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Vol. GC-11

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Vol. # GC-11

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This Book is a continuation of GC-07.

~~TD - Todd Dieft~~

TD - Todd B. Dietrich Student Scientist

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9 June 1993 RD

URANIUM SORPTION EXPERIMENT **B-IIIB:**
Kd vs pH; Equilibrium with atmospheric pCO_2; Initial $\Sigma U = 5$ ppb

WRITTEN BY: R.T. PABALAN
REVISION NO.: 0

DATE WRITTEN: May 27, 1993
DATE REVISED:

OBJECTIVE:

- To investigate the importance of uranium sorption on the zeolite mineral clinoptilolite as a function of solution pH and total uranium concentration. Experimental data will be correlated with uranium aqueous speciation.

- To investigate reversibility and reproducibility of uranium sorption reactions.

Note: This procedure is similar to that for Expt. B-III. Teflon (FEP) bottles are used here instead of polypropylene (PP) to minimize uranium losses to container walls. Smaller solution volumes and zeolite weights are also used compared to B-III. In addition, liquid scintillation counting, instead of alpha-spectrometry, will be used to measure uranium concentrations. Instead of $NaHCO_3$ solid, aqueous solutions of $NaHCO_3$ are used here to raise the starting pH of the uranium solutions.

EQUIPMENT:

Gyratory shaker or constant temperature shaker bath
Packard liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Automatic temperature compensator probe
Analytical balance

SUPPLIES:

	pH buffer (pH = 2,4,7,9,10)
40	60-ml FEP bottles (to contain experimental mixtures, control solutions, and B-IIIB*IU)
1	2000-ml teflon bottle (for preparation of 5 ppb U solution)
1	5-ml Eppendorf pipet (for transferring 5 ml cocktail into scintillation vial)
1	0.5-ml Eppendorf fixed-volume micropipet (for taking samples and for transferring 0.02 M HNO_3 solution into scintillation vial)
various	Eppendorf micropipets (fixed- or variable-volume; for adding HNO_3 or $NaHCO_3$ solutions to uranium solutions)
	scintillation vials
	weighing paper
	Na^+-clinoptilolite (CDV*100/200*UC*WA*HL*CPT*Naf)
	reagent grade $NaHCO_3$
	500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike

4 L	0.1 m $NaNO_3$ stock solution
1000 ml	stock solution of 1.0 m HNO_3
1000 ml	stock solution of 0.1 m HNO_3
1000 ml	stock solution of 0.02 m HNO_3
1000 ml	stock solution of 0.001 m HNO_3
500 ml	stock solution of 1.0 m $NaHCO_3$
500 ml	stock solution of 0.5 m $NaHCO_3$
500 ml	stock solution of 0.1 m $NaHCO_3$
500 ml	stock solution of 0.05 m $NaHCO_3$
500 ml	stock solution of 0.01 m $NaHCO_3$
500 ml	stock solution of 0.005 m $NaHCO_3$
500 ml	stock solution of 0.001 m $NaHCO_3$
	ultrapure water

PROCEDURE:

Note: In transferring uranium solutions, avoid using glass or polypropylene labware.

Solution B-IIIB (1 bottle for each pH value)

- Initial ΣU = 5 ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO_3 or $NaHCO_3$
- Initial volume = 50 ml
- Ionic strength = 0.1 m $NaNO_3$
- Wt. zeolite to use = 0.100±0.001
- Initial $[Na^+]$ = 0.1 m $NaNO_3$ + $[NaHCO_3]$ added
- pCO_2 = atmospheric = $10^{-3.48}$ bar

a) Prepare 2000-g of 5 ppb U solution in a pre-cleaned 2-liter teflon bottle by diluting 20 g of a 500 ppb stock solution (in 0.1 m $NaNO_3$ matrix; prepared previously from commercial 50 ppm ^{233}U spike) to a total of 2000 g by carefully taring 0.1 m $NaNO_3$ solution into the teflon bottle on a Mettler 4600 balance.

b) Into each of 29 60-ml FEP bottle labeled B-IIIB*pH*i* [where *i* is the approximate initial pH of the solution (see below)], tare 50 g of the 5 ppb uranium solution.

Into each of 10 60-ml FEP bottle labeled B-IIIB-C*pH*i* [where *i* is 2, 4, 5, 5.5, 6, 6.5, 7, 7.5, 8, or 9.5, representing the approximate initial pH of the solution], tare 50 g of the 5 ppb uranium solution. These are control solutions to determine uranium loss to the container walls as a function of pH.

Transfer the remaining solution into a 60-ml FEP bottle labeled B-IIIB*IU. Take two 0.5-ml samples from B-IIIB*IU with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIB-IU*a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02

M HNO_3. Reweigh each vial. Homogenize the mixture and save for later analysis of uranium concentration by liquid scintillation counting.

c) For each solution B-IIIB*pH*i* and B-IIIB-C*pH*i*:

Adjust the pH of each solution to the approximate value *i* by adding HNO_3 solution or $NaHCO_3$ solution with an Eppendorf micropipet. The concentration and approximate amount to be added is given in Table B-IIIB-1. Swirl the solutions by hand. Record the micropipet volume and concentration of solution added. *Do not measure the pH at this time.* Cover the bottles with a porous material (e.g., kimwipe) and place on gyratory shaker set to ~120 rpm. Leave the bottles on the shaker for about ten days to allow the solutions to reach equilibrium with atmospheric CO_2(g).

d) Measure and record the pH of each solution B-IIIB*pH*i* and B-IIIB-C*pH*i*. *Minimize the amount of time the glass electrode is in contact with the uranium solution. Make sure to rinse the electrode well before transferring into another solution.*

From each solution B-IIIB*pH*i* and B-IIIB-C*pH*i*, take 2 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIB*IU-ph*i**a (or b)] scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting. The measured concentrations are the initial values to be used in the calculation of sorption data.

e) Tare 0.100±0.001 gm of Na-clinoptilolite onto weighing paper, and carefully transfer into each of the B-IIIB*pH*i* (**not** the B-IIIB-C*pH*i*) bottles. Swirl each bottle by hand, replace the cover, then place on the shaker.

f) After equilibrium is reached (at least 10 days), take 2 0.5-ml samples from each bottle B-IIIB*ph*i* and B-IIIB-C*pH*i* with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIB-ph*i**a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of solutions B-IIIB*pH*i* and B-IIIB-C*pH*i*. Make sure to rinse the pH electrode very well before transferring into another solution.

g) Analyze the U concentration by liquid scintillation counting

****

Hold Point. Check quality of experimental data.

****

f) If the analytical results are good, reversibility and reproducibility tests can be done by changing the pH of the solutions and re-equilibrating them at the new pH values.

Procedure for reversibility and reproducibility experiments will be written later.

PREPARATION:

1. Preclean:
   - 40 60-ml FEP bottles (to contain experimental mixtures, control solutions, and B-IIIB-*IU)
   - 1 2000-ml teflon bottle (for preparation of 5 ppb U solution)

2. Prepare:
   - 500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
   - 4 L 0.1 m $NaNO_3$ stock solution
   - 1000 ml stock solution of 1.0 m HNO_3
   - 1000 ml stock solution of 0.1 m HNO_3
   - 1000 ml stock solution of 0.02 m HNO_3
   - 1000 ml stock solution of 0.001 m HNO_3
   - 500 ml stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml solution)
   - 500 ml stock solution of 0.5 M $NaHCO_3$ (21.003 in 500 ml solution)
   - 500 ml stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml solution)
   - 500 ml stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml solution)
   - 500 ml stock solution of 0.01 M $NaHCO_3$ (0.4201 g in 500 ml solution)
   - 500 ml stock solution of 0.005 M $NaHCO_3$ (0.2100 g in 500 ml solution)
   - 500 ml stock solution of 0.001 M $NaHCO_3$ (0.0420 g in 500 ml solution)

The $NaHCO_3$ solutions should be prepared with *degassed* deionized water and kept in tightly-capped glass reagent bottles.

Table B-IIIB-1. Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to 50 ml 0.1 m $NaNO_3$ solution containing 5 ppb U to result in pH values given in column-1. The amount of reagent to be added was estimated using EQ3 calculations.

Solution pH	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
2.00	0.606	1.0
2.25	0.340	1.0
2 50	0.190	1.0
2.75	0.107	1.0
3.00	0.060	1.0
3.25	0.335	0.1
3.50	0.187	0.1
3.75	0.103	0.1
4.00	0.281	0.02
4.25	0.149	0.02
4.50	0.075	0.02
4.75	0.653	0.001
5.00	0.168	0.001
Solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
5.25	0.123	0.001
5.50	0.321	0.001
5.75	0.492	0.001
6.00	0.139	0.005
6.25	0.200	0.005
6.50	0.301	0.005
6.75	0.478	0.005
7.00	0.396	0.01
7.25	0.135	0.05
7.50	0.234	0.05
7.75	0.412	0.05

Solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
8.00	0.367	0.1
8.25	0.132	0.5
8.50	0.241	0.5
8.75	0.448	0.5
9.00	0.433	1.0
[9.25]		
[9.50]	[1.99]	[1.0]

2000 g 5ppb ^{233}U solution were prepared by diluting 20g of the 500 ppb stock solution to 2000g using 0.1 m $NaNO_3$ (#3, #4).

Actual weight ^{233}U = 21.15
Final weight = 2001.1

50 g aliquots were placed in 60 mL FEP bottles. The pH of each was adjusted using the table on pages 5 and 6. The volume was adjusted up a down to the nearest 10µL.

pH	Adjustment	Molarity of HNO_3
2.00	0.610 mL	1.0
2.25	0.340	1.0
2.50	0.190	1.0
2.75	0.100	1.0
3.00	0.060	1.0
3.25	0.340	0.1
3.50	0.190	0.1
3.75	0.100	0.1
4.00	0.280	0.02
4.25	0.150	0.02
4.50	0.080	0.02
4.75	0.650	0.007
5.00	0.170	0.001

pH	Adjustment (mL)	Molarity of $NaHCO_3$
5.25	0.120	0.001
5.50	0.320	0.001
TD 5.75 ~~6.00~~	0.490	0.001
6.00	0.140	0.005
6.25	0.200	0.005
6.50	0.300	0.005
6.75	0.480	0.005
7.00	0.400	0.01
7.25	0.140	0.05
7.50	0.230	0.05
7.75	0.460	0.05
8.00	0.370	0.1
8.25	0.130	0.5
8.50	0.240	0.5
8.75	0.450	0.5
9.00	0.430	1.0
9.50	2.00	1.0

The bottles were covered with a kimwape TD cap and placed on a gyratory shaker set to 120 rpm.

~~10 June 1993~~ TD 10 June 1993

~~Prepared a 1L aliquots of 0.1m $NaNO_3$~~

2 500µL samples of the remaining initial solution TD 6/10/93 were taken and prepared for liquid scintillation ~~data~~ TD 6/10/93 analysis

	wt vial (g)	wt. vial + sample (g)	wt. sample (g)
~~BIIB~~ IUa	7.3319	7.8325	0.5006
IUb	7.3043	7.8059	0.5016

10 JUNE 1993 TD

Prepared 6 - 1L portions of 0.1m $NaNO_3$ by dissolving 8.499g $NaNO_3$ in 1000g H_2O.

Bottle #	Wt. $NaNO_3$ used (g)
1	8.4986
2	8.4993
3	8.4999
4	8.4991
5	8.5006
6	8.5007

lot # $NaNO_3$ = 7808 KCCI

14 JUNE 1993 TD

The counting of the 12th K3*A samples has finished the results follow. The procedure and other entries are in GC-07.

```
Protocol #: 5        Name:U-233 3% 2 sigma          11-Jun-93   03:58
Region A: LL-UL= 0.0-100.   Lcr=    0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=    0  Bkg= 0.00  %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=    0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

  S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
   1  999.98    18.88  1.46     2.859  3.74    27.73  1.20  133.70    B
   2   19.83     0.78 256.9   221.246  3.04   222.49  3.20  706.05
   3   20.05     0.00   0.00  218.837  3.04   219.30  3.20  713.04
   4   24.13     2.13  88.70  181.310  3.05   183.62  3.23  700.18
   5   24.41     1.76 105.5   179.238  3.05   181.65  3.23  703.66
   6    8.75     0.20 1473.   505.027  3.02   507.12  3.08  708.54
   7    8.80     0.66 452.8   502.482  3.02   504.43  3.08  708.62
(1 missing vial)
   9    8.46     8.18  43.84  522.673  3.02   529.71  3.07  703.31
  10    8.51     0.50 600.8   519.703  3.02   522.91  3.08  709.77
  11   81.63     0.59 170.9    51.594  3.17    52.95  3.81  706.32
  12   81.48     0.00   0.00   51.682  3.17    52.89  3.81  710.50
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
```

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
K3*A*A*12a	221.246	0.5041	438.8931	5.0752579E+13	8.42646E-11	19.6370
K3*A*A*12b	218.837	0.5039	434.2866	5.0219893E+13	8.33802E-11	19.4309
K3*A*B*12a	181.310	0.5042	359.5994	4.1583238E+13	6.90407E-11	16.0892
K3*A*B*12b	179.238	0.5045	355.2785	4.1083582E+13	6.82112E-11	15.8959
K3*A*C*12a	505.027	0.5033	1003.4314	1.1603448E+14	1.92652E-10	44.8956
K3*A*C*12b	502.482	0.5041	996.7903	1.1526652E+14	1.91377E-10	44.5985

The Initial Samples of B-I3 and B-IIIB also counted (#9-12). The results of the concentration analysis follow.

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)	AVG [U]i
B-IB*IUa	522.673	0.4999	1045.5551	1.2090557E+14	2.0074E-10	46.7803	
B-IB*IUb	519.703	0.4996	1040.2382	1.2029074E+14	1.99719E-10	46.5424	46.6614
B-IIIB*IUa	51.594	0.5006	103.0643	1.191812E+13	1.97877E-11	4.6113	
B-IIIB*IUb	51.682	0.5016	103.0343	1.1914647E+13	1.97819E-11	4.6100	4.6106

4 Additional samples were taken from W2-50*pH7.00. Two were taken with an Eppendorf pipet and two with a Nucleopore filter. This is to test wheter this is an acceptable filter. The filtering apparatus contains a long metal tube and a plastic housing for the filter, ~~which~~ this plastic housing is 2 pieces and has an o-ring and a metal screen. The samples taken were prepared for a L.S. analysis.

SAMPLE NAME	WT VIAL (g)	WT VIAL+SAMPLE (g)	WT SAMPLE (g)
W2-50*pH7.00*N1	7.2825	7.7760	0.4935
N2	7.3150	7.6493	0.3343
E1	7.4351	7.9178	0.4827
E2	7.3009	7.8006	0.4997

The K3*A solutions (See previous entries in GC-07) had their pH adjusted downward by the addition of 0.45 ~~0.9~~ TD 6/14/93 mL 0.1 M HNO_3. This amount was calculated by TD EQ3. Samples will again be taken at the same time intervals as specified by the procedure in GC-07.

K3*A*A INITIAL pH = 7.05, Start Time 1300 hrs, 6/14

SAMPLE #	TIME, DATE	ΔT (hours)	pH/T(°C)
1	1500, 6/14	2	4.38/21.6
2	1700, 6/14	4	4.41/22.4
3	1100, 6/15	22	4.56/20.5
4	1300, 6/16	~~24~~ TD 6/16/93 48	4.54/21.5
5	1300, 6/17	72	4.59/21.6
6	1300, 6/18	96	4.63/22.9
7	1115, 6/20	141.25	4.61/23.2
8	1330, 6/22	~~168.50~~ 192.5 TD 6/22/93	4.68/22.9
9	1300, 6/25	264	4.67/22.5
10	1500, 6/29	362	4.68/23.3
11	1300, 7/2	TD ~~434~~ 432	4.69/22.1
12	1306, 7/7	552	4.74/23.0

K3*B*B INITIAL pH = 6.96 Start Time 1301, 6/14

SAMPLE #	TIME/DATE	ΔT (hours)	pH/T(°C)
1	150~~0~~/6/14	2	4.10/~~22.0~~ TD 6/14/93 21.6
2	170~~0~~, 6/14	4	4.14/22.4
3	1101, 6/15	22	4.16/20.5
4	1301, 6/16	48	4.17/21.5
5	1301, 6/17	72	4.20/21.6
6	1301, 6/18	96	4.25/22.9
7	1116, 6/20	141.25	4.24/23.2
8	1331, 6/22	TD 6/22/93 ~~188.50~~ 192.5	4.29/22.9
9	1301, 6/25	264	4.28/22.6
10	1561, 6/29	362	4.27/23.4
11	1301, ~~7/2~~ TD 7/2/93	~~434~~	4.30/22.1
12	1304, 7/7	552	4.33/23.0

K3*A*C, INITIAL pH 6.96, 1302 6/14

SAMPLE #	TIME, DATE	ΔT (hours)	pH/T(°C)
1	1502, 6/14	2	4.07/21.6
2	1702, 6/14	4	4.08/22.4
3	1102, 6/15	22	4.04/20.5
4	1302, 6/16	48	4.04/21.5
5	1302, 6/17	72	4.05/21.6
6	1302, 6/18	96	~~4.25/22~~ TD 6/18/93 4.04/23.0
7	1117, 6/20	142.25	4.05/23.2
8	1332, 6/22	~~168.05~~ TD 6/22/93 192.5	4.09/~~23.2~~ TD 22.4
9	1302, 6/25	264	4.03/22.5
10	1502, 6/~~29~~	~~362~~ 362 6/25/93	4.04/23.4
11	1302, 7/2	432	4.06/22.1
12	1302, 7/7	552	4.06/23.0

The first two samples of each K3*A reverse experiments were taken at the times given in the tables on page 10 and above. The pH was measured and is also in the table. The samples were prepared for liquid scinfillation analysis and the weights are given below.

Reverse Kinetics, Samples 1 and 2, 14 June 1993

SAMPLE NAM	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
K3*A*AR*1	7.2999	7.8020	0.5021
K3*A*BR*1	7.4506	7.9527	0.5021
K3*A*CR*1	7.3616	7.8642	0.5026
K3*A*AR*2	7.8332	8.3327	0.4995
K3*A*BR*2	7.8754	8.3747	0.4993
K3*A*CR*2	7.8509	8.3534	0.5025

15 June 1993

The Spike 23A solution was taken from the large bottle and placed into ~~5~~ TD 2 1L bottles. 4 samples of the remaining solution were taken. 4 samples of the New 500 ppb solution were also taken and weighed, and prepared for liquid scintillation Analysis. The large bottle was rinsed and 3 more samples taken to make sure there is no residual activity. The third sample (2 from each) of K3*A was also taken. The time and pH can be found on pg 10-11.

The weights of all the samples are given below. TD 6/15/93

VIAL #	SAMPLE NAME	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
2	SPIKE 23A*S1	7.8373	8.3367	0.4994
3	SPIKE 23A*S2	7.8257	8.3312	0.5055
4	SPIKE 23A*S3	7.8865	8.3900	0.5035
5	SPIKE 23A*S4	7.9078	8.4106	0.5028
6	SPIKE 27A*S1	7.8060	8.3092	0.5032
7	SPIKE 27A*S2	7.8589	8.3610	0.5021
8	SPIKE 27A*S3	7.8443	8.3486	0.5043
9	SPIKE 27A*S4	7.8351	8.3367	0.5016
10	K3*A*AR*3a	7.9222	8.4255	0.5033
11	K3*A*AR*3b	7.8743	8.3764	0.5021
12	K3*A*BR*3a	7.7210	8.2231	0.5021
13	K3*A*BR*3b	7.9037	8.4034	0.4997
14	K3*A*CR*3a	7.8646	8.3672	0.5026
15	K3*A*CR*3b	7.8620	8.3650	0.5030
16	SPIKE 23A*R1	7.8143	8.3193	0.5050
17	SPIKE 23A*R2	7.8445	8.3415	0.4970
18	SPIKE 23A*R3	7.8824	8.3794	0.4970

16 June 1993 TD

The samples taken on 14 June have finished counting. The results of the counting are given below.

Protocol #: 5 Name:U-233 3% 2 sigma 16-Jun-93 03:44
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	18.67	1.46	2.898	3.72	27.42	1.21	135.52	B
2	13.15	1.86	134.9	335.049	3.03	337.52	3.12	703.78	
3	3.98	5.20	94.32	1116.45	3.00	1125.09	3.03	705.70	
4	3.57	4.02	125.6	1242.48	3.01	1247.65	3.03	708.40	
5	3.72	4.99	101.3	1193.61	3.01	1200.53	3.03	706.83	
6	10.69	0.00	0.00	413.005	3.02	411.68	3.11	711.00	
7	6.18	5.77	69.14	717.167	3.01	725.33	3.04	700.78	
8	5.40	4.48	92.64	820.620	3.01	826.28	3.04	701.33	
9	4.00	2.58	178.9	1108.85	3.01	1116.33	3.03	702.83	
10	10.35	0.56	490.4	426.474	3.02	427.55	3.10	705.83	
11	6.23	2.52	146.8	710.746	3.01	713.03	3.06	705.61	
12	6.93	4.85	76.14	639.526	3.01	645.45	3.05	705.27	
13	5.95	2.84	134.1	744.665	3.01	748.04	3.05	703.53	
(1 missing vial)									
15	8.23	1.02	305.7	537.321	3.02	538.55	3.08	704.96	W2-50*pH7.00*N1
16	11.87	2.22	119.9	371.491	3.02	374.18	3.11	717.23	
17	8.14	0.25	1222.	543.171	3.02	544.20	3.08	710.67	
18	7.83	1.38	232.3	564.790	3.02	565.94	3.08	705.34	
19	18.47	1.04	200.5	237.817	3.04	239.93	3.17	706.45	
20	18.30	1.88	113.8	239.998	3.04	243.07	3.17	705.65	
21	8.33	0.30	1013.	531.076	3.02	534.04	3.08	710.12	
22	17.61	1.04	205.8	249.515	3.03	251.45	3.17	703.98	
23	14.86	0.71	322.9	296.362	3.03	297.68	3.14	709.32	
24	8.29	2.92	110.8	534.014	3.01	538.08	3.07	707.97	K3*A*CR*2

The results of the concentration analysis are given below.

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
W2-50*pH7.00*N1	537.321	0.4935	1088.7964	1.2590589E+14	2.09042E-10	48.7150
W2-50*pH7.00*N2	371.491	0.3343	1111.2504	1.2850242E+14	2.13353E-10	49.7197
W2-50*pH7.00*E1	543.171	0.4827	1125.2766	1.3012438E+14	2.16046E-10	50.3472
W2-50*pH7.00*E2	564.79	0.4997	1130.2582	1.3070044E+14	2.17002E-10	50.5701
K3*A*AR*1	237.817	0.5021	473.6447	5.4771175E+13	9.09367E-11	21.1919
K3*A*BR*1	239.998	0.5021	477.9884	5.5273477E+13	9.17707E-11	21.3862
K3*A*CR*1	531.076	0.5026	1056.6574	1.2218941E+14	2.02871E-10	47.2771
K3*A*AR*2	249.515	0.4995	499.5295	5.7764438E+13	9.59064E-11	22.3500
K3*A*BR*2	296.362	0.4993	593.5550	6.8637323E+13	1.13959E-10	26.5569
K3*A*CR*2	534.014	0.5025	1062.7144	1.2288984E+14	2.04034E-10	47.5481

6/15/94 TD
FOR VERIFICATION
SEE pages 143-144 of this Notebook

The K3*A data will be plotted as a function of the total time of the experiment. EACH delta Time in the tables on pages 10 and 11 will have 600 5556 TD hours added to it. 6/16/93

The 4th sampling of the reverse K3*A was taken today. The time and measured pH is recorded on pages 10-11. The weights of the samples are given below. The samples were prepared for liquid scintillation analysis.

SAMPLE NAME	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
K3*A*AR*4	7.9237	8.4255	0.5018
K3*A*BR*4	7.8728	8.3739	0.5011
K3*A*CR*4	7.8332	8.3364	0.5032

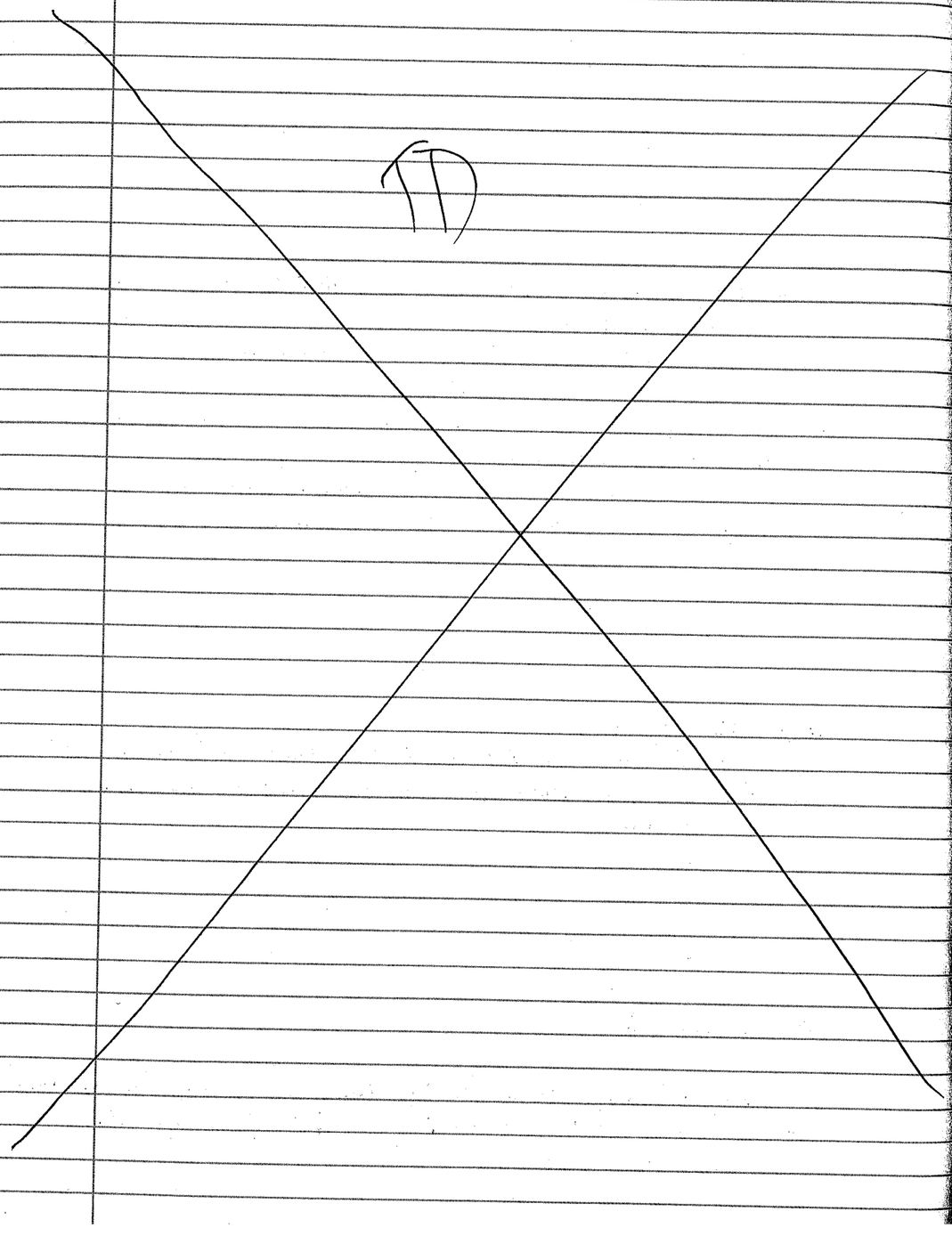
17 June 1993 TD 6/16/93

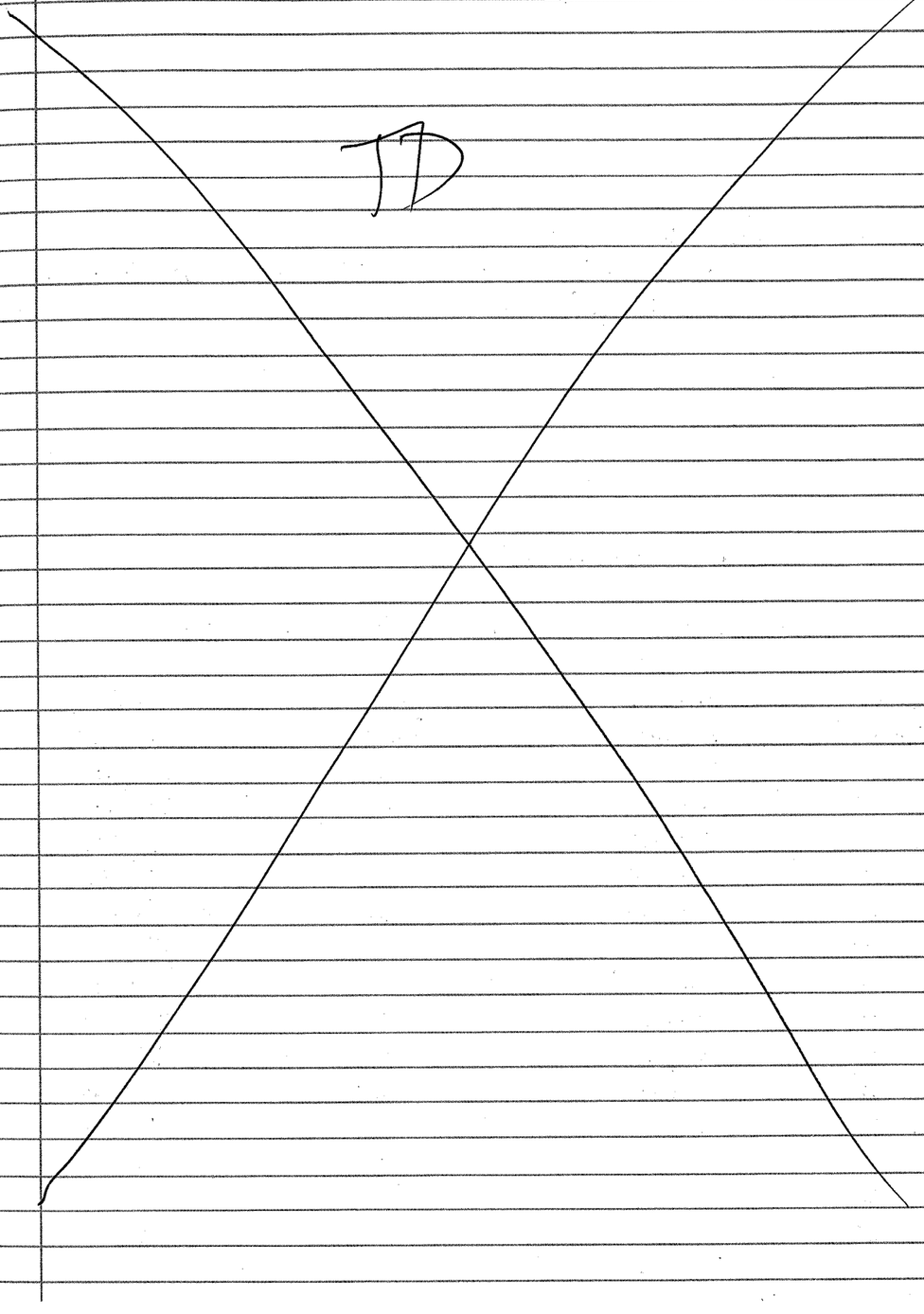
The fifth fifth sample of the reversed kinetics experiments were taken. The pH of the solutions was measured and recorded on pages 10 & 11 as well as the time.

SAMPLE	WT VIAL (g)	WT VIAL + SAMPLE (g	WT SAMPLE (g)
K3*A*AR*5	7.8725	8.3736	0.5011
K3*A*BR*5	7.8450	8.3464	0.5014
K3*A*CR*5	7.8730	8.3719	0.4989

18 June 1993 TD

The 6th sample of the reverse kinetics was taken. The solutions' pH was measured and recorded on page 10 & 11. TD 6/19/93 The sample weights are on the following page (page 16)





SAMPLE	WT VIAL (g)	WT VIAL + SAMPLE (g	WT SAMPLE (g)
K3*A*AR*6	7.8426	8.3420	0.4994
K3*A*AR*6	7.8074	8.3064	0.4990
K3*A*BR*6	7.8471	8.3499	0.5028
K3*A*BR*6	7.8122	8.3115	0.4993
K3*A*CR*6	7.8679	8.3711	0.5032
K3*A*CR*6	7.8338	8.3332	0.4994

20 June 1993 TD

The seventh samples of the reverse Kinetics solutions were taken today. The pH was also measured and recorded on pages 10 & 11

SAMPLE	WT VIAL (g)	WT VIAL + SAMPLE (g	WT SAMPLE (g)
K3*A*AR*7	7.8165	8.3196	0.5031
K3*A*BR*7	7.7687	8.2695	0.5008
K3*A*CR*7	7.8146	8.3159	0.5013

TD 21 June 1993 EXPERIMENT B-IB

The pH of each of the B-I solutions was measured.

SOLUTION	pH/T(°C)
B-IB pH 2.00	1.89/23.8
2.25	2.11/23.8
2.50	2.38/23.8
2.75	2.66/23.8
3.00	2.86/23.8
3.25	3.13/23.8
3.50	3.39/23.9
3.75	3.64/23.9
4.00	3.88/23.9
4.25	4.18/23.9
4.50	4.34/23.9
4.75	4.6/23.9
5.00	4.80/23.9
5.25	4.99/23.9
5.50	5.23/24.0
5.75	5.42/24.0

SOLUTION	pH/T(°C)
B-IB pH6.00	5.42/24.0
6.25	5.81/24.1
6.50	5.98/24.1
6.75	6.33/24.1
7.00	6.62 ~~6.64~~/24.2 (TD)
7.25	6.84 ~~7.13~~/24.2 (TD)
7.50	7.13 ~~7.30~~/24.2 (TD) (6/21/93)
7.75	7.30 ~~7.67~~/24.3 (TD)
8.00	7.67/24.3
8.25	7.98/24.3
8.50	8.28/24.3
8.75	8.63/24.3
9.00	8.87/24.3

The pH of the control solutions were also measured.

SOLUTION	pH/T(°C)
B-IB-C*pH2.0	1.87/24.3
4.0	3.80/24.3
5.0	4.82/24.4
5.5	5.11/24.4
6.0	5.58/24.4
6.5	6.17/24.4
7.0	6.61/24.4
7.5	7.11/24.4
8.0	7.70/24.5
9.5	9.34/24.5

Two samples were taken from each solution and prepared for Liquid Scintillation Analysis. The sample weights are given below.

SAMPLE	WT VIAL (g)	WT VIAL + SAMPLE (g	WT SAMPLE (g)
B-IB*pH2.00*IU1	7.8656	8.3632	0.4976
B-IB*pH2.00*IU2	7.8384	8.3377	0.4993
B-IB*pH2.25*IU1	7.8537	8.3568	0.5031
B-IB*pH2.25*IU2	7.8331	8.3353	0.5022
B-IB*pH2.50*IU1	7.8387	8.3410	0.5023
B-IB*pH2.50*IU2	7.8503	8.3518	0.5015
B-IB*pH2.75*IU1	7.8703	8.3737	0.5034
B-IB*pH2.75*IU2	7.7852	8.2855	0.5003
B-IB*pH3.00*IU1	7.7463	8.2485	0.5022
B-IB*pH3.00*IU2	7.7169	8.2174	0.5005
B-IB*pH3.25*IU1	7.7210	8.2258	0.5048
B-IB*pH3.25*IU2	7.7287	8.2295	0.5008
B-IB*pH3.50*IU1	7.7265	8.2270	0.5005
B-IB*pH3.50*IU2	7.8068	8.3072	0.5004
B-IB*pH3.75*IU1	7.6961	8.1995	0.5034
B-IB*pH3.75*IU2	7.7245	8.2240	0.4995
B-IB*pH4.00*IU1	7.6818	8.1841	0.5023
B-IB*pH4.00*IU2	7.7576	8.2586	0.5010
B-IB*pH4.25*IU1	7.8134	8.3136	0.5002
B-IB*pH4.25*IU2	7.6850	8.1848	0.4998
B-IB*pH4.50*IU1	7.6783	8.1796	0.5013
B-IB*pH4.50*IU2	7.7134	8.2133	0.4999
B-IB*pH4.75*IU1	7.7862	8.2886	0.5024
B-IB*pH4.75*IU2	7.6750	8.1745	0.4995
B-IB*pH5.00*IU1	7.8002	8.2998	0.4996
B-IB*pH5.00*IU2	7.7012	8.2000	0.4988
B-IB*pH5.25*IU1	7.7471	8.2480	0.5009
B-IB*pH5.25*IU2	7.7523	8.2526	0.5003
B-IB*pH5.50*IU1	7.7736	8.2745	0.5009
B-IB*pH5.50*IU2	7.7137	8.2128	0.4991
B-IB*pH5.75*IU1	7.6992	8.2035	0.5043
B-IB*pH5.75*IU2	7.8254	8.3255	0.5001
B-IB*pH6.00*IU1	7.7495	8.2500	0.5005
B-IB*pH6.00*IU2	7.8154	8.3138	0.4984
B-IB*pH6.25*IU1	7.7603	8.2604	0.5001
B-IB*pH6.25*IU2	7.7698	8.2589	0.4991
B-IB*pH6.50*IU1	7.7568	8.2530	0.4962
B-IB*pH6.50*IU2	7.7666	8.2638	0.4972
B-IB*pH6.75*IU1	7.7354	8.2350	0.4996
B-IB*pH6.75*IU2	7.7440	8.2427	0.4987
B-IB*pH7.00*IU1	7.7581	8.2582	0.5001
B-IB*pH7.00*IU2	7.7470	8.2452	0.4982
B-IB*pH7.25*IU1	7.7693	8.2705	0.5012
B-IB*pH7.25*IU2	7.7484	8.2481	0.4997
B-IB*pH7.50*IU1	7.7711	8.2712	0.5001
B-IB*pH7.50*IU2	7.7312	8.2311	0.4999
B-IB*pH7.75*IU1	7.7284	8.2288	0.5004
B-IB*pH7.75*IU2	7.8083	8.3080	0.4997
B-IB*pH8.00*IU1	7.7673	8.2665	0.4992
B-IB*pH8.00*IU2	7.7421	8.2384	0.4963
B-IB*pH8.25*IU1	7.7439	8.2441	0.5002
B-IB*pH8.25*IU2	7.7457	8.2454	0.4997
B-IB*pH8.50*IU1	7.8052	8.3006	0.4954
B-IB*pH8.50*IU2	7.7817	8.2804	0.4987
B-IB*pH8.75*IU1	7.7546	8.2562	0.5016
B-IB*pH8.75*IU2	7.7725	8.2717	0.4992
B-IB*pH9.00*IU1	7.7761	8.2766	0.5005
B-IB*pH9.00*IU2	7.6843	8.1826	0.4983
B-IB-C*pH2.0*IU1	7.7737	8.2767	0.5030
B-IB-C*pH2.0*IU2	7.7364	8.2357	0.4993
B-IB-C*pH4.0*IU1	7.6827	8.1825	0.4998
B-IB-C*pH4.0*IU2	7.7441	8.2417	0.4976
B-IB-C*pH5.0*IU1	7.7540	8.2500	0.4960
B-IB-C*pH5.0*IU2	7.7835	8.2798	0.4963
B-IB-C*pH5.5*IU1	7.7777	8.2791	0.5014
B-IB-C*pH5.5*IU2	7.7083	8.2065	0.4982
B-IB-C*pH6.0*IU1	7.8032	8.3027	0.4995
B-IB-C*pH6.0*IU2	7.7699	8.2674	0.4975
B-IB-C*pH6.5*IU1	7.7389	8.2389	0.5000
B-IB-C*pH6.5*IU2	7.6697	8.1676	0.4979
B-IB-C*pH7.0*IU1	7.7253	8.2262	0.5009
B-IB-C*pH7.0*IU2	7.8040	8.3049	0.5009
B-IB-C*pH7.5*IU1	7.8017	8.3011	0.4994
B-IB-C*pH7.5*IU2	7.7891	8.2873	0.4982
B-IB-C*pH8.0*IU1	7.7607	8.2616	0.5009
B-IB-C*pH8.0*IU2	7.7250	8.2211	0.4961
B-IB-C*pH9.5*IU1	7.7865	8.2872	0.5007
B-IB-C*pH9.5*IU2	7.7295	8.2280	0.4985

The liquid Scintillation Analysis of the 3rd and 4th K3*A Samples has finished. The results are given below.

```
Protocol #: 5        Name:U-233 3% 2 sigma          18-Jun-93   02:50
Region A: LL-UL= 0.0-100.   Lcr=    0  Bkg= 0.00   %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=    0  Bkg= 0.00   %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=    0  Bkg= 0.00   %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
  1 999.98    18.94  1.45    2.836  3.76    27.77  1.20 131.63    B
  2    0.83   22.03 63.80 5375.48  3.00 5413.19  2.99 724.62
  3    0.81   19.33 71.12 5518.15  2.99 5559.88  2.99 723.77
  4    0.81   16.86 78.86 5541.61  2.99 5594.45  2.98 727.00
  5    0.83   28.05 53.66 5380.30  2.99 5427.65  2.99 724.57
  6    0.84   34.63 46.12 5312.64  2.99 5360.32  2.99 719.34
  7    0.84   32.25 48.42 5342.40  2.99 5392.46  2.98 724.42
  8    0.82   23.74 60.78 5426.43  3.00 5469.79  2.99 724.13
  9    0.84   22.73 61.99 5343.59  2.99 5378.18  2.98 725.11
 10   12.90    1.60 158.3 341.660  3.03  343.70  3.12 725.59
 11   13.26    0.00  0.00 332.458  3.03  333.69  3.13 724.59
 12   10.44    1.85 153.5 422.930  3.02  426.34  3.09 717.59
 13   10.39    0.21 1272. 425.172  3.02  424.87  3.11 726.09
 14    8.45    0.47 647.7 523.909  3.01  525.95  3.08 729.41
 15    7.99    0.34 928.9 553.484  3.02  556.21  3.07 722.67
 16 999.98    0.00  0.00   0.401 38.87    0.35 136.7 2809.2
 17 999.98    0.00  0.00   0.441 35.46    0.71 66.53 2083.5
 18 999.98    0.00  0.00   0.445 35.15    0.86 55.43 989.79
 19   11.25    0.08 3119. 392.364  3.02  392.67  3.11 751.99
 20    9.56    0.00  0.00 462.122  3.02  461.24  3.10 752.01
 21    8.32    2.10 152.3 532.020  3.01  537.25  3.07 744.54
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
```

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
K3*A*AR3a	341.660	0.5033	678.8397	7.849945E+13	1.3033E-10	30.3727
K3*A*AR3b	332.458	0.5021	662.1350	7.656776E+13	1.2713E-10	29.6253
K3*A*BR3a	422.930	0.5021	842.3222	9.740419E+13	1.6172E-10	37.6873
K3*A*BR3b	425.172	0.4997	850.8545	9.839085E+13	1.6336E-10	38.0690
K3*A*CR3a	523.909	0.5026	1042.3975	1.205404E+14	2.0013E-10	46.6390
K3*A*CR3b	553.484	0.5030	1100.3658	1.272438E+14	2.1126E-10	49.2327
K3*A*AR4	392.364	0.5018	781.9131	9.041862E+13	1.5012E-10	34.9844
K3*A*BR4	462.122	0.5011	922.2151	1.066428E+14	1.7706E-10	41.2618
K3*A*CR4	532.020	0.5032	1057.2734	1.222607E+14	2.0299E-10	47.3046

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
SPIKE 23A*S1	5375.480	0.4994	10763.8767	1.24471E+15	2.0666E-09	481.5984
SPIKE 23A*S2	5518.150	0.5055	10916.2216	1.262327E+15	2.0958E-09	488.4146
SPIKE 23A*S3	5541.610	0.5035	11006.1768	1.272729E+15	2.1131E-09	492.4394
SPIKE 23A*S4	5380.300	0.5028	10700.6762	1.237401E+15	2.0545E-09	478.7707
SPIKE 27A*S1	5312.640	0.5032	10557.7107	1.220869E+15	2.027E-09	472.3741
SPIKE 27A*S2	5342.400	0.5021	10640.1115	1.230398E+15	2.0428E-09	476.0609
SPIKE 27A*S3	5426.430	0.5043	10760.3212	1.244299E+15	2.0659E-09	481.4393
SPIKE 27A*S4	5343.59	0.5016	10653.0901	1.231899E+15	2.0453E-09	476.6416
SPIKE 23A*R1	0.401	0.5050	0.7941	91823190668	1.5245E-13	0.0355
SPIKE 23A*R2	0.441	0.4970	0.8873	102608085810	1.7036E-13	0.0397
SPIKE 23A*R3	0.445	0.4970	0.8954	103538771396	1.7191E-13	0.0401

6/15/94 TD
FOR VERIFICATION
OF CALCULATIONS
SEE pages 143-4
of this volume.

Also included on the list was Analysis of the $Z^{233}U$ spike solutions. The bottle containing spike 23A was rinsed with 1.0 M HNO_3 followed by Ultra pure H_2O. The samples labeled R1–R3 were ~~on~~ TD 6/21/93 samples taken after rinsing to determine any residual activity. Since the amount was small, the bottle was discarded (Rinsing & disposal were discussed with Dr. Bret Leslie).

The B-IB samples had 0.100 g ± 0.001 g Na-clinoptilolite added. The solutions were swirled and returned to the gyratory shakers.

SOLUTION	Wt. Zeolite added(g)
B-IB* pH2.00	0.0997
2.25	0.1003
2.50	0.1000
2.75	0.0993
3.00	0.1000
3.25	0.1003
3.50	0.0994
3.75	0.1010
4.00	0.1005
4.25	0.1003
4.50	0.1009
4.75	0.1008
5.00	0.0996
5.25	0.1001
5.50	0.1002
5.75	0.1002
6.00	0.0997
6.25	0.1006
6/21/93 TD 6.50	0.1001
6.75	0.0995
7.00	0.1010
7.25	0.1001
7.50	0.0994
6/24/93 TD ~~8.00~~ 7.75	0.0999

SOLUTION	Wt. Zeolite (g)
~~9.00~~ TD 6/21/93	TD ~~0.1007~~
8.00	6/21/93 TD ~~0.1002~~ 0.1007
8.25	6/21/93 TD ~~0.1007~~ 0.100
8.50	0.1007
8.75	0.1007
9.00	0.1005

22 June 1993 TD

The liquid scintillation analysis of the 5th, 6th, and 7th samples from K3*A (Reverse) have finished counting. The raw data and results of calculations follow.

```
Protocol #: 5        Name:U-233 3% 2 sigma          22-Jun-93   03:20
Region A: LL-UL= 0.0-100.  Lcr=   0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=   0  Bkg= 0.00  %2 Sigma=3.00
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME    CPMA A:2S%    CPMB B:2S%    CPMC C:2S%    SIS FLAG
  1  999.98   18.73  1.46    2.882  3.73   27.66  1.20 135.61   B
  2   13.74    2.16 115.0  320.626  3.03  323.51  3.13 685.41
  3    4.04    2.06 220.5  1098.85  3.01 1102.05  3.03 687.95
  4    3.44    3.94 130.4  1289.56  3.01 1294.73  3.03 688.88
  5    3.57    4.24 119.9  1243.62  3.01 1247.13  3.03 688.47
  6   11.30    1.00 264.6  390.392  3.02  392.79  3.11 690.17   Jim's
  7    6.11    4.67 83.95  724.777  3.01  727.34  3.06 684.49   Samples
  8    5.55    5.41 77.22  798.379  3.01  804.78  3.04 690.99
  9    4.13    5.48 88.47  1074.60  3.01 1079.61  3.03 689.16
 10   10.37    3.64 81.01  426.433  3.02  431.84  3.08 686.04
 11    6.29    3.21 116.7  704.431  3.01  706.53  3.06 688.46
 12    6.87    2.96 120.5  644.134  3.01  647.02  3.06 688.14
 13    5.88    5.08 79.42  753.240  3.01  760.27  3.05 683.63
(2 missing vials)
 16   11.03    3.94 73.19  400.110  3.02  403.89  3.10 686.45 K3*A*AR
 17    9.57    1.96 150.7  461.695  3.02  463.78  3.09 692.80
 18    8.26    3.30 99.23  535.253  3.02  539.05  3.07 656.98
 19   11.00    3.27 86.91  401.391  3.02  405.07  3.10 689.16
 20   10.91    0.00  0.00  404.726  3.02  404.70  3.11 694.11
 21    9.28    3.25 95.02  475.997  3.02  479.89  3.08 689.12
 22    8.97    2.12 144.6  492.882  3.02  496.20  3.08 689.73
 23    8.28    1.68 187.6  533.954  3.02  535.27  3.08 696.50
 24    8.18    0.00  0.00  540.639  3.02  540.68  3.08 693.86
 25   11.00    1.82 151.3  401.209  3.02  402.07  3.11 694.05
 26    8.97    0.00  0.00  492.993  3.02  494.86  3.09 696.18
 27    8.05    2.51 129.8  549.664  3.01  553.84  3.07 693.49 K3*A*CR
```

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
K3*A*AR*5	400.110	0.5011	798.4634	9.233246E+13	1.533E-10	35.7249
K3*A*BR*5	461.695	0.5014	920.8117	1.064805E+14	1.7679E-10	41.1990
K3*A*CR*5	535.253	0.4989	1072.8663	1.240638E+14	2.0598E-10	48.0023
K3*A*AR*6a	401.391	0.4994	803.7465	9.294338E+13	1.5431E-10	35.9613
K3*A*AR*6b	404.726	0.4990	811.0741	9.379074E+13	1.5572E-10	36.2892
K3*A*BR*6a	475.997	0.5028	946.6925	1.094733E+14	1.8176E-10	42.3570
K3*A*BR*6b	492.882	0.4993	987.1460	1.141513E+14	1.8953E-10	44.1670
K3*A*CR*6a	533.954	0.5032	1061.1169	1.227051E+14	2.0373E-10	47.4766
K3*A*CR*6b	540.639	0.4994	1082.5771	1.251867E+14	2.0785E-10	48.4368
K3*A*AR*7	401.209	0.5031	797.4737	9.221801E+13	1.5311E-10	35.6806
K3*A*BR*7	492.993	0.5008	984.4109	1.13835E+14	1.89E-10	44.0446
K3*A*CR*7	549.664	0.5013	1096.4772	1.267941E+14	2.1052E-10	49.0587

6/15/94 TD
FOR VERIFICATION OF CALCULATIONS, SEE PAGES 142-4 OF THIS BOOK.

22 June 1993 EXPERIMENT B-IIIB

The pH of all the solutions was measured.

SOLUTION	pH/T(°C)	SOLUTION	pH/T(°C)
B-IIIB *pH2.00	1.84/22.9	B-IIIB-C *pH5.5	4.99/23.6
2.25	2.10/22.9	6.0	5.17/23.6
2.50	2.32/23.0	6.5	5.82/23.6
2.75	2.63/23.0	7.0	6.54/23.6
3.00	2.87/23.0	7.5	7.05/23.7
3.25	3.09/23.0	8.0	7.67/23.7
3.50	3.35/23.0	9.5	9.30/23.7
3.75	3.60/23.0		
4.00	3.84/23.1		
4.25	4.09/23.1		
4.50	4.27/23.1		
4.75	4.55/23.1		
5.00	4.68/23.2		
5.25	4.84/23.2		
5.50	4.95/23.2		
5.75	5.08/23.2		
6.00	5.31/23.2		
6.25	5.64/23.2		
6.50	5.96/23.3		
6.75	6.16/23.3		
7.00	6.55 ~~6.86~~ TD/23.3		
7.25	6.86 ~~7.10~~ TD/23.4		
7.50	7.10 ~~7.35~~ TD/23.4		
7.75	7.35 ~~7.84~~ TD/23.4		
8.00	7.84 ~~7.94~~ TD/23.4		
8.25	7.94 ~~8.27~~ TD/23.4		
8.50	8.27 ~~8.59~~ TD/23.4		
8.75	8.59/23.5		
9.00	8.89/23.5		
B-IIIB-C *pH2.0	1.87/23.6		
4.0	3.86/23.6		
5.0	4.69/23.6		

6/22/93

EXPERIMENT B-IIIB (CONT)

2 0.5 mL samples were taken from each solution and prepared for liquid scintillation analysis. The sample weights are given below.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g	WT SAMPLE (g)
B-IIIB*pH2.00*IU1	7.7500	8.2482	0.4982
B-IIIB*pH2.00*IU2	7.8185	8.3173	0.4988
B-IIIB*pH2.25*IU1	7.7062	8.2071	0.5009
B-IIIB*pH2.25*IU2	7.7076	8.2070	0.4994
B-IIIB*pH2.50*IU1	7.7685	8.2689	0.5004
B-IIIB*pH2.50*IU2	7.7368	8.2376	0.5008
B-IIIB*pH2.75*IU1	7.7689	8.2723	0.5034
B-IIIB*pH2.75*IU2	7.8267	8.3284	0.5017
B-IIIB*pH3.00*IU1	7.8062	8.3108	0.5046
B-IIIB*pH3.00*IU2	7.7589	8.2587	0.4998
B-IIIB*pH3.25*IU1	7.7932	8.2938	0.5006
B-IIIB*pH3.25*IU2	7.7797	8.2812	0.5015
B-IIIB*pH3.50*IU1	7.7962	8.2990	0.5028
B-IIIB*pH3.50*IU2	7.7649	8.2659	0.5010
B-IIIB*pH3.75*IU1	7.7749	8.2774	0.5025
B-IIIB*pH3.75*IU2	7.7757	8.2775	0.5018
B-IIIB*pH4.00*IU1	7.7454	8.2477	0.5023
B-IIIB*pH4.00*IU2	7.7290	8.2303	0.5013
B-IIIB*pH4.25*IU1	7.7056	8.2058	0.5002
B-IIIB*pH4.25*IU2	7.8265	8.3260	0.4995
B-IIIB*pH4.50*IU1	7.7495	8.2508	0.5013
B-IIIB*pH4.50*IU2	7.7204	8.2212	0.5008
B-IIIB*pH4.75*IU1	7.7336	8.2355	0.5019
B-IIIB*pH4.75*IU2	7.6780	8.1789	0.5009
B-IIIB*pH5.00*IU1	7.7312	8.2313	0.5001
B-IIIB*pH5.00*IU2	7.7254	8.2259	0.5005
B-IIIB*pH5.25*IU1	7.7468	8.2472	0.5004
B-IIIB*pH5.25*IU2	7.7723	8.2736	0.5013
B-IIIB*pH5.50*IU1	7.7689	8.2698	0.5009
B-IIIB*pH5.50*IU2	7.7486	8.2479	0.4993
B-IIIB*pH5.75*IU1	7.7567	8.2574	0.5007
B-IIIB*pH5.75*IU2	7.7760	8.2745	0.4985
B-IIIB*pH6.00*IU1	7.8151	8.3167	0.5016
B-IIIB*pH6.00*IU2	7.6962	8.1960	0.4998
B-IIIB*pH6.25*IU1	7.7300	8.2297	0.4997
B-IIIB*pH6.25*IU2	7.8122	8.3124	0.5002
B-IIIB*pH6.50*IU1	7.8013	8.3060	0.5047
B-IIIB*pH6.50*IU2	7.8188	8.3202	0.5014
B-IIIB*pH6.75*IU1	7.7538	8.2562	0.5024
B-IIIB*pH6.75*IU2	7.7479	8.2474	0.4995
B-IIIB*pH7.00*IU1	7.7615	8.2605	0.4990

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g	WT SAMPLE (g)
B-IIIB*pH7.00*IU2	7.7243	8.2232	0.4989
B-IIIB*pH7.25*IU1	7.6678	8.1684	0.5006
B-IIIB*pH7.25*IU2	7.8110	8.3098	0.4988
B-IIIB*pH7.50*IU1	7.7908	8.2920	0.5012
B-IIIB*pH7.50*IU2	7.7119	8.2115	0.4996
B-IIIB*pH7.75*IU1	7.7370	8.2370	0.5000
B-IIIB*pH7.75*IU2	7.8016	8.3011	0.4995
B-IIIB*pH8.00*IU1	7.6872	8.1875	0.5003
B-IIIB*pH8.00*IU2	7.7809	8.2781	0.4972
B-IIIB*pH8.25*IU1	7.7402	8.2410	0.5008
B-IIIB*pH8.25*IU2	7.7260	8.2260	0.5000
B-IIIB*pH8.50*IU1	7.8039	8.3032	0.4993
B-IIIB*pH8.50*IU2	7.7875	8.2855	0.4980
B-IIIB*pH8.75*IU1	7.6776	8.1779	0.5003
B-IIIB*pH8.75*IU2	7.7516	8.2506	0.4990
B-IIIB*pH9.00*IU1	7.7290	8.2308	0.5018
B-IIIB*pH9.00*IU2	7.7789	8.2774	0.4985
B-IIIB-C*pH2.0*IU1	7.7171	8.2177	0.5006
B-IIIB-C*pH2.0*IU2	7.8252	8.3235	0.4983
B-IIIB-C*pH4.0*IU1	7.7220	8.2231	0.5011
B-IIIB-C*pH4.0*IU2	7.7692	8.2678	0.4986
B-IIIB-C*pH5.0*IU1	7.7350	8.2373	0.5023
B-IIIB-C*pH5.0*IU2	7.7882	8.2865	0.4983
B-IIIB-C*pH5.5*IU1	7.7646	8.2663	0.5017
B-IIIB-C*pH5.5*IU2	7.7893	8.2897	0.5004
B-IIIB-C*pH6.0*IU1	7.7274	8.2281	0.5007
B-IIIB-C*pH6.0*IU2	7.7590	8.2566	0.4976
B-IIIB-C*pH6.5*IU1	7.7564	8.2540	0.4976
B-IIIB-C*pH6.5*IU2	7.7852	8.2859	0.5007
B-IIIB-C*pH7.0*IU1	7.8204	8.3179	0.4975
B-IIIB-C*pH7.0*IU2	7.8024	8.3009	0.4985
B-IIIB-C*pH7.5*IU1	7.7744	8.2761	0.5017
B-IIIB-C*pH7.5*IU2	7.7737	8.2708	0.4971
B-IIIB-C*pH8.0*IU1	7.7064	8.2064	0.5000
B-IIIB-C*pH8.0*IU2	7.6847	8.1831	0.4984
B-IIIB-C*pH9.5*IU1	7.7549	8.2559	0.5010
B-IIIB-C*pH9.5*IU2	7.6923	8.1934	0.5011

0.000 g ± 0.001 g Na - Clinoptilolite was added to each solution, but not the controls.

SOLUTION	WT. Zeolite added (g)	SOLUTION	WT. Zeolite added (g)	SOLUTION	WT. Zeolite
B-IIIB*pH2.00	0.1004	4.75	0.0993	7.50	0.1010
2.25	0.0996	5.00	0.1002	7.75	0.1005
2.50	0.1001	5.25	0.1003	8.00	0.1004
2.75	0.0997	5.50	0.1005	8.25	0.0992
3.00	0.0992	5.75	0.0991	8.50	0.1004
3.25	0.1005	6.00	0.1002	8.75	0.1008
3.50	0.0995	6.25	0.1007	9.00	0.1006
3.75	0.0994	6.50	0.1003		
4.00	0.0994	6.75	0.0997		
4.25	0.1002	7.00	0.1009		
4.50	0.1005	7.25	0.0997		

The solutions were swirled & returned to the gyratory shaker.

22 June 1993 TD EXPERIMENT K3*A

The 8th set of samples was taken. The weights are given below, and the pH and sampling times on pages 10 & 11

SAMPLE NAME	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
K3*A*AR*8	7.7294	8.2287	0.4993
K3*A*BR*8	7.7641	8.2625	0.4984
K3*A*CR*8	7.6826	8.1816	0.4990

24 June 1993 TD EXPERIMENT B-IB

The liquid scintillation Analysis of the BIB ~~initial~~ TD 6/24/93 Initial U concentrations has been completed. The raw data, as well as concentration calculations follow.

