4/7/99

Mike Peters
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Mike,

I have enclosed the an electronic table of the Pu and Am data, raw data for Pu and Am and copies of notebook entries Should you need anything more, please let me know

Thank you for your help

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ADMIN RECORD
SW-A-004058

May 1998.

Actinide Migration Studies at the Rocky Flats Environmental Technology Site.

May 1998

Second stage:

Size Distributions of Pu & Am

May 1998

Calibration of Ultrafiltration cartridges

Chemicals

System A: 0.1 μm
Amicon HiMP01-43
Series #: 7174-6A3(U)

0.3 μm Latex
MCL

System B 100 kDa
Amicon S10Y100
Series #: P7SM9114-018

0.022 μm
Fluorescent Red
Sulfate Latex

System C 1 kDa
Amicon S10Y1
Series #: 12278032

Vitamin B12
1,330 Dalton

6-3-98

Spike Ultrafiltration Experiments

A. Labeling:

SS#	UF System	Prefiltered water	Permeate	Retentate collo
1	0.1 μm	PF 0.1	UF 0.1	R 0.1
2	100 kDa	PF 100	UF 100	R 100
3	1 kDa	PF 1	UF 1	R 1

B. Experiment

Solution: tap water from Room 201 collected on June-2, 1998 at ~ 4:00 pm

Prefilter 0.45 μm

Spike: ^{240}Pu & ^{241}Am
~5.4 dpm ~4.7 dpm

Activity ~5 dpm for each isotope;

6-3-98.

SS#	System	Vol. of PFW (l)	Vol. of Cell	Starting Time/Finish	Pressure (PSI)
1	0.1 μm H1MP01-43	~20	2.25	3:00pm/5:50pm	straight valve
2	100 kDa (S10Y100)	~20	~2.10 l	2:40pm/3:49pm	straight valve
3	1 kDa (S10Y1)	~20	2.25	2:50pm/6:10pm	~30 psi

~~pH~~ Walnut Cr. ABV
Flume Pond @ GS05

8/26/98.
CSM

A: SPM

C-6

SS#	Filter #	water Vol.
1	E-011	300 + (-70ml) = 230ml + 10 = 240ml
2	E-012	105 ml ~~+10~~ = 105 ml only
3	E-013	

B: POC (filter before 1992)

SS#	Filter #	Vol. (ml)
1	27	100 + ⇒ 100ml
2	28	52 ml
3	26	BLK

C: DOC

SS#	Bottle #	Acidify
1	B275	✓
2	B062	✓
3	C068	✓
4		

pH = 9.48 (9.5 by pH paper)
DO_2 = 7.72 mg/L
Water Temp = 25° C
Air Temp = 31.5 °C
Specific Conductivity . 0.556 mS/cm

6

<0.45 μm @ GS05 8-26-98.

→ 0.1 μm System. & 100 kDa System

20 l start @ 4:30 pm stop @ 3:00 pm (8-27/98) @ 3.65 l

→ 100 kDa Cartridge – II { start @ : 8:03 pm / end @ 9:45 pm }

→ 100 kDa Cartridge – I. (20 l → 3.2 l Ret.)

combined coll & processed further to 3.4 l

SS#	Bottle #	Fraction	Acidify
1	A527	UFW-100	✓ 3d
2	B291	UFW-100	✓
3	B233	COC100-1 @ 3.2 l	✓ 2d
4	B032	COC100_2 @ 3.2 l	✓ 2d

Final concentration Factor for 100 kDa System

A. 100 kDa: ~40 l → 3.4 liter of Coll.

B. 0.1 μm System ~20 l → 3.65 l

SS#	DOC Bottle #	Fraction		Acid
1	A161	UFW0.1	20 ml	✓ 3d
2	D001	UF0.1	"	✓ "
3	B016	COC0.1	15 ml	✓ 2d
4	A599	COC0.1	"	✓ "
	A599			

7

8-26-98
G503 site.

(1) Particle & filtration.

$$\frac{2.6\ \text{Gal} + 1.6\ \text{Gal}}{2} = \sim 2.10\ \text{Gal} \approx 7.8\ l$$

Volume for ≥20μm filters. (x3 filters)
(*) ≳0.45μm particle loss a little bit in #2 & 3 filters,

(2) Total water for ppts: ~3.5 l

(3) water (<0.45μm) for ppts
≲20 liters

(4)

8-27-98.

A: SPM

SS#	Filter #	Vol. (ml)	Mark
1	E013	100+	✓
2	E014	100ml	✓
3	E015	100 ml	✓
4	E-016	100 ml	✓

B: POC

SS#	Filter #	Vol. (ml)	Acid	Mark
1	<1997-29	50ml ✓	✓	98827-POC-01
2	-30	50ml ✓	✓	98827-POC-02
3	-31	50ml ✓	✓	POC-03
4	-32	58m (58ml) ✓	✓	POC-04
5/6	-33/34	BLK		

C: DOC

SS#	Bottle #	Vol (ml)	~~Acid 5%~~
1	B153	20 ml	✓
2	B059	"	"
3	A185	"	"
4	B054	"	"

9

100 kDa 98827A. 1998-8-27

Prefiltration: mixed up & prefilter it (5μm → 0.45μm) into 8 20L containers

i) #1 & #8 for 98827A 100 kDa.
ii) #2 & #7 for 98827B 100 kDa;
iii) #3 & #6 for <0.45μm total; TD (total Disc.)
iv) #4 for 98827A 0.1μm System;
v). #5 for 98827B 0.1μm System;

100 kDa 98827A
start @ 5:10 pm → 6:45 pm
{ i) 20l → 1.80l Sample for DOC }
{ ii) 20l → ≥1.8l (≥1.8l) " }
start @ 7:07 pm → 8:34 pm

100l → 4.2l [98827B. i) start @ { 9:50am → 11:20am } ✓ Sample for DOC
{ 20l → 2.35l }
ii) start @ { start @ 12:50pm → 2:15pm
{ 20l → 1.8l }

0.1 μm System 98827A. #4 PFW
{ i) start @ 8:00 pm → 7:00am (8-28-98)
20l → 3.2l (3.2l)

ii) 0.1μm System 98827B #5 PFW
start @ 1:35 pm → 4:05AM (8-28-98)
20l → ≥2.6l

DOC from UFZ 8-27-98

98827A

SS#	Bottle #	Fraction	Acid.	Mark.
1	C190	100 U_1 - I	✓	A 20ml
2	C191	100 U_1 - II	✓	"
3	B127	100 R_1 - I	✓	15ml
4	C068	100 R_1 - II	✓	"
5	C006	100 U_2	✓	20ml
6	B191	100 R_2	✓	15ml
7	B124	0.1μ U_1	(98827A) 3d ✓	20ml
8	A201	0.1μ R_1	(98827A) 3d ✓	15ml.
~~9~~				
~~10~~				

98827B

9	D020	B100 U_1	✓	20ml
10	B119	B100 R_1	✓	15ml
11	A105	B0.1 U_1 (UFW)	✓	20ml
12	B286	B0.1 R_1 (Coll.)	✓	15ml

11

8-27-98

total water filtration

98827A

12 l → 20 μm → 0.45 μm → ppt ↓

4 filters.

98827B.

12 l → 20 μm

12

Solid Sample Digestion (SOP 773)

		C98826 5 (RF4)	C98826 0.45 (RF6)	C98827 5 (RF10)	C98827 0.45 (RF18)	Blankspike (RF11)	Blank (RF12)
1	Combust sample if applicable	9/6/98 →					→
2	Add tracers	9/7/98 →					→
3	In teflon beaker add 20 ml conc HNO_3, 20 ml conc HCL and 20 ml conc HF	✓	✓	✓	✓	✓	✓
4	Ensure solids go in to solution (IF not repeat step 3) Evaporate to dryness	✱	✓	✱	✓	✓	✓
5	Add 10 ml conc HNO_3 and 5 ml 30% H_2O_2 Let stand at room temp for a few minutes then evaporate to dryness		9/8/98		9/8/98	→	→
6	Add 10 ml conc HNO_3, 100ml DI and 2g H_3BO_3 Heat to ensure dissolution		✓		✓	✓	✓
7	Transfer to 250 ml cent Tube using DI		✓		✓	✓	✓
8	Add 1 ml (40mg/ml) Fe carrier		✓		✓	✓	✓
9	Ppt $Fe(OH)_3$ by adding conc NH_4OH (~50ml)		✓		✓	✓	✓
10	Centrifuge at 3500 rpm for 30 minutes		✓		✓	✓	✓
11	Dissolove ppt With 3x the vol of ppt with conc HCL		7ml 9/9/98		5ml 9/9/98	2ml →	2ml →
12	Add 75 ml 9N HCl		✓		✓	✓	✓
13	Add 1 ml saturated $NaNO_2$ mix thoroughly		✓		✓	✓	✓

✱ repeated digestion w/ conc HCl & HNO_3 moved to bath of other solids to start digestion from beginning.

Pu column (SOP 778)

	RF 4	RF 6	RF 16	RF 18	RF 11	RF 12
1 Fill disposable plastic column with 7 cm AG1x8 resin (by resin/DI slurry)	~~9/9/8~~	9/9/8	~~9/9/8~~	9/9/8	—	—
2 Place funnel on top of column with Whatman filter paper		✓		✓	✓	✓
3 Wet filter paper with 9N HCl		✓		✓	✓	✓
4 Condition resin with 50 ml 9 N HCl		✓		✓	✓	✓
5 Load sample through filter, rinse 2x with 20 ml 9N HCl (= Am fraction)		✓		✓	✓	✓
6 Rinse 2x with 20 ml 9N HCl, discard		✓		✓	✓	✓
7 Elute Pu with 20ml 9N HCl + 1 5 ml HI		✓		✓	✓	✓
8 Add 1 ml conc HNO_3, evaporate to dryness		✓		✓	✓	✓

Pu Microprecipitation (SOP 778)

1 Add 1 ml conc HCl, mix well to resolubilize		✓		✓	✓	✓
2 Add 14 ml DI, mix well		✓		✓	✓	✓
3 Add 1 0 ml lanthanum carrier + 0 5 ml H_20_2 mix well		✓		✓	✓	✓
4 Add 5 ml 3N HF		✓		✓	✓	✓
5 Let sample sit for min 15-20 minutes		✓		✓	✓	✓
6 Set up filtration apparatus place 25 mm filter membrane on support screen and lock		✓		✓	✓	✓
7 Apply vacuum, rinse filter with 1-2 ml methanol, rinse filter with DI		✓		✓	✓	✓
8 Transfer sample, rinsing beaker once with 5 ml DI		✓		✓	✓	✓
9 Rinse filter with 10-15 ml DI		✓		✓	✓	✓
10 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min		✓		✓	✓	✓
11 Mount filter on stainless steel planchet with double sided adhesive tape		✓		✓	✓	✓

Am Methanolic Anion Exchange Column (SOP 780)

1 Mix anion exchange resin with twice the volume of 1N HNO_3/93% methanol solution (for 160 ml 10ml conc HNO_3, 150 ml methanol) overnight

2 Add 5-10 ml conc HNO3,

3 Add 100-125 ml DI,

4 Add 1 0 ml Fe carrier

5 Transfer to cent tube and ppt with conc NH4OH Cent @3500 rpm for 15 min/

6 Add conc HNO_3 and evaporate, Repeat

7 Add conc HNO_3 until dissolved Add methanol (15 ml of methanol for each 1 ml conc HNO_3)

8 Pour resin slurry into disposable column and let resin settle to 7cm, place a layer of silica or glass beads on top of resin

