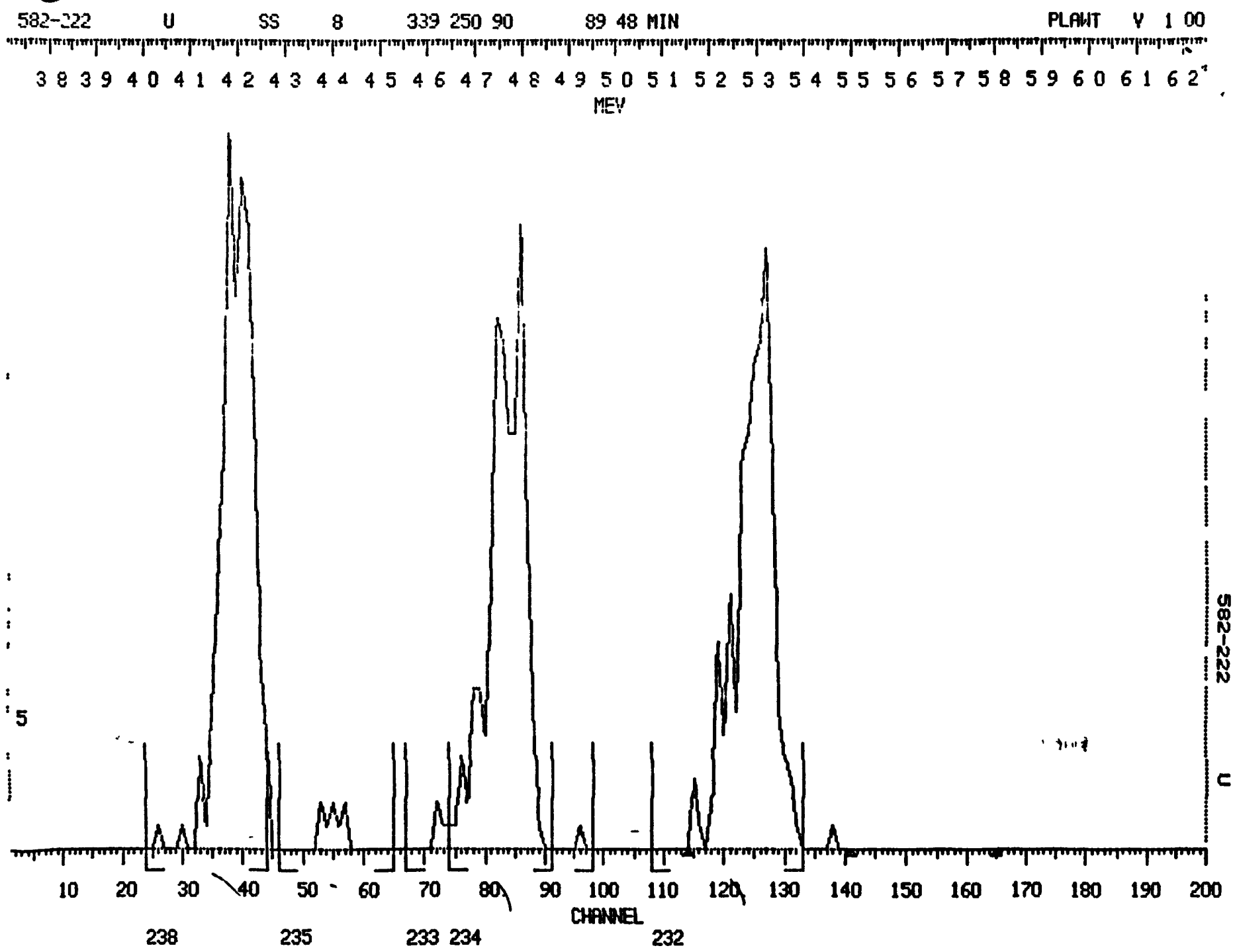
	U 238		U 235		U 233 /4		U 234	
Channels	24- 44		46- 65		67- 98		74- 91	
Bkg CPM	0 00000		0 00123		0 00288		0 00082	
Gross cnts	185		8		172		168	
Background	0		0		0		0	
Tracer cts	0	0	0	0	0	0	0	0
U235 cnts	1		0		1		0	
Net counts	184	14	8	3	171	13	168	13
Lambda	(4 2266E-13)		(2 6729E-12)		(1 1714E-08)		(7 6520E-09)	
Decay corr	1 0000		1 0000		1 0000		1 0000	
Brnch ratio	1 0000		0 8260		1 0000		1 0000	
DPM of aliq	1 2128E+01		6 3840E-01		1 1271E+01		1 1074E+01	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	1 2128E+01		6 3840E-01		1 1271E+01		1 1074E+01	
pCi /smpl	5 463E+00		2 876E-01		5 077E+00		4 988E+00	
1 sigma Err	10 8%		38 3%		10 8%		10 8%	
pCi Err	5 876E-01		1 100E-01		5 459E-01		5 411E-01	
2 sigma Err	21 5%		76 5%		21 5%		21 7%	
pCi Err	1 175E+00		2 201E-01		1 092E+00		1 082E+00	
Limitng Vlu	< 6 43E+00		< 4 69E-01		< 5 98E+00		< 5 88E+00	
MDA	1 38E-01		1 68E-01		1 38E-01		1 38E-01	

pCi/smp ± tot err 2σ 5.46 ± 1.20 (±22%) 0.29 ± 0.22 (77%) 5.08 ± 1.12 (±22%) W 12/5

582 222 U 339 250 89 48 MIN SS 8

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	635	0	156	568	0	104	502	0	-52	436	0
0	0	0	207	633	0	155	567	0	103	501	0	-51	434	0
0	0	0	206	632	0	154	566	0	102	500	0	-50	433	0
0	0	0	205	631	0	153	565	0	101	498	0	-49	432	0
256	696	0	204	630	0	152	563	0	100	497	0	-48	431	0
255	695	0	203	628	0	151	562	0	99	496	0	-47	429	0
254	693	0	202	627	0	150	561	0	-98	494	0	-46	428	0
253	692	0	201	626	0	149	559	0	-97	493	0	45	427	0
252	691	0	200	625	0	148	558	0	-96	492	1	-44	426	5
251	690	0	199	623	0	147	557	0	-95	491	0	-43	424	8
250	688	0	198	622	0	146	556	0	-94	489	0	-42	423	19
249	687	0	197	621	0	145	554	0	-93	488	0	-41	422	27
248	686	0	196	619	0	144	553	0	-92	487	0	-40	420	29
247	684	0	195	618	0	143	552	0	-91	485	0	-39	419	24
246	683	0	194	617	0	142	551	0	-90	484	0	-38	418	31
245	682	0	193	616	0	141	549	0	-89	483	1	-37	417	17
244	681	0	192	614	0	140	548	0	-88	482	6	-36	415	12
243	679	0	191	613	0	139	547	0	-87	480	14	-35	414	6
242	678	0	190	612	0	138	545	1	-86	479	27	-34	413	1
241	677	0	189	611	0	137	544	0	-85	478	18	-33	412	4
240	676	0	188	609	0	136	543	0	-84	477	18	-32	410	0
239	674	0	187	608	0	135	542	0	-83	475	22	-31	409	0
238	673	0	186	607	0	134	540	0	-82	474	23	-30	408	1
237	672	0	185	605	0	-133	539	0	-81	473	12	-29	406	0
236	670	0	184	604	0	-132	538	1	-80	471	5	-28	405	0
235	669	0	183	603	0	-131	537	3	-79	470	7	-27	404	0
234	668	0	182	602	0	-130	535	4	-78	469	7	-26	403	1
233	667	0	181	600	0	-129	534	6	-77	468	2	-25	401	0
232	665	0	180	599	0	-128	533	17	-76	466	4	-24	400	0
231	664	0	179	598	0	-127	531	26	-75	465	1	23	399	0
230	663	0	178	596	0	-126	530	22	-74	464	1	22	397	0
229	662	0	177	595	0	-125	529	21	-73	463	1	21	396	0
228	660	0	176	594	0	-124	528	18	-72	461	2	20	395	0
227	659	0	175	593	0	-123	526	17	-71	460	0	19	394	0
226	658	0	174	591	0	-122	525	6	-70	459	0	18	392	0
225	656	0	173	590	0	-121	524	11	-69	457	0	17	391	0
224	655	0	172	589	0	-120	522	5	-68	456	0	16	390	0
223	654	0	171	588	0	-119	521	9	-67	455	0	15	389	0
222	653	0	170	586	0	-118	520	2	66	454	0	14	387	0
221	651	0	169	585	0	-117	519	0	-65	452	0	13	386	0
220	650	0	168	584	0	-116	517	1	-64	451	0	12	385	0
219	649	0	167	582	0	-115	516	3	-63	450	0	11	383	0
218	647	0	166	581	0	-114	515	0	-62	449	0	10	382	0
217	646	0	165	580	0	-113	514	0	-61	447	0	9	381	0
216	645	0	164	579	0	-112	512	0	-60	446	0	8	380	0
215	644	0	163	577	0	-111	511	0	-59	445	0	7	378	0
214	642	0	162	576	0	-110	510	0	-58	443	0	6	377	0
213	641	0	161	575	0	-109	508	0	-57	442	2	5	376	0
212	640	0	160	574	0	-108	507	0	-56	441	1	4	375	0
211	639	0	159	572	0	107	506	0	-55	440	2	3	373	0
210	637	0	158	571	0	106	505	0	-54	438	1	2	372	0
209	636	0	157	570	0	105	503	0	-53	437	2	1	371	0

238	235	233	234	232
24- 44	46- 65	67- 98	74- 91	108- 133


582-222 U SS 8 339 250 90 89 48 MIN PLAWT V 1 00
3 8 3 9 4 0 4 1 4 2 4 3 4 4 4 5 4 6 4 7 4 8 4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8 5 9 6 0 6 1 6 2
MEV
5
582-222
U
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
CHANNEL
238 235 233 234 232

05-DEC-90 TMA Corporation 582-223 U
00 17 42 Alpha Spectroscopy GC 3841-3845
ASPEC V 2 09

Reviewed [illegible] Date 12/5/90

Counted on SS 10 89 48 minutes
GMT 339 250 90
Zero time 339 250 90

GMT of std 338 995 90
Sep time 0 000 0

Chemical yield 0 5628

Tracer - U 232 (F-F1-A-(13) 240 738-89)
11 41 Dpm X 0 9879 = 11 27 Corr tracer DPM

Channels 107-131
Bkg CPM 0 00822 (on 335 978 90 for 2433 53 Min

Gross cnts 158
Background 1
Net counts 157 8 3%

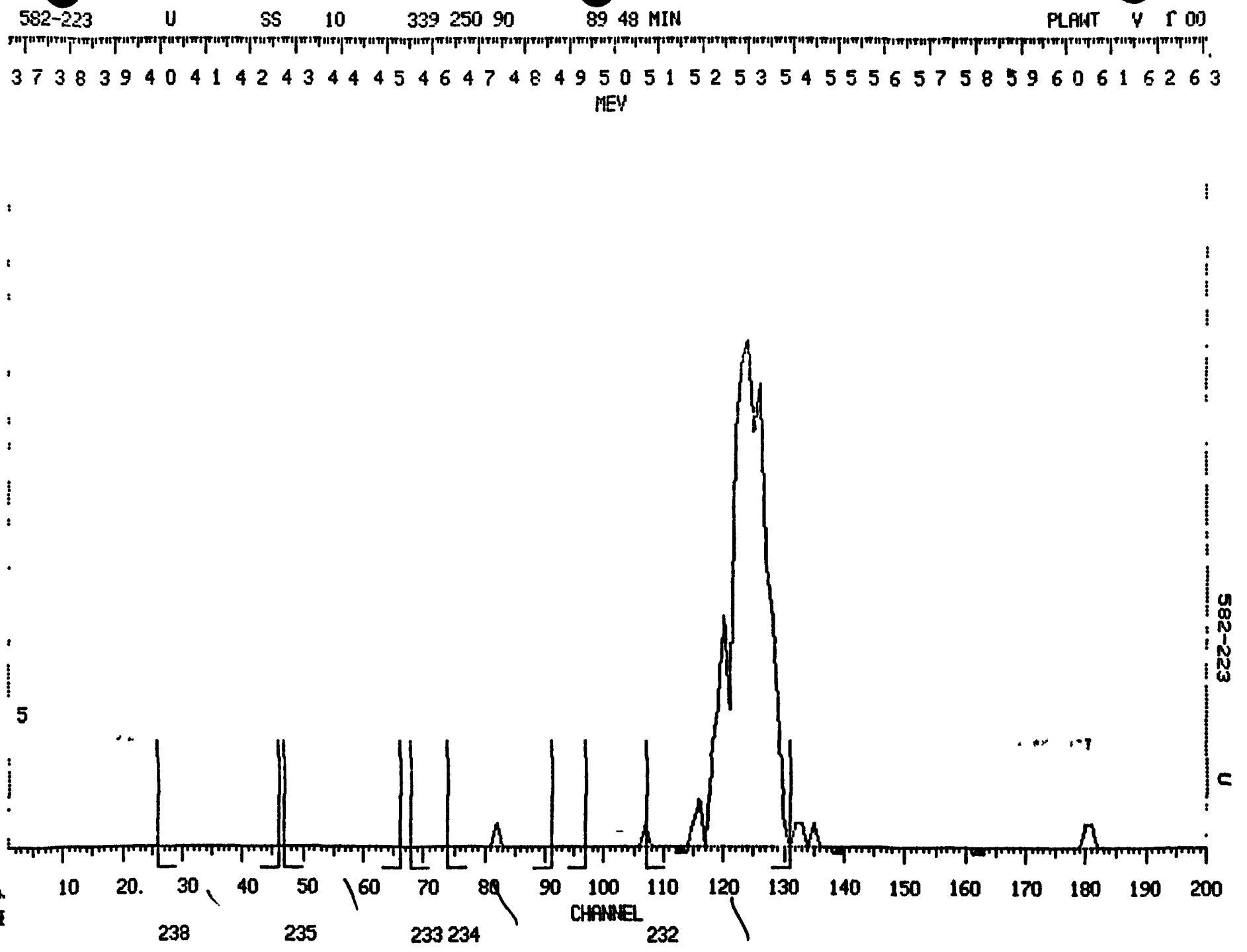
Divisor 1 3929E+01 (net counts / corr tracer DPM)
Det Eff 0 2766
Yield 0 5628 (net counts) / (eff x corr tracer DPM X time)

	U 238		U 235		U 233 /4		U 234	
Channels	26- 46		47- 66		68- 97		74- 91	
Bkg CPM	0 00000		0 00082		0 00164		0 00082	
Gross cnts	0		0		1		1	
Background	0		0		0		0	
Tracer cts	0	0	0	0	0	0	0	0
U235 cnts	0		0		0		0	
Net counts	0	1	0	1	1	1	1	1
Lambda	(4 2266E-13)		(2 6729E-12)		(1 1714E-08)		(7 6520E-09)	
Decay corr	1 0000		1 0000		1 0000		1 0000	
Brnch ratio	1 0000		0 8260		1 0000		1 0000	
DPM of aliq	0 0000E-01		0 0000E-01		7 1793E-02		7 1793E-02	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	0 0000E-01		0 0000E-01		7 1793E-02		7 1793E-02	
pCi /smpl	0 000E-01		0 000E-01		3 234E-02		3 234E-02	
1 sigma Err	0 0%		0 0%		100 3%		100 3%	
pCi Err	3 234E-02		3 915E-02		3 245E-02		3 245E-02	
2 sigma Err	0 0%		0 0%		200 7%		200 7%	
pCi Err	6 468E-02		7 830E-02		6 490E-02		6 490E-02	
Limitng Vlu	< 5 34E-02		< 6 46E-02		< 8 59E-02		< 8 59E-02	
MDA	1 51E-01		1 82E-01		1 51E-01		1 51E-01	