Protocol #: 5 Name:U-233 3% 2 sigma 23-Jun-93 22:59
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	18.95	1.45	3.235	3.52	28.57	1.18	141.99	B
2	15.30	0.00	0.00	287.484	3.03	287.25	3.17	711.86	
3	15.38	0.17	1319.	285.712	3.03	286.97	3.16	711.98	
4	4.26	4.76	99.22	1042.31	3.01	1046.08	3.04	705.04	
5	4.10	0.32	1345.	1080.91	3.01	1081.43	3.04	708.32	
6	3.38	5.02	106.2	1315.40	3.00	1319.95	3.03	705.99	
7	3.57	4.02	126.3	1243.54	3.01	1249.02	3.03	706.22	
8	3.72	3.37	145.7	1194.35	3.00	1198.32	3.03	710.25	
9	3.57	2.34	208.8	1242.98	3.01	1245.10	3.03	708.06	
(1 missing vial)									
11	11.90	0.00	0.00	370.546	3.03	368.24	3.14	715.20	
12	12.13	1.75	150.3	363.377	3.03	366.24	3.12	705.49	
13	6.55	1.51	234.4	675.238	3.01	676.62	3.07	705.45	
14	6.44	1.24	286.2	688.069	3.01	691.31	3.06	707.90	
15	5.90	2.75	139.8	750.833	3.01	756.01	3.05	704.66	
16	5.87	2.52	152.2	755.368	3.01	758.66	3.05	709.00	
17	4.35	0.36	1157.	1019.52	3.01	1020.63	3.04	706.23	
18	4.16	0.00	0.00	1067.20	3.01	1066.63	3.04	705.94	
19	11.15	0.34	784.4	395.689	3.02	396.01	3.12	711.63	
20	11.20	0.88	305.3	393.908	3.02	395.72	3.11	705.96	
21	6.35	0.58	604.3	697.237	3.01	698.52	3.06	705.40	
22	6.46	0.00	0.00	685.155	3.01	684.28	3.07	710.51	
23	7.10	3.59	99.55	622.680	3.02	626.64	3.07	705.22	
24	7.16	0.00	0.00	617.854	3.01	617.80	3.08	709.21	
25	5.94	3.11	124.3	745.586	3.01	749.21	3.05	706.03	
26	5.91	0.00	0.00	749.895	3.01	749.27	3.06	693.49	
(1 missing vial)									
28	3.56	4.37	117.3	1245.64	3.01	1250.09	3.03	696.15	
29	3.60	6.33	83.80	1233.15	3.01	1238.93	3.03	693.52	
30	3.58	2.28	213.6	1238.66	3.01	1240.71	3.04	701.92	
31	3.57	5.98	88.43	1242.14	3.01	1249.86	3.03	696.88	
(5 missing vials)									
37	8.52	1.71	182.6	518.948	3.02	521.08	3.08	702.59	
38	8.27	1.37	229.9	534.613	3.02	539.87	3.07	698.64	
39	7.99	2.58	127.6	553.336	3.02	554.79	3.08	699.10	
40	7.87	3.42	98.96	561.695	3.02	564.57	3.08	699.05	
41	8.19	1.32	238.7	539.744	3.02	541.89	3.08	702.82	
42	8.35	1.17	265.4	529.100	3.02	531.07	3.08	703.46	
43	8.11	3.25	102.2	545.717	3.02	550.84	3.07	698.78	
44	8.31	0.00	0.00	531.783	3.02	530.76	3.09	709.78	
45	8.26	2.24	143.5	534.779	3.02	538.02	3.08	703.51	
46	8.48	2.28	139.2	521.057	3.02	524.97	3.08	704.09	
47	8.10	0.81	388.2	545.777	3.02	548.84	3.08	706.44	
48	8.21	2.00	160.0	538.787	3.02	541.59	3.08	708.01	
49	7.95	0.30	1042.	556.136	3.02	556.97	3.08	707.88	
50	8.17	1.25	253.1	540.898	3.02	547.28	3.08	708.77	
51	8.16	0.79	397.7	541.986	3.02	543.61	3.08	708.75	
52	8.32	0.05	6741.	531.140	3.02	530.93	3.09	706.53	
53	8.38	0.27	1139.	527.075	3.02	527.76	3.09	708.49	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
54	8.35	1.17	265.4	529.100	3.02	530.00	3.09	706.56	
55	9.13	2.19	139.3	484.169	3.02	486.11	3.09	705.89	
56	9.01	0.70	424.0	490.439	3.02	491.52	3.09	689.27	
57	8.72	1.12	271.2	506.398	3.02	507.90	3.09	688.07	
58	8.65	0.36	831.2	510.522	3.02	513.28	3.08	695.46	
59	8.89	1.64	186.4	497.102	3.02	500.00	3.09	700.11	
60	8.84	1.08	280.6	499.593	3.02	501.98	3.09	701.29	
61	9.33	2.38	127.4	473.185	3.02	476.69	3.09	703.45	
62	9.34	0.01	53280	472.568	3.02	473.04	3.10	703.79	
63	9.36	0.00	0.00	471.658	3.02	472.18	3.10	704.11	
64	9.49	0.00	0.00	465.469	3.02	467.53	3.09	708.80	
65	9.43	0.00	0.00	468.345	3.02	467.62	3.10	706.35	
66	9.36	0.07	3994.	471.551	3.02	472.39	3.10	703.35	
67	10.08	1.19	238.0	438.134	3.02	439.29	3.10	707.55	
68	9.97	2.52	117.0	442.703	3.02	446.86	3.09	705.66	
69	10.35	0.76	362.7	426.330	3.02	428.05	3.10	709.55	
70	10.47	2.64	109.3	421.216	3.02	426.07	3.09	705.85	
71	11.56	2.16	125.7	381.194	3.03	384.93	3.11	706.89	
72	11.29	0.10	2665.	390.388	3.03	392.25	3.11	707.94	
73	12.31	0.00	0.00	358.016	3.03	359.33	3.13	708.61	
74	12.05	4.13	67.42	365.977	3.03	369.61	3.11	701.99	
75	10.02	0.91	309.2	440.378	3.02	443.59	3.10	704.10	
76	9.78	0.00	0.00	451.673	3.02	451.09	3.11	710.12	
77	9.84	0.57	499.2	448.391	3.02	449.28	3.10	706.60	
78	9.96	0.00	0.00	443.150	3.02	442.12	3.11	707.96	
79	8.84	3.00	105.4	499.593	3.02	504.58	3.08	705.10	
80	9.16	1.80	168.2	482.464	3.02	484.21	3.09	704.99	
81	8.47	0.54	569.1	521.794	3.02	522.91	3.09	708.43	
82	8.73	3.74	86.62	506.960	3.02	510.27	3.08	703.86	
83	8.79	4.15	78.42	502.567	3.02	506.47	3.08	697.24	
84	8.83	3.70	86.78	500.389	3.02	502.92	3.09	707.76	
85	8.31	3.08	106.2	531.783	3.02	535.45	3.08	706.10	
86	8.25	2.63	123.4	535.795	3.02	537.98	3.08	703.65	
87	8.12	3.47	96.13	544.179	3.02	547.91	3.08	704.46	
88	8.08	2.84	116.2	546.765	3.02	549.16	3.08	702.03	
89	8.46	1.62	193.0	523.124	3.02	524.74	3.08	706.42	
90	8.21	0.00	0.00	538.909	3.02	541.71	3.08	711.31	
91	8.12	3.22	102.9	544.302	3.02	549.27	3.07	706.00	
92	8.40	1.53	204.8	525.932	3.02	528.81	3.08	707.81	
93	8.21	1.88	169.8	538.056	3.02	540.98	3.08	705.84	
94	8.39	1.91	165.5	526.801	3.02	528.53	3.08	707.77	
95	8.24	3.26	101.0	536.207	3.02	540.85	3.07	701.51	
96	8.26	0.00	0.00	535.022	3.02	534.87	3.09	710.26	
97	8.40	3.32	98.52	526.408	3.02	530.72	3.08	704.73	
98	8.39	5.01	67.66	526.443	3.02	531.27	3.08	704.80	
99	9.69	3.55	86.14	455.795	3.02	459.46	3.09	705.78	
100	9.74	0.46	617.8	453.336	3.02	453.77	3.10	709.40	
101	11.73	1.69	158.2	375.708	3.03	378.42	3.11	707.16	
102	11.94	0.00	0.00	369.462	3.02	368.50	3.13	713.65	
103	10.70	2.18	129.8	412.185	3.02	414.52	3.11	705.18	
104	10.61	2.07	136.5	415.615	3.02	418.28	3.10	705.78	
105	10.75	1.98	141.3	410.253	3.02	412.08	3.11	702.56	
106	10.55	1.43	194.8	418.471	3.02	420.82	3.10	703.82	
107	9.03	2.87	108.7	489.345	3.02	494.47	3.08	702.24	
108	9.07	1.12	266.6	486.842	3.02	489.74	3.09	706.68	
109	8.59	2.13	147.9	514.111	3.02	517.30	3.08	702.06	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
110	8.65	0.00	0.00	510.753	3.02	511.09	3.09	709.43	
111	8.26	1.27	246.8	535.264	3.02	537.66	3.08	707.17	
112	8.35	2.01	158.0	529.579	3.02	532.63	3.08	705.96	
113	8.10	2.54	128.9	545.901	3.02	547.11	3.08	708.47	
114	8.29	4.46	75.66	533.315	3.02	539.59	3.07	704.52	
(1 missing vial)									
116	10.79	3.58	81.18	408.628	3.02	412.40	3.10	702.08	
117	9.32	0.69	422.7	473.804	3.02	475.19	3.10	706.86	
118	8.41	0.00	0.00	525.540	3.02	525.65	3.09	710.16	

vials 116-118 are the 8th sample of K3*A reverse. The results of their concentration calculations will also be given

6/15/94 TD CALCULATIONS VERIFIED ON PAGES 143-4 OF THIS NOTEBOOK.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
37	B-IB*pH2.00*IU1	518.948	0.4976	1042.9019	1.2060E+14	2.0023E-10	46.6616	
38	B-IB*pH2.00*IU2	534.613	0.4993	1070.7250	1.2382E+14	2.0557E-10	47.9065	47.2840
39	B-IB*pH2.25*IU1	553.336	0.5031	1099.8529	1.2718E+14	2.1116E-10	49.2097	
40	B-IB*pH2.25*IU2	561.695	0.5022	1118.4687	1.2934E+14	2.1474E-10	50.0426	49.6262
41	B-IB*pH2.50*IU1	539.744	0.5023	1074.5451	1.2426E+14	2.0631E-10	48.0774	
42	B-IB*pH2.50*IU2	529.100	0.5015	1055.0349	1.2200E+14	2.0256E-10	47.2045	47.6409
43	B-IB*pH2.75*IU1	545.717	0.5034	1084.0624	1.2536E+14	2.0813E-10	48.5032	
44	B-IB*pH2.75*IU2	531.783	0.5003	1062.9282	1.2291E+14	2.0408E-10	47.5576	48.0304
45	B-IB*pH3.00*IU1	534.779	0.5022	1064.8726	1.2314E+14	2.0445E-10	47.6446	
46	B-IB*pH3.00*IU2	521.057	0.5005	1041.0729	1.2039E+14	1.9988E-10	46.5798	47.1122
47	B-IB*pH3.25*IU1	545.777	0.5048	1081.1747	1.2502E+14	2.0758E-10	48.3740	
48	B-IB*pH3.25*IU2	538.787	0.5008	1075.8526	1.2441E+14	2.0656E-10	48.1359	48.2550
49	B-IB*pH3.50*IU1	556.136	0.5005	1111.1608	1.2849E+14	2.1334E-10	49.7157	
50	B-IB*pH3.50*IU2	540.829	0.5004	1080.7934	1.2498E+14	2.0751E-10	48.3570	49.0363
51	B-IB*pH3.75*IU1	541.986	0.5034	1076.6508	1.2450E+14	2.0671E-10	48.1716	
52	B-IB*pH3.75*IU2	531.140	0.4995	1063.3433	1.2296E+14	2.0416E-10	47.5762	47.8739
53	B-IB*pH4.00*IU1	527.075	0.5023	1049.3231	1.2134E+14	2.0146E-10	46.9489	
54	B-IB*pH4.00*IU2	529.100	0.5010	1056.0878	1.2212E+14	2.0276E-10	47.2516	47.1002
55	B-IB*pH4.25*IU1	484.169	0.5002	967.9508	1.1193E+14	1.8584E-10	43.3081	
56	B-IB*pH4.25*IU2	490.439	0.4998	981.2705	1.1347E+14	1.8840E-10	43.9041	43.6061
57	B-IB*pH4.50*IU1	506.398	0.5013	1010.1696	1.1681E+14	1.9395E-10	45.1971	
58	B-IB*pH4.50*IU2	510.552	0.4999	1021.3083	1.1810E+14	1.9608E-10	45.6955	45.4463
59	B-IB*pH4.75*IU1	497.102	0.5024	989.4546	1.1442E+14	1.8997E-10	44.2703	
60	B-IB*pH4.75*IU2	499.593	0.4995	1000.1862	1.1566E+14	1.9203E-10	44.7504	44.5103
61	B-IB*pH5.00*IU1	473.185	0.4996	947.1277	1.0952E+14	1.8184E-10	42.3765	
62	B-IB*pH5.00*IU2	472.568	0.4998	945.5142	1.0934E+14	1.8153E-10	42.3043	42.3404
63	B-IB*pH5.25*IU1	471.658	0.5009	941.6211	1.0889E+14	1.8079E-10	42.1301	
64	B-IB*pH5.25*IU2	465.469	0.5003	930.3798	1.0759E+14	1.7863E-10	41.6271	41.8786
65	B-IB*pH5.50*IU1	468.345	0.5009	935.0070	1.0812E+14	1.7952E-10	41.8342	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
66	B-IB*pH5.50*IU2	471.551	0.4991	944.8026	1.0925E+14	1.8140E-10	42.2724	42.0533
67	B-IB*pH5.75*IU1	438.134	0.5043	868.7964	1.0047E+14	1.6680E-10	38.8718	
68	B-IB*pH5.75*IU2	442.703	0.5001	885.2290	1.0237E+14	1.6996E-10	39.6070	39.2394
69	B-IB*pH6.00*IU1	426.330	0.5005	851.8082	9.8501E+13	1.6354E-10	38.1117	
70	B-IB*pH6.00*IU2	421.216	0.4984	845.1364	9.7730E+13	1.6226E-10	37.8132	37.9624
71	B-IB*pH6.25*IU1	381.194	0.5001	762.2356	8.8143E+13	1.4634E-10	34.1040	
72	B-IB*pH6.25*IU2	390.388	0.4991	782.1839	9.0450E+13	1.5017E-10	34.9965	34.5503
73	B-IB*pH6.50*IU1	358.016	0.4962	721.5155	8.3434E+13	1.3853E-10	32.2821	
74	B-IB*pH6.50*IU2	365.977	0.4972	736.0760	8.5118E+13	1.4132E-10	32.9336	32.6078
75	B-IB*pH6.75*IU1	440.378	0.4996	881.4612	1.0193E+14	1.6923E-10	39.4384	
76	B-IB*pH6.75*IU2	451.673	0.4987	905.7008	1.0473E+14	1.7389E-10	40.5230	39.9807
77	B-IB*pH7.00*IU1	448.391	0.5001	896.6027	1.0368E+14	1.7214E-10	40.1159	
78	B-IB*pH7.00*IU2	443.150	0.4982	889.5022	1.0286E+14	1.7078E-10	39.7982	39.9570
79	B-IB*pH7.25*IU1	499.593	0.5012	996.7937	1.1527E+14	1.9138E-10	44.5986	
80	B-IB*pH7.25*IU2	482.464	0.4997	965.5073	1.1165E+14	1.8537E-10	43.1988	43.8987
81	B-IB*pH7.50*IU1	521.794	0.5001	1043.3793	1.2065E+14	2.0032E-10	46.6830	
82	B-IB*pH7.50*IU2	506.960	0.4999	1014.1228	1.1727E+14	1.9470E-10	45.3740	46.0285
83	B-IB*pH7.75*IU1	502.567	0.5004	1004.3305	1.1614E+14	1.9282E-10	44.9359	
84	B-IB*pH7.75*IU2	500.389	0.4997	1001.3788	1.1580E+14	1.9226E-10	44.8038	44.8698
85	B-IB*pH8.00*IU1	531.783	0.4992	1065.2704	1.2319E+14	2.0452E-10	47.6624	
86	B-IB*pH8.00*IU2	535.795	0.4963	1079.5789	1.2484E+14	2.0727E-10	48.3026	47.9825
87	B-IB*pH8.25*IU1	544.179	0.5002	1087.9228	1.2580E+14	2.0887E-10	48.6759	
88	B-IB*pH8.25*IU2	546.765	0.4997	1094.1865	1.2653E+14	2.1008E-10	48.9562	48.8161
89	B-IB*pH8.50*IU1	523.124	0.4954	1055.9629	1.2211E+14	2.0274E-10	47.2460	
90	B-IB*pH8.50*IU2	538.909	0.4987	1080.6276	1.2496E+14	2.0747E-10	48.3495	47.7978
91	B-IB*pH8.75*IU1	544.302	0.5016	1085.1316	1.2548E+14	2.0834E-10	48.5511	
92	B-IB*pH8.75*IU2	525.932	0.4992	1053.5497	1.2183E+14	2.0227E-10	47.1380	47.8445
93	B-IB*pH9.00*IU1	538.056	0.5005	1075.0370	1.2431E+14	2.0640E-10	48.0994	
94	B-IB*pH9.00*IU2	526.801	0.4983	1057.1965	1.2225E+14	2.0297E-10	47.3012	47.7003

6/15/94 TD CALCULATIONS VERIFIED ON PAGE 143-134 OF THIS NOTE BOOK.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
95	B-IB-C*pH2.0*IU	536.207	0.5030	1066.0179	1.2327E+14	2.0467E-10	47.6959	
96	B-IB-C*pH2.0*IU	535.022	0.4993	1071.5442	1.2391E+14	2.0573E-10	47.9431	47.8195
97	B-IB-C*pH4.0*IU	526.408	0.4998	1053.2373	1.2179E+14	2.0221E-10	47.1240	
98	B-IB-C*pH4.0*IU	526.443	0.4976	1057.9642	1.2234E+14	2.0312E-10	47.3355	47.2298
99	B-IB-C*pH5.0*IU	455.795	0.4960	918.9415	1.0626E+14	1.7643E-10	41.1154	
100	B-IB-C*pH5.0*IU	453.336	0.4963	913.4314	1.0563E+14	1.7537E-10	40.8688	40.9921
101	B-IB-C*pH5.5*IU	375.708	0.5014	749.3179	8.6649E+13	1.4386E-10	33.5261	
102	B-IB-C*pH5.5*IU	369.462	0.4982	741.5937	8.5756E+13	1.4238E-10	33.1805	33.3533
103	B-IB-C*pH6.0*IU	412.185	0.4995	825.1952	9.5424E+13	1.5843E-10	36.9210	
104	B-IB-C*pH6.0*IU	415.615	0.4975	835.4070	9.6605E+13	1.6039E-10	37.3779	37.1494
105	B-IB-C*pH6.5*IU	410.253	0.5000	820.5060	9.4881E+13	1.5753E-10	36.7112	
106	B-IB-C*pH6.5*IU	418.471	0.4979	840.4720	9.7190E+13	1.6137E-10	37.6045	37.1578
107	B-IB-C*pH7.0*IU	489.345	0.5009	976.9315	1.1297E+14	1.8756E-10	43.7100	
108	B-IB-C*pH7.0*IU	486.842	0.5009	971.9345	1.1239E+14	1.8661E-10	43.4864	43.5982
109	B-IB-C*pH7.5*IU	514.111	0.4994	1029.4573	1.1904E+14	1.9765E-10	46.0601	
110	B-IB-C*pH7.5*IU	510.753	0.4982	1025.1967	1.1855E+14	1.9683E-10	45.8694	45.9648
111	B-IB-C*pH8.0*IU	535.264	0.5009	1068.6045	1.2357E+14	2.0517E-10	47.8116	
112	B-IB-C*pH8.0*IU	529.579	0.4961	1067.4844	1.2344E+14	2.0495E-10	47.7615	47.7865
113	B-IB-C*pH9.5*IU	545.901	0.5007	1090.2756	1.2608E+14	2.0933E-10	48.7812	
114	B-IB-C*pH9.5*IU	533.315	0.4985	1069.8395	1.2371E+14	2.0540E-10	47.8669	48.3240

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
K3*A*AR8	408.628	0.4993	818.4018	9.463808E+13	1.5713E-10	36.6170
K3*A*BR8	473.804	0.4984	950.6501	1.09931E+14	1.8252E-10	42.5341
K3*A*CR8	525.540	0.4990	1053.1864	1.21788E+14	2.022E-10	47.1218

25 June 1993 TD EXPERIMENT K3*A

The 9th set of samples was taken today. The pH & time are recorded on pages 10 & 11. The weights are given below.

SAMPLE NAME	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
K3*A*A*R9a	7.7814	8.2860	0.5046
K3*A*A*R9b	7.7919	8.2952	0.5033
K3*A*B*R9a	7.7153	8.2163	0.5010
K3*A*B*R9b	7.7544	8.2551	0.5007
K3*A*C*R9a	7.7576	8.2614	0.5038
K3*A*C*R9b	7.7483	8.2505	0.5022

28 June 1993 TD EXPERIMENT B-III-B

The liquid scintillation analysis of the initial concentrations has finished. The results of the calculations and Raw data appear on the following pages.

Protocol #: 6 Name:U-233 5% 2 Sigma 25-Jun-93 00:47
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=5.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 5% 2 sigma error for 5 ppb U-233 experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	551.55	18.97	1.96	2.905	5.00	27.76	1.62	133.03	B
2	27.01	0.00	0.00	56.333	5.26	56.73	6.29	713.53	
3	27.08	2.23	81.14	56.327	5.26	58.65	6.14	689.23	
4	26.80	0.00	0.00	56.909	5.26	55.79	6.38	735.87	
5	26.04	0.00	0.00	58.539	5.25	58.11	6.30	720.53	
6	26.69	0.00	0.00	57.043	5.26	56.99	6.30	722.40	
7	26.14	0.00	0.00	58.343	5.25	57.94	6.30	727.44	
8	27.66	0.08	2015.	55.013	5.27	56.37	6.24	713.74	
9	27.56	1.39	126.8	55.187	5.27	57.66	6.16	700.51	
10	27.58	0.00	0.00	55.109	5.27	54.66	6.38	733.67	
11	28.82	0.00	0.00	52.612	5.28	51.63	6.49	738.77	
12	26.92	0.00	0.00	56.531	5.26	57.05	6.27	720.39	
13	27.37	0.00	0.00	55.590	5.27	53.28	6.51	736.75	
14	28.76	0.22	744.8	52.798	5.28	53.78	6.32	719.71	
15	28.43	0.00	0.00	53.374	5.28	53.57	6.37	715.77	
16	26.33	0.00	0.00	57.863	5.26	56.75	6.36	730.52	
17	27.99	0.15	1163.	54.294	5.27	55.52	6.27	716.02	
18	27.79	0.00	0.00	54.706	5.27	54.54	6.36	720.95	
19	27.07	1.09	161.5	56.201	5.26	57.25	6.24	703.94	
20	29.82	0.00	0.00	50.751	5.29	49.54	6.56	733.52	
21	29.21	0.00	0.00	51.905	5.29	52.05	6.41	728.31	
22	32.16	0.22	732.2	46.847	5.32	47.83	6.48	712.82	
23	33.03	0.00	0.00	45.536	5.33	45.90	6.58	721.40	
24	39.44	0.00	0.00	37.714	5.40	38.80	6.80	717.36	
25	41.92	0.33	425.9	35.263	5.43	36.22	6.93	713.29	
26	53.78	0.00	0.00	26.883	5.56	25.53	7.99	766.94	
27	54.16	0.00	0.00	26.638	5.57	26.29	7.79	735.34	
28	72.26	0.00	0.00	19.265	5.80	18.30	9.06	769.64	
29	71.23	0.00	0.00	19.586	5.79	19.84	8.55	724.50	
30	64.33	0.25	471.0	21.967	5.70	22.80	8.02	715.84	
31	63.23	0.00	0.00	22.400	5.69	22.44	8.19	726.73	
32	68.30	0.00	0.00	20.522	5.75	20.11	8.62	740.07	
33	65.78	0.00	0.00	21.465	5.71	22.08	8.14	727.47	
34	87.15	0.00	0.00	15.466	6.01	14.97	9.82	786.99	
35	90.18	0.00	0.00	14.838	6.06	14.04	10.21	771.87	
36	92.15	0.02	4376.	14.458	6.09	14.62	9.77	724.92	
37	87.20	0.05	2213.	15.456	6.01	15.92	9.32	729.37	
38	45.49	0.00	0.00	32.290	5.47	32.56	7.21	719.58	
39	46.21	0.27	497.5	31.720	5.48	32.77	7.12	721.83	
40	64.20	0.00	0.00	22.080	5.69	21.17	8.52	759.68	
41	64.70	1.16	101.8	21.840	5.70	23.39	7.84	694.07	
42	38.06	0.00	0.00	39.134	5.38	39.32	6.85	735.01	
43	37.81	0.00	0.00	39.412	5.38	39.82	6.81	729.17	
44	35.15	0.00	0.00	42.672	5.35	41.60	6.84	755.16	
45	34.80	1.72	92.15	43.101	5.35	45.17	6.49	703.10	
46	32.02	0.52	308.7	47.064	5.32	48.48	6.43	716.42	
47	30.84	0.00	0.00	48.976	5.30	49.58	6.45	736.32	
48	29.82	0.00	0.00	50.784	5.29	51.45	6.39	728.98	
49	30.04	0.00	0.00						

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	27.71	0.16	1075.	54.909	5.27	55.35	6.31	717.27	
51	28.05	0.00	0.00	54.136	5.28	53.67	6.40	741.48	
52	27.43	0.00	0.00	55.426	5.27	54.56	6.40	737.80	
53	28.65	0.00	0.00	52.977	5.28	52.84	6.41	737.18	
54	28.07	0.16	1042.	54.096	5.28	54.43	6.34	727.23	
55	28.53	0.13	1249.	53.177	5.28	53.91	6.33	719.47	
56	28.63	0.84	203.9	53.016	5.28	54.22	6.30	704.84	
57	28.73	0.00	0.00	52.786	5.28	54.14	6.29	696.31	
58	27.20	0.00	0.00	56.103	5.26	56.21	6.30	726.31	
59	27.70	0.85	203.5	55.002	5.26	56.54	6.22	712.59	
60	27.47	0.00	0.00	55.341	5.27	54.59	6.40	738.53	
61	26.33	0.00	0.00	57.901	5.26	57.55	6.30	729.76	
62	29.40	0.08	2084.	51.551	5.29	51.90	6.40	725.08	
63	29.12	1.12	151.9	52.041	5.29	53.87	6.27	708.97	
64	50.23	0.82	159.5	28.949	5.52	30.20	7.27	702.78	
65	53.21	0.00	0.00	27.165	5.56	27.14	7.67	742.12	
66	73.25	0.72	153.4	18.938	5.82	20.23	8.30	701.84	
67	71.17	0.00	0.00	19.591	5.79	19.15	8.80	747.33	
68	88.84	0.00	0.00	15.117	6.04	15.28	9.57	731.40	
69	86.65	0.00	0.00	15.584	6.00	16.17	9.23	736.71	
70	53.46	0.00	0.00	27.043	5.56	25.91	7.93	755.26	
71	54.90	0.18	705.2	26.239	5.58	26.45	7.70	725.96	
72	37.28	1.47	103.7	40.068	5.37	42.42	6.56	707.32	
73	36.84	0.00	0.00	40.554	5.37	40.73	6.79	721.07	
74	29.80	0.00	0.00	50.787	5.29	50.53	6.48	737.95	
75	31.67	0.00	0.00	47.648	5.31	48.06	6.51	718.73	
76	28.73	0.80	212.0	52.786	5.28	53.90	6.31	714.70	
77	28.05	0.50	343.5	54.136	5.28	55.70	6.25	711.84	
78	27.75	0.00	0.00	54.753	5.27	54.12	6.40	721.09	
79	27.68	0.00	0.00	54.971	5.27	54.72	6.36	724.73	
(1 missing vial)									
81	486.91	0.00	0.00	0.381	57.47	0.14	455.3	1829.3	
82	441.71	0.00	0.00	0.718	32.34	0.33	201.8	2481.8	
83	539.78	0.00	0.00	0.061	337.5	0.00	0.00	0.000	

6/15/94
CALCULATIONS
VERIFIED
ON P. 143-4
OF THIS BOOK.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IIIB*pH2.00*IU	56.333	0.4982	113.0731	1.3076E+13	2.1709E-11	5.0591	
3	B-IIIB*pH2.00*IU	56.327	0.4988	112.9250	1.3058E+13	2.1681E-11	5.0525	5.0558
4	B-IIIB*pH2.25*IU	56.909	0.5009	113.6135	1.3138E+13	2.1813E-11	5.0833	
5	B-IIIB*pH2.25*IU	58.539	0.4994	117.2187	1.3555E+13	2.2505E-11	5.2446	5.1640
6	B-IIIB*pH2.50*IU	57.043	0.5004	113.9948	1.3182E+13	2.1886E-11	5.1004	
7	B-IIIB*pH2.50*IU	58.343	0.5008	116.4996	1.3472E+13	2.2367E-11	5.2124	5.1564
8	B-IIIB*pH2.75*IU	55.013	0.5034	109.2829	1.2637E+13	2.0982E-11	4.8895	
9	B-IIIB*pH2.75*IU	55.187	0.5017	110.0000	1.2720E+13	2.1119E-11	4.9216	4.9056
10	B-IIIB*pH3.00*IU	55.109	0.5046	109.2132	1.2629E+13	2.0968E-11	4.8864	
11	B-IIIB*pH3.00*IU	52.612	0.4998	105.2661	1.2173E+13	2.0210E-11	4.7098	4.7981
12	B-IIIB*pH3.25*IU	56.531	0.5006	112.9265	1.3059E+13	2.1681E-11	5.0526	
13	B-IIIB*pH3.25*IU	55.590	0.5015	110.8475	1.2818E+13	2.1282E-11	4.9595	5.0061
14	B-IIIB*pH3.50*IU	52.798	0.5028	105.0080	1.2143E+13	2.0161E-11	4.6983	
15	B-IIIB*pH3.50*IU	53.374	0.5010	106.5349	1.2319E+13	2.0454E-11	4.7666	4.7324
16	B-IIIB*pH3.75*IU	57.863	0.5025	115.1502	1.3316E+13	2.2108E-11	5.1521	
17	B-IIIB*pH3.75*IU	54.294	0.5018	108.1985	1.2512E+13	2.0773E-11	4.8410	4.9965
18	B-IIIB*pH4.00*IU	54.706	0.5023	108.9110	1.2594E+13	2.0910E-11	4.8729	
19	B-IIIB*pH4.00*IU	56.201	0.5013	112.1105	1.2964E+13	2.1524E-11	5.0161	4.9445
20	B-IIIB*pH4.25*IU	50.571	0.5002	101.1016	1.1691E+13	1.9411E-11	4.5235	
21	B-IIIB*pH4.25*IU	51.905	0.4995	103.9139	1.2016E+13	1.9951E-11	4.6493	4.5864
22	B-IIIB*pH4.50*IU	46.847	0.5013	93.4510	1.0806E+13	1.7942E-11	4.1812	
23	B-IIIB*pH4.50*IU	45.536	0.5008	90.9265	1.0515E+13	1.7457E-11	4.0682	4.1247
24	B-IIIB*pH4.75*IU	37.714	0.5019	75.1425	8.6893E+12	1.4427E-11	3.3620	
25	B-IIIB*pH4.75*IU	35.263	0.5009	70.3993	8.1408E+12	1.3516E-11	3.1498	3.2559
26	B-IIIB*pH5.00*IU	26.883	0.5001	53.7552	6.2161E+12	1.0321E-11	2.4051	
27	B-IIIB*pH5.00*IU	26.638	0.5005	53.2228	6.1546E+12	1.0218E-11	2.3813	2.3932
28	B-IIIB*pH5.25*IU	19.265	0.5004	38.4992	4.4520E+12	7.3916E-12	1.7225	
29	B-IIIB*pH5.25*IU	19.586	0.5013	39.0704	4.5180E+12	7.5013E-12	1.7481	1.7353
30	B-IIIB*pH5.50*IU	21.967	0.5009	43.8551	5.0713E+12	8.4199E-12	1.9622	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
31	B-IIIB*pH5.50*IU	22.400	0.4993	44.8628	5.1878E+12	8.6134E-12	2.0073	1.9847
32	B-IIIB*pH5.75*IU	20.522	0.5007	40.9866	4.7396E+12	7.8692E-12	1.8338	
33	B-IIIB*pH5.75*IU	21.465	0.4985	43.0592	4.9793E+12	8.2671E-12	1.9266	1.8802
34	B-IIIB*pH6.00*IU	15.466	0.5016	30.8333	3.5655E+12	5.9198E-12	1.3795	
35	B-IIIB*pH6.00*IU	14.838	0.4998	29.6879	3.4330E+12	5.6999E-12	1.3283	1.3539
36	B-IIIB*pH6.25*IU	14.458	0.4997	28.9334	3.3458E+12	5.5550E-12	1.2945	
37	B-IIIB*pH6.25*IU	15.456	0.5002	30.8996	3.5732E+12	5.9325E-12	1.3825	1.3385
38	B-IIIB*pH6.50*IU	32.290	0.5047	63.9786	7.3983E+12	1.2283E-11	2.8625	
39	B-IIIB*pH6.50*IU	31.720	0.5014	63.2629	7.3156E+12	1.2146E-11	2.8305	2.8465
40	B-IIIB*pH6.75*IU	22.080	0.5024	43.9490	5.0822E+12	8.4379E-12	1.9664	
41	B-IIIB*pH6.75*IU	21.840	0.4995	43.7237	5.0561E+12	8.3947E-12	1.9563	1.9613
42	B-IIIB*pH7.00*IU	39.134	0.4990	78.4248	9.0689E+12	1.5057E-11	3.5089	
43	B-IIIB*pH7.00*IU	39.412	0.4989	78.9978	9.1351E+12	1.5167E-11	3.5345	3.5217
44	B-IIIB*pH7.25*IU	42.672	0.5006	85.2417	9.8572E+12	1.6366E-11	3.8139	
45	B-IIIB*pH7.25*IU	43.101	0.4988	86.4094	9.9922E+12	1.6590E-11	3.8661	3.8400
46	B-IIIB*pH7.50*IU	47.064	0.5012	93.9026	1.0859E+13	1.8029E-11	4.2014	
47	B-IIIB*pH7.50*IU	48.976	0.4996	98.0304	1.1336E+13	1.8821E-11	4.3861	4.2937
48	B-IIIB*pH7.75*IU	50.784	0.5000	101.5680	1.1745E+13	1.9500E-11	4.5444	
49	B-IIIB*pH7.75*IU	50.458	0.4995	101.0170	1.1681E+13	1.9395E-11	4.5197	4.5320
50	B-IIIB*pH8.00*IU	54.909	0.5003	109.7521	1.2691E+13	2.1072E-11	4.9105	
51	B-IIIB*pH8.00*IU	54.136	0.4972	108.8817	1.2591E+13	2.0905E-11	4.8716	4.8911
52	B-IIIB*pH8.25*IU	55.426	0.5008	110.6749	1.2798E+13	2.1249E-11	4.9518	
53	B-IIIB*pH8.25*IU	52.977	0.5000	105.9540	1.2252E+13	2.0342E-11	4.7406	4.8462
54	B-IIIB*pH8.50*IU	54.096	0.4993	108.3437	1.2529E+13	2.0801E-11	4.8475	
55	B-IIIB*pH8.50*IU	53.177	0.4980	106.7811	1.2348E+13	2.0501E-11	4.7776	4.8126
56	B-IIIB*pH8.75*IU	53.016	0.5003	105.9684	1.2254E+13	2.0345E-11	4.7412	
57	B-IIIB*pH8.75*IU	52.786	0.4990	105.7836	1.2233E+13	2.0310E-11	4.7330	4.7371
58	B-IIIB*pH9.00*IU	56.103	0.5018	111.8035	1.2929E+13	2.1466E-11	5.0023	
59	B-IIIB*pH9.00*IU	55.002	0.4985	110.3350	1.2759E+13	2.1184E-11	4.9366	4.9695

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
60	B-IIIB-C*pH2.0*I	55.341	0.5006	110.5493	1.2784E+13	2.1225E-11	4.9462	
61	B-IIIB-C*pH2.0*I	57.901	0.4983	116.1971	1.3437E+13	2.2309E-11	5.1989	5.0726
62	B-IIIB-C*pH4.0*I	51.551	0.5001	103.0814	1.1920E+13	1.9791E-11	4.6121	
63	B-IIIB-C*pH4.0*I	52.041	0.4986	104.3742	1.2070E+13	2.0039E-11	4.6699	4.6410
64	B-IIIB-C*pH5.0*I	28.949	0.5023	57.6329	6.6645E+12	1.1065E-11	2.5786	
65	B-IIIB-C*pH5.0*I	27.165	0.4983	54.5154	6.3040E+12	1.0467E-11	2.4391	2.5089
66	B-IIIB-C*pH5.5*I	18.938	0.5017	37.7477	4.3651E+12	7.2473E-12	1.6889	
67	B-IIIB-C*pH5.5*I	19.591	0.5004	39.1507	4.5273E+12	7.5167E-12	1.7517	1.7203
68	B-IIIB-C*pH6.0*I	15.117	0.5007	30.1917	3.4913E+12	5.7966E-12	1.3508	
69	B-IIIB-C*pH6.0*I	15.584	0.4976	31.3183	3.6216E+12	6.0129E-12	1.4012	1.3760
70	B-IIIB-C*pH6.5*I	27.043	0.4976	54.3469	6.2845E+12	1.0434E-11	2.4316	
71	B-IIIB-C*pH6.5*I	26.239	0.5007	52.4046	6.0600E+12	1.0061E-11	2.3447	2.3881
72	B-IIIB-C*pH7.0*I	40.068	0.4975	80.5387	9.3133E+12	1.5463E-11	3.6035	
73	B-IIIB-C*pH7.0*I	40.554	0.4985	81.3521	9.4074E+12	1.5619E-11	3.6399	3.6217
74	B-IIIB-C*pH7.5*I	50.787	0.5017	101.2298	1.1706E+13	1.9435E-11	4.5292	
75	B-IIIB-C*pH7.5*I	47.648	0.4971	95.8519	1.1084E+13	1.8403E-11	4.2886	4.4089
76	B-IIIB-C*pH8.0*I	52.786	0.5000	105.5720	1.2208E+13	2.0269E-11	4.7235	
77	B-IIIB-C*pH8.0*I	54.136	0.4984	108.6196	1.2561E+13	2.0854E-11	4.8599	4.7917
78	B-IIIB-C*pH9.5*I	54.753	0.5010	109.2874	1.2638E+13	2.0982E-11	4.8897	
79	B-IIIB-C*pH9.5*I	54.971	0.5011	109.7007	1.2686E+13	2.1062E-11	4.9082	4.8990

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CALCULATIONS
VERIFIED ON
PAGE 143-4
OF THIS VOL.

29 JUNE 1993 TD EXPERIMENT K3*A

The 10th set of reverse samples was taken today. The pH and sampling time are on pages 10 & 11, while the weights of the samples is given below.

SAMPLE NAME	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
K3*A*AR*10	7.7347	8.2360	0.5013
K3*A*BR*10	7.7748	8.2747	0.4999
K3*A*CR*10	7.7585	8.2605	0.5020

2 July 1993 TD EXPERIMENT K3*A, Reverse

The liquid scintillation analysis of the 9th and 10th set of K3*A samples has finished. The raw data, as well as results of the calculations appears on the following page.

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	3.95	2.27	204.4	1122.87	3.01	1126.03	3.04	691.71	
51	3.99	5.82	85.82	1111.83	3.01	1120.22	3.03	690.79	
52	4.02	1.90	239.9	1104.51	3.01	1105.68	3.04	691.15	
53	3.97	3.17	149.1	1117.20	3.01	1121.73	3.03	691.54	
54	3.97	3.93	122.5	1120.22	3.00	1126.51	3.03	691.64	
55	3.93	0.00	0.00	1127.84	3.01	1129.10	3.04	693.52	
56	3.96	0.00	0.00	1122.30	3.00	1121.35	3.04	690.30	
57	3.83	5.81	87.69	1157.88	3.01	1165.06	3.03	689.00	
58	4.04	0.32	1388.	1098.53	3.01	1098.59	3.04	690.38	
59	3.92	8.30	63.64	1131.23	3.01	1143.28	3.02	690.47	
60	3.86	0.00	0.00	1148.60	3.01	1148.02	3.04	691.49	
61	4.12	3.34	139.7	1076.66	3.01	1080.35	3.04	685.76	
(11 missing vials)									
73	10.46	3.57	82.62	422.095	3.02	425.01	3.10	682.04	
74	10.94	1.76	157.5	403.537	3.02	404.85	3.11	686.34	
75	9.33	4.70	68.12	473.574	3.02	477.85	3.08	684.08	
76	9.37	2.67	114.2	471.753	3.02	474.52	3.09	689.29	
77	8.17	0.47	659.3	541.111	3.02	542.11	3.08	691.85	
78	8.06	0.00	0.00	549.280	3.01	547.41	3.09	692.23	
(1 missing vial)									
80	10.88	0.13	2111.	405.595	3.02	405.40	3.12	690.45	
81	9.33	0.00	0.00	473.896	3.02	471.75	3.10	693.95	
82	8.00	0.88	358.1	552.672	3.02	553.98	3.08	689.46	

S#	SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
73	K3*A*AR*9a	422.095	0.5046	836.4943	9.6730258E+13	1.60601E-10	37.4265
74	K3*A*AR*9b	403.537	0.5033	801.7822	9.2716241E+13	1.53937E-10	35.8734
75	K3*A*BR*9a	473.574	0.5010	945.2575	1.0930739E+14	1.81483E-10	42.2928
76	K3*A*BR*9b	471.753	0.5007	942.1869	1.0895232E+14	1.80894E-10	42.1554
77	K3*A*CR*9a	541.111	0.5038	1074.0592	1.2420171E+14	2.06212E-10	48.0557
78	K3*A*CR*9b	549.280	0.5022	1093.7475	1.2647843E+14	2.09992E-10	48.9366

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CALCULATION
VERIFIED
ON pg 143-4
of this
Vol.

S#	SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
80	K3*A*AR*10	405.595	0.5013	809.0864	9.3560875E+13	1.55339E-10	36.2002
81	K3*A*BR*10	471.750	0.4999	943.6887	1.0912598E+14	1.81182E-10	42.2226
82	K3*A*CR*10	553.980	0.5020	1103.5458	1.2761148E+14	2.11874E-10	49.3750

2 July 1993 TD TD 6/7/94

The 11th set of samples from K3*A, Reverse was taken today. The weights are given below, with the pH and time of sampling given on pages 10 & 11.

Sample weights for K3*A, Sample 11, 2 July 1993

VIAL #	SAMPLE NAME	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
2	K3*A*AR*11	7.8067	8.3112	0.5045
3	K3*A*BR*11	7.7561	8.2618	0.5057
4	K3*A*CR*11	7.7072	8.2109	0.5037

6 July 1993 En. BIB

Since about two weeks has passed, the B-IB solutions had 2 500µL samples taken. The weights are as follows.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IB*pH2.00*A	7.7775	8.2870	0.5095
B-IB*pH2.00*B	7.7846	8.2904	0.5058
B-IB*pH2.25*A	7.7408	8.2484	0.5076
B-IB*pH2.25*B	7.8221	8.3255	0.5034
B-IB*pH2.50*A	7.7483	8.2543	0.5060
B-IB*pH2.50*B	7.8082	8.3111	0.5029
B-IB*pH2.75*A	7.7962	8.2993	0.5031
B-IB*pH2.75*B	7.8010	8.3035	0.5025
B-IB*pH3.00*A	7.7853	8.2929	0.5076
B-IB*pH3.00*B	7.8258	8.3296	0.5038
B-IB*pH3.25*A	7.7474	8.2544	0.5070
B-IB*pH3.25*B	7.7825	8.2869	0.5044
B-IB*pH3.50*A	7.7414	8.2477	0.5063
B-IB*pH3.50*B	7.8084	8.3120	0.5036
B-IB*pH3.75*A	7.8006	8.3049	0.5043
B-IB*pH3.75*B	7.7763	8.2787	0.5024
B-IB*pH4.00*A	7.8045	8.3098	0.5053
B-IB*pH4.00*B	7.7452	8.2483	0.5031
B-IB*pH4.25*A	7.7901	8.2939	0.5038
B-IB*pH4.25*B	7.7435	8.2449	0.5014
B-IB*pH4.50*A	7.7572	8.2620	0.5048
B-IB*pH4.50*B	7.7852	8.2866	0.5014
B-IB*pH4.75*A	7.7711	8.2752	0.5041
B-IB*pH4.75*B	7.7445	8.2469	0.5024
B-IB*pH5.00*A	7.7497	8.2581	0.5084
B-IB*pH5.00*B	7.7903	8.2934	0.5031
B-IB*pH5.25*A	7.8055	8.3091	0.5036
B-IB*pH5.25*B	7.7183	8.2200	0.5017
B-IB*pH5.50*A	7.7590	8.2623	0.5033
B-IB*pH5.50*B	7.7579	8.2593	0.5014
B-IB*pH5.75*A	7.8038	8.3066	0.5028
B-IB*pH5.75*B	7.7493	8.2494	0.5001
B-IB*pH6.00*A	7.7262	8.2298	0.5036
B-IB*pH6.00*B	7.7471	8.2477	0.5006
B-IB*pH6.25*A	7.7680	8.2735	0.5055
B-IB*pH6.25*B	7.7940	8.2961	0.5021
B-IB*pH6.50*A	7.7990	8.8073	1.0083
B-IB*pH6.50*B	7.7836	8.7850	1.0014
B-IB*pH6.75*A	7.7527	8.2571	0.5044

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IB*pH6.75*B	7.7354	8.2365	0.5011
B-IB*pH7.00*A	7.7757	8.2795	0.5038
B-IB*pH7.00*B	7.7771	8.2797	0.5026
B-IB*pH7.25*A	7.7759	8.2795	0.5036
B-IB*pH7.25*B	7.7142	8.2153	0.5011
B-IB*pH7.50*A	7.8001	8.3073	0.5072
B-IB*pH7.50*B	7.7461	8.2503	0.5042
B-IB*pH7.75*A	7.8054	8.3112	0.5058
B-IB*pH7.75*B	7.7897	8.2928	0.5031
B-IB*pH8.00*A	7.7776	8.2815	0.5039
B-IB*pH8.00*B	7.8009	8.3029	0.5020
B-IB*pH8.25*A	7.7626	8.2663	0.5037
B-IB*pH8.25*B	7.7443	8.2454	0.5011
B-IB*pH8.50*A	7.7290	8.2341	0.5051
B-IB*pH8.50*B	7.7574	8.2582	0.5008
B-IB*pH8.75*A	7.7839	8.2892	0.5053
B-IB*pH8.75*B	7.7844	8.2860	0.5016
B-IB*pH9.00*A	7.7726	8.2806	0.5080
B-IB*pH9.00*B	7.7597	8.2634	0.5037
B-IB-C*pH2.0*A	7.7523	8.2568	0.5045
B-IB-C*pH2.0*B	7.7700	8.2704	0.5004
B-IB-C*pH4.0*A	7.7290	8.2336	0.5046
B-IB-C*pH4.0*B	7.7058	8.2046	0.4988
B-IB-C*pH5.0*A	7.7392	8.2437	0.5045
B-IB-C*pH5.0*B	7.7479	8.2478	0.4999
B-IB-C*pH5.5*A	7.7356	8.2368	0.5012
B-IB-C*pH5.5*B	7.7678	8.2711	0.5033
B-IB-C*pH6.0*A	7.7652	8.2710	0.5058
B-IB-C*pH6.0*B	7.7556	8.2588	0.5032
B-IB-C*pH6.5*A	7.7054	8.2101	0.5047
B-IB-C*pH6.5*B	7.7747	8.2759	0.5012
B-IB-C*pH7.0*A	7.7782	8.2802	0.5020
B-IB-C*pH7.0*B	7.7850	8.2912	0.5062
B-IB-C*pH7.5*A	7.7518	8.2537	0.5019
B-IB-C*pH7.5*B	7.7769	8.2746	0.4977
B-IB-C*pH8.0*A	7.7547	8.2564	0.5017
B-IB-C*pH8.0*B	7.7321	8.2373	0.5052
B-IB-C*pH9.5*A	7.7307	8.2375	0.5068
B-IB-C*pH9.5*B	7.8338	8.3385	0.5047

The pH of all the solutions was also measured.

SOLUTION	pH/T(°C)	SOLUTION	pH/T(°C)	SOLUTION	pH/T(°C)
B-IB pH2.00	2.04/20.9	4.75	4.97/21.3	7.75	7.35/21.7
2.25	2.28/20.9	5.00	5.17/21.3	8.00	7.78/21.7
2.50	2.50/20.9	5.25	5.27/21.3	8.25	8.00/21.8
2.75	2.74/21.0	5.50	5.42/21.3	8.50	8.28/21.6
3.00	2.97/21.0	5.75	5.49/21.4	~~9.00~~ 8.75 JD 6/7/93	8.59/21.8
3.25	3.24/21.0	6.00	5.61/21.4	9.00	8.85/21.9
3.50	3.52/21.1	6.25	5.89/21.5		
3.75	3.82/21.1	6.50	6.07/21.5		
4.00	4.12/21.1	6.75	6.36/21.5		
4.25	4.44/21.2	7.00	6.60/21.5		
4.50	4.69/21.2	7.25	6.79/21.6		
		7.50	7.16/21.6		

SOLUTION	pH/T(°C)
B-IB-C*pH 2.0	1.87/22.1
4.0	3.81/22.1
5.0	4.79/22.2
5.5	4.93/22.2
6.0	5.49/22.1
6.5	6.07/22.0
7.0	6.74/22.0
7.5	7.27/22.0
8.0	7.79/21.9
9.5	9.37/21.9

7 July 1993 TP

TD 7/7/93
The 7th 12 set of reverse kinetics samples was taken today. The pH & Sampling times can be found on pages 10 & 11. The sample weights are given below.

SAMPLE NAME	WT VIAL	WT VIAL+SAMPLE	WT SAMPLE
K3*A*AR*12a	7.7908	8.2918	0.5010
K3*A*AR*12b	7.8164	8.3163	0.4999
K3*A*BR*12a	7.7861	8.2848	0.4987
K3*A*BR*12b	7.7654	8.2662	0.5008
K3*A*CR*12a	7.8227	8.3221	0.4994
K3*A*CR*12b	7.7807	8.2775	0.4968

EXPERIMENT B-TLB

Two weeks has passed since the experiment was begun. 2 500µL samples of each solution were taken and prepared for liquid scintillation analysis. The pH of each solution was also measured (after sample taken).

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IIIB*pH2.00*A	7.7776	8.2802	0.5026
B-IIIB*pH2.00*B	7.7307	8.2285	0.4978
B-IIIB*pH2.25*A	7.7196	8.2219	0.5023
B-IIIB*pH2.25*B	7.7796	8.2819	0.5023
B-IIIB*pH2.50*A	7.7349	8.2369	0.5020
B-IIIB*pH2.50*B	7.7188	8.2204	0.5016
B-IIIB*pH2.75*A	7.7835	8.2854	0.5019
B-IIIB*pH2.75*B	7.8460	8.3469	0.5009
B-IIIB*pH3.00*A	7.7753	8.2785	0.5032
B-IIIB*pH3.00*B	7.7750	8.2765	0.5015
B-IIIB*pH3.25*A	7.7544	8.2566	0.5022
B-IIIB*pH3.25*B	7.8183	8.3190	0.5007
B-IIIB*pH3.50*A	7.7425	8.2441	0.5016
B-IIIB*pH3.50*B	7.7851	8.2870	0.5019
B-IIIB*pH3.75*A	7.7439	8.2462	0.5023
B-IIIB*pH3.75*B	7.7203	8.2215	0.5012
B-IIIB*pH4.00*A	7.7950	8.2958	0.5008
B-IIIB*pH4.00*B	7.8058	8.3084	0.5026
B-IIIB*pH4.25*A	7.7341	8.2342	0.5001
B-IIIB*pH4.25*B	7.7878	8.2876	0.4998
B-IIIB*pH4.50*A	7.7489	8.2496	0.5007
B-IIIB*pH4.50*B	7.7707	8.2713	0.5006
B-IIIB*pH4.75*A	7.7358	8.2400	0.5042
B-IIIB*pH4.75*B	7.7438	8.2451	0.5013
B-IIIB*pH5.00*A	7.7397	8.2410	0.5013
B-IIIB*pH5.00*B	7.7451	8.2496	0.5045
B-IIIB*pH5.25*A	7.7553	8.2576	0.5023
B-IIIB*pH5.25*B	7.7432	8.2445	0.5013
B-IIIB*pH5.50*A	7.7503	8.2523	0.5020
B-IIIB*pH5.50*B	7.7759	8.2779	0.5020
B-IIIB*pH5.75*A	7.7377	8.2480	0.5103
B-IIIB*pH5.75*B	7.7118	8.2184	0.5066
B-IIIB*pH6.00*A	7.7248	8.1836	0.4588
B-IIIB*pH6.00*B	7.7612	8.2624	0.5012
B-IIIB*pH6.25*A	7.7253	8.2278	0.5025
B-IIIB*pH6.25*B	7.8018	8.3054	0.5036
B-IIIB*pH6.50*A	7.8392	8.3430	0.5038
B-IIIB*pH6.50*B	7.7946	8.2965	0.5019
B-IIIB*pH6.75*A	7.8562	8.3522	0.4960

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IIIB*pH6.75*B	7.8163	8.3173	0.5010
B-IIIB*pH7.00*A	7.7894	8.2918	0.5024
B-IIIB*pH7.00*B	7.7586	8.2606	0.5020
B-IIIB*pH7.25*A	7.7962	8.2980	0.5018
B-IIIB*pH7.25*B	7.7770	8.2764	0.4994
B-IIIB*pH7.50*A	7.7653	8.2693	0.5040
B-IIIB*pH7.50*B	7.7854	8.2877	0.5023
B-IIIB*pH7.75*A	7.7402	8.2441	0.5039
B-IIIB*pH7.75*B	7.7617	8.2622	0.5005
B-IIIB*pH8.00*A	7.7640	8.2653	0.5013
B-IIIB*pH8.00*B	7.7251	8.2267	0.5016
B-IIIB*pH8.25*A	7.7677	8.2685	0.5008
B-IIIB*pH8.25*B	7.7368	8.2362	0.4994
B-IIIB*pH8.50*A	7.7754	8.2640	0.4886
B-IIIB*pH8.50*B	7.7846	8.2870	0.5024
B-IIIB*pH8.75*A	7.8204	8.3231	0.5027
B-IIIB*pH8.75*B	7.7796	8.3026	0.5230
B-IIIB*pH9.00*A	7.8400	8.3433	0.5033
B-IIIB*pH9.00*B	7.7463	8.2489	0.5026
B-IIIB-C*pH2.0*A	7.7767	8.2812	0.5045
B-IIIB-C*pH2.0*B	7.7534	8.2530	0.4996
B-IIIB-C*pH4.0*A	7.7087	8.2111	0.5024
B-IIIB-C*pH4.0*B	7.7391	8.2407	0.5016
B-IIIB-C*pH5.0*A	7.7493	8.2537	0.5044
B-IIIB-C*pH5.0*B	7.7297	8.2302	0.5005
B-IIIB-C*pH5.5*A	7.7703	8.2720	0.5017
B-IIIB-C*pH5.5*B	7.7706	8.2720	0.5014
B-IIIB-C*pH6.0*A	7.7717	8.2740	0.5023
B-IIIB-C*pH6.0*B	7.8244	8.3251	0.5007
B-IIIB-C*pH6.5*A	7.7966	8.2969	0.5003
B-IIIB-C*pH6.5*B	7.7331	8.2332	0.5001
B-IIIB-C*pH7.0*A	7.7747	8.2750	0.5003
B-IIIB-C*pH7.0*B	7.8066	8.3066	0.5000
B-IIIB-C*pH7.5*A	7.7215	8.2241	0.5026
B-IIIB-C*pH7.5*B	7.7814	8.2811	0.4997
B-IIIB-C*pH8.0*A	7.7655	8.2676	0.5021
B-IIIB-C*pH8.0*B	7.7710	8.2684	0.4974
B-IIIB-C*pH9.5*A	7.7824	8.2867	0.5043
B-IIIB-C*pH9.5*B	7.7573	8.2605	0.5032

SOLUTION	pH/T(°C)	SOLUTION	pH/T(°C)
B-IIIB × pH 2.00	1.92/23.2	B-IIIB-C × pH 7.5	7.21/23.6
2.25	2.17/23.3	8.0	7.65/23.6
2.50	2.39/23.3	9.5	9.31/23.6
2.75	2.70/23.3		
3.00	2.95/23.3		
3.25	3.22/23.3		
3.50	3.50/23.3		
3.75	3.81/23.3		
4.00	4.08/23.3		
4.25	4.44/23.3		
4.50	4.65/23.4		
4.75	4.93/23.4		
5.00	5.03/23.4		
5.25	5.14/23.4		
5.50	5.30/23.4		
5.75	5.43/23.4		
6.00	5.58/23.4		
6.25	5.82/23.4		
6.50	6.03/23.4		
6.75	6.31/23.4		
7.00	6.55/23.4		
7.25	6.86/23.5		
7.50	7.09/23.5		
7.75	7.37/23.5		
8.00	7.69/23.5		
8.25	8.00/23.5		
8.50	8.24/23.5		
8.75	8.58/23.5		
9.00	8.86/23.5		
B-IIIB-C × pH 2.0	1.85/23.5		
4.0	3.83/23.5		
5.0	4.62/23.5		
5.5	4.89/23.5		
6.0	5.05/23.5		
6.5	5.72/23.6		
7.0	6.55/23.6		

9 July 1993. TB

The liquid Scintillation analysis of the B-IIB samples and the K3×HR, 12th sample set has completed. The raw data, as well as results of calculations follow. The 11th set was also counted.