9 Place funnel on top of column with Whatman filter paper, wet filter with 1N HNO_3 /93% methanol solution

10 Condition column with 40 ml of 1N HNO_3 /93% methanol solution

8 Load the sample onto column through filter, rinse with 25 ml 1N HNO_3 /93% methanol solution

9 Remove and discard filter and rinse twice with 25 ml 1N HNO_3 / 93% methanol solution Discard into methanolic waste receptacle

10 Strip Am by passing three 20 ml volumes of 8 N HNO_3 through the column allowing each rinse to pass completely before adding next rinse Collect eluate in beaker for Teva column

11 Evaporate to dryness

RF4	RF9	RF10	RF18	RF11	RF12
	9/10/98		9/10/98	→	→
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	9/11/98		9/11/98	→	→
	~~IIII~~		IIII	~~IIII~~	~~IIII~~
	9/12/98		9/12/98	→	→
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	"		"	"	"
	III		III	III	III
	9/12/98		9/12/98	9/13/98	9/13/98

Am Teva Resin (SOP 780)

1 Redisolve sample from above in 10 ml 2M NH_4SCN/ 0 1M formic acid (for 100ml 15 2 g NH_4SCN & 0 35 ml 98% formic acid in 100ml DI) Allow sample to sit for 1 hour to ensure dissolution

2 Condition a TEVA resin 2 ml column with 5 ml of 2M NH_4SCN/ 0 1M formic acid solution

3 Transfer sample into TEVA column in two portions using disposable polyethylene transfer pipet Rinse the sample container with 1 ml of 2M NH_4SCN/ 0 1M formic acid and transfer to column Repeat rinse and add to column

4 Rinse the TEVA column with two 5 ml volumes of 1M NH_4SCN/ 0 1M formic acid (for 100 ml dissolve 7 6 g NH_4SCN and 0 35 ml 98% formic acid in 100 ml of DI) Allow first wash to pass completely before adding the second wash (This washes lanthanides from column)

5 Strip Am from column with 15 ml of 2N HCl in three 5ml portions allowing each 5 ml to pass completely

6 To decompose thiocyanate, add 2 5 ml conc HNO3 and 7 5 ml conc HCL to the Am solution Swirl gently Evaporate until ~1 drop solution is remaining

7 Add 5 ml conc HNO3 Evaporate until volume is ~1 drop

	RF 6		RF 8	RF 11	RF 12
	9/13/98		9/13/98		
	9/14/98		9/14/98		
	✓		✓	✓	✓
	✓		✓	✓	✓

Am Micro-precipitation (SOP 780)

1 Add 1 ml conc HCl to sample Heat for 5 minutes Add 15 ml DI

2 Add 0 5 ml lanthanum carrier mix well Add 5 ml HF Mix well

3 Allow sample to stand for 15-20 minutes minimum

4 Place 25 mm filter membrane in a filter funnel assembly and turn on vacuum Rinse with 1-2 ml alcohol

5 Load sample into filter Rinse sample beaker once with 5 ml DI and add to funnel

6 After sample has passed through filter Rinse filter with 10-15 ml DI

7 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

8 Mount filter on stainless steel planchet with double sided adhesive tape

	RF 6		RF 8	RF 11	RF 12
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓

Completed 9/15/98

Solid Sample Digestion (SOP 773)

		F98826 7045 (RF5)	F98824 7020 (RF3)	F988274 7045 (RF17)	F988274 7020 (RF15)	F988273 7020 (RF26)	
1	Combust sample if applicable leached in 8N HNO3						
2	Add tracers	9/6/98 →					
3	In teflon beaker add 20 ml conc HNO_3, 20 ml conc HCL and 20 ml conc HF	9/7/98 →					
4	Ensure solids go in to solution (IF not repeat step 3) Evaporate to dryness	✓	✓	✓	✓	✓	
5	Add 10 ml conc HNO_3 and 5 ml 30% H_2O_2 Let stand at room temp for a few minutes then evaporate to dryness	✓	✓	✓	✓	✓	
6	Add 10 ml conc HNO_3, 100ml DI and 2g H_3BO_3 Heat to ensure dissolution	9/8/98 →					
7	Transfer to 250 ml cent Tube using DI	✓	✓	✓	✓	✓	
8	Add 1 ml (40mg/ml) Fe carrier	✓	✓	✓	✓	✓	
9	Ppt $Fe(OH)_3$ by adding conc NH_4OH (~50ml)	✓	✓	✓	✓	✓	
10	Centrifuge at 3500 rpm for 30 minutes	✓	✓	✓	✓	✓	
11	Dissolove ppt With 3x the vol of ppt with conc HCL	✓	✓	✓	✓	✓	
12	Add 75 ml 9N HCl	1.5ml	5ml	2ml	3ml	3ml	
13	Add 1 ml saturated $NaNO_2$ mix thoroughly	✓	✓	✓	✓	✓	

Pu column (SOP 778)

	RF6	RF3	RF17	RF15	RF24	
1 Fill disposable plastic column with 7 cm AG1x8 resin (by resin/DI slurry)	9/9/98 →					
2 Place funnel on top of column with Whatman filter paper	✓	✓	✓	✓	✓	
3 Wet filter paper with 9N HCl	✓	✓	✓	✓	✓	
4 Condition resin with 50 ml 9 N HCl	✓	✓	✓	✓	✓	
5 Load sample through filter, rinse 2x with 20 ml 9N HCl (= Am fraction)	✓	✓	✓	✓	✓	
6 Rinse 2x with 20 ml 9N HCl, discard	✓	✓	✓	✓	✓	
7 Elute Pu with 20ml 9N HCl + 1 5 ml HI	✓	✓	✓	✓	✓	
8 Add 1 ml conc HNO_3, evaporate to dryness	✓	✓	✓	✓	✓	

Pu Microprecipitation (SOP 778)

1 Add 1 ml conc HCl, mix well to resolubilize	✓	✓	✓	✓	✓	
2 Add 14 ml DI, mix well	✓	✓	✓	✓	✓	
3 Add 1 0 ml lanthanum carrier + 0 5 ml H_20_2 mix well	✓	✓	✓	✓	✓	
4 Add 5 ml 3N HF	✓	✓	✓	✓	✓	
5 Let sample sit for min 15-20 minutes	✓	✓	✓	✓	✓	
6 Set up filtration apparatus place 25 mm filter membrane on support screen and lock	✓	✓	✓	✓	✓	
7 Apply vacuum, rinse filter with 1-2 ml methanol, rinse filter with DI	✓	✓	✓	✓	✓	
8 Transfer sample, rinsing beaker once with 5 ml DI	✓	✓	✓	✓	✓	
9 Rinse filter with 10-15 ml DI		✓	✓	✓	✓	
10 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min		✓	✓	✓	✓	
11 Mount filter on stainless steel planchet with double sided adhesive tape		✓	✓	✓	✓	

Am Methanolic Anion Exchange Column (SOP 780)

1 Mix anion exchange resin with twice the volume of 1N HNO_3/93% methanol solution (for 160 ml 10ml conc HNO_3, 150 ml methanol) overnight

2 Add 5-10 ml conc HNO3,

3 Add 100-125 ml DI,

4 Add 1 0 ml Fe carrier

5 Transfer to cent tube and ppt with conc NH4OH Cent @3500 rpm for 15 min/

6 Add conc HNO_3 and evaporate, Repeat

7 Add conc HNO_3 until dissolved Add methanol (15 ml of methanol for each 1 ml conc HNO_3)

8 Pour resin slurry into disposable column and let resin settle to 7cm, place a layer of silica or glass beads on top of resin

9 Place funnel on top of column with Whatman filter paper, wet filter with 1N HNO_3 /93% methanol solution

10 Condition column with 40 ml of 1N HNO_3 /93% methanol solution

8 Load the sample onto column through filter, rinse with 25 ml 1N HNO_3 /93% methanol solution

9 Remove and discard filter and rinse twice with 25 ml 1N HNO_3 / 93% methanol solution Discard into methanolic waste receptacle

10 Strip Am by passing three 20 ml volumes of 8 N HNO_3 through the column allowing each rinse to pass completely before adding next rinse Collect eluate in beaker for Teva column

11 Evaporate to dryness

RF5	RF3	RF17	RF15	RF20	
9/10/98 →					
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
9/11/98 →					
11	11	11	11	11	
11	11	11	1111	1111	
9/12/98 →					
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓1	✓1	✓1	✓1	✓1	
11	11	11	11	11	
111	111	111	111	111	
9/13/98	9/13/98	9/12/98	9/12/98	9/12/98	

A

Am Teva Resin (SOP 780)

1 Redisolve sample from above in 10 ml 2M NH_4SCN/ 0 1M formic acid (for 100ml 15 2 g NH_4SCN & 0 35 ml 98% formic acid in 100ml DI) Allow sample to sit for 1 hour to ensure dissolution

2 Condition a TEVA resin 2 ml column with 5 ml of 2M NH_4SCN/ 0 1M formic acid solution

3 Transfer sample into TEVA column in two portions using disposable polyethylene transfer pipet Rinse the sample container with 1 ml of 2M NH_4SCN/ 0 1M formic acid and transfer to column Repeat rinse and add to column

4 Rinse the TEVA column with two 5 ml volumes of 1M NH_4SCN/ 0 1M formic acid (for 100 ml dissolve 7 6 g NH_4SCN and 0 35 ml 98% formic acid in 100 ml of DI) Allow first wash to pass completely before adding the second wash (This washes lanthanides from column)

5 Strip Am from column with 15 ml of 2N HCl in three 5ml portions allowing each 5 ml to pass completely

6 To decompose thiocyanate, add 2 5 ml conc HNO3 and 7 5 ml conc HCL to the Am solution Swirl gently Evaporate until ~1 drop solution is remaining

7 Add 5 ml conc HNO3 Evaporate until volume is ~1 drop

RF5	RF3	RF7	RF15	RF20	
9/13/98 →					
✓	✓	✓	✓	✓	
9/14/98 →					
✓1	✓1	✓1	✓1	✓1	
11	11	11	11	11	
111	111	111	111	111	
11	11	11	11	11	
✓	✓	✓	✓	✓	

Am Micro-precipitation (SOP 780)

1 Add 1 ml conc HCl to sample Heat for 5 minutes Add 15 ml DI

2 Add 0 5 ml lanthanum carrier mix well Add 5 ml HF Mix well

3 Allow sample to stand for 15-20 minutes minimum

4 Place 25 mm filter membrane in a filter funnel assembly and turn on vacuum Rinse with 1-2 ml alcohol

5 Load sample into filter Rinse sample beaker once with 5 ml DI and add to funnel

6 After sample has passed through filter Rinse filter with 10-15 ml DI

7 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

8 Mount filter on stainless steel planchet with double sided adhesive tape

RF5	RF3	RF7	RF15	RF20	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	

Completed 9/15/98

Rocky Flats Am and Pu Sample Procedures

Coprecipitation (SOP 778)