582 223 U 339 250 89 48 MIN SS 10

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
'0	0	0	208	641	0	156	572	0	104	503	0	-52	434	0
0	0	0	207	640	0	155	571	0	103	502	0	-51	433	0
0	0	0	206	638	0	154	569	0	102	500	0	-50	431	0
0	0	0	205	637	0	153	568	0	101	499	0	-49	430	0
256	705	0	204	636	0	152	567	0	100	498	0	-48	429	0
255	703	0	203	634	0	151	565	0	99	496	0	-47	427	0
254	702	0	202	633	0	150	564	0	98	495	0	-46	426	0
253	701	0	201	632	0	149	563	0	-97	494	0	-45	425	0
252	699	0	200	630	0	148	561	0	-96	492	0	-44	423	0
251	698	0	199	629	0	147	560	0	-95	491	0	-43	422	0
250	697	0	198	628	0	146	559	0	-94	490	0	-42	421	0
249	695	0	197	626	0	145	557	0	-93	488	0	-41	419	0
248	694	0	196	625	0	144	556	0	-92	487	0	-40	418	0
247	693	0	195	624	0	143	555	0	-91	486	0	-39	417	0
246	691	0	194	622	0	142	553	0	-90	484	0	-38	415	0
245	690	0	193	621	0	141	552	0	-89	483	0	-37	414	0
244	689	0	192	620	0	140	551	0	-88	482	0	-36	413	0
243	687	0	191	618	0	139	549	0	-87	480	0	-35	411	0
242	686	0	190	617	0	138	548	0	-86	479	0	-34	410	0
241	685	0	189	616	0	137	547	0	-85	478	0	-33	409	0
240	683	0	188	614	0	136	545	0	-84	476	0	-32	407	0
239	682	0	187	613	0	135	544	1	-83	475	0	-31	406	0
238	681	0	186	612	0	134	543	0	-82	474	1	-30	405	0
237	679	0	185	610	0	133	541	1	-81	472	0	-29	403	0
236	678	0	184	609	0	132	540	1	-80	471	0	-28	402	0
235	677	0	183	608	0	-131	539	0	-79	470	0	-27	401	0
234	675	0	182	606	0	-130	537	1	-78	468	0	-26	399	0
233	674	0	181	605	1	-129	536	6	-77	467	0	25	398	0
232	673	0	180	604	1	-128	535	10	-76	466	0	24	397	0
231	671	0	179	602	0	-127	533	12	-75	464	0	23	395	0
230	670	0	178	601	0	-126	532	20	-74	463	0	22	394	0
229	669	0	177	600	0	-125	531	18	-73	462	0	21	393	0
228	667	0	176	598	0	-124	529	22	-72	460	0	20	391	0
227	666	0	175	597	0	-123	528	21	-71	459	0	19	390	0
226	665	0	174	596	0	-122	527	18	-70	458	0	18	389	0
225	663	0	173	594	0	-121	525	6	-69	456	0	17	387	0
224	662	0	172	593	0	-120	524	10	-68	455	0	16	386	0
223	661	0	171	592	0	-119	523	6	67	454	0	15	385	0
222	660	0	170	590	0	-118	521	4	-66	452	0	14	383	0
221	658	0	169	589	0	-117	520	0	-65	451	0	13	382	0
220	657	0	168	588	0	-116	519	2	-64	450	0	12	381	0
219	656	0	167	586	0	-115	517	1	-63	448	0	11	379	0
218	654	0	166	585	0	-114	516	0	-62	447	0	10	378	0
217	653	0	165	584	0	-113	515	0	-61	446	0	9	377	0
216	652	0	164	583	0	-112	513	0	-60	444	0	8	375	0
215	650	0	163	581	0	-111	512	0	-59	443	0	7	374	0
214	649	0	162	580	0	-110	511	0	-58	442	0	6	373	0
213	648	0	161	579	0	-109	509	0	-57	440	0	5	371	0
212	646	0	160	577	0	-108	508	0	-56	439	0	4	370	0
211	645	0	159	576	0	-107	507	1	-55	438	0	3	369	0
210	644	0	158	575	0	106	506	0	-54	436	0	2	367	0
209	642	0	157	573	0	105	504	0	-53	435	0	1	366	0

238	235	233	234	232
26- 46	47- 66	68- 97	74- 91	107- 131


582-223 U SS 10 339 250 90 89 48 MIN PLANT V 1 00
37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
MEV
582-223
U
5
10 20. 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
CHANNEL
238
235
233 234
232

05-DEC-90 TMA Corporation 582-224 U
20 32 04 Alpha Spectroscopy QC 3846-50, 56
ASPEC V 2 09 Reviewed Date 12/6/90

Counted on SS 1 122 62 minutes
GMT 340 099 90
Zero time 1 000 90

GMT of std 340 084 90
Sep time 0 000 0 Chemical yield 0 6194

Tracer - U 232 (F-F1-A-(13) 240 738-89)
11 41 Dpm X 0 9878 = 11 27 Corr tracer DPM
Channels 106-130
Bkg CPM 0 00288 (on 335 978 90 for 2433 53 Min

Gross cnts 237
Background 0
Net counts 237 6 3%

Divisor 2 1027E+01 (net counts / corr tracer DPM)
Det Eff 0 2768
Yield 0 6194 (net counts) / (eff x corr tracer DPM X time)

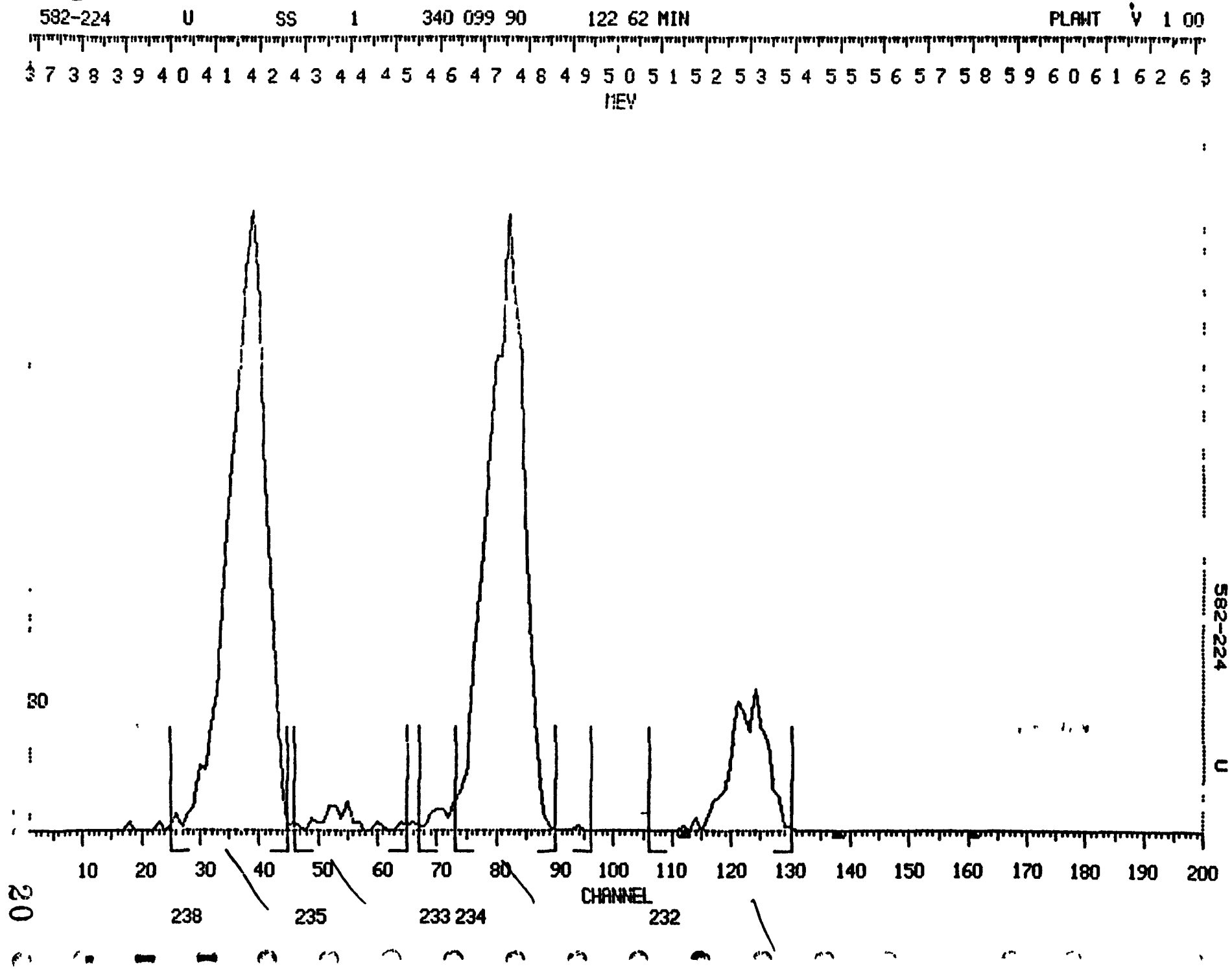
	U 238		U 235		U 233/4		U 234	
Channels	25- 45		46- 65		67- 96		73- 90	
Bkg CPM	0 00000		0 00041		0 00247		0 00082	
Gross cnts	1066		42		1056		1036	
Background	0		0		0		0	
Tracer cts	0	0	0	0	0	0	0	0
U235 cnts	4		0		5		0	
Net counts	1062	33	42	6	1051	33	1036	32
Lambda	(4 2266E-13)		(2 6729E-12)		(1 1714E-08)		(7 6520E-09)	
Decay corr	1 0000		1 0000		1 0000		1 0000	
Brnch ratio	1 0000		0 8260		1 0000		1 0000	
DPM of aliq	5 0506E+01		2 4182E+00		4 9983E+01		4 9270E+01	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	5 0506E+01		2 4182E+00		4 9983E+01		4 9270E+01	
pCi /smpl	2 275E+01		1 089E+00		2 252E+01		2 219E+01	
1 sigma Err	7 1%		15 6%		7 1%		7 0%	
pCi Err	1 604E+00		1 702E-01		1 591E+00		1 563E+00	
2 sigma Err	14 1%		31 2%		14 1%		14 1%	
pCi Err	3 208E+00		3 404E-01		3 181E+00		3 126E+00	
Limitng Vlu	< 2 54E+01		< 1 37E+00		< 2 51E+01		< 2 48E+01	
MDA	2 00E-01		1 21E-01		2 23E-01		9 98E-02	

pCi/smpl ± 1of err 26 22.8 ± 3.4 (15%) 1.09 ± 0.34 (31%) ~~2.24~~ 22.5 ± 3.2 (± 15%)

582 224 U 340 099 122.62 MIN SS 1

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	642	0	156	573	0	104	504	0	-52	435	6
0	0	0	207	641	0	155	572	0	103	503	0	-51	434	2
0	0	0	206	640	0	154	571	0	102	502	0	-50	433	2
0	0	0	205	638	0	153	569	0	101	500	0	-49	431	3
256	706	0	204	637	0	152	568	0	100	499	0	-48	430	0
255	705	0	203	636	0	151	567	0	99	498	0	-47	429	1
254	703	0	202	634	0	150	565	0	98	496	0	-46	427	2
253	702	0	201	633	0	149	564	0	97	495	0	-45	426	1
252	701	0	200	632	0	148	563	0	-96	494	0	-44	425	12
251	699	0	199	630	0	147	561	0	-95	492	0	-43	423	35
250	698	0	198	629	0	146	560	0	-94	491	1	-42	422	61
249	697	0	197	628	0	145	559	0	-93	490	0	-41	421	87
248	695	0	196	626	0	144	557	0	-92	488	0	-40	419	133
247	694	0	195	625	0	143	556	0	-91	487	0	-39	418	149
246	693	0	194	624	0	142	555	0	-90	486	0	-38	417	136
245	691	0	193	622	0	141	553	0	-89	484	1	-37	415	113
244	690	0	192	621	0	140	552	0	-88	483	4	-36	414	96
243	689	0	191	620	0	137	551	0	-87	482	15	-35	413	78
242	687	0	190	618	0	138	549	0	-86	480	41	-34	411	59
241	686	0	189	617	0	137	548	0	-85	479	66	-33	410	34
240	685	0	188	616	0	136	547	0	-84	478	116	-32	409	25
239	683	0	187	614	0	135	545	0	-83	476	128	-31	407	15
238	682	0	186	613	0	134	544	0	-82	475	148	-30	406	16
237	681	0	185	612	0	133	543	0	-81	474	114	-29	405	6
236	679	0	184	610	0	132	541	0	-80	472	114	-28	403	4
235	678	0	183	609	0	131	540	0	-79	471	94	-27	402	1
234	677	0	182	608	0	-130	539	1	-78	470	71	-26	401	4
233	675	0	181	606	0	-129	537	1	-77	468	55	-25	399	1
232	674	0	180	605	0	-128	536	8	-76	467	38	24	398	0
231	673	0	179	604	0	-127	535	10	-75	466	15	23	397	2
230	671	0	178	602	0	-126	533	22	-74	464	9	22	395	0
229	670	0	177	601	0	-125	532	25	-73	463	7	21	394	0
228	669	0	176	600	0	-124	531	34	-72	462	3	20	393	0
227	667	0	175	598	0	-123	529	24	-71	460	5	19	391	0
226	666	0	174	597	0	-122	528	29	-70	459	5	18	390	2
225	665	0	173	596	0	-121	527	31	-69	458	4	17	389	0
224	663	0	172	594	0	-120	525	20	-68	456	1	16	387	0
223	662	0	171	593	0	-119	524	10	-67	455	1	15	386	0
222	661	0	170	592	0	-118	523	8	66	454	2	14	385	0
221	660	0	169	590	0	-117	521	7	-65	452	1	13	383	0
220	658	0	168	589	0	-116	520	3	-64	451	2	12	382	0
219	657	0	167	588	0	-115	519	0	-63	450	0	11	381	0
218	656	0	166	586	0	-114	517	3	-62	448	0	10	379	0
217	654	0	165	585	0	-113	516	0	-61	447	1	9	378	0
216	653	0	164	584	0	-112	515	1	-60	446	2	8	377	0
215	652	0	163	583	0	-111	513	0	-59	444	0	7	375	0
214	650	0	162	581	0	-110	512	0	-58	443	0	6	374	0
213	649	0	161	580	0	-109	511	0	-57	442	2	5	373	0
212	648	0	160	579	0	-108	510	0	-56	440	2	4	371	0
211	646	0	159	577	0	-107	508	0	-55	439	7	3	370	0
210	645	0	158	576	0	-106	507	0	-54	438	3	2	369	0
209	644	0	157	575	0	105	506	0	-53	436	6	1	367	0

238	235	233	234	232
25- 45	46- 65	67- 96	73- 90	106- 130


582-224 U SS 1 340 099 90 122 62 MIN PLANT V 1 00
MEV
582-224
U
30
20
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
CHANNEL
238
235
233 234
232

11-JAN-91
13 06 03

TMA Corporation
Alpha Spectroscopy
ASPEC V 2 09

582-220 Pu
SPLIT 63 NP50173WC

Reviewed Date 1/11/91

Counted on	SS	8	1037 63 minutes
GMT	11	139	91
Zero time	270	292	90
GMT of std	11	060	91
Sep time	0	000	0

Chemical yield 0 7260

Tracer - Pu242 (G4-D2-A-(2) 160 269-90)
5 96 Dpm X 1 0000 = 5 96 Corr tracer DPM

Channels	83-102	
Bkg CPM	0 00297	(on 6 043 91 for 2353 23 Min
Gross cnts	1292	
Background	3	
Net counts	1289	2 8%
Divisor	2 1620E+02	(net counts / corr tracer DPM)
Det Eff	0 2870	
Yield	0 7260	(net counts) / (eff x corr tracer DPM X time)