Protocol #: 5 Name:U-233 3% 2 sigma 08-Jul-93 06:30
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	19.09	1.45	3.141	3.57	28.53	1.18	140.04	B
2	4.11	3.29	142.1	1079.10	3.01	1084.86	3.03	718.69	
3	4.26	1.33	330.4	1041.93	3.01	1046.59	3.04	717.01	
4	4.24	3.55	130.5	1047.10	3.01	1055.67	3.03	718.10	
5	4.16	2.54	179.9	1065.85	3.01	1073.16	3.03	719.09	
6	4.11	6.70	74.93	1078.61	3.01	1090.21	3.03	714.93	
7	4.22	2.71	168.3	1052.55	3.01	1058.68	3.03	714.33	
8	4.15	0.00	0.00	1067.94	3.01	1070.27	3.04	718.41	
9	4.09	6.82	73.90	1083.66	3.01	1092.99	3.03	714.27	
(10 missing vials)									
20	7.92	1.49	217.7	558.096	3.02	558.97	3.08	715.23	
21	7.95	0.00	0.00	555.853	3.02	555.12	3.09	718.16	
22	8.11	0.00	0.00	545.194	3.02	545.09	3.09	716.75	
23	8.09	1.67	192.4	546.179	3.02	546.88	3.08	715.47	
24	7.85	0.78	410.4	562.974	3.02	564.21	3.08	716.61	
25	7.88	4.51	77.00	560.945	3.02	566.65	3.07	711.37	
26	7.78	0.06	5499.	568.067	3.02	569.29	3.08	718.07	
27	8.07	3.71	91.01	548.160	3.02	553.26	3.07	714.08	
28	8.00	0.00	0.00	552.359	3.02	549.85	3.09	718.00	
29	8.00	0.03	10140	552.609	3.02	552.47	3.09	713.86	
30	8.20	0.00	0.00	539.298	3.02	539.77	3.09	718.45	
31	8.22	0.00	0.00	537.978	3.02	538.38	3.09	718.18	
32	8.19	0.00	0.00	539.472	3.02	536.80	3.10	719.02	
33	8.43	2.26	141.5	524.617	3.02	526.63	3.08	712.72	
34	8.74	2.07	150.8	505.669	3.02	509.69	3.08	713.12	
35	8.74	0.93	327.4	505.898	3.02	506.14	3.09	715.22	
36	9.16	0.01	27840	482.667	3.02	483.92	3.09	715.72	
37	8.99	0.82	366.1	491.742	3.02	492.94	3.09	710.84	
38	10.39	1.31	215.0	424.578	3.02	425.85	3.11	712.81	
39	10.72	0.68	400.5	411.691	3.02	412.52	3.11	715.05	
40	11.00	0.00	0.00	401.314	3.02	399.20	3.13	717.31	
41	10.99	0.00	0.00	401.318	3.02	401.32	3.12	718.47	
42	13.47	1.77	141.7	326.777	3.03	329.75	3.13	711.04	
43	13.19	1.83	138.4	333.932	3.03	335.39	3.13	711.21	
44	15.28	2.11	112.4	287.697	3.03	290.58	3.15	707.69	
45	15.56	1.28	180.3	282.656	3.03	285.16	3.15	710.73	
46	17.27	0.00	0.00	254.184	3.04	252.65	3.20	717.44	
47	17.49	0.00	0.00	250.947	3.04	248.15	3.21	718.31	
48	18.73	1.14	183.9	234.286	3.04	236.02	3.19	712.78	
49	17.26	0.89	242.7	254.391	3.04	254.85	3.18	711.24	
50	22.44	0.78	243.6	194.943	3.05	196.43	3.23	713.54	
51	22.49	0.60	313.6	194.547	3.05	194.99	3.24	715.28	
52	22.41	1.12	171.4	195.297	3.05	197.09	3.22	710.24	
53	22.35	1.35	142.9	195.696	3.05	197.16	3.23	713.71	
54	34.42	0.00	0.00	125.970	3.08	126.30	3.37	716.40	
55	35.29	0.26	580.5	122.787	3.08	123.39	3.37	712.19	
56	18.87	0.00	0.00	232.365	3.04	231.94	3.21	684.44	
57	18.60	0.00	0.00	235.784	3.04	235.99	3.20	685.11	
58	34.65	0.00	0.00	125.113	3.08	124.89	3.38	714.57	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
59	34.67	0.00	0.00	125.068	3.08	124.03	3.39	720.45	
60	30.31	0.00	0.00	143.477	3.07	143.07	3.33	716.03	
61	29.78	0.75	220.5	146.187	3.06	146.42	3.32	710.60	
62	21.34	0.00	0.00	205.200	3.05	204.98	3.23	718.60	
63	21.12	0.00	0.00	207.370	3.05	206.46	3.24	722.42	
64	15.89	0.04	5954.	276.532	3.03	276.07	3.17	718.60	
65	15.70	1.22	187.2	279.916	3.03	281.03	3.16	715.49	
66	12.34	0.00	0.00	357.151	3.03	355.10	3.14	718.84	
67	12.45	2.67	99.48	354.128	3.03	358.38	3.11	714.21	
68	9.29	0.00	0.00	475.330	3.02	473.73	3.11	724.31	
69	9.55	0.59	487.7	462.409	3.02	464.35	3.10	713.45	
70	8.41	0.00	0.00	525.634	3.02	522.48	3.10	718.74	
71	8.29	0.00	0.00	533.168	3.02	533.96	3.09	716.31	
72	8.02	0.73	431.8	551.223	3.02	552.27	3.08	717.71	
73	8.12	3.07	107.9	544.396	3.02	546.84	3.08	708.04	
74	8.04	4.16	81.96	551.088	3.01	556.30	3.07	696.20	
75	7.93	1.46	221.3	557.515	3.02	560.00	3.08	708.02	
76	7.91	0.00	0.00	558.679	3.02	558.58	3.09	701.10	
77	8.28	2.04	157.2	534.178	3.02	536.33	3.08	704.13	
78	8.03	1.45	220.9	550.533	3.02	552.30	3.08	701.64	
79	8.24	2.51	129.6	536.543	3.02	539.92	3.08	708.16	
80	8.03	1.08	294.7	550.782	3.02	552.92	3.08	707.31	
81	8.03	1.58	204.1	550.657	3.02	553.04	3.08	697.87	
82	9.25	2.42	126.6	477.832	3.02	480.12	3.09	704.95	
83	9.20	1.12	265.2	479.902	3.02	482.02	3.09	709.84	
84	10.91	0.00	0.00	404.192	3.02	405.94	3.11	710.60	
85	11.14	0.74	360.6	396.141	3.02	397.42	3.11	704.66	
86	10.29	0.00	0.00	429.123	3.02	425.70	3.12	711.15	
87	10.05	0.00	0.00	439.147	3.02	438.34	3.11	711.32	
88	10.68	0.00	0.00	412.964	3.02	411.83	3.12	704.33	
89	10.55	1.57	179.3	418.091	3.02	421.05	3.10	702.87	
90	9.28	0.84	350.1	476.277	3.02	477.51	3.09	686.27	
91	8.89	0.00	0.00	497.309	3.02	497.35	3.09	716.78	
92	8.32	1.70	186.8	530.994	3.02	533.85	3.08	712.97	
93	8.80	0.79	381.2	501.973	3.02	504.43	3.09	709.42	
94	8.06	3.98	85.26	548.720	3.02	553.98	3.07	706.16	
95	7.91	1.51	214.2	559.059	3.02	560.10	3.08	713.61	
96	8.27	0.62	503.7	534.586	3.02	535.56	3.08	709.87	
97	8.22	0.00	0.00	537.613	3.02	535.59	3.09	721.24	
(1 missing vial)									
99	10.84	2.40	117.9	406.914	3.02	409.11	3.11	710.10	
100	9.21	0.67	441.3	479.595	3.02	481.46	3.09	711.97	
101	7.94	0.00	0.00	556.557	3.02	557.75	3.08	713.25	
(1 missing vial)									
103	10.99	0.00	0.00	401.500	3.02	402.14	3.11	713.10	
104	9.52	2.02	148.2	463.876	3.02	464.54	3.10	715.23	
105	11.10	0.00	0.00	397.219	3.02	395.89	3.13	714.46	
106	9.44	2.20	137.2	467.939	3.02	469.25	3.10	709.29	
107	8.05	1.65	195.2	549.281	3.02	550.36	3.08	714.25	
108	8.09	0.00	0.00	546.426	3.02	546.38	3.09	715.03	

SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
20	B-IB*pH2.00*A	558.096	0.5095	1095.3798	1.2667E+14	2.1031E-10	49.0096	
21	B-IB*pH2.00*B	555.853	0.5058	1098.9581	1.2708E+14	2.1099E-10	49.1697	49.0896
22	B-IB*pH2.25*A	545.194	0.5076	1074.0623	1.2420E+14	2.0621E-10	48.0558	
23	B-IB*pH2.25*B	546.179	0.5034	1084.9801	1.2546E+14	2.0831E-10	48.5443	48.3000
24	B-IB*pH2.50*A	562.974	0.5060	1112.5968	1.2866E+14	2.1361E-10	49.7799	
25	B-IB*pH2.50*B	560.945	0.5029	1115.4206	1.2898E+14	2.1415E-10	49.9063	49.8431
26	B-IB*pH2.75*A	568.067	0.5031	1129.1334	1.3057E+14	2.1679E-10	50.5198	
27	B-IB*pH2.75*B	548.160	0.5025	1090.8657	1.2615E+14	2.0944E-10	48.8076	49.6637
28	B-IB*pH3.00*A	552.359	0.5076	1088.1777	1.2583E+14	2.0892E-10	48.6873	
29	B-IB*pH3.00*B	552.609	0.5038	1096.8817	1.2684E+14	2.1059E-10	49.0768	48.8821
30	B-IB*pH3.25*A	539.298	0.5070	1063.7041	1.2300E+14	2.0422E-10	47.5924	
31	B-IB*pH3.25*B	537.978	0.5044	1066.5702	1.2334E+14	2.0477E-10	47.7206	47.6565
32	B-IB*pH3.50*A	539.472	0.5063	1065.5185	1.2321E+14	2.0457E-10	47.6735	
33	B-IB*pH3.50*B	524.617	0.5036	1041.7335	1.2046E+14	2.0001E-10	46.6093	47.1414
34	B-IB*pH3.75*A	505.669	0.5043	1002.7147	1.1595E+14	1.9251E-10	44.8636	
35	B-IB*pH3.75*B	505.898	0.5024	1006.9626	1.1644E+14	1.9333E-10	45.0536	44.9586
36	B-IB*pH4.00*A	482.667	0.5053	955.2088	1.1046E+14	1.8339E-10	42.7380	
37	B-IB*pH4.00*B	491.742	0.5031	977.4240	1.1303E+14	1.8766E-10	43.7320	43.2350
38	B-IB*pH4.25*A	424.578	0.5038	842.7511	9.7454E+13	1.6180E-10	37.7064	
39	B-IB*pH4.25*B	411.691	0.5014	821.0830	9.4948E+13	1.5764E-10	36.7370	37.2217
40	B-IB*pH4.50*A	401.314	0.5048	794.9960	9.1932E+13	1.5263E-10	35.5698	
41	B-IB*pH4.50*B	401.318	0.5014	800.3949	9.2556E+13	1.5367E-10	35.8113	35.6906
42	B-IB*pH4.75*A	326.777	0.5041	648.2384	7.4961E+13	1.2446E-10	29.0035	
43	B-IB*pH4.75*B	333.932	0.5024	664.6736	7.6861E+13	1.2761E-10	29.7389	29.3712
44	B-IB*pH5.00*A	287.967	0.5084	566.4182	6.5499E+13	1.0875E-10	25.3427	
45	B-IB*pH5.00*B	282.656	0.5031	561.8287	6.4969E+13	1.0787E-10	25.1374	25.2401
46	B-IB*pH5.25*A	254.184	0.5036	504.7339	5.8366E+13	9.6906E-11	22.5829	
47	B-IB*pH5.25*B	250.947	0.5017	500.1933	5.7841E+13	9.6034E-11	22.3797	22.4813
48	B-IB*pH5.50*A	234.286	0.5033	465.4997	5.3829E+13	8.9373E-11	20.8274	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
49	B-IB*pH5.50*B	254.391	0.5014	507.3614	5.8670E+13	9.7410E-11	22.7004	21.7639
50	B-IB*pH5.75*A	194.943	0.5028	387.7148	4.4834E+13	7.4439E-11	17.3472	
51	B-IB*pH5.75*B	194.547	0.5001	389.0162	4.4985E+13	7.4689E-11	17.4054	17.3763
52	B-IB*pH6.00*A	195.297	0.5036	387.8018	4.4845E+13	7.4455E-11	17.3511	
53	B-IB*pH6.00*B	195.696	0.5006	390.9229	4.5205E+13	7.5055E-11	17.4907	17.4209
54	B-IB*pH6.25*A	125.970	0.5055	249.1988	2.8817E+13	4.7845E-11	11.1497	
55	B-IB*pH6.25*B	122.787	0.5021	244.5469	2.8279E+13	4.6951E-11	10.9415	11.0456
56	B-IB*pH6.50*A	232.365	1.0083	230.4522	2.6649E+13	4.4245E-11	10.3109	
57	B-IB*pH6.50*B	235.784	1.0014	235.4544	2.7227E+13	4.5206E-11	10.5347	10.4228
58	B-IB*pH6.75*A	125.113	0.5044	248.0432	2.8683E+13	4.7623E-11	11.0980	
59	B-IB*pH6.75*B	125.068	0.5011	249.5869	2.8862E+13	4.7919E-11	11.1670	11.1325
60	B-IB*pH7.00*A	143.477	0.5038	284.7896	3.2932E+13	5.4678E-11	12.7421	
61	B-IB*pH7.00*B	146.187	0.5026	290.8615	3.3635E+13	5.5844E-11	13.0138	12.8779
62	B-IB*pH7.25*A	205.200	0.5036	407.4662	4.7118E+13	7.8231E-11	18.2309	
63	B-IB*pH7.25*B	207.370	0.5011	413.8296	4.7854E+13	7.9453E-11	18.5156	18.3732
64	B-IB*pH7.50*A	276.532	0.5072	545.2129	6.3047E+13	1.0468E-10	24.3940	
65	B-IB*pH7.50*B	279.916	0.5042	555.1686	6.4198E+13	1.0659E-10	24.8394	24.6167
66	B-IB*pH7.75*A	357.151	0.5058	706.1111	8.1653E+13	1.3557E-10	31.5929	
67	B-IB*pH7.75*B	354.128	0.5031	703.8919	8.1396E+13	1.3514E-10	31.4936	31.5432
68	B-IB*pH8.00*A	475.330	0.5039	943.3022	1.0908E+14	1.8111E-10	42.2053	
69	B-IB*pH8.00*B	462.409	0.5020	921.1335	1.0652E+14	1.7685E-10	41.2134	41.7094
70	B-IB*pH8.25*A	525.634	0.5037	1043.5458	1.2067E+14	2.0035E-10	46.6904	
71	B-IB*pH8.25*B	533.168	0.5011	1063.9952	1.2304E+14	2.0428E-10	47.6054	47.1479
72	B-IB*pH8.50*A	551.223	0.5051	1091.3146	1.2620E+14	2.0953E-10	48.8277	
73	B-IB*pH8.50*B	544.396	0.5008	1087.0527	1.2570E+14	2.0871E-10	48.6370	48.7324
74	B-IB*pH8.75*A	551.088	0.5053	1090.6155	1.2612E+14	2.0939E-10	48.7964	
75	B-IB*pH8.75*B	557.515	0.5016	1111.4733	1.2853E+14	2.1340E-10	49.7296	49.2630
76	B-IB*pH9.00*A	558.679	0.5080	1099.7618	1.2717E+14	2.1115E-10	49.2056	
77	B-IB*pH9.00*B	534.178	0.5037	1060.5082	1.2263E+14	2.0361E-10	47.4494	48.3275

6/15/94 TD CALCULATIONS VERIFIED ON PAGE 143-24 OF THIS VOLUME.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
78	B-IB-C*pH2.0*A	550.533	0.5045	1091.2448	1.2619E+14	2.0951E-10	48.8246	
79	B-IB-C*pH2.0*B	536.543	0.5004	1072.2282	1.2399E+14	2.0586E-10	47.9737	48.3992
80	B-IB-C*pH4.0*A	550.782	0.5046	1091.5220	1.2622E+14	2.0957E-10	48.8370	
81	B-IB-C*pH4.0*B	550.657	0.4988	1103.9635	1.2766E+14	2.1195E-10	49.3936	49.1153
82	B-IB-C*pH5.0*A	477.832	0.5045	947.1397	1.0953E+14	1.8184E-10	42.3770	
83	B-IB-C*pH5.0*B	479.902	0.4999	959.9960	1.1101E+14	1.8431E-10	42.9522	42.6646
84	B-IB-C*pH5.5*A	404.192	0.5012	806.4485	9.3256E+13	1.5483E-10	36.0822	
85	B-IB-C*pH5.5*B	396.141	0.5033	787.0872	9.1017E+13	1.5112E-10	35.2159	35.6491
86	B-IB-C*pH6.0*A	429.123	0.5058	848.4045	9.8108E+13	1.6289E-10	37.9594	
87	B-IB-C*pH6.0*B	439.147	0.5032	872.7087	1.0092E+14	1.6755E-10	39.0468	38.5031
88	B-IB-C*pH6.5*A	412.964	0.5047	818.2366	9.4619E+13	1.5710E-10	36.6096	
89	B-IB-C*pH6.5*B	418.091	0.5012	834.1800	9.6463E+13	1.6016E-10	37.3230	36.9663
90	B-IB-C*pH7.0*A	476.277	0.5020	948.7590	1.0971E+14	1.8216E-10	42.4495	
91	B-IB-C*pH7.0*B	497.309	0.5062	982.4358	1.1361E+14	1.8862E-10	43.9562	43.2028
92	B-IB-C*pH7.5*A	530.994	0.5019	1057.9677	1.2234E+14	2.0312E-10	47.3357	
93	B-IB-C*pH7.5*B	501.973	0.4977	1008.5855	1.1663E+14	1.9364E-10	45.1262	46.2310
94	B-IB-C*pH8.0*A	548.720	0.5017	1093.7213	1.2648E+14	2.0999E-10	48.9354	
95	B-IB-C*pH8.0*B	559.059	0.5052	1106.6093	1.2797E+14	2.1246E-10	49.5120	49.2237
96	B-IB-C*pH9.5*A	534.586	0.5068	1054.8264	1.2198E+14	2.0252E-10	47.1951	
97	B-IB-C*pH9.5*B	537.613	0.5047	1065.2130	1.2318E+14	2.0451E-10	47.6599	47.4275

VIAL #	SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
99	K3*A*AR*11	406.914	0.5045	806.5689	9.326976E+13	1.5486E-10	36.0876
100	K3*A*BR*11	479.595	0.5057	948.3785	1.096683E+14	1.8208E-10	42.4324
101	K3*A*CR*11	556.557	0.5037	1104.9375	1.277724E+14	2.1214E-10	49.4372

VIAL#	SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)
103	K3*A*AR*12a	401.500	0.5010	801.3972	9.267172E+13	1.5386E-10	35.8562
105	K3*A*AR*12b	397.219	0.4987	796.5089	9.210845E+13	1.5292E-10	35.6375
104	K3*A*BR*12a	463.876	0.4999	927.9376	1.073046E+14	1.7816E-10	41.5179
106	K3*A*BR*12b	467.939	0.5008	934.3830	1.080499E+14	1.794E-10	41.8063
107	K3*A*CR*12a	549.281	0.4944	1111.0053	1.284741E+14	2.1331E-10	49.7087
108	K3*A*CR*12b	546.426	0.4968	1099.8913	1.271889E+14	2.1117E-10	49.2114

6/15/94 TD.
VERIFICATION OF CALCULATION IS ON Pg 143-4 OF THIS BOOK.

URANIUM SORPTION EXPERIMENT **B-IIB:**
Kd vs pH; Equilibrium with atmospheric pCO_2; Initial $\Sigma U = 500$ ppb

WRITTEN BY: R.T. PABALAN
REVISION NO.: 0
DATE WRITTEN: May 27, 1993
DATE REVISED:

OBJECTIVE:

- To investigate the importance of uranium sorption on the zeolite mineral clinoptilolite as a function of solution pH and total uranium concentration. Experimental data will be correlated with uranium aqueous speciation.
- To investigate reversibility and reproducibility of uranium sorption reactions.

Note: This procedure is similar to that for Expt. B-II. Teflon (FEP) bottles are used here instead of polypropylene (PP) to minimize uranium losses to container walls. Smaller solution volumes and zeolite weights are also used compared to B-II. In addition, liquid scintillation counting, instead of alpha-spectrometry, will be used to measure uranium concentrations. Instead of $NaHCO_3$ solid, aqueous solutions of $NaHCO_3$ are used here to raise the starting pH of the uranium solutions.

EQUIPMENT:

Gyratory shaker or constant temperature shaker bath
Packard liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Automatic temperature compensator probe
Analytical balance

SUPPLIES:

	pH buffer (pH = 2,4,7,9,10)
40	60-ml FEP bottles (to contain experimental mixtures, control solutions, and B-IIB*IU)
1	2000-ml teflon bottle (for preparation of 500 ppb U solution)
4	glass droppers (for adjusting pH by addition of HNO_3 or $NaHCO_3$ solution)
1	5-ml Eppendorf pipet (for transferring 5 ml cocktail into scintillation vial)
1	0.5-ml Eppendorf fixed-volume micropipet (for taking samples and for transferring 0.02 M HNO_3 solution into scintillation vial)
various	Eppendorf micropipets (fixed- or variable-volume; for adding HNO_3 or $NaHCO_3$ solutions to uranium solutions)
	scintillation vials
	weighing paper
	Na^+-clinoptilolite (CDV*100/200*UC*WA*HL*CPT*Naf)
	reagent grade $NaHCO_3$

	500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
4 L	0.1 m $NaNO_3$ stock solution
1000 ml	stock solution of 1.0 m HNO_3
1000 ml	stock solution of 0.1 m HNO_3
1000 ml	stock solution of 0.02 m HNO_3
500 ml	stock solution of 1.0 m $NaHCO_3$
500 ml	stock solution of 0.5 m $NaHCO_3$
500 ml	stock solution of 0.1 m $NaHCO_3$
500 ml	stock solution of 0.05 m $NaHCO_3$
	ultrapure water

PROCEDURE:

Note: In transferring uranium solutions, avoid using glass or polypropylene labware.

Solution B-IIB (1 bottle for each pH value)

- Initial ΣU = 500 ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO_3 or $NaHCO_3$
- Initial volume = 50 ml
- Ionic strength = 0.1 m $NaNO_3$
- Wt. zeolite to use = 0.100±0.001
- Initial $[Na^+]$ = 0.1 m $NaNO_3$ + $[NaHCO_3]$ added
- pCO_2 = atmospheric = $10^{-3.48}$ bar

a) Into each of 29 60-ml FEP bottle labeled B-IIB*pH*i* [where *i* is the approximate initial pH of the solution (see below)], tare 50 g of the 500 ppb uranium solution.

Into each of 10 60-ml FEP bottle labeled B-IIB-C*pH*i* [where *i* is 2, 4, 5, 5.5, 6, 6.5, 7, 7.5, 8, or 9.5, representing the approximate initial pH of the solution], tare 50 g of the 500 ppb uranium solution. These are control solutions to determine uranium loss to the container walls as a function of pH.

Transfer the remaining solution into a 60-ml FEP bottle labeled B-IIB*IU. Take two 0.5-ml samples from B-IIB*IU with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIB-IU*a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixture and save for later analysis of uranium concentration by liquid scintillation counting.

b) For each solution B-IIB*pH*i* and B-IIB-C*pH*i*:

Adjust the pH of each solution to the approximate value *i* by adding HNO_3 solution or $NaHCO_3$ solution with an Eppendorf micropipet. The concentration and approximate amount to be added is given in Table B-IIB-1. Swirl the solutions by hand. Record the

micropipet volume and concentration of solution added. *Do not measure the pH at this time.* Cover the bottles with a porous material (e.g., kimwipe) and place on gyratory shaker set to ~120 rpm. Leave the bottles on the shaker for about ten days to allow the solutions to reach equilibrium with atmospheric CO_2(g).

d) Measure and record the pH of each solution B-IIB*pH*i* and B-IIB-C*pH*i*. *Minimize the amount of time the glass electrode is in contact with the uranium solution. Make sure to rinse the electrode well before transferring into another solution.*

From each solution B-IIB*pH*i* and B-IIB-C*pH*i*, take 2 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIB*IU-ph*i*a (or b)] scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting. The measured concentrations are the initial values to be used in the calculation of sorption data.

e) Tare 0.100±0.001 gm of Na-clinoptilolite onto weighing paper, and carefully transfer into each of the B-IIB*pH*i* (**not** the B-IIB-C*pH*i*) bottles. Swirl each bottle by hand, replace the cover, then place on the shaker.

f) After equilibrium is reached (at least 10 days), take 2 0.5-ml samples from each bottle B-IIB*ph*i* and B-IIB-C*pH*i* with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIB-ph*i*a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of solutions B-IIB*pH*i* and B-IIB-C*pH*i*. Make sure to rinse the pH electrode very well before transferring into another solution.

g) Analyze the U concentration by liquid scintillation counting.

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Hold Point. Check quality of experimental data.

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f) If the analytical results are good, reversibility and reproducibility tests can be done by changing the pH of the solutions and re-equilibrating them at the new pH values.

Procedure for reversibility and reproducibility experiments will be written later.

PREPARATION:

1. Preclean:
   - 40 60-ml FEP bottles (to contain experimental mixtures, control solutions, and B-IIB-*IU)
   - 1 2000-ml teflon bottle (for preparation of 50 ppb U solution)

2. Prepare:

	500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
4 L	0.1 m $NaNO_3$ stock solution
1000 ml	stock solution of 1.0 m HNO_3
1000 ml	stock solution of 0.1 m HNO_3
1000 ml	stock solution of 0.02 m HNO_3
500 ml	stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml solution)
500 ml	stock solution of 0.5 M $NaHCO_3$ (21.003 in 500 ml solution)
500 ml	stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml solution)
500 ml	stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml solution)

The $NaHCO_3$ solutions should be prepared with *degassed* deionized water and kept in tightly-capped glass reagent bottles.

Table B-IIB-1. Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to 50 ml 0.1 m $NaNO_3$ solution containing 500 ppb U to result in pH values given in column-1. The amount of reagent to be added was estimated using EQ3 calculations.

Solution pH	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
2.00	0.567	1.0
2.25	0.300	1.0
2.50	0.151	1.0
2.75	0.067	1.0
3.00	0.205	0.1
Solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
3.25	0.118	0.05
3.50	0.207	0.1
3.75	0.291	0.1
4.00	0.338	0.1
4.25	0.364	0.1
4.50	0.379	0.1
4.75	0.388	0.1
5.00	0.393	0.1
5.25	0.396	0.1
5.50	0.398	0.1
5.75	0.400	0.1
6.00	0.403	0.1
6.25	0.406	0.1
6.50	0.411	0.1
6.75	0.420	0.1
7.00	0.436	0.1
7.25	0.464	0.1
7.50	0.514	0.1
7.75	0.121	0.5

Solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
8.00	0.153	0.5
8.25	0.212	0.5
8.50	0.320	0.5
8.75	0.264	1.0
9.00	0.473	1.0
[9.25]		
[9.50]	[2.04]	[1.0]

13 July 1993 EXPERIMENT B-IIB ID

Experiment B-IIB was begun by taring 60 g 500 ppb ^{233}U into 60 mL teflon bottles labeled B-IIB*pHi (i=2,9, ΔpH 0.25) or B-IIB-C*pHj (j=2,4,5.0,5.5,6,6.5,7,7.5,8,9.5). The solution was adjusted to the target pH using the data from table B-IIB-1 on page 44. The actual aq adjustments are given below.

TARGET pH	Adjustment MADE
2.00	0.570 mL, 1.0 M HNO_3
2.25	0.300 mL
2.50	0.150 mL
2.75	0.070 mL
3.00	0.210 mL, 0.1 M HNO_3
3.25	0.120 mL, 0.05 M $NaHCO_3$
3.50	0.210 mL, 0.1 M $NaHCO_3$
3.75	0.290 mL
4.00	0.340 mL
4.25	0.360 mL
4.50	0.370 mL
4.75	0.380 mL
5.00	0.390 mL
5.25	0.395 mL
5.50	0.400 mL
5.75	0.400 mL
6.00	0.405 mL
6.25	0.410 mL
6.50	0.415 mL
6.75	0.420 mL
7.00	0.440 mL
7.25	0.460 mL
7.50	0.510 mL
7.75	0.120 mL, 0.5 M $NaHCO_3$
8.00	0.150 mL

TARGET pH	ADJUSTMENT
8.25	0.210 mL, 0.5 M $NaHCO_3$
8.50	0.320 mL,
8.75	0.260 mL, 1.0 M $NaHCO_3$
9.00	0.470 mL
9.50	2.00 mL

The same adjustments were used for the experimental and control solutions.

2 500 µL samples of the initial solution were taken. The sample weights are given below.

	wt. vial	wt. vial + sample	wt. sample (g)
B-IIB*IV$_a$	7.8814	TSTD 8.3847	0.5033
IV$_b$	7.8149	8.3151	0.5002

All the solutions were covered with a Kimwipe and placed on a gyratory shaker set to ~120 rpm.

The TD 7/13/93 solution weights were noted, and the adjustment weights (1mL ≈ 1g) were added to take into account any dilution. The original weights, as well as adjustments are given in a table on the following page.

SOLUTION NAME	INITIAL WEIGHT	ADJUSTMENT WEIGHT	FINAL WEIGHT
B-IIB*pH2.00	49.73	0.570	50.300
B-IIB*pH2.25	50.22	0.300	50.520
B-IIB*pH2.50	50.21	0.150	50.360
B-IIB*pH2.75	50.03	0.070	50.100
B-IIB*pH3.00	50.17	0.210	50.380
B-IIB*pH3.25	49.97	0.120	50.090
B-IIB*pH3.50	49.81	0.210	50.020
B-IIB*pH3.75	50.18	0.290	50.470
B-IIB*pH4.00	49.76	0.340	50.100
B-IIB*pH4.25	49.88	0.360	50.240
B-IIB*pH4.50	49.88	0.370	50.250
B-IIB*pH4.75	50.21	0.380	50.590
B-IIB*pH5.00	49.90	0.390	50.290
B-IIB*pH5.25	50.09	0.395	50.485
B-IIB*pH5.50	50.12	0.400	50.520
B-IIB*pH5.75	49.95	0.400	50.350
B-IIB*pH6.00	49.95	0.405	50.355
B-IIB*pH6.25	50.06	0.410	50.470
B-IIB*pH6.50	49.94	0.415	50.355
B-IIB*pH6.75	49.94	0.420	50.360
B-IIB*pH7.00	50.06	0.440	50.500
B-IIB*pH7.25	49.87	0.460	50.330
B-IIB*pH7.50	49.70	0.510	50.210
B-IIB*pH7.75	49.79	0.120	49.910
B-IIB*pH8.00	49.76	0.150	49.910
B-IIB*pH8.25	50.18	0.210	50.390
B-IIB*pH8.50	50.20	0.320	50.520
B-IIB*pH8.75	50.05	0.260	50.310
B-IIB*pH9.00	49.65	0.470	50.120
B-IIB-C*pH2.0	50.04	0.570	50.610
B-IIB-C*pH4.0	50.11	0.340	50.450
B-IIB-C*pH5.0	50.03	0.390	50.420
B-IIB-C*pH5.5	49.61	0.400	50.010
B-IIB-C*pH6.0	50.04	0.405	50.445
B-IIB-C*pH6.5	50.17	0.415	50.585
B-IIB-C*pH7.0	49.99	0.440	50.430
B-IIB-C*pH7.5	50.10	0.510	50.610
B-IIB-C*pH8.0	50.04	0.150	50.190
B-IIB-C*pH9.5	49.62	2.000	51.620

NOTE: ALL WEIGHTS ARE IN GRAMS.

15 July 1993 TD

2000 g 1.1 m $NaNO_3$ was prepared by dissolving 93.49 g $NaNO_3$ in 1000 g H_2O (2 solns prepared in this manner)

Wt. $NaNO_3$ used: (1) 93.50 g
(2) 93.50 g

lot # 7808 KCCL

16 July 1993 EXPERIMENT B-IB, REVERSE

Reversibility experiments:

h) Prior to starting the reverse experiments, take 2 0.5-ml samples from each bottle B-IB*ph*i* listed in Table B-IB-2 and **all** B-IB-C*pH*i* solutions using Eppendorf pipets, transfer into pre-labeled [e.g., B-IB**R**-ph*i**a, B-IB**R**-C*pH*i**a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of those solutions. Make sure to rinse the pH electrode very well before transferring into another solution.

i) Adjust the pH of the solutions B-IB*ph*i* listed in Table B-IB-2 up or down by about 1 pH unit by adding HNO_3 or $NaHCO_3$ solutions in the amounts given in the table. Swirl each bottle by hand, replace the cover, then place on the gyratory shaker.

j) After equilibrium is reached (at least 10 days), take 2 0.5-ml samples from each solution in step (h) using Eppendorf pipets, transfer into pre-labeled [e.g., B-IB**R**-ph*i**a, B-IB**R**-C*pH*i**a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of those solutions. Make sure to rinse the pH electrode very well before transferring into another solution.

k) Analyze the U concentration by liquid scintillation counting.

Table B-IB-2. For reverse experiments: Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to remaining 0.1 m $NaNO_3$ solution containing 50 ppb U to decrease or increase the pH by 1 unit. The amount of reagent to be added was estimated using EQ3 calculations.

Mixture Label	Equilibrium pH (end of forward expt.)	Volume of HNO_3 needed, ml	Molarity of HNO_3 solution to use
B-IB*pH3.00	2.97	0.546	1.0
B-IB*pH4.00	4.12	0.543	0.1
B-IB*pH4.50	4.69	0.172	0.1
B-IB*pH5.00	5.17	0.055	0.1
B-IB*pH5.50	5.42	0.091	0.02
B-IB*pH6.00	5.61	0.044	0.02
B-IB*pH6.25	5.89	0.044	0.02
Mixture Label	Equilibrium pH (end of forward expt.)	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
B-IB*pH6.50	6.07	0.102	0.1
B-IB*pH6.75	6.36	0.182	0.1
B-IB*pH7.00	6.60	0.328	0.1
B-IB*pH7.50	7.16	0.109	1.0

19 July 1993 TD

The liquid scintillation analysis of the B-IIIB solutions has completed. The raw data, as well as the results of the calculations follow.

```
Protocol #: 6       Name:U-233 5% 2 Sigma          15-Jul-93   18:31
Region A: LL-UL= 0.0-100.  Lcr=   0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=   0  Bkg= 0.00  %2 Sigma=5.00
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 5% 2 sigma error for 5 ppb U-233 experiments
```

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	545.28	18.92	1.97	2.936	5.00	27.71	1.63	132.88	B
2	26.86	0.00	0.00	56.669	5.26	56.76	6.30	700.16	
3	26.45	0.67	263.2	57.555	5.26	58.68	6.21	688.74	
4	26.47	1.37	130.5	57.510	5.26	60.69	6.07	678.17	
5	26.29	0.64	277.4	57.924	5.26	58.82	6.22	687.48	
6	26.08	0.00	0.00	58.414	5.26	58.22	6.28	691.01	
7	26.85	0.00	0.00	56.654	5.27	55.57	6.39	705.25	
8	26.48	2.01	90.53	57.525	5.26	60.39	6.09	666.72	
9	25.36	0.00	0.00	60.195	5.25	60.85	6.19	694.49	
10	27.69	0.00	0.00	54.883	5.27	54.88	6.35	698.46	
11	26.81	0.00	0.00	56.743	5.27	56.77	6.30	693.92	
12	27.87	0.00	0.00	54.473	5.28	54.63	6.35	692.87	
13	27.16	0.53	329.8	55.974	5.27	57.27	6.23	687.80	
14	28.25	0.41	411.2	53.843	5.27	54.62	6.31	677.44	
15	28.12	0.00	0.00	53.963	5.28	52.62	6.48	708.54	
16	29.54	0.52	322.4	51.262	5.29	52.45	6.34	684.05	
17	29.82	0.00	0.00	50.786	5.29	50.49	6.48	691.69	
18	31.53	0.00	0.00	47.809	5.32	47.83	6.54	689.92	
19	31.11	0.00	0.00	48.494	5.31	47.86	6.58	702.86	
20	38.29	0.00	0.00	38.850	5.39	39.46	6.81	692.66	
21	40.25	0.00	0.00	36.815	5.41	37.06	6.95	695.27	
22	46.68	0.00	0.00	31.340	5.49	29.98	7.57	718.52	
23	50.64	0.00	0.00	28.659	5.54	28.01	7.66	706.31	
24	75.73	0.43	250.5	18.192	5.86	18.48	8.80	673.69	
25	76.13	0.92	118.2	18.081	5.87	19.54	8.39	665.47	
26	108.57	0.00	0.00	11.801	6.37	11.99	10.77	708.74	
27	101.85	0.05	1740.	12.783	6.25	13.05	10.29	688.62	
28	126.78	0.36	238.5	9.684	6.69	10.46	11.35	675.73	
29	129.63	0.00	0.00	9.407	6.74	8.98	12.86	730.11	
30	127.42	0.15	580.6	9.629	6.70	10.66	11.13	683.40	
31	122.02	0.33	267.7	10.176	6.60	11.12	10.93	673.74	
32	130.97	0.00	0.00	9.280	6.77	9.07	12.70	731.63	
33	127.70	0.00	0.00	9.593	6.71	9.19	12.69	748.28	
34	165.86	0.07	1090.	6.717	7.51	7.34	13.95	696.09	
35	149.38	0.00	0.00	7.782	7.14	8.10	13.31	701.39	
36	182.76	0.00	0.00	5.819	7.93	6.27	15.52	710.82	
37	175.25	0.62	123.9	6.194	7.74	7.03	14.20	633.95	
38	161.89	0.16	489.3	6.966	7.41	7.81	13.32	687.66	
39	167.42	0.11	670.3	6.651	7.53	7.09	14.35	690.88	
40	179.25	0.92	82.60	5.990	7.84	7.46	13.32	627.15	
41	186.01	0.00	0.00	5.671	8.02	5.89	16.34	719.39	
42	134.73	0.00	0.00	8.939	6.84	9.06	12.56	705.35	
43	124.80	0.00	0.00	9.884	6.65	9.93	11.96	704.00	
44	96.15	0.41	237.4	13.705	6.16	14.73	9.53	679.29	
45	99.54	0.00	0.00	13.138	6.22	12.04	11.15	750.11	
46	73.92	0.00	0.00	18.709	5.84	17.95	9.11	731.87	
47	71.37	0.00	0.00	19.496	5.80	19.04	8.82	710.75	
48	49.91	0.00	0.00	29.122	5.53	29.91	7.34	698.64	
49	47.60	0.00	0.00	30.677	5.50	30.61	7.38	698.43	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	34.06	0.00	0.00	44.040	5.34	43.78	6.70	707.15	
51	33.84	0.65	241.8	44.375	5.34	45.25	6.57	682.93	
52	28.43	1.91	91.81	53.483	5.28	56.46	6.15	670.87	
53	28.59	0.46	365.1	53.062	5.28	54.20	6.30	694.40	
54	28.86	0.07	2275.	52.677	5.28	53.99	6.29	693.34	
55	27.18	0.00	0.00	55.931	5.27	56.03	6.32	703.37	
56	26.24	1.13	158.1	58.078	5.26	60.17	6.13	687.30	
57	26.35	0.00	0.00	57.823	5.26	57.79	6.28	712.28	
58	26.75	0.00	0.00	56.877	5.26	55.88	6.38	723.63	
59	26.04	0.00	0.00	58.508	5.26	59.04	6.23	698.86	
60	26.13	0.03	6076.	58.296	5.26	58.40	6.27	698.08	
61	27.02	1.14	154.1	56.279	5.27	57.74	6.21	685.49	
62	29.69	0.82	203.4	50.954	5.30	51.88	6.37	692.79	
63	27.11	0.04	3830.	56.083	5.27	57.79	6.20	700.75	
64	42.70	1.01	139.6	34.535	5.44	35.75	6.94	680.86	
65	44.32	1.35	104.2	33.165	5.46	35.10	6.90	670.92	
66	59.88	0.11	1117.	23.784	5.65	24.34	7.88	696.70	
67	56.38	1.73	73.17	25.443	5.61	27.95	7.29	654.28	
68	70.72	0.00	0.00	19.688	5.79	19.37	8.74	713.97	
69	68.63	0.00	0.00	20.392	5.76	20.69	8.40	704.65	
70	57.65	0.00	0.00	24.818	5.62	25.25	7.80	712.53	
71	55.35	0.00	0.00	25.971	5.59	25.12	7.98	732.32	
72	37.15	0.00	0.00	40.213	5.37	40.17	6.82	705.23	
73	37.61	0.00	0.00	39.632	5.38	40.25	6.77	714.46	
74	29.44	0.00	0.00	51.412	5.29	50.79	6.49	714.32	
75	28.83	0.00	0.00	52.596	5.28	52.72	6.39	704.12	
76	27.94	0.00	0.00	54.365	5.28	54.50	6.35	698.73	
77	26.85	0.49	355.9	56.729	5.26	58.02	6.21	688.06	
78	26.23	0.00	0.00	58.063	5.26	57.04	6.35	704.04	
79	27.49	0.00	0.00	55.267	5.27	55.70	6.31	713.45	

SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IIIB*pH2.00*A	56.669	0.5026	112.7517	1.3038E+13	2.1648E-11	5.0447	
3	B-IIIB*pH2.00*B	57.555	0.4978	115.6187	1.3370E+13	2.2198E-11	5.1730	5.1089
4	B-IIIB*pH2.25*A	57.510	0.5023	114.4933	1.3240E+13	2.1982E-11	5.1227	
5	B-IIIB*pH2.25*B	57.924	0.5023	115.3175	1.3335E+13	2.2140E-11	5.1595	5.1411
6	B-IIIB*pH2.50*A	58.414	0.5020	116.3625	1.3456E+13	2.2341E-11	5.2063	
7	B-IIIB*pH2.50*B	56.654	0.5016	112.9466	1.3061E+13	2.1685E-11	5.0535	5.1299
8	B-IIIB*pH2.75*A	57.525	0.5019	114.6145	1.3254E+13	2.2005E-11	5.1281	
9	B-IIIB*pH2.75*B	60.195	0.5009	120.1737	1.3897E+13	2.3073E-11	5.3768	5.2525
10	B-IIIB*pH3.00*A	54.883	0.5032	109.0680	1.2612E+13	2.0940E-11	4.8799	
11	B-IIIB*pH3.00*B	56.743	0.5015	113.1466	1.3084E+13	2.1723E-11	5.0624	4.9712
12	B-IIIB*pH3.25*A	54.473	0.5022	108.4687	1.2543E+13	2.0825E-11	4.8531	
13	B-IIIB*pH3.25*B	55.974	0.5007	111.7915	1.2927E+13	2.1463E-11	5.0018	4.9275
14	B-IIIB*pH3.50*A	53.843	0.5016	107.3425	1.2413E+13	2.0609E-11	4.8027	
15	B-IIIB*pH3.50*B	53.963	0.5019	107.5174	1.2433E+13	2.0643E-11	4.8106	4.8066
16	B-IIIB*pH3.75*A	51.262	0.5023	102.0545	1.1801E+13	1.9594E-11	4.5661	
17	B-IIIB*pH3.75*B	50.786	0.5012	101.3288	1.1717E+13	1.9454E-11	4.5337	4.5499
18	B-IIIB*pH4.00*A	47.809	0.5008	95.4653	1.1039E+13	1.8329E-11	4.2713	
19	B-IIIB*pH4.00*B	48.494	0.5026	96.4863	1.1157E+13	1.8525E-11	4.3170	4.2942
20	B-IIIB*pH4.25*A	38.850	0.5001	77.6845	8.9833E+12	1.4915E-11	3.4758	
21	B-IIIB*pH4.25*B	36.815	0.4998	73.6595	8.5178E+12	1.4142E-11	3.2957	3.3857
22	B-IIIB*pH4.50*A	31.340	0.5007	62.5924	7.2380E+12	1.2017E-11	2.8005	
23	B-IIIB*pH4.50*B	28.659	0.5006	57.2493	6.6202E+12	1.0991E-11	2.5615	2.6810
24	B-IIIB*pH4.75*A	18.192	0.5042	36.0809	4.1723E+12	6.9273E-12	1.6143	
25	B-IIIB*pH4.75*B	18.081	0.5013	36.0682	4.1708E+12	6.9249E-12	1.6138	1.6141
26	B-IIIB*pH5.00*A	11.801	0.5013	23.5408	2.7222E+12	4.5197E-12	1.0533	
27	B-IIIB*pH5.00*B	12.783	0.5045	25.3380	2.9300E+12	4.8647E-12	1.1337	1.0935
28	B-IIIB*pH5.25*A	9.864	0.5023	19.6377	2.2709E+12	3.7703E-12	0.8786	
29	B-IIIB*pH5.25*B	9.407	0.5013	18.7652	2.1700E+12	3.6028E-12	0.8396	0.8591
30	B-IIIB*pH5.50*A	9.629	0.5020	19.1813	2.2181E+12	3.6827E-12	0.8582	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
31	B-IIIB*pH5.50*B	10.176	0.5020	20.2709	2.3441E+12	3.8919E-12	0.9070	0.8826
32	B-IIIB*pH5.75*A	9.280	0.5103	18.1854	2.1029E+12	3.4915E-12	0.8137	
33	B-IIIB*pH5.75*B	9.593	0.5066	18.9360	2.1897E+12	3.6356E-12	0.8472	0.8304
34	B-IIIB*pH6.00*A	6.717	0.4588	14.6404	1.6930E+12	2.8109E-12	0.6550	
35	B-IIIB*pH6.00*B	7.782	0.5012	15.5267	1.7955E+12	2.9810E-12	0.6947	0.6749
36	B-IIIB*pH6.25*A	5.819	0.5025	11.5801	1.3391E+12	2.2233E-12	0.5181	
37	B-IIIB*pH6.25*B	6.194	0.5036	12.2994	1.4223E+12	2.3614E-12	0.5503	0.5342
38	B-IIIB*pH6.50*A	6.966	0.5038	13.8269	1.5989E+12	2.6547E-12	0.6186	
39	B-IIIB*pH6.50*B	6.651	0.5019	13.2516	1.5324E+12	2.5442E-12	0.5929	0.6058
40	B-IIIB*pH6.75*A	5.990	0.4960	12.0766	1.3965E+12	2.3186E-12	0.5403	
41	B-IIIB*pH6.75*B	5.671	0.5010	11.3194	1.3089E+12	2.1732E-12	0.5065	0.5234
42	B-IIIB*pH7.00*A	8.939	0.5024	17.7926	2.0575E+12	3.4161E-12	0.7961	
43	B-IIIB*pH7.00*B	9.884	0.5020	19.6892	2.2768E+12	3.7802E-12	0.8809	0.8385
44	B-IIIB*pH7.25*A	13.705	0.5018	27.3117	3.1583E+12	5.2437E-12	1.2220	
45	B-IIIB*pH7.25*B	13.138	0.4994	26.3076	3.0421E+12	5.0509E-12	1.1771	1.1995
46	B-IIIB*pH7.50*A	18.709	0.5040	37.1210	4.2926E+12	7.1270E-12	1.6609	
47	B-IIIB*pH7.50*B	19.496	0.5023	38.8135	4.4883E+12	7.4519E-12	1.7366	1.6987
48	B-IIIB*pH7.75*A	29.122	0.5039	57.7932	6.6831E+12	1.1096E-11	2.5858	
49	B-IIIB*pH7.75*B	30.677	0.5005	61.2927	7.0877E+12	1.1768E-11	2.7424	2.6641
50	B-IIIB*pH8.00*A	44.040	0.5013	87.8516	1.0159E+13	1.6867E-11	3.9307	
51	B-IIIB*pH8.00*B	44.375	0.5016	88.4669	1.0230E+13	1.6985E-11	3.9582	3.9444
52	B-IIIB*pH8.25*A	53.483	0.5008	106.7951	1.2350E+13	2.0504E-11	4.7782	
53	B-IIIB*pH8.25*B	53.062	0.4994	106.2515	1.2287E+13	2.0400E-11	4.7539	4.7661
54	B-IIIB*pH8.50*A	52.677	0.4886	107.8121	1.2467E+13	2.0699E-11	4.8237	
55	B-IIIB*pH8.50*B	55.931	0.5024	111.3276	1.2874E+13	2.1374E-11	4.9810	4.9024
56	B-IIIB*pH8.75*A	58.078	0.5027	115.5321	1.3360E+13	2.2181E-11	5.1691	
57	B-IIIB*pH8.75*B	57.823	0.5230	110.5602	1.2785E+13	2.1227E-11	4.9467	5.0579
58	B-IIIB*pH9.00*A	56.877	0.5033	113.0081	1.3068E+13	2.1697E-11	5.0562	
59	B-IIIB*pH9.00*B	58.508	0.5026	116.4107	1.3461E+13	2.2350E-11	5.2085	5.1323

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
60	B-IIIB-C*pH2.0*A	58.296	0.5045	115.5520	1.3362E+13	2.2185E-11	5.1700	
61	B-IIIB-C*pH2.0*B	56.279	0.4996	112.6481	1.3026E+13	2.1628E-11	5.0401	5.1051
62	B-IIIB-C*pH4.0*A	50.954	0.5024	101.4212	1.1728E+13	1.9472E-11	4.5378	
63	B-IIIB-C*pH4.0*B	56.083	0.5016	111.8082	1.2929E+13	2.1466E-11	5.0025	4.7702
64	B-IIIB-C*pH5.0*A	34.535	0.5044	68.4675	7.9174E+12	1.3145E-11	3.0634	
65	B-IIIB-C*pH5.0*B	33.165	0.5005	66.2637	7.6626E+12	1.2722E-11	2.9648	3.0141
66	B-IIIB-C*pH5.5*A	23.784	0.5017	47.4068	5.4820E+12	9.1018E-12	2.1211	
67	B-IIIB-C*pH5.5*B	25.443	0.5014	50.7439	5.8679E+12	9.7425E-12	2.2704	2.1957
68	B-IIIB-C*pH6.0*A	19.688	0.5023	39.1957	4.5325E+12	7.5253E-12	1.7537	
69	B-IIIB-C*pH6.0*B	20.392	0.5007	40.7270	4.7096E+12	7.8193E-12	1.8222	1.7880
70	B-IIIB-C*pH6.5*A	24.818	0.5003	49.6062	5.7364E+12	9.5241E-12	2.2195	
71	B-IIIB-C*pH6.5*B	25.971	0.5001	51.9316	6.0053E+12	9.9705E-12	2.3235	2.2715
72	B-IIIB-C*pH7.0*A	40.213	0.5003	80.3778	9.2947E+12	1.5432E-11	3.5963	
73	B-IIIB-C*pH7.0*B	39.632	0.5000	79.2640	9.1659E+12	1.5218E-11	3.5464	3.5714
74	B-IIIB-C*pH7.5*A	51.412	0.5026	102.2921	1.1829E+13	1.9639E-11	4.5768	
75	B-IIIB-C*pH7.5*B	52.596	0.4997	105.2552	1.2171E+13	2.0208E-11	4.7093	4.6430
76	B-IIIB-C*pH8.0*A	54.365	0.5021	108.2752	1.2521E+13	2.0788E-11	4.8445	
77	B-IIIB-C*pH8.0*B	56.729	0.4974	114.0511	1.3189E+13	2.1897E-11	5.1029	4.9737
78	B-IIIB-C*pH9.5*A	58.063	0.5043	115.1358	1.3314E+13	2.2105E-11	5.1514	
79	B-IIIB-C*pH9.5*B	55.267	0.5032	109.8311	1.2701E+13	2.1087E-11	4.9141	5.0327

6/14/94 TD VERIFICATION OF CALCULATIONS ON THIS PAGE AND THE PRECEEDING PAGE ARE ON p143-148 OF THIS BOOK.

TD 20 July 1993 Experiment B-IB, REVERSE

The reverse experiments were begun, according to the procedure on page 48. 2 500µL TD Triplets were samples were taken and acidified after the pH was measured. The pH of each solution was adjusted up or down using Table B-IB-2. The pH and sample weights are given below. The solutions were covered with a kimwipe and placed on a gyratory shaker

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)	pH T (C)	ADJUSTMENT
B-IBR*pH3.00*IUA	7.9067	8.4057	0.4990	3.08	**1.0M HNO3**
B-IBR*pH3.00*IUB	7.9022	8.4022	0.5000	22.7	0.55
B-IBR*pH4.00*IUA	7.8390	8.3400	0.5010	4.23	**0.1M HNO3**
B-IBR*pH4.00*IUB	7.8569	8.3566	0.4997	22.8	0.54
B-IBR*pH4.50*IUA	7.8762	8.3766	0.5004	4.79	
B-IBR*pH4.50*IUB	7.9971	8.4955	0.4984	22.8	0.17
B-IBR*pH5.00*IUA	7.8554	8.3572	0.5018	5.23	
B-IBR*pH5.00*IUB	7.8627	8.3629	0.5002	22.8	0.06
B-IBR*pH5.50*IUA	7.8689	8.3701	0.5012	5.41	**0.02M HNO3**
B-IBR*pH5.50*IUB	7.8832	8.3829	0.4997	22.8	0.09
B-IBR*pH6.00*IUA	7.9386	8.4392	0.5006	5.49	
B-IBR*pH6.00*IUB	7.8588	8.3589	0.5001	22.9	0.04
B-IBR*pH6.25*IUA	7.8651	8.3652	0.5001	5.84	
B-IBR*pH6.25*IUB	7.8776	8.3779	0.5003	23.0	0.04
B-IBR*pH6.50*IUA	7.8532	8.3560	0.5028	5.82	**0.1m NaHCO3**
B-IBR*pH6.50*IUB	7.8683	8.3703	0.5020	23.0	0.10
B-IBR*pH6.75*IUA	7.8892	8.3897	0.5005	6.27	
B-IBR*pH6.75*IUB	7.8427	8.3421	0.4994	23.0	0.18
B-IBR*pH7.00*IUA	7.8389	8.3387	0.4998	6.62	
B-IBR*pH7.00*IUB	7.8738	8.3751	0.5013	23.0	0.33
B-IBR*pH7.50*IUA	7.9091	8.4084	0.4993	7.20	**1.0m NaHCO3**
B-IBR*pH7.50*IUB	7.8502	8.3461	0.4959	23.1	0.11
B-IBR-C*pH2.0*IUA	7.8919	8.3934	0.5015	1.89	
B-IBR-C*pH2.0*IUB	7.9091	8.4133	0.5042	23.1	
B-IBR-C*pH4.0*IUA	7.9112	8.4143	0.5031	3.82	
B-IBR-C*pH4.0*IUB	7.8614	8.3612	0.4998	23.2	
B-IBR-C*pH5.0*IUA	7.8444	8.3477	0.5033	4.75	
B-IBR-C*pH5.0*IUB	7.8701	8.3706	0.5005	23.2	
B-IBR-C*pH5.5*IUA	7.8627	8.3655	0.5028	4.88	
B-IBR-C*pH5.5*IUB	7.8238	8.3225	0.4987	23.2	
B-IBR-C*pH6.0*IUA	7.8872	8.3867	0.4995	5.31	
B-IBR-C*pH6.0*IUB	7.8741	8.3906	0.5165	23.2	
B-IBR-C*pH6.5*IUA	7.7729	8.2747	0.5018	5.87	
B-IBR-C*pH6.5*IUB	7.8763	8.3763	0.5000	23.2	
B-IBR-C*pH7.0*IUA	7.9105	8.4100	0.4995	6.65	
B-IBR-C*pH7.0*IUB	7.8938	8.3919	0.4981	23.3	
B-IBR-C*pH7.5*IUA	7.8691	8.3693	0.5002	7.12	
B-IBR-C*pH7.5*IUB	7.8691	8.3666	0.4975	23.4	
B-IBR-C*pH8.0*IUA	7.8218	8.3199	0.4981	7.62	
B-IBR-C*pH8.0*IUB	7.8772	8.3744	0.4972	23.4	
B-IBR-C*pH9.5*IUA	7.8958	8.4014	0.5056	9.43	
B-IBR-C*pH9.5*IUB	7.8736	8.3746	0.5010	23.4	

The samples will be counted using L.S. and this will be used as the initial concentrations.

EXPERIMENT B-III B, REVERSE.

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If the analytical results are good, reversibility tests can be done by changing the pH of the solutions and re-equilibrating them at the new pH values.

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Reversibility experiments:

h) Prior to starting the reverse experiments, take 2 0.5-ml samples from each bottle B-IIIB*ph*i* listed in Table B-IIIB-2 and **all** B-IIIB-C*pH*i* solutions using Eppendorf pipets, transfer into pre-labeled [e.g., B-IIIB**R**-ph*i**a, B-IIIB**R**-C*pH*i**a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of those solutions. Make sure to rinse the pH electrode very well before transferring into another solution.

i) Adjust the pH of the solutions B-IIIB*ph*i* listed in Table B-IIIB-2 up or down by about 1 pH unit by adding HNO_3 or $NaHCO_3$ solutions in the amounts given in the table. Swirl each bottle by hand, replace the cover, then place on the gyratory shaker.

j) After equilibrium is reached (at least 10 days), take 2 0.5-ml samples from each solution in step (h) using Eppendorf pipets, transfer into pre-labeled [e.g., B-IIIB**R**-ph*i**a, B-IIIB**R**-C*pH*i**a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of those solutions. Make sure to rinse the pH electrode very well before transferring into another solution.

k) Analyze the U concentration by liquid scintillation counting.

Table B-IIIB-2. For reverse experiments: Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to remaining 0.1 m $NaNO_3$ solution containing 5 ppb U to decrease or increase the pH by 1 unit. The amount of reagent to be added was estimated using EQ3 calculations.

Mixture Label	Equilibrium pH (end of forward expt.)	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
B-IIIB*pH3.00		0.546	1.0
B-IIIB*pH4.00		0.543	0.1
B-IIIB*pH4.50		0.172	0.1
B-IIIB*pH5.00		0.055	0.1
B-IIIB*pH5.50		0.091	0.02
B-IIIB*pH6.00		0.044	0.02
B-IIIB*pH6.25		0.044	0.02
Mixture Label	Equilibrium pH (end of forward expt.)	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
B-IIIB*pH6.50		0.102	0.1
B-IIIB*pH6.75		0.182	0.1
B-IIIB*pH7.00		0.328	0.1
B-IIIB*pH7.50		0.109	1.0

The B-IIIB reverse experiments were begun, according to the procedure on page 53. 2 500 µL samples of each solution were taken, and prepared for Liquid Scintillation Analysis. The pH was also measured. The sample weights and pH follow. The solutions' pH was adjusted according to B-I TD 7/20/93 Table B-IIIB-2. The solutions were covered with a kimwipe and returned to the gyratory shaker.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)	pH T (C)	ADJUSTMENT
B-IIIBR*pH3.00*IUA	7.8969	8.3881	0.4912	3.07	**1.0M HNO3**
B-IIIBR*pH3.00*IUB	7.9044	8.4037	0.4993	23.5	0.55
B-IIIBR*pH4.00*IUA	7.9070	8.4061	0.4991	4.23	**0.1M HNO3**
B-IIIBR*pH4.00*IUB	7.8586	8.3574	0.4988	23.5	0.54
B-IIIBR*pH4.50*IUA	7.8816	8.3815	0.4999	4.67	
B-IIIBR*pH4.50*IUB	7.8424	8.3395	0.4971	23.5	0.17
B-IIIBR*pH5.00*IUA	7.8531	8.3557	0.5026	5.12	
B-IIIBR*pH5.00*IUB	7.7979	8.2962	0.4983	23.6	0.06
B-IIIBR*pH5.50*IUA	7.8513	8.3479	0.4966	5.36	**0.02M HNO3**
B-IIIBR*pH5.50*IUB	7.8293	8.3294	0.5001	23.6	0.09
B-IIIBR*pH6.00*IUA	7.8360	8.3361	0.5001	5.58	
B-IIIBR*pH6.00*IUB	7.8865	8.3852	0.4987	23.6	0.04
B-IIIBR*pH6.25*IUA	7.8033	8.3032	0.4999	5.77	
B-IIIBR*pH6.25*IUB	7.8375	8.3354	0.4979	23.7	0.04
B-IIIBR*pH6.50*IUA	7.8774	8.3772	0.4998	6.09	**0.1m NaHCO3**
B-IIIBR*pH6.50*IUB	7.8305	8.3286	0.4981	23.7	0.10
B-IIIBR*pH6.75*IUA	7.8596	8.3585	0.4989	6.37	
B-IIIBR*pH6.75*IUB	7.8219	8.3195	0.4976	23.7	0.18
B-IIIBR*pH7.00*IUA	7.8988	8.3967	0.4979	6.47	
B-IIIBR*pH7.00*IUB	7.8282	8.3260	0.4978	23.8	0.33
B-IIIBR*pH7.50*IUA	7.8856	8.3850	0.4994	7.24	**1.0m NaHCO3**
B-IIIBR*pH7.50*IUB	7.8723	8.3703	0.4980	23.8	0.11
B-IIIBR-C*pH2.0*IUA	7.8619	8.3605	0.4986	1.91	
B-IIIBR-C*pH2.0*IUB	7.8538	8.3526	0.4988	23.9	
B-IIIBR-C*pH4.0*IUA	7.8479	8.3446	0.4967	3.9	
B-IIIBR-C*pH4.0*IUB	7.8775	8.3742	0.4967	23.9	
B-IIIBR-C*pH5.0*IUA	7.8544	8.3527	0.4983	4.65	
B-IIIBR-C*pH5.0*IUB	7.8750	8.3723	0.4973	23.9	
B-IIIBR-C*pH5.5*IUA	7.8711	8.3691	0.4980	4.88	
B-IIIBR-C*pH5.5*IUB	7.8094	8.3077	0.4983	23.9	
B-IIIBR-C*pH6.0*IUA	7.8062	8.3055	0.4993	5.03	
B-IIIBR-C*pH6.0*IUB	7.8959	8.3926	0.4967	24.0	
B-IIIBR-C*pH6.5*IUA	7.9108	8.4114	0.5006	5.77	
B-IIIBR-C*pH6.5*IUB	7.8504	8.3507	0.5003	24.0	
B-IIIBR-C*pH7.0*IUA	7.8997	8.3977	0.4980	6.68	
B-IIIBR-C*pH7.0*IUB	7.8899	8.3912	0.5013	24.0	
B-IIIBR-C*pH7.5*IUA	7.8879	8.3871	0.4992	7.23	
B-IIIBR-C*pH7.5*IUB	7.8648	8.3621	0.4973	24.1	
B-IIIBR-C*pH8.0*IUA	7.9065	8.4062	0.4997	7.72	
B-IIIBR-C*pH8.0*IUB	7.9015	8.4016	0.5001	24.1	
B-IIIBR-C*pH9.5*IUA	7.8613	8.3592	0.4979	9.37	
B-IIIBR-C*pH9.5*IUB	7.8512	8.3471	0.4959	24.2	

26 July 1993 Experiment B-IB, Reverse

The liquid Scintillation Analysis of the B-IB reverse solution's Initial Uranium concentrations has finished. The Raw data & calculation results follow.

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
111	4.09	3.64	129.0	1084.65	3.01	1089.99	3.03	687.28	
112	3.98	5.52	89.77	1114.22	3.01	1122.40	3.03	687.86	
113	3.94	2.22	209.1	1125.05	3.01	1127.74	3.04	691.00	
114	3.97	0.00	0.00	1116.27	3.01	1115.73	3.04	694.28	
115	4.02	6.03	82.70	1102.35	3.01	1108.47	3.03	686.36	
116	3.92	3.34	142.6	1130.81	3.01	1136.19	3.03	688.62	
117	4.03	3.73	127.1	1101.10	3.01	1107.14	3.03	688.89	
118	3.82	2.09	224.2	1160.75	3.01	1164.57	3.03	690.22	
119	3.99	3.20	147.0	1114.17	3.00	1120.27	3.03	687.23	
120	3.94	8.56	61.70	1124.80	3.01	1134.34	3.03	683.18	
121	3.86	3.17	150.9	1149.21	3.01	1155.84	3.03	689.56	
122	3.95	5.71	87.52	1122.45	3.01	1128.10	3.03	685.57	
123	4.06	0.85	516.9	1092.20	3.01	1092.59	3.04	688.22	
124	3.94	4.75	103.1	1127.34	3.01	1134.34	3.03	688.15	
125	3.86	4.47	110.2	1148.43	3.01	1153.76	3.03	687.38	
126	3.93	6.34	79.98	1130.98	3.00	1139.58	3.03	686.61	
127	3.84	4.33	113.7	1155.47	3.01	1161.48	3.03	688.19	
128	3.76	2.69	178.1	1179.33	3.01	1183.60	3.03	688.99	
129	3.89	5.06	98.19	1139.30	3.01	1145.42	3.03	687.41	
130	3.89	0.69	653.7	1140.32	3.01	1138.48	3.04	689.04	
131	3.89	0.00	0.00	1140.07	3.01	1141.05	3.04	687.59	
132	3.91	3.40	140.6	1133.71	3.01	1137.37	3.04	692.01	
(1 missing vial)									
134	3.88	5.63	89.31	1144.56	3.01	1151.28	3.03	687.91	
135	3.94	1.20	376.6	1126.32	3.01	1131.04	3.03	690.13	
136	3.91	0.00	0.00	1134.48	3.01	1135.33	3.04	690.43	
137	3.88	1.25	364.1	1142.50	3.01	1145.35	3.04	690.16	
(3 missing vials)									
141	4.18	4.36	108.4	1062.43	3.01	1067.83	3.03	690.61	
142	4.19	3.11	147.6	1057.74	3.01	1063.31	3.04	691.52	
143	4.22	1.77	250.8	1050.43	3.01	1054.60	3.04	691.28	
144	4.26	2.04	217.4	1041.95	3.01	1047.02	3.03	691.41	
(1 missing vial)									
146	4.09	7.80	65.55	1085.14	3.01	1093.42	3.03	690.47	
147	3.97	5.83	85.60	1118.79	3.01	1127.57	3.03	691.49	
148	4.12	9.79	53.93	1076.25	3.01	1089.86	3.02	690.95	
149	4.15	6.69	74.26	1070.61	3.00	1080.09	3.03	692.84	
(13 missing vials)									
163	8.15	3.97	84.55	542.278	3.02	547.48	3.07	692.63	
164	7.91	0.00	0.00	558.826	3.02	557.11	3.09	696.21	
165	9.07	0.11	2565.	487.397	3.02	486.78	3.10	692.63	
166	9.19	2.48	123.5	480.775	3.02	481.69	3.09	695.10	
167	11.58	0.93	284.1	380.644	3.02	382.00	3.12	694.97	
168	11.18	0.00	0.00	394.374	3.02	394.80	3.12	692.34	
169	16.35	1.58	142.8	268.928	3.03	269.94	3.17	705.62	
170	16.25	1.89	120.6	270.417	3.03	272.39	3.16	690.51	
171	20.11	0.00	0.00	217.963	3.04	217.00	3.22	696.83	
172	19.45	0.74	274.4	225.362	3.04	225.83	3.20	696.71	
173	21.71	1.46	133.6	201.669	3.05	204.05	3.21	694.60	
174	21.41	0.30	638.1	204.445	3.05	205.15	3.22	695.86	
175	33.04	0.00	0.00	131.413	3.07	131.01	3.36	700.03	
176	32.89	0.00	0.00	131.996	3.07	131.89	3.35	695.60	
177	33.32	0.51	305.3	130.282	3.07	131.05	3.35	694.72	
178	33.61	0.00	0.00	129.221	3.07	129.26	3.36	696.91	
179	35.49	0.65	232.6	122.097	3.08	123.01	3.37	693.31	
180	35.28	0.00	0.00	122.899	3.08	122.66	3.38	699.16	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
181	31.82	0.00	0.00	136.602	3.07	137.24	3.33	700.72	
182	31.54	0.00	0.00	137.811	3.07	137.47	3.34	698.55	
183	16.76	2.75	83.20	262.034	3.04	265.57	3.15	691.88	
184	16.86	1.67	133.0	260.461	3.04	263.30	3.16	698.43	
185	7.81	1.76	184.8	565.893	3.02	567.55	3.08	699.02	
186	7.52	0.70	464.0	587.969	3.02	591.85	3.07	698.09	
187	7.88	3.10	107.9	561.092	3.02	566.32	3.07	694.68	
188	8.21	0.00	0.00	538.535	3.02	537.31	3.09	701.79	
189	8.93	1.19	251.9	494.639	3.02	495.08	3.09	699.25	
190	9.22	1.87	161.4	478.983	3.02	481.44	3.09	695.18	
191	10.56	2.17	130.5	417.996	3.02	420.10	3.10	697.81	
192	10.82	1.48	185.9	407.600	3.02	407.76	3.11	697.09	
193	10.04	0.00	0.00	439.907	3.02	441.72	3.10	697.55	
194	9.72	0.90	317.3	454.286	3.02	455.34	3.10	696.43	
195	10.33	2.25	127.5	427.179	3.02	429.60	3.10	693.92	
196	10.43	2.82	102.8	423.053	3.02	425.88	3.10	693.46	
197	9.17	0.00	0.00	482.048	3.02	482.48	3.09	696.92	
198	8.96	1.57	192.7	492.861	3.02	495.56	3.09	696.77	
199	8.35	2.95	110.1	529.454	3.02	534.41	3.07	696.21	
200	8.40	1.63	192.8	525.927	3.02	529.16	3.08	696.71	
201	8.10	1.89	169.9	546.015	3.02	548.20	3.08	694.43	
202	8.17	0.37	840.8	541.310	3.02	541.30	3.09	695.52	
203	7.79	1.18	273.8	567.354	3.02	570.36	3.07	700.02	
204	7.86	1.12	284.7	562.401	3.02	564.27	3.08	696.80	
(1 missing vial)									
206	0.83	22.11	63.55	5396.88	2.99	5427.32	2.99	699.16	
207	0.83	8.86	130.5	5398.88	2.99	5417.68	2.99	696.99	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U pp
163	B-IBR*pH3.00*IUA	542.278	0.4990	1086.7295	1.2567E+14	2.0864E-10	48.6226	
164	B-IBR*pH3.00*IUB	558.826	0.5000	1117.6520	1.2924E+14	2.1458E-10	50.0061	49.3143
165	B-IBR*pH4.00*IUA	487.397	0.5010	972.8483	1.1250E+14	1.8678E-10	43.5273	
166	B-IBR*pH4.00*IUB	480.775	0.4997	962.1273	1.1126E+14	1.8472E-10	43.0476	43.2874
167	B-IBR*pH4.50*IUA	380.644	0.5004	760.6795	8.7963E+13	1.4605E-10	34.0344	
168	B-IBR*pH4.50*IUB	394.374	0.4984	791.2801	9.1502E+13	1.5192E-10	35.4035	34.7190
169	B-IBR*pH5.00*IUA	268.928	0.5018	535.9267	6.1973E+13	1.0289E-10	23.9785	
170	B-IBR*pH5.00*IUB	270.417	0.5002	540.6178	6.2516E+13	1.0380E-10	24.1884	24.0834
171	B-IBR*pH5.50*IUA	217.963	0.5012	434.8823	5.0289E+13	8.3495E-11	19.4575	
172	B-IBR*pH5.50*IUB	225.362	0.4997	450.9946	5.2152E+13	8.6588E-11	20.1784	19.8180
173	B-IBR*pH6.00*IUA	201.669	0.5006	402.8546	4.6585E+13	7.7345E-11	18.0246	
174	B-IBR*pH6.00*IUB	204.445	0.5001	408.8082	4.7274E+13	7.8489E-11	18.2909	18.1577
175	B-IBR*pH6.25*IUA	131.413	0.5001	262.7734	3.0387E+13	5.0451E-11	11.7570	
176	B-IBR*pH6.25*IUB	131.996	0.5003	263.8337	3.0509E+13	5.0654E-11	11.8045	11.7808
177	B-IBR*pH6.50*IUA	130.282	0.5028	259.1130	2.9963E+13	4.9748E-11	11.5933	
178	B-IBR*pH6.50*IUB	129.221	0.5020	257.4124	2.9767E+13	4.9421E-11	11.5172	11.5552
179	B-IBR*pH6.75*IUA	122.097	0.5005	243.9500	2.8210E+13	4.6837E-11	10.9148	
180	B-IBR*pH6.75*IUB	122.899	0.4994	246.0933	2.8458E+13	4.7248E-11	11.0107	10.9628
181	B-IBR*pH7.00*IUA	136.602	0.4998	273.3133	3.1605E+13	5.2474E-11	12.2286	
182	B-IBR*pH7.00*IUB	137.811	0.5013	274.9072	3.1790E+13	5.2780E-11	12.2999	12.2643
183	B-IBR*pH7.50*IUA	262.034	0.4993	524.8027	6.0687E+13	1.0076E-10	23.4808	
184	B-IBR*pH7.50*IUB	260.461	0.4959	525.2289	6.0736E+13	1.0084E-10	23.4998	23.4903
185	B-IBR-C*pH2.0*IUA	565.893	0.5015	1128.4008	1.3049E+14	2.1665E-10	50.4870	
186	B-IBR-C*pH2.0*IU	587.969	0.5042	1166.1424	1.3485E+14	2.2389E-10	52.1757	51.3313
187	B-IBR-C*pH4.0*IUA	561.092	0.5031	1115.2693	1.2897E+14	2.1412E-10	49.8995	
188	B-IBR-C*pH4.0*IU	538.535	0.4998	1077.5010	1.2460E+14	2.0687E-10	48.2097	49.0546
189	B-IBR-C*pH5.0*IUA	494.639	0.5003	988.6848	1.1433E+14	1.8982E-10	44.2358	
190	B-IBR-C*pH5.0*IU	478.983	0.5005	957.0090	1.1067E+14	1.8374E-10	42.8186	43.5272
191	B-IBR-C*pH5.5*IUA	417.996	0.5028	831.3365	9.6134E+13	1.5961E-10	37.1957	

6/15/94 TD
CALCULATIONS VERIFIED ON PAGE 143-143 OF THIS VOLUME.