1 To 10L of sample add of conc HNO_3 until pH <2 Let sample sit for 16 hours after acidification before processing

2 Add 50 ml conc HCl

3 Add tracers (^{243}Am and ^{242}Pu)

4 Add 5 ml ferric chloride carrier (40 mg Fe3+/ml)

5 Mix sample and measure pH with pH paper, if pH >1 add 12N HCl until pH <1 Cover and stir for 30 min

6 Check pH again If <1, gently add conc NH4OH, add until turbidity persists than add additional 50 ml

7 Stir for 30 minutes then let settle overnight

8 Siphon ~9L of solution, discard

9 Transfer remaining ~1L into 250ml centrifuge tubes, rinsing bucket and transfer beaker (if used) with minimum DI

10 Centrifuge for 15 min at 3500 rpm

11 Decant and discard supernate

12 To dissolve precipitate add 3 times ppt volume of conc HCl and mix by vortexing

13 Add 75 ml of 9 N HCl

14 Add 2 ml of saturated NaNO2 to samples, mix well and set aside for 15 minutes

RF8	RF10	RF20	RF21	RF22	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	

21

Pu column (SOP 778)

1 Fill disposable plastic column with 7 cm AG1x8 resin (by resin/DI slurry)

2 Place funnel on top of column with Whatman filter paper

3 Wet filter paper with 9N HCl

4 Condition resin with 50 ml 9 N HCl

5 Load sample through filter, rinse 2x with 20 ml 9N HCl (= Am fraction)

6 Rinse 2x with 20 ml 9N HCl, discard

7 Elute Pu with 20ml 9N HCl + 1 5 ml HI

8 Add 1 ml conc HNO_3, evaporate to dryness

KF8	KF10	KF20	KF21	KF22	
9/5/95 ✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓ 11	✓ 11	✓ 11	✓ 11	✓ 11	
11	11	11	11	11	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	

Pu Microprecipitation (SOP 778)

1 Add 1 ml conc HCl, mix well to resolubilize

2 Add 14 ml DI, mix well

3 Add 1 0 ml lanthanum carrier + 0 5 ml H_20_2 mix well

4 Add 5 ml 3N HF

5 Let sample sit for min 15-20 minutes

6 Set up filtration apparatus place 25 mm filter membrane on support screen and lock

7 Apply vacuum, rinse filter with 1-2 ml methanol, rinse filter with DI

8 Transfer sample, rinsing beaker once with 5 ml DI

9 Rinse filter with 10-15 ml DI

10 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

11 Mount filter on stainless steel planchet with double sided adhesive tape

KF8	KF10	KF20	KF21	KF22	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	

Am Methanolic Anion Exchange Column (SOP 780)

	RF8	RF10	RF20	RF21	RF22	
1 Mix anion exchange resin with twice the volume of 1N HNO_3/93% methanol solution (for 160 ml 10ml conc HNO_3, 150 ml methanol) overnight	✓	✓	✓	✓	✓	
2 Add 5-10 ml conc HNO3,	✓	✓	✓	✓	✓	
3 Add 100-125 ml DI,	✓	✓	✓	✓	✓	
4 Add 1 0 ml Fe carrier	9/19/98 →					
5 Transfer to cent tube and ppt with conc NH4OH Cent @3500 rpm for 15 min/	✓	✓	✓	✓	✓	
6 Add conc HNO_3 and evaporate, Repeat	9/21/98 →			✓ ✓	✓ ✓	
7 Add conc HNO_3 until dissolved Add methanol (15 ml of methanol for each 1 ml conc HNO_3)	|||	|||	|||	|||	|||	
8 Pour resin slurry into disposable column and let resin settle to 7cm, place a layer of silica or glass beads on top of resin	9/23/98 →					
9 Place funnel on top of column with Whatman filter paper, wet filter with 1N HNO_3 /93% methanol solution	✓	✓	✓	✓	✓	
10 Condition column with 40 ml of 1N HNO_3 /93% methanol solution	✓	✓	✓	✓	✓	
8 Load the sample onto column through filter, rinse with 25 ml 1N HNO_3 /93% methanol solution	✓|	✓|	✓|	✓|	✓|	
9 Remove and discard filter and rinse twice with 25 ml 1N HNO_3 / 93% methanol solution Discard into methanolic waste receptacle	||	||	||	||	||	
10 Strip Am by passing three 20 ml volumes of 8 N HNO_3 through the column allowing each rinse to pass completely before adding next rinse Collect eluate in beaker for Teva column	|||	|||	|||	|||	|||	
11 Evaporate to dryness	9/24/98 →					

Am Teva Resin (SOP 780)

1 Redisolve sample from above in 10 ml 2M NH_4SCN/ 0 1M formic acid (for 100ml 15 2 g NH_4SCN & 0 35 ml 98% formic acid in 100ml DI) Allow sample to sit for 1 hour to ensure dissolution

2 Condition a TEVA resin 2 ml column with 5 ml of 2M NH_4SCN/ 0 1M formic acid solution

3 Transfer sample into TEVA column in two portions using disposable polyethylene transfer pipet Rinse the sample container with 1 ml of 2M NH_4SCN/ 0 1M formic acid and transfer to column Repeat rinse and add to column

4 Rinse the TEVA column with two 5 ml volumes of 1M NH_4SCN/ 0 1M formic acid (for 100 ml dissolve 7 6 g NH_4SCN and 0 35 ml 98% formic acid in 100 ml of DI) Allow first wash to pass completely before adding the second wash (This washes lanthanides from column)

5 Strip Am from column with 15 ml of 2N HCl in three 5ml portions allowing each 5 ml to pass completely

6 To decompose thiocyanate, add 2 5 ml conc HNO3 and 7 5 ml conc HCL to the Am solution Swirl gently Evaporate until ~1 drop solution is remaining

7 Add 5 ml conc HNO3 Evaporate until volume is ~1 drop

RF8	RF10	RF20	RF21	RF22	
9/24/98	→				
✓	✓	✓	✓		
✓ 11	✓ 11	✓ 11	✓ 11		
11	11	11	11		
111	111	111	111		
✓	✓	✓	✓		
9/25/98	→				

Am Micro-precipitation (SOP 780)

1 Add 1 ml conc HCl to sample Heat for 5 minutes Add 15 ml DI

2 Add 0 5 ml lanthanum carrier mix well Add 5 ml HF Mix well

3 Allow sample to stand for 15-20 minutes minimum

4 Place 25 mm filter membrane in a filter funnel assembly and turn on vacuum Rinse with 1-2 ml alcohol

5 Load sample into filter Rinse sample beaker once with 5 ml DI and add to funnel

6 After sample has passed through filter Rinse filter with 10-15 ml DI

7 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

8 Mount filter on stainless steel planchet with double sided adhesive tape

RF8	RF10	RF20	RF21	RF22	
9/25/98	→				
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓ *	✓	✓	✓	
✓	✓ *	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	

* filtered v.quickly

Rocky Flats Am and Pu Sample Procedures

Coprecipitation (SOP 778)

1 To 10L of sample add of conc HNO_3 until pH <2 Let sample sit for 16 hours after acidification before processing

2 Add 50 ml conc HCl

3 Add tracers (^{243}Am and ^{242}Pu)

4 Add 5 ml ferric chloride carrier (40 mg Fe3+/ml)

5 Mix sample and measure pH with pH paper, if pH >1 add 12N HCl until pH <1 Cover and stir for 30 min

6 Check pH again If <1, gently add conc NH4OH, add until turbidity persists than add additional 50 ml

7 Stir for 30 minutes then let settle overnight

8 Siphon ~9L of solution, discard

9 Transfer remaining ~1L into 250ml centrifuge tubes, rinsing bucket and transfer beaker (if used) with minimum DI

10 Centrifuge for 15 min at 3500 rpm

11 Decant and discard supernate

12 To dissolve precipitate add 3 times ppt volume of conc HCl and mix by vortexing (Shipped in 3N HCl -> evaporated

13 Add 75 ml of 9 N HCl

14 Add 2 ml of saturated NaNO2 to samples, mix well and set aside for 15 minutes

RF2	RF7	RF9	RF14	RF19	RF27	RF31	RF32
9/10/98							
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	

Pu column (SOP 778)

1 Fill disposable plastic column with 7 cm AG1x8 resin (by resin/DI slurry)

2 Place funnel on top of column with Whatman filter paper

3 Wet filter paper with 9N HCl

4 Condition resin with 50 ml 9 N HCl

5 Load sample through filter, rinse 2x with 20 ml 9N HCl (= Am fraction)

6 Rinse 2x with 20 ml 9N HCl, discard

7 Elute Pu with 20ml 9N HCl + 1 5 ml HI

8 Add 1 ml conc HNO_3, evaporate to dryness

Pu Microprecipitation (SOP 778)

1 Add 1 ml conc HCl, mix well to resolubilize

2 Add 14 ml DI, mix well

3 Add 1 0 ml lanthanum carrier + 0 5 ml H_2O_2 mix well

4 Add 5 ml 3N HF

5 Let sample sit for min 15-20 minutes

6 Set up filtration apparatus place 25 mm filter membrane on support screen and lock

7 Apply vacuum, rinse filter with 1-2 ml methanol, rinse filter with DI

8 Transfer sample, rinsing beaker once with 5 ml DI

9 Rinse filter with 10-15 ml DI

10 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

11 Mount filter on stainless steel planchet with double sided adhesive tape

RF2	RF7	RF9	RF14	RF19	RF27	RF31	RF32
9/11/98							
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓ II	✓ II	✓ II	✓ II	✓ II	✓ II	✓ II	✓ II
II	II	II	II	II	II	II	II
✓	✓	✓	✓	✓	✓	✓	✓
✓		✓	✓	✓	✓		

RF2	RF7	RF9	RF14	RF19	RF27	RF31	RF32
✓	9/12/98	✓	✓	✓	✓	9/12/98	✓
✓	✓	✓	✓	✓	✓	✓	✓
9/12/98							
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓

Am Methanolic Anion Exchange Column (SOP 780)

1 Mix anion exchange resin with twice the volume of 1N HNO_3/93% methanol solution (for 160 ml 10ml conc HNO_3, 150 ml methanol) overnight

2 Add 5-10 ml conc HNO3,

3 Add 100-125 ml DI,

4 Add 1 0 ml Fe carrier

5 Transfer to cent tube and ppt with conc NH4OH Cent @3500 rpm for 15 min/

6 Add conc HNO_3 and evaporate, Repeat

7 Add conc HNO_3 until dissolved Add methanol (15 ml of methanol for each 1 ml conc HNO_3)

8 Pour resin slurry into disposable column and let resin settle to 7cm, place a layer of silica or glass beads on top of resin

9 Place funnel on top of column with Whatman filter paper, wet filter with 1N HNO_3 /93% methanol solution

10 Condition column with 40 ml of 1N HNO_3 /93% methanol solution

8 Load the sample onto column through filter, rinse with 25 ml 1N HNO_3 /93% methanol solution

9 Remove and discard filter and rinse twice with 25 ml 1N HNO_3 / 93% methanol solution Discard into methanolic waste receptacle

10 Strip Am by passing three 20 ml volumes of 8 N HNO_3 through the column allowing each rinse to pass completely before adding next rinse Collect eluate in beaker for Teva column

11 Evaporate to dryness

RF2	RF7	RF9	RF14	RF19	RF27	RF31	RF32
9/13/98 →						9/13/98	
✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓		✓	✓
9/14/98 →							
✓	✓	✓	✓	✓	✓	✓	✓
9/16/98 →							
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓

Am Teva Resin (SOP 780)

1 Redisolve sample from above in 10 ml 2M NH_4SCN/ 0 1M formic acid (for 100ml 15 2 g NH_4SCN & 0 35 ml 98% formic acid in 100ml DI) Allow sample to sit for 1 hour to ensure dissolution