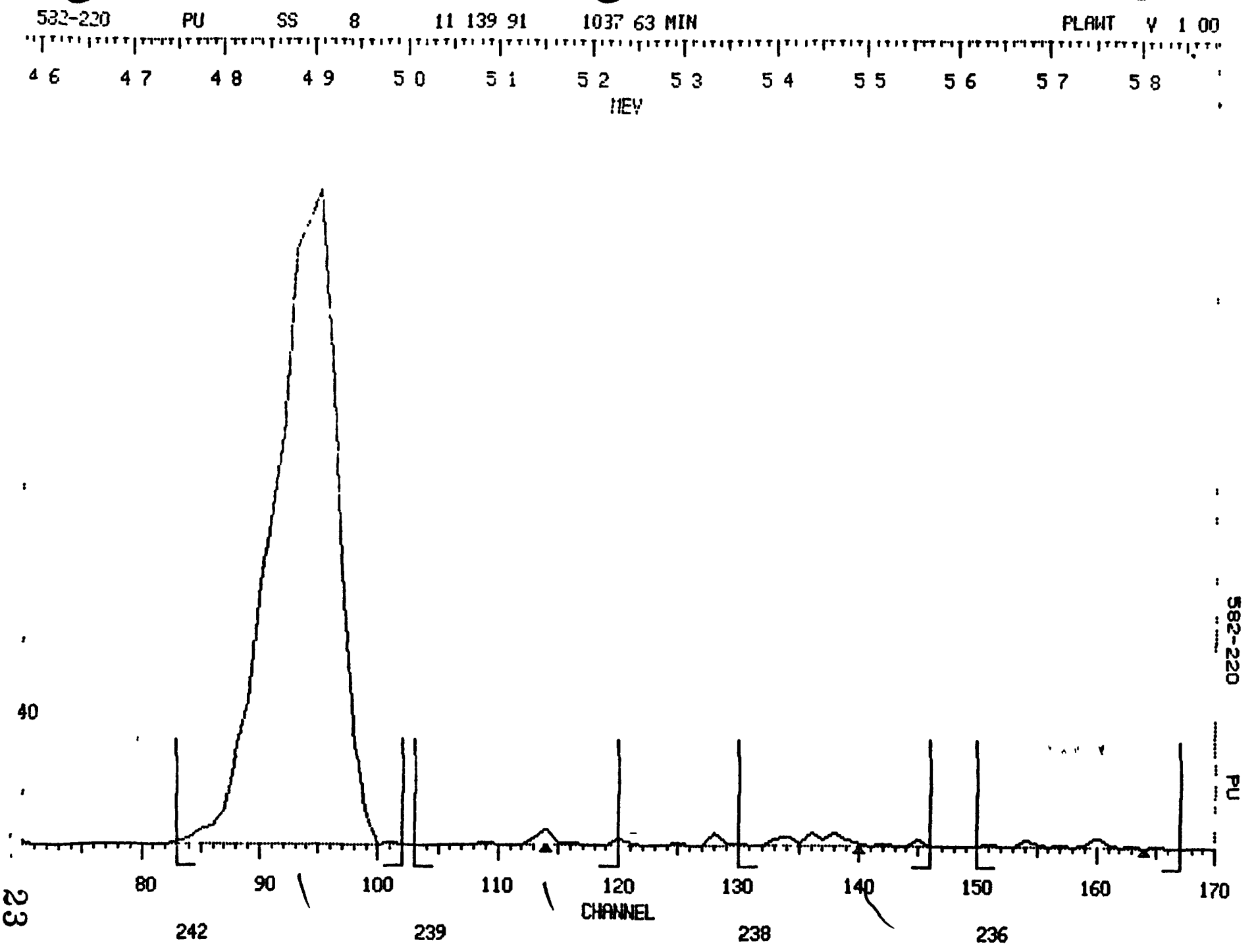
	Pu239		Pu238		Pu236	
Channels	103-120		130-146		150-167	
Bkg CPM	0 00382		0 00850		0 00850	
Gross cnts	12		23		12	
Background	4		9		9	
Tracer cts	0	0	0	0	0	0
Net counts	8	4	14	6	3	5
Lambda	(7 7775E-08)		(2 2005E-05)		(6 6560E-04)	
Decay corr	1 0000		0 9977		0 9320	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	3 7003E-02		6 4905E-02		1 4889E-02	
Aliquot	2 5000E+00		2 5000E+00		2 5000E+00	
Dpm/l	1 4801E-02		2 5962E-02		5 9555E-03	
pCi /l	6 667E-03		1 169E-02		2 683E-03	
1 sigma Err	50 1%		42 9%		166 7%	
pCi Err	3 339E-03		5 023E-03		4 472E-03	
2 sigma Err	100 2%		85 9%		333 4%	
pCi Err	6 678E-03		1 005E-02		8 943E-03	
Limitng Vlu	< 1 22E-02		< 2 00E-02		< 1 01E-02	
MDA	7 77E-03		1 17E-02		1 25E-02	

582 220 Pu 11 139 1037 63 MIN SS B

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	637	0	-156	570	0	-104	502	0	52	434	0
0	0	0	207	636	0	-155	568	1	-103	501	0	51	433	0
0	0	0	206	635	0	-154	567	2	-102	499	0	50	432	1
0	0	0	205	633	0	-153	566	0	-101	498	1	49	430	0
256	700	0	204	632	0	-152	564	0	-100	497	0	48	429	0
255	699	0	203	631	0	-151	563	1	-99	495	10	47	428	0
254	697	0	202	630	1	-150	562	0	-98	494	33	46	427	0
253	696	0	201	628	0	149	561	0	-97	493	79	45	425	0
252	695	0	200	627	0	148	559	0	-96	492	154	44	424	0
251	693	0	199	626	0	147	558	0	-95	490	207	43	423	1
250	692	0	198	624	1	-146	557	0	-94	489	197	42	421	0
249	691	0	197	623	0	-145	555	2	-93	488	189	41	420	0
248	689	0	196	622	0	-144	554	0	-92	486	133	40	419	0
247	688	0	195	620	0	-143	553	0	-91	485	105	39	417	0
246	687	0	194	619	0	-142	551	1	-90	484	83	38	416	0
245	686	1	193	618	0	-141	550	0	-89	482	46	37	415	0
244	684	2	192	617	0	-140	549	1	-88	481	30	36	413	0
243	683	1	191	615	0	-139	548	2	-87	480	11	35	412	0
242	682	0	190	614	0	-138	546	4	-86	479	6	34	411	1
241	680	0	189	613	0	-137	545	2	-85	477	5	33	410	0
240	679	1	188	611	1	-136	544	4	-84	476	2	32	408	0
239	678	0	187	610	0	-135	542	1	-83	475	1	31	407	0
238	676	0	186	609	0	-134	541	3	82	473	0	30	406	0
237	675	1	185	607	0	-133	540	2	81	472	0	29	404	0
236	674	0	184	606	0	-132	538	0	80	471	0	28	403	0
235	673	0	183	605	0	-131	537	0	79	469	0	27	402	0
234	671	0	182	604	0	-130	536	1	78	468	0	26	400	0
233	670	0	181	602	1	129	535	1	77	467	0	25	399	0
232	669	0	180	601	0	128	533	4	76	466	0	24	398	0
231	667	1	179	600	0	127	532	0	75	464	0	23	397	0
230	666	0	178	598	0	126	531	0	74	463	0	22	395	0
229	665	0	177	597	0	125	529	1	73	462	0	21	394	0
228	663	0	176	596	0	124	528	0	72	460	0	20	393	0
227	662	0	175	594	0	123	527	0	71	459	0	19	391	0
226	661	0	174	593	0	122	525	0	70	458	1	18	390	0
225	660	0	173	592	0	121	524	1	69	456	0	17	389	0
224	658	0	172	591	0	-120	523	2	68	455	0	16	387	0
223	657	0	171	589	0	-119	522	0	67	454	0	15	386	0
222	656	0	170	588	0	-118	520	0	66	453	0	14	385	0
221	654	0	169	587	0	-117	519	0	65	451	0	13	384	0
220	653	0	168	585	0	-116	518	1	64	450	0	12	382	1
219	652	0	-167	584	0	-115	516	1	63	449	0	11	381	0
218	650	0	-166	583	0	-114	515	5	62	447	1	10	380	0
217	649	0	-165	581	1	-113	514	2	61	446	0	9	378	0
216	648	0	-164	580	0	-112	512	0	60	445	0	8	377	0
215	646	0	-163	579	1	-111	511	0	59	443	0	7	376	0
214	645	0	-162	578	0	-110	510	0	58	442	1	6	374	0
213	644	0	-161	576	1	-109	509	1	57	441	0	5	373	1
212	643	0	-160	575	3	-108	507	0	56	440	1	4	372	0
211	641	0	-159	574	1	-107	506	0	55	438	0	3	371	0
210	640	0	-158	572	0	-106	505	0	54	437	0	2	369	0
209	639	0	-157	571	1	-105	503	0	53	436	0	1	368	0

239 238 236 0 242

103- 120 130- 146 150- 167 0- 0 83- 102


582-220 PU SS 8 11 139 91 1037 63 MIN PLOT Y 1 00
46 47 48 49 50 51 52 53 54 55 56 57 58
MEV
582-220
PU
40
80 90 100 110 120 130 140 150 160 170
CHANNEL
242 239 238 236

08-DEC-90 TMA Corporation 582-221 Pu
17 10 32 Alpha Spectroscopy SPLIT 84 NP50193WC
ASPEC V 2 09

12/10 Reviewed [illegible] Date 12/10/90

Counted on SS 16 1013 55 minutes
GMT 342 251 90
Zero time 284 292 90

GMT of std 342 106 90
Sep time 0 000 0

Chemical yield 0 5545

Tracer - Pu242 (04-D2-A-(2) 160 269-90)
5 96 Dpm X 1 0000 = 5 96 Corr tracer DPM

Channels 85-103
Bkg CPM 0 00411 (on 335 978 90 for 2434 98 Min

Gross cnts 926
Background 4
Net counts 922 3 3%

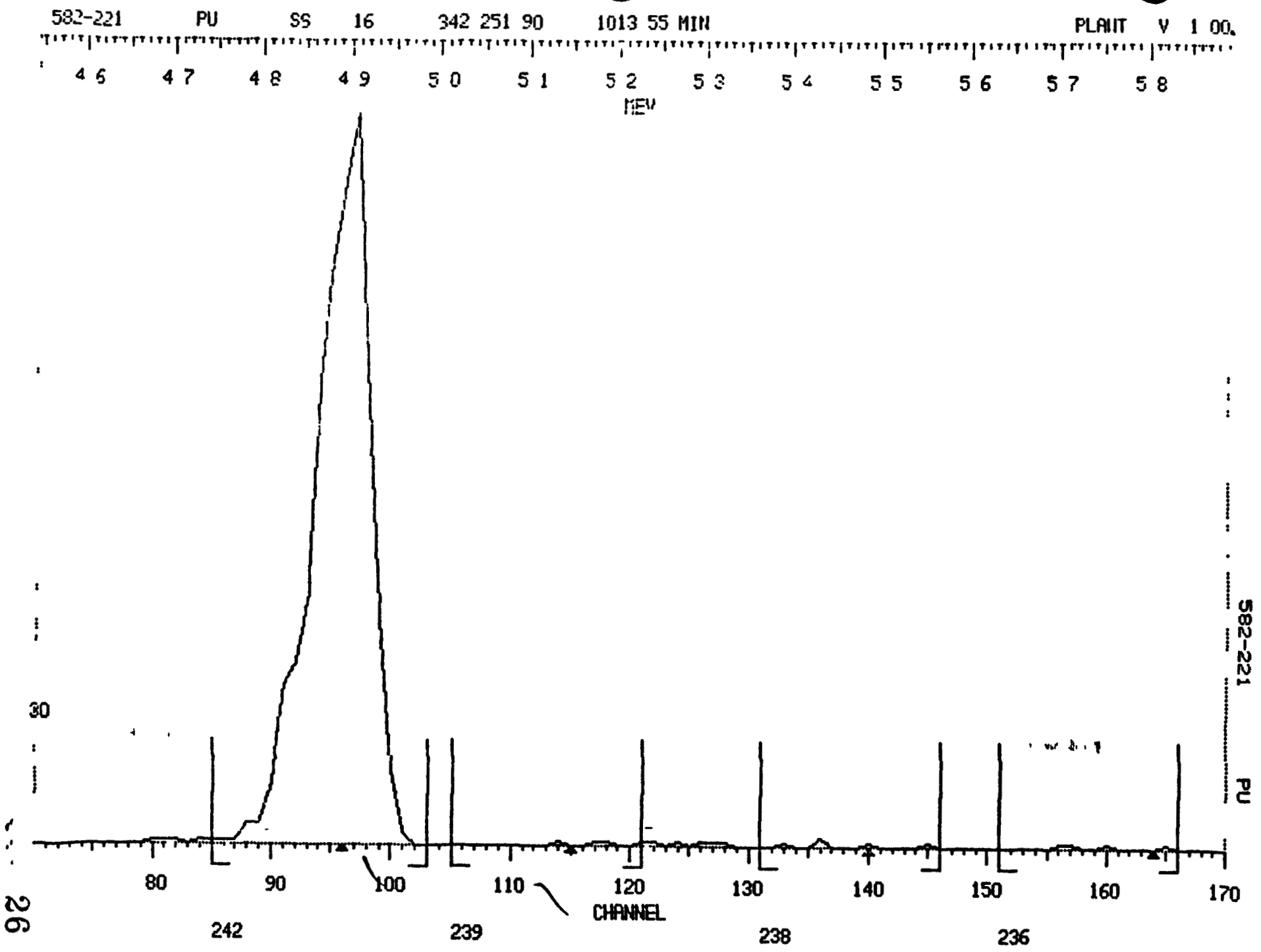
Divisor 1 5465E+02 (net counts / corr tracer DPM)
Det Eff 0 2752
Yield 0 5545 (net counts) / (eff x corr tracer DPM X time)

	Pu239		Pu238		Pu236	
Channels	105-121		131-146		151-166	
Bkg CPM	0 00082		0 00082		0 00246	
Gross cnts	4		5		4	
Background	1		1		2	
Tracer cts	0	0	0	0	0	0
Net counts	3	2	4	2	2	2
Lambda	(7 7775E-08)		(2 2005E-05)		(6 6560E-04)	
Decay corr	1 0000		0 9987		0 9622	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	1 9399E-02		2 5098E-02		1 3441E-02	
Aliquot	2 5000E+00		2 5000E+00		2 5000E+00	
Dpm/l	7 7597E-03		1 0039E-02		5 3766E-03	
pCi /l	3 495E-03		4 666E-03		2 422E-03	
1 sigma Err	66 7%		50 1%		100 1%	
pCi Err	2 333E-03		2 338E-03		2 423E-03	
2 sigma Err	133 5%		100 2%		200 1%	
pCi Err	4 666E-03		4 676E-03		4 846E-03	
Limitng Vlu	< 7 34E-03		< 8 52E-03		< 6 42E-03	
MDA	5 43E-03		5 44E-03		7 98E-03	

582 221 Pu 342 251 1013 55 MIN SS 16

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	640	0	-156	570	1	104	500	0	52	430	0
0	0	0	207	639	0	-155	568	0	-103	498	0	51	428	0
0	0	0	206	637	0	-154	567	0	-102	497	0	50	427	0
0	0	0	205	636	0	-153	566	0	-101	496	3	49	426	0
256	705	0	204	634	0	-152	564	0	-100	494	17	48	424	0
255	703	0	203	633	0	-151	563	0	-99	493	51	47	423	0
254	702	0	202	632	0	150	562	0	-98	492	107	46	422	0
253	700	0	201	630	0	149	560	0	-97	490	173	45	420	0
252	699	0	200	629	0	148	559	0	-96	489	157	44	419	0
251	698	0	199	628	0	147	558	0	-95	488	139	43	418	0
250	696	0	198	626	0	-146	556	0	-94	486	111	42	416	0
249	695	0	197	625	0	-145	555	1	-93	485	59	41	415	0
248	694	0	196	624	0	-144	554	0	-92	484	43	40	414	0
247	692	0	195	622	0	-143	552	0	-91	482	38	39	412	0
246	691	0	194	621	0	-142	551	0	-90	481	15	38	411	0
245	690	0	193	620	0	-141	550	0	-89	480	5	37	410	0
244	688	0	192	618	0	-140	548	1	-88	478	5	36	408	0
243	687	0	191	617	0	-139	547	0	-87	477	1	35	407	0
242	686	0	190	616	0	-138	546	0	-86	476	1	34	405	0
241	684	0	189	614	0	-137	544	0	-85	474	1	33	404	0
240	683	0	188	613	0	-136	543	2	84	473	1	32	403	0
239	682	0	187	612	0	-135	542	0	83	471	0	31	401	0
238	680	0	186	610	0	-134	540	0	82	470	1	30	400	0
237	679	0	185	609	0	-133	539	1	81	469	1	29	399	0
236	678	0	184	608	1	-132	538	0	80	467	1	28	397	0
235	676	0	183	606	0	-131	536	0	79	466	0	27	396	0
234	675	0	182	605	0	130	535	0	78	465	0	26	395	0
233	674	0	181	604	0	129	533	0	77	463	0	25	393	0
232	672	0	180	602	0	128	532	1	76	462	0	24	392	0
231	671	0	179	601	0	127	531	1	75	461	0	23	391	0
230	670	0	178	599	0	126	529	1	74	459	0	22	389	0
229	668	0	177	598	0	125	528	0	73	458	0	21	388	0
228	667	0	176	597	0	124	527	1	72	457	0	20	387	0
227	665	0	175	595	0	123	525	0	71	455	0	19	385	0
226	664	0	174	594	0	122	524	1	70	454	0	18	384	0
225	663	0	173	593	0	-121	523	1	69	453	0	17	383	1
224	661	0	172	591	0	-120	521	0	68	451	0	16	381	0
223	660	0	171	590	0	-119	520	0	67	450	0	15	380	0
222	659	0	170	589	0	-118	519	1	66	449	0	14	379	0
221	657	0	169	587	0	-117	517	1	65	447	0	13	377	0
220	656	0	168	586	0	-116	516	0	64	446	0	12	376	0
219	655	0	167	585	0	-115	515	0	63	445	0	11	375	1
218	653	0	-166	583	0	-114	513	1	62	443	0	10	373	0
217	652	0	-165	582	1	-113	512	0	61	442	0	9	372	0
216	651	0	-164	581	0	-112	511	0	60	441	1	8	370	0
215	649	0	-163	579	0	-111	509	0	59	439	0	7	369	0
214	648	0	-162	578	0	-110	508	0	58	438	1	6	368	0
213	647	0	-161	577	0	-109	507	0	57	436	0	5	366	0
212	645	0	-160	575	1	-108	505	0	56	435	0	4	365	0
211	644	0	-159	574	0	-107	504	0	55	434	0	3	364	0
210	643	0	-158	573	0	-106	502	0	54	432	0	2	362	0
209	641	0	-157	571	1	-105	501	0	53	431	1	1	361	0

239	238	236	0	242
105- 121	131- 146	151- 166	0- 0	85- 103


582-221 PU SS 16 342 251 90 1013 55 MIN
PLANT V 1 00.
46 47 48 49 50 51 52 53 54 55 56 57 58
MEV
30
80 90 100 110 120 130 140 150 160 170
CHANNEL
242 239 238 236
582-221
PU

15-DEC-90 TMA Corporation 582-222R1 Pu
15 10 27 Alpha Spectroscopy GC 3836-40, 54
ASPEC V 2 09 W 12/17 Reviewed [illegible] Date 12/17/90

Counted on SS 24 998 18 minutes
GMT 349 243 90
Zero time 1 000 90

GMT of std 349 164 90
Sep time 0 000 0 Chemical yield 0 3158

Tracer - Pu242 (G4-D2-A-(2) 160 269-90)
5 96 Dpm X 1 0000 = 5.96 Corr. tracer DPM

Channels 87-105
Bkg CPM 0 00248 (on 343 006 90 for 2416 00 Min.