6/15/94 TD CALCULATIONS VERIFIED ON P. 143-143 OF THIS VOL.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
192	B-IBR-C*pH5.5*IU	407.600	0.4987	817.3250	9.4514E+13	1.5692E-10	36.5688	36.8823
193	B-IBR-C*pH6.0*IUA	439.907	0.4995	880.6947	1.0184E+14	1.6909E-10	39.4041	
194	B-IBR-C*pH6.0*IU	454.286	0.5165	879.5470	1.0171E+14	1.6887E-10	39.3528	39.3784
195	B-IBR-C*pH6.5*IUA	427.179	0.5018	851.2933	9.8442E+13	1.6344E-10	38.0886	
196	B-IBR-C*pH6.5*IU	423.053	0.5000	846.1060	9.7842E+13	1.6245E-10	37.8566	37.9726
197	B-IBR-C*pH7.0*IUA	482.048	0.4995	965.0611	1.1160E+14	1.8529E-10	43.1789	
198	B-IBR-C*pH7.0*IU	492.861	0.4981	989.4820	1.1442E+14	1.8997E-10	44.2715	43.7252
199	B-IBR-C*pH7.5*IUA	529.454	0.5002	1058.4846	1.2240E+14	2.0322E-10	47.3588	
200	B-IBR-C*pH7.5*IU	525.927	0.4975	1057.1397	1.2225E+14	2.0296E-10	47.2986	47.3287
201	B-IBR-C*pH8.0*IUA	546.015	0.4981	1096.1955	1.2676E+14	2.1046E-10	49.0461	
202	B-IBR-C*pH8.0*IU	541.310	0.4972	1088.7168	1.2590E+14	2.0903E-10	48.7115	48.8788
203	B-IBR-C*pH9.5*IUA	567.654	0.5056	1122.7334	1.2983E+14	2.1556E-10	50.2334	
204	B-IBR-C*pH9.5*IU	562.401	0.5010	1122.5569	1.2981E+14	2.1552E-10	50.2255	50.2295
206	B-IIB*IU1	5396.880	0.5033	10722.9883	1.2400E+15	2.0587E-09	479.7689	
207	B-IIB*IU2	5396.880	0.5002	10789.4442	1.2477E+15	2.0715E-09	482.7423	481.2556

27 July 1993 EXPERIMENT B-III, Reverse TD

The liquid scintillation analysis of the Initial Uranium concentration of each solution has been completed. The Raw data, as well as results of calculations, follow.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IIIBR*pH3.00*IU	59.439	0.4912	121.0077	1.3993E+13	2.3233E-11	5.4141	
3	B-IIIBR*pH3.00*IU	56.727	0.4993	113.6131	1.3138E+13	2.1813E-11	5.0833	5.2487
4	B-IIIBR*pH4.00*IU	44.578	0.4991	89.3168	1.0328E+13	1.7148E-11	3.9962	
5	B-IIIBR*pH4.00*IU	46.653	0.4988	93.5305	1.0816E+13	1.7957E-11	4.1847	4.0905
6	B-IIIBR*pH4.50*IU	30.526	0.4999	61.0642	7.0613E+12	1.1724E-11	2.7321	
7	B-IIIBR*pH4.50*IU	30.840	0.4971	62.0398	7.1741E+12	1.1911E-11	2.7758	2.7540
8	B-IIIBR*pH5.00*IU	13.449	0.5026	26.7589	3.0943E+12	5.1375E-12	1.1972	
9	B-IIIBR*pH5.00*IU	13.009	0.4983	26.1068	3.0189E+12	5.0123E-12	1.1681	1.1827
10	B-IIIBR*pH5.50*IU	9.949	0.4966	20.0342	2.3167E+12	3.8464E-12	0.8964	
11	B-IIIBR*pH5.50*IU	9.946	0.5001	19.8880	2.2998E+12	3.8184E-12	0.8898	0.8931
12	B-IIIBR*pH6.00*IU	7.510	0.5001	15.0170	1.7365E+12	2.8832E-12	0.6719	
13	B-IIIBR*pH6.00*IU	7.800	0.4987	15.6407	1.8087E+12	3.0029E-12	0.6998	0.6858
14	B-IIIBR*pH6.25*IU	6.677	0.4999	13.3567	1.5445E+12	2.5644E-12	0.5976	
15	B-IIIBR*pH6.25*IU	6.852	0.4979	13.7618	1.5914E+12	2.6422E-12	0.6157	0.6067
16	B-IIIBR*pH6.50*IU	6.124	0.4998	12.2529	1.4169E+12	2.3525E-12	0.5482	
17	B-IIIBR*pH6.50*IU	6.345	0.4981	12.7384	1.4730E+12	2.4457E-12	0.5699	0.5591
18	B-IIIBR*pH6.75*IU	5.832	0.4989	11.6897	1.3518E+12	2.2443E-12	0.5230	
19	B-IIIBR*pH6.75*IU	5.820	0.4976	11.6961	1.3525E+12	2.2456E-12	0.5233	0.5232
20	B-IIIBR*pH7.00*IU	9.118	0.4979	18.3129	2.1177E+12	3.5160E-12	0.8194	
21	B-IIIBR*pH7.00*IU	8.669	0.4978	17.4146	2.0138E+12	3.3435E-12	0.7792	0.7993
22	B-IIIBR*pH7.50*IU	19.324	0.4994	38.6944	4.4745E+12	7.4291E-12	1.7313	
23	B-IIIBR*pH7.50*IU	19.104	0.4980	38.3614	4.4360E+12	7.3651E-12	1.7164	1.7238
24	B-IIIBR-C*pH2.0*IU	59.093	0.4986	118.5178	1.3705E+13	2.2755E-11	5.3027	
25	B-IIIBR-C*pH2.0*IU	56.756	0.4988	113.7851	1.3158E+13	2.1846E-11	5.0910	5.1969
26	B-IIIBR-C*pH4.0*IU	53.613	0.4967	107.9384	1.2482E+13	2.0723E-11	4.8294	
27	B-IIIBR-C*pH4.0*IU	53.872	0.4967	108.4598	1.2542E+13	2.0824E-11	4.8527	4.8411
28	B-IIIBR-C*pH5.0*IU	36.849	0.4983	73.9494	8.5513E+12	1.4198E-11	3.3087	
29	B-IIIBR-C*pH5.0*IU	37.345	0.4973	75.0955	8.6839E+12	1.4418E-11	3.3599	3.3343
30	B-IIIBR-C*pH5.5*IU	27.253	0.4980	54.7249	6.3283E+12	1.0507E-11	2.4485	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
31	B-IIIBR-C*pH5.5*IU	28.079	0.4983	56.3496	6.5161E+12	1.0819E-11	2.5212	2.4849
32	B-IIIBR-C*pH6.0*IU	23.652	0.4993	47.3703	5.4778E+12	9.0948E-12	2.1194	
33	B-IIIBR-C*pH6.0*IU	24.383	0.4967	49.0900	5.6767E+12	9.4250E-12	2.1964	2.1579
34	B-IIIBR-C*pH6.5*IU	26.366	0.5006	52.6688	6.0905E+12	1.0112E-11	2.3565	
35	B-IIIBR-C*pH6.5*IU	25.471	0.5003	50.9115	5.8873E+12	9.7747E-12	2.2779	2.3172
36	B-IIIBR-C*pH7.0*IU	38.081	0.4980	76.4679	8.8426E+12	1.4681E-11	3.4213	
37	B-IIIBR-C*pH7.0*IU	38.369	0.5013	76.5390	8.8508E+12	1.4695E-11	3.4245	3.4229
38	B-IIIBR-C*pH7.5*IU	50.570	0.4992	101.3021	1.1714E+13	1.9449E-11	4.5325	
39	B-IIIBR-C*pH7.5*IU	52.181	0.4973	104.9286	1.2134E+13	2.0146E-11	4.6947	4.6136
40	B-IIIBR-C*pH8.0*IU	55.479	0.4997	111.0246	1.2839E+13	2.1316E-11	4.9675	
41	B-IIIBR-C*pH8.0*IU	55.289	0.5001	110.5559	1.2784E+13	2.1226E-11	4.9465	4.9570
42	B-IIIBR-C*pH9.5*IU	55.346	0.4979	111.1589	1.2854E+13	2.1342E-11	4.9735	
43	B-IIIBR-C*pH9.5*IU	57.457	0.4959	115.8641	1.3398E+13	2.2245E-11	5.1840	5.0787

6/15/94 ID
VERIFICATION
OF CALCULATIONS
ON PAGE 143-4
OF THIS BOOK

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Protocol #: 6        Name:U-233 5% 2 Sigma          24-Jul-93   09:41
Region A: LL-UL= 0.0-100.  Lcr=   0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=   0  Bkg= 0.00  %2 Sigma=5.00
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 5% 2 sigma error for 5 ppb U-233 experiments

 S#   TIME     CPMA A:2S%    CPMB B:2S%    CPMC C:2S%    SIS FLAG
  1 582.82    18.98  1.90    2.745  5.00   27.56  1.58 129.44    B
  2  25.73     1.23 147.5   59.439  5.24   60.94  6.13 683.68
  3  26.92     1.04 169.7   56.727  5.25   58.29  6.17 685.34
  4  33.81     0.00  0.00   44.578  5.32   44.11  6.67 709.62
  5  32.41     0.00  0.00   46.653  5.30   47.11  6.51 701.87
  6  48.15     0.00  0.00   30.526  5.46   31.03  7.25 700.01
  7  47.64     0.00  0.00   30.840  5.46   31.32  7.23 704.75
  8  98.80     0.00  0.00   13.449  6.11   13.55 10.05 730.09
  9 101.62     0.00  0.00   13.009  6.14   13.46  9.98 711.06
 10 126.04     0.00  0.00    9.949  6.53    9.91 11.85 728.30
 11 126.15     0.36 240.5    9.946  6.53   11.11 10.71 675.26
 12 156.02     0.21 382.4    7.510  7.07    8.17 12.87 685.09
 13 152.01     0.49 164.0    7.800  6.98    8.96 11.97 653.72
 14 169.91     0.07 1034.    6.677  7.35    7.04 14.22 678.72
 15 166.81     0.00  0.00    6.852  7.28    7.16 14.11 755.56
 16 180.51     0.00  0.00    6.124  7.58    6.30 15.38 714.09
 17 176.01     0.00  0.00    6.345  7.48    6.71 14.66 702.59
 18 186.53     0.00  0.00    5.832  7.72    6.20 15.41 729.97
 19 186.79     0.00  0.00    5.820  7.73    5.63 16.85 763.06
 20 134.95     0.00  0.00    9.118  6.68    9.03 12.50 724.32
 21 140.35     0.00  0.00    8.669  6.77    8.31 13.24 751.99
 22  72.50     0.00  0.00   19.324  5.75   19.56  8.54 701.57
 23  73.32     0.18 605.7   19.104  5.76   19.70  8.44 685.59
 24  25.89     0.25 698.9   59.093  5.24   59.70  6.19 694.95
 25  28.89     0.28 617.9   56.756  5.25   58.79  6.14 697.30
 26  28.39     0.00  0.00   53.613  5.26   52.51  6.45 717.86
 27  28.26     0.48 354.9   53.872  5.26   53.76  6.36 692.18
 28  40.41     0.00  0.00   36.849  5.39   36.02  7.07 719.42
 29  39.91     0.00  0.00   37.345  5.38   37.39  6.92 706.95
 30  53.37     0.00  0.00   27.253  5.52   26.93  7.68 712.27
 31  51.94     0.00  0.00   28.079  5.51   28.89  7.37 704.84
 32  60.65     0.00  0.00   23.652  5.61   23.59  8.00 737.02
 33  58.98     0.00  0.00   24.383  5.59   24.29  7.92 715.86
 34  55.03     0.00  0.00   26.366  5.54   25.49  7.89 722.52
 35  56.74     0.00  0.00   25.471  5.56   25.54  7.76 700.37
 36  39.19     0.00  0.00   38.081  5.37   37.33  6.99 725.04
 37  38.94     0.00  0.00   38.369  5.37   38.52  6.86 709.29
 38  30.01     0.00  0.00   50.570  5.28   50.25  6.47 699.81
 39  29.13     0.00  0.00   52.181  5.27   52.15  6.40 703.67
 40  27.48     0.63 274.0   55.479  5.25   56.94  6.21 692.20
 41  27.57     0.00  0.00   55.289  5.25   56.34  6.24 701.86
 42  27.56     0.00  0.00   55.346  5.25   54.55  6.38 712.44
 43  26.71     0.00  0.00   57.457  5.23   56.34  6.34 703.43
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
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ID 29 July 1993 EXPERIMENT B-IIB

The pH has had sufficent time to equilibrate, so 2 500µL samples were taken from each solution. The weights are given below.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IIB*pH2.00*IUA	7.9268	8.4328	0.5060
B-IIB*pH2.00*IUB	7.8391	8.3439	0.5048
B-IIB*pH2.25*IUA	7.8482	8.3530	0.5048
B-IIB*pH2.25*IUB	7.8059	8.3076	0.5017
B-IIB*pH2.50*IUA	7.8349	8.3393	0.5044
B-IIB*pH2.50*IUB	7.8730	8.3751	0.5021
B-IIB*pH2.75*IUA	7.8251	8.3257	0.5006
B-IIB*pH2.75*IUB	7.8421	8.3425	0.5004
B-IIB*pH3.00*IUA	7.8482	8.3478	0.4996
B-IIB*pH3.00*IUB	7.8574	8.3553	0.4979
B-IIB*pH3.25*IUA	7.8673	8.3664	0.4991
B-IIB*pH3.25*IUB	7.8917	8.3908	0.4991
B-IIB*pH3.50*IUA	7.8107	8.3091	0.4984
B-IIB*pH3.50*IUB	7.8918	8.3903	0.4985
B-IIB*pH3.75*IUA	7.8412	8.3441	0.5029
B-IIB*pH3.75*IUB	7.8241	8.3234	0.4993
B-IIB*pH4.00*IUA	7.8628	8.3609	0.4981
B-IIB*pH4.00*IUB	7.8540	8.3537	0.4997
B-IIB*pH4.25*IUA	7.8341	8.3341	0.5000
B-IIB*pH4.25*IUB	7.8082	8.3063	0.4981
B-IIB*pH4.50*IUA	7.8854	8.3857	0.5003
B-IIB*pH4.50*IUB	7.8727	8.3711	0.4984
B-IIB*pH4.75*IUA	7.8656	8.3650	0.4994
B-IIB*pH4.75*IUB	7.8474	8.3454	0.4980
B-IIB*pH5.00*IUA	7.8882	8.3861	0.4979
B-IIB*pH5.00*IUB	7.8507	8.3486	0.4979
B-IIB*pH5.25*IUA	7.8634	8.3622	0.4988
B-IIB*pH5.25*IUB	7.9260	8.4241	0.4981
B-IIB*pH5.50*IUA	7.8757	8.3755	0.4998
B-IIB*pH5.50*IUB	7.8769	8.3758	0.4989
B-IIB*pH5.75*IUA	7.9044	8.4029	0.4985
B-IIB*pH5.75*IUB	7.8741	8.3709	0.4968
B-IIB*pH6.00*IUA	7.8352	8.3318	0.4966
B-IIB*pH6.00*IUB	7.9304	8.4300	0.4996
B-IIB*pH6.25*IUA	7.8731	8.3723	0.4992
B-IIB*pH6.25*IUB	7.8847	8.3839	0.4992
B-IIB*pH6.50*IUA	7.8152	8.3169	0.5017
B-IIB*pH6.50*IUB	7.8459	8.3437	0.4978
B-IIB*pH6.75*IUA	7.8575	8.3566	0.4991

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IIB*pH6.75*IUB	7.8452	8.3433	0.4981
B-IIB*pH7.00*IUA	7.9071	8.4068	0.4997
B-IIB*pH7.00*IUB	7.8460	8.3449	0.4989
B-IIB*pH7.25*IUA	7.8926	8.3915	0.4989
B-IIB*pH7.25*IUB	7.8417	8.3409	0.4992
B-IIB*pH7.50*IUA	7.8498	8.3502	0.5004
B-IIB*pH7.50*IUB	7.8288	8.3273	0.4985
B-IIB*pH7.75*IUA	7.8312	8.3310	0.4998
B-IIB*pH7.75*IUB	7.8727	8.3728	0.5001
B-IIB*pH8.00*IUA	7.8252	8.3238	0.4986
B-IIB*pH8.00*IUB	7.8571	8.3578	0.5007
B-IIB*pH8.25*IUA	7.8945	8.3930	0.4985
B-IIB*pH8.25*IUB	7.8726	8.3720	0.4994
B-IIB*pH8.50*IUA	7.9229	8.4218	0.4989
B-IIB*pH8.50*IUB	7.8695	8.3689	0.4994
B-IIB*pH8.75*IUA	7.8562	8.3556	0.4994
B-IIB*pH8.75*IUB	7.9019	8.4011	0.4992
B-IIB*pH9.00*IUA	7.8605	8.3597	0.4992
B-IIB*pH9.00*IUB	7.8433	8.3431	0.4998
B-IIB-C*pH2.0*IUA	7.8439	8.3433	0.4994
B-IIB-C*pH2.0*IUB	7.8283	8.3275	0.4992
B-IIB-C*pH4.0*IUA	7.8542	8.3544	0.5002
B-IIB-C*pH4.0*IUB	7.8659	8.3631	0.4972
B-IIB-C*pH5.0*IUA	7.8704	8.3669	0.4965
B-IIB-C*pH5.0*IUB	7.8894	8.3882	0.4988
B-IIB-C*pH5.5*IUA	7.8694	8.3719	0.5025
B-IIB-C*pH5.5*IUB	7.8982	8.3991	0.5009
B-IIB-C*pH6.0*IUA	7.9226	8.4231	0.5005
B-IIB-C*pH6.0*IUB	7.8866	8.3843	0.4977
B-IIB-C*pH6.5*IUA	7.9068	8.4056	0.4988
B-IIB-C*pH6.5*IUB	7.9056	8.4033	0.4977
B-IIB-C*pH7.0*IUA	7.8644	8.3625	0.4981
B-IIB-C*pH7.0*IUB	7.8247	8.3222	0.4975
B-IIB-C*pH7.5*IUA	7.8741	8.3724	0.4983
B-IIB-C*pH7.5*IUB	7.8457	8.3420	0.4963
B-IIB-C*pH8.0*IUA	7.8940	8.3765	0.4825
B-IIB-C*pH8.0*IUB	7.8752	8.3647	0.4895
B-IIB-C*pH9.5*IUA	7.8881	8.3861	0.4980
B-IIB-C*pH9.5*IUB	7.8599	8.3602	0.5003

The samples were acidified and prepared for Liquid Scintillation Analysis. The pH of each solution was also measured. The results can be seen on the following page. 0.100 I 0.001 g Na-Clinoptilolite was added to each solution, but not the B-IIB-C solutions. Those weights are also on the following page. The solutions were swirled, covered with a kimwipe, and returned to the shaker.

SOLUTION NAME	pH/T(C)	WT. ZEOLITE ADDED (g)
B-IIB*pH2.00	1.93/23.6	0.1000
B-IIB*pH2.25	2.14/23.6	0.0992
B-IIB*pH2.50	2.40/23.6	0.0994
B-IIB*pH2.75	2.70/23.7	0.1002
B-IIB*pH3.00	2.92/23.7	0.1000
B-IIB*pH3.25	3.18/23.7	0.1005
B-IIB*pH3.50	3.44/23.7	0.1009
B-IIB*pH3.75	3.66/23.7	0.0999
B-IIB*pH4.00	4.00/23.8	0.0996
B-IIB*pH4.25	4.21/23.8	0.1007
B-IIB*pH4.50	4.42/23.8	0.1002
B-IIB*pH4.75	4.62/23.8	0.0995
B-IIB*pH5.00	5.30/23.8	0.0998
B-IIB*pH5.25	5.92/23.9	0.1003
B-IIB*pH5.50	5.76/23.9	0.0998
B-IIB*pH5.75	6.05/23.9	0.1010
B-IIB*pH6.00	6.11/23.9	0.1004
B-IIB*pH6.25	6.92/24.0	0.0995
B-IIB*pH6.50	6.55/24.0	0.0990
B-IIB*pH6.75	6.56/24.1	0.0995
B-IIB*pH7.00	7.18/24.1	0.0994
B-IIB*pH7.25	7.09/24.2	0.0996
B-IIB*pH7.50	7.32/24.2	0.1008
B-IIB*pH7.75	7.51/24.3	0.1006
B-IIB*pH8.00	7.74/24.3	0.1000
B-IIB*pH8.25	8.03/24.4	0.0999
B-IIB*pH8.50	8.33/24.4	0.0995
B-IIB*pH8.75	8.61/24.4	0.1005
B-IIB*pH9.00	8.88/24.4	0.1003
B-IIB-C*pH2.0	1.91/24.5	
B-IIB-C*pH4.0	4.00/24.5	
B-IIB-C*pH5.0	5.13/24.5	
B-IIB-C*pH5.5	6.17/24.5	
B-IIB-C*pH6.0	6.42/24.6	
B-IIB-C*pH6.5	6.49/24.6	
B-IIB-C*pH7.0	6.83/24.7	
B-IIB-C*pH7.5	7.31/24.8	
B-IIB-C*pH8.0	7.74/24.8	
B-IIB-C*pH9.5	9.40/24.8	

2 Aug 1993 TD

The liquid Scintillation Analysis of the B-IIB *...*IV solutions was finished. The raw data, as well as results of the U concentration analysis follow.

Protocol #: 4 Name:U-233 1% 2 sigma 31-Jul-93 03:21
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=1.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 1% 2 sigma error for 500 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	18.54	1.47	2.94	3.69	27.51	1.21	135.19	B
2	7.24	11.44	35.66	5523.30	1.00	5549.70	1.00	708.78	
3	7.30	15.03	28.80	5479.66	1.00	5508.73	1.00	704.79	
4	7.21	13.36	31.55	5550.46	1.00	5577.48	1.00	704.81	
5	7.28	14.52	29.45	5514.14	1.00	5541.22	1.00	703.44	
6	7.25	14.02	30.30	5517.61	1.00	5548.35	1.00	704.87	
7	7.23	17.29	25.80	5536.89	1.00	5566.82	1.00	705.06	
8	7.26	15.07	28.61	5512.07	1.00	5539.29	1.00	705.15	
9	7.22	16.64	28.58	5542.35	1.00	5572.77	1.00	703.00	
10	7.25	14.98	28.76	5518.16	1.00	5546.83	1.00	704.03	
11	7.22	17.75	25.30	5544.15	1.00	5576.78	1.00	703.33	
12	7.27	13.65	30.89	5501.46	1.00	5530.67	1.00	704.67	
13	7.23	11.20	36.29	5533.71	1.00	5558.38	1.00	704.66	
14	7.28	13.33	31.45	5497.33	1.00	5521.80	1.00	703.53	
15	7.33	12.71	32.57	5456.00	1.00	5480.40	1.00	706.09	
16	7.25	13.33	31.53	5517.75	1.00	5546.70	1.00	706.10	
17	7.36	11.22	35.93	5432.25	1.00	5457.54	1.00	703.68	
18	7.42	8.69	44.21	5392.61	1.00	5410.63	1.00	706.14	
19	7.34	17.84	25.00	5449.92	1.00	5476.44	1.00	707.86	
20	7.38	13.71	30.55	5417.11	1.00	5441.59	1.00	708.77	
21	7.40	9.98	39.44	5403.28	1.00	5425.19	1.00	709.42	
22	7.56	14.40	29.05	5293.88	1.00	5319.18	1.00	708.46	
23	7.57	17.79	24.87	5287.55	1.00	5316.08	1.00	705.68	
24	7.73	14.19	29.06	5179.34	1.00	5204.44	1.00	706.88	
25	7.73	16.00	26.47	5175.71	1.00	5203.67	1.00	707.81	
26	7.51	18.48	24.07	5325.15	1.00	5356.11	1.00	709.30	
27	7.55	11.66	34.38	5301.30	1.00	5323.08	1.00	709.66	
28	7.75	15.40	27.24	5161.58	1.00	5187.58	1.00	709.03	
29	7.71	12.33	32.52	5188.76	1.00	5210.23	1.00	708.75	
30	8.33	12.32	31.33	4802.70	1.00	4824.47	1.00	708.11	
31	8.28	12.10	31.85	4825.28	1.00	4844.62	1.00	708.56	
32	7.87	21.38	21.38	5218.05	1.00	5246.80	1.00	706.27	
33	7.71	14.54	28.58	5189.80	1.00	5217.49	1.00	710.02	
34	7.85	17.39	24.66	5099.10	1.00	5129.94	1.00	707.66	
35	7.71	13.37	30.50	5187.85	1.00	5211.14	1.00	708.43	
36	7.58	15.50	27.40	5279.78	1.00	5302.83	1.00	706.79	
37	7.83	13.97	29.62	5245.81	1.00	5270.26	1.00	708.30	
38	7.81	9.12	41.37	5122.41	1.00	5140.86	1.00	707.86	
39	7.77	11.71	33.78	5150.34	1.00	5188.63	1.00	706.70	
40	7.68	11.02	35.69	5205.52	1.00	5228.92	1.00	707.83	
41	7.85	9.18	41.59	5231.31	1.00	5250.40	1.00	710.40	
42	7.70	10.81	36.20	5194.46	1.00	5214.18	1.00	709.10	
43	7.75	9.08	41.70	5164.54	1.00	5179.20	1.00	709.12	
44	7.54	13.56	30.50	5303.96	1.00	5325.94	1.00	709.24	
45	7.52	11.12	35.81	5322.72	1.00	5342.44	1.00	708.85	
46	7.47	9.44	41.09	5354.49	1.00	5371.95	1.00	707.40	
47	7.49	11.37	35.23	5338.18	1.00	5357.40	1.00	707.42	
48	7.40	11.80	34.88	5406.38	1.00	5428.03	1.00	708.88	
49	7.33	7.83	46.05	5456.13	1.00	5471.94	1.00	707.00	
50	7.35	7.72	49.08	5445.49	1.00	5462.98	1.00	708.47	
51	7.34	15.52	27.81	5449.10	1.00	5473.85	1.00	705.63	
52	7.30	21.19	22.06	5478.98	1.00	5508.52	1.00	705.17	
53	7.33	15.02	28.54	5457.63	1.00	5481.90	1.00	704.57	
54	7.33	9.02	43.09	5455.59	1.00	5468.94	1.00	708.05	
55	7.32	12.61	32.78	5465.64	1.00	5484.37	1.00	706.05	
56	7.25	15.95	27.41	5516.09	1.00	5540.63	1.00	705.33	
57	7.22	10.27	38.98	5542.35	1.00	5557.53	1.00	708.57	
58	7.25	10.02	39.72	5514.71	1.00	5531.94	1.00	706.49	
59	7.32	13.84	30.45	5469.46	1.00	5493.53	1.00	707.80	
60	7.36	12.85	32.21	5432.39	1.00	5460.67	1.00	703.27	
61	7.33	12.84	32.29	5454.63	1.00	5482.58	1.00	704.75	
62	7.33	8.75	44.22	5457.36	1.00	5478.35	1.00	706.39	
63	7.47	11.85	34.11	5355.43	1.00	5377.44	1.00	707.24	
64	7.73	9.87	39.62	5172.87	1.00	5196.29	1.00	708.41	
65	7.70	14.06	29.33	5193.29	1.00	5217.68	1.00	708.23	
66	7.86	14.23	29.13	5223.30	1.00	5247.68	1.00	706.04	
67	7.58	9.83	39.46	5274.63	1.00	5295.05	1.00	708.38	
68	7.82	10.62	36.46	5115.73	1.00	5135.66	1.00	706.31	
69	7.83	11.09	35.16	5109.32	1.00	5129.19	1.00	707.30	
70	7.97	13.58	29.82	5019.77	1.00	5044.26	1.00	704.97	
71	7.93	16.02	26.12	5043.84	1.00	5070.09	1.00	708.51	
72	8.21	13.01	30.21	4873.31	1.00	4896.48	1.00	707.84	
73	8.20	8.78	41.69	4876.82	1.00	4899.44	1.00	710.01	
74	7.61	10.11	38.48	5253.56	1.00	5271.31	1.00	707.02	
75	7.64	12.09	33.19	5235.02	1.00	5253.90	1.00	705.32	
76	7.31	13.75	30.64	5469.15	1.00	5489.45	1.00	707.75	
77	7.35	11.80	34.50	5445.36	1.00	5463.37	1.00	709.73	
78	7.58	11.81	33.97	5275.95	1.00	5304.41	1.00	709.33	
79	7.52	10.45	37.66	5316.34	1.00	5338.05	1.00	708.76	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IIB*pH2.00*IU	5523.30	0.5060	10915.6126	1.2623E+15	2.0957E-09	488.3874	
3	B-IIB*pH2.00*IU	5479.66	0.5048	10855.1109	1.2553E+15	2.0841E-09	485.6804	487.0339
4	B-IIB*pH2.25*IU	5550.46	0.5048	10995.3645	1.2715E+15	2.1110E-09	491.9556	
5	B-IIB*pH2.25*IU	5514.14	0.5017	10990.9109	1.2710E+15	2.1102E-09	491.7564	491.8560
6	B-IIB*pH2.50*IU	5517.61	0.5044	10938.9572	1.2650E+15	2.1002E-09	489.4318	
7	B-IIB*pH2.50*IU	5536.89	0.5021	11027.4646	1.2752E+15	2.1172E-09	493.3919	491.4119
8	B-IIB*pH2.75*IU	5512.07	0.5006	11010.9269	1.2733E+15	2.1140E-09	492.6519	
9	B-IIB*pH2.75*IU	5542.35	0.5004	11075.8393	1.2808E+15	2.1265E-09	495.5562	494.1041
10	B-IIB*pH3.00*IU	5518.16	0.4996	11045.1561	1.2772E+15	2.1206E-09	494.1834	
11	B-IIB*pH3.00*IU	5544.15	0.4979	11135.0673	1.2876E+15	2.1379E-09	498.2062	496.1948
12	B-IIB*pH3.25*IU	5501.46	0.4991	11022.7610	1.2746E+15	2.1163E-09	493.1814	
13	B-IIB*pH3.25*IU	5533.71	0.4991	11087.3773	1.2821E+15	2.1287E-09	496.0725	494.6269
14	B-IIB*pH3.50*IU	5497.33	0.4984	11029.9559	1.2755E+15	2.1177E-09	493.5033	
15	B-IIB*pH3.50*IU	5456.00	0.4985	10944.8345	1.2656E+15	2.1013E-09	489.6948	491.5991
16	B-IIB*pH3.75*IU	5517.75	0.5029	10971.8632	1.2688E+15	2.1065E-09	490.9041	
17	B-IIB*pH3.75*IU	5432.25	0.4993	10879.7316	1.2581E+15	2.0888E-09	486.7820	488.8431
18	B-IIB*pH4.00*IU	5392.61	0.4981	10826.3602	1.2519E+15	2.0786E-09	484.3940	
19	B-IIB*pH4.00*IU	5449.92	0.4997	10906.3838	1.2612E+15	2.0940E-09	487.9744	486.1842
20	B-IIB*pH4.25*IU	5417.11	0.5000	10834.2200	1.2528E+15	2.0801E-09	484.7457	
21	B-IIB*pH4.25*IU	5403.28	0.4981	10847.7816	1.2544E+15	2.0827E-09	485.3525	485.0491
22	B-IIB*pH4.50*IU	5293.88	0.5003	10581.4112	1.2236E+15	2.0316E-09	473.4345	
23	B-IIB*pH4.50*IU	5287.55	0.4984	10609.0490	1.2268E+15	2.0369E-09	474.6711	474.0528
24	B-IIB*pH4.75*IU	5179.34	0.4994	10371.1254	1.1993E+15	1.9912E-09	464.0259	
25	B-IIB*pH4.75*IU	5175.71	0.4980	10392.9920	1.2018E+15	1.9954E-09	465.0042	464.5150
26	B-IIB*pH5.00*IU	5325.15	0.4979	10695.2199	1.2368E+15	2.0534E-09	478.5265	
27	B-IIB*pH5.00*IU	5301.30	0.4979	10647.3187	1.2312E+15	2.0442E-09	476.3833	477.4549
28	B-IIB*pH5.25*IU	5161.58	0.4988	10347.9952	1.1966E+15	1.9867E-09	462.9910	
29	B-IIB*pH5.25*IU	5188.76	0.4981	10417.1050	1.2046E+15	2.0000E-09	466.0831	464.5370
30	B-IIB*pH5.50*IU	4802.70	0.4998	9609.2437	1.1112E+15	1.8449E-09	429.9377	
31	B-IIB*pH5.50*IU	4825.29	0.4989	9671.8581	1.1184E+15	1.8569E-09	432.7392	431.3384
32	B-IIB*pH5.75*IU	5218.05	0.4985	10467.5025	1.2104E+15	2.0097E-09	468.3380	
33	B-IIB*pH5.75*IU	5189.80	0.4968	10446.4573	1.2080E+15	2.0057E-09	467.3964	467.8672
34	B-IIB*pH6.00*IU	5099.10	0.4966	10268.0226	1.1874E+15	1.9714E-09	459.4128	
35	B-IIB*pH6.00*IU	5187.85	0.4996	10384.0072	1.2008E+15	1.9937E-09	464.6022	462.0075
36	B-IIB*pH6.25*IU	5279.78	0.4992	10576.4824	1.2230E+15	2.0306E-09	473.2140	
37	B-IIB*pH6.25*IU	5245.81	0.4992	10508.4335	1.2152E+15	2.0176E-09	470.1693	471.6916
38	B-IIB*pH6.50*IU	5122.41	0.5017	10210.1056	1.1807E+15	1.9603E-09	456.8215	
39	B-IIB*pH6.50*IU	5150.34	0.4978	10346.2033	1.1964E+15	1.9864E-09	462.9108	459.8661
40	B-IIB*pH6.75*IU	5205.52	0.4991	10429.8137	1.2061E+15	2.0025E-09	466.6517	
41	B-IIB*pH6.75*IU	5231.31	0.4981	10502.5296	1.2145E+15	2.0164E-09	469.9052	468.2784
42	B-IIB*pH7.00*IU	5194.46	0.4997	10395.1571	1.2021E+15	1.9958E-09	465.1011	
43	B-IIB*pH7.00*IU	5164.54	0.4989	10351.8541	1.1971E+15	1.9875E-09	463.1636	464.1324
44	B-IIB*pH7.25*IU	5303.96	0.4989	10631.3089	1.2294E+15	2.0411E-09	475.6670	
45	B-IIB*pH7.25*IU	5322.72	0.4992	10662.5000	1.2330E+15	2.0471E-09	477.0626	476.3648
46	B-IIB*pH7.50*IU	5354.49	0.5004	10700.4197	1.2374E+15	2.0544E-09	478.7592	
47	B-IIB*pH7.50*IU	5338.18	0.4985	10708.4855	1.2383E+15	2.0560E-09	479.1201	478.9396
48	B-IIB*pH7.75*IU	5406.38	0.4998	10817.0868	1.2509E+15	2.0768E-09	483.9791	
49	B-IIB*pH7.75*IU	5456.13	0.5001	10910.0780	1.2616E+15	2.0947E-09	488.1397	486.0594
50	B-IIB*pH8.00*IU	5445.49	0.4986	10921.5604	1.2629E+15	2.0969E-09	488.6535	
51	B-IIB*pH8.00*IU	5449.10	0.5007	10882.9639	1.2585E+15	2.0895E-09	486.9266	487.7900
52	B-IIB*pH8.25*IU	5478.98	0.4985	10990.9328	1.2710E+15	2.1102E-09	491.7573	
53	B-IIB*pH8.25*IU	5457.63	0.4994	10928.3740	1.2637E+15	2.0982E-09	488.9583	490.3578
54	B-IIB*pH8.50*IU	5455.59	0.4989	10935.2375	1.2645E+15	2.0995E-09	489.2654	
55	B-IIB*pH8.50*IU	5465.64	0.4994	10944.4133	1.2656E+15	2.1013E-09	489.6760	489.4707
56	B-IIB*pH8.75*IU	5516.09	0.4994	11045.4345	1.2773E+15	2.1207E-09	494.1959	
57	B-IIB*pH8.75*IU	5542.35	0.4992	11102.4639	1.2839E+15	2.1316E-09	496.7475	495.4717
58	B-IIB*pH9.00*IU	5514.71	0.4992	11047.0954	1.2775E+15	2.1210E-09	494.2702	
59	B-IIB*pH9.00*IU	5469.46	0.4998	10943.2973	1.2655E+15	2.1010E-09	489.6260	491.9481

6/15/94 TD
CALCULATIONS VERIFIED ON PG 143-4 OF THIS BOOK.

6/15/94 TD
CALCULATIONS
VERIFIED ON
P. 113-14 OF
THIS VOL.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
60	B-IIB-C*pH2.0*I	5432.39	0.4994	10877.8334	1.2579E+15	2.0885E-09	486.6970	
61	B-IIB-C*pH2.0*I	5454.63	0.4992	10926.7428	1.2635E+15	2.0979E-09	488.8853	487.7912
62	B-IIB-C*pH4.0*I	5457.36	0.5002	10910.3559	1.2616E+15	2.0947E-09	488.1522	
63	B-IIB-C*pH4.0*I	5355.43	0.4972	10771.1786	1.2456E+15	2.0680E-09	481.9251	485.0386
64	B-IIB-C*pH5.0*I	5172.87	0.4965	10418.6707	1.2048E+15	2.0003E-09	466.1531	
65	B-IIB-C*pH5.0*I	5193.29	0.4988	10411.5678	1.2040E+15	1.9990E-09	465.8353	465.9942
66	B-IIB-C*pH5.5*I	5223.30	0.5025	10394.6269	1.2020E+15	1.9957E-09	465.0774	
67	B-IIB-C*pH5.5*I	5274.63	0.5009	10530.3055	1.2177E+15	2.0218E-09	471.1479	468.1126
68	B-IIB-C*pH6.0*I	5115.73	0.5005	10221.2388	1.1820E+15	1.9624E-09	457.3196	
69	B-IIB-C*pH6.0*I	5109.32	0.4977	10265.8630	1.1871E+15	1.9710E-09	459.3162	458.3179
70	B-IIB-C*pH6.5*I	5019.77	0.4988	10063.6929	1.1637E+15	1.9322E-09	450.2707	
71	B-IIB-C*pH6.5*I	5043.84	0.4977	10134.2978	1.1719E+15	1.9457E-09	453.4297	451.8502
72	B-IIB-C*pH7.0*I	4873.31	0.4981	9783.7984	1.1314E+15	1.8784E-09	437.7476	
73	B-IIB-C*pH7.0*I	4876.82	0.4975	9802.6533	1.1336E+15	1.8820E-09	438.5912	438.1694
74	B-IIB-C*pH7.5*I	5253.56	0.4983	10542.9661	1.2192E+15	2.0242E-09	471.7144	
75	B-IIB-C*pH7.5*I	5235.02	0.4963	10548.0959	1.2198E+15	2.0252E-09	471.9439	471.8291
76	B-IIB-C*pH8.0*I	5469.15	0.4825	11335.0259	1.3108E+15	2.1763E-09	507.1528	
77	B-IIB-C*pH8.0*I	5445.36	0.4895	11124.3309	1.2864E+15	2.1358E-09	497.7259	502.4393
78	B-IIB-C*pH9.5*I	5275.95	0.4980	10594.2771	1.2251E+15	2.0340E-09	474.0101	
79	B-IIB-C*pH9.5*I	5316.34	0.5003	10626.3042	1.2288E+15	2.0402E-09	475.4431	474.7266

TD 2 AUGUST 1993 EXPERIMENT C-I

URANIUM SORPTION EXPERIMENT C-I:

Kd vs pH; Ionic strength effect; atmospheric pCO_2; Initial $\Sigma U = 50$ ppb

WRITTEN BY: R.T. PABALAN
REVISION NO.: 1
OBJECTIVE:

DATE WRITTEN: May 27, 1993
DATE REVISED: July 12, 1993

- To investigate the effect of ionic strength on uranium sorption on the zeolite mineral clinoptilolite.

Note: This experiment, which is done at I=1.0 m $NaNO_3$, is designed to complement experiment C-I, which was conducted at I=0.1 m $NaNO_3$. Procedure modified from that for B-IB.

EQUIPMENT:

Gyratory shaker or constant temperature shaker bath
Packard liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Automatic temperature compensator probe
Analytical balance

SUPPLIES:

	pH buffer (pH = 2,4,7,9,10)
40	60-ml FEP bottles (to contain experimental mixtures, control solutions, and C-I*IU)
1	2000-ml teflon bottle (for preparation of 50 ppb U solution)
1	5-ml Eppendorf pipet (for transferring 5 ml cocktail into scintillation vial)
1	0.5-ml Eppendorf fixed-volume micropipet (for taking samples and for transferring 0.02 M HNO_3 solution into scintillation vial)
various	Eppendorf micropipets (fixed- or variable-volume; for adding HNO_3 or $NaHCO_3$ solutions to uranium solutions)
	scintillation vials
	weighing paper
	Na^+-clinoptilolite (CDV*100/200*UC*WA*HL*CPT*Naf)
	reagent grade $NaHCO_3$
	500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
2 L	1.10 m $NaNO_3$ stock solution
1000 ml	stock solution of 1.0 m HNO_3
1000 ml	stock solution of 0.1 m HNO_3
1000 ml	stock solution of 0.02 m HNO_3
500 ml	stock solution of 1.0 m $NaHCO_3$
500 ml	stock solution of 0.5 m $NaHCO_3$
500 ml	stock solution of 0.1 m $NaHCO_3$
500 ml	stock solution of 0.05 m $NaHCO_3$
500 ml	stock solution of 0.01 m $NaHCO_3$
500 ml	stock solution of 0.005 m $NaHCO_3$
	ultrapure water

PROCEDURE:

Note: In transferring uranium solutions, avoid using glass or polypropylene labware.

Solution C-I (1 bottle for each pH value)

- Initial ΣU = 50 ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO_3 or $NaHCO_3$
- Initial volume = 50 ml
- Ionic strength = 1.0 m $NaNO_3$
- Wt. zeolite to use = 0.100±0.001
- Initial $[Na^+]$ = 1.0 m $NaNO_3$ + $[NaHCO_3]$ added
- pCO_2 = atmospheric = $10^{-3.48}$ bar

a) Prepare 2000-g of 50 ppb U solution in a pre-cleaned 2-liter teflon bottle by diluting 200 g of a 500 ppb stock solution (in 0.1 m $NaNO_3$ matrix; prepared previously from commercial 50 ppm ^{233}U spike) to a total of 2000 g by carefully taring **1.10** m $NaNO_3$ solution into the teflon bottle on a Mettler 4600 balance.

b) Into each of 29 60-ml FEP bottle labeled C-I*pH*i* [where *i* is the approximate initial pH of the solution (see below)], tare 50 g of the 50 ppb uranium solution.

Into each of 10 60-ml FEP bottle labeled C-I-C*pH*i* [where *i* is 2, 4, 5, 5.5, 6, 6.5, 7, 7.5, 8, or 9.5, representing the approximate initial pH of the solution], tare 50 g of the 50 ppb uranium solution. These are control solutions to determine uranium loss to the container walls as a function of pH.

Transfer the remaining solution into a 60-ml FEP bottle labeled C-I*IU. Take two 0.5-ml samples from C-I*IU with an Eppendorf pipet, transfer into pre-labeled [e.g., C-I-IU*a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixture and save for later analysis of uranium concentration by liquid scintillation counting.

c) For each solution C-I*pH*i* and C-I-C*pH*i*:

Adjust the pH of each solution to the approximate value *i* by adding HNO_3 solution or $NaHCO_3$ solution with an Eppendorf micropipet. The concentration and approximate amount to be added is given in Table C-I-1. Swirl the solutions by hand. Record the micropipet volume and concentration of solution added. *Do not measure the pH at this time.* Cover the bottles with a porous material (e.g., kimwipe) and place on gyratory shaker set to ~120 rpm. Leave the bottles on the shaker for about ten days to allow the solutions to reach equilibrium with atmospheric CO_2(g).

d) Measure and record the pH of each solution C-I*pH*i* and C-I-C*pH*i*. *Minimize the amount of time the glass electrode is in contact with the uranium solution. Make sure to rinse the electrode well before transferring into another solution.*

From each solution C-I*pH*i* and C-I-C*pH*i*, take 2 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., C-I*IU-phi*a (or b)] scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting. The measured concentrations are the initial values to be used in the calculation of sorption data.

e) Tare 0.100±0.001 gm of Na-clinoptilolite onto weighing paper, and carefully transfer into each of the C-I*pH*i* (**not** the C-I-C*pH*i*) bottles. Swirl each bottle by hand, replace the cover, then place on the shaker.

f) After equilibrium is reached (at least 10 days), take 2 0.5-ml samples from each bottle C-I*phi and C-I-C*pH*i* with an Eppendorf pipet, transfer into pre-labeled [e.g., C-I-phi*a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Homogenize the mixtures and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of solutions C-I*pH*i* and C-I-C*pH*i*. Make sure to rinse the pH electrode very well before transferring into another solution.

g) Analyze the U concentration by liquid scintillation counting.

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Hold Point. Check quality of experimental data.

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f) If the analytical results are good, reversibility and reproducibility tests can be done by changing the pH of the solutions and re-equilibrating them at the new pH values.

Procedure for reversibility and reproducibility experiments will be written later.

PREPARATION:

1. Preclean:
   - 40 60-ml FEP bottles (to contain experimental mixtures, control solutions, and C-I-*IU)
   - 1 2000-ml teflon bottle (for preparation of 50 ppb U solution)

2. Prepare:
   - 500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
   - 2 L 1.10 m $NaNO_3$ stock solution
   - 1000 ml stock solution of 1.0 m HNO_3
   - 1000 ml stock solution of 0.1 m HNO_3
   - 1000 ml stock solution of 0.02 m HNO_3
   - 500 ml stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml solution)
   - 500 ml stock solution of 0.5 M $NaHCO_3$ (21.003 in 500 ml solution)
   - 500 ml stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml solution)
   - 500 ml stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml solution)
   - 500 ml stock solution of 0.01 M $NaHCO_3$ (0.4201 g in 500 ml solution)
   - 500 ml stock solution of 0.005 M $NaHCO_3$ (0.2100 g in 500 ml solution)

The $NaHCO_3$ solutions should be prepared with *degassed* deionized water and kept in tightly-capped glass reagent bottles.

Table C-I-1. Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to 50 ml 1.0 m $NaNO_3$ solution containing 50 ppb U to result in pH values given in column-1. The amount of reagent to be added was estimated using EQ3 calculations.

Solution pH	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
2.00	0.694	1.0
2.25	0.371	1.0
2.50	0.201	1.0
2.75	0.110	1.0
3.00	0.595	0.1
3.25	0.315	0.1
3.50	0.159	0.1
3.75	0.072	0.1
4.00	0.115	0.02
Solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
4.25	0.092	0.005
4.50	0.403	0.005
4.75	0.290	0.01
5.00	0.340	0.01
5.25	0.374	0.01
5.50	0.398	0.01
5.75	0.422	0.01
6.00	0.454	0.01
6.25	0.504	0.01
6.50	0.118	0.05
6.75	0.148	0.05
7.00	0.201	0.05
7.25	0.297	0.05
7.50	0.467	0.05
7.75	0.387	0.10

Solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
8.00	0.133	0.5
8.25	0.236	0.5
8.50	0.430	0.5
8.75	0.408	1.0
9.00	0.812	1.0
[9.25]	[1.72] or [0.145 g $NaHCO_3$ solid]	[1.0]
[9.50]	[4.01] or [0.337 g $NaHCO_3$ solid]	[1.0]

Experiment C-I was begun by diluting 200.97 g 500 ppb ^{233}U to 2006.9 g using 1.1 m $NaNO_3$ (to give final concentration of 0.1 m). The resulting 50 ppb solution was transferred to 60 mL FEP bottles in 50 g aliquots. The weights can be found in the table below. The pH of each solution was adjusted according to Table C-I-1, with the amounts rounded to the nearest 10 µL. The actual adjustments are also given in the Table below. Solid $NaHCO_3$ was used to adjust the pH. The solutions were covered with Kimwipes and placed on a gyratory shaker set at ~120 rpm.

SAMPLE NAME	SOLUTION WEIGHT (g)	ADJUSTMENT VOLUME	ADJUSTMENT MOLARITY	FINAL WEIGHT (g)
C-I*pH2.00	50.09	0.69	1.0 M HNO3	50.78
C-I*pH2.25	50.20	0.37	1.0 M HNO3	50.57
C-I*pH2.50	50.01	0.20	1.0 M HNO3	50.21
C-I*pH2.75	49.88	0.11	1.0 M HNO3	49.99
C-I*pH3.00	49.83	0.60	0.1 M HNO3	50.43
C-I*pH3.25	50.18	0.32	0.1 M HNO3	50.50
C-I*pH3.50	50.02	0.16	0.1 M HNO3	50.18
C-I*pH3.75	49.99	0.07	0.1 M HNO3	50.06
C-I*pH4.00	50.13	0.12	0.02 M HNO3	50.25
C-I*pH4.25	50.08	0.09	0.005 M NaHCO3	50.17
C-I*pH4.50	49.96	0.40	0.005 M NaHCO3	50.36
C-I*pH4.75	49.87	0.29	0.01 M NaHCO3	50.16
C-I*pH5.00	50.21	0.34	0.01 M NaHCO3	50.55
C-I*pH5.25	49.82	0.37	0.01 M NaHCO3	50.19
C-I*pH5.50	50.00	0.40	0.01 M NaHCO3	50.40
C-I*pH5.75	50.14	0.42	0.01 M NaHCO3	50.56
C-I*pH6.00	49.76	0.45	0.01 M NaHCO3	50.21
C-I*pH6.25	49.97	0.50	0.01 M NaHCO3	50.47
C-I*pH6.50	50.16	0.12	0.05 M NaHCO3	50.28
C-I*pH6.75	49.65	0.15	0.05 M NaHCO3	49.80
C-I*pH7.00	49.70	0.20	0.05 M NaHCO3	49.90
C-I*pH7.25	50.05	0.30	0.05 M NaHCO3	50.35
C-I*pH7.50	49.83	0.47	0.05 M NaHCO3	50.30
C-I*pH7.75	50.16	0.39	0.1 M NaHCO3	50.55
C-I*pH8.00	50.18	0.13	0.5 M NaHCO3	50.31
C-I*pH8.25	49.95	0.24	0.5 M NaHCO3	50.19
C-I*pH8.50	49.89	0.43	0.5 M NaHCO3	50.32
C-I*pH8.75	49.88	0.41	1.0 M NaHCO3	50.29
C-I*pH9.00	50.03	0.81	1.0 M NaHCO3	50.84
C-I-C*pH2.0	49.84	0.69	1.0 M HNO3	50.53
C-I-C*pH4.0	50.06	0.12	0.02 M HNO3	50.18
C-I-C*pH5.0	49.71	0.34	0.01 M NaHCO3	50.05
C-I-C*pH5.5	49.91	0.40	0.01 M NaHCO3	50.31
C-I-C*pH6.0	50.11	0.45	0.01 M NaHCO3	50.56
C-I-C*pH6.5	50.20	0.12	0.05 M NaHCO3	50.32
C-I-C*pH7.0	49.63	0.20	0.05 M NaHCO3	49.83
C-I-C*pH7.5	50.32	0.47	0.05 M NaHCO3	50.79
C-I-C*pH8.0	50.01	0.13	0.5 M NaHCO3	50.14
C-I-C*pH9.5	50.17	0.337 g NaHCO3 solid		50.17

Two samples of the remaining C-I initial solution were taken for analysis by liquid scintillation. The sample weights are given below.

SAMPLE NAME	WT. VIAL (g)	WT. VIAL + Sample (g)	Wt. Sample(g)
C-I*IVA	7.4208	7.9462	0.5254
*IVB	7.4121	7.9365	0.5244

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2 500 µL samples were taken from each of the B-IB Reverse solution. The sample weights are in the Table to the right. The pH was also measured.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)	pH T(C)
B-IBR*pH3.00*A	7.8644	8.3681	0.5037	1.95
B-IBR*pH3.00*B	7.8612	8.3619	0.5007	19.6
B-IBR*pH4.00*A	7.8687	8.3707	0.5020	3.01
B-IBR*pH4.00*B	7.8631	8.3639	0.5008	19.6
B-IBR*pH4.50*A	7.8546	8.3517	0.4971	3.59
B-IBR*pH4.50*B	7.8233	8.3212	0.4979	19.6
B-IBR*pH5.00*A	7.8432	8.3448	0.5016	4.18
B-IBR*pH5.00*B	8.0032	8.5032	0.5000	19.6
B-IBR*pH5.50*A	7.7404	8.2443	0.5039	4.84
B-IBR*pH5.50*B	7.8923	8.3905	0.4982	19.6
B-IBR*pH6.00*A	7.8766	8.3787	0.5021	5.16
B-IBR*pH6.00*B	7.8488	8.3495	0.5007	19.7
B-IBR*pH6.25*A	7.8680	8.3705	0.5025	5.35
B-IBR*pH6.25*B	7.8336	8.3318	0.4982	19.7
B-IBR*pH6.50*A	7.8736	8.3744	0.5008	6.43
B-IBR*pH6.50*B	7.8179	8.3159	0.4980	19.7
B-IBR*pH6.75*A	7.9071	8.4088	0.5017	6.71
B-IBR*pH6.75*B	7.9004	8.3997	0.4993	19.7
B-IBR*pH7.00*A	7.8706	8.3711	0.5005	7.12
B-IBR*pH7.00*B	7.8274	8.3215	0.4941	19.7
B-IBR*pH7.50*A	7.8461	8.3486	0.5025	8.44
B-IBR*pH7.50*B	7.8538	8.3513	0.4975	19.8
B-IBR-C*pH2.0*A	7.8567	8.3595	0.5028	1.96
B-IBR-C*pH2.0*B	7.8372	8.3385	0.5013	19.8
B-IBR-C*pH4.0*A	7.8405	8.3427	0.5022	3.86
B-IBR-C*pH4.0*B	7.9247	8.4231	0.4984	19.8
B-IBR-C*pH5.0*A	7.8394	8.3416	0.5022	4.73
B-IBR-C*pH5.0*B	7.8756	8.3735	0.4979	19.8
B-IBR-C*pH5.5*A	7.8554	8.3570	0.5016	4.84
B-IBR-C*pH5.5*B	7.8491	8.3470	0.4979	19.8
B-IBR-C*pH6.0*A	7.8560	8.3585	0.5025	4.83
B-IBR-C*pH6.0*B	7.8758	8.3734	0.4976	19.8
B-IBR-C*pH6.5*A	7.9068	8.4100	0.5032	5.90
B-IBR-C*pH6.5*B	7.8630	8.3626	0.4996	19.9
B-IBR-C*pH7.0*A	7.8643	8.3652	0.5009	6.56
B-IBR-C*pH7.0*B	7.8993	8.3973	0.4980	19.9
B-IBR-C*pH7.5*A	7.8706	8.3734	0.5028	7.25
B-IBR-C*pH7.5*B	7.8946	8.3939	0.4993	19.9
B-IBR-C*pH8.0*A	7.8931	8.3962	0.5031	7.83
B-IBR-C*pH8.0*B	7.8294	8.3281	0.4987	20.0
B-IBR-C*pH9.5*A	7.8043	8.3076	0.5033	9.48
B-IBR-C*pH9.5*B	7.8333	8.3333	0.5000	20.0

12 August 1993 TD

Two 500 µL samples of each of the B-IIIB, Reverse solutions were taken and weighed. The weights are given below. The pH was also measured.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)	pH T(C)
B-IIIBR*pH3.00*A	7.8180	8.3194	0.5014	2.04
B-IIIBR*pH3.00*B	7.8356	8.3359	0.5003	20.0
B-IIIBR*pH4.00*A	7.8945	8.3934	0.4989	3.06
B-IIIBR*pH4.00*B	7.9033	8.3968	0.4935	20.0
B-IIIBR*pH4.50*A	7.8797	8.3828	0.5031	3.60
B-IIIBR*pH4.50*B	7.8992	8.3976	0.4984	20.0
B-IIIBR*pH5.00*A	7.9017	8.4024	0.5007	4.18
B-IIIBR*pH5.00*B	7.8776	8.3757	0.4981	20.1
B-IIIBR*pH5.50*A	7.8531	8.3541	0.5010	4.84
B-IIIBR*pH5.50*B	7.9084	8.4055	0.4971	20.1
B-IIIBR*pH6.00*A	7.8769	8.3787	0.5018	5.19
B-IIIBR*pH6.00*B	7.8870	8.3870	0.5000	20.1
B-IIIBR*pH6.25*A	7.9198	8.4242	0.5044	5.37
B-IIIBR*pH6.25*B	7.8537	8.3519	0.4982	20.1
B-IIIBR*pH6.50*A	7.8536	8.3548	0.5012	6.45
B-IIIBR*pH6.50*B	7.8923	8.3911	0.4988	20.2
B-IIIBR*pH6.75*A	7.8864	8.3893	0.5029	6.79
B-IIIBR*pH6.75*B	7.8636	8.3632	0.4996	20.2
B-IIIBR*pH7.00*A	7.8796	8.3792	0.4996	7.00
B-IIIBR*pH7.00*B	7.8850	8.3835	0.4985	20.2
B-IIIBR*pH7.50*A	7.8476	8.3511	0.5035	8.44
B-IIIBR*pH7.50*B	7.8407	8.3408	0.5001	20.2
B-IIIBR-C*pH2.0*A	7.9200	8.4188	0.4988	1.97
B-IIIBR-C*pH2.0*B	7.8856	8.3821	0.4965	20.2
B-IIIBR-C*pH4.0*A	7.8659	8.3687	0.5028	3.94
B-IIIBR-C*pH4.0*B	7.9326	8.4311	0.4985	20.2
B-IIIBR-C*pH5.0*A	7.8781	8.3812	0.5031	4.65
B-IIIBR-C*pH5.0*B	7.8809	8.3790	0.4981	20.3
B-IIIBR-C*pH5.5*A	7.8884	8.3938	0.5054	4.80
B-IIIBR-C*pH5.5*B	7.8559	8.3560	0.5001	20.3
B-IIIBR-C*pH6.0*A	7.8028	8.3034	0.5006	4.92
B-IIIBR-C*pH6.0*B	7.8387	8.3385	0.4998	20.3
B-IIIBR-C*pH6.5*A	7.8623	8.3634	0.5011	5.65
B-IIIBR-C*pH6.5*B	7.8392	8.3377	0.4985	20.3
B-IIIBR-C*pH7.0*A	7.9455	8.4473	0.5018	6.73
B-IIIBR-C*pH7.0*B	7.8853	8.3845	0.4992	20.3
B-IIIBR-C*pH7.5*A	7.8517	8.3465	0.4948	7.27
B-IIIBR-C*pH7.5*B	7.8178	8.3174	0.4996	20.4
B-IIIBR-C*pH8.0*A	7.8031	8.3037	0.5006	7.87
B-IIIBR-C*pH8.0*B	7.9149	8.4139	0.4990	20.4
B-IIIBR-C*pH9.5*A	7.8107	8.3094	0.4987	9.47
B-IIIBR-C*pH9.5*B	7.8232	8.3200	0.4968	20.4

19 AUGUST 1993 TD

The B-IIB solutions were sampled and the pH measured. 2 500 µL samples were taken and prepared for L.S.A. The pH of the solutions was also measured and recorded. The pH of the solutions were listed in Table B-IIB-2 were adjusted using the volumes and molarities of the acids or base given, rounded to the nearest 10 µL. The actual adjustments are given below Table B-IIB-2.

Table B-IIB-2. For reverse experiments: Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to remaining 0.1 m $NaNO_3$ solution containing 500 ppb U to decrease or increase the pH by 1 unit. The amount of reagent to be added was estimated using EQ3 calculations.