2 Condition a TEVA resin 2 ml column with 5 ml of 2M NH_4SCN/ 0 1M formic acid solution

3 Transfer sample into TEVA column in two portions using disposable polyethylene transfer pipet Rinse the sample container with 1 ml of 2M NH_4SCN/ 0 1M formic acid and transfer to column Repeat rinse and add to column

4 Rinse the TEVA column with two 5 ml volumes of 1M NH_4SCN/ 0 1M formic acid (for 100 ml dissolve 7 6 g NH_4SCN and 0 35 ml 98% formic acid in 100 ml of DI) Allow first wash to pass completely before adding the second wash (This washes lanthanides from column)

5 Strip Am from column with 15 ml of 2N HCl in three 5ml portions allowing each 5 ml to pass completely

6 To decompose thiocyanate, add 2 5 ml conc HNO3 and 7 5 ml conc HCL to the Am solution Swirl gently Evaporate until ~1 drop solution is remaining

7 Add 5 ml conc HNO3 Evaporate until volume is ~1 drop

RF2	RF7	RF9	RF14	RF19	RF27	RF31	RF32
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓

Am Micro-precipitation (SOP 780)

1 Add 1 ml conc HCl to sample Heat for 5 minutes Add 15 ml DI

2 Add 0 5 ml lanthanum carrier mix well Add 5 ml HF Mix well

3 Allow sample to stand for 15-20 minutes minimum

4 Place 25 mm filter membrane in a filter funnel assembly and turn on vacuum Rinse with 1-2 ml alcohol

5 Load sample into filter Rinse sample beaker once with 5 ml DI and add to funnel

6 After sample has passed through filter Rinse filter with 10-15 ml DI

7 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

8 Mount filter on stainless steel planchet with double sided adhesive tape

RF2	RF7	RF9	RF14	RF19	RF27	RF31	RF32
✓	✓	✓	✓	✓	✓	✓	✓
9/28/98	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓

Completed 9/28/98

Rocky Flats Am and Pu Sample Procedures

Coprecipitation (SOP 778)

1 To 10L of sample add of conc HNO_3 until pH <2 Let sample sit for 16 hours after acidification before processing

2 Add 50 ml conc HCl ~~Slupped in 3N HCl w/tracers~~

3 Add tracers (^{243}Am and ^{242}Pu)

4 Add 5 ml ferric chloride carrier (40 mg Fe3+/ml)

5 Mix sample and measure pH with pH paper, if pH >1 add 12N HCl until pH <1 Cover and stir for 30 min

6 Check pH again If <1, gently add conc NH4OH, add until turbidity persists than add additional 50 ml

7 Stir for 30 minutes then let settle overnight

8 Siphon ~9L of solution, discard

9 Transfer remaining ~1L into 250ml centrifuge tubes, rinsing bucket and transfer beaker (if used) with minimum DI

10 Centrifuge for 15 min at 3500 rpm

11 Decant and discard supernate

12 To dissolve precipitate add 3 times ppt volume of conc HCl and mix by vortexing
Slupped in 3N HCl ; evaporated ; add conc HCl

13 Add 75 ml of 9 N HCl

14 Add 2 ml of saturated NaNO2 to samples, mix well and set aside for 15 minutes

RF23	RF28	RF29	RF30		
7/14/98 ✓	✓	✓	✓		
✓	✓	✓	✓		

Pu column (SOP 778)

	KF23	KF28	KF29	KF30		
	KF	KF	KF	KF		
1 Fill disposable plastic column with 7 cm AG1x8 resin (by resin/DI slurry)	9/14/98 ✓	✓	✓	✓		
2 Place funnel on top of column with Whatman filter paper	✓	✓	✓	✓		
3 Wet filter paper with 9N HCl	✓	✓	✓	✓		
4 Condition resin with 50 ml 9 N HCl	✓	✓	✓	✓		
5 Load sample through filter, rinse 2x with 20 ml 9N HCl (= Am fraction)	✓ "	✓ "	✓ "	✓ "		
6 Rinse 2x with 20 ml 9N HCl, discard	"	"	"	"		
7 Elute Pu with 20ml 9N HCl + 1 5 ml HI	✓	✓	✓	✓		
8 Add 1 ml conc HNO_3, evaporate to dryness	✓	✓	✓	✓		

Pu Microprecipitation (SOP 778)

	KF23	KF28	KF29	KF30		
1 Add 1 ml conc HCl, mix well to resolubilize	✓	✓	✓	✓		
2 Add 14 ml DI, mix well	✓	✓	✓	✓		
3 Add 1 0 ml lanthanum carrier + 0 5 ml H_20_2 mix well	✓	✓	✓	✓		
4 Add 5 ml 3N HF	✓	✓	✓	✓		
5 Let sample sit for min 15-20 minutes	✓	✓	✓	✓		
6 Set up filtration apparatus place 25 mm filter membrane on support screen and lock	✓	✓	✓	✓		
7 Apply vacuum, rinse filter with 1-2 ml methanol, rinse filter with DI	✓	✓	✓	✓		
8 Transfer sample, rinsing beaker once with 5 ml DI	✓	✓	✓	✓		
9 Rinse filter with 10-15 ml DI	✓	✓	✓	✓		
10 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min	✓	✓	✓	✓		
11 Mount filter on stainless steel planchet with double sided adhesive tape	✓	✓	✓	✓		

Am Methanolic Anion Exchange Column (SOP 780)

	RF23	RF28	RF29	RF30		
1 Mix anion exchange resin with twice the volume of 1N HNO_3/93% methanol solution (for 160 ml 10ml conc HNO_3, 150 ml methanol) overnight						
2 Add 5-10 ml conc HNO3,	✓	✓	✓	✓		
3 Add 100-125 ml DI,	✓	✓	✓	✓		
4 Add 1 0 ml Fe carrier	9/17/98 →					
5 Transfer to cent tube and ppt with conc NH4OH Cent @3500 rpm for 15 min/	✓	✓	✓	✓		
6 Add conc HNO_3 and evaporate, Repeat	9/21/98 ✓ ✓ →					
7 Add conc HNO_3 until dissolved Add methanol (15 ml of methanol for each 1 ml conc HNO_3) mk	|||	|||	|||	|||		
8 Pour resin slurry into disposable column and let resin settle to 7cm, place a layer of silica or glass beads on top of resin	9/23/98 →					
9 Place funnel on top of column with Whatman filter paper, wet filter with 1N HNO_3 /93% methanol solution	✓	✓	✓	✓		
10 Condition column with 40 ml of 1N HNO_3 /93% methanol solution	✓	✓	✓	✓		
8 Load the sample onto column through filter, rinse with 25 ml 1N HNO_3 /93% methanol solution	✓	✓	✓	✓		
9 Remove and discard filter and rinse twice with 25 ml 1N HNO_3 / 93% methanol solution Discard into methanolic waste receptacle	||	||	||	||		
10 Strip Am by passing three 20 ml volumes of 8 N HNO_3 through the column allowing each rinse to pass completely before adding next rinse Collect eluate in beaker for Teva column	|||	|||	|||	|||		
11 Evaporate to dryness	9/24/98 →					

Am Teva Resin (SOP 780)

1 Redisolve sample from above in 10 ml 2M NH_4SCN/ 0 1M formic acid (for 100ml 15 2 g NH_4SCN & 0 35 ml 98% formic acid in 100ml DI) Allow sample to sit for 1 hour to ensure dissolution

2 Condition a TEVA resin 2 ml column with 5 ml of 2M NH_4SCN/ 0 1M formic acid solution

3 Transfer sample into TEVA column in two portions using disposable polyethylene transfer pipet Rinse the sample container with 1 ml of 2M NH_4SCN/ 0 1M formic acid and transfer to column Repeat rinse and add to column

4 Rinse the TEVA column with two 5 ml volumes of 1M NH_4SCN/ 0 1M formic acid (for 100 ml dissolve 7 6 g NH_4SCN and 0 35 ml 98% formic acid in 100 ml of DI) Allow first wash to pass completely before adding the second wash (This washes lanthanides from column)

5 Strip Am from column with 15 ml of 2N HCl in three 5ml portions allowing each 5 ml to pass completely

6 To decompose thiocyanate, add 2 5 ml conc HNO3 and 7 5 ml conc HCL to the Am solution Swirl gently Evaporate until ~1 drop solution is remaining

7 Add 5 ml conc HNO3 Evaporate until volume is ~1 drop

RF23	RF28	RF29	RF30		
9/24/98 →					
✓	✓	✓	✓		
✓ //	✓ //	✓ //	✓ //		
//	//	//	//		
///	///	///	///		
✓	✓	✓	✓		
9/25/98 →					

Am Micro-precipitation (SOP 780)

1 Add 1 ml conc HCl to sample Heat for 5 minutes Add 15 ml DI

2 Add 0 5 ml lanthanum carrier mix well Add 5 ml HF Mix well

3 Allow sample to stand for 15-20 minutes minimum

4 Place 25 mm filter membrane in a filter funnel assembly and turn on vacuum Rinse with 1-2 ml alcohol

5 Load sample into filter Rinse sample beaker once with 5 ml DI and add to funnel

6 After sample has passed through filter Rinse filter with 10-15 ml DI

7 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

8 Mount filter on stainless steel planchet with double sided adhesive tape

RF23	RF28	RF29	RF30		
9/25/98 →					
✓	✓	✓	✓		
✓	✓	✓	✓		
✓		✓	✓		
✓		✓	✓		
✓		✓	✓		
✓		✓	✓		
✓		✓	✓		

Am Methanolic Anion Exchange Column (SOP 780)

	RF4	RF16	RF1	RF13	RF24	
1 Mix anion exchange resin with twice the volume of 1N HNO_3/93% methanol solution (for 160 ml 10ml conc HNO_3, 150 ml methanol) overnight						
2 Add 5-10 ml conc HNO3,	✓	✓	✓	✓	✓	
3 Add 100-125 ml DI,	✓	✓	✓	✓	✓	
4 Add 1 0 ml Fe carrier	9/17/98 →					
5 Transfer to cent tube and ppt with conc NH4OH Cent @3500 rpm for 15 min/	✓	✓	✓	✓	✓	
6 Add conc HNO_3 and evaporate, Repeat	9/21/98 →					
7 Add conc HNO_3 until dissolved Add methanol (15 ml of methanol for each 1 ml conc HNO_3) mls	~~|||~~	~~|||~~	|||	|||	|||	
8 Pour resin slurry into disposable column and let resin settle to 7cm, place a layer of silica or glass beads on top of resin	10/22/98 →		9/23/98 →			
9 Place funnel on top of column with Whatman filter paper, wet filter with 1N HNO_3 /93% methanol solution	✓	✓	✓	✓	✓	
10 Condition column with 40 ml of 1N HNO_3 /93% methanol solution	✓	✓	✓	✓	✓	
8 Load the sample onto column through filter, rinse with 25 ml 1N HNO_3 /93% methanol solution	|✓	|✓	✓|	✓|	✓|	
9 Remove and discard filter and rinse twice with 25 ml 1N HNO_3 / 93% methanol solution Discard into methanolic waste receptacle	✓|	✓	||	||	||	
10 Strip Am by passing three 20 ml volumes of 8 N HNO_3 through the column allowing each rinse to pass completely before adding next rinse Collect eluate in beaker for Teva column	|||	|||	|||	|||	|||	
11 Evaporate to dryness			9/24/98 →			

Am Teva Resin (SOP 780)