Gross cnts 616
Background 2
Net counts 614 4 1%

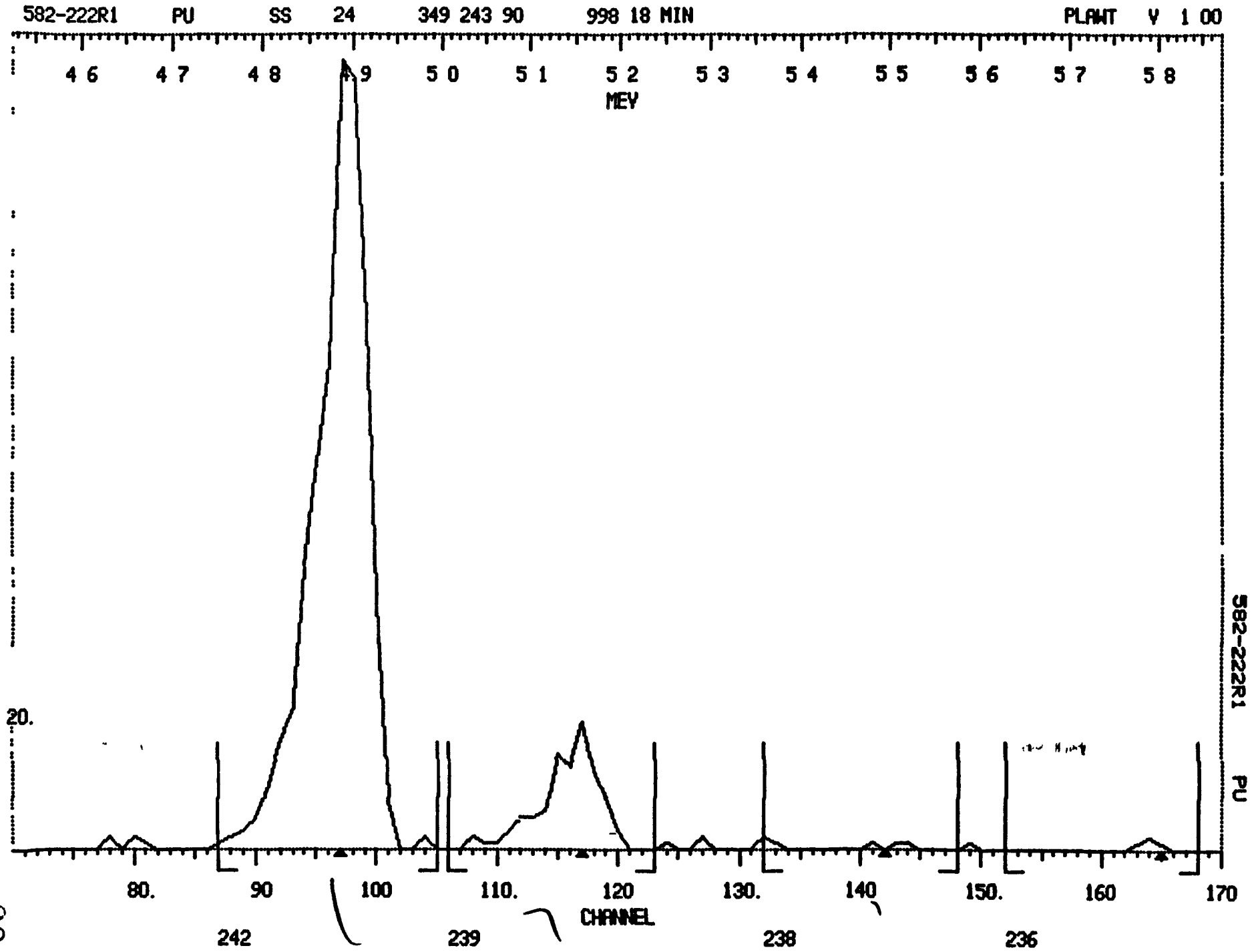
Divisor 1 0299E+02 (net counts / corr. tracer DPM)
Det Eff 0 3267
Yield 0 3158 (net counts) / (eff. x corr. tracer DPM X time)

	Pu239		Pu238		Pu236	
Channels	106-123		132-148		152-168	
Bkg CPM	0 00083		0 00579		0.00207	
Gross cnts	94		6		4	
Background	1		6		2	
Tracer cts	0	0	0	0	0	0
Net counts	93	10	0	3	2	2
Lambda	(7 7775E-08)		(2 2005E-05)		(6 6560E-04)	
Decay corr	1 0000		0 9924		0.7931	
Brnch ratio	1 0000		1 0000		1.0000	
DPM of aliq	9 0306E-01		0 0000E-01		2.4486E-02	
Aliquot	1 0000E+00		1 0000E+00		1.0000E+00	
Dpm/smpl	9 0306E-01		0 0000E-01		2.4486E-02	
pCi /smpl	4 068E-01		0 000E-01		1.103E-02	
1 sigma Err	11 5%		0 0%		100 1%	
pCi Err	4 677E-02		1 322E-02		1.104E-02	
2 sigma Err	23 0%		0 0%		200 2%	
pCi Err	9 354E-02		2 645E-02		2 208E-02	
Limitng Vlu	< 4 84E-01		< 2 18E-02		< 2 92E-02	
MDA	2 04E-02		5 03E-02		3 63E-02	

pCi/smp tot err ±26 0 41 ± 0.10
±242 W 12/17

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	638	0	-156	568	0	-104	498	2	52	428	0
0	0	0	207	637	0	-155	566	0	-103	496	0	51	426	0
0	0	0	206	635	0	-154	565	0	-102	495	0	50	425	0
0	0	0	205	634	0	-153	564	0	-101	494	7	49	424	0
256	703	0	204	633	0	-152	562	0	-100	492	37	48	422	0
255	701	0	203	631	0	151	561	0	-99	491	85	47	421	0
254	700	0	202	630	0	150	560	0	-98	490	120	46	420	0
253	699	0	201	629	0	149	558	1	-97	488	123	45	418	0
252	697	0	200	627	0	-148	557	0	-96	487	76	44	417	0
251	696	0	199	626	0	-147	556	0	-95	486	61	43	415	0
250	695	0	198	624	0	-146	554	0	-94	484	45	42	414	0
249	693	0	197	623	0	-145	553	0	-93	483	22	41	413	0
248	692	0	196	622	0	-144	552	1	-92	482	17	40	411	0
247	691	0	195	620	0	-143	550	1	-91	480	10	39	410	0
246	689	0	194	619	0	-142	549	0	-90	479	5	38	409	0
245	688	0	193	618	0	-141	548	1	-89	478	3	37	407	0
244	686	0	192	616	0	-140	546	0	-88	476	2	36	406	1
243	685	0	191	615	0	-139	545	0	-87	475	1	35	405	0
242	684	0	190	614	0	-138	544	0	86	473	0	34	403	0
241	682	0	189	612	0	-137	542	0	85	472	0	33	402	0
240	681	0	188	611	1	-136	541	0	84	471	0	32	401	0
239	680	0	187	610	2	-135	540	0	83	469	0	31	399	0
238	678	0	186	608	0	-134	538	0	82	468	0	30	398	0
237	677	0	185	607	2	-133	537	1	81	467	1	29	397	0
236	676	0	184	606	2	-132	535	2	80	465	2	28	395	0
235	674	0	183	604	2	131	534	0	79	464	0	27	394	0
234	673	0	182	603	0	130	533	0	78	463	2	26	393	0
233	672	0	181	602	0	129	531	0	77	461	0	25	391	0
232	670	0	180	600	1	128	530	0	76	460	0	24	390	0
231	669	0	179	599	0	127	529	2	75	459	0	23	389	0
230	668	0	178	597	0	126	527	0	74	457	0	22	387	0
229	666	0	177	596	2	125	526	0	73	456	0	21	386	0
228	665	0	176	595	0	124	525	1	72	455	0	20	384	0
227	664	0	175	593	0	-123	523	0	71	453	0	19	383	1
226	662	0	174	592	0	-122	522	0	70	452	0	18	382	0
225	661	0	173	591	0	-121	521	0	69	451	0	17	380	0
224	660	0	172	589	0	-120	519	3	68	449	1	16	379	0
223	658	0	171	588	0	-119	518	8	67	448	0	15	378	0
222	657	0	170	587	0	-118	517	12	66	447	1	14	376	0
221	655	0	169	585	0	-117	515	20	65	445	0	13	375	0
220	654	0	-168	584	0	-116	514	13	64	444	0	12	374	1
219	653	0	-167	583	0	-115	513	15	63	442	0	11	372	0
218	651	0	-166	581	0	-114	511	6	62	441	0	10	371	0
217	650	0	-165	580	1	-113	510	5	61	440	0	9	370	0
216	649	0	-164	579	2	-112	509	5	60	438	0	8	368	0
215	647	0	-163	577	1	-111	507	3	59	437	0	7	367	0
214	646	0	-162	576	0	-110	506	1	58	436	0	6	366	0
213	645	0	-161	575	0	-109	504	1	57	434	0	5	364	0
212	643	0	-160	573	0	-108	503	2	56	433	0	4	363	0
211	642	0	-159	572	0	-107	502	0	55	432	0	3	362	0
210	641	0	-158	571	0	-106	500	0	54	430	0	2	360	0
209	639	0	-157	569	0	-105	499	0	53	429	0	1	359	0

239	238	236	0	242
106- 123	132- 148	152- 168	0- 0	87- 105


582-222R1 PU SS 24 349 243 90 998 18 MIN PLAWT V 1 00
4 6 4 7 4 8 4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8
MEV
20.
582-222R1
PU
80. 90 100 110. 120 130. 140 150. 160 170
CHANNEL
242 239 238 236

12-DEC-90 TMA Corporation 582-223 Pu
07 51 23 Alpha Spectroscopy QC 3841-45,55
ASPEC V 2.09

W.2/12 Reviewed [illegible] Date 12/12/90

Counted on 88 21 2415 02 minutes
GMT 344 978 90
Zero time 344 978 90

GMT of std 342.978 90
Sep time 0 000 0 Chemical yield 0.3283

Tracer - Pu242 (Q4-D2-A-(2) 160 269-90)
5 96 Dpm X 1.0000 = 5.96 Corr. tracer DPM
Channels 82-100 Drift correction 2.3
Bkg CPM 0.00248 (on 343.006 90 for 2416.00 Min.

Gross cnts 1447.
Background 6
Net counts 1441 2.6%

Divisor 2.4170E+02 (net counts / corr. tracer DPM)
Det Eff 0 3049
Yield 0 3283 (net counts) / (eff. x corr. tracer DPM X time)

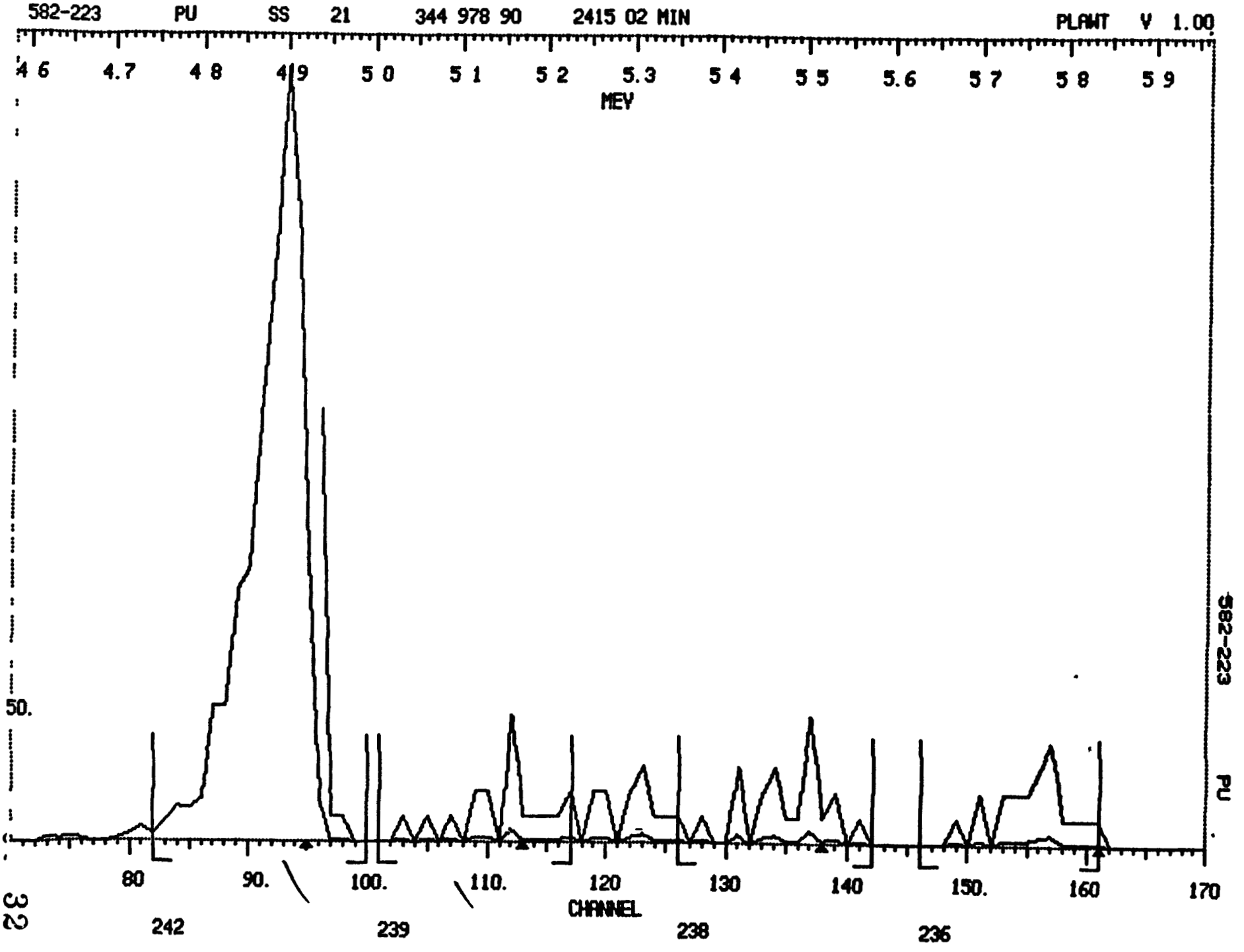
	Pu239		Pu238		Pu236	
Channels	101-117		126-142		146-161	
Bkg CPM	0 00124		0.00373		0.00166	
Gross cnts	18		21		20	
Background	3		9		4	
Tracer cts	0	0	0	0	0	0
Net counts	15	5	12	5	16	5
Lambda	(7 7775E-08)		(2 2005E-05)		(6 6560E-04)	
Decay corr	1 0000		1 0000		1.0000	
Brnch ratio	1 0000		1.0000		1.0000	
DPM of aliq	6 2061E-02		4 9649E-02		6.6198E-02	
Aliquot	1.0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	6 2061E-02		4 9649E-02		6 6198E-02	
pCi /smpl	2 796E-02		2 236E-02		2 982E-02	
1 sigma Err	33.4%		41 8%		31 4%	
pCi Err	9 348E-03		9 337E-03		9 352E-03	
2 sigma Err	66 9%		83 5%		62.7%	
pCi Err	1 870E-02		1 867E-02		1.870E-02	
Limitng Vlu	< 4 34E-02		< 3 78E-02		< 4 52E-02	
MDA	1 50E-02		2 61E-02		1.74E-02	