Mixture Label	Equilibrium pH (end of forward expt.)	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
B-IIB*pH3.00		0.546	1.0
B-IIB*pH4.00		0.543	0.1
B-IIB*pH4.50		0.172	0.1
B-IIB*pH5.00		0.055	0.1
B-IIB*pH5.50		0.091	0.02
B-IIB*pH6.00		0.044	0.02
B-IIB*pH6.25		0.044	0.02
Mixture Label	Equilibrium pH (end of forward expt.)	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ solution to use
B-IIB*pH6.50		0.102	0.1
B-IIB*pH6.75		0.182	0.1
B-IIB*pH7.00		0.328	0.1
B-IIB*pH7.50		0.109	1.0

Solution Name	Adjustment
B-IIB*pH3.00	0.55 mL 1.0 M HNO_3
B-IIB*pH4.00	0.54 mL 0.1 M HNO_3
B-IIB*pH4.50	0.17 mL 0.1 M HNO_3
B-IIB*pH5.00	0.06 mL 0.1 M HNO_3
B-IIB*pH5.50	0.09 mL 0.02 M HNO_3
B-IIB*pH6.00	0.04 mL 0.02 M HNO_3
B-IIB*pH6.25	0.04 mL 0.02 M HNO_3
B-IIB*pH6.50	0.10 mL 0.1 M $NaHCO_3$
B-IIB*pH6.75	0.18 mL 0.1 M $NaHCO_3$
B-IIB*pH7.00	0.33 mL 0.1 M $NaHCO_3$
B-IIB*pH7.50	0.11 mL 1.0 M $NaHCO_3$

The sample weights are given below.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IIB*pH2.00*A	7.8364	8.3358	0.4994
B-IIB*pH2.00*B	7.8379	8.3368	0.4989
B-IIB*pH2.25*A	7.8371	8.3367	0.4996
B-IIB*pH2.25*B	7.8352	8.3330	0.4978
B-IIB*pH2.50*A	7.8520	8.3513	0.4993
B-IIB*pH2.50*B	7.8999	8.3969	0.4970
B-IIB*pH2.75*A	7.8710	8.3694	0.4984
B-IIB*pH2.75*B	7.8428	8.3404	0.4976
B-IIB*pH3.00*A	7.8779	8.3811	0.5032
B-IIB*pH3.00*B	7.8595	8.3592	0.4997
B-IIB*pH3.25*A	7.8411	8.3387	0.4976
B-IIB*pH3.25*B	7.8759	8.3738	0.4979
B-IIB*pH3.50*A	7.8448	8.3491	0.5043
B-IIB*pH3.50*B	7.9121	8.4103	0.4982
B-IIB*pH3.75*A	7.9242	8.4246	0.5004
B-IIB*pH3.75*B	7.8921	8.3895	0.4974
B-IIB*pH4.00*A	7.8267	8.3237	0.4970
B-IIB*pH4.00*B	7.8596	8.3553	0.4957
B-IIB*pH4.25*A	7.8363	8.3352	0.4989
B-IIB*pH4.25*B	7.8980	8.3945	0.4965
B-IIB*pH4.50*A	7.8870	8.3853	0.4983
B-IIB*pH4.50*B	7.8530	8.3496	0.4966
B-IIB*pH4.75*A	7.8553	8.3541	0.4988
B-IIB*pH4.75*B	7.8363	8.3328	0.4965
B-IIB*pH5.00*A	7.8230	8.3219	0.4989
B-IIB*pH5.00*B	7.8226	8.3201	0.4975
B-IIB*pH5.25*A	7.8347	8.3361	0.5014
B-IIB*pH5.25*B	7.8589	8.3547	0.4958
B-IIB*pH5.50*A	7.8878	8.3889	0.5011
B-IIB*pH5.50*B	7.8413	8.3397	0.4984
B-IIB*pH5.75*A	7.8465	8.3461	0.4996
B-IIB*pH5.75*B	7.7986	8.2967	0.4981
B-IIB*pH6.00*A	7.8123	8.3110	0.4987
B-IIB*pH6.00*B	7.8170	8.3114	0.4944
B-IIB*pH6.25*A	7.8276	8.3254	0.4978
B-IIB*pH6.25*B	7.7880	8.2829	0.4949
B-IIB*pH6.50*A	7.8879	8.3850	0.4971
B-IIB*pH6.50*B	7.8195	8.3142	0.4947
B-IIB*pH6.75*A	7.8065	8.3056	0.4991

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IIB*pH6.75*B	7.8223	8.3181	0.4958
B-IIB*pH7.00*A	7.8027	8.2985	0.4958
B-IIB*pH7.00*B	7.8534	8.3485	0.4951
B-IIB*pH7.25*A	7.8633	8.3646	0.5013
B-IIB*pH7.25*B	7.8252	8.3223	0.4971
B-IIB*pH7.50*A	7.8193	8.3167 TD 8/19/93	0.4974 TD 8/19/93 TD
B-IIB*pH7.50*B	7.8567	~~8.3230~~ 8.3530	~~0.4663~~ 0.4963 B-IIB*pH 7.75 A
B-IIB*pH7.75*A	7.8139	~~8.3102~~	~~0.4993~~ 0.4963 TD values are correct
B-IIB*pH7.75*B	7.8782	8.3754	0.4972 TD
B-IIB*pH8.00*A	7.7633	8.2647	0.5014
B-IIB*pH8.00*B	7.7724	8.2714	0.4990
B-IIB*pH8.25*A	7.8600	8.3609	0.5009
B-IIB*pH8.25*B	7.8571	8.3534	0.4963
B-IIB*pH8.50*A	7.8793	8.3758	0.4965
B-IIB*pH8.50*B	7.8328	8.3300	0.4972
B-IIB*pH8.75*A	7.8354	8.3299	0.4945
B-IIB*pH8.75*B	7.8685	8.3644	0.4959
B-IIB*pH9.00*A	7.7950	8.2917	0.4967
B-IIB*pH9.00*B	7.7836	8.2774	0.4938
B-IIB-C*pH2.0*A	7.8563	8.3437	0.4874
B-IIB-C*pH2.0*B	7.8140	8.3095	0.4955
B-IIB-C*pH4.0*A	7.8737	8.3720	0.4983
B-IIB-C*pH4.0*B	7.8768	8.3727	0.4959
B-IIB-C*pH5.0*A	7.8820	8.3834	0.5014
B-IIB-C*pH5.0*B	7.7903	8.2874	0.4971
B-IIB-C*pH5.5*A	7.8910	8.3887	0.4977
B-IIB-C*pH5.5*B	7.8810	8.3764	0.4954
B-IIB-C*pH6.0*A	7.7981	8.2962	0.4981
B-IIB-C*pH6.0*B	7.8481	8.3460	0.4979
B-IIB-C*pH6.5*A	7.9273	8.4239	0.4966
B-IIB-C*pH6.5*B	7.8807	8.3759	0.4952
B-IIB-C*pH7.0*A	~~7.8663~~ 7.8603 TD	8.3598	~~0.5535~~ 0.4995 TD 8/19/93
B-IIB-C*pH7.0*B	7.8031 8/19/93	8.2982	0.4951
B-IIB-C*pH7.5*A	7.8371	8.3369	0.4998
B-IIB-C*pH7.5*B	7.7946	8.2891	0.4945
B-IIB-C*pH8.0*A	7.9084	8.4051	0.4967
B-IIB-C*pH8.0*B	7.8365	8.3308	0.4943
B-IIB-C*pH9.5*A	7.8661	8.3644	0.4983
B-IIB-C*pH9.5*B	7.8980	8.3927	0.4947

TD 19 August 1993 EXPERIMENT B-IIB, Reverse

The liquid scintillation analysis has finished. The raw data, as well as the results of calculations follow. The last two vials were C-I*Eu samples.

Protocol #: 5 Name:U-233 3% 2 sigma 19-Aug-93 05:12
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	19.04	1.45	2.984	3.66	27.88	1.20	135.48	B
2	7.62	2.22	151.2	580.743	3.01	583.67	3.07	712.44	
3	7.51	0.00	0.00	588.893	3.02	587.04	3.08	716.30	
4	7.59	1.25	263.3	582.523	3.02	583.59	3.08	713.04	
5	7.70	2.26	148.0	574.678	3.01	578.75	3.07	712.57	
6	7.97	0.00	0.00	554.732	3.02	554.31	3.08	712.21	
7	8.00	2.46	133.9	553.391	3.01	556.25	3.07	709.60	
8	8.98	0.00	0.00	492.450	3.02	491.39	3.10	713.31	
9	8.95	0.00	0.00	493.776	3.02	493.91	3.09	706.78	
10	11.36	1.38	195.5	388.389	3.02	390.26	3.11	720.07	
11	11.25	1.40	193.4	392.394	3.02	394.35	3.11	710.43	
12	14.32	0.65	363.7	307.561	3.03	307.53	3.15	714.34	
13	14.64	0.56	415.9	300.636	3.03	301.09	3.15	710.47	
14	17.91	0.00	0.00	245.201	3.04	242.48	3.21	718.47	
15	17.98	0.00	0.00	244.179	3.04	243.09	3.20	715.73	
16	40.57	0.00	0.00	106.555	3.09	106.19	3.44	719.64	
17	37.50	0.00	0.00	115.523	3.08	115.62	3.40	718.03	
18	30.30	0.00	0.00	143.683	3.06	144.14	3.31	716.14	
19	30.78	0.00	0.00	141.428	3.06	141.23	3.33	716.51	
20	22.70	0.98	198.4	192.831	3.05	193.89	3.23	712.22	
21	22.71	0.00	0.00	192.789	3.05	191.63	3.25	716.82	
22	7.91	0.00	0.00	559.342	3.01	560.62	3.08	715.17	
23	7.84	1.24	261.0	564.235	3.02	567.28	3.07	715.60	
24	7.32	0.00	0.00	604.803	3.01	604.50	3.08	714.62	
25	7.26	0.00	0.00	609.413	3.01	609.31	3.08	712.42	
26	7.53	2.87	119.3	587.321	3.02	591.12	3.07	710.00	
27	7.63	1.01	322.5	579.454	3.02	581.04	3.08	717.55	
28	8.24	1.95	164.2	536.336	3.02	539.24	3.08	710.20	
29	8.57	1.38	225.1	515.686	3.02	517.17	3.08	711.88	
30	9.82	0.00	0.00	449.562	3.02	450.33	3.10	715.74	
31	9.82	1.83	159.9	450.071	3.02	453.08	3.09	713.02	
32	8.45	0.00	0.00	523.170	3.02	523.25	3.09	712.46	
33	8.48	2.07	153.4	521.544	3.02	524.72	3.08	715.47	
34	9.97	0.00	0.00	442.753	3.02	443.74	3.10	714.16	
35	9.96	4.15	73.85	443.301	3.02	448.43	3.09	714.83	
36	9.27	1.13	262.4	476.628	3.02	477.84	3.09	717.23	
37	9.10	1.29	233.4	485.917	3.02	488.39	3.09	718.36	
38	8.17	1.40	227.3	541.447	3.02	544.22	3.08	717.25	
39	8.30	2.40	134.3	532.558	3.02	535.98	3.08	712.31	
40	7.60	4.77	74.41	582.411	3.01	589.49	3.06	710.18	
41	8.01	5.30	65.98	552.946	3.01	560.64	3.06	711.33	
42	7.83	1.01	318.8	564.577	3.02	567.02	3.08	714.07	
43	7.67	0.00	0.00	576.938	3.01	579.69	3.07	717.43	
(3 missing vials)									
47	8.18	4.06	83.03	541.026	3.01	544.13	3.07	683.51	
48	8.10	1.82	176.9	546.028	3.02	549.28	3.07	686.97	

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)	AVG [U]
C-I*IUa	541.026	0.5254	1029.7411	1.19076882E+14	1.977036E-10	46.0728	
C-I*IUb	546.028	0.5244	1041.2433	1.20406967E+14	1.999119E-10	46.5874	46.3301

6/15/94 TD
CALCULATIONS VERIFIED ON PAGE 143-4 OF THIS VOL.

6/15/94 TD
CALCULATIONS VERIFIED ON PAGE 143-4 OF THIS VOL.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IBR*pH3.00*A	580.743	0.5037	1152.9541	1.3332E+14	2.2136E-10	51.5856	
3	B-IBR*pH3.00*B	588.893	0.5007	1176.1394	1.3601E+14	2.2581E-10	52.6229	52.1043
4	B-IBR*pH4.00*A	582.523	0.5020	1160.4044	1.3419E+14	2.2279E-10	51.9189	
5	B-IBR*pH4.00*B	574.732	0.5008	1147.6278	1.3271E+14	2.2034E-10	51.3473	51.6331
6	B-IBR*pH4.50*A	554.732	0.4971	1115.9364	1.2904E+14	2.1425E-10	49.9293	
7	B-IBR*pH4.50*B	553.391	0.4979	1111.4501	1.2853E+14	2.1339E-10	49.7286	49.8290
8	B-IBR*pH5.00*A	492.450	0.5016	981.7584	1.1353E+14	1.8849E-10	43.9259	
9	B-IBR*pH5.00*B	493.776	0.5000	987.5520	1.1420E+14	1.8960E-10	44.1851	44.0555
10	B-IBR*pH5.50*A	388.389	0.5039	770.7660	8.9130E+13	1.4798E-10	34.4857	
11	B-IBR*pH5.50*B	392.394	0.4982	787.6234	9.1079E+13	1.5122E-10	35.2399	34.8628
12	B-IBR*pH6.00*A	307.561	0.5021	612.5493	7.0834E+13	1.1761E-10	27.4067	
13	B-IBR*pH6.00*B	300.636	0.5007	600.4314	6.9432E+13	1.1528E-10	26.8646	27.1356
14	B-IBR*pH6.25*A	245.201	0.5025	487.9822	5.6427E+13	9.3666E-11	21.8324	
15	B-IBR*pH6.25*B	244.179	0.4982	490.1224	5.6677E+13	9.4100E-11	21.9291	21.8808
16	B-IBR*pH6.50*A	106.555	0.5008	212.7696	2.4604E+13	4.0850E-11	9.5198	
17	B-IBR*pH6.50*B	115.523	0.4980	231.9739	2.6825E+13	4.4537E-11	10.3790	9.9494
18	B-IBR*pH6.75*A	143.683	0.5017	286.3923	3.3118E+13	5.4985E-11	12.8138	
19	B-IBR*pH6.75*B	141.428	0.4993	283.2526	3.2755E+13	5.4383E-11	12.6733	12.7436
20	B-IBR*pH7.00*A	192.831	0.5005	385.2767	4.4553E+13	7.3971E-11	17.2381	
21	B-IBR*pH7.00*B	192.789	0.4941	390.1821	4.5120E+13	7.4912E-11	17.4576	17.3478
22	B-IBR*pH7.50*A	559.342	0.5025	1113.1184	1.2872E+14	2.1371E-10	49.8032	
23	B-IBR*pH7.50*B	564.235	0.4975	1134.1407	1.3115E+14	2.1775E-10	50.7438	50.2735
24	B-IBR-C*pH2.0*A	604.803	0.5028	1202.8699	1.3910E+14	2.3094E-10	53.8189	
25	B-IBR-C*pH2.0*B	609.413	0.5013	1215.6653	1.4056E+14	2.3340E-10	54.3914	54.1052
26	B-IBR-C*pH4.0*A	587.321	0.5022	1169.4962	1.3524E+14	2.2454E-10	52.3257	
27	B-IBR-C*pH4.0*B	579.454	0.4984	1162.6284	1.3444E+14	2.2322E-10	52.0184	52.1721
28	B-IBR-C*pH5.0*A	536.336	0.5022	1067.9729	1.2350E+14	2.0504E-10	47.7833	
29	B-IBR-C*pH5.0*B	515.686	0.4979	1035.7220	1.1977E+14	1.9885E-10	46.3404	47.0619
30	B-IBR-C*pH5.5*A	449.562	0.5016	896.2560	1.0364E+14	1.7208E-10	40.1004	
31	B-IBR-C*pH5.5*B	450.071	0.4979	903.9385	1.0453E+14	1.7355E-10	40.4441	40.2722
32	B-IBR-C*pH6.0*A	523.170	0.5025	1041.1343	1.2039E+14	1.9989E-10	46.5825	
33	B-IBR-C*pH6.0*B	521.544	0.4976	1048.1190	1.2120E+14	2.0123E-10	46.8950	46.7388
34	B-IBR-C*pH6.5*A	442.753	0.5032	879.8748	1.0175E+14	1.6893E-10	39.3674	
35	B-IBR-C*pH6.5*B	443.301	0.4996	887.3118	1.0261E+14	1.7036E-10	39.7002	39.5338
36	B-IBR-C*pH7.0*A	476.628	0.5009	951.5432	1.1003E+14	1.8269E-10	42.5740	
37	B-IBR-C*pH7.0*B	485.917	0.4980	975.7369	1.1283E+14	1.8734E-10	43.6565	43.1153
38	B-IBR-C*pH7.5*A	541.447	0.5028	1076.8638	1.2453E+14	2.0675E-10	48.1811	
39	B-IBR-C*pH7.5*B	532.558	0.4993	1066.6093	1.2334E+14	2.0478E-10	47.7223	47.9517
40	B-IBR-C*pH8.0*A	582.411	0.5031	1157.6446	1.3387E+14	2.2226E-10	51.7954	
41	B-IBR-C*pH8.0*B	552.946	0.4987	1108.7748	1.2822E+14	2.1288E-10	49.6089	50.7022
42	B-IBR-C*pH9.5*A	564.577	0.5033	1121.7504	1.2972E+14	2.1537E-10	50.1895	
43	B-IBR-C*pH9.5*B	576.938	0.5000	1153.8760	1.3343E+14	2.2154E-10	51.6268	50.9081

20 August 1993 TD
EXPERIMENT B-IIIB, Reverse

The Liquid Scintillation Analysis of the B-IIIB samples has completed. The raw data & results of calculations follow.

```
Protocol #: 6        Name:U-233 5% 2 Sigma          20-Aug-93   00:08
Region A: LL-UL= 0.0-100.. Lcr=   0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=   0  Bkg= 0.00  %2 Sigma=5.00
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 5% 2 sigma error for 5 ppb U-233 experiments
```

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	560.09	18.88	1.95	2.860	5.00	27.76	1.60	132.45	B
2	26.29	0.00	0.00	58.037	5.25	56.65	6.37	727.41	
3	25.55	0.46	387.3	59.762	5.24	60.58	6.18	717.53	
4	24.98	0.00	0.00	61.191	5.24	61.43	6.19	722.67	
5	27.15	0.72	241.7	56.219	5.25	56.77	6.27	709.45	
6	27.94	0.38	447.5	54.441	5.27	55.06	6.31	714.07	
7	27.64	0.91	189.3	55.172	5.26	56.83	6.21	711.43	
8	32.69	0.55	288.5	46.115	5.32	46.85	6.52	714.24	
9	34.77	1.08	143.8	43.156	5.34	44.89	6.52	698.49	
10	56.10	0.38	326.7	25.678	5.58	26.00	7.72	713.49	
11	58.02	0.00	0.00	24.734	5.61	24.79	7.88	724.44	
12	93.81	0.05	2124.	14.195	6.09	14.82	9.58	718.77	
13	92.13	0.00	0.00	14.507	6.07	14.28	9.96	732.62	
14	104.31	0.02	4621.	12.479	6.25	12.43	10.61	724.80	
15	99.31	0.00	0.00	13.271	6.17	13.25	10.26	739.10	
16	185.57	0.00	0.00	5.773	7.87	5.54	17.26	781.35	
17	173.80	0.00	0.00	6.369	7.58	6.80	14.85	749.38	
18	157.92	0.00	0.00	7.278	7.23	6.95	14.94	782.51	
19	155.82	0.08	1040.	7.414	7.19	7.84	13.45	721.47	
20	102.62	0.55	173.1	12.790	6.21	13.75	9.80	706.60	
21	101.72	1.13	84.92	12.869	6.21	14.20	9.57	669.77	
22	27.29	0.47	365.0	55.843	5.26	57.84	6.17	727.54	
23	27.65	0.00	0.00	55.042	5.26	54.38	6.39	749.11	
24	25.46	0.00	0.00	59.983	5.24	59.32	6.28	734.24	
25	24.53	0.00	0.00	62.366	5.23	61.03	6.28	744.44	
26	26.22	0.00	0.00	58.162	5.25	57.41	6.33	742.40	
27	26.08	0.14	1223.	58.528	5.25	58.78	6.24	735.65	
28	34.99	0.00	0.00	42.896	5.34	42.35	6.77	746.23	
29	35.06	0.00	0.00	42.776	5.34	42.18	6.78	748.21	
30	44.74	0.00	0.00	32.902	5.45	33.04	7.18	745.23	
31	44.37	0.19	711.3	33.200	5.45	33.12	7.20	729.43	
32	49.96	1.18	111.8	29.185	5.51	30.99	7.14	711.58	
33	49.58	0.00	0.00	29.411	5.51	28.31	7.67	757.94	
34	51.31	0.00	0.00	28.362	5.52	28.49	7.51	737.03	
35	41.73	0.00	0.00	35.481	5.42	35.41	7.06	739.98	
36	52.96	0.03	4898.	27.351	5.55	28.02	7.50	731.02	
37	40.54	0.00	0.00	36.656	5.40	35.88	7.09	750.07	
38	28.34	0.18	939.9	53.668	5.27	54.39	6.31	729.73	
39	28.24	0.46	369.5	53.797	5.27	54.11	6.35	728.53	
40	26.87	0.00	0.00	56.686	5.26	56.98	6.28	739.46	
41	26.93	0.00	0.00	56.627	5.26	56.94	6.28	742.27	
42	27.17	1.29	136.2	56.028	5.26	57.89	6.18	722.11	
43	25.20	0.33	539.4	60.632	5.24	61.65	6.15	733.90	

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SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
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6/15/94 TD
CALCULATIONS
VERIFIED ON
PGS 193-4
OF THIS BOOK.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IIIBR*pH3.00*A	56.037	0.5014	115.7499	1.3385E+13	2.2223E-11	5.1789	
3	B-IIIBR*pH3.00*B	59.762	0.5003	119.4523	1.3813E+13	2.2934E-11	5.3445	5.2617
4	B-IIIBR*pH4.00*A	61.191	0.4989	122.6518	1.4183E+13	2.3548E-11	5.4877	
5	B-IIIBR*pH4.00*B	56.219	0.4935	113.9189	1.3173E+13	2.1872E-11	5.0970	5.2923
6	B-IIIBR*pH4.50*A	54.441	0.5031	108.2111	1.2513E+13	2.0776E-11	4.8416	
7	B-IIIBR*pH4.50*B	55.172	0.4984	110.6982	1.2801E+13	2.1253E-11	4.9529	4.8972
8	B-IIIBR*pH5.00*A	46.115	0.5007	92.1011	1.0650E+13	1.7683E-11	4.1208	
9	B-IIIBR*pH5.00*B	43.156	0.4981	86.6412	1.0019E+13	1.6635E-11	3.8765	3.9987
10	B-IIIBR*pH5.50*A	25.678	0.5010	51.2535	5.9268E+12	9.8403E-12	2.2932	
11	B-IIIBR*pH5.50*B	24.734	0.4971	49.7586	5.7537E+12	9.5529E-12	2.2262	2.2597
12	B-IIIBR*pH6.00*A	14.195	0.5018	28.2882	3.2712E+12	5.4311E-12	1.2657	
13	B-IIIBR*pH6.00*B	14.507	0.5000	29.0140	3.3551E+12	5.5705E-12	1.2981	1.2819
14	B-IIIBR*pH6.25*A	12.479	0.5044	24.7403	2.8609E+12	4.7500E-12	1.1069	
15	B-IIIBR*pH6.25*B	13.271	0.4982	26.6379	3.0803E+12	5.1143E-12	1.1918	1.1494
16	B-IIIBR*pH6.50*A	5.773	0.5012	11.5184	1.3320E+12	2.2114E-12	0.5154	
17	B-IIIBR*pH6.50*B	6.369	0.4988	12.7686	1.4765E+12	2.4515E-12	0.5713	0.5433
18	B-IIIBR*pH6.75*A	7.278	0.5029	14.4721	1.6735E+12	2.7785E-12	0.6475	
19	B-IIIBR*pH6.75*B	7.414	0.4996	14.8399	1.7160E+12	2.8492E-12	0.6640	0.6557
20	B-IIIBR*pH7.00*A	12.790	0.4996	25.6005	2.9604E+12	4.9151E-12	1.1454	
21	B-IIIBR*pH7.00*B	12.869	0.4985	25.8154	2.9852E+12	4.9564E-12	1.1550	1.1502
22	B-IIIBR*pH7.50*A	55.843	0.5035	110.9096	1.2825E+13	2.1294E-11	4.9623	
23	B-IIIBR*pH7.50*B	55.042	0.5001	110.0620	1.2727E+13	2.1131E-11	4.9244	4.9434
24	B-IIIBR-C*pH2.0*A	59.983	0.4988	120.2546	1.3906E+13	2.3088E-11	5.3804	
25	B-IIIBR-C*pH2.0*B	62.366	0.4965	125.6113	1.4525E+13	2.4117E-11	5.6201	5.5003
26	B-IIIBR-C*pH4.0*A	58.162	0.5028	115.6762	1.3377E+13	2.2209E-11	5.1756	
27	B-IIIBR-C*pH4.0*B	58.528	0.4985	117.4082	1.3577E+13	2.2542E-11	5.2531	5.2143
28	B-IIIBR-C*pH5.0*A	42.896	0.5031	85.2634	9.8597E+12	1.6370E-11	3.8149	
29	B-IIIBR-C*pH5.0*B	42.776	0.4981	85.8783	9.9308E+12	1.6488E-11	3.8424	3.8286
30	B-IIIBR-C*pH5.5*A	32.902	0.5054	65.1009	7.5281E+12	1.2499E-11	2.9128	
31	B-IIIBR-C*pH5.5*B	33.200	0.5001	66.3867	7.6768E+12	1.2746E-11	2.9703	2.9415
32	B-IIIBR-C*pH6.0*A	29.185	0.5006	58.3000	6.7417E+12	1.1193E-11	2.6085	
33	B-IIIBR-C*pH6.0*B	29.411	0.4998	58.8455	6.8048E+12	1.1298E-11	2.6329	2.6207
34	B-IIIBR-C*pH6.5*A	28.362	0.5011	56.5995	6.5450E+12	1.0867E-11	2.5324	
35	B-IIIBR-C*pH6.5*B	35.481	0.4985	71.1755	8.2306E+12	1.3665E-11	3.1845	2.8585
36	B-IIIBR-C*pH7.0*A	27.351	0.5018	54.5058	6.3029E+12	1.0465E-11	2.4387	
37	B-IIIBR-C*pH7.0*B	36.656	0.4992	73.4295	8.4912E+12	1.4098E-11	3.2854	2.8620
38	B-IIIBR-C*pH7.5*A	53.668	0.4948	108.4640	1.2543E+13	2.0824E-11	4.8529	
39	B-IIIBR-C*pH7.5*B	53.797	0.4996	107.6601	1.2452E+13	2.0674E-11	4.8178	4.8354
40	B-IIIBR-C*pH8.0*A	56.686	0.5006	113.2361	1.3094E+13	2.1741E-11	5.0664	
41	B-IIIBR-C*pH8.0*B	56.627	0.4990	113.4610	1.3123E+13	2.1788E-11	5.0774	5.0719
42	B-IIIBR-C*pH9.5*A	56.028	0.4987	112.3481	1.2992E+13	2.1570E-11	5.0267	
43	B-IIIBR-C*pH9.5*B	60.632	0.4968	122.0451	1.4113E+13	2.3432E-11	5.4606	5.2436

TD 26 AUGUST 1993 EXPERIMENT C-I

The pH of the solutions has had time to equilibrate, so the experiment will proceed. 2-500µL ~~aliquots~~ TD 26/8/93 samples ~~were~~ were 8/25/93 taken from each solutions. These were acidified and prepared for liquid scintillation analysis. The sample weights can be found on the next page (p.78).

The pH of each solution was also measured. 0.1000 ± 0.0079 TD eq of Na-Clinoptilolite was added to each solution, but not those labeled C-I-C*.... The solution C-I*pH 5.50 accidentally had 2 portions of zeolite added. The pH values and zeolite weights can be found on page 79 TD 80

SAMPLE WEIGHTS FOR C-I.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
C-I*pH2.00*IUA	7.8598	8.3860	0.5262
C-I*pH2.00*IUB	7.8078	8.3308	0.5230
C-I*pH2.25*IUA	7.8535	8.3785	0.5250
C-I*pH2.25*IUB	7.8404	8.3622	0.5218
C-I*pH2.50*IUA	7.8090	8.3297	0.5207
C-I*pH2.50*IUB	7.8237	8.3434	0.5197
C-I*pH2.75*IUA	7.8721	8.3980	0.5259
C-I*pH2.75*IUB	7.8514	8.3733	0.5219
C-I*pH3.00*IUA	7.8016	8.3247	0.5231
C-I*pH3.00*IUB	7.8005	8.3220	0.5215
C-I*pH3.25*IUA	7.8275	8.3504	0.5229
C-I*pH3.25*IUB	7.8084	8.3293	0.5209
C-I*pH3.50*IUA	7.8244	8.3488	0.5244
C-I*pH3.50*IUB	7.8527	8.3743	0.5216
C-I*pH3.75*IUA	7.8850	8.4100	0.5250
C-I*pH3.75*IUB	7.8195	8.3417	0.5222
C-I*pH4.00*IUA	7.8526	8.3775	0.5249
C-I*pH4.00*IUB	7.8138	8.3348	0.5210
C-I*pH4.25*IUA	7.8183	8.3414	0.5231
C-I*pH4.25*IUB	7.7834	8.3034	0.5200
C-I*pH4.50*IUA	7.8691	8.3936	0.5245
C-I*pH4.50*IUB	7.8463	8.3688	0.5225
C-I*pH4.75*IUA	7.9288	8.4526	0.5238
C-I*pH4.75*IUB	7.8901	8.4117	0.5216
C-I*pH5.00*IUA	7.8928	8.4188	0.5260
C-I*pH5.00*IUB	7.8315	8.3531	0.5216
C-I*pH5.25*IUA	7.7641	8.2907	0.5266
C-I*pH5.25*IUB	7.8501	8.3727	0.5226
C-I*pH5.50*IUA	7.8292	8.3550	0.5258
C-I*pH5.50*IUB	7.9126	8.4342	0.5216
C-I*pH5.75*IUA	7.7890	8.3135	0.5245
C-I*pH5.75*IUB	7.8820	8.4036	0.5216
C-I*pH6.00*IUA	7.8371	8.3632	0.5261
C-I*pH6.00*IUB	7.8347	8.3558	0.5211
C-I*pH6.25*IUA	7.8608	8.3864	0.5256
C-I*pH6.25*IUB	7.8628	8.3850	0.5222
C-I*pH6.50*IUA	7.8918	8.4149	0.5231
C-I*pH6.50*IUB	7.8477	8.3681	0.5204

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
C-I*pH6.75*IUA	7.9038	8.4264	0.5226
C-I*pH6.75*IUB	7.8269	8.3501	0.5232
C-I*pH2.00*IUA	7.7578	8.2824	0.5246
C-I*pH7.00*IUB	7.7973	8.3183	0.5210
C-I*pH7.25*IUA	7.8543	8.3849	0.5306
C-I*pH7.25*IUB	7.8304	8.3580	0.5276
C-I*pH7.50*IUA	7.8673	8.3906	0.5233
C-I*pH7.50*IUB	7.8537	8.3738	0.5201
C-I*pH7.75*IUA	7.7862	8.3132	0.5270
C-I*pH7.75*IUB	7.8263	8.3491	0.5228
C-I*pH8.00*IUA	7.8358	8.3616	0.5258
C-I*pH8.00*IUB	7.7888	8.3115	0.5227
C-I*pH8.25*IUA	7.8499	8.3737	0.5238
C-I*pH8.25*IUB	7.8519	8.3730	0.5211
C-I*pH8.50*IUA	7.8117	8.3313	0.5196
C-I*pH8.50*IUB	7.7898	8.3704 8.3674	0.5806 . 5176
C-I*pH8.75*IUA	7.8641	8.3837	0.5196
C-I*pH8.75*IUB	7.8860	8.4041	0.5181
C-I*pH9.00*IUA	7.8713	8.3915	0.5202
C-I*pH9.00*IUB	7.8263	8.3468	0.5205
C-I-C*pH2.0*IUA	7.8363	8.3630	0.5267
C-I-C*pH2.0*IUB	7.8578	8.3800	0.5222
C-I-C*pH4.0*IUA	7.7906	8.3151	0.5245
C-I-C*pH4.0*IUB	7.7905	8.3120	0.5215
C-I-C*pH5.0*IUA	7.8304	8.3547	0.5243
C-I-C*pH5.0*IUB	7.7963	8.3175	0.5212
C-I-C*pH5.5*IUA	7.8061	8.3298	0.5237
C-I-C*pH5.5*IUB	7.8930	8.4122	0.5192
C-I-C*pH6.0*IUA	7.8136	8.3363	0.5227
C-I-C*pH6.0*IUB	7.8084	8.3296	0.5212
C-I-C*pH6.5*IUA	7.8150	8.3378	0.5228
C-I-C*pH6.5*IUB	7.8576	8.3785	0.5209
C-I-C*pH7.0*IUA	7.8087	8.3340	0.5253
C-I-C*pH7.0*IUB	7.8251	8.3470	0.5219
C-I-C*pH7.5*IUA	7.8276	8.3525	0.5249
C-I-C*pH7.5*IUB	7.8804	8.4022	0.5218
C-I-C*pH8.0*IUA	7.8795	8.4052	0.5257
C-I-C*pH8.0*IUB	7.7849	8.3056	0.5207

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
C-I-C*pH9.5*IUA	7.8495	8.3763	0.5268
C-I-C*pH9.5*IUB	7.8588	8.3826	0.5238

SOLUTION NAME	pH	T (C)	WT ZEOLITE ADDED (g)
C-I*pH2.00	1.71	23.2	0.0997
C-I*pH2.25	1.98	23.2	0.1003
C-I*pH2.50	2.26	23.2	0.0999
C-I*pH2.75	2.51	23.2	0.1000
C-I*pH3.00	2.80	23.2	0.0990
C-I*pH3.25	3.06	23.2	0.0995
C-I*pH3.50	3.28	23.2	0.0997
C-I*pH3.75	3.56	23.2	0.1005
C-I*pH4.00	3.78	23.2	0.1009
C-I*pH4.25	4.04	23.3	0.1010
C-I*pH4.50	4.25	23.3	0.0994
C-I*pH4.75	4.51	23.3	0.0996
C-I*pH5.00	4.73	23.3	0.1006
C-I*pH5.25	4.69	23.3	0.1000
C-I*pH5.50	***5.13***	***23.4***	***0.1990***
C-I*pH5.75	5.23	23.4	0.0994
C-I*pH6.00	6.01	23.4	0.0997
C-I*pH6.25	6.07	23.4	0.1005
C-I*pH6.50	6.27	23.4	0.0998
C-I*pH6.75	6.47	23.5	0.1008
C-I*pH7.00	6.75	23.5	0.1003
C-I*pH7.25	7.04	23.5	0.0994
C-I*pH7.50	7.27	23.5	0.0996
C-I*pH7.75	7.64	23.5	0.1005
C-I*pH8.00	7.90	23.5	0.1010
C-I*pH8.25	8.15	23.5	0.0998
C-I*pH8.50	8.40	23.5	0.1000
C-I*pH8.75	8.66	23.6	0.0996
C-I*pH9.00	8.91	23.6	0.1003

SOLUTION NAME	pH	T (C)
C-I-C*pH2.0	1.66	23.6
C-I-C*pH4.0	3.77	23.6
C-I-C*pH5.0	4.77	23.6
C-I-C*pH5.5	5.08	23.6
C-I-C*pH6.0	5.85	23.6
C-I-C*pH6.5	6.20	23.6
C-I-C*pH7.0	6.75	23.6
C-I-C*pH7.5	7.24	23.6
C-I-C*pH8.0	7.90	23.6
C-I-C*pH9.5	9.34	23.6

7 SEPT 1993 TD EXPERIMENT B-IIB

The results of the pH measurements of 19 August (p71) were ~~accidentally~~ TD 9/7/93 accidentally left out of the note book. The results are given on the next page.

SOLUTION NAME	pH/T(C)
B-IIB*pH2.00	1.89/20.5
B-IIB*pH2.25	2.18/20.6
B-IIB*pH2.50	2.45/20.6
B-IIB*pH2.75	2.71/20.6
B-IIB*pH3.00	2.96/20.6
B-IIB*pH3.25	3.26/20.6
B-IIB*pH3.50	3.61/20.6
B-IIB*pH3.75	3.88/20.6
B-IIB*pH4.00	4.27/20.6
B-IIB*pH4.25	4.55/20.6
B-IIB*pH4.50	4.79/20.7
B-IIB*pH4.75	5.01/20.7
B-IIB*pH5.00	5.71/20.7
B-IIB*pH5.25	5.87/20.8
B-IIB*pH5.50	5.86/20.8
B-IIB*pH5.75	6.04/20.8
B-IIB*pH6.00	6.17/20.9
B-IIB*pH6.25	6.92/20.9
B-IIB*pH6.50	6.58/20.9
B-IIB*pH6.75	6.53/20.9
B-IIB*pH7.00	7.11/21
B-IIB*pH7.25	7.03/21
B-IIB*pH7.50	7.32/21.1
B-IIB*pH7.75	7.57/21.1
B-IIB*pH8.00	7.8/21.1
B-IIB*pH8.25	8.08/21.1
B-IIB*pH8.50	8.34/21.1
B-IIB*pH8.75	8.67/21.1
B-IIB*pH9.00	8.9/21.2
B-IIB-C*pH2.0	1.84/21.2
B-IIB-C*pH4.0	3.93/21.2
B-IIB-C*pH5.0	4.95/21.2
B-IIB-C*pH5.5	6.08/21.3
B-IIB-C*pH6.0	6.42/21.3
B-IIB-C*pH6.5	6.54/21.3
B-IIB-C*pH7.0	6.87/21.4
B-IIB-C*pH7.5	7.26/21.4
B-IIB-C*pH8.0	7.7/21.4
B-IIB-C*pH9.5	9.41/21.4

The calculations based on the liquid scintillation analysis of the B-IIB and C-I-IU solutions have finished. The raw data & results are given on the following pages.

LSA RESULTS FOR B-IIB

Protocol #: 4 Name:U-233 1% 2 sigma 28-Aug-93 06:06
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=1.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 1% 2 sigma error for 500 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	18.92	1.45	3.19	3.54	28.11	1.19	140.93	B
2	7.04	20.99	22.72	5679.05	1.00	5704.27	1.00	702.86	
3	7.01	14.74	29.78	5708.08	1.00	5728.80	1.00	703.54	
4	6.97	8.48	46.87	5736.55	1.00	5747.35	1.00	707.48	
5	7.00	20.94	22.83	5713.81	1.00	5738.17	1.00	702.86	
6	6.98	11.02	37.67	5732.91	1.00	5745.67	1.00	701.78	
7	6.98	15.61	28.56	5731.91	1.00	5751.26	1.00	706.24	
8	7.03	12.52	33.86	5695.67	1.00	5712.71	1.00	705.78	
9	7.04	12.04	34.90	5679.91	1.00	5695.04	1.00	705.56	
10	7.02	7.15	54.06	5700.37	1.00	5708.50	1.00	706.70	
11	6.97	9.77	41.62	5740.71	1.00	5753.23	1.00	703.74	
12	7.08	14.84	29.49	5646.81	1.00	5665.25	1.00	705.12	
13	6.98	15.61	28.56	5735.64	1.00	5751.26	1.00	703.37	
14	7.08	20.63	22.96	5655.57	1.00	5680.22	1.00	704.15	
15	7.18	15.62	28.14	5573.55	1.00	5589.85	1.00	705.02	
16	7.32	21.24	22.09	5462.93	1.00	5486.37	1.00	703.26	
17	7.32	7.03	53.68	5461.29	1.00	5471.07	1.00	703.02	
18	7.66	13.98	29.72	5222.79	1.00	5238.47	1.00	703.31	
19	7.64	18.91	23.58	5237.26	1.00	5258.40	1.00	701.15	
20	8.03	13.58	29.70	4979.87	1.00	4997.17	1.00	701.87	
21	8.10	10.71	35.81	4937.18	1.00	4949.29	1.00	706.21	
22	8.76	14.07	27.66	4564.96	1.00	4580.56	1.00	704.19	
23	8.72	7.23	48.08	4585.69	1.00	4594.25	1.00	706.27	
24	9.38	6.35	51.91	4261.31	1.00	4270.71	1.00	706.63	
25	9.43	5.26	61.15	4238.59	1.00	4245.80	1.00	705.90	
26	11.57	10.98	29.38	3454.89	1.00	3468.78	1.00	705.46	
27	11.58	12.17	27.03	3451.04	1.00	3464.98	1.00	707.64	
28	14.18	7.45	36.78	2819.31	1.00	2829.64	1.00	706.50	
29	14.21	9.09	31.05	2812.57	1.00	2822.27	1.00	707.09	
30	14.66	3.93	63.92	2725.60	1.00	2731.91	1.00	707.28	
31	14.73	4.57	55.61	2712.90	1.00	2719.41	1.00	707.65	
32	15.55	8.35	31.91	2569.29	1.00	2578.96	1.00	704.42	
33	15.35	6.81	38.23	2603.65	1.00	2612.47	1.00	703.40	
34	16.17	8.29	31.47	2471.89	1.00	2482.83	1.00	702.28	
35	16.29	2.63	88.23	2453.90	1.00	2458.07	1.01	702.83	
36	13.33	7.19	39.14	2999.36	1.00	3010.37	1.00	703.38	
37	13.51	3.58	72.50	2959.73	1.00	2964.93	1.00	707.65	
38	17.73	8.43	29.64	2254.23	1.00	2264.61	1.00	703.76	
39	18.01	5.68	41.46	2217.96	1.00	2224.19	1.01	703.01	
40	16.23	6.65	37.98	2462.24	1.00	2471.15	1.00	705.36	
41	16.22	5.00	48.89	2464.57	1.00	2471.15	1.00	703.99	
42	12.09	4.98	56.71	3307.40	1.00	3315.06	1.00	703.78	
43	12.09	7.46	39.76	3307.07	1.00	3316.55	1.00	705.45	
44	13.07	8.16	35.43	3058.78	1.00	3068.21	1.00	706.17	
45	12.97	7.29	39.17	3080.85	1.00	3088.93	1.00	706.20	
46	10.81	8.37	38.12	3699.12	1.00	3708.24	1.00	707.19	
47	10.85	7.16	43.47	3685.20	1.00	3693.55	1.00	705.68	
48	8.91	9.02	39.37	4489.40	1.00	4501.63	1.00	706.39	
49	8.97	10.29	35.18	4461.25	1.00	4474.45	1.00	707.77	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	7.60	5.82	62.23	5266.02	1.00	5272.28	1.00	708.75	
51	7.65	14.80	28.43	5229.75	1.00	5246.66	1.00	706.83	
52	7.01	10.18	40.12	5704.80	1.00	5717.82	1.00	707.00	
53	7.18	16.04	27.57	5568.26	1.00	5588.04	1.00	709.10	
54	7.06	16.35	27.40	5664.09	1.00	5682.51	1.00	710.11	
55	7.03	8.67	45.79	5687.42	1.00	5698.63	1.00	709.64	
56	7.02	11.85	35.42	5700.66	1.00	5714.34	1.00	707.36	
57	7.05	10.16	40.08	5677.66	1.00	5692.03	1.00	707.96	
58	7.01	13.89	31.22	5708.22	1.00	5725.95	1.00	706.62	
59	7.06	10.82	38.01	5664.94	1.00	5678.54	1.00	706.88	
60	7.06	18.76	24.68	5664.80	1.00	5698.37	1.00	706.85	
61	6.99	11.84	35.52	5721.42	1.00	5750.00	1.00	706.62	
62	7.05	15.55	28.50	5673.83	1.00	5700.25	1.00	707.40	
63	7.08	16.95	26.60	5646.53	1.00	5673.58	1.00	705.97	
64	7.32	11.82	34.76	5464.16	1.00	5480.63	1.00	706.25	
65	7.41	16.71	26.30	5395.33	1.00	5418.85	1.00	708.39	
66	7.31	9.12	43.05	5472.73	1.00	5487.62	1.00	711.75	
67	7.30	12.86	32.52	5478.32	1.00	5496.13	1.00	705.90	
68	7.50	19.75	23.04	5336.54	1.00	5364.02	1.00	705.38	
69	7.49	18.86	23.86	5343.54	1.00	5368.01	1.00	711.88	
70	7.65	14.67	28.62	5230.54	1.00	5252.02	1.00	706.06	
71	7.60	15.42	27.63	5263.92	1.00	5285.57	1.00	707.14	
72	7.83	17.60	24.59	5106.90	1.00	5132.93	1.00	706.39	
73	7.88	12.04	33.00	5073.59	1.00	5092.32	1.00	709.61	
74	7.23	14.41	29.86	5532.91	1.00	5553.63	1.00	706.22	
75	7.36	18.99	23.95	5438.11	1.00	5463.60	1.00	708.77	
76	6.98	17.18	26.52	5730.91	1.00	5754.41	1.00	706.82	
77	7.02	16.26	27.58	5699.23	1.00	5720.46	1.00	707.65	
78	7.18	16.73	26.69	5575.08	1.00	5605.87	1.00	708.82	
79	7.23	15.52	28.18	5534.98	1.00	5563.59	1.00	706.28	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IIB*pH2.00*A	5679.05	0.4994	11371.7461	1.3150E+15	2.1833E-09	508.80	
3	B-IIB*pH2.00*B	5708.08	0.4989	11441.3309	1.3230E+15	2.1967E-09	511.91	510.35
4	B-IIB*pH2.25*A	5736.55	0.4996	11482.2858	1.3278E+15	2.2045E-09	513.74	
5	B-IIB*pH2.25*B	5713.81	0.4978	11478.1237	1.3273E+15	2.2037E-09	513.56	513.65
6	B-IIB*pH2.50*A	5732.91	0.4993	11481.8947	1.3277E+15	2.2044E-09	513.72	
7	B-IIB*pH2.50*B	5731.91	0.4970	11533.0181	1.3337E+15	2.2143E-09	516.01	514.87
8	B-IIB*pH2.75*A	5695.67	0.4984	11427.9093	1.3215E+15	2.1941E-09	511.31	
9	B-IIB*pH2.75*B	5679.91	0.4976	11414.6101	1.3200E+15	2.1915E-09	510.71	511.01
10	B-IIB*pH3.00*A	5700.37	0.5032	11328.2393	1.3100E+15	2.1749E-09	506.85	
11	B-IIB*pH3.00*B	5740.71	0.4997	11488.3130	1.3285E+15	2.2057E-09	514.01	510.43
12	B-IIB*pH3.25*A	5646.81	0.4976	11348.0908	1.3123E+15	2.1788E-09	507.74	
13	B-IIB*pH3.25*B	5735.64	0.4979	11519.6626	1.3321E+15	2.2117E-09	515.41	511.58
14	B-IIB*pH3.50*A	5655.57	0.5043	11214.6936	1.2968E+15	2.1531E-09	501.77	
15	B-IIB*pH3.50*B	5573.55	0.4982	11187.3745	1.2937E+15	2.1479E-09	500.55	501.16
16	B-IIB*pH3.75*A	5462.93	0.5004	10917.1263	1.2624E+15	2.0960E-09	488.46	
17	B-IIB*pH3.75*B	5461.29	0.4974	10979.6743	1.2697E+15	2.1080E-09	491.25	489.85
18	B-IIB*pH4.00*A	5222.79	0.4970	10508.6318	1.2152E+15	2.0176E-09	470.18	
19	B-IIB*pH4.00*B	5237.26	0.4957	10565.3823	1.2218E+15	2.0285E-09	472.72	471.45
20	B-IIB*pH4.25*A	4979.87	0.4989	9981.6997	1.1543E+15	1.9164E-09	446.60	
21	B-IIB*pH4.25*B	4937.18	0.4965	9943.9678	1.1499E+15	1.9092E-09	444.91	445.76
22	B-IIB*pH4.50*A	4564.96	0.4983	9161.0676	1.0594E+15	1.7589E-09	409.89	
23	B-IIB*pH4.50*B	4585.69	0.4966	9234.1724	1.0678E+15	1.7729E-09	413.16	411.52
24	B-IIB*pH4.75*A	4261.31	0.4988	8543.1235	9.8791E+14	1.6402E-09	382.24	
25	B-IIB*pH4.75*B	4238.59	0.4965	8536.9386	9.8719E+14	1.6390E-09	381.96	382.10
26	B-IIB*pH5.00*A	3454.89	0.4989	6925.0150	8.0079E+14	1.3296E-09	309.84	
27	B-IIB*pH5.00*B	3451.04	0.4975	6936.7638	8.0215E+14	1.3318E-09	310.37	310.10
28	B-IIB*pH5.25*A	2819.31	0.5014	5622.8759	6.5022E+14	1.0796E-09	251.58	
29	B-IIB*pH5.25*B	2812.57	0.4958	5672.7914	6.5599E+14	1.0891E-09	253.81	252.70
30	B-IIB*pH5.50*A	2725.60	0.5011	5439.2337	6.2898E+14	1.0443E-09	243.36	

TD 6/15/94 calculations verified on pgs 143-144 of this book.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
31	B-IIB*pH5.50*B	2712.90	0.4984	5443.2183	6.2944E+14	1.0451E-09	243.54	243.45
32	B-IIB*pH5.75*A	2569.29	0.4996	5142.6942	5.9469E+14	9.8736E-10	230.09	
33	B-IIB*pH5.75*B	2603.65	0.4981	5227.1632	6.0446E+14	1.0036E-09	233.87	231.98
34	B-IIB*pH6.00*A	2471.89	0.4987	4956.6673	5.7318E+14	9.5165E-10	221.77	
35	B-IIB*pH6.00*B	2453.90	0.4944	4963.3900	5.7395E+14	9.5294E-10	222.07	221.92
36	B-IIB*pH6.25*A	2999.36	0.4978	6025.2310	6.9674E+14	1.1568E-09	269.58	
37	B-IIB*pH6.25*B	2959.73	0.4949	5980.4607	6.9157E+14	1.1482E-09	267.58	268.58
38	B-IIB*pH6.50*A	2254.23	0.4971	4534.7616	5.2439E+14	8.7064E-10	202.89	
39	B-IIB*pH6.50*B	2217.96	0.4947	4483.4445	5.1846E+14	8.6079E-10	200.60	201.75
40	B-IIB*pH6.75*A	2462.24	0.4991	4933.3600	5.7048E+14	9.4717E-10	220.73	
41	B-IIB*pH6.75*B	2464.57	0.4958	4970.8955	5.7482E+14	9.5438E-10	222.41	221.57
42	B-IIB*pH7.00*A	3307.40	0.4958	6670.8350	7.7140E+14	1.2808E-09	298.47	
43	B-IIB*pH7.00*B	3307.07	0.4951	6679.6001	7.7241E+14	1.2824E-09	298.86	298.66
44	B-IIB*pH7.25*A	3058.78	0.5013	6101.6956	7.0559E+14	1.1715E-09	273.00	
45	B-IIB*pH7.25*B	3080.85	0.4971	6197.6463	7.1668E+14	1.1899E-09	277.30	275.15
46	B-IIB*pH7.50*A	3699.12	0.4974	7436.9119	8.5999E+14	1.4278E-09	332.74	
47	B-IIB*pH7.50*B	3685.20	0.4963	7425.3476	8.5865E+14	1.4256E-09	332.23	332.48
48	B-IIB*pH7.75*A	4489.40	0.4993	8991.3879	1.0397E+15	1.7263E-09	402.29	
49	B-IIB*pH7.75*B	4461.25	0.4972	8972.7474	1.0376E+15	1.7227E-09	401.46	401.88
50	B-IIB*pH8.00*A	5266.02	0.5014	10502.6326	1.2145E+15	2.0164E-09	469.91	
51	B-IIB*pH8.00*B	5229.75	0.4990	10480.4609	1.2119E+15	2.0122E-09	468.92	469.41
52	B-IIB*pH8.25*A	5704.80	0.5009	11389.0996	1.3170E+15	2.1866E-09	509.57	
53	B-IIB*pH8.25*B	5568.26	0.4963	11219.5446	1.2974E+15	2.1541E-09	501.99	505.78
54	B-IIB*pH8.50*A	5664.09	0.4965	11408.0363	1.3192E+15	2.1903E-09	510.42	
55	B-IIB*pH8.50*B	5687.42	0.4972	11438.8978	1.3228E+15	2.1962E-09	511.80	511.11
56	B-IIB*pH8.75*A	5700.66	0.4945	11528.1294	1.3331E+15	2.2133E-09	515.79	
57	B-IIB*pH8.75*B	5677.66	0.4959	11449.2035	1.3240E+15	2.1982E-09	512.26	514.03
58	B-IIB*pH9.00*A	5708.22	0.4967	11492.2891	1.3289E+15	2.2064E-09	514.19	
59	B-IIB*pH9.00*B	5664.94	0.4938	11472.1345	1.3266E+15	2.2026E-09	513.29	513.74

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
60	B-IIB-C*pH2.0*A	5664.80	0.4874	11622.4867	1.3440E+15	2.2314E-09	520.01	
61	B-IIB-C*pH2.0*B	5721.42	0.4955	11546.7608	1.3352E+15	2.2169E-09	516.63	518.32
62	B-IIB-C*pH4.0*A	5673.83	0.4983	11386.3737	1.3167E+15	2.1861E-09	509.45	
63	B-IIB-C*pH4.0*B	5646.53	0.4959	11386.4287	1.3167E+15	2.1861E-09	509.45	509.45
64	B-IIB-C*pH5.0*A	5464.16	0.5014	10897.8061	1.2602E+15	2.0923E-09	487.59	
65	B-IIB-C*pH5.0*B	5395.33	0.4971	10853.6109	1.2551E+15	2.0838E-09	485.61	486.60
66	B-IIB-C*pH5.5*A	5472.73	0.4977	10996.0418	1.2716E+15	2.1112E-09	491.99	
67	B-IIB-C*pH5.5*B	5478.32	0.4954	11058.3771	1.2788E+15	2.1231E-09	494.77	493.38
68	B-IIB-C*pH6.0*A	5336.54	0.4981	10713.7924	1.2389E+15	2.0570E-09	479.36	
69	B-IIB-C*pH6.0*B	5343.54	0.4979	10732.1551	1.2410E+15	2.0605E-09	480.18	479.77
70	B-IIB-C*pH6.5*A	5230.54	0.4966	10532.7024	1.2180E+15	2.0222E-09	471.26	
71	B-IIB-C*pH6.5*B	5263.92	0.4952	10629.8869	1.2292E+15	2.0409E-09	475.60	473.43
72	B-IIB-C*pH7.0*A	5106.90	0.4995	10224.0240	1.1823E+15	1.9629E-09	457.44	
73	B-IIB-C*pH7.0*B	5073.59	0.4951	10247.6065	1.1850E+15	1.9675E-09	458.50	457.97
74	B-IIB-C*pH7.5*A	5532.91	0.4998	11070.2481	1.2801E+15	2.1254E-09	495.31	
75	B-IIB-C*pH7.5*B	5438.11	0.4945	10997.1891	1.2717E+15	2.1114E-09	492.04	493.67
76	B-IIB-C*pH8.0*A	5730.91	0.4967	11537.9706	1.3342E+15	2.2152E-09	516.23	
77	B-IIB-C*pH8.0*B	5699.23	0.4943	11529.9009	1.3333E+15	2.2137E-09	515.87	516.05
78	B-IIB-C*pH9.5*A	5575.08	0.4983	11188.1999	1.2938E+15	2.1481E-09	500.58	
79	B-IIB-C*pH9.5*B	5534.98	0.4947	11188.5587	1.2938E+15	2.1481E-09	500.60	500.59

6/15/94 TD Calculations verified on pages 143-145 of this volume.

LSA RESULTS FOR C-I#...→IV

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Protocol #: 5        Name:U-233 3% 2 sigma          29-Aug-93    12:00
Region A: LL-UL= 0.0-100.   Lcr=   0  Bkg= 0.00   %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=   0  Bkg= 0.00   %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=   0  Bkg= 0.00   %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
  1  999.98    18.90  1.45    2.984  3.66    28.07  1.19  137.81    B
  2    7.81     2.99 112.4  566.542  3.01   570.78  3.07  662.50
  3    7.59     0.00  0.00  582.787  3.01   580.63  3.09  687.84
  4    7.79     2.02 162.9  567.619  3.02   571.03  3.07  684.61
  5    7.71     0.00  0.00  573.799  3.01   573.75  3.08  690.47
  6    7.70     2.39 139.4  574.419  3.02   578.94  3.07  681.17
  7    7.88     1.53 211.7  561.102  3.02   565.08  3.07  683.27
  8    7.54     2.18 153.7  586.804  3.01   589.70  3.07  688.28
  9    7.62     1.04 311.3  580.218  3.02   583.22  3.07  684.85
 10    7.96     0.00  0.00  555.559  3.02   554.34  3.09  692.08
 11    7.93     2.15 151.8  557.419  3.02   561.59  3.07  684.45
 12    7.73     5.16 68.62  573.083  3.01   580.08  3.06  684.60
 13    7.77     3.23 104.8  569.345  3.01   573.73  3.07  685.12
 14    7.61     1.73 191.4  582.036  3.01   585.33  3.07  686.75
 15    7.80     2.12 155.3  567.529  3.01   569.11  3.08  688.36
 16    7.74     3.45 98.92  571.564  3.01   575.16  3.07  683.77
 17    7.65     1.10 296.2  578.062  3.02   580.69  3.07  684.41
 18    7.85     0.00  0.00  563.640  3.01   563.40  3.08  690.08
 19    7.68     2.06 161.0  576.443  3.01   579.61  3.07  676.24
 20    7.84     1.38 234.6  563.980  3.02   566.57  3.07  676.49
 21    7.76     4.03 85.52  570.341  3.01   575.80  3.06  674.30
 22    7.83     2.81 119.1  564.704  3.02   569.25  3.07  680.35
 23    7.84     3.67 92.73  564.108  3.02   568.10  3.07  677.97
 24    8.12     0.43 718.6  544.922  3.01   546.69  3.08  681.58
 25    7.80     2.63 126.6  566.888  3.02   571.03  3.07  676.03
 26    8.36     0.23 1296.  528.834  3.02   530.78  3.08  677.86
 27    8.48     0.00  0.00  521.190  3.02   521.93  3.09  680.78
 28    7.73     1.02 316.6  572.436  3.01   575.17  3.07  680.27
 29    7.90     3.37 99.87  560.434  3.01   565.86  3.07  679.37
 30    8.38     2.58 124.8  527.923  3.02   532.43  3.07  673.91
 31    8.57     1.63 190.4  516.269  3.02   518.96  3.08  679.73
 32    8.51     1.78 176.1  519.460  3.02   521.29  3.08  679.83
 33    8.36     1.67 188.6  529.073  3.02   531.62  3.08  675.84
 34    8.77     0.37 813.8  503.743  3.02   506.25  3.08  679.56
 35    8.74     2.49 126.1  505.940  3.02   510.72  3.08  677.72
 36    9.80     0.00  0.00  450.791  3.02   453.56  3.09  678.67
 37    9.45     0.00  0.00  467.704  3.02   468.12  3.10  676.73
 38    8.82     0.60 500.5  501.438  3.02   503.00  3.09  681.31
 39    8.79     0.44 683.7  502.704  3.02   502.76  3.09  680.68
 40    8.01     2.44 134.1  551.947  3.02   556.20  3.07  681.04
 41    8.10     3.19 103.8  546.275  3.01   551.81  3.07  674.10
 42    8.35     2.53 127.0  529.711  3.02   533.37  3.08  675.80
 43    8.13     3.11 106.1  544.371  3.01   548.68  3.07  678.21
 44    7.80     2.38 139.4  567.529  3.01   571.80  3.07  676.48
 45    7.87     2.70 123.3  561.819  3.02   565.58  3.07  679.45
 46    7.82     1.68 193.4  566.070  3.01   570.27  3.07  633.90
 47    7.77     4.26 81.29  568.959  3.02   575.54  3.06  674.59
 48    7.49     1.12 292.4  591.141  3.01   593.29  3.07  676.89
 49    7.82     0.15 2098.  565.814  3.01   568.10  3.07  679.32
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S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	7.70	2.00	165.0	574.419	3.02	578.42	3.07	677.84	
51	7.70	1.36	240.2	574.159	3.02	577.00	3.07	678.91	
52	7.56	0.80	402.8	585.508	3.01	588.07	3.07	681.25	
53	7.88	1.15	279.3	561.229	3.02	563.43	3.08	682.44	
54	7.87	0.28	1110.	562.073	3.02	564.31	3.08	685.33	
55	7.67	2.48	135.2	577.068	3.01	578.97	3.07	678.47	
56	7.95	2.48	132.8	556.513	3.01	562.62	3.06	681.88	
57	7.87	1.43	226.3	562.200	3.01	564.69	3.07	682.33	
58	7.69	1.51	216.3	575.039	3.02	577.26	3.07	679.66	
59	7.71	3.66	93.70	574.188	3.01	581.01	3.06	677.84	
60	7.81	1.58	205.5	566.542	3.01	568.73	3.07	682.24	
61	7.69	0.73	438.5	575.169	3.02	577.00	3.08	682.72	
62	7.75	1.74	188.2	570.435	3.02	572.96	3.07	678.72	
63	8.11	0.00	0.00	545.228	3.02	546.28	3.08	684.08	
64	8.15	2.81	116.5	542.783	3.02	547.88	3.07	679.09	
65	8.46	2.14	148.2	522.430	3.02	526.19	3.08	682.47	
66	8.10	1.22	259.6	545.781	3.02	550.45	3.07	679.32	
67	8.35	1.22	256.4	529.471	3.02	531.57	3.08	683.90	
68	9.24	2.42	126.3	478.077	3.02	482.21	3.08	682.10	
69	8.99	4.34	74.31	491.454	3.02	497.96	3.07	674.96	
70	8.83	0.80	374.5	500.300	3.02	503.30	3.08	680.21	
71	8.84	1.68	182.0	499.844	3.02	503.27	3.08	681.43	
72	7.97	4.81	71.96	555.109	3.01	562.02	3.06	676.04	
73	8.03	1.02	309.8	550.939	3.02	553.50	3.08	681.95	
74	7.52	0.00	0.00	587.973	3.02	587.62	3.08	686.51	
75	7.61	5.01	70.96	581.247	3.01	588.75	3.06	676.55	
76	7.71	5.09	69.52	573.410	3.02	579.58	3.06	674.25	
77	7.68	0.00	0.00	575.922	3.02	573.49	3.09	681.84	
78	7.85	0.00	0.00	563.768	3.01	565.05	3.08	678.22	
79	7.57	1.17	278.2	584.466	3.01	589.24	3.07	679.40	

SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	C-I*pH2.00*IUA	566.542	0.5262	1076.6667	1.2450E+14	2.0671E-10	48.1723	
3	C-I*pH2.00*IUB	582.787	0.5230	1114.3155	1.2886E+14	2.1394E-10	49.8568	49.0146
4	C-I*pH2.25*IUA	567.619	0.5250	1081.1790	1.2503E+14	2.0758E-10	48.3742	
5	C-I*pH2.25*IUB	573.799	0.5218	1099.6531	1.2716E+14	2.1113E-10	49.2008	48.7875
6	C-I*pH2.50*IUA	574.419	0.5207	1103.1669	1.2757E+14	2.1180E-10	49.3580	
7	C-I*pH2.50*IUB	561.102	0.5197	1079.6652	1.2485E+14	2.0729E-10	48.3065	48.8322
8	C-I*pH2.75*IUA	586.804	0.5259	1115.8091	1.2903E+14	2.1423E-10	49.9236	
9	C-I*pH2.75*IUB	580.218	0.5219	1111.7417	1.2856E+14	2.1345E-10	49.7417	49.8326
10	C-I*pH3.00*IUA	555.559	0.5231	1062.0512	1.2281E+14	2.0391E-10	47.5184	
11	C-I*pH3.00*IUB	557.419	0.5215	1068.8763	1.2360E+14	2.0522E-10	47.8238	47.6711
12	C-I*pH3.25*IUA	573.083	0.5229	1095.9705	1.2674E+14	2.1042E-10	49.0360	
13	C-I*pH3.25*IUB	569.345	0.5209	1093.0025	1.2639E+14	2.0985E-10	48.9032	48.9696
14	C-I*pH3.50*IUA	582.036	0.5244	1109.9085	1.2835E+14	2.1310E-10	49.6596	
15	C-I*pH3.50*IUB	567.529	0.5216	1088.0541	1.2582E+14	2.0890E-10	48.6818	49.1707
16	C-I*pH3.75*IUA	571.564	0.5250	1088.6933	1.2589E+14	2.0902E-10	48.7104	
17	C-I*pH3.75*IUB	578.062	0.5222	1106.9743	1.2801E+14	2.1253E-10	49.5283	49.1194
18	C-I*pH4.00*IUA	563.640	0.5249	1073.8045	1.2417E+14	2.0616E-10	48.0443	
19	C-I*pH4.00*IUB	576.443	0.5210	1106.4165	1.2794E+14	2.1242E-10	49.5034	48.7738
20	C-I*pH4.25*IUA	563.980	0.5231	1078.1495	1.2467E+14	2.0700E-10	48.2387	
21	C-I*pH4.25*IUB	570.341	0.5200	1096.8096	1.2683E+14	2.1058E-10	49.0736	48.6561
22	C-I*pH4.50*IUA	564.704	0.5245	1076.6520	1.2450E+14	2.0671E-10	48.1717	
23	C-I*pH4.50*IUB	564.108	0.5225	1079.6325	1.2485E+14	2.0728E-10	48.3050	48.2383
24	C-I*pH4.75*IUA	544.922	0.5238	1040.3246	1.2030E+14	1.9974E-10	46.5463	
25	C-I*pH4.75*IUB	566.888	0.5216	1086.8252	1.2568E+14	2.0866E-10	48.6268	47.5866
26	C-I*pH5.00*IUA	528.834	0.5260	1005.3878	1.1626E+14	1.9303E-10	44.9832	
27	C-I*pH5.00*IUB	521.190	0.5216	999.2140	1.1555E+14	1.9184E-10	44.7069	44.8450
28	C-I*pH5.25*IUA	572.436	0.5266	1087.0414	1.2570E+14	2.0870E-10	48.6365	
29	C-I*pH5.25*IUB	560.434	0.5226	1072.3957	1.2401E+14	2.0589E-10	47.9812	48.3089
30	C-I*pH5.50*IUA	527.923	0.5258	1004.0377	1.1610E+14	1.9277E-10	44.9227	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
31	C-I*pH5.50*IUB	516.269	0.5216	989.7795	1.1446E+14	1.9003E-10	44.2848	44.6038
32	C-I*pH5.75*IUA	519.460	0.5245	990.3908	1.1453E+14	1.9015E-10	44.3122	
33	C-I*pH5.75*IUB	529.073	0.5216	1014.3271	1.1729E+14	1.9474E-10	45.3831	44.8476
34	C-I*pH6.00*IUA	503.743	0.5261	957.5043	1.1072E+14	1.8383E-10	42.8407	
35	C-I*pH6.00*IUB	505.940	0.5211	970.9077	1.1227E+14	1.8641E-10	43.4404	43.1406
36	C-I*pH6.25*IUA	450.791	0.5256	857.6693	9.9179E+13	1.6467E-10	38.3739	
37	C-I*pH6.25*IUB	467.704	0.5222	895.6415	1.0357E+14	1.7196E-10	40.0729	39.2234
38	C-I*pH6.50*IUA	501.438	0.5231	958.5892	1.1085E+14	1.8404E-10	42.8893	
39	C-I*pH6.50*IUB	502.704	0.5204	965.9954	1.1171E+14	1.8546E-10	43.2207	43.0550
40	C-I*pH6.75*IUA	551.947	0.5226	1056.1558	1.2213E+14	2.0278E-10	47.2546	
41	C-I*pH6.75*IUB	546.275	0.5232	1044.1036	1.2074E+14	2.0046E-10	46.7154	46.9850
42	C-I*pH7.00*IUA	529.711	0.5246	1009.7427	1.1676E+14	1.9386E-10	45.1780	
43	C-I*pH7.00*IUB	544.371	0.5210	1044.8580	1.2082E+14	2.0061E-10	46.7491	45.9636
44	C-I*pH7.25*IUA	567.529	0.5306	1069.5986	1.2369E+14	2.0536E-10	47.8561	
45	C-I*pH7.25*IUB	561.819	0.5276	1064.8578	1.2314E+14	2.0445E-10	47.6440	47.7500
46	C-I*pH7.50*IUA	566.070	0.5233	1081.7313	1.2509E+14	2.0769E-10	48.3989	
47	C-I*pH7.50*IUB	568.959	0.5201	1093.9415	1.2650E+14	2.1003E-10	48.9452	48.6721
48	C-I*pH7.75*IUA	591.141	0.5270	1121.7097	1.2971E+14	2.1536E-10	50.1876	
49	C-I*pH7.75*IUB	565.814	0.5228	1082.2762	1.2515E+14	2.0779E-10	48.4233	49.3055
50	C-I*pH8.00*IUA	574.419	0.5258	1092.4667	1.2633E+14	2.0975E-10	48.8792	
51	C-I*pH8.00*IUB	574.159	0.5227	1098.4484	1.2702E+14	2.1089E-10	49.1469	49.0131
52	C-I*pH8.25*IUA	585.508	0.5238	1117.8083	1.2926E+14	2.1461E-10	50.0131	
53	C-I*pH8.25*IUB	561.229	0.5211	1077.0083	1.2454E+14	2.0678E-10	48.1876	49.1003
54	C-I*pH8.50*IUA	562.073	0.5196	1081.7417	1.2509E+14	2.0769E-10	48.3994	
55	C-I*pH8.50*IUB	577.068	0.5176	1114.8918	1.2892E+14	2.1405E-10	49.8826	49.1410
56	C-I*pH8.75*IUA	556.513	0.5196	1071.0412	1.2385E+14	2.0563E-10	47.9206	
57	C-I*pH8.75*IUB	562.200	0.5181	1085.1187	1.2548E+14	2.0834E-10	48.5505	48.2356
58	C-I*pH9.00*IUA	575.039	0.5202	1105.4191	1.2783E+14	2.1223E-10	49.4588	
59	C-I*pH9.00*IUB	574.188	0.5205	1103.1470	1.2757E+14	2.1180E-10	49.3571	49.4079

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
60	C-I-C*pH2.0*IUA	566.542	0.5267	1075.6446	1.2439E+14	2.0652E-10	48.1266	
61	C-I-C*pH2.0*IUB	575.169	0.5222	1101.4343	1.2737E+14	2.1147E-10	49.2805	48.7035
62	C-I-C*pH4.0*IUA	570.435	0.5245	1087.5786	1.2577E+14	2.0881E-10	48.6605	
63	C-I-C*pH4.0*IUB	545.228	0.5215	1045.4995	1.2090E+14	2.0073E-10	46.7778	47.7192
64	C-I-C*pH5.0*IUA	542.783	0.5243	1035.2527	1.1971E+14	1.9876E-10	46.3194	
65	C-I-C*pH5.0*IUB	522.430	0.5212	1002.3599	1.1591E+14	1.9245E-10	44.8477	45.5835
66	C-I-C*pH5.5*IUA	545.781	0.5237	1042.1635	1.2051E+14	2.0009E-10	46.6286	
67	C-I-C*pH5.5*IUB	529.471	0.5192	1019.7824	1.1793E+14	1.9579E-10	45.6272	46.1279
68	C-I-C*pH6.0*IUA	478.077	0.5227	914.6298	1.0577E+14	1.7560E-10	40.9225	
69	C-I-C*pH6.0*IUB	491.454	0.5212	942.9279	1.0904E+14	1.8104E-10	42.1886	41.5555
70	C-I-C*pH6.5*IUA	500.300	0.5228	956.9625	1.1066E+14	1.8373E-10	42.8165	
71	C-I-C*pH6.5*IUB	499.844	0.5209	959.5777	1.1096E+14	1.8423E-10	42.9335	42.8750
72	C-I-C*pH7.0*IUA	555.109	0.5253	1056.7466	1.2220E+14	2.0289E-10	47.2811	
73	C-I-C*pH7.0*IUB	550.939	0.5219	1055.6409	1.2207E+14	2.0268E-10	47.2316	47.2563
74	C-I-C*pH7.5*IUA	587.973	0.5249	1120.1619	1.2953E+14	2.1506E-10	50.1184	
75	C-I-C*pH7.5*IUB	581.247	0.5218	1113.9268	1.2881E+14	2.1387E-10	49.8394	49.9789
76	C-I-C*pH8.0*IUA	573.410	0.5257	1090.7552	1.2613E+14	2.0942E-10	48.8027	
77	C-I-C*pH8.0*IUB	575.922	0.5207	1106.0534	1.2790E+14	2.1236E-10	49.4871	49.1449
78	C-I-C*pH9.5*IUA	563.768	0.5268	1070.1746	1.2375E+14	2.0547E-10	47.8819	
79	C-I-C*pH9.5*IUB	584.466	0.5238	1115.8190	1.2903E+14	2.1423E-10	49.9241	48.9030

6/15/94 TD
Calculations of 10/15/94 on this page and preceeding pages are verified on pages 143-4 of this notebook.