	RF4	RF10	RF1	RF13	RF21	
1 Redisolve sample from above in 10 ml 2M NH_4SCN/ 0 1M formic acid (for 100ml 15 2 g NH_4SCN & 0 35 ml 98% formic acid in 100ml DI) Allow sample to sit for 1 hour to ensure dissolution	10/22/98		9/24/98		→	
2 Condition a TEVA resin 2 ml column with 5 ml of 2M NH_4SCN/ 0 1M formic acid solution	✓	✓	✓	✓	✓	
3 Transfer sample into TEVA column in two portions using disposable polyethylene transfer pipet Rinse the sample container with 1 ml of 2M NH_4SCN/ 0 1M formic acid and transfer to column Repeat rinse and add to column	✓ II	✓ II	✓ II	✓ II	✓ II	
4 Rinse the TEVA column with two 5 ml volumes of 1M NH_4SCN/ 0 1M formic acid (for 100 ml dissolve 7 6 g NH_4SCN and 0 35 ml 98% formic acid in 100 ml of DI) Allow first wash to pass completely before adding the second wash (This washes lanthanides from column)	II	II	II	II	II	
5 Strip Am from column with 15 ml of 2N HCl in three 5ml portions allowing each 5 ml to pass completely	III	III	III	III	III	
6 To decompose thiocyanate, add 2 5 ml conc HNO3 and 7 5 ml conc HCL to the Am solution Swirl gently Evaporate until ~1 drop solution is remaining	✓	✓	✓	✓	✓	
7 Add 5 ml conc HNO3 Evaporate until volume is ~1 drop			9/25/98		→	

Am Micro-precipitation (SOP 780)

	RF4	RF10	RF1	RF13	RF21	
1 Add 1 ml conc HCl to sample Heat for 5 minutes Add 15 ml DI			9/25/98		→	
2 Add 0 5 ml lanthanum carrier mix well Add 5 ml HF Mix well	✓	✓	✓	✓	✓	
3 Allow sample to stand for 15-20 minutes minimum	✓	✓	✓	✓	✓	
4 Place 25 mm filter membrane in a filter funnel assembly and turn on vacuum Rinse with 1-2 ml alcohol			✓	✓	✓	
5 Load sample into filter Rinse sample beaker once with 5 ml DI and add to funnel			✓	✓	✓	
6 After sample has passed through filter Rinse filter with 10-15 ml DI			✓	✓	✓	
7 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min			✓	✓	✓	
8 Mount filter on stainless steel planchet with double sided adhesive tape			✓	✓	✓	

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                : 10/02/98 12:09:54 PM

Sample Title                       : 98826WH
Spectrum Description               :
Sample Identification              : RF1AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/28/98 10:24:34 AM

Live Time                          :   351938.0 seconds
Real Time                          :   351939.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

135

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
* ************************************************************************
```

Detector Name: Q1-DET01
Sample Title: 98826WH
Peak Analysis Performed on: 10/02/98 12:09:53 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	445-	481	469.64	5262.83	1.33E+003	36.48	0.00E+000
2	481-	503	492.12	5455.88	6.00E+001	7.75	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

36

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


R  ort Generated On                : 10/12/98 10:28:14 AM

Sample Title                       : 98826 TD
Spectrum Description               :
Sample Identification              : RF2Am
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/02/98 12:31:20 PM

Live Time                          :   419025.0 seconds
Real Time                          :   419025.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

37

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
*************************************************************************
```

Detector Name: Q1-DET01
Sample Title: 98826 TD
Peak Analysis Performed on: 10/12/98 10:28:14 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	436-	478	463.94	5213.87	1.20E+003	34.63	0.00E+000
2	481-	503	492.55	5459.58	4.20E+001	6.48	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************


I  ort Generated On                : 10/12/98  9:37:49 AM

Sample Title                       :
Spectrum Description               :
Sample Identification              : RF3AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/15/98  4:30:50 PM

Live Time                          :   232713.0 seconds
Real Time                          :   232713.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*  ***********************************************************************
```

Detector Name: Q1-DET01
Sample Title:
Peak Analysis Performed on: 10/12/98 9:37:49 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	475	469.82	5264.38	1.04E+002	10.20	0.00E+000
2	477-	503	485.86	5402.13	2.10E+001	4.58	0.00E+000
3	481-	503	492.45	5458.78	1.10E+001	3.32	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                : 10/28/98 10:37:18 AM

Sample Title                       : 98826 >20
Spectrum Description               :
Sample Identification              : RF3AM2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/22/98 11:39:33 AM

Live Time                          :  1009269.0 seconds
Real Time                          :  1009271.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

4H

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q1-DET01
Sample Title: 98826 >20
Peak Analysis Performed on: 10/28/98 10:37:18 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	447-	482	467.37	5243.38	6.96E+002	26.38	0.00E+000
2	483-	505	491.16	5447.69	8.60E+001	9.27	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

42

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ɔort Generated On                : 10/28/98  2:21:51 PM

Sample Title                       : 98826 >5
Spectrum Description               :
Sample Identification              : RF4AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/23/98  3:10:58 PM

Live Time                          :   415469.0 seconds
Real Time                          :   415470.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

43

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*************************************************************************
```

Detector Name: Q3-DET11
Sample Title: 98826 >5
Peak Analysis Performed on: 10/28/98 2:21:51 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	445-	482	470.30	5268.56	1.60E+003	39.97	0.00E+000
2	483-	505	494.83	5480.09	1.29E+003	35.86	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

44

```
*****************************************************************************
******        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

' ›ort Generated On                : 10/12/98  9:36:52 AM

Sample Title                      :
Spectrum Description              :
Sample Identification             : RF5AM
Sample Type                       :
Sample Geometry                   :

Peak Locate Threshold             :  3.00
Peak Locate Range (in channels)   :     1 -  1024
Peak Area Range (in channels)     :     1 -  1024
Identification Energy Tolerance   :    0.020 MeV

Sample Size                       :  1.000E+000 Unit

Sample Taken On                   :
Acquisition Started               :  9/15/98  4:30:52 PM

Live Time                         :   232804.0 seconds
Real Time                         :   232805.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

45

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*  ***********************************************************************
```

Detector Name: Q1-DET02
Sample Title:
Peak Analysis Performed on: 10/12/98 9:36:52 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	444-	481	468.84	5257.37	7.62E+002	27.60	0.00E+000
2	481-	503	491.73	5451.43	1.10E+001	3.32	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

46

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                : 10/28/98  1:23:58 PM

Sample Title                       : 98826 >0.45 F
Spectrum Description               :
Sample Identification              : RF5AM2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/22/98 11:39:35 AM

Live Time                          :  1009313.0 seconds
Real Time                          :  1009314.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

47

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
*************************************************************************
```

Detector Name: Q1-DET02
Sample Title: 98826 >0.45 F
Peak Analysis Performed on: 10/28/98 1:23:58 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	441-	482	468.87	5257.61	3.62E+003	60.14	0.00E+000
2	484-	511	495.28	5481.51	6.90E+001	8.31	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

48

```
*****************************************************************************
*****          G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ɔort Generated On                : 10/12/98  9:35:01 AM

Sample Title                       : 98826 >0.45 C
Spectrum Description               :
Sample Identification              : RF6AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/15/98  4:30:54 PM

Live Time                          :   232804.0 seconds
Real Time                          :   232805.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

49

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   *************************************************************************
```

Detector Name: Q1-DET03
Sample Title: 98826 >0.45 C
Peak Analysis Performed on: 10/12/98 9:35.01 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	447-	482	469.77	5265.74	7.02E+002	26.50	0.00E+000
2	481-	503	492.77	5464.73	4.30E+001	6.56	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************

. ɔort Generated On                : 10/28/98  1:37:04 PM

Sample Title                       : 98826 >0.45 C
Spectrum Description               :
Sample Identification              : RF6AM2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/22/98 11:39:37 AM

Live Time                          :  1009339.0 seconds
Real Time                          :  1009342.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

51

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q1-DET03
Sample Title: 98826 >0.45 C
Peak Analysis Performed on: 10/28/98 1:37:04 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	429-	482	469.29	5261.53	3.84E+003	61.98	0.00E+000
2	486-	508	494.52	5479.88	1.91E+002	13.82	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


F  ort Generated On                : 10/12/98 10:28:40 AM

Sample Title                       : 98826 0.1 U
Spectrum Description               :
Sample Identification              : RF7AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/02/98 12:31:21 PM

Live Time                          :   419078.0 seconds
Real Time                          :   419079.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*  ***********************************************************************
```

Detector Name: Q1-DET02
Sample Title: 98826 0.1 U
Peak Analysis Performed on: 10/12/98 10:28:40 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	466.64	5238.71	1.13E+003	33.66	0.00E+000
2	481-	503	493.11	5463.16	1.80E+001	4.24	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

54

```
*************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


F  ort Generated On                : 10/02/98 12:10:30 PM

Sample Title                       : 98826 0.1R
Spectrum Description               :
Sample Identification              : RF8AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/28/98  5:02:27 PM

Live Time                          :   328068.0 seconds
Real Time                          :   328069.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

55

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
*************************************************************************
```

Detector Name: Q1-DET02
Sample Title: 98826 0.1R
Peak Analysis Performed on: 10/02/98 12:10:30 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	467.89	5249.26	4.55E+002	21.33	0.00E+000
2	481-	503	491.15	5446.56	1.30E+001	3.61	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

56

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

F ort Generated On                : 10/12/98 10:29:27 AM

Sample Title                      : 98826 100 U
Spectrum Description              :
Sample Identification             : RF9AM
Sample Type                       :
Sample Geometry                   :

Peak Locate Threshold             :  3.00
Peak Locate Range (in channels)   :     1 -  1024
Peak Area Range (in channels)     :     1 -  1024
Identification Energy Tolerance   :    0.020 MeV

Sample Size                       :  1.000E+000 Unit

Sample Taken On                   :
Acquisition Started               : 10/02/98 12:31:23 PM

Live Time                         :   419138.0 seconds
Real Time                         :   419139.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

57

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*  ***********************************************************************
```

Detector Name: Q1-DET03
Sample Title: 98826 100 U
Peak Analysis Performed on: 10/12/98 10:29:27 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	467.39	5245.12	9.61E+002	31.00	0.00E+000
2	481-	503	492.93	5466.10	2.70E+001	5.20	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


F  ort Generated On                : 10/02/98 12:10:59 PM

Sample Title                       : 98826 100R
Spectrum Description               :
Sample Identification              : RF10AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/28/98 10:24:37 AM

Live Time                          :   351938.0 seconds
Real Time                          :   351939.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

59

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*************************************************************************
```

Detector Name: Q1-DET03
Sample Title: 98826 100R
Peak Analysis Performed on: 10/02/98 12:10:59 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	469.09	5259.83	1.10E+001	3.32	0.00E+000
2	481-	503	490.00	5440.78	2.00E+000	1.41	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

60

```
*************************************************************************
*****.      G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************

  ɔort Generated On                : 10/02/98 12:15:49 PM

Sample Title                       : 98827A WH
Spectrum Description               :
Sample Identification              : RF13AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/28/98 10:24:39 AM

Live Time                          :   351938.0 seconds
Real Time                          :   351938.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

61

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*************************************************************************
```

Detector Name: Q1-DET04
Sample Title: 98827A WH
Peak Analysis Performed on: 10/02/98 12:15:49 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	447-	481	469.40	5264.08	1.65E+003	40.56	0.00E+000
2	482-	499	493.07	5465.80	5.90E+001	7.68	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

62

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

I  ort Generated On                : 10/12/98  8:33:53 AM

Sample Title                       : 98827A TD
Spectrum Description               :
Sample Identification              : RF14AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/07/98  2:26:42 PM