582 223 Pu 344 978 2415 02 MIN SS 21

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	649	0	-156	577	3	-104	505	0	52	433	0
0	0	0	207	647	0	-155	575	2	-103	503	1	51	432	0
0	0	0	206	646	0	-154	574	2	-102	502	0	50	430	1
0	0	0	205	644	0	-153	573	2	-101	501	0	49	429	0
256	715	0	204	643	0	-152	571	0	-100	499	0	48	427	0
255	714	0	203	642	0	-151	570	2	-99	498	0	47	426	0
254	712	0	202	640	0	-150	568	0	-98	497	1	46	425	0
253	711	0	201	639	0	-149	567	1	-97	495	1	45	423	1
252	709	0	200	638	0	-148	566	0	-96	494	17	44	422	1
251	708	0	199	636	0	-147	564	0	-95	492	108	43	420	0
250	707	0	198	635	1	-146	563	0	-94	491	244	42	419	0
249	705	0	197	633	0	145	561	0	-93	490	305	41	418	0
248	704	0	196	632	1	144	560	0	-92	488	230	40	416	0
247	703	0	195	631	0	143	559	0	-91	487	173	39	415	1
246	701	0	194	629	0	-142	557	0	-90	485	108	38	414	0
245	700	0	193	628	0	-141	556	1	-89	484	99	37	412	0
244	698	0	192	626	0	-140	555	0	-88	483	53	36	411	0
243	697	0	191	625	0	-139	553	2	-87	481	53	35	409	0
242	696	0	190	624	0	-138	552	1	-86	480	17	34	408	0
241	694	0	189	622	0	-137	550	5	-85	479	13	33	407	0
240	693	0	188	621	0	-136	549	1	-84	477	14	32	405	1
239	691	0	187	620	0	-135	548	1	-83	476	8	31	404	1
238	690	0	186	618	1	-134	546	3	-82	474	3	30	402	0
237	689	0	185	617	0	-133	545	2	81	473	6	29	401	0
236	687	0	184	615	0	-132	544	0	80	472	3	28	400	0
235	686	0	183	614	0	-131	542	3	79	470	1	27	398	0
234	685	0	182	613	0	-130	541	0	78	469	0	26	397	0
233	683	0	181	611	0	-129	539	0	77	467	0	25	396	0
232	682	0	180	610	0	-128	538	1	76	466	1	24	394	0
231	680	0	179	608	0	-127	537	0	75	465	2	23	393	1
230	679	0	178	607	0	-126	535	1	74	463	1	22	391	0
229	678	0	177	606	0	125	534	1	73	462	2	21	390	0
228	676	0	176	604	0	124	532	1	72	461	0	20	389	0
227	675	0	175	603	0	123	531	3	71	459	0	19	387	1
226	673	0	174	602	0	122	530	2	70	458	0	18	386	0
225	672	0	173	600	0	121	528	0	69	456	1	17	385	0
224	671	0	172	599	0	120	527	2	68	455	0	16	383	0
223	669	0	171	597	0	119	526	2	67	454	0	15	382	0
222	668	0	170	596	0	118	524	0	66	452	0	14	380	0
221	667	0	169	595	0	-117	523	2	65	451	1	13	379	0
220	665	0	168	593	0	-116	521	1	64	449	0	12	378	0
219	664	0	167	592	0	-115	520	1	63	448	0	11	376	1
218	662	0	166	591	0	-114	519	1	62	447	0	10	375	0
217	661	0	165	589	0	-113	517	1	61	445	0	9	373	0
216	660	0	164	588	0	-112	516	5	60	444	1	8	372	0
215	658	0	163	586	0	-111	514	0	59	443	0	7	371	0
214	657	0	162	585	0	-110	513	2	58	441	0	6	369	0
213	656	0	-161	584	1	-109	512	2	57	440	0	5	368	0
212	654	0	-160	582	1	-108	510	0	56	438	1	4	367	0
211	653	0	-159	581	1	-107	509	1	55	437	0	3	365	0
210	651	0	-158	579	1	-106	508	0	54	436	0	2	364	41767
209	650	0	-157	578	4	-105	506	1	53	434	2	1	362	0

239 238 236 0 242

101- 117 126- 142 146- 161 0- 0 82- 100


582-223 PU SS 21 344 978 90 2415 02 MIN
PLANT V 1.00
4.6 4.7 4.8 4.9 5.0 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9
MEV
50.
80 90. 100. 110. 120 130 140 150. 160 170
CHANNEL
242 239 238 236
582-223
PU

10-DEC-90
15 54 45

TMA Corporation
Alpha Spectroscopy
ASPEC V 2 09

582-224 Pu
QC 3846-50, 56

Reviewed Date 12/10/90

Counted on SS 19 1013 55 minutes
GMT 342 251 90
Zero time 1 000 90

GMT of std 342 106 90
Sep time 0 000 0

****
** RECALCULATED DATA **
****

Chemical yield 0 3181

Tracer - Pu242 (G4-D2-A-(2) 160 269-90)
5 96 Dpm X 1 0000 = 5 96 Corr tracer DPM

Channels 84-101*
Bkg CPM 0 00287 (on 335 978 90 for 2434 98 Min

Gross cnts 536
Background 3
Net counts 533 4 3%

Divisor 8 9400E+01 (net counts / corr tracer DPM)
Det Eff 0 2773
Yield 0 3181 (net counts) / (eff x corr tracer DPM X time)

	Pu239		Pu238		Pu236	
Channels	105-121*		132-147		152-167	
Bkg CPM	0 00123		0 00246		0 00205	
Gross cnts	385		3		2	
Background	1		2		2	
Tracer cts	0	0	0	0	0	0
Net counts	384	20	1	2	0	2
Lambda	(7 7775E-08)		(2 2005E-05)		(6 6560E-04)	
Decay corr	1 0000		0 9925		0 7968	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	4 2954E+00		1 1270E-02		0 0000E-01	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	4 2954E+00		1 1270E-02		0 0000E-01	
pCi /smpl	1 935E+00		5 077E-03		0 000E-01	
1 sigma Err	6 8%		200 0%		0 0%	
pCi Err	1 309E-01		1 016E-02		1 265E-02	
2 sigma Err	13 5%		400 1%		0 0%	
pCi Err	2 617E-01		2 031E-02		2 529E-02	
Limitng Vlu	< 2 15E+00		< 2 18E-02		< 2 09E-02	
MDA	2 35E-02		3 35E-02		4 17E-02	

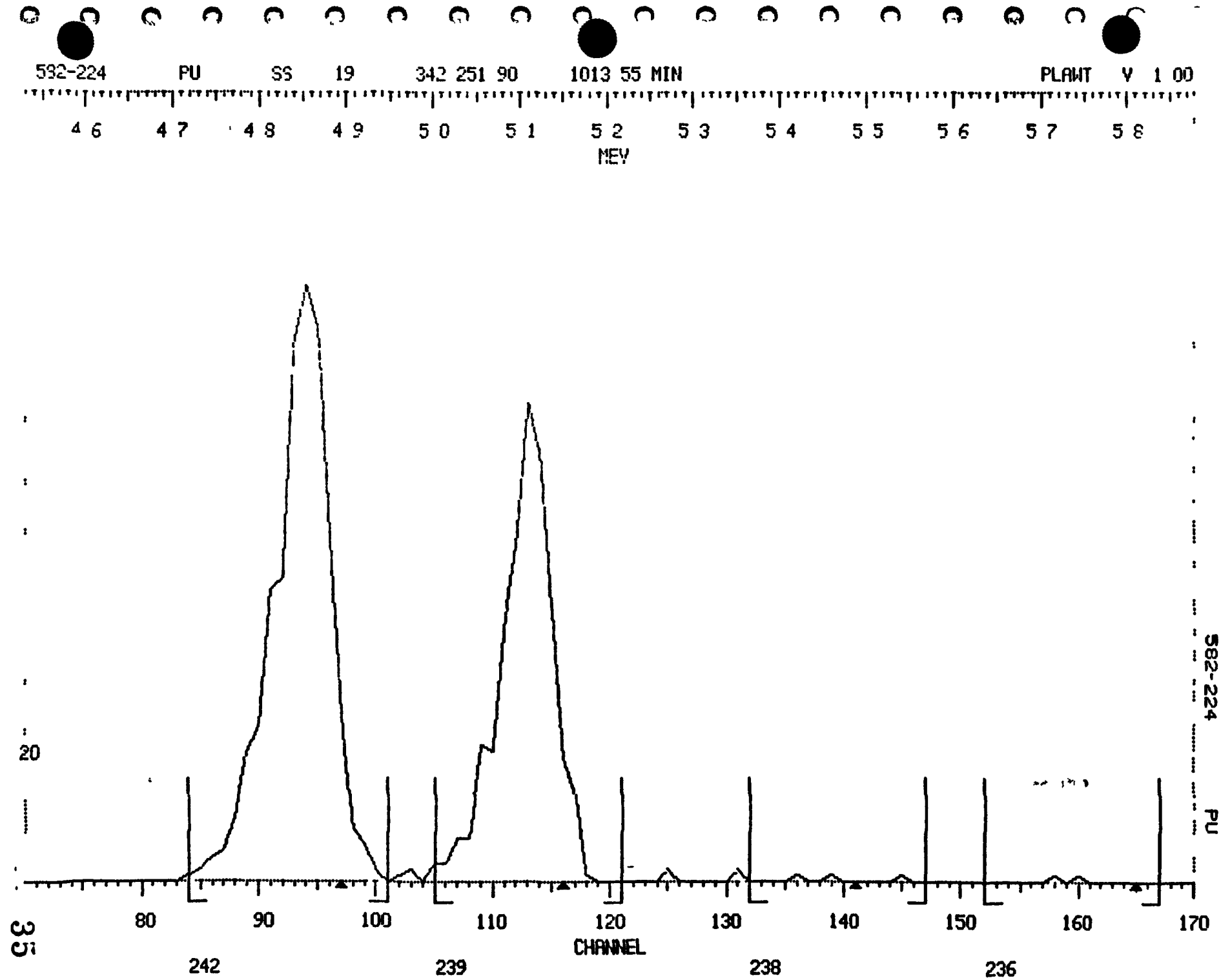
pCi/smpl ± tot err 2σ 1.94 ± 0.27
±14%

582 224 Pu 342 251 1013 55 MIN SS 19

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	639	0	-156	568	0	104	498	0	52	428	0
0	0	0	207	637	0	-155	567	0	103	497	2	51	427	1
0	0	0	206	636	0	-154	566	0	102	496	1	50	426	1
0	0	0	205	634	0	-153	564	0	-101	494	0	49	424	0
256	703	0	204	633	0	-152	563	0	-100	493	2	48	423	0
255	702	0	203	632	0	151	562	0	-99	492	6	47	422	0
254	701	0	202	630	0	150	560	0	-98	490	9	46	420	0
253	699	0	201	629	0	149	559	0	-97	489	27	45	419	0
252	698	0	200	628	0	148	558	0	-96	488	55	44	418	0
251	696	0	199	626	0	-147	556	0	-95	486	89	43	416	0
250	695	0	198	625	0	-146	555	0	-94	485	96	42	415	0
249	694	0	197	624	0	-145	554	1	-93	484	87	41	414	1
248	692	0	196	622	0	-144	552	0	-92	482	49	40	412	0
247	691	0	195	621	0	-143	551	0	-91	481	47	39	411	0
246	690	0	194	620	0	-142	550	0	-90	480	25	38	410	0
245	688	0	193	618	0	-141	548	0	-89	478	21	37	408	0
244	687	0	192	617	0	-140	547	0	-88	477	11	36	407	0
243	686	0	191	616	0	-139	546	1	-87	476	5	35	405	0
242	684	0	190	614	0	-138	544	0	-86	474	4	34	404	0
241	683	0	189	613	0	-137	543	0	-85	473	2	33	403	0
240	682	0	188	612	0	-136	542	1	-84	471	1	32	401	0
239	680	0	187	610	0	-135	540	0	83	470	0	31	400	0
238	679	0	186	609	0	-134	539	0	82	469	0	30	399	0
237	678	0	185	608	0	-133	538	0	81	467	0	29	397	0
236	676	0	184	606	0	-132	536	0	80	466	0	28	396	0
235	675	0	183	605	0	131	535	2	79	465	0	27	395	0
234	674	0	182	604	1	130	533	0	78	463	0	26	393	0
233	672	0	181	602	0	129	532	0	77	462	0	25	392	0
232	671	0	180	601	0	128	531	0	76	461	0	24	391	0
231	670	0	179	599	0	127	529	0	75	459	0	23	389	0
230	668	0	178	598	0	126	528	0	74	458	0	22	388	0
229	667	0	177	597	1	125	527	2	73	457	0	21	387	0
228	665	0	176	595	0	124	525	0	72	455	0	20	385	0
227	664	0	175	594	0	123	524	0	71	454	0	19	384	0
226	663	0	174	593	0	122	523	0	70	453	0	18	383	0
225	661	0	173	591	0	-121	521	0	69	451	0	17	381	0
224	660	0	172	590	0	-120	520	0	68	450	0	16	380	0
223	659	0	171	589	0	-119	519	0	67	449	1	15	379	1
222	657	0	170	587	0	-118	517	1	66	447	0	14	377	0
221	656	0	169	586	0	-117	516	14	65	446	0	13	376	0
220	655	0	168	585	0	-116	515	20	64	445	0	12	375	0
219	653	0	-167	583	0	-115	513	44	63	443	0	11	373	0
218	652	0	-166	582	0	-114	512	69	62	442	0	10	372	0
217	651	0	-165	581	0	-113	511	77	61	441	0	9	370	0
216	649	0	-164	579	0	-112	509	55	60	439	0	8	369	0
215	648	0	-163	578	0	-111	508	42	59	438	0	7	368	0
214	647	0	-162	577	0	-110	507	21	58	436	0	6	366	0
213	645	0	-161	575	0	-109	505	22	57	435	0	5	365	0
212	644	0	-160	574	1	-108	504	7	56	434	0	4	364	0
211	643	0	-159	573	0	-107	502	7	55	432	0	3	362	0
210	641	0	-158	571	1	-106	501	3	54	431	0	2	36156417	
209	640	0	-157	570	0	-105	500	3	53	430	0	1	360	0

239 238 236 0 242

105- 121 132- 147 152- 167 0- 0 84- 101


582-224 PU SS 19 342 251 90 1013 55 MIN PLAWT V 1 00
46 47 48 49 50 51 52 53 54 55 56 57 58
MEV
20
80 90 100 110 120 130 140 150 160 170
CHANNEL
242 239 238 236
582-224
PU

13-DEC-90
16 01 49

TMA Corporation
Alpha Spectroscopy
ASPEC V 2 09

W 12/14

582-220 Tp
SPLIT 63 NP50173WC

Reviewed [illegible] Date 12/14/90

Counted on	SS 23	1105 95 minutes
GMT	346 256 90	
Zero time	270 292 90	
GMT of std	346 150 90	
Sep. time	0 000 0	

****
** RECALCULATED DATA **
****

Chemical yield 0.6409

Tracer - Am243 (H-E1-A-(5) 263 950-89)