9 Sept 1993 EXPERIMENT B-IIB, REVERSE TD

The pH of the reverse solution have had time to equilibrate. 2 500 µL samples were taken from each reverse solution, as well as the 10 control solutions, and the samples weighed and acidified. The pH and temperature of each solution was also measured.

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)	pH T(C)
B-IIBR*pH3.00*A	7.8212	8.3298	0.5086	1.97
B-IIBR*pH3.00*B	7.8581	8.3637	0.5056	21.9
B-IIBR*pH4.00*A	7.8549	8.3613	0.5064	2.96
B-IIBR*pH4.00*B	7.8587	8.3638	0.5051	22.0
B-IIBR*pH4.50*A	7.8620	8.3732	0.5112	3.50
B-IIBR*pH4.50*B	7.8567	8.3635	0.5068	22.0
B-IIBR*pH5.00*A	7.8138	8.3208	0.5070	4.13
B-IIBR*pH5.00*B	7.7997	8.3056	0.5059	22.0
B-IIBR*pH5.50*A	7.8273	8.3310	0.5037	4.89
B-IIBR*pH5.50*B	7.9432	8.4481	0.5049	22.0
B-IIBR*pH6.00*A	7.7956	8.3010	0.5054	5.58
B-IIBR*pH6.00*B	7.7930	8.2972	0.5042	22.1
B-IIBR*pH6.25*A	7.8365	8.3419	0.5054	6.83
B-IIBR*pH6.25*B	7.8477	8.3523	0.5046	22.2
B-IIBR*pH6.50*A	7.8003	8.3065	0.5062	7.22
B-IIBR*pH6.50*B	7.8703	8.3743	0.5040	22.2
B-IIBR*pH6.75*A	7.8400	8.3495	0.5095	7.48
B-IIBR*pH6.75*B	7.8252	8.3319	0.5067	22.3
B-IIBR*pH7.00*A	7.8472	8.3532	0.5060	7.91
B-IIBR*pH7.00*B	7.8150	8.3190	0.5040	22.3
B-IIBR*pH7.50*A	7.8965	8.4011	0.5046	8.41
B-IIBR*pH7.50*B	7.8682	8.3709	0.5027	22.3
B-IIBR-C*pH2.0*A	7.8024	8.3070	0.5046	1.89
B-IIBR-C*pH2.0*B	7.8188	8.3223	0.5035	22.4
B-IIBR-C*pH4.0*A	7.9160	8.4220	0.5060	3.92
B-IIBR-C*pH4.0*B	7.8559	8.3591	0.5032	22.4
B-IIBR-C*pH5.0*A	7.8516	8.3560	0.5044	4.85
B-IIBR-C*pH5.0*B	7.8369	8.3392	0.5023	22.4
B-IIBR-C*pH5.5*A	7.8484	8.3523	0.5039	6.06
B-IIBR-C*pH5.5*B	7.7938	8.2974	0.5036	22.5
B-IIBR-C*pH6.0*A	7.8741	8.3791	0.5050	6.41
B-IIBR-C*pH6.0*B	7.8356	8.3393	0.5037	22.6
B-IIBR-C*pH6.5*A	7.8182	8.3239	0.5057	6.49
B-IIBR-C*pH6.5*B	7.7793	8.2825	0.5032	22.6
B-IIBR-C*pH7.0*A	7.8305	8.3336	0.5031	6.75
B-IIBR-C*pH7.0*B	7.7855	8.2872	0.5017	22.5
B-IIBR-C*pH7.5*A	7.8919	8.3928	0.5009	7.26
B-IIBR-C*pH7.5*B	7.8645	8.3646	0.5001	22.6
B-IIBR-C*pH8.0*A	7.8413	8.3437	0.5024	7.81
B-IIBR-C*pH8.0*B	7.8843	8.3856	0.5013	22.7
B-IIBR-C*pH9.5*A	7.7838	8.2863	0.5025	9.40
B-IIBR-C*pH9.5*B	7.8227	8.3248	0.5021	22.7

The remaining solution was also weighed. As soon as the bottles are empty and dry, they will be weighed so that losses due to evaporation can be determined.

SOLUTION NAME	WEIGHT (g)
B-IIB* pH2.00	65.27
2.25	66.62
2.50	68.50
2.75	69.10
3.00	66.16
3.25	67.58
3.50	67.75
3.75	68.80
4.00	66.74
4.25	68.02
4.50	68.11
4.75	70.20
5.00	66.07
5.25	67.37
5.50	67.96
5.75	64.25
6.00	66.33
6.25	63.68
6.50	67.27
6.75	68.50
7.00	64.40
7.25	69.02
7.50	65.07
7.75	68.61
8.00	65.99
8.25	66.70
8.50	68.93
8.75	65.81
9.00	67.91
B-IIB-C* pH2.0	67.67
4.0	66.97
8/9/93 TD ~~5.0~~ 5.0	68.13
5.5	66.15
6.0	65.46
6.5	67.66
7.0	69.51

SOLUTION NAME	WEIGHT (g)
B-IIBC* pH7.5	67.84
8.0	66.49
9.5	67.33

16 Sept 1993 TD Experiment C-I

The solutions have had sufficient time to equilibrate, so 2 500 µL samples of each solution were taken, weighed and ~~acidified~~ TD 9/14/93 acidified, and prepared for Liquid Scintillation analysis. The pH of each solution was also measured. The sample weights and results of pH measurements are given below.

SOLUTION NAME	pH	T (C)
C-I*pH2.00	1.72	24.1
C-I*pH2.25	1.99	24.1
C-I*pH2.50	2.26	24.1
C-I*pH2.75	2.50	24.1
C-I*pH3.00	2.77	24.1
C-I*pH3.25	3.05	24.1
C-I*pH3.50	3.32	24.1
C-I*pH3.75	3.64	24.1
C-I*pH4.00	3.88	24.1
C-I*pH4.25	4.22	24.1
C-I*pH4.50	4.52	24.1
C-I*pH4.75	4.77	24.1
C-I*pH5.00	4.97	24.1
C-I*pH5.25	4.96	24.1
*C-I*pH5.50*	*5.23*	24.1
C-I*pH5.75	5.32	24.1
C-I*pH6.00	5.55	24.1
C-I*pH6.25	5.80	24.1
C-I*pH6.50	6.16	24.1
C-I*pH6.75	6.42	24.1
C-I*pH7.00	6.69	24.1
C-I*pH7.25	6.97	24.1
C-I*pH7.50	7.26	24.1
C-I*pH7.75	7.59	24.1
C-I*pH8.00	7.88	24.0
C-I*pH8.25	8.11	24.0
C-I*pH8.50	8.37	24.0
C-I*pH8.75	8.62	24.0
C-I*pH9.00	8.84	24.0
C-I-C*pH2.0	1.68	24.0
C-I-C*pH4.0	3.71	24.0
C-I-C*pH5.0	4.68	24.0
C-I-C*pH5.5	4.89	24.0
C-I-C*pH6.0	5.90	24.0
C-I-C*pH6.5	6.25	24.0
C-I-C*pH7.0	6.75	24.0
C-I-C*pH7.5	7.31	23.9
C-I-C*pH8.0	7.88	23.9
C-I-C*pH9.5	9.31	23.9

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
C-I*pH2.00*A	7.8294	8.3571	0.5277
C-I*pH2.00*B	7.8183	8.3453	0.5270
C-I*pH2.25*A	7.8389	8.3663	0.5274
C-I*pH2.25*B	7.8463	8.3714	0.5251
C-I*pH2.50*A	7.8082	8.3343	0.5261
C-I*pH2.50*B	7.8536	8.3782	0.5246
C-I*pH2.75*A	7.8551	8.3851	0.5300
C-I*pH2.75*B	7.7926	8.3193	0.5267
C-I*pH3.00*A	7.9255	8.4542	0.5287
C-I*pH3.00*B	7.8244	8.3508	0.5264
C-I*pH3.25*A	7.7977	8.3233	0.5256
C-I*pH3.25*B	7.7675	8.2927	0.5252
C-I*pH3.50*A	7.8629	8.3901	0.5272
C-I*pH3.50*B	7.8265	8.3532	0.5267
C-I*pH3.75*A	7.8456	8.3714	0.5258
C-I*pH3.75*B	7.7928	8.3157	0.5229
C-I*pH4.00*A	7.8095	8.3327	0.5232
C-I*pH4.00*B	7.9029	8.4273	0.5244
C-I*pH4.25*A	7.7873	8.3170	0.5297
C-I*pH4.25*B	7.8079	8.3336	0.5257
C-I*pH4.50*A	7.8407	8.3687	0.5280
C-I*pH4.50*B	7.8727	8.3976	0.5249
C-I*pH4.75*A	7.8457	8.3745	0.5288
C-I*pH4.75*B	7.8212	8.3465	0.5253
C-I*pH5.00*A	7.8261	8.3541	0.5280
C-I*pH5.00*B	7.8251	8.3515	0.5264
C-I*pH5.25*A	7.8915	8.4174	0.5259
C-I*pH5.25*B	7.8516	8.3759	0.5243
C-I*pH5.50*A	7.8701	8.3975	0.5274
C-I*pH5.50*B	7.8773	8.4013	0.5240
C-I*pH5.75*A	7.8031	8.3317	0.5286
C-I*pH5.75*B	7.8037	8.3281	0.5244
C-I*pH6.00*A	7.8512	8.3746	0.5234
C-I*pH6.00*B	7.8903	8.4144	0.5241
C-I*pH6.25*A	7.9003	8.4249	0.5246
C-I*pH6.25*B	7.8345	8.3575	0.5230
C-I*pH6.50*A	7.8733	8.3400	0.4667
C-I*pH6.50*B	7.8008	8.3258	0.5250

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
C-I*pH6.75*A	7.8418	8.3683	0.5265
C-I*pH6.75*B	7.7708	8.2930	0.5222
C-I*pH2.00*A	7.8278	8.3533	0.5255
C-I*pH7.00*B	7.8401	8.3630	0.5229
C-I*pH7.25*A	7.8523	8.3770	0.5247
C-I*pH7.25*B	7.8474	8.3716	0.5242
C-I*pH7.50*A	7.7968	8.3207	0.5239
C-I*pH7.50*B	7.8462	8.3685	0.5223
C-I*pH7.75*A	7.7969	8.3199	0.5230
C-I*pH7.75*B	7.7669	8.2897	0.5228
C-I*pH8.00*A	7.8439	8.3686	0.5247
C-I*pH8.00*B	7.8299	8.3524	0.5225
C-I*pH8.25*A	7.7867	8.3140	0.5273
C-I*pH8.25*B	7.8471	8.3708	0.5237
C-I*pH8.50*A	7.8234	8.3472	0.5238
C-I*pH8.50*B	7.8661	8.3891	0.5230
C-I*pH8.75*A	7.8938	8.4179	0.5241
C-I*pH8.75*B	7.8165	8.3378	0.5213
C-I*pH9.00*A	7.8799	8.4070	0.5271
C-I*pH9.00*B	7.8099	8.3346	0.5247
C-I-C*pH2.0*A	7.8226	8.3463	0.5237
C-I-C*pH2.0*B	7.8176	8.3399	0.5223
C-I-C*pH4.0*A	7.8801	8.4040	0.5239
C-I-C*pH4.0*B	7.8162	8.3377	0.5215
C-I-C*pH5.0*A	7.8608	8.3857	0.5249
C-I-C*pH5.0*B	7.8224	8.3459	0.5235
C-I-C*pH5.5*A	7.8463	8.3796	0.5333
C-I-C*pH5.5*B	7.8699	8.3959	0.5260
C-I-C*pH6.0*A	7.9058	8.4311	0.5253
C-I-C*pH6.0*B	7.8963	8.4204	0.5241
C-I-C*pH6.5*A	7.8955	8.4201	0.5246
C-I-C*pH6.5*B	7.8188	8.3402	0.5214
C-I-C*pH7.0*A	7.8033	8.3273	0.5240
C-I-C*pH7.0*B	7.9511	8.4737	0.5226
C-I-C*pH7.5*A	7.7939	8.3198	0.5259
C-I-C*pH7.5*B	7.8978	8.4215	0.5237
C-I-C*pH8.0*A	7.8695	8.3947	0.5252
C-I-C*pH8.0*B	7.8368	8.3608	0.5240

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
C-I-C*pH9.5*A	7.8423	8.3723	0.5300
C-I-C*pH9.5*B	7.8133	8.3378	0.5245

27 Sept 1993 TD

The LSA of the B-IIB R and C-I samples has finished. The raw data as well as ~~print~~ TD 9/27/93 results of calculations follow. The B-IIB*pHi*IUa6v5) (i=4-7) and B-IIB-C*pHi*IUa6v5) were recounted to check the previous results.

Experiment B-IIB.

Protocol #: 4 Name:U-233 1% 2 sigma 24-Sep-93 03:50
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=1.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 1% 2 sigma error for 500 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	19.04	1.45	2.91	3.71	27.91	1.20	131.80	B
2	6.63	11.28	38.01	6037.82	1.00	6054.60	1.00	690.79	
3	6.63	12.33	35.35	6037.82	1.00	6053.84	1.00	689.78	
4	6.70	7.08	55.93	5972.76	1.00	5979.55	1.00	690.72	
5	6.70	10.96	38.70	5970.97	1.00	5985.08	1.00	687.84	
6	6.82	7.06	55.57	5862.34	1.00	5870.77	1.00	690.39	
7	6.85	11.76	36.14	5840.16	1.00	5852.53	1.00	690.13	
8	7.00	6.10	62.29	5715.81	1.00	5724.81	1.00	691.21	
9	7.13	10.27	39.57	5609.01	1.00	5622.02	1.00	689.73	
10	8.80	9.14	39.27	4544.02	1.00	4555.16	1.00	689.30	
11	8.74	11.74	32.06	4577.53	1.00	4592.34	1.00	691.36	
12	12.28	7.26	40.49	3256.70	1.00	3264.93	1.00	688.75	
13	12.06	4.92	57.55	3316.83	1.00	3323.25	1.00	690.36	
14	13.54	6.22	44.16	2952.71	1.00	2961.38	1.00	692.47	
15	13.54	3.34	77.50	2952.78	1.00	2958.65	1.00	690.26	
16	10.59	8.63	37.61	3775.66	1.00	3786.07	1.00	688.31	
17	10.65	5.37	56.60	3755.31	1.00	3761.29	1.00	694.33	
18	8.52	4.67	71.72	4693.81	1.00	4702.26	1.00	689.90	
19	8.63	11.55	32.69	4633.36	1.00	4646.71	1.00	690.91	
20	7.10	8.28	47.49	5636.25	1.00	5647.44	1.00	696.80	
21	7.20	20.13	23.22	5552.93	1.00	5575.98	1.00	690.04	
22	6.79	10.12	41.05	5893.12	1.00	5905.96	1.00	691.55	
23	6.77	11.83	36.18	5910.83	1.00	5926.30	1.00	690.95	
24	6.63	15.50	29.51	6032.99	1.00	6061.68	1.00	689.56	
25	6.59	15.40	29.74	6071.75	1.00	6098.19	1.00	687.62	
26	6.56	10.53	40.41	6095.42	1.00	6116.30	1.00	695.38	
27	6.63	19.57	24.70	6038.27	1.00	6066.66	1.00	690.69	
28	7.00	14.53	30.20	5715.52	1.00	5736.52	1.00	689.84	
29	6.92	12.03	35.31	5783.51	1.00	5801.28	1.00	688.45	
30	7.09	10.44	39.16	5645.61	1.00	5661.79	1.00	695.97	
31	7.08	11.33	36.65	5651.19	1.00	5668.70	1.00	689.52	
32	7.12	13.54	31.66	5617.74	1.00	5634.03	1.00	688.06	
33	7.16	12.66	33.31	5585.92	1.00	5605.75	1.00	690.29	
34	7.10	12.23	34.40	5637.80	1.00	5656.18	1.00	690.64	
35	7.20	15.26	28.66	5554.87	1.00	5578.62	1.00	690.20	
36	7.50	15.09	28.33	5331.63	1.00	5349.56	1.00	688.79	
37	7.48	8.23	46.52	5348.83	1.00	5363.13	1.00	694.86	
38	7.04	10.22	39.99	5684.31	1.00	5699.22	1.00	692.26	
39	7.02	8.31	47.63	5696.38	1.00	5708.99	1.00	692.17	
40	6.47	15.89	29.30	6183.65	1.00	6207.49	1.00	690.68	
41	6.55	16.53	28.24	6106.25	1.00	6129.50	1.00	691.47	
42	6.75	15.48	29.28	5928.94	1.00	5957.13	1.00	689.61	
43	6.70	14.09	31.62	5974.26	1.00	6000.00	1.00	694.51	
(11 missing vials)									
55	7.42	18.16	24.71	5393.18	1.00	5415.08	1.00	692.76	
56	7.38	12.94	32.25	5424.19	1.00	5441.47	1.00	695.13	
57	7.42	9.93	39.88	5388.87	1.00	5404.84	1.00	696.93	
58	7.50	13.63	30.70	5333.36	1.00	5352.76	1.00	692.63	
59	7.57	17.42	25.25	5281.50	1.00	5303.53	1.00	697.42	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
60	7.59	8.49	44.96	5267.32	1.00	5282.10	1.00	692.70	
61	7.71	7.42	50.09	5192.55	1.00	5206.59	1.00	696.04	
62	7.75	12.96	31.43	5162.77	1.00	5178.41	1.00	696.06	
63	7.61	20.25	22.48	5258.85	1.00	5282.87	1.00	699.18	
64	7.56	17.60	25.07	5289.55	1.00	5310.32	1.00	696.36	
65	7.71	15.46	27.43	5185.42	1.00	5204.39	1.00	697.25	
66	7.73	14.59	28.65	5174.06	1.00	5192.53	1.00	697.00	
67	8.30	11.68	33.02	4817.45	1.00	4831.85	1.00	695.96	
68	8.34	15.85	25.87	4796.73	1.00	4816.82	1.00	696.29	
69	7.71	19.74	22.77	5191.64	1.00	5218.27	1.00	698.99	
70	7.73	15.24	27.69	5178.08	1.00	5196.80	1.00	696.96	
71	7.80	16.22	26.28	5129.01	1.00	5149.14	1.00	695.83	
72	7.65	8.54	44.58	5227.81	1.00	5240.06	1.00	695.18	
73	7.66	18.82	23.67	5223.33	1.00	5245.98	1.00	696.47	
74	7.65	6.32	57.80	5233.43	1.00	5245.03	1.00	697.56	
75	7.82	10.75	36.39	5114.10	1.00	5128.87	1.00	693.98	
76	7.89	14.29	28.83	5067.43	1.00	5085.91	1.00	695.35	
77	7.71	10.92	36.19	5189.44	1.00	5203.35	1.00	694.42	
78	7.77	7.34	50.34	5147.41	1.00	5157.55	1.00	696.77	
79	7.69	10.87	36.38	5202.03	1.00	5216.69	1.00	698.30	
80	7.73	7.48	49.67	5173.68	1.00	5185.16	1.00	692.86	
81	7.40	18.66	24.24	5408.71	1.00	5434.39	1.00	696.40	
82	7.42	14.38	29.58	5391.97	1.00	5412.66	1.00	695.68	
83	7.77	8.76	43.31	5149.86	1.00	5162.70	1.00	698.89	
84	7.73	6.19	58.59	5178.46	1.00	5188.78	1.00	694.39	
85	7.57	15.83	27.17	5282.96	1.00	5300.89	1.00	693.92	
86	7.52	10.08	39.14	5316.37	1.00	5329.14	1.00	696.08	
87	7.86	15.44	27.19	5090.73	1.00	5110.26	1.00	692.02	
88	7.95	13.03	30.89	5028.66	1.00	5045.17	1.00	696.21	
89	7.94	10.68	36.32	5036.76	1.00	5051.18	1.00	697.65	
90	7.93	18.41	23.66	5045.39	1.00	5069.06	1.00	695.96	
91	8.20	14.37	28.15	4877.58	1.00	4895.87	1.00	695.58	
92	8.15	14.46	28.11	4907.40	1.00	4925.59	1.00	692.62	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	B-IIBR*pH3.00*A	6037.82	0.5066	11871.4510	1.3728E+15	2.2792E-09	531.1536	
3	B-IIBR*pH3.00*B	6037.82	0.5056	11941.8908	1.3809E+15	2.2928E-09	534.3052	532.7294
4	B-IIBR*pH4.00*A	5972.76	0.5064	11794.5498	1.3639E+15	2.2645E-09	527.7128	
5	B-IIBR*pH4.00*B	5970.97	0.5051	11821.3621	1.3670E+15	2.2698E-09	528.9125	528.3127
6	B-IIBR*pH4.50*A	5862.34	0.5112	11467.8013	1.3261E+15	2.2017E-09	513.0934	
7	B-IIBR*pH4.50*B	5840.16	0.5068	11523.5991	1.3326E+15	2.2125E-09	515.5899	514.3417
8	B-IIBR*pH5.00*A	5715.81	0.5070	11273.7870	1.3037E+15	2.1645E-09	504.4126	
9	B-IIBR*pH5.00*B	5609.01	0.5059	11087.1911	1.2821E+15	2.1287E-09	496.0641	500.2385
10	B-IIBR*pH5.50*A	4544.02	0.5037	9021.2825	1.0432E+15	1.7320E-09	403.6311	
11	B-IIBR*pH5.50*B	4577.53	0.5049	9066.2111	1.0484E+15	1.7407E-09	405.6413	404.6362
12	B-IIBR*pH6.00*A	3256.70	0.5054	6443.8089	7.4515E+14	1.2372E-09	288.3094	
13	B-IIBR*pH6.00*B	3316.83	0.5042	6578.4014	7.6071E+14	1.2630E-09	294.3315	291.3204
14	B-IIBR*pH6.25*A	2952.71	0.5054	5842.3229	6.7559E+14	1.1217E-09	261.3978	
15	B-IIBR*pH6.25*B	2952.78	0.5046	5851.7241	6.7668E+14	1.1235E-09	261.8184	261.6081
16	B-IIBR*pH6.50*A	3775.66	0.5062	7458.8305	8.6252E+14	1.4320E-09	333.7237	
17	B-IIBR*pH6.50*B	3755.31	0.5040	7451.0119	8.6162E+14	1.4305E-09	333.3739	333.5488
18	B-IIBR*pH6.75*A	4693.81	0.5095	9212.5810	1.0653E+15	1.7688E-09	412.1902	
19	B-IIBR*pH6.75*B	4633.36	0.5067	9144.1879	1.0574E+15	1.7556E-09	409.1301	410.6601
20	B-IIBR*pH7.00*A	5636.25	0.5060	11138.8340	1.2881E+15	2.1386E-09	498.3748	
21	B-IIBR*pH7.00*B	5552.93	0.5040	11017.7183	1.2741E+15	2.1153E-09	492.9558	495.6653
22	B-IIBR*pH7.50*A	5893.12	0.5046	11678.7951	1.3505E+15	2.2423E-09	522.5337	
23	B-IIBR*pH7.50*B	5910.83	0.5027	11758.1659	1.3597E+15	2.2575E-09	526.0850	524.3094
24	B-IIBR-C*pH2.0*A	6032.99	0.5046	11955.9849	1.3826E+15	2.2955E-09	534.9358	
25	B-IIBR-C*pH2.0*B	6075.75	0.5035	12067.0308	1.3954E+15	2.3168E-09	539.9042	537.4200
26	B-IIBR-C*pH4.0*A	6095.42	0.5060	12046.2846	1.3930E+15	2.3128E-09	538.9780	
27	B-IIBR-C*pH4.0*B	6038.27	0.5032	11999.7417	1.3876E+15	2.3039E-09	536.8936	537.9348
28	B-IIBR-C*pH5.0*A	5715.52	0.5044	11331.3243	1.3103E+15	2.1755E-09	506.9872	
29	B-IIBR-C*pH5.0*B	5783.51	0.5023	11514.0553	1.3315E+15	2.2106E-09	515.1629	511.0751
30	B-IIBR-C*pH5.5*A	5645.61	0.5039	11203.8301	1.2956E+15	2.1511E-09	501.2828	
31	B-IIBR-C*pH5.5*B	5651.19	0.5036	11221.5846	1.2976E+15	2.1545E-09	502.0772	501.6800
32	B-IIBR-C*pH6.0*A	5617.74	0.5050	11124.2376	1.2864E+15	2.1358E-09	497.7217	
33	B-IIBR-C*pH6.0*B	5585.92	0.5037	11089.7757	1.2824E+15	2.1292E-09	496.1798	496.9507
34	B-IIBR-C*pH6.5*A	5637.80	0.5057	11148.5070	1.2892E+15	2.1404E-09	498.8075	
35	B-IIBR-C*pH6.5*B	5554.87	0.5032	11039.0898	1.2765E+15	2.1194E-09	493.9120	496.3598
36	B-IIBR-C*pH7.0*A	5331.63	0.5031	10597.5552	1.2255E+15	2.0347E-09	474.1568	
37	B-IIBR-C*pH7.0*B	5348.83	0.5017	10661.4112	1.2329E+15	2.0469E-09	477.0139	475.5853
38	B-IIBR-C*pH7.5*A	5684.31	0.5009	11348.1933	1.3123E+15	2.1788E-09	507.7419	
39	B-IIBR-C*pH7.5*B	5696.36	0.5001	11390.4819	1.3172E+15	2.1869E-09	509.6340	508.6880
40	B-IIBR-C*pH8.0*A	6183.65	0.5024	12308.2205	1.4233E+15	2.3631E-09	550.6956	
41	B-IIBR-C*pH8.0*B	6106.25	0.5013	12180.8298	1.4086E+15	2.3386E-09	544.9958	547.8457
42	B-IIBR-C*pH9.5*A	5928.94	0.5025	11798.8856	1.3644E+15	2.2653E-09	527.9068	
43	B-IIBR-C*pH9.5*B	5974.26	0.5021	11898.5461	1.3759E+15	2.2844E-09	532.3659	530.1364

TD 6/15/94 calculations verified on page 143-4 of this notebook.

6/15/94 TD
CALCULATIONS
VERIFIED ON
Pgs 143-4 of
this book.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
55	B-IIB*pH4.00*IUA	5393.18	0.4981	10827.5045	1.2521E+15	2.0788E-09	484.4452	
56	B-IIB*pH4.00*IUB	5424.19	0.4997	10854.8929	1.2552E+15	2.0841E-09	485.6708	485.0579
57	B-IIB*pH4.25*IUA	5388.87	0.5000	10777.7400	1.2463E+15	2.0693E-09	482.2187	
58	B-IIB*pH4.25*IUB	5333.36	0.4981	10707.4082	1.2382E+15	2.0558E-09	479.0719	480.6453
59	B-IIB*pH4.50*IUA	5281.50	0.5003	10556.6660	1.2207E+15	2.0268E-09	472.3273	
60	B-IIB*pH4.50*IUB	5267.32	0.4984	10568.4591	1.2221E+15	2.0291E-09	472.8550	472.5912
61	B-IIB*pH4.75*IUA	5192.55	0.4994	10397.5771	1.2024E+15	1.9963E-09	465.2094	
62	B-IIB*pH4.75*IUB	5162.77	0.4980	10367.0080	1.1988E+15	1.9904E-09	463.8416	464.5255
63	B-IIB*pH5.00*IUA	5258.85	0.4979	10562.0607	1.2214E+15	2.0278E-09	472.5687	
64	B-IIB*pH5.00*IUB	5289.55	0.4979	10623.7198	1.2285E+15	2.0397E-09	475.3275	473.9481
65	B-IIB*pH5.25*IUA	5185.42	0.4988	10395.7899	1.2021E+15	1.9959E-09	465.1294	
66	B-IIB*pH5.25*IUB	5174.06	0.4981	10387.5929	1.2012E+15	1.9944E-09	464.7627	464.9460
67	B-IIB*pH5.50*IUA	4817.45	0.4998	9638.7555	1.1146E+15	1.8506E-09	431.2581	
68	B-IIB*pH5.50*IUB	4796.73	0.4989	9614.6121	1.1118E+15	1.8459E-09	430.1779	430.7180
69	B-IIB*pH5.75*IUA	5191.64	0.4985	10414.5236	1.2043E+15	1.9995E-09	465.9676	
70	B-IIB*pH5.75*IUB	5178.08	0.4968	10422.8663	1.2053E+15	2.0011E-09	466.3409	466.1542
71	B-IIB*pH6.00*IUA	5129.01	0.4966	10328.2521	1.1943E+15	1.9830E-09	462.1076	
72	B-IIB*pH6.00*IUB	5227.81	0.4996	10463.9912	1.2100E+15	2.0090E-09	468.1809	465.1442
73	B-IIB*pH6.25*IUA	5223.33	0.4992	10463.4014	1.2100E+15	2.0089E-09	468.1545	
74	B-IIB*pH6.25*IUB	5233.43	0.4992	10483.6338	1.2123E+15	2.0128E-09	469.0597	468.6071
75	B-IIB*pH6.50*IUA	5114.10	0.5017	10193.5420	1.1788E+15	1.9571E-09	456.0804	
76	B-IIB*pH6.50*IUB	5067.43	0.4978	10179.6505	1.1772E+15	1.9544E-09	455.4589	455.7696
77	B-IIB*pH6.75*IUA	5189.44	0.4991	10397.5957	1.2024E+15	1.9963E-09	465.2102	
78	B-IIB*pH6.75*IUB	5147.41	0.4981	10334.0895	1.1950E+15	1.9841E-09	462.3683	463.7895
79	B-IIB*pH7.00*IUA	5202.03	0.4997	10410.3062	1.2038E+15	1.9987E-09	465.7789	
80	B-IIB*pH7.00*IUB	5173.68	0.4989	10370.1744	1.1992E+15	1.9910E-09	463.9833	464.8811
81	B-IIB-C*pH4.0*IUA	5408.71	0.5002	10813.0948	1.2504E+15	2.0760E-09	483.8005	
82	B-IIB-C*pH4.0*IUB	5391.97	0.4972	10844.6702	1.2541E+15	2.0821E-09	485.2132	484.5069
83	B-IIB-C*pH5.0*IUA	5149.86	0.4965	10372.3263	1.1994E+15	1.9914E-09	464.0796	
84	B-IIB-C*pH5.0*IUB	5178.46	0.4988	10381.8364	1.2005E+15	1.9932E-09	464.5051	464.2923
85	B-IIB-C*pH5.5*IUA	5282.96	0.5025	10513.3532	1.2157E+15	2.0185E-09	470.3894	
86	B-IIB-C*pH5.5*IUB	5316.37	0.5009	10613.6355	1.2273E+15	2.0377E-09	474.8763	472.6329
87	B-IIB-C*pH6.0*IUA	5090.73	0.5005	10171.2887	1.1762E+15	1.9528E-09	455.0848	
88	B-IIB-C*pH6.0*IUB	5026.66	0.4977	10103.7975	1.1684E+15	1.9399E-09	452.0651	453.5749
89	B-IIB-C*pH6.5*IUA	5036.76	0.4988	10097.7546	1.1677E+15	1.9387E-09	451.7947	
90	B-IIB-C*pH6.5*IUB	5045.39	0.4977	10137.4121	1.1723E+15	1.9463E-09	453.5690	452.6819
91	B-IIB-C*pH7.0*IUA	4877.58	0.4981	9792.3710	1.1324E+15	1.8801E-09	438.1312	
92	B-IIB-C*pH7.0*IUB	4907.40	0.4976	9864.1206	1.1407E+15	1.8938E-09	441.3414	439.7363

TD

EXPERIMENT
C-I

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Protocol #: 5        Name:U-233 3% 2 sigma          25-Sep-93   07:58
Region A: LL-UL= 0.0-100.  Lcr=    0  Bkg= 0.00   %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=    0  Bkg= 0.00   %2 Sigma=3.00
Region C: LL-UL= 0.0-2000  Lcr=    0  Bkg= 0.00   %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
  1  999.98    18.95  1.45    3.215  3.53    28.75  1.18  141.21    B
  2    7.59     1.21 271.1  582.687  3.02   584.96  3.07  656.34
  3    7.56     2.08 160.9  584.616  3.02   587.52  3.07  653.85
  4    7.37     0.00  0.00  600.448  3.01   602.60  3.07  654.59
  5    7.03     1.39 245.6  629.075  3.02   630.71  3.07  652.19
  6    7.49     0.67 481.5  590.910  3.01   591.68  3.08  651.82
  7    7.38     1.78 188.9  599.901  3.01   600.79  3.08  650.50
  8    7.39     0.94 350.2  598.409  3.02   600.08  3.07  653.40
  9    7.45     1.59 210.2  593.832  3.02   596.76  3.07  651.69
 10    7.43     0.70 467.2  595.708  3.01   595.21  3.08  655.61
 11    7.49     0.67 481.5  590.376  3.02   590.75  3.08  647.18
 12    7.68     0.00  0.00  576.212  3.01   576.46  3.08  654.89
 13    7.49     0.54 598.2  590.376  3.02   591.41  3.08  651.92
 14    7.41     0.00  0.00  596.515  3.02   596.09  3.08  653.97
 15    7.66     2.59 130.0  577.072  3.02   580.65  3.07  648.58
 16    7.76     2.44 136.5  569.852  3.02   572.41  3.08  646.44
 17    7.73     2.78 120.9  571.947  3.02   576.17  3.07  650.39
 18    7.96     0.00  0.00  555.705  3.02   555.43  3.09  653.30
 19    7.86     1.53 211.5  563.070  3.01   563.11  3.08  656.39
 20    7.80     3.10 108.8  566.529  3.02   568.69  3.08  651.12
 21    7.91     5.32  66.04 558.732  3.02   565.31  3.07  650.36
 22    8.85     0.00  0.00  499.384  3.02   498.94  3.10  655.55
 23    9.03     2.53 122.3  489.033  3.02   491.63  3.09  651.52
 24    9.60     0.22 1319.  460.118  3.02   461.05  3.10  652.01
 25   10.12     1.31 217.8  436.212  3.02   437.36  3.10  655.60
 26   11.07     0.00  0.00  398.592  3.02   395.19  3.13  655.44
 27   11.42     1.71 157.8  386.102  3.02   386.14  3.12  649.64
 28   10.95     0.00  0.00  402.721  3.02   402.30  3.12  657.07
 29   10.81     0.00  0.00  407.886  3.02   407.79  3.12  659.94
 30   17.43     0.00  0.00  251.748  3.04   252.15  3.19  655.93
 31   17.57     2.22 99.62  249.716  3.04   251.05  3.18  650.40
 32   13.65     0.00  0.00  322.426  3.03   322.10  3.15  656.41
 33   13.74     3.17 80.43  320.220  3.03   324.09  3.13  650.35
 34   16.72     0.00  0.00  262.694  3.04   263.42  3.18  660.30
 35   17.26     1.09 198.4  254.317  3.04   255.09  3.18  653.14
 36   26.62     0.51 341.2  163.765  3.06   163.93  3.29  655.11
 37   26.09     0.29 600.4  167.157  3.06   168.57  3.27  660.72
 38   31.62     0.00  0.00  137.361  3.07   137.16  3.35  665.24
 39   31.22     0.20 783.5  139.130  3.07   139.77  3.33  660.55
 40   24.43     1.92 97.12  178.692  3.05   180.83  3.24  656.31
 41   24.86     1.85 100.3  175.546  3.06   177.93  3.25  655.47
 42   20.99     1.39 142.9  208.505  3.05   210.65  3.21  657.75
 43   21.19     2.99 68.62  206.507  3.05   209.43  3.21  654.27
 44   14.65     0.00  0.00  300.334  3.03   300.13  3.16  660.32
 45   14.35     2.16 112.9  306.541  3.03   307.77  3.15  655.40
 46    9.58     0.46 616.4  460.668  3.02   461.23  3.10  660.34
 47    9.39     0.00  0.00  470.374  3.02   470.30  3.10  661.81
 48    8.12     2.85 115.5  544.568  3.02   546.38  3.08  655.83
 49    8.19     3.27 101.1  539.520  3.02   543.05  3.08  658.94