Live Time                          :   410759.0 seconds
Real Time                          :   410760.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

63

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
*************************************************************************
```

Detector Name: Q2-DET05
Sample Title: 98827A TD
Peak Analysis Performed on: 10/12/98 8:33:53 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	468.45	5265.83	1.56E+003	39.50	0.00E+000
2	481-	503	494.72	5492.51	3.20E+001	5.66	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

64

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************

 :port Generated On                 :  9/28/98  9:05:32 AM

Sample Title                        :
Spectrum Description                :
Sample Identification               : RF15AM
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/23/98  8:45:51 AM

Live Time                           :   433155.0 seconds
Real Time                           :   433156.0 seconds


            Energy Calibration Used Done On       :  8/05/98
            Efficiency Calibration Used Done On   :  8/05/98
```

65

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q3-DET09
Sample Title:
Peak Analysis Performed on: 9/28/98 9:05:32 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	483	470.33	5270.08	1.73E+003	41.61	0.00E+000
2	485-	503	493.09	5468.22	1.20E+002	10.95	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

66

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


. port Generated On                : 10/28/98  2:26:30 PM

Sample Title                       : 98827A>5
Spectrum Description               :
Sample Identification              : RF16AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/23/98  3:10:53 PM

Live Time                          :   415476.0 seconds
Real Time                          :   415476.0 seconds


            Energy Calibration Used Done On       :  8/06/98
            Efficiency Calibration Used Done On   :  8/06/98
```

67

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q3-DET12
Sample Title: 98827A>5
Peak Analysis Performed on: 10/28/98 2:26:30 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	445-	480	468.60	5257.40	1.61E+003	40.06	0.00E+000
2	481-	504	493.53	5470.99	9.24E+002	30.40	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

68

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

 ˈ ɔort Generated On                  :  9/28/98  9:06:19 AM

Sample Title                          :
Spectrum Description                  :
Sample Identification                 : RF17AM
Sample Type                           :
Sample Geometry                       :

Peak Locate Threshold                 :  3.00
Peak Locate Range (in channels)       :     1 -  1024
Peak Area Range (in channels)         :     1 -  1024
Identification Energy Tolerance       :    0.020 MeV

Sample Size                           :  1.000E+000 Unit

Sample Taken On                       :
Acquisition Started                   :  9/23/98  8:45:52 AM

Live Time                             :   433155.0 seconds
Real Time                             :   433156.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

69

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*  ***********************************************************************
```

Detector Name: Q3-DET10
Sample Title:
Peak Analysis Performed on: 9/28/98 9:06:19 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	442-	482	468.73	5266.29	1.87E+003	43.22	0.00E+000
2	484-	503	492.81	5472.63	4.30E+001	6.56	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

70

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

 :port Generated On                 :  9/28/98  9:07:09 AM

Sample Title                        :
Spectrum Description                :
Sample Identification               : RF18AM
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/23/98  8:45:55 AM

Live Time                           :   433154.0 seconds
Real Time                           :   433155.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

71

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T           *****
*************************************************************************
```

Detector Name: Q3-DET11
Sample Title:
Peak Analysis Performed on: 9/28/98 9:07:09 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	475	468.97	5257.11	1.24E+002	11.14	0.00E+000
2	476-	503	488.73	5427.47	1.43E+002	11.96	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

72

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


  ›ort Generated On                : 10/28/98  1:37:55 PM

Sample Title                       : 98827A >0.45 C
Spectrum Description               :
Sample Identification              : RF18AM2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/22/98 11:39:39 AM

Live Time                          :  1009368.0 seconds
Real Time                          :  1009369.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

73

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   *********************************************************************
```

Detector Name: Q1-DET04
Sample Title: 98827A >0.45 C
Peak Analysis Performed on: 10/28/98 1:37:55 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	455-	481	470.81	5276.09	2.76E+002	16.61	0.00E+000
2	483-	504	491.26	5450.38	2.40E+002	15.49	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


R ort Generated On                : 10/12/98 10:30:00 AM

Sample Title                      : 98827A 0.1 U
Spectrum Description              :
Sample Identification             : RF19AM
Sample Type                       :
Sample Geometry                   :

Peak Locate Threshold             :  3.00
Peak Locate Range (in channels)   :     1 -  1024
Peak Area Range (in channels)     :     1 -  1024
Identification Energy Tolerance   :    0.020 MeV

Sample Size                       :  1.000E+000 Unit

Sample Taken On                   :
Acquisition Started               : 10/02/98 12:31:25 PM

Live Time                         :   419190.0 seconds
Real Time                         :   419191.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

75

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q1-DET04
Sample Title: 98827A 0.1 U
Peak Analysis Performed on: 10/12/98 10:30:00 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	468.06	5252.70	8.21E+002	28.65	0.00E+000
2	481-	503	491.64	5453.65	1.40E+001	3.74	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

76

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

 ' ,ort Generated On                : 10/28/98  2:13:10 PM

Sample Title                       : 98827A 0.1 - 0.45
Spectrum Description               :
Sample Identification              : RF20AM2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/23/98  3:10:37 PM

Live Time                          :  1007579.0 seconds
Real Time                          :  1007582.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

77

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q2-DET05
Sample Title: 98827A 0.1 - 0.45
Peak Analysis Performed on: 10/28/98 2:13:10 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	453-	474	466.62	5250.02	1.43E+002	11.96	0.00E+000
2	481-	503	493.59	5482.75	1.70E+001	4.12	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

18

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*****************************************************************************


Report Generated On                  : 10/12/98 10:36:33 AM

Sample Title                         : 98827A 100U
Spectrum Description                 :
Sample Identification                : RF21AM
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  : 10/05/98 10:52:17 AM

Live Time                            :   414697.0 seconds
Real Time                            :   414697.0 seconds


          Energy Calibration Used Done On        :  8/05/98
          Efficiency Calibration Used Done On    :  8/05/98
```

79

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q3-DET10
Sample Title: 98827A 100U
Peak Analysis Performed on: 10/12/98 10:36:33 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	468.04	5260.39	1.51E+003	38.85	0.00E+000
2	481-	503	493.57	5479.12	2.80E+001	5.29	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

80

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

 port Generated On                : 10/12/98 10:36:57 AM

Sample Title                      : 98827A 100 R
Spectrum Description              :
Sample Identification             : RF22AM
Sample Type                       :
Sample Geometry                   :

Peak Locate Threshold             :  3.00
Peak Locate Range (in channels)   :     1 -  1024
Peak Area Range (in channels)     :     1 -  1024
Identification Energy Tolerance   :    0.020 MeV

Sample Size                       :  1.000E+000 Unit

Sample Taken On                   :
Acquisition Started               : 10/07/98  2:26:53 PM

Live Time                         :   413052.0 seconds
Real Time                         :   413054.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

81

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q3-DET09
Sample Title: 98827A 100 R
Peak Analysis Performed on: 10/12/98 10:36:57 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	469.70	5264.59	6.73E+002	25.94	0.00E+000
2	481-	503	492.70	5464.77	2.30E+001	4.80	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

82

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


  port Generated On                : 10/12/98  9:00:03 AM

Sample Title                       : 98827A <0.45 filter
Spectrum Description               :
Sample Identification              : RF23AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/07/98  2:26:41 PM

Live Time                          :   410766.0 seconds
Real Time                          :   410766.0 seconds


            Energy Calibration Used Done On       :  8/05/98
            Efficiency Calibration Used Done On   :  8/05/98
```

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   ************************************************************************
```

Detector Name: Q2-DET08
Sample Title: 98827A <0.45 filter
Peak Analysis Performed on: 10/12/98 9:00:03 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	481	469.27	5264.13	1.26E+003	35.50	0.00E+000
2	481-	503	489.24	5436.78	2.90E+001	5.39	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

84

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ɔort Generated On                : 10/12/98  8:28:47 AM

Sample Title                       : 98827B whole water
Spectrum Description               :
Sample Identification              : RF24AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/07/98  2:26:34 PM

Live Time                          :   410518.0 seconds
Real Time                          :   410518.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

85

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q1-DET01
Sample Title: 98827B whole water
Peak Analysis Performed on: 10/12/98 8:28:47 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	467.33	5242.98	7.63E+002	27.62	0.00E+000
2	481-	503	492.58	5459.85	1.90E+001	4.36	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

86

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

F  ort Generated On                  :  9/28/98  9:07:40 AM

Sample Title                         :
Spectrum Description                 :
Sample Identification                : RF26AM
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/23/98  8:45:56 AM

Live Time                            :   433155.0 seconds
Real Time                            :   433156.0 seconds


              Energy Calibration Used Done On       :  8/06/98
              Efficiency Calibration Used Done On   :  8/06/98
```

87

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
*************************************************************************
```

Detector Name: Q3-DET12
Sample Title.
Peak Analysis Performed on: 9/28/98 9:07:40 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	480	469.10	5261.63	1.31E+003	36.12	0.00E+000
2	481-	503	493.02	5466.60	5.80E+001	7.62	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

88

```
*************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*************************************************************************

  port Generated On                : 10/12/98  8:49:27 AM

Sample Title                       : 98827B 0.1 U
Spectrum Description               :
Sample Identification              : RF27AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/07/98  2:26:44 PM

Live Time                          :   410760.0 seconds
Real Time                          :   410760.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

89

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q2-DET06
Sample Title: 98827B 0.1 U
Peak Analysis Performed on: 10/12/98 8:49:27 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	425-	478	463.29	5209.10	1.59E+003	39.91	0.00E+000
2	481-	503	491.97	5451.68	3.00E+001	5.48	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

90

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                : 10/12/98  8:29:30 AM

Sample Title                       : 98827B 0.1 R
Spectrum Description               :
Sample Identification              : RF28AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/07/98  2:26:35 PM

Live Time                          :   410518.0 seconds
Real Time                          :   410518.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

91

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q1-DET02
Sample Title· 98827B 0.1 R
Peak Analysis Performed on: 10/12/98 8:29:30 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	468.64	5255.68	6.52E+002	25.53	0.00E+000
2	481-	503	491.26	5447.45	3.10E+001	5.57	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

92

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                : 10/12/98  8:30:09 AM

Sample Title                       : 98827B 100U
Spectrum Description               :
Sample Identification              : RF29AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/07/98  2:26:36 PM

Live Time                          :   410517.0 seconds
Real Time                          :   410518.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

93

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*  ***********************************************************************
```

Detector Name: Q1-DET03
Sample Title: 98827B 100U
Peak Analysis Performed on: 10/12/98 8:30:09 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	450-	478	469.55	5263.81	7.86E+002	28.04	0.00E+000
2	481-	503	490.45	5444.65	4.70E+001	6.86	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

94

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ›ort Generated On                : 10/12/98  8:30:49 AM

Sample Title                       : 98827B 100 R
Spectrum Description               :
Sample Identification              : RF30AM
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/07/98  2:26:33 PM

Live Time                          :   410524.0 seconds
Real Time                          :   410525.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

95

```
*********************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*********************************************************************


  port Generated On                : 10/28/98  4:33:40 PM

Sample Title                       : 98827B 100kDa - 0.45
Spectrum Description               :
Sample Identification              : RF30AM2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/23/98  3:10:38 PM

Live Time                          :  1007615.0 seconds
Real Time                          :  1007617.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

97

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q2-DET06
Sample Title: 98827B 100kDa - 0.45
Peak Analysis Performed on: 10/28/98 4:33:40 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	447-	482	469.85	5264.57	1.54E+003	39.29	0.00E+000
2	483-	506	492.14	5453.15	5.70E+001	7.55	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