9.77 Dpm X 0.9999 = 9.77 Corr. tracer DPM

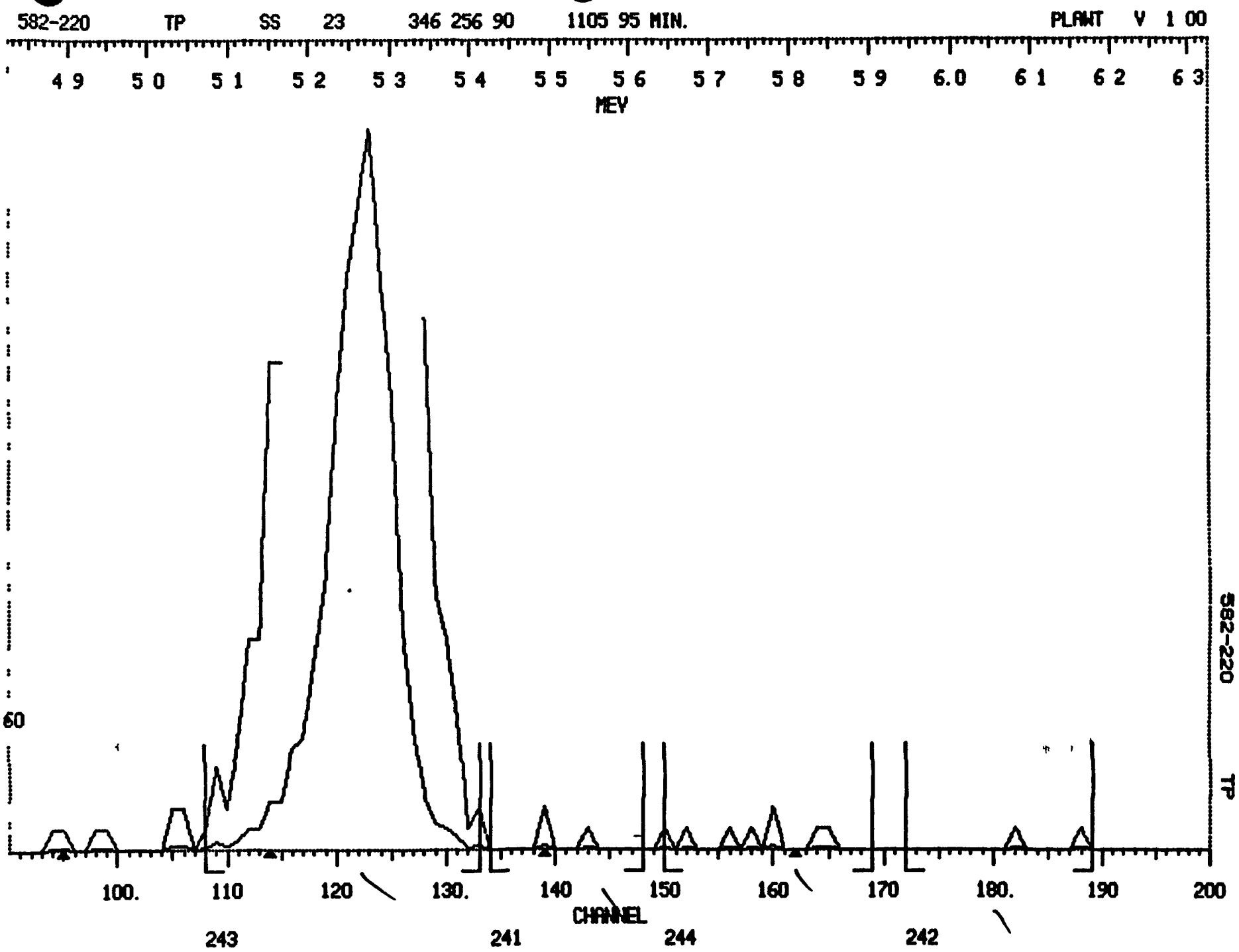
Channels	108-133*	
Bkg CPM	0 00290	(on 343 006 90 for 2416 00 Min.
Gross cnts	2218	
Background	3	
Net counts	2215	2 1%
Divisor	2 2681E+02	(net counts / corr tracer DPM)
Det. Eff	0 3200	
Yield	0 6409	(net counts) / (eff. x corr. tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	134-148*		172-189		150-169	
Bkg CPM	0 00000		0 00000		0.00166	
Gross cnts	3		2		8	
Background	0		0		2	
Tracer cts	4	0	0	0	2	0
Net counts	-1	2	2	1	4	3
Lambda	(4 0291E-06)		(4 2525E-03)		(1 0632E-04)	
Decay corr	0.9997		0 7239		0.9920	
Brnch ratio	1.0000		1 0000		1.0000	
DPM of aliq	-4 4103E-03		1 2180E-02		1.7779E-02	
Aliquot	2 5000E+00		2 5000E+00		2 5000E+00	
Dpm/l	-1 7641E-03		4 8722E-03		7 1116E-03	
pCi /l	-7.947E-04		2 195E-03		3 203E-03	
1 sigma Err	200 0%		50 0%		75 0%	
pCi Err	1.589E-03		1 098E-03		2.404E-03	
2 sigma Err	400 0%		100 1%		150 1%	
pCi Err	3 179E-03		2 197E-03		4 807E-03	
Limitng Vlu	< 2 62E-03		< 4 01E-03		< 7 17E-03	
MDA	3 70E-03		5 11E-03		5 28E-03	

582 220 Tp 346 256 1105 95 MIN SS 23

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	643	0	-156	572	1	104	501	0	52	430	0
0	0	0	207	642	0	-155	571	0	103	500	0	51	429	0
0	0	0	206	640	0	-154	569	0	102	498	0	50	427	0
0	0	0	205	639	0	-153	568	0	101	497	0	49	426	0
256	709	0	204	638	0	-152	567	1	100	496	0	48	425	0
255	707	0	203	636	0	-151	565	0	99	494	1	47	423	0
254	706	0	202	635	0	-150	564	1	98	493	1	46	422	0
253	704	0	201	633	0	149	562	0	97	491	0	45	420	0
252	703	0	200	632	0	-148	561	0	96	490	0	44	419	0
251	702	0	199	631	0	-147	560	0	95	489	1	43	418	1
250	700	0	198	629	0	-146	558	0	94	487	1	42	416	0
249	699	0	197	628	0	-145	557	0	93	486	0	41	415	0
248	698	0	196	627	0	-144	556	0	92	485	0	40	414	0
247	696	0	195	625	0	-143	554	1	91	483	0	39	412	0
246	695	0	194	624	0	-142	553	0	90	482	0	38	411	0
245	694	0	193	623	0	-141	552	0	89	481	1	37	410	0
244	692	0	192	621	0	-140	550	0	88	479	0	36	408	0
243	691	0	191	620	0	-139	549	2	87	478	0	35	407	0
242	689	0	190	618	0	-138	547	0	86	476	0	34	405	0
241	688	0	-189	617	0	-137	546	0	85	475	0	33	404	0
240	687	0	-188	616	1	-136	545	0	84	474	0	32	403	0
239	685	0	-187	614	0	-135	543	0	83	472	0	31	401	0
238	684	0	-186	613	0	-134	542	0	82	471	2	30	400	0
237	683	0	-185	612	0	-133	541	2	81	470	0	29	399	0
236	681	0	-184	610	0	-132	539	1	80	468	0	28	397	0
235	680	0	-183	609	0	-131	538	6	79	467	0	27	396	0
234	679	0	-182	608	1	-130	537	10	78	466	0	26	395	0
233	677	0	-181	606	0	-129	535	12	77	464	0	25	393	0
232	676	0	-180	605	0	-128	534	25	76	463	0	24	392	0
231	674	0	-179	603	0	-127	532	56	75	461	0	23	390	0
230	673	0	-178	602	0	-126	531	104	74	460	1	22	389	1
229	672	0	-177	601	0	-125	530	213	73	459	1	21	388	0
228	670	0	-176	599	0	-124	528	271	72	457	0	20	386	0
227	669	0	-175	598	0	-123	527	339	71	456	0	19	385	0
226	668	0	-174	597	0	-122	526	306	70	455	0	18	384	0
225	666	0	-173	595	0	-121	524	269	69	453	0	17	382	0
224	665	0	-172	594	0	-120	523	208	68	452	1	16	381	0
223	664	0	171	593	0	-119	522	128	67	451	0	15	380	0
222	662	0	170	591	0	-118	520	89	66	449	0	14	378	0
221	661	0	-169	590	0	-117	519	53	65	448	1	13	377	0
220	659	0	-168	588	0	-116	517	48	64	446	0	12	375	0
219	658	0	-167	587	0	-115	516	23	63	445	0	11	374	0
218	657	0	-166	586	0	-114	515	23	62	444	0	10	373	0
217	655	0	-165	584	1	-113	513	10	61	442	0	9	371	0
216	654	0	-164	583	1	-112	512	10	60	441	0	8	370	0
215	653	0	-163	582	0	-111	511	5	59	440	0	7	369	0
214	651	0	-162	580	0	-110	509	2	58	438	0	6	367	0
213	650	0	-161	579	0	-109	508	4	57	437	0	5	366	0
212	648	0	-160	577	2	-108	507	1	56	436	0	4	365	0
211	647	0	-159	576	0	107	505	0	55	434	0	3	363	0
210	646	0	-158	575	1	106	504	2	54	433	0	2	362	0
209	644	0	-157	573	0	105	502	2	53	431	0	1	360	0

241	242	244	0	243
134- 148	172- 189	150- 169	0- 0	108- 133


582-220 TP SS 23 346 256 90 1105 95 MIN.
PLANT V 1 00
4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8 5 9 6.0 6 1 6 2 6 3
MEV
60
582-220
TP
100. 110 120 130. 140 150 160 170 180. 190 200
CHANNEL
243 241 244 242

14-DEC-90 TMA Corporation 582-221 Am
14 43 24 Alpha Spectroscopy SPLIT 84 NP50193WC
ASPEC V 2 09

12/14 Reviewed [illegible] Date 12/14/90

Counted on 88 11 1041.53 minutes
GMT 348 203 90
Zero time 284 292 90

GMT of std 348 118 90
Sep. time 0.000 0 Chemical yield 0.8275

Tracer - Am243 (H-E1-A-(5) 263 950-89)
9 77 Dpm X 0 9999 = 9 77 Corr. tracer DPM
Channels 115-134 Drift correction -2.3
Bkg CPM 0 00538 (on 343 006 90 for 2416.00 Min.

Gross cnts 2309.
Background 6
Net counts 2303 2 1%

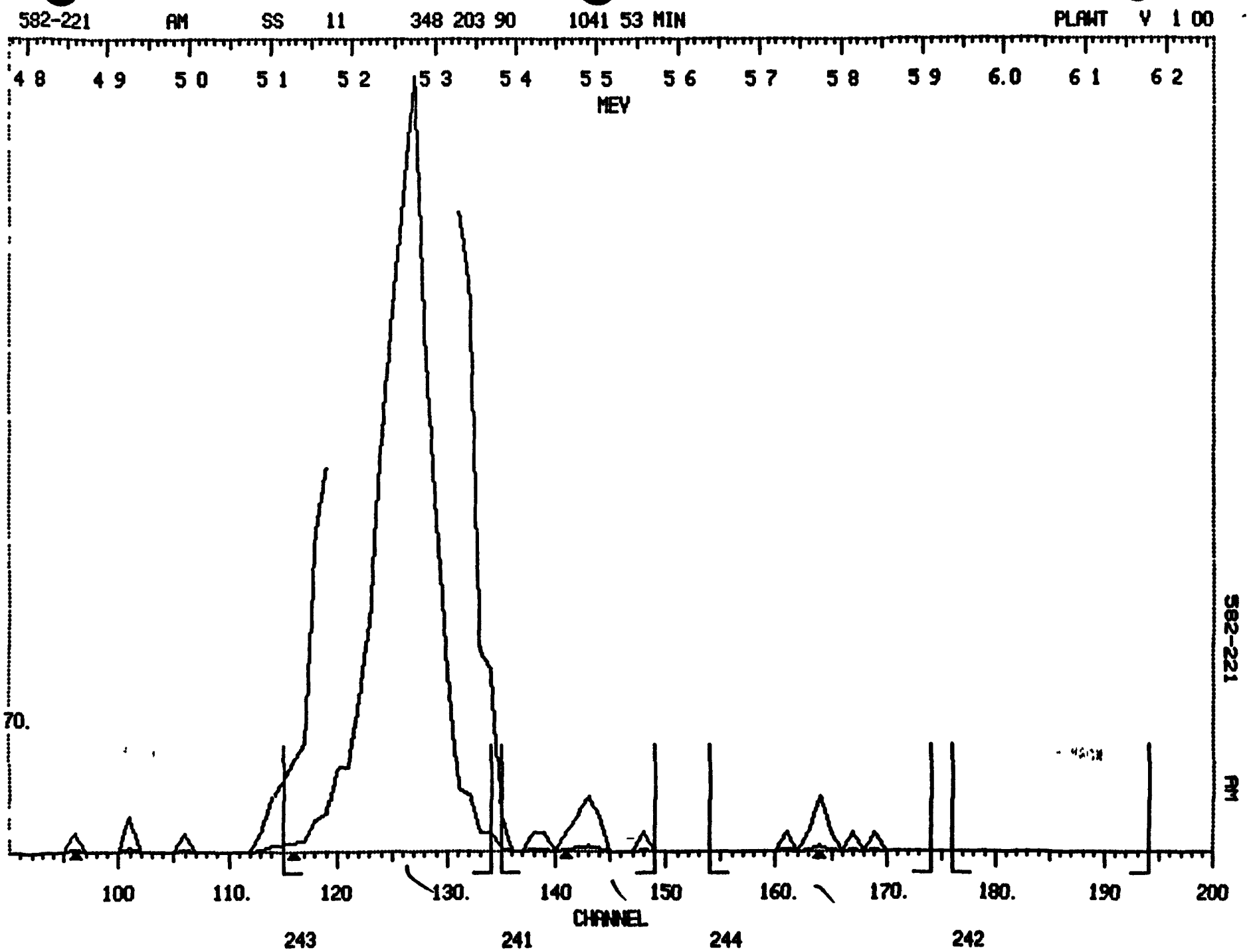
Divisor 2 3582E+02 (net counts / corr. tracer DPM)
Det Eff 0 2736
Yield 0 8275 (net counts) / (eff. x corr. tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	135-149		176-194		154-174	
Bkg CPM	0 00083		0 00000		0.00207	
Gross cnts	13		0		8	
Background	1		0		2	
Tracer cts	4	0	0	0	2	0
Net counts	8	4	0	1	4	3
Lambda	(4 0291E-06)		(4 2525E-03)		(1.0632E-04)	
Decay corr	0 9997		0.7620		0.9932	
Brnch ratio	1.0000		1.0000		1 0000	
DPM of aliq	3 3933E-02		0 0000E-01		1.7078E-02	
Aliquot	2 5000E+00		2 5000E+00		2.5000E+00	
Dpm/l	1 3573E-02		0 0000E-01		6 8311E-03	
pCi /l	6 114E-03		0 000E-01		3.077E-03	
1 sigma Err	50 0%		0 0%		75 0%	
pCi Err	3 060E-03		1 003E-03		2 309E-03	
2 sigma Err	100 1%		0 0%		150.1%	
pCi Err	6 119E-03		2 005E-03		4 617E-03	
Limitng Vlu	< 1 12E-02		< 1 65E-03		< 6 89E-03	
MDA	3 56E-03		4 67E-03		5 07E-03	

582 221 Am 348.203 1041.53 MIN SS 11

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	636	0	-156	566	0	104	496	0	52	426	0
0	0	0	207	635	0	-155	565	0	103	495	0	51	425	0
0	0	0	206	634	0	-154	563	0	102	493	0	50	423	1
0	0	0	205	632	0	153	562	0	101	492	2	49	422	0
256	701	0	204	631	0	152	561	0	100	491	0	48	421	0
255	700	0	203	630	0	151	559	0	99	489	0	47	419	0
254	698	0	202	628	0	150	558	0	98	488	0	46	418	0
253	697	0	201	627	0	-149	557	0	97	487	0	45	416	0
252	696	0	200	625	0	-148	555	1	96	485	1	44	415	0
251	694	0	199	624	0	-147	554	0	95	484	0	43	414	0
250	693	0	198	623	0	-146	553	0	94	483	0	42	412	0
249	692	0	197	621	0	-145	551	0	93	481	0	41	411	0
248	690	0	196	620	0	-144	550	2	92	480	0	40	410	0
247	689	0	195	619	0	-143	549	3	91	479	0	39	408	0
246	687	0	-194	617	0	-142	547	2	90	477	0	38	407	0
245	686	0	-193	616	0	-141	546	1	89	476	1	37	406	0
244	685	0	-192	615	0	-140	545	0	88	474	2	36	404	0
243	683	0	-191	613	0	-139	543	1	87	473	1	35	403	0
242	682	0	-190	612	0	-138	542	1	86	472	0	34	402	0
241	681	0	-189	611	0	-137	541	0	85	470	0	33	400	0
240	679	0	-188	609	0	-136	539	0	84	469	0	32	399	1
239	678	0	-187	608	0	-135	538	2	83	468	0	31	398	0
238	677	0	-186	607	0	-134	536	10	82	466	1	30	396	0
237	675	0	-185	605	0	-133	535	11	81	465	0	29	395	0
236	674	0	-184	604	0	-132	534	31	80	464	0	28	394	0
235	673	0	-183	603	0	-131	532	35	79	462	1	27	392	0
234	671	0	-182	601	0	-130	531	98	78	461	0	26	391	0
233	670	0	-181	600	0	-129	530	185	77	460	0	25	390	0
232	669	0	-180	598	0	-128	528	278	76	458	0	24	388	0
231	667	0	-179	597	0	-127	527	423	75	457	0	23	387	0
230	666	0	-178	596	0	-126	526	358	74	456	0	22	385	1
229	665	0	-177	594	0	-125	524	295	73	454	1	21	384	0
228	663	0	-176	593	0	-124	523	224	72	453	2	20	383	0
227	662	0	175	592	0	-123	522	130	71	452	0	19	381	1
226	661	0	-174	590	0	-122	520	85	70	450	0	18	380	0
225	659	0	-173	589	0	-121	519	47	69	449	0	17	379	0
224	658	0	-172	588	0	-120	518	46	68	447	0	16	377	1
223	656	0	-171	586	0	-119	516	21	67	446	0	15	376	0
222	655	0	-170	585	0	-118	515	17	66	445	0	14	375	0
221	654	0	-169	584	1	-117	514	6	65	443	1	13	373	0
220	652	0	-168	582	0	-116	512	5	64	442	0	12	372	0
219	651	0	-167	581	1	-115	511	4	63	441	0	11	371	0
218	650	0	-166	580	0	114	510	3	62	439	0	10	369	0
217	648	0	-165	578	1	113	508	1	61	438	0	9	368	0
216	647	0	-164	577	3	112	507	0	60	437	0	8	367	0
215	646	0	-163	576	1	111	505	0	59	435	0	7	365	0
214	644	0	-162	574	0	110	504	0	58	434	0	6	364	0
213	643	0	-161	573	1	109	503	0	57	433	0	5	363	0
212	642	0	-160	572	0	108	501	0	56	431	0	4	361	0
211	640	0	-159	570	0	107	500	0	55	430	0	3	360	0
210	639	0	-158	569	0	106	499	1	54	429	0	2	359	0
209	638	0	-157	567	0	105	497	0	53	427	0	1	357	0