 S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
 50    7.73     0.00  0.00  572.205  3.02   570.35  3.09  664.24
 51    7.53     2.43 139.2  587.622  3.01   590.25  3.07  658.27
 52    7.37     0.00  0.00  600.041  3.02   596.90  3.09  658.20
 53    7.47     2.87 119.5  591.832  3.02   594.55  3.07  655.27
 54    7.45     0.00  0.00  593.698  3.02   592.60  3.08  660.79
 55    7.67     0.00  0.00  577.228  3.01   577.12  3.08  662.87
 56    7.37     2.35 145.1  600.177  3.02   603.82  3.07  660.76
 57    7.46     1.29 256.3  592.898  3.02   594.18  3.08  660.43
 58    7.33     0.00  0.00  603.197  3.02   602.91  3.08  663.78
 59    7.60     1.84 180.6  581.653  3.02   583.36  3.08  656.95
 60    7.45     0.00  0.00  593.295  3.02   593.00  3.08  663.34
 61    7.39     0.94 350.2  598.409  3.02   600.35  3.07  660.10
 62    7.60     4.07 85.70  582.180  3.02   587.04  3.07  657.10
 63    7.36     0.07 4586.  601.133  3.01   601.42  3.08  659.78
 64    8.17     1.24 253.7  540.726  3.02   542.86  3.08  659.15
 65    7.86     1.79 182.5  562.307  3.02   565.02  3.08  660.22
 66    7.74     0.17 1855.  571.074  3.02   572.93  3.08  662.37
 67    7.70     3.52 97.48  574.058  3.02   576.97  3.08  657.43
 68    8.60     0.82 373.1  513.762  3.02   516.60  3.08  658.68
 69    8.86     0.00  0.00  498.478  3.02   498.12  3.10  663.47
 70    8.55     0.70 436.3  516.785  3.02   517.69  3.09  657.87
 71    8.27     1.60 197.2  534.512  3.02   536.07  3.08  656.44
 72    7.70     1.18 275.4  574.317  3.02   576.19  3.08  656.67
 73    7.98     0.22 1405.  553.928  3.02   553.84  3.09  663.80
 74    7.61     3.91 88.87  580.885  3.02   584.66  3.07  661.57
 75    7.58     3.08 111.1  583.460  3.02   588.67  3.07  656.99
 76    7.43     2.58 132.3  595.304  3.02   598.17  3.07  659.58
 77    7.46     0.00  0.00  592.495  3.02   592.30  3.08  662.64
 78    7.45     2.39 142.1  593.698  3.02   596.74  3.07  657.82
```

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
2	C-I*pH2.00*A	582.687	0.5277	1104.2013	1.2769E+14	2.1200E-10	49.4043	
3	C-I*pH2.00*B	584.616	0.5270	1109.3283	1.2828E+14	2.1298E-10	49.6337	49.5190
4	C-I*pH2.25*A	600.448	0.5274	1138.5059	1.3165E+14	2.1859E-10	50.9391	
5	C-I*pH2.25*B	629.075	0.5251	1198.0099	1.3854E+14	2.3001E-10	53.6015	52.2703
6	C-I*pH2.50*A	590.910	0.5261	1123.1895	1.2988E+14	2.1565E-10	50.2539	
7	C-I*pH2.50*B	599.901	0.5246	1143.5398	1.3224E+14	2.1955E-10	51.1644	50.7091
8	C-I*pH2.75*A	598.409	0.5300	1129.0736	1.3056E+14	2.1677E-10	50.5171	
9	C-I*pH2.75*B	593.832	0.5267	1127.4578	1.3038E+14	2.1646E-10	50.4448	50.4810
10	C-I*pH3.00*A	595.708	0.5287	1126.7411	1.3029E+14	2.1633E-10	50.4128	
11	C-I*pH3.00*B	590.376	0.5264	1121.5350	1.2969E+14	2.1533E-10	50.1798	50.2963
12	C-I*pH3.25*A	576.212	0.5256	1096.2938	1.2677E+14	2.1048E-10	49.0505	
13	C-I*pH3.25*B	590.376	0.5252	1124.0975	1.2999E+14	2.1582E-10	50.2945	49.6725
14	C-I*pH3.50*A	596.515	0.5272	1131.4776	1.3084E+14	2.1724E-10	50.6247	
15	C-I*pH3.50*B	577.072	0.5267	1095.6370	1.2670E+14	2.1036E-10	49.0211	49.8229
16	C-I*pH3.75*A	569.852	0.5258	1083.7809	1.2533E+14	2.0808E-10	48.4906	
17	C-I*pH3.75*B	571.947	0.5229	1093.7980	1.2648E+14	2.1000E-10	48.9388	48.7147
18	C-I*pH4.00*A	555.705	0.5232	1062.1273	1.2282E+14	2.0392E-10	47.5218	
19	C-I*pH4.00*B	563.070	0.5244	1073.7414	1.2416E+14	2.0615E-10	48.0414	47.7816
20	C-I*pH4.25*A	566.529	0.5297	1069.5280	1.2368E+14	2.0534E-10	47.8529	
21	C-I*pH4.25*B	558.732	0.5257	1062.8343	1.2290E+14	2.0406E-10	47.5534	47.7032
22	C-I*pH4.50*A	499.384	0.5280	945.8030	1.0937E+14	1.8159E-10	42.3172	
23	C-I*pH4.50*B	489.033	0.5249	931.6689	1.0774E+14	1.7887E-10	41.6848	42.0010
24	C-I*pH4.75*A	460.118	0.5288	870.1172	1.0062E+14	1.6706E-10	38.9309	
25	C-I*pH4.75*B	436.212	0.5253	830.4055	9.6026E+13	1.5943E-10	37.1541	38.0425
26	C-I*pH5.00*A	398.592	0.5280	754.9091	8.7296E+13	1.4494E-10	33.7762	
27	C-I*pH5.00*B	386.102	0.5264	733.4764	8.4818E+13	1.4082E-10	32.8173	33.2967
28	C-I*pH5.25*A	402.721	0.5259	765.7749	8.8552E+13	1.4702E-10	34.2624	
29	C-I*pH5.25*B	407.886	0.5243	777.9630	8.9962E+13	1.4936E-10	34.8077	34.5350
30	C-I*pH5.50*A	251.748	0.5274	477.3379	5.5198E+13	9.1646E-11	21.3571	

6/15/94 TD Calculations verified on pgs 143-144 of this notebook

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
31	C-I*pH5.50*B	249.716	0.5240	476.5573	5.5108E+13	9.1496E-11	21.3222	21.3396
32	C-I*pH5.75*A	322.426	0.5286	609.9622	7.0535E+13	1.1711E-10	27.2910	
33	C-I*pH5.75*B	320.220	0.5244	610.6407	7.0613E+13	1.1724E-10	27.3213	27.3062
34	C-I*pH6.00*A	262.694	0.5234	501.8991	5.8038E+13	9.6361E-11	22.4560	
35	C-I*pH6.00*B	254.317	0.5241	485.2452	5.6113E+13	9.3164E-11	21.7109	22.0835
36	C-I*pH6.25*A	163.765	0.5246	312.1712	3.6099E+13	5.9935E-11	13.9672	
37	C-I*pH6.25*B	167.157	0.5230	319.6119	3.6959E+13	6.1363E-11	14.3001	14.1336
38	C-I*pH6.50*A	137.361	0.4667	294.3240	3.4035E+13	5.6508E-11	13.1687	
39	C-I*pH6.50*B	139.130	0.5250	265.0095	3.0645E+13	5.0880E-11	11.8571	12.5129
40	C-I*pH6.75*A	178.692	0.5265	339.3960	3.9247E+13	6.5162E-11	15.1853	
41	C-I*pH6.75*B	175.546	0.5222	336.1662	3.8873E+13	6.4542E-11	15.0408	15.1130
42	C-I*pH7.00*A	208.505	0.5255	396.7745	4.5882E+13	7.6178E-11	17.7525	
43	C-I*pH7.00*B	206.507	0.5229	394.9264	4.5668E+13	7.5823E-11	17.6698	17.7112
44	C-I*pH7.25*A	300.334	0.5247	572.3918	6.6190E+13	1.0990E-10	25.6100	
45	C-I*pH7.25*B	306.541	0.5242	584.7787	6.7622E+13	1.1227E-10	26.1642	25.8871
46	C-I*pH7.50*A	460.668	0.5239	879.3052	1.0168E+14	1.6882E-10	39.3420	
47	C-I*pH7.50*B	470.374	0.5223	900.5820	1.0414E+14	1.7291E-10	40.2939	39.8179
48	C-I*pH7.75*A	544.568	0.5230	1041.2390	1.2041E+14	1.9991E-10	46.5872	
49	C-I*pH7.75*B	539.520	0.5228	1031.9816	1.1934E+14	1.9813E-10	46.1730	46.3801
50	C-I*pH8.00*A	572.205	0.5247	1090.5374	1.2611E+14	2.0938E-10	48.7929	
51	C-I*pH8.00*B	587.622	0.5225	1124.6354	1.3005E+14	2.1592E-10	50.3185	49.5557
52	C-I*pH8.25*A	600.041	0.5273	1137.9499	1.3159E+14	2.1848E-10	50.9143	
53	C-I*pH8.25*B	591.832	0.5237	1130.0974	1.3068E+14	2.1697E-10	50.5629	50.7386
54	C-I*pH8.50*A	593.698	0.5238	1133.4441	1.3107E+14	2.1761E-10	50.7127	
55	C-I*pH8.50*B	577.228	0.5230	1103.6864	1.2763E+14	2.1190E-10	49.3812	50.0470
56	C-I*pH8.75*A	600.177	0.5241	1145.1574	1.3242E+14	2.1986E-10	51.2367	
57	C-I*pH8.75*B	592.898	0.5213	1137.3451	1.3152E+14	2.1836E-10	50.8872	51.0620
58	C-I*pH9.00*A	603.197	0.5271	1144.3692	1.3233E+14	2.1971E-10	51.2015	
59	C-I*pH9.00*B	581.653	0.5247	1108.5439	1.2819E+14	2.1283E-10	49.5986	50.4000

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
60	C-IC-C*pH2.0*A	593.295	0.5237	1132.8910	1.3100E+14	2.1751E-10	50.6879	
61	C-IC-C*pH2.0*B	598.409	0.5223	1145.7189	1.3249E+14	2.1997E-10	51.2619	50.9749
62	C-IC-C*pH4.0*A	582.180	0.5239	1111.2426	1.2850E+14	2.1335E-10	49.7193	
63	C-IC-C*pH4.0*B	601.133	0.5215	1152.6999	1.3330E+14	2.2131E-10	51.5742	50.6468
64	C-IC-C*pH5.0*A	540.726	0.5249	1030.1505	1.1912E+14	1.9778E-10	46.0911	
65	C-IC-C*pH5.0*B	562.307	0.5235	1074.1299	1.2421E+14	2.0623E-10	48.0588	47.0750
66	C-IC-C*pH5.5*A	571.074	0.5333	1070.8307	1.2383E+14	2.0559E-10	47.9112	
67	C-IC-C*pH5.5*B	574.058	0.5260	1091.3650	1.2620E+14	2.0953E-10	48.8300	48.3706
68	C-IC-C*pH6.0*A	513.762	0.5253	978.0354	1.1310E+14	1.8778E-10	43.7594	
69	C-IC-C*pH6.0*B	498.478	0.5241	951.1124	1.0998E+14	1.8261E-10	42.5548	43.1571
70	C-IC-C*pH6.5*A	516.785	0.5246	985.1029	1.1392E+14	1.8913E-10	44.0756	
71	C-IC-C*pH6.5*B	534.512	0.5214	1025.1477	1.1855E+14	1.9682E-10	45.8673	44.9714
72	C-IC-C*pH7.0*A	574.317	0.5240	1096.0248	1.2674E+14	2.1043E-10	49.0384	
73	C-IC-C*pH7.0*B	553.928	0.5226	1059.9464	1.2257E+14	2.0350E-10	47.4242	48.2313
74	C-IC-C*pH7.5*A	580.885	0.5259	1104.5541	1.2773E+14	2.1207E-10	49.4201	
75	C-IC-C*pH7.5*B	583.460	0.5237	1114.1111	1.2883E+14	2.1390E-10	49.8477	49.6339
76	C-IC-C*pH8.0*A	595.304	0.5252	1133.4806	1.3107E+14	2.1762E-10	50.7143	
77	C-IC-C*pH8.0*B	592.495	0.5240	1130.7156	1.3075E+14	2.1709E-10	50.5906	50.6524
78	C-IC-C*pH9.5*A	593.698	0.5300	1120.1849	1.2954E+14	2.1507E-10	50.1194	
79	C-IC-C*pH9.5*B	592.898	0.5245	1130.4061	1.3072E+14	2.1703E-10	50.5767	50.3481

6/15/94 TD calculations verified on pgs 143-144 of this book

10/29/93 TD BATCH EQUILIBRATION METHOD OF PZC DETERMINATION (BE)

1 L 0.5 M NaOH prepared from a DILUT-IT analytical concentrate, Lot # 4691. The solution was prepared by draining the concentrate into a 1000 mL volumetric flask and diluting to the mark with Deionized H_2O.

2 1L portions of 0.1 M $NaNO_3$ were prepared by dissolving 8.499 g $NaNO_3$ in DI H_2O in a volumetric flask and diluting to the mark.

Wt. $NaNO_3$ used: 8.4998g
8.5002g lot # 7808 KCCL

2 Nov 1993 TD 11/2/94 TD BE 11/2/94

0.1 g of ~~the~~ Wedron Silica was ~~pi~~ weighed out and placed into each 30 mL PP bottle labeled SiO_2*PZC*pH i (i= 1-11, ΔpH=1.0). The silica had been ultrasonically cleaned several times and dried.

SOLUTION NAME	WT. SILICA (SiO_2) ADDED(g)
SiO_2 * PZC * pH 1.00	0.0998
2.00	0.0992
3.00	0.0996
4.00	0.1001
5.00	0.1007
6.00	0.0995
7.00	0.0997
8.00	0.1008
9.00	0.1007
10.00	0.1008
11.00	0.0001

The experimental solutions were prepared in the following manner:

(1) 60 mL 0.1M $NaNO_3$ was measured with a graduated cylinder and placed into a 100mL Plastic beaker.

(2) The pH of the solutions[TD] was adjusted either up or down using acid or base to the desired pH value (measured using pH electrode [calibrated]).

(3) 2-25 mL ~~aliquots~~[TD 11/2/93] aliquots of the final solution were taken, one as a control solution (SiO_2*pZC*pHi*C) the other as an experimental solution (SiO_2*pZC*pHi) containing silica.

(4) The solutions were then covered w/a kimwipe- TD and placed on a gyratory shaker @ 120 rpm.

SOLUTION	Adjustment	pH/T(°C)
SiO_2 *pZC *pH 1.00	1d. conc HNO_3, 14 5d. 1.0M HNO_3	1.05/19.0
2.00	16d 1.0M	2.03/19.0
3.00	12d 1.0M, 7d. 0.1M	3.02/19.0
4.00	2d 0.1M	3.97/19.1
5.00	1d 0.02M	5.04/19.1
6.00	1d. 0.01M NaOH	5.99/19.3
7.00	3d 0.01M	6.98/19.5
8.00	4d 0.01M	8.01/19.5
9.00	1d 0.05M, 1d 0.01M	8.99/19.5

SOLUTION	Adjustment	pH/T(°C)
... 10.00	1d. 0.05M NaOH, 17d 0.01M	9.96/19.6
11.00	27d 0.05M, 15d 0.01M	10.98/19.7
pH 7 buffer		7.00/19.7
pH 10 buffer		10.04/19.7

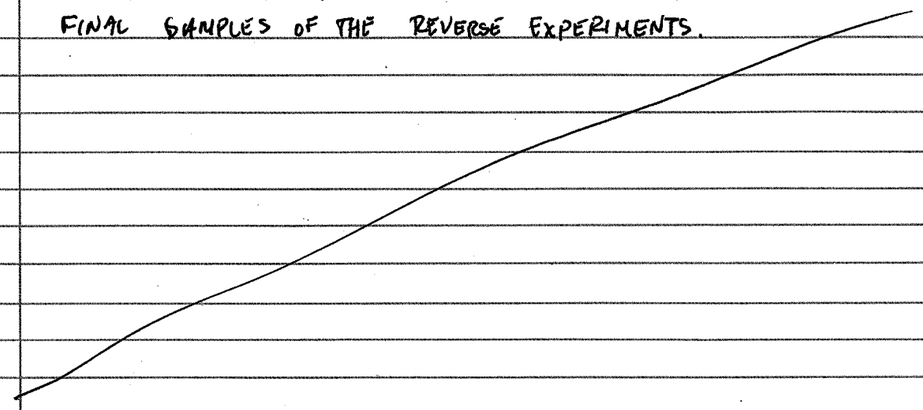
The lot #'s are: 0.05N NaOH - 925797-24
0.01N NaOH - 931156-12

The different acid concentrations were prepared previously for other experiments.

The pH will be monitored periodically until it equilibrates. Then, the final pH vs. change in pH will be plotted. The intersection of this plot with the x-axis is the point of zero charge.

4 Nov 1993 TD EXPERIMENT B-III

ALL THE SAMPLES FOR THIS EXPERIMENT WERE RECOUNTED BY LSA ON OCT 1 - BUT THE RESULTS WERE NOT PUT INTO THE LAB NOTE BOOK. THE RAW DATA AND CALCULATIONS FOLLOW. VIALS 1-79 ARE THE INITIAL SAMPLES, TAKEN BEFORE ZEOLITE ADDITION. VIALS 81-158 ARE THE SAMPLES TAKEN AFTER EQUILIBRATION WITH THE ZEOLITE. SAMPLE 160-201 ARE THE INITIAL [D] FOR THE REVERSE EXPERIMENTS, TAKEN BEFORE THE pH WAS CHANGED TO INITIATE THE REVERSE EXPERIMENTS. VIALS 203-244 ARE THE FINAL SAMPLES OF THE REVERSE EXPERIMENTS.



Protocol #: 6 Name:U-233 5% 2 Sigma 01-Oct-93 08:47
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=5.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 5% 2 sigma error for 5 ppb U-233 experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	552.33	18.74	1.97	2.899	5.00	27.60	1.62	135.70	B
2	26.50	0.00	0.00	57.479	5.26	58.71	6.19	713.37	
3	26.49	1.72	104.4	57.539	5.26	59.64	6.13	690.85	
4	27.12	0.00	0.00	56.098	5.26	55.30	6.37	720.03	
5	27.05	0.63	274.5	56.251	5.26	56.95	6.26	706.75	
6	26.85	0.00	0.00	56.803	5.26	56.35	6.33	712.20	
7	27.08	0.00	0.00	56.186	5.26	55.49	6.36	721.77	
8	27.62	1.79	98.61	55.030	5.27	56.69	6.21	690.83	
9	27.43	1.06	164.8	55.432	5.27	56.73	6.23	700.21	
10	26.33	0.00	0.00	57.907	5.25	57.29	6.32	725.19	
11	27.02	0.84	208.0	56.317	5.26	57.93	6.19	702.34	
12	27.85	0.43	392.1	54.552	5.27	55.31	6.29	713.67	
13	27.43	0.54	315.1	55.432	5.27	56.47	6.25	707.37	
14	27.31	0.37	459.0	55.725	5.26	56.77	6.24	711.40	
15	26.74	0.74	235.0	56.937	5.26	58.23	6.20	712.52	
16	27.46	3.07	59.23	55.404	5.27	59.73	6.02	676.70	
17	27.74	0.00	0.00	54.780	5.27	55.14	6.32	725.46	
18	28.43	0.00	0.00	53.415	5.28	52.64	6.44	734.33	
19	27.88	0.92	187.9	54.526	5.27	55.65	6.26	705.93	
20	29.62	1.72	99.07	51.153	5.29	53.46	6.24	686.30	
21	30.44	0.67	243.0	49.762	5.29	50.69	6.39	708.75	
22	32.27	0.00	0.00	46.714	5.32	45.88	6.65	737.75	
23	32.66	0.40	397.7	46.091	5.32	46.78	6.52	713.15	
24	42.65	1.63	87.52	34.639	5.43	36.46	6.83	690.69	
25	38.62	0.86	171.0	38.531	5.39	39.73	6.74	700.93	
26	52.34	1.23	105.2	27.671	5.55	29.42	7.26	692.25	
27	51.35	0.66	195.7	28.280	5.53	29.48	7.31	699.73	
28	73.23	1.37	80.86	18.991	5.81	20.59	8.17	677.05	
29	68.01	0.21	526.3	20.627	5.75	22.06	8.01	708.15	
30	66.56	0.31	365.2	21.140	5.73	21.47	8.26	705.74	
31	65.10	1.21	96.18	21.725	5.70	23.63	7.74	662.23	
32	65.54	0.87	133.3	21.560	5.71	22.39	8.05	695.54	
33	68.21	0.64	176.1	20.558	5.75	21.28	8.23	702.62	
34	90.98	1.07	94.12	14.688	6.07	16.56	8.84	683.16	
35	87.69	0.95	106.6	15.370	6.01	16.69	8.93	688.71	
36	94.64	0.31	312.4	14.008	6.12	14.55	9.67	693.78	
37	90.55	0.00	0.00	14.782	6.06	15.21	9.51	725.16	
38	46.27	0.04	3278.	31.681	5.48	32.49	7.15	717.75	
39	45.01	0.57	240.3	32.671	5.46	33.86	7.03	708.34	
40	65.44	0.93	124.9	21.551	5.71	22.53	8.02	701.48	
41	64.07	0.00	0.00	22.074	5.69	21.52	8.40	759.78	
42	39.65	0.10	1438.	37.505	5.40	37.85	6.89	727.38	
43	39.59	0.86	169.1	37.591	5.39	39.29	6.71	714.94	
44	36.18	0.00	0.00	41.325	5.36	41.72	6.72	724.37	
45	37.15	0.32	466.2	40.170	5.37	40.67	6.76	726.53	
46	32.33	0.84	190.7	46.622	5.32	47.63	6.47	720.22	
47	30.76	0.38	431.6	49.117	5.30	49.97	6.42	725.73	
48	30.04	2.00	85.17	50.397	5.29	52.80	6.25	699.69	
49	30.22	0.88	187.4	50.046	5.30	51.29	6.36	717.30	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	27.90	1.83	95.83	54.449	5.27	56.10	6.23	701.89	
51	27.86	1.90	92.73	54.639	5.27	57.22	6.15	705.58	
52	27.65	0.17	971.7	55.076	5.26	55.55	6.29	720.54	
53	27.69	1.30	133.6	55.028	5.26	56.15	6.25	709.22	
54	27.43	0.69	249.5	55.505	5.26	56.25	6.27	713.06	
55	27.84	0.26	649.0	54.609	5.27	55.16	6.30	713.28	
56	28.69	1.20	142.7	52.870	5.28	54.77	6.24	697.40	
57	27.00	1.63	109.0	56.361	5.26	58.96	6.12	668.40	
58	27.74	0.33	515.8	54.816	5.27	55.39	6.30	721.16	
59	28.21	0.61	276.3	53.819	5.28	54.29	6.33	715.42	
60	26.41	0.00	0.00	57.722	5.26	56.80	6.34	736.54	
61	28.36	2.24	78.55	53.554	5.28	55.73	6.20	698.81	
62	30.34	0.00	0.00	49.870	5.30	49.86	6.47	725.12	
63	29.61	1.62	104.6	51.137	5.29	53.09	6.28	706.28	
64	53.39	0.00	0.00	27.070	5.56	27.64	7.54	730.79	
65	50.34	0.09	1399.	28.905	5.52	29.36	7.40	727.13	
66	72.73	0.54	204.0	19.101	5.81	20.31	8.29	714.54	
67	76.56	0.00	36901	18.000	5.86	18.52	8.72	731.15	
68	85.29	0.38	265.7	15.861	5.98	16.70	9.04	709.69	
69	84.56	1.02	101.4	16.023	5.97	17.45	8.75	677.43	
70	57.79	0.00	0.00	24.788	5.62	25.34	7.76	732.95	
71	53.81	0.53	235.9	26.836	5.57	28.12	7.41	713.93	
72	37.28	0.17	863.8	40.020	5.37	40.11	6.81	731.57	
73	37.48	1.46	103.9	39.817	5.37	42.68	6.50	699.36	
74	29.83	0.84	198.5	50.739	5.29	51.89	6.35	707.55	
75	31.41	1.22	134.0	48.041	5.31	49.61	6.38	703.64	
76	27.74	0.69	248.5	54.816	5.27	56.11	6.24	711.01	
77	29.02	0.11	1524.	52.236	5.28	52.49	6.39	717.52	
78	27.97	0.00	0.00	54.341	5.27	53.81	6.39	725.32	
79	29.50	0.07	2247.	51.373	5.29	51.83	6.39	717.77	
(1 missing vial)									
81	26.09	0.85	209.6	58.428	5.25	60.14	6.14	713.67	
82	25.36	0.46	384.3	60.232	5.24	61.72	6.12	714.04	
83	26.69	2.05	87.81	57.086	5.26	58.65	6.18	697.48	
84	26.00	1.41	127.3	58.640	5.25	60.06	6.16	710.28	
85	25.46	1.53	119.4	59.945	5.25	61.72	6.11	701.23	
86	25.79	0.96	186.7	59.180	5.25	60.62	6.15	709.02	
87	27.47	1.50	117.1	55.383	5.27	57.95	6.14	701.06	
88	27.06	0.00	0.00	56.229	5.26	55.74	6.35	731.09	
89	27.88	1.24	140.0	54.562	5.27	56.80	6.18	707.85	
90	26.21	2.13	85.58	58.147	5.26	60.58	6.10	699.41	
91	28.60	0.00	0.00	53.045	5.28	52.82	6.41	731.30	
92	27.63	0.00	0.00	55.009	5.27	55.00	6.34	728.60	
93	28.60	1.96	88.88	53.115	5.28	55.03	6.23	699.12	
94	28.89	0.00	0.00	52.484	5.28	52.99	6.36	725.06	
95	29.82	0.54	304.6	50.757	5.29	51.61	6.37	718.72	
96	30.42	1.15	144.5	49.698	5.30	50.74	6.39	713.04	
97	32.74	1.05	152.0	45.971	5.32	47.63	6.43	710.70	
98	31.80	0.32	503.6	47.416	5.31	49.51	6.35	730.03	
99	38.49	0.72	204.3	38.723	5.38	38.97	6.85	711.18	
100	38.57	0.86	171.2	38.584	5.39	39.58	6.76	706.87	
101	43.40	0.00	0.00	33.968	5.44	33.99	7.13	728.21	
102	49.51	0.93	140.9	29.418	5.51	30.37	7.28	701.13	
103	76.99	0.00	0.00	17.883	5.87	17.77	9.00	731.46	
104	77.88	0.85	125.2	17.659	5.88	19.05	8.46	695.24	
105	109.28	0.00	0.00	11.743	6.36	12.16	10.58	736.08	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
106	102.43	0.15	621.6	12.722	6.24	13.45	9.98	702.30	
107	126.76	0.00	0.00	9.732	6.66	9.77	12.01	760.79	
108	131.05	0.00	0.00	9.326	6.73	9.28	12.40	746.94	
109	126.27	0.46	185.8	9.773	6.65	10.56	11.24	693.82	
110	128.46	0.45	191.0	9.557	6.69	10.56	11.16	685.81	
111	126.30	0.00	0.00	9.770	6.65	10.11	11.68	746.31	
112	128.23	0.07	1226.	9.579	6.69	9.99	11.72	725.15	
113	167.79	0.00	0.00	6.637	7.51	6.59	15.29	789.85	
114	156.37	0.00	0.00	7.334	7.25	7.33	14.26	750.29	
115	183.63	0.00	0.00	5.815	7.90	6.19	15.63	740.18	
116	178.01	0.00	0.00	6.106	7.74	6.49	15.15	745.82	
117	177.15	0.13	574.8	6.133	7.73	7.03	14.09	711.45	
118	173.71	0.13	581.2	6.318	7.64	7.19	13.92	727.78	
119	183.12	0.00	0.00	5.839	7.88	6.20	15.63	738.51	
120	181.24	0.34	216.6	5.929	7.84	6.35	15.35	680.71	
121	134.82	0.08	1081.	8.969	6.81	9.45	12.06	719.45	
122	126.94	0.00	0.00	9.706	6.66	9.52	12.30	762.11	
123	98.49	0.00	0.00	13.357	6.18	13.79	9.95	733.59	
124	95.36	0.00	0.00	13.880	6.13	14.36	9.75	727.67	
125	73.42	0.00	0.00	18.894	5.82	18.70	8.82	743.79	
126	71.94	0.00	0.00	19.370	5.79	19.12	8.75	735.60	
127	49.22	0.54	241.6	29.629	5.51	30.86	7.21	713.52	
128	49.97	0.00	0.00	29.121	5.52	29.20	7.46	735.05	
129	33.28	0.00	0.00	45.298	5.32	44.85	6.65	738.37	
130	34.31	0.35	439.0	43.735	5.34	44.19	6.62	721.80	
131	28.06	0.29	581.9	54.158	5.27	54.23	6.35	719.52	
132	28.10	0.16	1076.	54.183	5.27	54.82	6.30	715.89	
133	27.94	1.37	126.4	54.367	5.27	56.05	6.23	709.22	
134	27.65	1.69	103.8	55.004	5.27	56.78	6.20	706.81	
135	26.19	0.73	240.8	58.193	5.25	59.15	6.20	719.64	
136	27.40	0.13	1328.	55.496	5.27	55.40	6.33	727.64	
137	27.08	0.76	229.4	56.186	5.27	57.60	6.21	719.07	
138	27.08	0.72	240.9	56.186	5.26	57.49	6.22	719.51	
139	26.31	1.21	146.7	58.029	5.25	59.10	6.19	712.63	
140	27.56	0.00	0.00	55.302	5.26	54.62	6.38	738.68	
141	28.63	1.17	146.2	52.987	5.28	55.74	6.17	712.05	
142	28.81	0.07	2293.	52.672	5.28	53.31	6.34	727.40	
143	41.66	0.97	147.3	35.508	5.42	36.66	6.88	710.36	
144	43.26	0.28	484.9	34.087	5.44	34.40	7.08	717.02	
145	57.09	0.16	758.1	25.127	5.61	26.00	7.65	728.49	
146	61.68	1.07	111.3	23.058	5.66	24.80	7.65	694.77	
147	68.10	0.28	406.2	20.596	5.75	21.19	8.26	714.42	
148	67.37	0.00	0.00	20.851	5.74	20.87	8.41	733.89	
149	59.17	0.26	466.4	24.159	5.63	24.74	7.81	715.61	
150	54.25	0.89	141.3	26.613	5.57	27.78	7.45	701.62	
151	38.66	0.94	156.2	38.488	5.39	39.94	6.71	709.80	
152	36.54	0.00	0.00	40.889	5.37	41.21	6.75	729.16	
153	29.64	0.00	0.00	51.116	5.29	51.32	6.42	730.51	
154	29.03	1.58	108.2	52.217	5.28	54.77	6.21	711.19	
155	27.55	0.86	200.8	55.178	5.27	56.03	6.27	717.75	
156	28.46	0.44	378.9	53.356	5.28	53.68	6.35	723.86	
157	26.51	0.57	304.9	57.494	5.26	58.90	6.18	727.94	
158	26.63	1.50	118.8	57.184	5.26	58.74	6.18	713.19	
(1 missing vial)									
160	25.92	1.71	106.3	58.830	5.25	61.37	6.08	704.22	
161	26.44	1.30	136.4	57.616	5.26	59.89	6.12	714.67	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
162	34.29	0.57	273.3	43.762	5.34	44.35	6.61	713.24	
163	32.70	1.75	92.95	46.031	5.32	48.64	6.34	702.01	
164	26.92	0.91	192.1	56.537	5.26	58.25	6.18	711.38	
165	47.25	0.18	732.2	30.964	5.49	31.62	7.22	731.84	
166	47.80	0.00	0.00	30.574	5.49	29.96	7.48	720.64	
167	99.96	0.00	0.00	13.108	6.20	12.54	10.72	760.67	
168	33.28	0.00	0.00	45.178	5.33	44.43	6.70	736.73	
169	56.85	1.21	102.8	25.246	5.60	26.34	7.59	690.76	
170	118.94	0.00	0.00	10.554	6.52	10.61	11.49	744.11	
171	161.14	0.16	479.5	7.031	7.36	7.42	13.94	711.44	
172	158.06	0.61	129.1	7.224	7.29	8.36	12.60	655.75	
173	161.60	0.00	0.00	7.002	7.37	7.35	14.04	735.85	
174	167.97	0.00	0.00	6.627	7.51	7.05	14.35	738.40	
175	176.22	0.00	0.00	6.198	7.70	5.91	16.59	800.04	
176	181.77	0.05	1581.	5.904	7.85	6.19	15.69	705.12	
177	185.73	0.62	119.8	5.721	7.95	6.79	14.29	641.81	
178	188.52	0.06	1147.	5.594	8.02	6.25	15.33	706.66	
179	142.85	0.06	1306.	8.302	6.97	8.67	12.71	721.23	
180	140.16	0.00	0.00	8.524	6.91	8.80	12.65	741.17	
181	73.80	0.00	0.00	18.795	5.82	18.85	8.74	731.84	
182	75.44	0.23	468.4	18.310	5.85	19.14	8.55	720.02	
183	25.95	0.76	233.7	58.758	5.25	60.07	6.16	710.42	
184	25.18	1.67	109.9	60.684	5.24	62.40	6.10	706.95	
185	28.21	0.54	311.8	53.819	5.28	54.72	6.30	716.64	
186	40.92	0.00	0.00	36.226	5.41	35.50	7.11	747.84	
187	42.85	0.00	0.00	34.441	5.44	34.15	7.15	744.61	
188	53.70	0.27	457.3	26.897	5.56	27.64	7.52	719.85	
189	53.36	0.00	0.00	27.086	5.56	27.07	7.66	732.75	
190	56.34	0.25	484.9	25.518	5.60	26.68	7.55	707.40	
191	59.15	0.00	0.00	24.185	5.63	24.42	7.89	726.72	
192	56.14	0.00	0.00	25.602	5.59	25.72	7.78	731.30	
193	55.46	1.04	120.3	26.005	5.58	27.72	7.38	702.49	
194	40.11	0.41	351.6	36.992	5.41	37.60	6.88	719.68	
195	41.12	0.54	260.5	36.012	5.42	37.09	6.87	713.26	
196	28.62	0.48	352.4	53.041	5.28	53.05	6.38	718.78	
197	29.66	1.56	108.9	51.080	5.29	53.19	6.26	703.84	
198	28.33	0.36	473.0	53.579	5.28	53.98	6.34	716.35	
199	27.33	0.98	177.2	55.645	5.27	56.56	6.26	718.85	
200	27.12	1.02	170.7	56.098	5.26	58.21	6.16	720.24	
201	28.19	0.00	0.00	53.930	5.27	54.28	6.33	721.00	
(1 missing vial)									
203	24.94	0.87	209.0	61.255	5.24	62.50	6.12	704.26	
204	25.50	0.51	345.4	59.925	5.24	60.68	6.18	714.28	
205	25.87	0.00	0.00	58.988	5.25	59.65	6.20	721.89	
206	25.42	0.26	679.5	60.044	5.25	60.96	6.17	717.13	
207	27.34	0.24	703.6	55.624	5.27	57.30	6.20	720.22	
208	28.07	0.57	299.0	54.102	5.27	55.13	6.28	719.19	
209	32.91	0.89	178.7	45.901	5.32	46.94	6.48	715.99	
210	98.45	0.84	114.5	13.353	6.18	14.09	9.77	694.97	
211	116.77	0.70	128.0	10.804	6.48	11.54	10.75	683.94	
212	55.94	0.51	240.1	25.703	5.59	26.66	7.58	701.13	
213	90.94	0.78	128.2	14.805	6.04	15.78	9.20	684.93	
214	95.60	0.00	0.00	13.859	6.13	14.06	9.92	726.86	
215	105.83	0.00	0.00	12.220	6.30	12.02	10.83	748.38	
216	105.18	0.00	0.00	12.313	6.29	12.41	10.57	734.36	
217	177.12	0.00	0.00	6.135	7.73	6.53	15.08	740.23	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
218	173.14	0.10	758.4	6.354	7.63	6.77	14.73	705.63	
219	156.96	0.00	0.00	7.301	7.26	7.48	13.99	740.07	
220	154.79	0.00	0.00	7.444	7.21	7.52	13.99	744.34	
221	101.42	0.00	0.00	12.887	6.23	13.48	10.01	723.48	
222	99.54	0.71	135.1	13.175	6.20	14.13	9.70	690.15	
223	26.22	0.37	476.0	58.162	5.25	58.90	6.21	714.74	
224	27.61	0.00	0.00	55.051	5.27	55.56	6.30	729.71	
225	25.03	0.60	301.3	61.025	5.24	62.10	6.14	723.58	
226	24.95	0.00	0.00	61.270	5.24	60.86	6.23	726.81	
227	26.78	0.30	568.9	56.885	5.26	57.73	6.23	719.80	
228	26.49	0.00	0.00	57.577	5.25	58.59	6.20	724.62	
229	36.36	0.68	222.9	41.106	5.36	42.59	6.61	708.43	
230	35.29	0.98	156.9	42.440	5.35	43.53	6.60	702.72	
231	44.93	0.51	265.9	32.735	5.46	33.99	7.01	713.07	
232	47.02	0.00	0.00	31.129	5.49	30.72	7.40	740.34	
233	49.98	0.00	0.00	29.114	5.52	29.31	7.44	730.55	
234	49.52	0.00	0.00	29.412	5.51	29.51	7.43	731.80	
235	54.60	0.09	1411.	26.405	5.58	26.36	7.73	717.40	
236	57.07	0.00	0.00	25.137	5.61	25.41	7.79	734.53	
237	38.78	0.42	347.0	38.360	5.39	38.86	6.84	712.92	
238	40.65	0.87	166.0	36.462	5.41	37.96	6.79	711.74	
239	28.80	0.18	908.5	52.657	5.28	53.62	6.32	718.25	
240	28.29	0.00	0.00	53.658	5.28	53.46	6.39	720.56	
241	26.25	0.38	455.7	58.054	5.26	60.02	6.13	720.78	
242	25.91	1.52	118.7	58.892	5.25	61.33	6.09	709.48	
243	24.70	0.13	1420.	61.879	5.24	62.49	6.15	723.75	
244	26.17	1.97	92.22	58.240	5.25	60.86	6.09	703.64	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
2	B-IIIB*pH2.00*IU1	57.479	0.4982	115.3733	1.3342E+13	2.2151E-11	5.1620	
3	B-IIIB*pH2.00*IU2	57.539	0.4988	115.3549	1.3339E+13	2.2147E-11	5.1612	5.1616
4	B-IIIB*pH2.25*IU1	56.098	0.5009	111.9944	1.2951E+13	2.1502E-11	5.0109	
5	B-IIIB*pH2.25*IU2	56.251	0.4994	112.6372	1.3025E+13	2.1626E-11	5.0396	5.0252
6	B-IIIB*pH2.50*IU1	56.803	0.5004	113.5152	1.3127E+13	2.1794E-11	5.0789	
7	B-IIIB*pH2.50*IU2	56.186	0.5008	112.1925	1.2974E+13	2.1540E-11	5.0197	5.0493
8	B-IIIB*pH2.75*IU1	55.030	0.5034	109.3166	1.2641E+13	2.0988E-11	4.8911	
9	B-IIIB*pH2.75*IU2	55.432	0.5017	110.4883	1.2777E+13	2.1213E-11	4.9435	4.9173
10	B-IIIB*pH3.00*IU1	57.907	0.5046	114.7582	1.3270E+13	2.2033E-11	5.1345	
11	B-IIIB*pH3.00*IU2	56.317	0.4998	112.6791	1.3030E+13	2.1634E-11	5.0415	5.0880
12	B-IIIB*pH3.25*IU1	54.552	0.5006	108.9732	1.2601E+13	2.0922E-11	4.8757	
13	B-IIIB*pH3.25*IU2	55.432	0.5015	110.5324	1.2782E+13	2.1222E-11	4.9455	4.9106
14	B-IIIB*pH3.50*IU1	55.725	0.5028	110.8294	1.2816E+13	2.1279E-11	4.9587	
15	B-IIIB*pH3.50*IU2	56.937	0.5010	113.6467	1.3142E+13	2.1819E-11	5.0848	5.0218
16	B-IIIB*pH3.75*IU1	55.404	0.5025	110.2567	1.2750E+13	2.1169E-11	4.9331	
17	B-IIIB*pH3.75*IU2	54.780	0.5018	109.1670	1.2624E+13	2.0959E-11	4.8844	4.9087
18	B-IIIB*pH4.00*IU1	53.415	0.5023	106.3408	1.2297E+13	2.0417E-11	4.7579	
19	B-IIIB*pH4.00*IU2	54.526	0.5013	108.7692	1.2578E+13	2.0883E-11	4.8666	4.8122
20	B-IIIB*pH4.25*IU1	51.153	0.5002	102.2651	1.1826E+13	1.9634E-11	4.5756	
21	B-IIIB*pH4.25*IU2	49.762	0.4995	99.6236	1.1520E+13	1.9127E-11	4.4574	4.5165
22	B-IIIB*pH4.50*IU1	46.714	0.5013	93.1857	1.0776E+13	1.7891E-11	4.1693	
23	B-IIIB*pH4.50*IU2	46.091	0.5008	92.0347	1.0643E+13	1.7670E-11	4.1178	4.1436
24	B-IIIB*pH4.75*IU1	34.639	0.5019	69.0157	7.9808E+12	1.3251E-11	3.0879	
25	B-IIIB*pH4.75*IU2	38.531	0.5009	76.9235	8.8953E+12	1.4769E-11	3.4417	3.2648
26	B-IIIB*pH5.00*IU1	27.671	0.5001	55.3309	6.3983E+12	1.0623E-11	2.4756	
27	B-IIIB*pH5.00*IU2	28.280	0.5005	56.5035	6.5339E+12	1.0848E-11	2.5281	2.5019
28	B-IIIB*pH5.25*IU1	18.991	0.5004	37.9516	4.3886E+12	7.2865E-12	1.6980	
29	B-IIIB*pH5.25*IU2	20.627	0.5013	41.1470	4.7581E+12	7.9000E-12	1.8410	1.7695
30	B-IIIB*pH5.50*IU1	21.140	0.5009	42.2040	4.8804E+12	8.1029E-12	1.8883	
31	B-IIIB*pH5.50*IU2	21.725	0.4993	43.5109	5.0315E+12	8.3538E-12	1.9468	1.9175
32	B-IIIB*pH5.75*IU1	21.569	0.5007	43.0597	4.9793E+12	8.2672E-12	1.9266	

6/15/94 TD Calculations verified on pgs 143-4 of this book

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
33	B-IIIB*pH5.75*IU2	20.558	0.4985	41.2397	4.7689E+12	7.9178E-12	1.8452	1.8859
34	B-IIIB*pH6.00*IU1	14.688	0.5016	29.2823	3.3861E+12	5.6220E-12	1.3102	
35	B-IIIB*pH6.00*IU2	15.370	0.4998	30.7523	3.5561E+12	5.9042E-12	1.3759	1.3430
36	B-IIIB*pH6.25*IU1	14.008	0.4997	28.0328	3.2417E+12	5.3821E-12	1.2542	
37	B-IIIB*pH6.25*IU2	14.782	0.5002	29.5522	3.4173E+12	5.6738E-12	1.3222	1.2882
38	B-IIIB*pH6.50*IU1	31.681	0.5047	62.7719	7.2588E+12	1.2052E-11	2.8085	
39	B-IIIB*pH6.50*IU2	32.671	0.5014	65.1596	7.5349E+12	1.2510E-11	2.9154	2.8620
40	B-IIIB*pH6.75*IU1	21.551	0.5024	42.8961	4.9604E+12	8.2358E-12	1.9193	
41	B-IIIB*pH6.75*IU2	22.074	0.4995	44.1922	5.1103E+12	8.4846E-12	1.9773	1.9483
42	B-IIIB*pH7.00*IU1	37.505	0.4990	75.1603	8.6914E+12	1.4430E-11	3.3628	
43	B-IIIB*pH7.00*IU2	37.591	0.4980	75.3478	8.7130E+12	1.4466E-11	3.3712	3.3670
44	B-IIIB*pH7.25*IU1	41.325	0.5006	82.5509	9.5460E+12	1.5849E-11	3.6935	
45	B-IIIB*pH7.25*IU2	40.170	0.4988	80.5333	9.3127E+12	1.5462E-11	3.6032	3.6484
46	B-IIIB*pH7.50*IU1	46.622	0.5012	93.0208	1.0757E+13	1.7859E-11	4.1619	
47	B-IIIB*pH7.50*IU2	49.117	0.4996	98.3127	1.1369E+13	1.8875E-11	4.3987	4.2803
48	B-IIIB*pH7.75*IU1	50.397	0.5000	100.7940	1.1656E+13	1.9352E-11	4.5097	
49	B-IIIB*pH7.75*IU2	50.046	0.4995	100.1922	1.1586E+13	1.9236E-11	4.4828	4.4963
50	B-IIIB*pH8.00*IU1	54.449	0.5003	108.8327	1.2585E+13	2.0895E-11	4.8694	
51	B-IIIB*pH8.00*IU2	54.639	0.4972	109.8934	1.2708E+13	2.1099E-11	4.9169	4.8931
52	B-IIIB*pH8.25*IU1	55.076	0.5008	109.9760	1.2717E+13	2.1115E-11	4.9206	
53	B-IIIB*pH8.25*IU2	55.028	0.5000	110.0560	1.2727E+13	2.1130E-11	4.9241	4.9223
54	B-IIIB*pH8.50*IU1	55.505	0.4993	111.1656	1.2855E+13	2.1343E-11	4.9738	
55	B-IIIB*pH8.50*IU2	54.609	0.4980	109.6566	1.2680E+13	2.1053E-11	4.9063	4.9400
56	B-IIIB*pH8.75*IU1	52.870	0.5003	105.6766	1.2220E+13	2.0289E-11	4.7282	
57	B-IIIB*pH8.75*IU2	56.361	0.4990	112.9479	1.3061E+13	2.1685E-11	5.0535	4.8909
58	B-IIIB*pH9.00*IU1	54.816	0.5018	109.2387	1.2632E+13	2.0973E-11	4.8876	
59	B-IIIB*pH9.00*IU2	53.819	0.4985	107.9619	1.2484E+13	2.0728E-11	4.8304	4.8590
60	B-IIIB-C*pH2.0*IU1	57.722	0.5006	115.3056	1.3334E+13	2.2138E-11	5.1590	
61	B-IIIB-C*pH2.0*IU2	53.554	0.4983	107.4734	1.2428E+13	2.0634E-11	4.8086	4.9838
62	B-IIIB-C*pH4.0*IU1	49.870	0.5001	99.7201	1.1531E+13	1.9146E-11	4.4617	
63	B-IIIB-C*pH4.0*IU2	51.137	0.4986	102.5612	1.1860E+13	1.9691E-11	4.5888	4.5252

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
64	B-IIIB-C*pH5.0*IU1	27.070	0.5023	53.8921	6.2320E+12	1.0347E-11	2.4112	
65	B-IIIB-C*pH5.0*IU2	28.905	0.4983	58.0072	6.7078E+12	1.1137E-11	2.5954	2.5033
66	B-IIIB-C*pH5.5*IU1	19.101	0.5017	38.0726	4.4026E+12	7.3097E-12	1.7034	
67	B-IIIB-C*pH5.5*IU2	18.000	0.5004	35.9712	4.1596E+12	6.9062E-12	1.6094	1.6564
68	B-IIIB-C*pH6.0*IU1	15.861	0.5007	31.6777	3.6631E+12	6.0819E-12	1.4173	
69	B-IIIB-C*pH6.0*IU2	16.023	0.4976	32.2006	3.7236E+12	6.1823E-12	1.4407	1.4290
70	B-IIIB-C*pH6.5*IU1	24.788	0.4976	49.8151	5.7605E+12	9.5642E-12	2.2288	
71	B-IIIB-C*pH6.5*IU2	26.836	0.5007	53.5970	6.1978E+12	1.0290E-11	2.3980	2.3134
72	B-IIIB-C*pH7.0*IU1	40.020	0.4975	80.4422	9.3022E+12	1.5444E-11	3.5992	
73	B-IIIB-C*pH7.0*IU2	39.817	0.4985	79.8736	9.2364E+12	1.5335E-11	3.5737	3.5864
74	B-IIIB-C*pH7.5*IU1	50.739	0.5017	101.1341	1.1695E+13	1.9417E-11	4.5250	
75	B-IIIB-C*pH7.5*IU2	48.041	0.4971	96.6425	1.1176E+13	1.8555E-11	4.3240	4.4245
76	B-IIIB-C*pH8.0*IU1	54.816	0.5000	109.6320	1.2678E+13	2.1049E-11	4.9052	
77	B-IIIB-C*pH8.0*IU2	52.236	0.4984	104.8074	1.2120E+13	2.0122E-11	4.6893	4.7972
78	B-IIIB-C*pH9.5*IU1	54.341	0.5010	108.4651	1.2543E+13	2.0825E-11	4.8530	
79	B-IIIB-C*pH9.5*IU2	51.373	0.5011	102.5205	1.1855E+13	1.9683E-11	4.5870	4.7200

6/15/94 TD Calculations verified on pgs 143-144 of this book

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
81	B-IIIB*pH2.00*A	58.428	0.5026	116.2515	1.3443E+13	2.2320E-11	5.2013	
82	B-IIIB*pH2.00*B	60.232	0.4978	120.9964	1.3992E+13	2.3231E-11	5.4136	5.3075
83	B-IIIB*pH2.25*A	57.086	0.5023	113.6492	1.3142E+13	2.1820E-11	5.0849	
84	B-IIIB*pH2.25*B	58.640	0.5023	116.7430	1.3500E+13	2.2414E-11	5.2233	5.1541
85	B-IIIB*pH2.50*A	59.945	0.5020	119.4124	1.3809E+13	2.2926E-11	5.3428	
86	B-IIIB*pH2.50*B	59.180	0.5016	117.9825	1.3643E+13	2.2652E-11	5.2788	5.3108
87	B-IIIB*pH2.75*A	55.383	0.5019	110.3467	1.2760E+13	2.1186E-11	4.9371	
88	B-IIIB*pH2.75*B	56.229	0.5009	112.2559	1.2981E+13	2.1552E-11	5.0226	4.9799
89	B-IIIB*pH3.00*A	54.562	0.5032	108.4300	1.2539E+13	2.0818E-11	4.8514	
90	B-IIIB*pH3.00*B	58.147	0.5015	115.9462	1.3408E+13	2.2261E-11	5.1877	5.0195
91	B-IIIB*pH3.25*A	53.045	0.5022	105.6252	1.2214E+13	2.0279E-11	4.7259	
92	B-IIIB*pH3.25*B	55.009	0.5007	109.8642	1.2704E+13	2.1093E-11	4.9156	4.8207
93	B-IIIB*pH3.50*A	53.115	0.5016	105.8911	1.2245E+13	2.0330E-11	4.7378	
94	B-IIIB*pH3.50*B	52.484	0.5019	104.5706	1.2092E+13	2.0077E-11	4.6787	4.7083
95	B-IIIB*pH3.75*A	50.757	0.5023	101.0492	1.1685E+13	1.9401E-11	4.5212	
96	B-IIIB*pH3.75*B	49.698	0.5012	99.1580	1.1466E+13	1.9038E-11	4.4365	4.4788
97	B-IIIB*pH4.00*A	45.971	0.5008	91.7951	1.0615E+13	1.7624E-11	4.1071	
98	B-IIIB*pH4.00*B	47.416	0.5026	94.3414	1.0909E+13	1.8113E-11	4.2210	4.1641
99	B-IIIB*pH4.25*A	38.723	0.5001	77.4305	8.9539E+12	1.4866E-11	3.4644	
100	B-IIIB*pH4.25*B	38.584	0.4998	77.1989	8.9271E+12	1.4822E-11	3.4540	3.4592
101	B-IIIB*pH4.50*A	33.968	0.5007	67.8410	7.8450E+12	1.3025E-11	3.0353	
102	B-IIIB*pH4.50*B	29.418	0.5006	58.7655	6.7955E+12	1.1283E-11	2.6293	2.8323
103	B-IIIB*pH4.75*A	17.883	0.5042	35.4681	4.1014E+12	6.8096E-12	1.5869	
104	B-IIIB*pH4.75*B	17.659	0.5013	35.2264	4.0735E+12	6.7632E-12	1.5761	1.5815
105	B-IIIB*pH5.00*A	11.743	0.5013	23.4251	2.7088E+12	4.4975E-12	1.0481	
106	B-IIIB*pH5.00*B	12.722	0.5045	25.2170	2.9160E+12	4.8415E-12	1.1283	1.0882
107	B-IIIB*pH5.25*A	9.732	0.5023	19.3749	2.2405E+12	3.7199E-12	0.8669	
108	B-IIIB*pH5.25*B	9.326	0.5013	18.6036	2.1513E+12	3.5718E-12	0.8324	0.8496
109	B-IIIB*pH5.50*A	9.773	0.5020	19.4681	2.2512E+12	3.7378E-12	0.8710	
110	B-IIIB*pH5.50*B	9.557	0.5020	19.0378	2.2015E+12	3.6551E-12	0.8518	0.8614
111	B-IIIB*pH5.75*A	9.770	0.5103	19.1456	2.2140E+12	3.6758E-12	0.8566	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
112	B-IIIB*pH5.75*B	9.579	0.5066	18.9084	2.1865E+12	3.6303E-12	0.8490	0.8513
113	B-IIIB*pH6.00*A	6.637	0.4588	14.4660	1.6728E+12	2.7774E-12	0.6472	
114	B-IIIB*pH6.00*B	7.334	0.5012	14.6329	1.6921E+12	2.8094E-12	0.6547	0.6510
115	B-IIIB*pH6.25*A	5.815	0.5025	11.5721	1.3382E+12	2.2218E-12	0.5178	
116	B-IIIB*pH6.25*B	6.106	0.5036	12.1247	1.4021E+12	2.3279E-12	0.5425	0.5301
117	B-IIIB*pH6.50*A	6.133	0.5038	12.1735	1.4077E+12	2.3372E-12	0.5447	
118	B-IIIB*pH6.50*B	6.318	0.5019	12.5882	1.4557E+12	2.4168E-12	0.5632	0.5539
119	B-IIIB*pH6.75*A	5.839	0.4960	11.7722	1.3613E+12	2.2602E-12	0.5267	
120	B-IIIB*pH6.75*B	5.929	0.5010	11.8343	1.3685E+12	2.2721E-12	0.5295	0.5281
121	B-IIIB*pH7.00*A	8.969	0.5024	17.8523	2.0644E+12	3.4275E-12	0.7987	
122	B-IIIB*pH7.00*B	9.706	0.5020	19.3347	2.2358E+12	3.7121E-12	0.8651	0.8319
123	B-IIIB*pH7.25*A	13.357	0.5018	26.6182	3.0781E+12	5.1105E-12	1.1910	
124	B-IIIB*pH7.25*B	13.880	0.4994	27.7934	3.2140E+12	5.3361E-12	1.2435	1.2172
125	B-IIIB*pH7.50*A	18.894	0.5040	37.4881	4.3350E+12	7.1975E-12	1.6773	
126	B-IIIB*pH7.50*B	19.370	0.5023	38.5626	4.4593E+12	7.4038E-12	1.7254	1.7013
127	B-IIIB*pH7.75*A	29.629	0.5039	58.7994	6.7994E+12	1.1289E-11	2.6308	
128	B-IIIB*pH7.75*B	29.121	0.5005	58.1838	6.7282E+12	1.1171E-11	2.6033	2.6170
129	B-IIIB*pH8.00*A	45.298	0.5013	90.3611	1.0449E+13	1.7349E-11	4.0429	
130	B-IIIB*pH8.00*B	43.735	0.5016	87.1910	1.0083E+13	1.6740E-11	3.9011	3.9720
131	B-IIIB*pH8.25*A	54.158	0.5008	108.1430	1.2505E+13	2.0763E-11	4.8385	
132	B-IIIB*pH8.25*B	54.183	0.4994	108.4962	1.2546E+13	2.0831E-11	4.8543	4.8464
133	B-IIIB*pH8.50*A	54.367	0.4886	111.2710	1.2867E+13	2.1363E-11	4.9785	
134	B-IIIB*pH8.50*B	55.004	0.5024	109.4825	1.2660E+13	2.1020E-11	4.8985	4.9385
135	B-IIIB*pH8.75*A	58.193	0.5027	115.7609	1.3386E+13	2.2225E-11	5.1794	
136	B-IIIB*pH8.75*B	55.496	0.5230	106.1109	1.2270E+13	2.0373E-11	4.7476	4.9635
137	B-IIIB*pH9.00*A	56.186	0.5033	111.6352	1.2909E+13	2.1433E-11	4.9948	
138	B-IIIB*pH9.00*B	56.186	0.5026	111.7907	1.2927E+13	2.1463E-11	5.0017	4.9983
139	B-IIIB-C*pH2.0*A	58.029	0.5045	115.0228	1.3301E+13	2.2084E-11	5.1464	
140	B-IIIB-C*pH2.0*B	55.302	0.4996	110.6926	1.2800E+13	2.1252E-11	4.9526	5.0495
141	B-IIIB-C*pH4.0*A	52.987	0.5024	105.4678	1.2196E+13	2.0249E-11	4.7188	
142	B-IIIB-C*pH4.0*B	52.672	0.5016	105.0080	1.2143E+13	2.0161E-11	4.6983	4.7086

6/15/94 TD calculations verified on pgs 143-144 of this book.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
143	B-IIIB-C*pH5.0*A	35.508	0.5044	70.3965	8.1405E+12	1.3516E-11	3.1497	
144	B-IIIB-C*pH5.0*B	34.087	0.5005	68.1059	7.8756E+12	1.3076E-11	3.0472	3.0984
145	B-IIIB-C*pH5.5*A	25.127	0.5017	50.0837	5.7916E+12	9.6157E-12	2.2409	
146	B-IIIB-C*pH5.5*B	23.058	0.5014	45.9872	5.3179E+12	8.8293E-12	2.0576	2.1492
147	B-IIIB-C*pH6.0*A	20.596	0.5023	41.0034	4.7415E+12	7.8724E-12	1.8346	
148	B-IIIB-C*pH6.0*B	20.851	0.5007	41.6437	4.8156E+12	7.9953E-12	1.8632	1.8489
149	B-IIIB-C*pH6.5*A	24.159	0.5003	48.2890	5.5840E+12	9.2712E-12	2.1606	
150	B-IIIB-C*pH6.5*B	26.613	0.5001	53.2154	6.1537E+12	1.0217E-11	2.3810	2.2708
151	B-IIIB-C*pH7.0*A	38.488	0.5003	76.9298	8.8960E+12	1.4770E-11	3.4420	
152	B-IIIB-C*pH7.0*B	40.889	0.5000	81.7780	9.4566E+12	1.5701E-11	3.6589	3.5505
153	B-IIIB-C*pH7.5*A	51.116	0.5026	101.7031	1.1761E+13	1.9526E-11	4.5504	
154	B-IIIB-C*pH7.5*B	52.217	0.4997	104.4967	1.2084E+13	2.0063E-11	4.6754	4.6129
155	B-IIIB-C*pH8.0*A	55.178	0.5021	109.8944	1.2708E+13	2.1099E-11	4.9169	
156	B-IIIB-C*pH8.0*B	53.356	0.4974	107.2698	1.2404E+13	2.0595E-11	4.7995	4.8582
157	B-IIIB-C*pH9.5*A	57.494	0.5043	114.0075	1.3184E+13	2.1889E-11	5.1009	
158	B-IIIB-C*pH9.5*B	57.184	0.5032	113.6407	1.3141E+13	2.1818E-11	5.0845	5.0927

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
160	B-IIIBR*pH3.00*IUA	58.830	0.4912	119.7679	1.3850E+13	2.2995E-11	5.3587	
161	B-IIIBR*pH3.00*IUB	57.616	0.4993	115.3936	1.3344E+13	2.2155E-11	5.1629	5.2608
162	B-IIIBR*pH4.00*IUA	46.762	0.4991	93.6926	1.0834E+13	1.7988E-11	4.1920	
163	B-IIIBR*pH4.00*IUB	46.031	0.4988	92.2835	1.0671E+13	1.7718E-11	4.1290	4.1605
165	B-IIIBR*pH4.50*IUA	30.964	0.4999	61.9404	7.1626E+12	1.1892E-11	2.7713	
166	B-IIIBR*pH4.50*IUB	30.574	0.4971	61.5047	7.1123E+12	1.1809E-11	2.7519	2.7616
167	B-IIIBR*pH5.00*IUA	13.108	0.5026	26.0804	3.0159E+12	5.0073E-12	1.1669	
210	B-IIIBR*pH5.00*IUB	13.353	0.4983	26.7971	3.0988E+12	5.1449E-12	1.1990	1.1829
211	B-IIIBR*pH5.50*IUA	10.804	0.4966	21.7559	2.5158E+12	4.1770E-12	0.9734	
170	B-IIIBR*pH5.50*IUB	10.554	0.5001	21.1038	2.4404E+12	4.0518E-12	0.9442	0.9588
171	B-IIIBR*pH6.00*IUA	7.031	0.5001	14.0592	1.6258E+12	2.6993E-12	0.6290	
172	B-IIIBR*pH6.00*IUB	7.224	0.4987	14.4857	1.6751E+12	2.7812E-12	0.6481	0.6386
173	B-IIIBR*pH6.25*IUA	7.002	0.4999	14.0068	1.6197E+12	2.6892E-12	0.6267	
174	B-IIIBR*pH6.25*IUB	6.627	0.4979	13.3099	1.5391E+12	2.5554E-12	0.5955	0.6111
175	B-IIIBR*pH6.50*IUA	6.198	0.4998	12.4010	1.4340E+12	2.3809E-12	0.5548	
176	B-IIIBR*pH6.50*IUB	5.904	0.4981	11.8530	1.3707E+12	2.2757E-12	0.5303	0.5426
177	B-IIIBR*pH6.75*IUA	5.721	0.4989	11.4672	1.3260E+12	2.2016E-12	0.5131	
178	B-IIIBR*pH6.75*IUB	5.594	0.4976	11.2420	1.3000E+12	2.1584E-12	0.5030	0.5080
179	B-IIIBR*pH7.00*IUA	8.302	0.4979	16.6740	1.9281E+12	3.2013E-12	0.7460	
180	B-IIIBR*pH7.00*IUB	8.524	0.4978	17.1233	1.9801E+12	3.2876E-12	0.7661	0.7561
181	B-IIIBR*pH7.50*IUA	18.795	0.4994	37.6352	4.3520E+12	7.2257E-12	1.6839	
182	B-IIIBR*pH7.50*IUB	18.310	0.4980	36.7671	4.2517E+12	7.0590E-12	1.6450	1.6645
183	B-IIIBR-C*pH2.0*IUA	58.758	0.4986	117.8460	1.3627E+13	2.2626E-11	5.2727	
184	B-IIIBR-C*pH2.0*IUB	60.684	0.4988	121.6600	1.4068E+13	2.3358E-11	5.4433	5.3580
185	B-IIIBR-C*pH4.0*IUA	53.819	0.4967	108.3531	1.2530E+13	2.0803E-11	4.8479	
164	B-IIIBR-C*pH4.0*IUB	56.537	0.4967	113.8252	1.3162E+13	2.1854E-11	5.0928	4.9704
186	B-IIIBR-C*pH5.0*IUA	36.226	0.4983	72.6992	8.4068E+12	1.3958E-11	3.2527	
187	B-IIIBR-C*pH5.0*IUB	34.441	0.4973	69.2560	8.0086E+12	1.3297E-11	3.0987	3.1757
188	B-IIIBR-C*pH5.5*IUA	26.897	0.4980	54.0100	6.2456E+12	1.0370E-11	2.4165	
189	B-IIIBR-C*pH5.5*IUB	27.086	0.4983	54.3568	6.2857E+12	1.0436E-11	2.4320	2.4243
190	B-IIIBR-C*pH6.0*IUA	25.518	0.4993	51.1076	5.9100E+12	9.8123E-12	2.2867	

6/15/94 TD calculations verified on pgs 143-144 of this notebook

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
191	B-IIIBR-C*pH6.0*IUB	24.185	0.4967	48.6914	5.6306E+12	9.3484E-12	2.1786	2.2326
192	B-IIIBR-C*pH6.5*IUA	25.602	0.5006	51.1426	5.9140E+12	9.8191E-12	2.2882	
193	B-IIIBR-C*pH6.5*IUB	26.005	0.5003	51.9788	6.0107E+12	9.9796E-12	2.3256	2.30697
194	B-IIIBR-C*pH7.0*IUA	36.992	0.4980	74.2811	8.5897E+12	1.4261E-11	3.3235	
195	B-IIIBR-C*pH7.0*IUB	36.102	0.5013	72.0168	8.3279E+12	1.3827E-11	3.2222	3.2728
196	B-IIIBR-C*pH7.5*IUA	53.041	0.4992	106.2520	1.2287E+13	2.0400E-11	4.7539	
197	B-IIIBR-C*pH7.5*IUB	51.080	0.4973	102.7147	1.1878E+13	1.9721E-11	4.5957	4.6748
198	B-IIIBR-C*pH8.0*IUA	53.579	0.4997	107.2223	1.2399E+13	2.0586E-11	4.7974	
199	B-IIIBR-C*pH8.0*IUB	55.645	0.5001	111.2677	1.2867E+13	2.1363E-11	4.9784	4.8879
200	B-IIIBR-C*pH9.5*IUA	56.098	0.4979	112.6692	1.3029E+13	2.1632E-11	5.0411	
201	B-IIIBR-C*pH9.5*IUB	53.930	0.4959	108.7518	1.2576E+13	2.0880E-11	4.8658	4.9534

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
203	B-IIIBR*pH3.00*A	61.255	0.5014	122.1679	1.4127E+13	2.3455E-11	5.4660	
204	B-IIIBR*pH3.00*B	59.925	0.5003	119.7781	1.3851E+13	2.2997E-11	5.3591	5.4126
205	B-IIIBR*pH4.00*A	58.988	0.4989	118.2361	1.3673E+13	2.2701E-11	5.2901	
206	B-IIIBR*pH4.00*B	60.044	0.4935	121.6697	1.4070E+13	2.3360E-11	5.4438	5.3669
207	B-IIIBR*pH4.50*A	55.624	0.5031	110.5625	1.2785E+13	2.1227E-11	4.9468	
208	B-IIIBR*pH4.50*B	54.102	0.4984	108.5514	1.2553E+13	2.0841E-11	4.8568	4.9018
209	B-IIIBR*pH5.00*A	45.901	0.5007	91.6737	1.0601E+13	1.7601E-11	4.1017	
168	B-IIIBR*pH5.00*B	45.178	0.4981	90.7007	1.0488E+13	1.7414E-11	4.0581	4.0799
169	B-IIIBR*pH5.50*A	25.246	0.5010	50.3912	5.8271E+12	9.6748E-12	2.2546	
212	B-IIIBR*pH5.50*B	25.703	0.4971	51.7059	5.9791E+12	9.9272E-12	2.3134	2.2840
213	B-IIIBR*pH6.00*A	14.805	0.5018	29.5038	3.4117E+12	5.6645E-12	1.3201	
214	B-IIIBR*pH6.00*B	13.859	0.5000	27.7180	3.2052E+12	5.3217E-12	1.2402	1.2801
215	B-IIIBR*pH6.25*A	12.220	0.5044	24.2268	2.8015E+12	4.6514E-12	1.0840	
216	B-IIIBR*pH6.25*B	12.313	0.4982	24.7150	2.8580E+12	4.7451E-12	1.1058	1.0949
217	B-IIIBR*pH6.50*A	6.135	0.5012	12.2406	1.4155E+12	2.3501E-12	0.5477	
218	B-IIIBR*pH6.50*B	6.354	0.4988	12.7386	1.4731E+12	2.4457E-12	0.5700	0.5588
219	B-IIIBR*pH6.75*A	7.301	0.5029	14.5178	1.6788E+12	2.7873E-12	0.6496	
220	B-IIIBR*pH6.75*B	7.444	0.4996	14.8999	1.7230E+12	2.8607E-12	0.6667	0.6581
221	B-IIIBR*pH7.00*A	12.887	0.4996	25.7946	2.9828E+12	4.9524E-12	1.1541	
222	B-IIIBR*pH7.00*B	13.175	0.4985	26.4293	3.0562E+12	5.0743E-12	1.1825	1.1683
223	B-IIIBR*pH7.50*A	58.162	0.5035	115.5154	1.3358E+13	2.2178E-11	5.1684	
224	B-IIIBR*pH7.50*B	55.051	0.5001	110.0800	1.2729E+13	2.1135E-11	4.9252	5.0468
225	B-IIIBR-C*pH2.0*A	61.025	0.4988	122.3436	1.4148E+13	2.3489E-11	5.4739	
226	B-IIIBR-C*pH2.0*B	61.270	0.4965	123.4038	1.4270E+13	2.3693E-11	5.5213	5.4976
227	B-IIIBR-C*pH4.0*A	56.885	0.5028	113.1364	1.3083E+13	2.1721E-11	5.0620	
228	B-IIIBR-C*pH4.0*B	57.577	0.4985	115.5005	1.3356E+13	2.2175E-11	5.1677	5.1148
229	B-IIIBR-C*pH5.0*A	41.106	0.5031	81.7054	9.4482E+12	1.5687E-11	3.6557	
230	B-IIIBR-C*pH5.0*B	42.440	0.4981	85.2038	9.8528E+12	1.6359E-11	3.8122	3.7339
231	B-IIIBR-C*pH5.5*A	32.735	0.5054	64.7705	7.4899E+12	1.2436E-11	2.8980	
232	B-IIIBR-C*pH5.5*B	31.129	0.5001	62.2456	7.1979E+12	1.1951E-11	2.7850	2.8415
233	B-IIIBR-C*pH6.0*A	29.114	0.5006	58.1582	6.7253E+12	1.1166E-11	2.6021	

6/15/94 ID Calculations verified on page 143-144 of this book.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb	AVG U ppb
234	B-IIIBR-C*pH6.0*B	29.412	0.4998	58.8475	6.8050E+12	1.1298E-11	2.6330	2.6175
235	B-IIIBR-C*pH6.5*A	26.405	0.5011	52.6941	6.0934E+12	1.0117E-11	2.3576	
236	B-IIIBR-C*pH6.5*B	25.137	0.4985	50.4253	5.8311E+12	9.6813E-12	2.2561	2.3069
237	B-IIIBR-C*pH7.0*A	38.360	0.5018	76.4448	8.8399E+12	1.4677E-11	3.4203	
238	B-IIIBR-C*pH7.0*B	36.462	0.4992	73.0409	8.4463E+12	1.4023E-11	3.2680	3.3442
239	B-IIIBR-C*pH7.5*A	52.657	0.4948	106.4208	1.2306E+13	2.0432E-11	4.7615	
240	B-IIIBR-C*pH7.5*B	53.658	0.4996	107.4019	1.2420E+13	2.0620E-11	4.8054	4.7834
241	B-IIIBR-C*pH8.0*A	58.054	0.5006	115.9688	1.3410E+13	2.2265E-11	5.1887	
242	B-IIIBR-C*pH8.0*B	58.892	0.4990	118.0200	1.3648E+13	2.2659E-11	5.2805	5.2346
243	B-IIIBR-C*pH9.5*A	61.879	0.4987	124.0806	1.4348E+13	2.3823E-11	5.5516	
244	B-IIIBR-C*pH9.5*B	58.240	0.4968	117.2303	1.3556E+13	2.2507E-11	5.2451	5.3984

4 Nov 1993 ID PZC - BATCH EQUILIBRATION

The pH of all of the experimental solutions were remeasured. The control experiments were not remeasured, as it will take about 10 days for these to equilibrate. The equilibration time for the solution & mineral is unknown.

SOLUTION NAME	pH/T(°C)
SiO_2 *PZC*pH 1.00	1.07/22.3
2.00	2.01/22.3
3.00	3.02/22.4
4.00	4.08/22.4
5.00	5.02/22.4
6.00	5.73/22.4
7.00	6.10/22.4
8.00	6.39/22.5
9.00	6.49/22.5
10.00	6.97/22.6
11.00	8.00/22.6

9 Nov 1993 ID PZC - BATCH EQUILIBRATION

THE pH OF ALL SOLUTIONS WAS REMEASURED

SOLUTION	pH/T(°C) [EXPERIMENTAL]	pH/T(°C) [CONTROL]
SiO_2*PZC*pH 1.00	1.04/20.1	1.04/20.1
2.00	1.99/20.1	1.99/20.1
3.00	3.00/20.1	2.99/20.1
4.00	4.18/20.2	3.96/20.2
5.00	5.06/20.2	4.99/20.2
6.00	5.72/20.2	5.58/20.2
7.00	6.03/20.3	5.99/20.3
8.00	6.41/20.3	6.32/20.3
9.00	6.46/20.4	6.41/20.4
10.00	7.09/20.5	7.04/20.5
11.00	7.97/20.5	8.00/20.5

10 Nov 1993 TD

All the B-IIB solutions were filtered to remove the zeolite. The zeolite from the solutions where the pH was either .00 or .50 (range from ~~TD 11/10/93~~ 2-9) were rinsed with the experimental solutions and saved separately. The others were filtered collectively and rinsed several times with 0.1 M HNO_3 followed by several with DI H_2O. These were saved and labeled as reclaimed for further use and washings. The solution was analyzed by LS to determine its total U activity.

12 Nov 1993 TD

The results of the waste analysis follow.

```
Protocol #:23        Name:U-233 Waste              12-Nov-93   22:12
Region A: LL-UL= 0.0-100.  Lcr=    0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=    0  Bkg= 0.00  %2 Sigma=5.00
Region C: LL-UL= 0.0-2000  Lcr=    0  Bkg= 0.00  %2 Sigma=0.10
Time = 60.00      QIP = SIS
Waste counted at 60 min

 S#   TIME    CPMA A:2S%    CPMB B:2S%    CPMC C:2S%    SIS FLAG
  1  60.00    20.07  5.76   3.667 13.48   30.45  4.68 143.48    B
  2   0.48     0.77 1725. 3371.33  4.97 3377.88  4.99 659.58
```

This gives an activity of 3.005 nCi/g. Dumping 25g gives a total disposal of 75.125 nCi.

23 Nov 1993 TD

All the solutions for C-I were filtered and the zeolites ~~TD 11/23/93~~ saved collectively. The zeolite was washed with 0.1 M HNO_3 and DI H_2O several times. After drying it was added to the zeolite from B-IIB. A sample of the total solution mixture was taken for LSA to determine the ^{233}U activity. The total weight of solution from Spike 27A is 2,055.69g.

The sample weight is 0.5179 g.

30 Nov 1993 TD

The solutions from experiment B-IIIB were filtered and the zeolite saved. The zeolite was saved collectively and washed with 0.1 M HNO_3 and DI H_2O. These solutions were added to those filtered from C-I. The final weight of the combinations of the solutions is 4039.49 g ~~solution~~ ~~TD 11/30/93~~ This gives 1983.8 g added. A sample of the final mixture was taken for LS analysis. The sample weight is 0.5106 g.

2 Dec 1993 TD

The LSA of the ^{233}U solution in waste container #2 finished. The printout is given below.

```
Protocol #:23        Name:U-233 Waste              30-Nov-93   18:21
Region A: LL-UL= 0.0-100.  Lcr=    0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=    0  Bkg= 0.00  %2 Sigma=5.00
Region C: LL-UL= 0.0-2000  Lcr=    0  Bkg= 0.00  %2 Sigma=0.10
Time = 60.00      QIP = SIS
Waste counted at 60 min

 S#   TIME    CPMA A:2S%    CPMB B:2S%    CPMC C:2S%    SIS FLAG
  1  60.00    17.12  6.24   2.683 15.76   26.12  5.05 140.58    B
  2  60.00     2.25 69.31   0.683 92.94    2.48 76.91 152.83
  3  60.00     2.52 62.20   0.367 168.6    3.65 52.88 115.28
  4   4.05     3.13 146.9 392.872  5.03  395.61  5.17 686.86
  5  10.19     2.31 128.0 154.333  5.09  156.81  5.47 693.46
```

S 1: BACKGROUND

2, 3 > CHECKS OF RINSED LS VIALS; OK TO THROW OUT

4: ACTIVITY FROM C-I (SPIKE 27A) SOLUTIONS ONLY

5: ACTIVITY FROM TOTAL ^{233}U in CONTAINER (27A + 234 from B-IIB).

These results lead to the following activities.

FOR 27A:

CPM B= 392.872

WT. SAMPLE = 0.5179 g

CPM/g = 758.5866

ACT/g = 0.3417 nCi/g

TOTAL ACTIVITY FROM 27A = 702.4409 nCi

FOR THE TOTAL VOLUME

CPMB = 154.333

WT SAMPLE = 0.5106

CPM/g = 302.2588

ACT/g = 0.1362 nCi

TOTAL ACTIVITY = ~~549.7746~~ 98.59 nCi TD 12/2/93

THIS activity appears too low. Therefore, another sample will be taken and counted and this value recalculated.

7 Dec 1993 TD

Two samples were taken from ^{233}U Waste 2 for analysis by liquid Scintillation. The purpose is to know the total activity of the waste for disposal. The sample weights are given below.

	Wt (g)
A	0.5156
B	0.5175

9 Dec 1993 TD

The liquid scintillation analysis has finished. The results & calculations follow.

Protocol #:23 Name:U-233 Waste 08-Dec-93 20:17
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=5.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time = 60.00 QIP = SIS
Waste counted at 60 min

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	60.00	18.30	6.04	2.900	15.16	27.38	4.93	138.80	B
2	5.77	0.94	407.0	274.743	5.05	277.47	5.26	713.29	
3	5.58	0.70	553.1	284.197	5.05	284.62	5.28	725.39	
4	60.00	0.85	185.9	0.000	0.00	0.00	0.00	0.000	

SAMPLE A

CPMB = 274.743

Wt Sample = 0.5156 g

CPM/g = 532.8607

ACT/g = 0.2400 nCi

Total activity = 969.59 nCi

SAMPLE B

CPMB = 284.197

Wt Sample = 0.5175

CPM/g = 549.1729

ACT/g = 0.2474 nCi

Total Activity = 999.27 nCi

AVG Total Act = 984.43 nCi

AVG ACT/g = 0.2437 nCi

∴ 400 g per day can be disposed of with a total activity of 97.48 nCi. ~~This breaks down to~~ TD 12/9/93

3 Jan 94 TD

The solutions from Exp. B-I and B-II were filtered and the solution placed into ^{233}U Waste 3. The zeolite was filtered and washed with 1.0 N HNO_3 several times, followed by several washings with DI H_2O. A portable radiation detector TD 1/5/94 was used to determine if all the activity was removed. It was not so the zeolite will be exchanged with a 1.0M HNO_3/1.0M NaCl solution for several weeks to remove the remaining activity. The zeolite will then be discarded. The wt. is 4110.47g.

4 Jan 1994 TD

Some of the K3-1 & K3-2 solutions were filtered in to ^{233}U waste 4. The zeolite was saved and dried & added to the other that will be cleaned and discarded. Some of the B-III solutions were also filtered with the K3 solutions. The final weight of the solution filtered was 3819.83g.

5 Jan 1994 TD

2 samples each from Waste 3 and Waste 4 were taken for liquid scintillation analysis. The TD 1/5/94 samples were taken and prepared as before.

SAMPLE NAME	wt. VIAL(g)	wt. vial + sample(g)	wt. Sample(g)
WASTE 3A	7.2451	7.7406	0.4955
3B	7.2733	7.7693	0.4960
4A	7.2644	7.7581	0.4937
4B	7.2944	7.7913	0.4969

12 Jan 94 TD

The liquid Scintillation analysis of the Waste 3 & Waste 4 solutions has finished. The total activity and activity/g will be calculated as before (pg. 113).

```
Protocol #:23        Name:U-233 Waste              11-Jan-94   15:27
Region A: LL-UL= 0.0-100.   Lcr=    0  Bkg= 0.00   %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=    0  Bkg= 0.00   %2 Sigma=5.00
Region C: LL-UL= 0.0-2000   Lcr=    0  Bkg= 0.00   %2 Sigma=0.10
Time = 60.00      QIP = SIS
Waste counted at 60 min

 S#   TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
  1  60.00    18.90  5.94     2.800 15.43    27.67  4.91  129.72    B   Blank
  2   0.43    53.19 48.73  3732.08  4.99  3783.96  4.98  709.33        3A
  3   0.45    52.21 48.20  3554.98  5.00  3619.00  4.98  715.73        3B
  4   3.60     6.38 84.94   443.033 5.02   449.56  5.13  711.91        4A
  5   3.36     8.48 68.61   473.391 5.03   482.15  5.12  678.64        4B
```

FOR ^{233}U waste 3

A	B
CPM B = 3732.08	CPM B = 3554.98
Wt = 0.4955g	Wt = 0.4960 g
CPM/g = 7531.95	CPM/g = 6764.01
Act/g = 3.39 nCi/g	Act/g = 3.05
TOTAL ACT = 13,945.88	TOTAL ACT = 12,523.99

AVG. ACT./g = 3.22 nCi/g

AVG TOTAL ACT = 13,235.71 nCi

DISPOSAL OF 25g DISPOSES OF 80.50 nCi OF ACTIVITY.

FOR ^{233}U WASTE 4

A	B
CPM B = 443.033	CPM B = 473.391
Wt = 0.4937	Wt = 0.4969
CPM/g = 897.373	CPM/g = 952.689
Act/g = 0.404 nCi/g	Act/g = 0.429
TOTAL ACT = 1544.059 nCi	TOTAL ACT = 1,639.238 nCi

AVG ACT/g = 0.417 nCi/g

AVG TOTAL ACTIVITY = 1590.959 nCi

2008

1/12/94 TD

The pH of some of the B-IB solutions were 1/12/94 TD re measured. The solutions chosen had an expected pH between 4.5 and 7.00. These solutions will be used in a test to determine if addition of zeolite will effect container sorption. The solutions in this range will be filtered of all zeolite, have all the remaining liquid removed, and 50 g 0.1 M HNO_3 added. After equilibration, samples will be taken for Liquid Scintillation Analysis.

SOLUTION	pH/T(°C)
B-IB* pH 3.75	4.05/21.1
4.00	3.04/21.1
4.25	4.72/21.1 *
4.50	3.60/21.1
4.75	5.06/21.1 *
5.00	4.26/21.1 * TD 1/12/94
5.25	5.26/21.2 *
5.50	4.94/21.2 *
5.75	5.35/21.2 *
6.00	5.44/21.2 *
6.25	5.31/21.2 *
6.50	5.99/21.2 *
6.75	6.56/21.2 *

The solutions marked with * will be used.

1/19/94 TD

A 1 ml TD 1/19/94 sample of each of the marked solutions (p 116) were taken for Liquid Scintillation Analysis to know the U concentration. The sample weights are given below.

SAMPLE NAME	WT. VIAL (g)	WT. VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IB*pH4.25	7.7517	8.2588	0.5071
B-IB*pH4.75	7.7537	8.2567	0.5030
B-IB*pH5.25	7.7600	8.2607	0.5007
B-IB*pH5.50	7.7174	8.2210	0.5036
B-IB*pH5.75	7.7535	8.2542	0.5007
B-IB*pH6.00	7.7227	8.2268	0.5041
B-IB*pH6.25	7.7558	8.2632	0.5074
B-IB*pH6.50	7.7538	8.2578	0.5040
B-IB*pH6.75	7.7823	8.2864	0.5041

1/24/94 TD

The L.S. Analysis of the B-IB solution samples taken on 1/19/94 has finished. TD 1/24/94 A copy of the print out, as well as results of calculations follows.