98

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                  :  9/23/98  8:29:58 AM

Sample Title                        : 98826WH
Spectrum Description                :
Sample Identification               : RF1PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/18/98  4:53:47 PM

Live Time                           :   401793.0 seconds
Real Time                           :   401794.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

99

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q1-DET01
Sample Title: 98826WH
Peak Analysis Performed on: 9/23/98 8:29:58 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	410.42	4754.25	7.70E+001	8.77	0.00E+000
2	435-	465	454.93	5136.49	1.21E+002	11.00	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

100

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                  :  9/24/98  3:21:06 PM

Sample Title                         : 98826TD
Spectrum Description                 :
Sample Identification                : RF2PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/15/98  4:31:08 PM

Live Time                            :   409848.0 seconds
Real Time                            :   409849.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

101

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*************************************************************************
```

Detector Name: Q3-DET10
Sample Title:
Peak Analysis Performed on: 9/24/98 3:21:06 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	421.98	4865.71	1.54E+003	39.22	0.00E+000
2	435-	465	451.90	5122.04	4.90E+001	7.00	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

102

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


. port Generated On                 :  9/15/98  3:57:53 PM

Sample Title                        : 98826 >20 F
Spectrum Description                :
Sample Identification               : RF3PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/11/98  9:01:35 AM

Live Time                           :   370278.0 seconds
Real Time                           :   370279.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

103

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q1-DET01
Sample Title: 98826 >20 F
Peak Analysis Performed on: 9/15/98 3:57:53 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	413.13	4777.54	1.48E+003	38.52	0.00E+000
2	435-	465	444.02	5042.87	1.29E+002	11.36	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

104

```
*************************************************************************
***** .      G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


  port Generated On                : 10/28/98  2:15:14 PM

Sample Title                       : 98826 >20 F
Spectrum Description               :
Sample Identification              : RF3PU2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/23/98  3:10:45 PM

Live Time                          :  1007706.0 seconds
Real Time                          :  1007708.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

105

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
  *************************************************************************
```

Detector Name: Q2-DET07
Sample Title: 98826 >20 F
Peak Analysis Performed on: 10/28/98 2:15:14 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	386-	430	421.63	4856.56	2.69E+003	51.87	0.00E+000
2	435-	460	452.20	5117.25	2.27E+002	15.07	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

106

```
*****************************************************************************
*****          G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                  :  9/23/98  8:30:30 AM

Sample Title                         : 98826>5 C
Spectrum Description                 :
Sample Identification                : RF4PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/18/98  4:53:48 PM

Live Time                            :   401794.0 seconds
Real Time                            :   401795.0 seconds


          Energy Calibration Used Done On        :  8/04/98
          Efficiency Calibration Used Done On    :  8/04/98
```

107

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T            *****
   *************************************************************************
```

Detector Name: Q1-DET02
Sample Title: 98826>5 C
Peak Analysis Performed on: 9/23/98 8:30:30 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	421.42	4855.20	1.25E+003	35.37	0.00E+000
2	435-	465	453.20	5124.72	2.25E+003	47.40	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

108

```
*****************************************************************************
*****          G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                  :  9/15/98  3:58:10 PM

Sample Title                         : 98826 >0.45 F
Spectrum Description                 :
Sample Identification                : RF5PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/11/98  9:01:36 AM

Live Time                            :   370278.0 seconds
Real Time                            :   370279.0 seconds


          Energy Calibration Used Done On        :  8/04/98
          Efficiency Calibration Used Done On    :  8/04/98
```

109

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q1-DET02
Sample Title: 98826 >0.45 F
Peak Analysis Performed on: 9/15/98 3:58:10 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	421.68	4857.43	1.31E+003	36.19	0.00E+000
2	435-	465	451.36	5109.08	1.40E+001	3.74	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

110

```
*****************************************************************************
***** .      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************


. port Generated On                 :  9/15/98  3:58:23 PM

Sample Title                        : 98826 >0.45 C
Spectrum Description                :
Sample Identification               : RF6PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/11/98  9:01:38 AM

Live Time                           :   370278.0 seconds
Real Time                           :   370279.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

111

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q1-DET03
Sample Title: 98826 >0.45 C
Peak Analysis Performed on: 9/15/98 3:58:23 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.96	4869.26	1.28E+003	35.71	0.00E+000
2	435-	465	454.45	5133.10	1.03E+002	10.15	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

112

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


I  ort Generated On                : 10/28/98  2:19:53 PM

Sample Title                       : 98827A >5
Spectrum Description               :
Sample Identification              : RF16PU2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/22/98 11:39:56 AM

Live Time                          :   591473.0 seconds
Real Time                          :   591474.0 seconds


            Energy Calibration Used Done On        :  8/05/98
            Efficiency Calibration Used Done On    :  8/05/98
```

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   ************************************************************************
```

Detector Name: Q3-DET11
Sample Title: 98827A >5
Peak Analysis Performed on: 10/28/98 2:19:53 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	389-	434	424.41	4872.93	2.34E+003	48.37	0.00E+000
2	434-	465	455.14	5137.87	3.22E+003	56.71	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

114

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S              *****
*****************************************************************************

. ›ort Generated On                  :  9/24/98  3:30:37 PM

Sample Title                         : 98826 0 1 U
Spectrum Description                 :
Sample Identification                : RF7PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/15/98  4:31:09 PM

Live Time                            :   409849.0 seconds
Real Time                            :   409850.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

115

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   ***********************************************************************
```

Detector Name: Q3-DET11
Sample Title:
Peak Analysis Performed on: 9/24/98 3:30:37 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts

116

```
*****************************************************************************
*****'        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

I  ›ort Generated On                 :  9/23/98  8:31:02 AM

Sample Title                         : 988260.1R
Spectrum Description                 :
Sample Identification                : RF8PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/18/98  4:53:50 PM

Live Time                            :   401795.0 seconds
Real Time                            :   401796.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

117

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   *************************************************************************
```

Detector Name: Q1-DET03
Sample Title: 988260.1R
Peak Analysis Performed on: 9/23/98 8:31:02 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	424.42	4873.25	1.20E+003	34.64	0.00E+000
2	435-	465	453.47	5124.68	3.80E+001	6.16	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

118

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

 port Generated On                  :  9/24/98  3:30:57 PM

Sample Title                        : 98826 100U
Spectrum Description                :
Sample Identification               : RF9PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/15/98  4:31:10 PM

Live Time                           :   409844.0 seconds
Real Time                           :   409845.0 seconds


              Energy Calibration Used Done On       :  8/06/98
              Efficiency Calibration Used Done On   :  8/06/98
```

119

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   *********************************************************************
```

Detector Name: Q3-DET12
Sample Title:
Peak Analysis Performed on: 9/24/98 3:30:57 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	419.62	4837.63	9.10E+001	9.54	0.00E+000
2	435-	465	453.83	5130.84	1.20E+001	3.46	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

ort Generated On                  :  9/23/98  8:31:23 AM

Sample Title                       : 98826 100R
Spectrum Description               :
Sample Identification              : RF10PU
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/18/98  4:53:53 PM

Live Time                          :   401794.0 seconds
Real Time                          :   401794.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

121

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q1-DET04
Sample Title: 98826 100R
Peak Analysis Performed on: 9/23/98 8:31:23 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	425.14	4886.86	2.71E+003	52.04	0.00E+000
2	435-	465	456.88	5157.37	4.90E+001	7.00	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

122

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q2-DET05
Sample Title: 98827AWH
Peak Analysis Performed on: 9/23/98 8:32:54 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	422.36	4868.18	1.25E+003	35.28	0.00E+000
2	435-	465	454.04	5141.53	7.30E+001	8.54	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ›ort Generated On                 :  9/24/98  3:31:12 PM

Sample Title                        : 98827A TD
Spectrum Description                :
Sample Identification               : RF14PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/15/98  4:30:59 PM

Live Time                           :   232948.0 seconds
Real Time                           :   232948.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

124

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*************************************************************************
```

Detector Name: Q2-DET05
Sample Title:
Peak Analysis Performed on: 9/24/98 3:31:12 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.68	4879.58	1.01E+003	31.72	0.00E+000
2	435-	465	454.21	5143.02	1.40E+001	3.74	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

125

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

P  ort Generated On                 :  9/15/98  3:55:10 PM

Sample Title                        : 98827A >20 F
Spectrum Description                :
Sample Identification               : RF15PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/13/98  3:00:19 PM

Live Time                           :   341755.0 seconds
Real Time                           :   341755.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

126

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q2-DET06
Sample Title: 98827A >20 F
Peak Analysis Performed on: 9/15/98 3:55:10 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	422.49	4863.99	1.08E+003	32.79	0.00E+000
2	435-	465	453.05	5122.52	1.29E+002	11.36	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

127

```
*****************************************************************************
*****          G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

I  ort Generated On                 :  9/23/98  8:33:17 AM

Sample Title                        : 98827A >5 C
Spectrum Description                :
Sample Identification               : RF16PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/18/98  4:54:29 PM

Live Time                           :   401921.0 seconds
Real Time                           :   401922.0 seconds


          Energy Calibration Used Done On       :  8/04/98
          Efficiency Calibration Used Done On   :  8/04/98
```

128

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q2-DET06
Sample Title: 98827A >5 C
Peak Analysis Performed on: 9/23/98 8:33:17 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	422.99	4868.23	1.67E+003	40.89	0.00E+000
2	435-	465	454.23	5132.50	2.14E+003	46.24	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

129

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

I  ort Generated On                  :  9/15/98  3:55:37 PM

Sample Title                         : 98827A >0.45 F
Spectrum Description                 :
Sample Identification                : RF17PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/13/98  3:00:21 PM

Live Time                            :   369805.0 seconds
Real Time                            :   369806.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

130

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   ***********************************************************************
```

Detector Name: Q2-DET07
Sample Title: 98827A >0.45 F
Peak Analysis Performed on: 9/15/98 3:55:36 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	422.72	4865.80	8.26E+002	28.74	0.00E+000
2	435-	465	452.74	5121.87	5.00E+001	7.07	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

131

```
*************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*************************************************************************

 ›ort Generated On                 :  9/15/98  3:56:44 PM

Sample Title                       : 98827A >0.45 C
Spectrum Description               :
Sample Identification              : RF18PU
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                :  9/13/98  3:00:23 PM

Live Time                          :   369806.0 seconds
Real Time                          :   369806.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

132

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   *************************************************************************
```

Detector Name: Q2-DET08
Sample Title: 98827A >0.45 C
Peak Analysis Performed on: 9/15/98 3:56:44 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.27	4866.38	1.32E+003	36.30	0.00E+000
2	435-	465	453.53	5128.00	1.55E+002	12.45	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

133

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ɔort Generated On                  :  9/24/98  3:31:34 PM

Sample Title                         : 98827A0 1U
Spectrum Description                 :
Sample Identification                : RF19PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/15/98  4:31:01 PM

Live Time                            :   232948.0 seconds
Real Time                            :   232948.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

134

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
  *************************************************************************
```

Detector Name: Q2-DET06
Sample Title:
Peak Analysis Performed on: 9/24/98 3:31:34 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.02	4868.45	9.80E+002	31.30	0.00E+000
2	435-	465	453.15	5123.36	1.30E+001	3.61	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


  port Generated On                : 10/28/98  2:16:12 PM

Sample Title                       : 98827A <0.1
Spectrum Description               :
Sample Identification              : RF19PU2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/23/98  3:10:35 PM

Live Time                          :  1007759.0 seconds
Real Time                          :  1007763.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

13V

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
   *************************************************************************
```