241	242	244	0	243
135- 149	176- 194	154- 174	0- 0	115- 134


582-221 AM SS 11 348 203 90 1041 53 MIN PLAWT V 1 00
4 8 4 9 5 0 5 1 5 2 5 3 5 4 5 5 5 6 5 7 5 8 5 9 6.0 6 1 6 2
MEV
70.
100 110. 120 130. 140 150 160. 170. 180. 190 200
CHANNEL
243 241 244 242
582-221
AM

07-JAN-91 TMA Corporation 582-222 Tp
14 31 26 Alpha Spectroscopy QC 3836-40.54
ASPEC V 2 09

Reviewed Date 1/7/91

Counted on SS 10 1106 35 minutes
GMT 4 206 91
Zero time 1 000 90

GMT of std 3 883 91
Sep time 0 000 0

****
** RECALCULATED DATA **
****

Chemical yield 0 4100

Tracer - Am243 (H-E1-A-(5) 263 950-89)
9 77 Dpm X 0 9999 = 9.77 Corr tracer DPM

Channels 110-131*
Bkg CPM 0 00663 (on 1 009 91 for 2867 25 Min

Gross cnts 1239
Background 7
Net counts 1232 2 8%

Divisor 1 2615E+02 (net counts / corr tracer DPM)
Det Eff 0 2781
Yield 0 4100 (net counts) / (eff x corr tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	132-146*		172-190		150-170	
Bkg CPM	0 00593		0 00000		0 00523	
Gross cnts	148		0		122	
Background	7		0		6	
Tracer cts	2	0	0	0	1	0
Net counts	139	12	0	1	115	11
Lambda	(4 0291E-06)		(4 2525E-03)		(1 0632E-04)	
Decay corr	0 9985		0 2089		0 9616	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	1 1035E+00		0 0000E-01		9 4798E-01	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	1 1035E+00		0 0000E-01		9.4798E-01	
pCi /smpl	4 971E-01		0 000E-01		4 270E-01	
1 sigma Err	9 1%		0 0%		10 0%	
pCi Err	4 518E-02		1 709E-02		4 261E-02	
2 sigma Err	18 2%		0 0%		20 0%	
pCi Err	9 035E-02		3 418E-02		8 522E-02	
Limitng Vlu	< 5 72E-01		< 2 82E-02		< 4 97E-01	
MDA	4 41E-02		7 96E-02		4 24E-02	

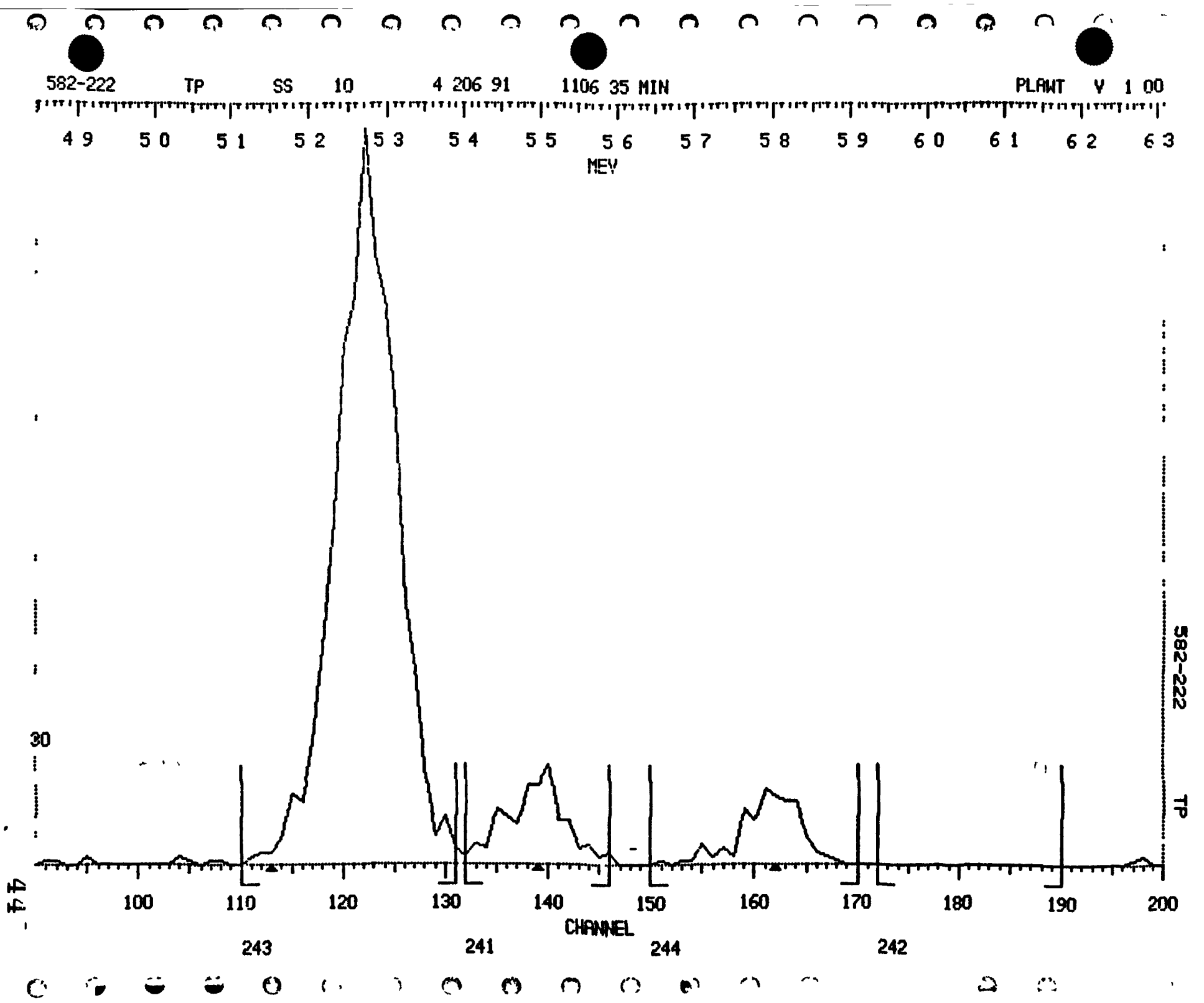
42

pCi/smpl ± tot err 2σ 0.50 ± 0.10 ± 19% 0.43 ± 0.10 ± 22%

582 222 Tp 4 206 1106 35 MIN SS 10

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	641	0	-156	572	2	104	503	2	52	434	0
0	0	0	207	640	0	-155	571	5	103	502	0	51	433	0
0	0	0	206	638	0	-154	569	1	102	500	0	50	431	1
0	0	0	205	637	0	-153	568	1	101	499	0	49	430	0
256	705	0	204	636	1	-152	567	0	100	498	0	48	429	0
255	703	0	203	634	1	-151	565	1	99	496	0	47	427	0
254	702	0	202	633	0	-150	564	0	98	495	0	46	426	1
253	701	0	201	632	0	149	563	0	97	494	0	45	425	1
252	699	0	200	630	0	148	561	0	96	492	0	44	423	1
251	698	0	199	629	0	147	560	0	95	491	2	43	422	0
250	697	0	198	628	2	-146	559	3	94	490	0	42	421	3
249	695	0	197	626	1	-145	557	2	93	488	0	41	419	3
248	694	0	196	625	0	-144	556	5	92	487	1	40	418	1
247	693	0	195	624	0	-143	555	4	91	486	1	39	417	2
246	691	0	194	622	0	-142	553	11	90	484	0	38	415	0
245	690	0	193	621	0	-141	552	11	89	483	0	37	414	2
244	689	0	192	620	0	-140	551	25	88	482	2	36	413	0
243	687	0	191	618	0	-139	549	20	87	480	0	35	411	0
242	686	0	-190	617	0	-138	548	20	86	479	2	34	410	0
241	685	0	-189	616	0	-137	547	10	85	478	3	33	409	0
240	683	0	-188	614	0	-136	545	12	84	476	5	32	407	0
239	682	0	-187	613	0	-135	544	14	83	475	0	31	406	0
238	681	0	-186	612	0	-134	543	4	82	474	3	30	405	0
237	679	1	-185	610	0	-133	541	5	81	472	6	29	403	0
236	678	1	-184	609	0	-132	540	2	80	471	1	28	402	0
235	677	0	-183	608	0	-131	539	4	79	470	2	27	401	0
234	675	0	-182	606	0	-130	537	12	78	468	1	26	399	0
233	674	0	-181	605	0	-129	536	7	77	467	0	25	398	0
232	673	0	-180	604	0	-128	535	23	76	466	0	24	397	0
231	671	0	-179	602	0	-127	533	48	75	464	1	23	395	0
230	670	0	-178	601	0	-126	532	65	74	463	1	22	394	0
229	669	0	-177	600	0	-125	531	113	73	462	0	21	393	1
228	667	0	-176	598	0	-124	529	140	72	460	0	20	391	0
227	666	0	-175	597	0	-123	528	152	71	459	0	19	390	0
226	665	0	-174	596	0	-122	527	184	70	458	0	18	389	0
225	663	0	-173	594	0	-121	525	142	69	456	0	17	387	0
224	662	0	-172	593	0	-120	524	129	68	455	0	16	386	1
223	661	0	171	592	0	-119	523	84	67	454	0	15	385	0
222	660	0	-170	590	0	-118	521	56	66	452	0	14	383	0
221	658	0	-169	589	0	-117	520	31	65	451	0	13	382	0
220	657	0	-168	588	1	-116	519	16	64	450	0	12	381	0
219	656	0	-167	586	2	-115	517	18	63	448	1	11	379	0
218	654	0	-166	585	3	-114	516	7	62	447	0	10	378	0
217	653	0	-165	584	7	-113	515	3	61	446	0	9	377	0
216	652	0	-164	583	16	-112	513	3	60	444	0	8	375	0
215	650	0	-163	581	16	-111	512	2	59	443	1	7	374	0
214	649	0	-162	580	17	-110	511	0	58	442	0	6	373	0
213	648	0	-161	579	19	109	509	0	57	440	0	5	371	0
212	646	1	-160	577	11	108	508	1	56	439	1	4	370	0
211	645	0	-159	576	14	107	507	1	55	438	0	3	369	0
210	644	0	-158	575	2	106	506	0	54	436	0	2	367	0
209	642	0	-157	573	4	105	504	1	53	435	0	1	366	0

241	242	244	0	243
132- 146	172- 190	150- 170	0- 0	110- 131


582-222 TP SS 10 4 206 91 1106 35 MIN PLANT V 1 00
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
MEV
30
44
100 110 120 130 140 150 160 170 180 190 200
CHANNEL
243 241 244 242
582-222
TP

17-DEC-90 TMA Corporation 582-223 Tp
11 42 54 Alpha Spectroscopy QC 3841-45, 55
ASPEC V 2.09 Reviewed Date 12/17/90

Counted on SS 15 1041 53 minutes
GMT 348 203 90
Zero time 348 203 90

GMT of std 348 118 90
Sep time 0 000 0

****
** RECALCULATED DATA **
****

Chemical yield 0 5731

Tracer - Am243 (H-E1-A-(5) 263.950-89)
9 77 Dpm X 0.9999 = 9.77 Corr. tracer DPM

Channels 113-134*
Bkg CPM 0.00497 (on 343 006 90 for 2416 00 Min.

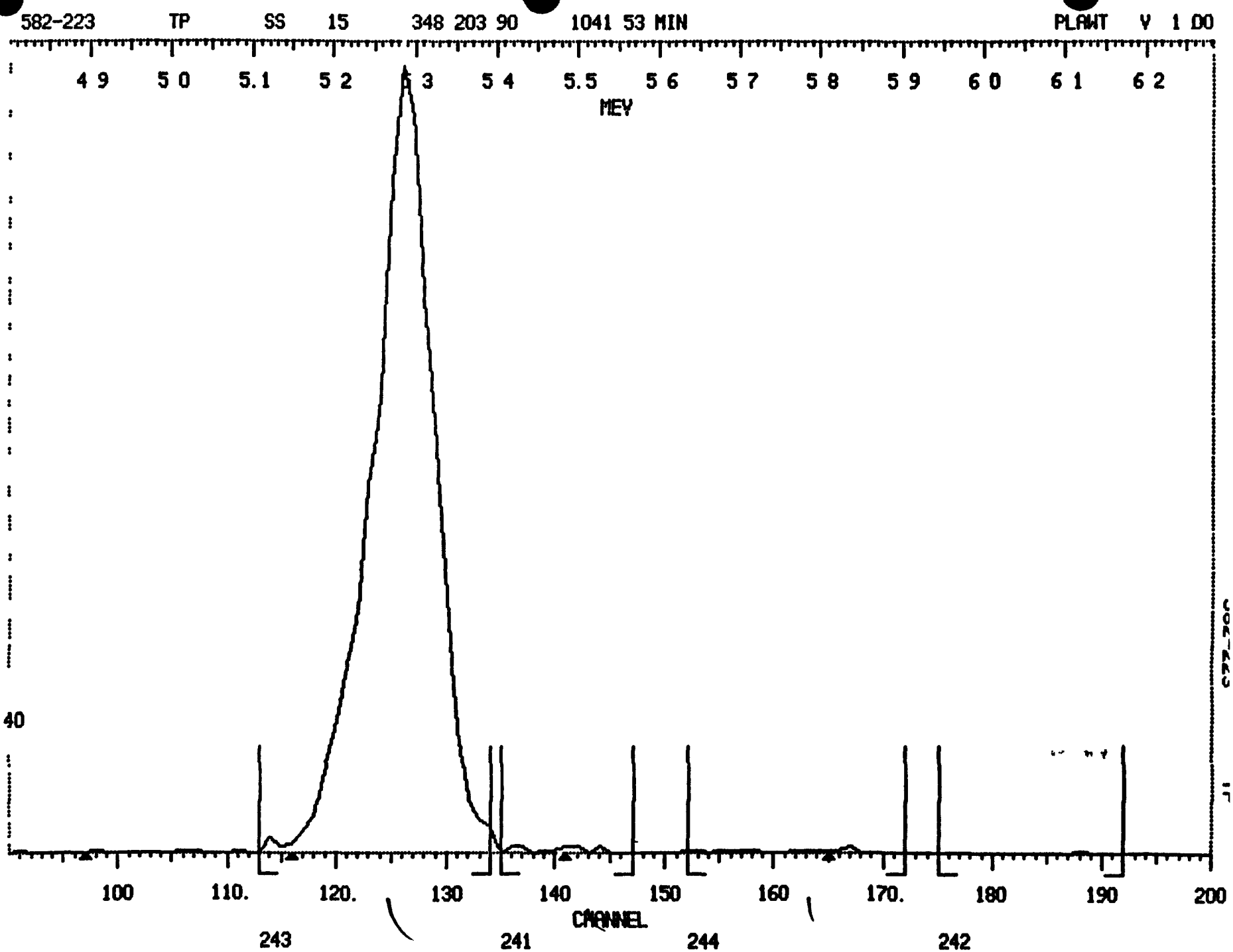
Gross cnts 1630
Background 5
Net counts 1625 2 5%

Divisor 1 6640E+02 (net counts / corr tracer DPM)
Det Eff 0 2788
Yield 0 5731 (net counts) / (eff. x corr. tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	135-147*		175-192		152-172	
Bkg CPM	0 00248		0 00000		0 00124	
Gross cnts	12		1		13	
Background	3		0		1	
Tracer cts	3	0	0	0	1	0
Net counts	6	4	1	1	11	4
Lambda	(4 0291E-06)		(4 2525E-03)		(1 0632E-04)	
Decay corr	1 0000		1 0000		1 0000	
Brnch ratio	1 0000		1 0000		1.0000	
DPM of aliq	3 6059E-02		6 0098E-03		6 6108E-02	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	3 6059E-02		6 0098E-03		6 6108E-02	
pCi /smpl	1 624E-02		2 707E-03		2.978E-02	
1 sigma Err	66 7%		100 0%		36 4%	
pCi Err	1 084E-02		2 708E-03		1 085E-02	
2 sigma Err	133 4%		200 1%		72 9%	
pCi Err	2 167E-02		5 416E-03		2 171E-02	
Limitng Vlu	< 3 41E-02		< 7 18E-03		< 4 77E-02	
MDA	2 19E-02		1 26E-02		1 26E-02	

CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS	CH	MEV	CTS
0	0	0	208	639	0	-156	568	1	104	498	0	52	428	0
0	0	0	207	637	0	-155	567	1	103	497	0	51	427	0
0	0	0	206	636	0	-154	566	0	102	496	0	50	426	0
0	0	0	205	634	0	-153	564	1	101	494	0	49	424	0
256	703	0	204	633	0	-152	563	1	100	493	0	48	423	0
255	702	0	203	632	0	151	562	0	99	492	0	47	422	0
254	701	0	202	630	0	150	560	0	98	490	1	46	420	0
253	699	0	201	629	0	149	559	0	97	489	0	45	419	0
252	698	0	200	628	0	148	558	0	96	488	0	44	418	0
251	696	0	199	626	0	-147	556	0	95	486	0	43	416	1
250	695	0	198	625	0	-146	555	0	94	485	0	42	415	0
249	694	0	197	624	0	-145	554	0	93	484	0	41	414	0
248	692	0	196	622	0	-144	552	2	92	482	0	40	412	0
247	691	0	195	621	0	-143	551	0	91	481	1	39	411	0
246	690	0	194	620	0	-142	550	2	90	480	0	38	410	0
245	688	0	193	618	0	-141	548	2	89	478	0	37	408	0
244	687	0	-192	617	0	-140	547	1	88	477	0	36	407	0
243	686	0	-191	616	0	-139	546	1	87	476	0	35	405	0
242	684	0	-190	614	0	-138	544	0	86	474	1	34	404	0
241	683	0	-189	613	0	-137	543	2	85	473	0	33	403	0
240	682	0	-188	612	1	-136	542	2	84	471	0	32	401	0
239	680	0	-187	610	0	-135	540	0	83	470	0	31	400	0
238	679	0	-186	609	0	-134	539	8	82	469	0	30	399	0
237	678	0	-185	608	0	-133	538	10	81	467	0	29	397	0
236	676	0	-184	606	0	-132	536	17	80	466	0	28	396	0
235	675	0	-183	605	0	-131	535	38	79	465	0	27	395	0
234	674	0	-182	604	0	-130	533	81	78	463	0	26	393	0
233	672	0	-181	602	0	-129	532	130	77	462	0	25	392	0
232	671	0	-180	601	0	-128	531	171	76	461	0	24	391	0
231	670	0	-179	599	0	-127	529	230	75	459	0	23	389	0
230	668	0	-178	598	0	-126	528	246	74	458	1	22	388	0
229	667	0	-177	597	0	-125	527	208	73	457	0	21	387	0
228	665	0	-176	595	0	-124	525	141	72	455	0	20	385	0
227	664	0	-175	594	0	-123	524	117	71	454	0	19	384	0
226	663	0	174	593	0	-122	523	77	70	453	0	18	383	0
225	661	0	173	591	0	-121	521	59	69	451	0	17	381	0
224	660	0	-172	590	0	-120	520	41	68	450	0	16	380	0
223	659	0	-171	589	0	-119	519	27	67	449	0	15	379	0
222	657	0	-170	587	0	-118	517	12	66	447	0	14	377	1
221	656	0	-169	586	0	-117	516	7	65	446	0	13	376	0
220	655	0	-168	585	0	-116	515	3	64	445	0	12	375	0
219	653	0	-167	583	2	-115	513	2	63	443	0	11	373	0
218	652	0	-166	582	1	-114	512	5	62	442	0	10	372	0
217	651	0	-165	581	1	-113	511	0	61	441	0	9	370	0
216	649	0	-164	579	1	112	509	0	60	439	0	8	369	0
215	648	0	-163	578	1	111	508	1	59	438	0	7	368	0
214	647	0	-162	577	1	110	507	0	58	436	0	6	366	1
213	645	0	-161	575	0	109	505	0	57	435	0	5	365	0
212	644	0	-160	574	0	108	504	0	56	434	0	4	364	0
211	643	0	-159	573	0	107	502	1	55	432	0	3	362	0
210	641	0	-158	571	1	106	501	1	54	431	0	2	361	0
209	640	0	-157	570	1	105	500	0	53	430	0	1	360	0

241	242	244	0	243
135- 147	175- 192	152- 172	0- 0	113- 134


582-223 TP SS 15 348 203 90 1041 53 MIN PLAWT V 1 00
4 9 5 0 5.1 5 2 5 3 5 4 5.5 5 6 5 7 5 8 5 9 6 0 6 1 6 2
MEV
40
100 110. 120. 130 140 150 160 170. 180 190 200
CHANNEL
243
241
244
242

Reviewed ____ Date ____

Counted on SS 26 1060 47 minutes
GMT 5 205 91
Zero time 1 000 90

GMT of std 5 076 91
Sep time 0 000 0

Chemical yield 0 9500

Tracer - Am243 (H-E1-A-(5) 263 950-89)

9 77 Dpm X 0 9999 = 9 77 Corr. tracer DPM

Channels 113-133
Bkg CPM 0 00139 (on 1 010 91 for 2868 38 Min

Gross cnts 2619
Background 1
Net counts 2618 1 9%

Divisor 2 6808E+02 (net counts / corr tracer DPM)
Det Eff 0 2661
Yield 0 9500 (net counts) / (eff x corr tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	134-148		176-193		153-173	
Bkg CPM	0 00279		0 00070		0 00174	
Gross cnts	1313		0		2051	
Background	3		1		2	
Tracer cts	4	0	0	0	2	0
Net counts	1306	36	-1	1	2047	45
Lambda	(4 0291E-06)		(4 2525E-03)		(1 0632E-04)	
Decay corr	0 9985		0 2080		0 9615	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	4 8790E+00		-1 7931E-02		7 9416E+00	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	4 8790E+00		-1 7931E-02		7 9416E+00	
pCi /smpl	2 198E+00		-8 077E-03		3 577E+00	
1 sigma Err	3 4%		100 0%		2 9%	
pCi Err	7 410E-02		8 078E-03		1 051E-01	
2 sigma Err	6 8%		200 0%		5 9%	
pCi Err	1 484E-01		1 616E-02		2 101E-01	
Limitng Vlu	< 2 32E+00		< 1 33E-02		< 3 75E+00	
MDA	1 36E-02		3 76E-02		1 15E-02	

pCi/smpl ± tot err 2σ 2.20 ± 0.18 ± 8% 3.58 ± 0.43 ± 12%

48 W.17

Counted on SS 26 1060 47 minutes
GMT 5 205 91
Zero time 1 000 90

GMT of std 5 076 91
Sep time 0 000 0 Chemical yield 0 9500

Tracer - Am243 (H-E1-A-(5) 263 950-89)
9 77 Dpm X 0 9999 = 9 77 Corr. tracer DPM
Channels 113-133
Bkg CPM 0 00139 (on 1 010 91 for 2868 38 Min.

Gross cnts 2619
Background 1
Net counts 2618 1 9%

Divisor 2 6808E+02 (net counts / corr tracer DPM)
Det Eff 0 2661
Yield 0 9500 (net counts) / (eff x corr tracer DPM X time)

	Am241		Cm242		Cm244	
Channels	134-148		176-193		153-173	
Bkg CPM	0 00279		0 00070		0.00174	
Gross cnts	1313		0		2051	
Background	3		1		2	
Tracer cts	4	0	0	0	2	0
Net counts	1306	36	-1	1	2047	45
Lambda	(4 0291E-06)		(4 2525E-03)		(1 0632E-04)	
Decay corr	0 9985		0 2080		0 9615	
Brnch ratio	1 0000		1 0000		1 0000	
DPM of aliq	4 8790E+00		-1 7931E-02		7 9416E+00	
Aliquot	1 0000E+00		1 0000E+00		1 0000E+00	
Dpm/smpl	4 8790E+00		-1 7931E-02		7 9416E+00	
pCi /smpl	2 198E+00		-8 077E-03		3 577E+00	
1 sigma Err	3 4%		100 0%		2 9%	
pCi Err	7 418E-02		8 078E-03		1 051E-01	
2 sigma Err	6 8%		200 0%		5 9%	
pCi Err	1 484E-01		1 616E-02		2 101E-01	
Limitng Vlu	< 2 32E+00		< 1 33E-02		< 3 75E+00	
MDA	1 36E-02		3 76E-02		1 15E-02	

pCi/smpl ± tot err 2σ 2.20 ± 0.18 ± 8% 3.58 ± 0.43 ± 12%

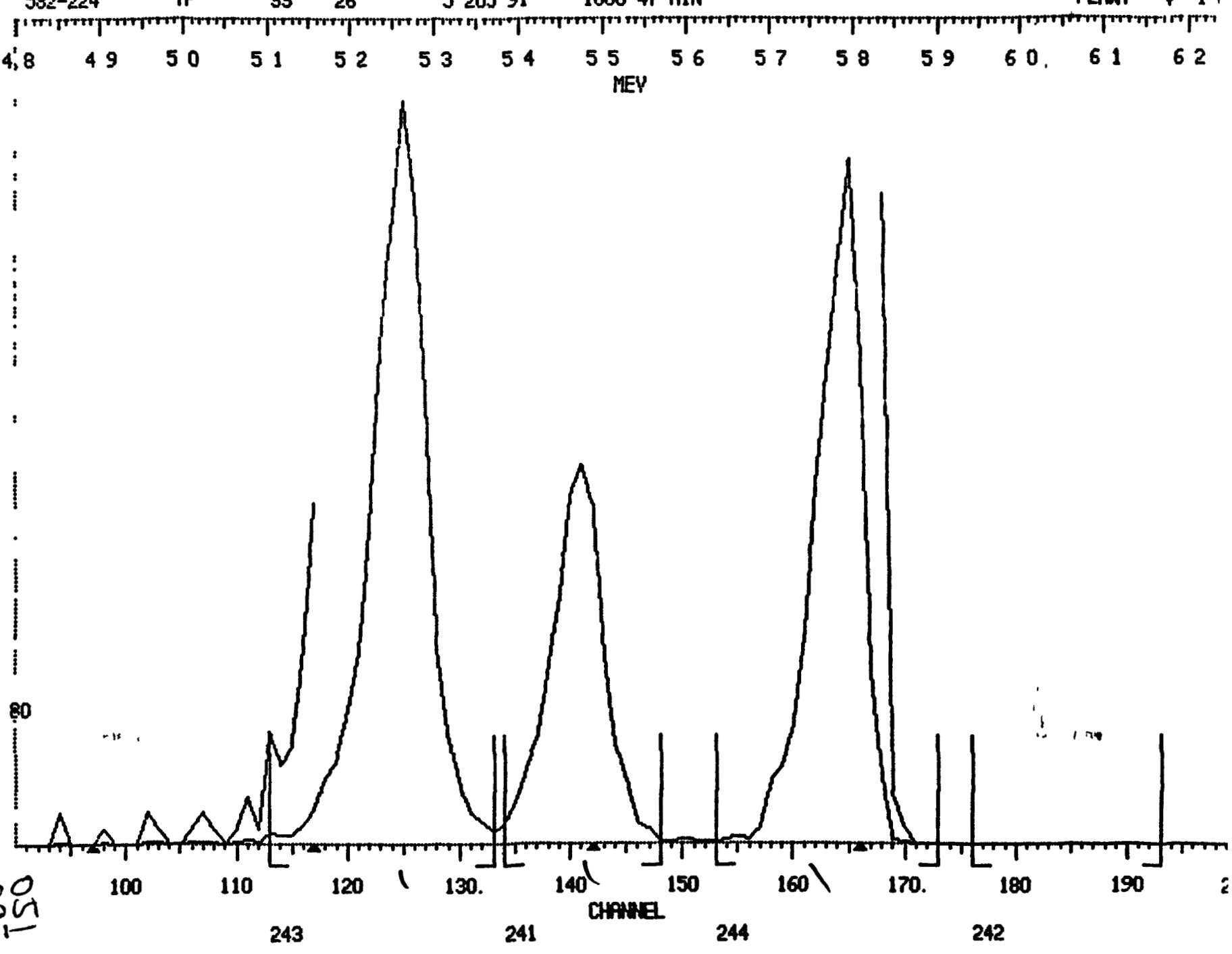
049 ~~063~~

W.17

0	0	0	208	636	0	-156	567	3	104	498	0	52	429	0
0	0	0	207	635	0	-155	566	4	103	497	1	51	427	2
0	0	0	206	634	0	-154	564	3	102	495	2	50	426	0
0	0	0	205	632	0	-153	563	1	101	494	0	49	425	0
256	700	0	204	631	0	152	562	2	100	493	0	48	423	0
255	699	0	203	630	0	151	560	2	99	491	0	47	422	0
254	697	0	202	628	0	150	559	3	98	490	1	46	421	0
253	696	0	201	627	1	149	558	1	97	489	0	45	419	2
252	695	0	200	626	0	-148	556	1	96	487	0	44	418	0
251	693	0	199	624	0	-147	555	9	95	486	0	43	417	0
250	692	0	198	623	0	-146	554	13	94	485	2	42	415	0
249	691	0	197	622	0	-145	552	39	93	483	0	41	414	0
248	689	0	196	620	0	-144	551	62	92	482	0	40	413	0
247	688	0	195	619	0	-143	550	118	91	481	0	39	411	0
246	687	0	194	618	0	-142	548	208	90	479	0	38	410	0
245	685	0	-193	616	0	-141	547	234	89	478	0	37	409	0
244	684	0	-192	615	0	-140	546	215	88	477	0	36	407	0
243	683	0	-191	614	0	-139	544	153	87	475	1	35	406	0
242	681	0	-190	612	0	-138	543	109	86	474	0	34	405	1
241	680	0	-189	611	0	-137	542	66	85	473	0	33	403	1
240	679	1	-188	610	0	-136	540	48	84	471	0	32	402	0
239	677	0	-187	608	0	-135	539	26	83	470	0	31	401	0
238	676	0	-186	607	0	-134	538	12	82	469	1	30	399	0
237	675	0	-185	606	0	-133	536	8	81	467	0	29	398	0
236	673	0	-184	604	0	-132	535	14	80	466	1	28	397	0
235	672	0	-183	603	0	-131	534	19	79	465	0	27	395	0
234	671	0	-182	602	0	-130	532	35	78	463	0	26	394	0
233	670	0	-181	600	0	-129	531	65	77	462	0	25	393	1
232	668	0	-180	599	0	-128	530	118	76	461	0	24	391	0
231	667	0	-179	598	0	-127	528	270	75	459	0	23	390	0
230	666	0	-178	596	0	-126	527	396	74	458	1	22	389	0
229	664	0	-177	595	0	-125	526	457	73	457	0	21	387	0
228	663	0	-176	594	0	-124	524	383	72	455	1	20	386	0
227	662	0	175	592	0	-123	523	312	71	454	0	19	385	0
226	660	0	174	591	0	-122	522	197	70	453	0	18	383	0
225	659	0	-173	590	0	-121	520	118	69	451	0	17	382	0
224	658	0	-172	588	0	-120	519	81	68	450	0	16	381	0
223	656	0	-171	587	0	-119	518	53	67	449	1	15	379	0
222	655	0	-170	586	1	-118	516	42	66	447	0	14	378	0
221	654	0	-169	584	3	-117	515	21	65	446	0	13	377	0
220	652	0	-168	583	40	-116	514	12	64	445	1	12	375	0
219	651	0	-167	582	107	-115	513	6	63	443	0	11	374	0
218	650	0	-166	580	303	-114	511	5	62	442	0	10	373	1
217	648	0	-165	579	422	-113	510	7	61	441	1	9	371	0
216	647	0	-164	578	358	112	509	1	60	439	0	8	370	0
215	646	0	-163	576	290	111	507	3	59	438	0	7	369	0
214	644	0	-162	575	220	110	506	1	58	437	0	6	367	1
213	643	0	-161	574	126	109	505	0	57	435	0	5	366	0
212	642	0	-160	572	71	108	503	1	56	434	0	4	365	0
211	640	0	-159	571	49	107	502	2	55	433	0	3	363	0
210	639	0	-158	570	40	106	501	1	54	431	0	2	362	0
209	638	0	-157	568	10	105	499	0	53	430	0	1	361	0

241	242	244	0	243
134- 148	176- 193	153- 173	0- 0	113- 133

~~064~~


582-224 TP SS 26 5 205 91 1060 47 MIN PLANT V 1
4.8 4.9 5.0 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 6.0 6.1 6.2
MEV
80
100 110 120 130. 140 150 160 170. 180 190
CHANNEL
243 241 244 242