Detector Name: Q2-DET08
Sample Title: 98827A <0.1
Peak Analysis Performed on: 10/28/98 2:16:11 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	432	423.26	4866.28	3.87E+003	62.20	0.00E+000
2	445-	464	453.54	5128.12	3.50E+001	5.92	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

137

```
*****************************************************************************
*****      G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  port Generated On                  :  9/28/98  9:01:28 AM

Sample Title                        : 98827A01R
Spectrum Description                :
Sample Identification               : RF20PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/23/98  8:45:36 AM

Live Time                           :   432965.0 seconds
Real Time                           :   432966.0 seconds


            Energy Calibration Used Done On       :  8/04/98
            Efficiency Calibration Used Done On   :  8/04/98
```

138

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q2-DET05
Sample Title:
Peak Analysis Performed on: 9/28/98 9:01:28 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	424.78	4889.04	2.33E+003	48.22	0.00E+000
2	435-	465	454.92	5149.14	2.60E+001	5.10	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

139

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

 ˙ ›ort Generated On                  :  9/28/98  9:02:06 AM

Sample Title                          : 98827A 100J
Spectrum Description                  :
Sample Identification                 : RF21PU
Sample Type                           :
Sample Geometry                       :

Peak Locate Threshold                 :  3.00
Peak Locate Range (in channels)       :     1 -  1024
Peak Area Range (in channels)         :     1 -  1024
Identification Energy Tolerance       :    0.020 MeV

Sample Size                           :  1.000E+000 Unit

Sample Taken On                       :
Acquisition Started                   :  9/23/98  8:45:38 AM

Live Time                             :   432966.0 seconds
Real Time                             :   432967.0 seconds


              Energy Calibration Used Done On       :  8/04/98
              Efficiency Calibration Used Done On   :  8/04/98
```

140

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q2-DET06
Sample Title:
Peak Analysis Performed on: 9/28/98 9:02:05 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.29	4870.71	1.47E+003	38.33	0.00E+000
2	435-	465	454.43	5134.15	4.20E+001	6.48	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

141

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ›ort Generated On                 :  9/23/98  8:33:49 AM

Sample Title                        : 98827A 100R
Spectrum Description                :
Sample Identification               : RF22PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/18/98  4:54:31 PM

Live Time                           :   401921.0 seconds
Real Time                           :   401921.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

142

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
*************************************************************************
```

Detector Name: Q2-DET07
Sample Title: 98827A 100R
Peak Analysis Performed on: 9/23/98 8:33:49 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	422.65	4865.27	8.30E+002	28.81	0.00E+000
2	435-	465	454.00	5132.62	1.90E+001	4.36	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

143

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*****************************************************************************


F  ort Generated On                 :  9/23/98  8:34:15 AM

Sample Title                        : 98827A <0.45 CART FILTERED
Spectrum Description                :
Sample Identification               : RF23PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/18/98  4:54:32 PM

Live Time                           :   401921.0 seconds
Real Time                           :   401921.0 seconds


            Energy Calibration Used Done On       :  8/05/98
            Efficiency Calibration Used Done On   :  8/05/98
```

144

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q2-DET08
Sample Title: 98827A <0.45 CART FILTERED
Peak Analysis Performed on: 9/23/98 8:34:15 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	424.59	4877.83	1.06E+003	32.51	0.00E+000
2	435-	465	452.38	5118.02	8.00E+000	2.83	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

145

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

I  ort Generated On                  :  9/23/98  8:34:40 AM

Sample Title                         : 98827BWH
Spectrum Description                 :
Sample Identification                : RF24PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/18/98  4:54:08 PM

Live Time                            :   401942.0 seconds
Real Time                            :   401944.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

146

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q3-DET09
Sample Title: 98827BWH
Peak Analysis Performed on: 9/23/98 8:34:40 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.15	4859.34	6.53E+002	25.55	0.00E+000
2	435-	465	456.23	5147.32	2.20E+001	4.69	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

147

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

  ›ort Generated On                  :  9/15/98  3:57:26 PM

Sample Title                         : 98827B >20 F
Spectrum Description                 :
Sample Identification                : RF26PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/13/98  3:00:31 PM

Live Time                            :   369891.0 seconds
Real Time                            :   369892.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

148

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q3-DET09
Sample Title: 98827B >20 F
Peak Analysis Performed on: 9/15/98 3:57:26 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	424.32	4869.57	1.32E+003	36.39	0.00E+000
2	435-	465	453.92	5127.27	8.00E+001	8.94	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

149

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                : 10/28/98  2:16:46 PM

Sample Title                       : 98827B <0.1
Spectrum Description               :
Sample Identification              : RF27PU2
Sample Type                        :
Sample Geometry                    :

Peak Locate Threshold              :  3.00
Peak Locate Range (in channels)    :     1 -  1024
Peak Area Range (in channels)      :     1 -  1024
Identification Energy Tolerance    :    0.020 MeV

Sample Size                        :  1.000E+000 Unit

Sample Taken On                    :
Acquisition Started                : 10/23/98  3:10:55 PM

Live Time                          :  1006614.0 seconds
Real Time                          :  1006617.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

150

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q3-DET09
Sample Title: 98827B <0.1
Peak Analysis Performed on: 10/28/98 2:16:46 PM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	386-	433	424.67	4872.59	3.95E+003	62.87	0.00E+000
2	446-	470	456.36	5148.45	4.20E+001	6.48	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

151

```
*************************************************************************
******      G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************

Report Generated On                  :  9/23/98  8:35:02 AM

Sample Title                         : 98827B 0.1R
Spectrum Description                 :
Sample Identification                : RF28PU
Sample Type                          :
Sample Geometry                      :

Peak Locate Threshold                :  3.00
Peak Locate Range (in channels)      :     1 -  1024
Peak Area Range (in channels)        :     1 -  1024
Identification Energy Tolerance      :    0.020 MeV

Sample Size                          :  1.000E+000 Unit

Sample Taken On                      :
Acquisition Started                  :  9/18/98  4:54:09 PM

Live Time                            :   401943.0 seconds
Real Time                            :   401944.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

152

```
*************************************************************************
*****            P E A K   A N A L Y S I S   R E P O R T            *****
   ***********************************************************************
```

Detector Name: Q3-DET10
Sample Title: 98827B 0.1R
Peak Analysis Performed on: 9/23/98 8:35:02 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.23	4876.39	1.70E+003	41.28	0.00E+000
2	435-	465	453.21	5133.32	1.40E+001	3.74	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

153

```
*****************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S          *****
*****************************************************************************

Report Generated On                  :  9/23/98  8:35:19 AM

Sample Title                        : 98827B 100U
Spectrum Description                :
Sample Identification               : RF29PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/18/98  4:54:11 PM

Live Time                           :   401942.0 seconds
Real Time                           :   401943.0 seconds


              Energy Calibration Used Done On       :  8/05/98
              Efficiency Calibration Used Done On   :  8/05/98
```

154

```
*************************************************************************
*****          P E A K   A N A L Y S I S   R E P O R T          *****
*************************************************************************
```

Detector Name: Q3-DET11
Sample Title: 98827B 100U
Peak Analysis Performed on: 9/23/98 8:35:19 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	425.50	4882.38	5.66E+002	23.79	0.00E+000
2	435-	465	455.38	5139.92	1.60E+001	4.00	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

155

```
*************************************************************************
*****        G A M M A   S P E C T R U M   A N A L Y S I S        *****
*************************************************************************


I  ort Generated On                 :  9/23/98  8:36:23 AM

Sample Title                        : 98827B100R
Spectrum Description                :
Sample Identification               : RF30PU
Sample Type                         :
Sample Geometry                     :

Peak Locate Threshold               :  3.00
Peak Locate Range (in channels)     :     1 -  1024
Peak Area Range (in channels)       :     1 -  1024
Identification Energy Tolerance     :    0.020 MeV

Sample Size                         :  1.000E+000 Unit

Sample Taken On                     :
Acquisition Started                 :  9/18/98  4:54:14 PM

Live Time                           :   401941.0 seconds
Real Time                           :   401942.0 seconds


          Energy Calibration Used Done On       :  8/06/98
          Efficiency Calibration Used Done On   :  8/06/98
```

156

****
***** P E A K A N A L Y S I S R E P O R T *****
****

Detector Name: Q3-DET12
Sample Title: 98827B100R
Peak Analysis Performed on: 9/23/98 8:36:23 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 1024

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	383-	433	423.44	4870.38	1.61E+003	40.10	0.00E+000
2	435-	465	453.50	5127.98	2.20E+001	4.69	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

157

Solid Sample Digestion (SOP 773)

1 ~~Combust sample if applicable~~ Samples in 3N HCl w/tracers evaporate then to Step 3

2 ~~Add tracers~~

3 In teflon beaker add 20 ml conc HNO_3, 20 ml conc HCL and 20 ml conc HF

4 Ensure solids go in to solution (IF not repeat step 3) Evaporate to dryness

5 Add 10 ml conc HNO_3 and 5 ml 30% H_2O_2 Let stand at room temp for a few minutes then evaporate to dryness

6 Add 10 ml conc HNO_3, 100ml DI and 2g H_3BO_3 Heat to ensure dissolution

7 Transfer to 250 ml cent Tube using DI

8 Add 1 ml (40mg/ml) Fe carrier

9 Ppt $Fe(OH)_3$ by adding conc NH_4OH (~50ml)

10 Centrifuge at 3500 rpm for 30 minutes

11 Dissolove ppt With 3x the vol of ppt with conc HCL

12 Add 75 ml 9N HCl

13 Add 1 ml saturated $NaNO_2$ mix thoroughly

RF7	RF14	RF1	RF13	RF24	
9/10/98 →					
9/11/98 →					
✓	✓	✓	✓	✓	
9/12/98 →					
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
9/16/98 →					

Pu column (SOP 778)

1 Fill disposable plastic column with 7 cm AG1x8 resin (by resin/DI slurry)

2 Place funnel on top of column with Whatman filter paper

3 Wet filter paper with 9N HCl

4 Condition resin with 50 ml 9 N HCl

5 Load sample through filter, rinse 2x with 20 ml 9N HCl (= Am fraction)

6 Rinse 2x with 20 ml 9N HCl, discard

7 Elute Pu with 20ml 9N HCl + 1 5 ml HI

8 Add 1 ml conc HNO_3, evaporate to dryness

RF4	RF16	RF1	RF13	RF24	
9/16/98 →					
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	

Pu Microprecipitation (SOP 778)

1 Add 1 ml conc HCl, mix well to resolubilize

2 Add 14 ml DI, mix well

3 Add 1 0 ml lanthanum carrier + 0 5 ml H_2O_2 mix well

4 Add 5 ml 3N HF

5 Let sample sit for min 15-20 minutes

6 Set up filtration apparatus place 25 mm filter membrane on support screen and lock

7 Apply vacuum, rinse filter with 1-2 ml methanol, rinse filter with DI

8 Transfer sample, rinsing beaker once with 5 ml DI

9 Rinse filter with 10-15 ml DI

10 Turn off vacuum, use "sharpie" and place dot on outside edge of filter marking which side is up Place filter in pyrex beaker and put in drying oven (90-100°C) for ~ 1min

11 Mount filter on stainless steel planchet with double sided adhesive tape

RF4	RF14	RF1	RF13	RF24	
9/17/98 →					
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	
✓	✓	✓	✓	✓	