```
Protocol #: 5        Name:U-233 3% 2 sigma          22-Jan-94   03:37
Region A: LL-UL= 0.0-100.   Lcr=    0  Bkg= 0.00   %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=    0  Bkg= 0.00   %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=    0  Bkg= 0.00   %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME     CPMA A:2S%      CPMB B:2S%      CPMC C:2S%      SIS FLAG
  1  999.98   19.63  1.43     2.918  3.70     28.60  1.18  135.48    B
  2   11.49    0.73 366.2   383.940  3.02    384.19  3.12  697.74
  3   14.73    0.80 296.5   299.051  3.03    300.25  3.15  699.25
  4   18.40    0.00   0.00   238.604  3.04    238.08  3.20  698.30
  5   11.77    0.59 449.5   374.737  3.02    375.13  3.12  697.26
  6   19.72    0.95 216.3   222.437  3.04    223.17  3.21  696.13
  7   16.53    0.51 435.7   265.926  3.03    266.50  3.17  694.23
  8   17.35    0.94 233.1   253.220  3.04    254.22  3.18  692.21
  9   34.12    0.82 191.3   127.328  3.07    128.11  3.36  689.88
 10   29.40    0.09 1778.   148.306  3.06    148.34  3.32  694.26
```

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CON	ATOM CON	MOLE CON	U ppb
2	B-IB*pH4.25	383.940	0.5071	757.1288	8.7553E+13	1.4536E-10	33.8755
3	B-IB*pH4.75	299.051	0.5030	594.5348	6.8751E+13	1.1415E-10	26.6007
4	B-IB*pH5.25	238.604	0.5007	476.5408	5.5106E+13	9.1493E-11	21.3214
5	B-IB*pH5.50	374.737	0.5036	744.1164	8.6048E+13	1.4287E-10	33.2933
6	B-IB*pH5.75	222.437	0.5007	444.2520	5.1372E+13	8.5294E-11	19.8768
7	B-IB*pH6.00	265.926	0.5041	527.5263	6.1002E+13	1.0128E-10	23.6026
8	B-IB*pH6.25	253.220	0.5074	499.0540	5.7709E+13	9.5815E-11	22.3287
9	B-IB*pH6.50	127.328	0.5040	252.6349	2.9214E+13	4.8504E-11	11.3034
10	B-IB*pH6.75	148.306	0.5041	294.1996	3.4021E+13	5.6484E-11	13.1631

6/15/94 TD Calculations verified on pg 143-144 of this book

1/24/94 TD

The filtering of the B-IB solutions ~~has~~ was begun. 1/24/94
The solutions noted on the following page are being filtered TD separately and the ~~solution~~ TD 1/24/94 bottles washed with the solution in them. All traces of liquid are removed, and 50g 0.1M HNO_3 added. The solutions will be resampled after ~10 days to check the container sorption. The zeolite from these ~~were~~ TD was saved individually. All the other solutions will be filtered collectively and the zeolite saved for re-use.

The weights of the bottles and acid were measured and recorded.

SOLUTION NAME	BOTTLE WT (g)*	WT. ACID (g)	TOTAL (g)
B-IB* pH 4.25	26.03	49.97	76.00
4.75	27.74	49.85	77.59
5.25	27.63	50.19	77.82
5.50	28.11	49.54	77.65
5.75	27.97	50.00	77.97
6.00	26.09	50.11	76.20
6.25	28.05	49.87	77.92
6.50	26.68	49.71	76.39
6.75	~~1168~~ 28.00	49.81	77.81

* WITH LID ON

TD

1/31/94 TD

The following solutions are being analyzed for ^{233}U concentration so they can be disposed of. All of them, except Waste 5 are solutions from the α-aluminum experiments (& related experiments) done by Jim Prikryl. WASTE 5 contains solutions from B-IB, W1, and W2 and K3*A.

SOLUTION NAME	TOTAL WEIGHT (g)	WT. VIAL (g	WT. VIAL AND SAMPLE (g)	WT SAMPLE (g)	SPIKE
B-8007-B	843.89	7.2407	7.7465	0.5058	22A
B-8007-A	877.66	7.2516	7.7571	0.5055	22A
K alpha	203.28	7.2799	7.7987	0.5188	23A
TL & FL	564.53	7.3148	7.8201	0.5053	23A
CL-100	631.10	7.2439	7.7520	0.5081	23A
B-8005-A	953.53	7.2459	7.7547	0.5088	22A
B-8005-B	604.92	7.1952	7.7039	0.5087	22A
B-8006-A	820.83	7.2580	7.7646	0.5066	22A
B-8006-B	813.55	7.3175	7.8273	0.5098	22A
B-8005B-B	364.00	7.2631	7.7682	0.5051	23A
B-8005B-A	930.30	7.2785	7.7860	0.5075	23A
B-8006B	957.10	7.2545	7.7636	0.5091	23A
B-8007B	957.80	7.2183	7.7283	0.5100	23A
WASTE 5	3066.69	7.2715	7.7746	0.5031	23A

2/2/94 TD

The liquid scintillation analysis of the waste solutions above has finished. The raw data and results of calculations follow. The activity per gram values were found by dividing the counts per gram by 2220 counts/nci. 2/2/94 TD

```
Protocol #:23        Name:U-233 Waste                01-Feb-94   13:25
Region A: LL-UL= 0.0-100.  Lcr=   0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=   0  Bkg= 0.00  %2 Sigma=5.00
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time = 60.00      QIP = SIS
Waste counted at 60 min
```

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	60.00	19.33	5.87	2.850	15.29	28.23	4.86	134.03	B
2	17.78	0.69	349.3	87.139	5.19	87.68	6.03	714.70	
3	19.97	1.95	120.9	77.270	5.22	78.83	6.13	706.57	
4	1.65	6.73	119.4	969.271	5.01	980.86	5.04	725.70	
5	1.56	17.85	55.08	1024.07	5.01	1049.33	5.01	720.95	
6	1.20	9.00	108.7	1382.15	4.92	1393.43	4.94	731.50	
7	20.37	0.45	504.7	75.697	5.22	77.22	6.16	718.27	
8	16.92	1.77	141.9	91.831	5.17	93.69	5.91	717.26	
9	19.71	0.91	255.2	78.327	5.21	78.92	6.16	712.87	
10	20.83	0.00	0.00	73.962	5.23	74.12	6.26	732.97	
11	1.42	2.50	317.2	1125.32	5.01	1122.47	5.07	725.53	
12	1.80	2.89	246.4	886.594	5.01	888.43	5.08	725.74	
13	1.47	9.92	90.68	1088.31	5.01	1100.34	5.04	727.37	
14	1.35	2.89	283.6	1187.52	5.00	1187.32	5.06	724.85	
15	3.79	2.04	239.5	419.314	5.04	420.84	5.18	726.92	

Results of Waste Analysis

SOLUTION NAME	S#	CPM B	COUNTS PER GRAM	ACTIVITY (nCi) PER GRAM	TOTAL ACTIVITY (nC
B-8007-B	2	87.139	172.280	0.078	65.489
B-8007-A	3	77.270	152.859	0.069	60.431
K alpha	4	969.271	1868.294	0.842	171.075
TL & FL	5	1024.070	2026.657	0.913	515.364
CL-100	6	1382.150	2720.232	1.225	773.306
B-8005-A	7	75.697	148.776	0.067	63.902
B-8005-B	8	91.831	180.521	0.081	49.190
B-8006-A	9	78.327	154.613	0.070	57.167
B-8006-B	10	73.962	145.080	0.065	53.167
B-8005B-B	11	1125.320	2227.915	1.004	365.298
B-8005B-A	12	886.594	1746.983	0.787	732.080
B-8006B	13	1088.310	2137.714	0.963	921.624
B-8007B	14	1187.520	2328.471	1.049	1004.599
WASTE 5	15	419.314	833.461	0.375	1151.336

2/2/94 TD

The B-IB solution bottles being checked for container loss (p. 118) had the acid solution in them sampled for LSA. The weights of the bottles and solutions were also measured BEFORE SAMPLING. One ml samples were taken to try and speed up the counting. TD 2/2/94

SOLUTION NAME	WT BOTTLE AND ACID (g)	WT. VIAL (g)	WT VIAL + SAMPLE (g)	WT. SAMPLE (g)
B-IB*pH4.25*CL	75.87	7.3119	8.3089	0.9970
B-IB*pH4.75*CL	77.40	7.2778	8.2725	0.9947
B-IB*pH5.25*CL	77.62	7.2641	8.2612	0.9971
B-IB*pH5.50*CL	77.43	7.2711	8.2663	0.9952
B-IB*pH5.75*CL	77.78	7.2648	8.2552	0.9904
B-IB*pH6.00*CL	76.06	7.2860	8.2818	0.9958
B-IB*pH6.25*CL	77.75	7.2322	8.2246	0.9924
B-IB*pH6.50*CL	76.27	7.3227	8.3170	0.9943
B-IB*pH6.75*CL	77.57	7.3184	8.3081	0.9897

2/7/94 TD

The liquid scintillation analysis of the B-IB containes samples has finished. The raw data and results follow on the next page.


```
Protocol #: 5        Name:U-233 3% 2 sigma          04-Feb-94   12:31
Region A: LL-UL= 0.0-100.  Lcr=   0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=   0  Bkg= 0.00  %2 Sigma=3.00
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

  S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
   1 999.98     19.37  1.44     3.326  3.47    29.24  1.17 145.23    B
   2  54.98      0.01 8423.    77.503  3.13    78.51  3.59 687.51
   3 104.64      0.45 204.9    39.162  3.27    39.39  4.20 677.04
   4  74.72      1.06 101.9    56.163  3.18    57.49  3.80 674.68
   5  71.31      0.81 136.6    59.007  3.17    60.57  3.75 674.46
   6  79.73      2.17 49.53    52.450  3.20    55.12  3.78 671.02
   7  66.33      1.34 85.94    63.672  3.16    65.41  3.69 684.93
   8  50.67      3.38 40.49    84.379  3.12    87.93  3.48 675.39
   9  43.15      3.22 45.75    99.710  3.10   103.14  3.41 674.86
  10  81.62      0.96 107.5    51.121  3.20    52.47  3.87 689.41
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
WARNING!!! - USE CHI SQUARE RESULTS IF CHI SQUARE FILES VIEW AS GOOD
```

SOLUTION NAME	WT. SAMPLE (g)	CPM B	MASS CONV	ATOM CONV	MOLE CONV	U ppb
B-IB*pH4.25*CL	0.9970	77.503	77.7362	8.9892E+12	1.4925E-11	3.4781
B-IB*pH4.75*CL	0.9947	39.162	39.3707	4.5527E+12	7.5589E-12	1.7615
B-IB*pH5.25*CL	0.9971	56.163	56.3263	6.5134E+12	1.0814E-11	2.5202
B-IB*pH5.50*CL	0.9952	59.007	59.2916	6.8563E+12	1.1384E-11	2.6528
B-IB*pH5.75*CL	0.9904	52.450	52.9584	6.1240E+12	1.0168E-11	2.3695
B-IB*pH6.00*CL	0.9958	63.672	63.9406	7.3939E+12	1.2276E-11	2.8608
B-IB*pH6.25*CL	0.9924	84.379	85.0252	9.8321E+12	1.6324E-11	3.8042
B-IB*pH6.50*CL	0.9943	99.710	100.2816	1.1596E+13	1.9253E-11	4.4868
B-IB*pH6.75*CL	0.9897	51.121	51.6530	5.9730E+12	9.9170E-12	2.3111

6/15/94 TD calculations verified on page 143-144 of this book.

NOTE:

There was an error message from the LSA. The samples will be rerun.

2/10/94 TD

The re-analysis of the B-IB container samples has finished. The results and calculations follow. This time there was no error from the counting.

```
Protocol #: 5        Name:U-233 3% 2 sigma          09-Feb-94   03:28
Region A: LL-UL= 0.0-100.   Lcr=    0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=    0  Bkg= 0.00  %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=    0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

  S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
   1  999.98    19.36  1.44     3.200  3.54    29.13  1.17 140.98    B
   2   53.82     2.35 55.43    79.371  3.12    81.74  3.54 666.89
   3  103.18     1.28 73.32    39.958  3.25    41.22  4.09 664.93
   4   74.81     0.88 122.2    56.204  3.18    56.69  3.83 669.22
   5   70.73     1.33 84.10    59.630  3.17    60.69  3.76 661.78
   6   81.62     0.76 135.5    51.260  3.19    51.73  3.90 672.65
   7   67.73     1.11 102.4    62.413  3.16    63.46  3.72 669.73
   8   52.69     2.98 44.66    81.142  3.12    84.27  3.51 661.16
   9   42.45     1.87 77.13   101.535  3.10   103.36  3.43 676.20
  10   81.36     1.67 62.99    51.434  3.19    53.37  3.83 673.42
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
```

SOLUTION NAME	WT. SAMPLE (g)	CPM B	MASS CONV	ATOM CONV	MOLE CONV	U ppb
B-IB*pH4.25*CL	0.9970	79.371	79.6098	9.2059E+12	1.5285E-11	3.5619
B-IB*pH4.75*CL	0.9947	39.958	40.1709	4.6453E+12	7.7126E-12	1.7973
B-IB*pH5.25*CL	0.9971	56.204	56.3675	6.5182E+12	1.0822E-11	2.5220
B-IB*pH5.50*CL	0.9952	59.630	59.9176	6.9287E+12	1.1504E-11	2.6808
B-IB*pH5.75*CL	0.9904	51.260	51.7569	5.9850E+12	9.9370E-12	2.3157
B-IB*pH6.00*CL	0.9958	62.413	62.6762	7.2477E+12	1.2033E-11	2.8043
B-IB*pH6.25*CL	0.9924	81.142	81.7634	9.4549E+12	1.5698E-11	3.6583
B-IB*pH6.50*CL	0.9943	101.535	102.1171	1.1809E+13	1.9606E-11	4.5689
B-IB*pH6.75*CL	0.9897	51.434	51.9693	6.0096E+12	9.9778E-12	2.3252

6/15/94 TD
Calculations verified on pages 143-144 of this book

Note that the error message from the L.S. counter (see p.121) did not effect the CPM values very much. Compare the CPM values on this page with those on p121 and TD 7 Feb 1994 it is evident that there is not much difference.

11 FEB 1994 TD

The acid solutions used by Jim Prikryl to clean the α-alumina used for sorption experiments were sampled. The sample weights are given on the next page. The samples were then prepared for liquid scintillation counting.

SOLN. NAME	WT. VIAL (g)	WT. VIAL + SAMPLE (g)	WT. SAMPLE (g)	TOTAL SOLN. WT. (g)
B-8005*AS	7.3433	7.8454	0.5021	1029.63
B-80068AS	7.3363	7.8374	0.5011	831.67
B-8007*AS	7.3199	7.8260	0.5061	1009.97
Kalpha*AS	7.2997	7.7988	0.4991	1030.85

15 FEB 1994 TD

The liquid scintillation of the waste samples taken on 11 Feb has finished. The raw data and results follow.

```
Protocol #:23        Name:U-233 Waste                14-Feb-94   11:50
Region A: LL-UL= 0.0-100.   Lcr=    0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=    0  Bkg= 0.00  %2 Sigma=5.00
Region C: LL-UL= 0.0-2000   Lcr=    0  Bkg= 0.00  %2 Sigma=0.10
Time = 60.00      QIP = SIS
Waste counted at 60 min

  S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
   1   60.00    18.73  5.97     2.717 15.67    26.75  4.99 131.21    B
   2   60.00     0.60 265.5    14.433  7.97    16.23 13.28 682.23
   3   51.04     0.11 1440.    28.631  5.67    29.34  8.47 724.49
   4   60.00     1.58 101.9     5.250 16.07     8.05 25.16 615.79
   5   31.82     1.51 129.4    47.598  5.36    50.53  6.71 695.11
```

SOLN. NAME	WT. SAMPLE (g)	CPM B	CPM per GRAM	ACT. per GRAM (nCi)	TOTAL ACT. (nCi)
B-8005*AS	0.5021	14.433	28.745	0.013	13.332
B-80068AS	0.5011	28.631	57.136	0.026	21.405
B-8007*AS	0.5061	5.250	10.373	0.005	4.719
Kalpha*AS	0.4991	47.598	95.368	0.043	44.284

TD

2/22/94 TD

URANIUM SORPTION CONTROL TEST W3 ~~W1~~ ALL CHANGES MADE
Uranium loss to container walls; ~~Polypropylene~~ vs Teflon BY TODD DIETRICH
Polycarbonate 21 FEB 1994

WRITTEN BY: R.T. PABALAN DATE WRITTEN: April 6, 1993
REVISION NO.: 1 DATE REVISED: April 8, 1993

OBJECTIVE:

- To investigate the potential loss of uranium from solution to the container walls
- To compare uranium loss to ~~polypropylene~~ bottles versus uranium loss to teflon bottles
Polycarbonate

EQUIPMENT:

Gyratory shaker or constant temperature shaker bath
Liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Automatic temperature compensator probe
Analytical balance

SUPPLIES:

pH buffer (pH = 4,7,9) Polycarbonate (PC)
8 ~~8~~ 60-ml ~~polypropylene (PP)~~ bottle
8 ~~8~~ 60-ml teflon (FEP) bottles
2 500-ml FEP bottles
reagent grade $NaHCO_3$
500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
1 L 0.10 m $NaNO_3$ stock solution

PROCEDURE:

1. Solution W3 ~~W1~~-50

- Initial $\Sigma U \approx 50$ ppb
- Initial pH ≈ 7.0; adjustment made with $NaHCO_3$
- Initial volume ≈ 50 ml
- Ionic strength = 0.1 m $NaNO_3$
- Initial $[Na^+]$ = 0.1 m $NaNO_3$ + $[NaHCO_3]$ added
- pCO_2 = atmospheric = $10^{-3.48}$ bar

a) ~~50~~ In a pre-cleaned 500-ml teflon (FEP) bottle, prepare ~~400~~ 500 g of 50 ppb U solution by diluting ~~20~~ g of a 500 ppb stock solution (in 0.1 m $NaNO_3$ matrix; prepared previously from commercial 50 ppm ^{233}U spike) to a total of ~~400~~ 500 g by carefully taring 0.10 m $NaNO_3$ solution into the bottle on a Mettler 4600 balance.

Within the same day, analyze 5 samples (sample names ~~W1~~ W3-50-IU*i*, where *i* is 1,2,3,4, or 5) to determine the starting U concentration using standard liquid scintillation methods (5 ml Ultima + 0.5 ml 0.02 N HNO_3 + 0.5 g sample). If possible transfer the 0.5 g sample into the scintillation vial by pouring directly from the 500-ml FEP bottle instead of using a pipet. Note that the exact weight of the sample must be measured.

Adjust the pH of the remaining solution to about 7.0 by adding 0.0027 g $NaHCO_3$ to the solution. Mix well, then place the bottle (covered with Kimwipe) on a gyratory shaker (~ 100-120 rpm). Monitor the pH for several days until it remains constant.

b) Into each of ~~3~~ 4 60-ml ~~PP~~ PC bottles labeled ~~W1-50-PPi~~ W3-50-PCi and ~~3~~ 4 60-ml FEP bottles labeled ~~W1-~~ W3-50-FEP*i* [where *i* is the mixture number ~~1,2 or 3~~ 1,2,3 or 4), tare 50±2 g of the 50 ppb uranium solution. Cover each bottle with a Kimwipe, then place the bottles on a gyratory shaker.

Within the same day, use the remaining solution to analyze the initial U concentration by standard liquid scintillation counting procedures (5 ml Ultima cocktail + 0.5 ml 0.02 N HNO_3 + 0.5 g sample). Analyze 5 samples (sample names ~~W1~~ W3-50-IU*i*, where *i* is 6,7,8,9, or 10).

c) After periods of one, two and three weeks, analyze three samples from each ~~PP~~ PC and FEP bottle by liquid scintillation counting.

After taking the last set of samples, measure the pH of each solution.

d) Compare uranium losses for ~~PP~~ PC and FEP bottles.

2. Solution ~~W1-5~~ W3-5

- Initial $\Sigma U \approx 5$ ppb
- Initial pH ≈ 7.0; adjustment made with $NaHCO_3$
- Initial volume ≈ 50 ml
- Ionic strength = 0.1 m $NaNO_3$
- Initial $[Na^+]$ = 0.1 m $NaNO_3$ + $[NaHCO_3]$ added
- pCO_2 = atmospheric = $10^{-3.48}$ bar

a) In a pre-cleaned 500-ml teflon (FEP) bottle, prepare ~~400~~ 500 g of 5 ppb U solution by diluting ~~2~~ g of a 500 ppb stock solution (in 0.1 m $NaNO_3$ matrix; prepared previously from commercial 50 ppm ^{233}U spike) to a total of ~~400~~ 500 g by carefully taring 0.10 m $NaNO_3$ solution into the bottle on a Mettler 4600 balance.

Within the same day, analyze 5 samples (sample names ~~W1~~ W3-5-IU*i*, where *i* is 1,2,3,4, or 5) to determine the starting U concentration using standard liquid scintillation methods (5 ml Ultima + 0.5 ml 0.02 N HNO_3 + 0.5 g sample). If possible transfer the 0.5 g sample into the scintillation vial by pouring directly from the 500-ml FEP bottle instead of using a pipet. Note that the exact weight of the sample must be measured.

Adjust the pH to about 7.0 by adding 0.0027 g $NaHCO_3$ to the solution. Mix well, then place the bottle (covered with Kimwipe) on a gyratory shaker (~ 100-120 rpm). Monitor the pH for several days until it remains constant.

b) Into each of ~~3~~ 4 60-ml ~~PP~~ PC bottles labeled ~~W1-5-PPi~~ W3-5-PCi and ~~3~~ 4 60-ml FEP bottles labeled ~~W1-~~ W3-5-FEP*i* [where *i* is the mixture number ~~1,2 or 3~~ 1,2,3 or 4), tare 50±2 g of the 50 ppb uranium solution. Cover each bottle with a Kimwipe, then place the bottles on a gyratory shaker.

Within the same day, use the remaining solution to analyze the initial U concentration by standard liquid scintillation counting procedures (5 ml Ultima cocktail + 0.5 ml 0.02 N HNO_3 + 0.5 g sample). Analyze 5 samples (sample names ~~W1~~ W3-5-IU*i*, where *i* is 6,7,8,9, or 10).

c) After periods of one, two and three weeks, analyze three samples from each ~~PP~~ PC and FEP bottle by liquid scintillation counting.

After taking the last set of samples, measure the pH of each solution.

d) Compare uranium losses for ~~PP~~ PC and FEP bottles.

Experiment W3 was begun today. NOTE that it is an adaptation of EXPERIMENT W1. W1 can be found on pg 245-247 of GC-07.

1000g 0.1 m $NaNO_3$ were prepared by dissolving 8.499 g $NaNO_3$ in 1000g Deonized H_2O.

Actual wt $NaNO_3$ used - 8.4984 g

500 g of a 50 ppb ^{233}U solution was prepared according to the instructions of step 1a on pg 124.

Wt ^{233}U (500ppb) used : 50.05g
Final Wt : 500.09 g

500 g of a 5 ppb ^{233}U solution was prepared according to the instructions of step 2a on p. 125.

Wt. ^{233}U (500ppb) used: ~~50~~ TD 2/22/94 5.19 g
Final Wt: 500.01g

The solutions were mixed, and 5 samples from the 50ppb and 5 samples from the 5 ppb solution were taken and prepared for liquid scintillation counting. The sample weights are given below.

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-50*IU1	7.7335	8.2357	0.5022
W3-50*IU2	7.7778	8.2802	0.5024
W3-50*IU3	7.7347	8.2374	0.5027
W3-50*IU4	7.7250	8.2272	0.5022
W3-50*IU5	7.8242	8.3266	0.5024
W3-5*IU1	7.8074	8.3106	0.5032
W3-5*IU2	7.7705	8.2736	0.5031
W3-5*IU3	7.8066	8.3091	0.5025
W3-5*IU4	7.7737	8.2764	0.5027
W3-5*IU5	7.7558	8.2580	0.5022

The pH of each solution was adjusted using $NaHCO_3$. The target pH is ~6.5. It will be measured periodically until it equilibrates w/ CO_2 in the atmosphere.

wt $NaHCO_3$ used for W3-50 : 0.0029
wt $NaHCO_3$ used for W3-5 : 0.0030

The solutions were loosely capped and placed on a gyratory shaker set to about 120 rpm.

2/25/94 EXPERIMENT W3 TD

The pH of each of the W-3 solutions was measured.

	pH/(T°C)
W3-50	5.13/18.6
W3-5	6.72/18.7

28 FEB 1994 TD W3

The Liquid Scintillation analysis of the W3-50 and W3-5 initial solutions has finished. The raw data & results of the calculations are given below.

```
Protocol #: 5       Name:U-233 3% 2 sigma          26-Feb-94   03:28
Region A: LL-UL= 0.0-100.   Lcr=   0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=   0  Bkg= 0.00  %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99     QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#   TIME    CPMA A:2S%    CPMB B:2S%    CPMC C:2S%     SIS FLAG
  1 999.98   19.22  1.44    3.182  3.55   28.80  1.18  143.26    B
  2   8.37    5.75 60.24  528.120  3.02  536.31  3.06  705.88
  3   8.30   13.67 29.19  532.240  3.02  546.26  3.05  698.02
  4   8.35   17.91 23.60  529.153  3.02  548.20  3.03  685.69
  5   8.17   11.14 34.70  540.759  3.02  552.35  3.05  699.15
  6   8.22    0.73 426.2  538.180  3.02  539.20  3.08  713.24
(12 missing vials)
 19  80.31    0.46 225.3   52.154  3.19   52.47  3.89  709.72
 20  79.99    2.51  42.97  52.375  3.19   54.90  3.78  681.61
 21  80.44    1.23  84.85  52.064  3.19   53.23  3.85  699.42
 22  78.74    1.56  68.22  53.257  3.19   54.60  3.82  699.60
 23  79.05    0.50 205.6   53.036  3.19   53.82  3.85  717.59
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
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6/15/94 TD Calculations Verified on page 143-144 of book.

S#	SAMPLE NAME	CPM B	WEIGHT (g)	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
2	W3-50*IU1	528.120	0.5022	1051.613	1.216E+14	2.02E-10	47.05
3	W3-50*IU2	532.240	0.5024	1059.395	1.225E+14	2.03E-10	47.40
4	W3-50*IU3	529.153	0.5027	1052.622	1.217E+14	2.02E-10	47.10
5	W3-50*IU4	540.759	0.5022	1076.780	1.245E+14	2.07E-10	48.18
6	W3-50*IU5	538.180	0.5024	1071.218	1.239E+14	2.06E-10	47.93
19	W3-5*IU1	52.154	0.5032	103.645	1.199E+13	1.99E-11	4.64
20	W3-5*IU2	52.375	0.5031	104.105	1.204E+13	2.00E-11	4.66
21	W3-5*IU3	52.064	0.5025	103.610	1.198E+13	1.99E-11	4.64
22	W3-5*IU4	53.257	0.5027	105.942	1.225E+13	2.03E-11	4.74
23	W3-5*IU5	53.036	0.5022	105.607	1.221E+13	2.03E-11	4.73

4 March 1994 W3 TD

The pH of the solutions was remeasured.

	pH/T(°C)
W3-50	4.95/21.4
W3-5	6.79/21.4

The pH of W3-50 was adjusted upward using 1.0M $NaHCO_3$ with dropwise addition. The final pH was 5.92

7 March 1994 TD W3

The pH of the solutions was remeasured.

	pH/T(°C) 3/7/94
W3-50	5.90/21.4
W3-5	6.71/21.3

Since the W3-5 solution has equilibrated, the experiment will proceed for this solution. 5 samples were taken for liquid scintillation analysis. The sample weights are given below. 3/7/94

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-5*IU6	7.7504	8.2611	0.5107
W3-5*IU7	7.8055	8.3094	0.5039
W3-5*IU8	7.7448	8.2476	0.5028
W3-5*IU9	7.7825	8.2854	0.5029
W3-5*IU10	7.7501	8.2540	0.5039

Into to each of 4 Poly carbonate (PC) and 4 teflon (FEP) bottles, 50 ± 2 g of the solution was placed. The bottle weights, solution, and total weights are given on the next page

NAME	WT BOTTLE + LID (g)	WT SOLN (g)	TOTAL WT (g)
W3-5*PC*A	19.69	50.46	70.15
W3-5*PC*B	20.06	49.98	70.04
W3-5*PC*C	20.21	50.06	70.27
W3-5*PC*D	19.97	50.63	70.60
W3-5*FEP*A	26.10	49.88	75.98
W3-5*FEP*B	26.15	50.24	76.39
W3-5*FEP*C	22.06	50.44	72.50
W3-5*FEP*D	25.95	50.14	76.09

the solutions were loosely capped and placed on a gyratory shaker @ ~120 rpm.

8 Mar 1994 TD W3

The pH of the W3-50 solution was remeasured.

pH = 5.90/21.7

10 March 1994 TD

The liquid Scintillation Analysis of the W-3*IU6-10 samples has finished. The raw data & results of calculations TD 3/10/94 follow.

W3-5 Initial [U] (prior to taking 50 g aliquots)

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Protocol #: 5        Name:U-233 3% 2 sigma          09-Mar-94   03:28
Region A: LL-UL= 0.0-100.  Lcr=    0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=    0  Bkg= 0.00  %2 Sigma=3.00
Region C: LL-UL= 0.0-2000  Lcr=    0  Bkg= 0.00  %2 Sigma=0.10
Time =999.93      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

  S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
   1 999.98    19.57  1.43    2.853  3.74    28.51  1.18 131.60    B
   2  84.92     0.13 774.6   49.479  3.18    50.44  3.88 697.01
   3  89.33     0.07 1307.   46.895  3.19    47.33  3.98 701.89
   4  88.20     0.00  0.00   47.532  3.19    47.33  3.98 701.89
   5  88.58     0.72 139.4   47.316  3.19    48.54  3.90 698.27
   6  86.79     0.93 109.2   48.351  3.18    49.81  3.87 695.27
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
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W3-5I.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-5*IU6	2	49.479	96.885	1.1204E+13	1.8601E-11	4.3348
W3-5*IU7	3	46.895	93.064	1.0762E+13	1.7868E-11	4.1639
W3-5*IU8	4	47.532	94.535	1.0932E+13	1.8150E-11	4.2297
W3-5*IU9	5	47.316	94.086	1.0880E+13	1.8064E-11	4.2096
W3-5*IU10	6	48.351	95.954	1.1096E+13	1.8422E-11	4.2932

6/15/94 TD Calculations verified on page 143-144 of this book.

14 March 1994 TD

The W3-5 *PC (or FEP) solution have been sitting a week, so the pH, weight, and ^{233}U concentration will be measured. The pH & weight were measured directly, and the [U] will be determined by LSA. The results & sample weights are given below.

W3-5.XLS

NAME	pH	T(C)	WEIGHT (g)
W3-5*PC*A	6.60	19.4	69.84
W3-5*PC*B	6.61	19.4	69.84
W3-5*PC*C	6.56	19.4	70.08
W3-5*PC*D	6.60	19.4	70.40
W3-5*FEP*A	6.67	19.4	75.85
W3-5*FEP*B	6.70	19.5	76.24
W3-5*FEP*C	6.69	19.5	72.40
W3-5*FEP*D	6.73	19.6	75.97

Weight was measured BEFORE pH measurement or sampling.

W3-5.XLS

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-5*PC*A1	7.7739	8.2783	0.5044
W3-5*PC*A2	7.7944	8.2973	0.5029
W3-5*PC*B1	7.8211	8.3260	0.5049
W3-5*PC*B2	7.7742	8.2751	0.5009
W3-5*PC*C1	7.8590	8.3601	0.5011
W3-5*PC*C2	7.7624	8.2623	0.4999
W3-5*PC*D1	7.8231	8.3230	0.4999
W3-5*PC*D2	7.7694	8.2690	0.4996
W3-5*FEP*A1	7.7966	8.2980	0.5014
W3-5*FEP*A2	7.7787	8.2810	0.5023
W3-5*FEP*B1	7.7887	8.2955	0.5068
W3-5*FEP*B2	7.7652	8.2654	0.5002
W3-5*FEP*C1	7.7794	8.2877	0.5083
W3-5*FEP*C2	7.7825	8.2878	0.5053
W3-5*FEP*D1	7.7814	8.2864	0.5050
W3-5*FEP*D2	7.8109	8.3133	0.5024

22 March 1994 TD

The LSA of the W3-5 week 1 samples has finished. The raw data and results follow.

W3-5.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-5*PC*A1	2	16.793	33.293	3.8499E+12	6.3920E-12	1.4896
W3-5*PC*A2	3	16.618	33.044	3.8212E+12	6.3443E-12	1.4785
W3-5*PC*B1	4	16.404	32.490	3.7570E+12	6.2378E-12	1.4537
W3-5*PC*B2	5	16.254	32.450	3.7524E+12	6.2301E-12	1.4519
W3-5*PC*C1	6	14.660	29.256	3.3831E+12	5.6169E-12	1.3090
W3-5*PC*C2	7	14.924	29.854	3.4522E+12	5.7318E-12	1.3357
W3-5*PC*D1	8	12.895	25.795	2.9829E+12	4.9525E-12	1.1541
W3-5*PC*D2	9	12.987	25.995	3.0060E+12	4.9908E-12	1.1631
W3-5*FEP*A1	10	7.165	14.290	1.6525E+12	2.7436E-12	0.6394
W3-5*FEP*A2	11	6.939	13.814	1.5975E+12	2.6523E-12	0.6181
W3-5*FEP*B1	12	13.001	25.653	2.9665E+12	4.9252E-12	1.1478
W3-5*FEP*B2	13	11.988	23.966	2.7714E+12	4.6014E-12	1.0723
W3-5*FEP*C1	14	6.959	13.691	1.5832E+12	2.6285E-12	0.6126
W3-5*FEP*C2	15	7.128	14.106	1.6312E+12	2.7084E-12	0.6312
W3-5*FEP*D1	16	7.027	13.915	1.6091E+12	2.6716E-12	0.6226
W3-5*FEP*D2	17	6.849	13.633	1.5764E+12	2.6174E-12	0.6099

6/15/93 TD
calculations verified on pgs 143-144 of this book.


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Protocol #: 5        Name:U-233 3% 2 sigma          16-Mar-94    03:16
Region A: LL-UL= 0.0-100.   Lcr=    0  Bkg= 0.00   %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=    0  Bkg= 0.00   %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=    0  Bkg= 0.00   %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
  1 999.98    18.92  1.45    3.085  3.60    27.98  1.20 137.44    B
  2 223.61     0.00  0.00   16.793  3.61    17.12  5.60 695.84
  3 225.65     0.11 571.2   16.618  3.62    17.15  5.57 690.47
  4 228.18     0.13 478.6   16.404  3.63    16.88  5.62 690.49
  5 229.79     0.00  0.00   16.254  3.63    16.39  5.74 708.29
  6 250.44     0.00  0.00   14.660  3.71    15.49  5.80 704.79
  7 246.77     0.01 8614.   14.924  3.70    15.41  5.86 700.51
  8 278.09     0.00  0.00   12.895  3.82    13.39  6.28 702.46
  9 276.51     0.22 273.4   12.987  3.81    13.65  6.19 689.98
 10 433.54     0.31 160.6    7.165  4.56     7.96  8.36 681.10
 11 443.54     0.06 828.1    6.939  4.62     7.42  8.84 695.74
 12 276.33     0.00  0.00   13.001  3.81    13.65  6.19 701.76
 13 294.84     0.00  0.00   11.988  3.88    12.18  6.65 710.29
 14 442.46     0.29 172.6    6.959  4.62     7.78  8.48 685.08
 15 435.22     0.48 105.4    7.128  4.57     8.23  8.10 662.73
 16 439.49     0.08 604.7    7.027  4.60     7.59  8.69 697.54
 17 447.43     0.40 123.2    6.849  4.64     7.65  8.57 679.67
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
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The number of counts seems to be small for only one week, so they will be recounted.

W3-50

The pH of the stock solution has finally equilibrated to ~~a~~ a pH in ~~the~~ acceptable range. The experiment will proceed.

pH = 5.96

24 March 1994 TD

The W3-5 solutions were sampled for the second time. The weight of the solution was measured before sampling, the pH was also measured. The samples were prepared for Liquid Scintillation analysis. The weights and pH values are given on the next page.

W3-5, 2nd sampling

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-5*PC*A3	7.7749	8.2793	0.5044
W3-5*PC*A4	7.8331	8.3357	0.5026
W3-5*PC*B3	7.8521	8.3525	0.5004
W3-5*PC*B4	7.7643	8.2645	0.5002
W3-5*PC*C3	7.8237	8.3225	0.4988
W3-5*PC*C4	7.7726	8.2724	0.4998
W3-5*PC*D3	7.7203	8.2216	0.5013
W3-5*PC*D4	7.7380	8.2253	0.4873
W3-5*FEP*A3	7.8408	8.3420	0.5012
W3-5*FEP*A4	7.7550	8.2566	0.5016
W3-5*FEP*B3	7.7389	8.2404	0.5015
W3-5*FEP*B4	7.8235	8.3247	0.5012
W3-5*FEP*C3	7.7437	8.2431	0.4994
W3-5*FEP*C4	7.8039	8.2968	0.4929
W3-5*FEP*D3	7.8326	8.3362	0.5036
W3-5*FEP*D4	7.7908	8.2976	0.5068

NAME	pH	T(C)	WEIGHT (g)
W3-5*PC*A	6.62	22.4	68.37
W3-5*PC*B	6.56	22.4	68.42
W3-5*PC*C	6.55	22.4	68.86
W3-5*PC*D	6.61	22.5	69.20
W3-5*FEP*A	6.56	22.5	74.61
W3-5*FEP*B	6.58	22.5	75.08
W3-5*FEP*C	6.57	22.5	71.25
W3-5*FEP*D	6.56	22.5	74.79

Weight was measured BEFORE pH measurement or sampling.

25 March 1993 TD

The W3-50 solution was distributed, in 50g aliquots, into the poly carbonate (PC) and teflon (FEP) bottles. The bottles were pre-weighed and the weight of solution was also recorded.

NAME	WT BOTTLE + LID (g)	WT SOLN (g)	TOTAL WT (g)
W3-50*PC*A	20.2892	50.20	70.49
W3-50*PC*B	20.0410	49.86	69.90
W3-50*PC*C	20.1501	49.90	70.05
W3-50*PC*D	20.1024	49.82	69.92
W3-50*FEP*A	25.5566	50.22	75.78
W3-50*FEP*B	24.8957	49.54	74.44
W3-50*FEP*C	27.0687	50.49	77.56
W3-50*FEP*D	27.5444	49.79	77.33

These are the total weights at the start of the experiment.

of the stock solution W3-50

5 samples/ were taken for L.S. analysis. Their concentration will be the initial [U]. The weights are given below.

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-50*IU6	7.7547	8.2544	0.4997
W3-50*IU7	7.7839	8.2837	0.4998
W3-50*IU8	7.8286	8.3285	0.4999
W3-50*IU9	7.7767	8.2777	0.5010
W3-50*IU10	7.7759	8.2785	0.5026

4 April 1994. TD

The liquid scintillation analysis of the W3-5 and W3-50 solutions has finished. Results of calculations and ~~of~~ raw data follow.

W3-50.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-50*IU6	91	474.225	949.019	1.0974E+14	1.8221E-10	42.4611
W3-50*IU7	92	478.528	957.439	1.1072E+14	1.8382E-10	42.8378
W3-50*IU8	93	491.166	982.529	1.1362E+14	1.8864E-10	43.9604
W3-50*IU9	94	476.258	950.615	1.0993E+14	1.8251E-10	42.5325
W3-50*IU10	95	467.818	930.796	1.0764E+14	1.7871E-10	41.6458

These are the initial (U) for the experimen

```
 91   9.33    4.20 75.25 474.225  3.02  479.26  3.08 704.54
 92   9.23    4.13 76.89 478.528  3.02  484.97  3.07 702.57
 93   9.00    0.16 1799. 491.166  3.02  492.52  3.09 709.54
 94   9.28    0.88 334.0 476.258  3.02  478.11  3.09 706.39
 95   9.44    0.00  0.00 467.818  3.02  468.37  3.10 703.42
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
```

6/15/94 TD Calculations verified on pgs 143-4 of this book

W3-5.XLS

RECOUNTED NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-5*PC*A1	2	16.135	31.989	3.6991E+12	6.1416E-12	1.4312
W3-5*PC*A2	3	16.586	32.981	3.8138E+12	6.3321E-12	1.4756
W3-5*PC*B1	4	16.696	33.068	3.8239E+12	6.3488E-12	1.4795
W3-5*PC*B2	5	16.379	32.699	3.7813E+12	6.2780E-12	1.4630
W3-5*PC*C1	6	14.736	29.407	3.4006E+12	5.6460E-12	1.3157
W3-5*PC*C2	7	14.611	29.228	3.3798E+12	5.6116E-12	1.3077
W3-5*PC*D1	8	13.482	26.969	3.1187E+12	5.1779E-12	1.2067
W3-5*PC*D2	9	13.222	26.465	3.0604E+12	5.0811E-12	1.1841
W3-5*FEP*A1	10	6.974	13.909	1.6084E+12	2.6704E-12	0.6223
W3-5*FEP*A2	11	7.237	14.408	1.6661E+12	2.7662E-12	0.6446
W3-5*FEP*B1	12	12.620	24.901	2.8795E+12	4.7809E-12	1.1141
W3-5*FEP*B2	13	12.275	24.540	2.8378E+12	4.7116E-12	1.0980
W3-5*FEP*C1	14	6.798	13.374	1.5465E+12	2.5677E-12	0.5984
W3-5*FEP*C2	15	6.765	13.388	1.5482E+12	2.5704E-12	0.5990
W3-5*FEP*D1	16	6.915	13.693	1.5834E+12	2.6290E-12	0.6127
W3-5*FEP*D2	17	6.819	13.573	1.5695E+12	2.6059E-12	0.6073

6/15/94 TD calculations verified on pgs 143-144 of this book.

W3-5 RECOUNT

```
Protocol #: 5        Name:U-233 3% 2 sigma          26-Mar-94   07:55
Region A: LL-UL= 0.0-100.  Lcr=    0  Bkg= 0.00  %2 Sigma=0.25
Region B: LL-UL=100.-350.  Lcr=    0  Bkg= 0.00  %2 Sigma=3.00
Region C: LL-UL= 0.0-2000  Lcr=    0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

  S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
   1 999.98    18.95  1.45    2.945  3.69   27.92  1.20 135.10    B
   2 232.91     0.18 346.6   16.135  3.61   16.83  5.58 692.87
   3 227.59     0.76 85.22   16.586  3.59   18.02  5.32 677.79
   4 226.31     0.40 161.1   16.696  3.59   17.62  5.43 697.61
   5 230.03     0.00  0.00   16.379  3.60   16.65  5.65 712.65
   6 251.40     0.08 798.2   14.736  3.67   15.28  5.85 712.72
   7 253.19     0.25 241.9   14.611  3.68   15.44  5.78 700.01
   8 270.53     0.34 178.8   13.482  3.74   14.41  5.96 693.85
   9 274.88     0.06 1055.   13.222  3.76   13.96  6.08 702.34
  10 448.33     0.18 282.2    6.974  4.54    7.51  8.71 703.34
  11 436.56     0.34 146.4    7.237  4.48    7.91  8.38 748.22
  12 285.52     0.00  0.00   12.620  3.80   12.81  6.45 724.38
  13 291.99     0.34 173.3   12.275  3.82   12.95  6.33 691.89
  14 456.12     0.00  0.00    6.798  4.59    6.91  9.34 747.68
  15 457.66     0.23 210.9    6.765  4.60    7.41  8.75 729.82
  16 450.81     0.00  0.00    6.915  4.56    6.95  9.33 749.47
  17 455.14     0.00  0.00    6.819  4.58    6.99  9.26 745.81
(1 missing vial)
```

6/15/94 TD
Calculations verified on pg 143-144 of this volume.

W3-5.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-5*PC*A3	73	16.470	32.653	3.7759E+12	6.2691E-12	1.4609
W3-5*PC*A4	74	17.195	34.212	3.9562E+12	6.5685E-12	1.5307
W3-5*PC*B3	75	15.938	31.851	3.6831E+12	6.1151E-12	1.4251
W3-5*PC*B4	76	15.643	31.273	3.6164E+12	6.0043E-12	1.3992
W3-5*PC*C3	77	15.292	30.658	3.5452E+12	5.8861E-12	1.3717
W3-5*PC*C4	78	15.488	30.988	3.5834E+12	5.9496E-12	1.3865
W3-5*PC*D3	79	13.995	27.917	3.2283E+12	5.3600E-12	1.2491
W3-5*PC*D4	80	12.652	25.963	3.0024E+12	4.9848E-12	1.1617
W3-5*FEP*A3	81	8.692	17.342	2.0054E+12	3.3296E-12	0.7759
W3-5*FEP*A4	82	8.691	17.327	2.0036E+12	3.3266E-12	0.7752
W3-5*FEP*B3	83	13.449	26.818	3.1011E+12	5.1488E-12	1.1999
W3-5*FEP*B4	84	13.187	26.311	3.0425E+12	5.0515E-12	1.1772
W3-5*FEP*C3	85	8.346	16.712	1.9325E+12	3.2086E-12	0.7477
W3-5*FEP*C4	86	8.365	16.971	1.9625E+12	3.2583E-12	0.7593
W3-5*FEP*D3	87	8.262	16.406	1.8971E+12	3.1498E-12	0.7340
W3-5*FEP*D4	88	8.412	16.598	1.9194E+12	3.1868E-12	0.7426

```
 73 228.90     0.00  0.00   16.470  3.60   16.72  5.65 716.77
 74 220.65     0.36 179.9   17.195  3.57   18.09  5.38 711.78
 75 235.39     0.60 106.8   15.938  3.62   16.93  5.52 710.71
 76 239.08     0.00  0.00   15.643  3.63   15.37  5.95 736.28
 77 243.74     0.00  0.00   15.292  3.65   14.91  6.05 739.43
 78 241.09     0.00  0.00   15.488  3.64   15.74  5.81 716.85
 79 262.33     0.00  0.00   13.995  3.71   14.07  6.16 718.25
 80 284.99     0.00  0.00   12.652  3.80   12.58  6.56 745.04
 81 382.13     0.00  0.00    8.692  4.20    9.16  7.72 721.45
 82 381.99     0.00  0.00    8.691  4.21    9.21  7.68 708.24
 83 271.13     0.00  0.00   13.449  3.74   13.89  6.15 729.04
 84 275.47     0.06 1068.   13.187  3.76   13.61  6.21 705.65
 85 393.68     0.00  0.00    8.346  4.26    8.51  8.15 755.58
 86 393.00     0.00  0.00    8.365  4.26    8.73  7.98 710.67
 87 396.53     0.00  0.00    8.262  4.28    8.54  8.11 724.19
 88 391.57     0.00  0.00    8.412  4.25    8.76  7.96 730.99
(2 missing vials)
```


TD 5 April 1994 EXPT. W3-5

The final sample of w3-5 was taken. The weight & pH of each solution was measured. The samples were prepared for liquid scintillation analysis

NAME	pH	T(C)	WEIGHT (g)
W3-5*PC*A	6.57	20.6	66.71
W3-5*PC*B	6.55	20.6	66.97
W3-5*PC*C	6.57	20.6	67.43
W3-5*PC*D	6.59	20.6	67.81
W3-5*FEP*A	6.57	20.7	73.31
W3-5*FEP*B	6.58	20.7	73.81
W3-5*FEP*C	6.59	20.7	70.01
W3-5*FEP*D	6.54	20.7	73.54
			Weight was measured BEFORE pH measurement or sampling.

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-5*PC*A5	7.7877	8.2899	0.5022
W3-5*PC*A6	7.7836	8.2851	0.5015
W3-5*PC*B5	7.7439	8.2470	0.5031
W3-5*PC*B6	7.7484	8.2500	0.5016
W3-5*PC*C5	7.8224	8.3219	0.4995
W3-5*PC*C6	7.7640	8.2639	0.4999
W3-5*PC*D5	7.7733	8.2732	0.4999
W3-5*PC*D6	7.8692	8.3697	0.5005
W3-5*FEP*A5	7.8007	8.3006	0.4999
W3-5*FEP*A6	7.7523	8.2518	0.4995
W3-5*FEP*B5	7.7710	8.2713	0.5003
W3-5*FEP*B6	7.8383	8.3412	0.5029
W3-5*FEP*C5	7.7725	8.2729	0.5004
W3-5*FEP*C6	7.7506	8.2519	0.5013
W3-5*FEP*D5	7.7539	8.2521	0.4982
W3-5*FEP*D6	7.8515	8.3542	0.5027

TD 6 April 1994 EXPT. W3-50

The ~~first~~ 6/14/94 W3-50 was taken. The weight & pH of each solution (TD) were also measured. The samples were prepared for liquid scintillation Analysis

NAME	pH	T(C)	WEIGHT (g)
W3-50*PC*A	5.73	20.7	70.17
W3-50*PC*B	5.72	20.7	69.57
W3-50*PC*C	5.70	20.8	69.70
W3-50*PC*D	5.72	20.8	69.60
W3-50*FEP*A	6.08	20.8	75.47
W3-50*FEP*B	6.02	20.9	74.18
W3-50*FEP*C	6.05	20.9	77.20
W3-50*FEP*D	6.07	20.9	77.06
			Weight was measured BEFORE pH measuremen or sampling.

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-50*PC*A1	7.7989	8.2986	0.4997
W3-50*PC*A2	7.7465	8.2485	0.5020
W3-50*PC*B1	7.7899	8.2891	0.4992
W3-50*PC*B2	7.7670	8.2683	0.5013
W3-50*PC*C1	7.7780	8.2791	0.5011
W3-50*PC*C2	7.7901	8.2898	0.4997
W3-50*PC*D1	7.7626	8.2596	0.4970
W3-50*PC*D2	7.7614	8.2617	0.5003
W3-50*FEP*A1	7.8482	8.3492	0.5010
W3-50*FEP*A2	7.7650	8.2644	0.4994
W3-50*FEP*B1	7.7919	8.2916	0.4997
W3-50*FEP*B2	7.7879	8.2885	0.5006
W3-50*FEP*C1	7.8604	8.3584	0.4980
W3-50*FEP*C2	7.7512	8.2514	0.5002
W3-50*FEP*D1	7.7492	8.2489	0.4997
W3-50*FEP*D2	7.7332	8.2330	0.4998

15 April 1994 TD W3-50

The second set of samples for W3-50 ~~was~~ TD was taken and prepared for Liquid Scintillation Analysis. The pH was measured and the tube and solution weighed.

W3-50.XLS

NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-50*PC*A3	7.7590	8.2648	0.5058
W3-50*PC*A4	7.7919	8.2971	0.5052
W3-50*PC*B3	7.7978	8.3034	0.5056
W3-50*PC*B4	7.7798	8.2834	0.5036
W3-50*PC*C3	7.7741	8.2750	0.5009
W3-50*PC*C4	7.8301	8.3325	0.5024
W3-50*PC*D3	7.7247	8.2324	0.5077
W3-50*PC*D4	7.8535	8.3588	0.5053
W3-50*FEP*A3	7.7684	8.2713	0.5029
W3-50*FEP*A4	7.7626	8.2645	0.5019
W3-50*FEP*B3	7.7690	8.2723	0.5033
W3-50*FEP*B4	7.8745	8.3773	0.5028
W3-50*FEP*C3	7.7863	8.2886	0.5023
W3-50*FEP*C4	7.8337	8.3352	0.5015
W3-50*FEP*D3	7.7566	8.2560	0.4994
W3-50*FEP*D4	7.8578	8.3589	0.5011

W3-50.XLS

NAME	pH	T(C)	WEIGHT (g)
W3-50*PC*A	5.72	22.4	68.91
W3-50*PC*B	5.70	22.4	68.32
W3-50*PC*C	5.75	22.4	68.39
W3-50*PC*D	5.73	22.4	68.34
W3-50*FEP*A	6.05	22.4	74.26
W3-50*FEP*B	6.02	22.5	72.99
W3-50*FEP*C	6.01	22.5	75.96
W3-50*FEP*D	6.05	22.5	75.89

Weight was measured BEFORE pH measurement or sampling.

18 April 1994 TD

The liquid scintillation analysis of the W3-5 and W3-50 solutions has finished. The raw data and results of calculations follow.

W3-5.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-5*PC*A5	2	16.827	33.507	3.8746E+12	6.4330E-12	1.4992
W3-5*PC*A6	3	16.085	32.074	3.7089E+12	6.1580E-12	1.4350
W3-5*PC*B5	4	16.302	32.403	3.7470E+12	6.2212E-12	1.4498
W3-5*PC*B6	5	16.109	32.115	3.7137E+12	6.1659E-12	1.4369
W3-5*PC*C5	6	17.254	34.543	3.9944E+12	6.6319E-12	1.5455
W3-5*PC*C6	7	17.470	34.947	4.0412E+12	6.7096E-12	1.5636
W3-5*PC*D5	8	13.385	26.775	3.0962E+12	5.1407E-12	1.1980
W3-5*PC*D6	9	12.766	25.506	2.9495E+12	4.8971E-12	1.1412
W3-5*FEP*A5	10	8.946	17.896	2.0694E+12	3.4358E-12	0.8007
W3-5*FEP*A6	11	9.548	19.115	2.2104E+12	3.6700E-12	0.8553
W3-5*FEP*B5	12	13.974	27.931	3.2299E+12	5.3626E-12	1.2497
W3-5*FEP*B6	13	14.600	29.032	3.3571E+12	5.5739E-12	1.2989
W3-5*FEP*C5	14	8.274	16.535	1.9120E+12	3.1746E-12	0.7398
W3-5*FEP*C6	15	8.114	16.186	1.8717E+12	3.1076E-12	0.7242
W3-5*FEP*D5	16	8.556	17.174	1.9859E+12	3.2973E-12	0.7684
W3-5*FEP*D6	17	8.467	16.843	1.9477E+12	3.2338E-12	0.7536

6/15/94 TD Calculations verified on pgs 143-144 of this book

W3-50.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-50*PC*A1	19	300.161	600.682	6.9462E+13	1.1533E-10	26.8758
W3-50*PC*A2	20	297.229	592.090	6.8468E+13	1.1368E-10	26.4913
W3-50*PC*B1	21	304.349	609.673	7.0501E+13	1.1705E-10	27.2781
W3-50*PC*B2	22	312.563	623.505	7.2101E+13	1.1971E-10	27.8969
W3-50*PC*C1	23	282.711	564.181	6.5241E+13	1.0832E-10	25.2426
W3-50*PC*C2	24	280.772	561.881	6.4975E+13	1.0788E-10	25.1397
W3-50*PC*D1	25	304.349	612.372	7.0813E+13	1.1757E-10	27.3988
W3-50*PC*D2	26	311.448	622.522	7.1987E+13	1.1952E-10	27.8530
W3-50*FEP*A1	27	264.712	528.367	6.1099E+13	1.0144E-10	23.6403
W3-50*FEP*A2	28	274.392	549.443	6.3536E+13	1.0549E-10	24.5832
W3-50*FEP*B1	29	131.260	262.678	3.0375E+13	5.0432E-11	11.7527
W3-50*FEP*B2	30	124.709	249.119	2.8808E+13	4.7829E-11	11.1461
W3-50*FEP*C1	31	201.109	403.833	4.6698E+13	7.7533E-11	18.0683
W3-50*FEP*C2	32	206.095	412.025	4.7646E+13	7.9106E-11	18.4349
W3-50*FEP*D1	33	282.409	565.157	6.5353E+13	1.0851E-10	25.2863
W3-50*FEP*D2	34	293.824	587.883	6.7981E+13	1.1287E-10	26.3031

6/15/94 TD

W3-50.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-50*PC*A3	55	323.188	638.964	7.3888E+13	1.2268E-10	28.5886
W3-50*PC*A4	56	321.778	636.932	7.3653E+13	1.2229E-10	28.4977
W3-50*PC*B3	57	323.927	640.678	7.4087E+13	1.2301E-10	28.6653
W3-50*PC*B4	58	335.156	665.520	7.6959E+13	1.2778E-10	29.7768
W3-50*PC*C3	59	300.575	600.070	6.9391E+13	1.1521E-10	26.8484
W3-50*PC*C4	60	306.772	610.613	7.0610E+13	1.1723E-10	27.3201
W3-50*PC*D3	61	332.305	654.530	7.5688E+13	1.2567E-10	29.2851
W3-50*PC*D4	62	336.445	665.832	7.6995E+13	1.2784E-10	29.7907
W3-50*FEP*A3	63	284.057	564.838	6.5317E+13	1.0845E-10	25.2720
W3-50*FEP*A4	64	291.276	580.347	6.7110E+13	1.1142E-10	25.9659
W3-50*FEP*B3	65	151.200	300.417	3.4740E+13	5.7678E-11	13.4413
W3-50*FEP*B4	66	149.024	296.388	3.4274E+13	5.6905E-11	13.2610
W3-50*FEP*C3	67	234.682	467.215	5.4028E+13	8.9702E-11	20.9042
W3-50*FEP*C4	68	240.754	480.068	5.5514E+13	9.2170E-11	21.4792
W3-50*FEP*D3	69	305.981	612.697	7.0851E+13	1.1763E-10	27.4134
W3-50*FEP*D4	70	307.567	613.784	7.0977E+13	1.1784E-10	27.4620

```
Protocol #: 5          Name:U-233 3% 2 sigma          13-Apr-94  11:16
Region A: LL-UL= 0.0-100.   Lcr=   0  Bkg= 0.00   %2 Sigma=0.25
Region B: LL-UL=100.-350.   Lcr=   0  Bkg= 0.00   %2 Sigma=3.00
Region C: LL-UL= 0.0-2000   Lcr=   0  Bkg= 0.00   %2 Sigma=0.10
Time =999.99       QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME     CPMA A:2S%     CPMB B:2S%     CPMC C:2S%     SIS FLAG
  1  999.98    19.04  1.45    2.838  3.75    27.83  1.20  131.48    B
  2  225.98     0.17 376.6    16.827  3.56    17.65  5.42  728.20
  3  234.90     0.10 623.6    16.085  3.59    16.66  5.59  726.21
  4  232.18     0.31 204.5    16.302  3.58    17.03  5.52  718.81
  5  234.55     0.12 540.4    16.109  3.59    16.65  5.60  729.41
  6  221.18     0.27 240.1    17.254  3.55    18.03  5.38  726.21
  7  218.83     0.00   0.00   17.470  3.54    17.65  5.50  741.30
  8  273.93     0.00   0.00   13.385  3.72    13.71  6.18  747.13
  9  284.79     0.35 168.0    12.766  3.76    13.82  6.04  729.12
 10  377.13     0.04 1322.     8.946  4.13     9.67  7.38  745.71
 11  358.79     0.02 2345.     9.548  4.05    10.41  7.04  741.28
 12  264.34     0.00   0.00   13.974  3.69    14.06  6.14  759.70
 13  254.85     0.00   0.00   14.600  3.66    14.66  6.02  757.66
 14  400.02     0.05 972.0     8.274  4.23     8.84  7.82  737.62
 15  405.77     0.00   0.00    8.114  4.26     8.34  8.20  751.92
 16  390.11     0.00   0.00    8.556  4.18     8.97  7.80  765.75
 17  393.64     0.00   0.00    8.467  4.20     8.32  8.32  802.11
(1 missing vial)
 19   14.67     0.87 270.8    300.161  3.03   301.21  3.15  747.06
 20   14.81     0.00   0.00   297.229  3.03   296.81  3.16  749.49
 21   14.47     0.86 273.1    304.349  3.03   306.38  3.14  745.39
 22   14.09     0.00   0.00   312.563  3.03   312.55  3.15  747.19
 23   15.57     0.55 410.5    282.711  3.03   284.24  3.15  747.76
 24   15.68     0.73 309.1    280.772  3.03   281.48  3.16  745.47
 25   14.47     0.00   0.00   304.349  3.03   303.89  3.15  747.99
 26   14.14     1.40 172.9    311.448  3.03   313.68  3.14  744.16
 27   16.61     0.11 2029.    264.712  3.03   264.04  3.18  745.74
 28   16.03     0.24 928.9    274.392  3.03   275.29  3.16  745.75
 29   33.14     0.00 74975    131.260  3.07   131.94  3.34  742.22
 30   34.85     0.00   0.00   124.709  3.07   124.19  3.37  748.98
 31   21.79     1.11 175.3    201.109  3.04   202.50  3.22  741.62
 32   21.27     1.22 161.0    206.095  3.04   207.90  3.21  741.27
 33   15.59     0.00   0.00   282.409  3.03   281.53  3.17  746.29
```

W3-50 LS Results

(11 missing vials)

55	13.64	0.61	396.3	323.188	3.03	324.88	3.13	746.88
56	13.69	1.49	165.7	321.778	3.03	323.66	3.13	743.84
57	13.60	0.00	0.00	323.927	3.03	323.27	3.15	752.75
58	13.16	0.00	0.00	335.156	3.02	334.40	3.14	750.10
59	14.65	0.00	0.00	300.575	3.03	300.22	3.15	746.00
60	14.36	0.53	443.7	306.772	3.03	309.00	3.14	746.06

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
61	13.26	0.42	582.5	332.305	3.03	333.40	3.13	748.00	
62	13.11	0.64	384.5	336.445	3.02	337.84	3.13	749.76	
63	15.49	0.01	36246	284.057	3.03	284.69	3.16	751.20	
64	15.12	0.87	266.0	291.276	3.03	293.79	3.14	748.69	
65	28.85	0.16	1007.	151.200	3.06	152.06	3.29	748.07	
66	29.27	0.00	0.00	149.024	3.06	149.41	3.30	753.35	
67	18.71	0.95	219.3	234.682	3.04	235.98	3.19	746.25	
68	18.26	1.99	108.7	240.754	3.03	243.80	3.17	749.45	
69	14.40	0.00	0.00	305.981	3.03	306.40	3.15	750.41	
70	14.32	0.00	0.00	307.567	3.03	306.87	3.15	756.18	

SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED

D 2 May 1994 W3-50

The third samples of the W3-50 solutions was done. The bottles were weighed, the solution pH measured, and 2 - 500 µL samples were taken and prepared for L.S.A. The pH and weights are given below.

W3-50.XLS

NAME	pH	T(C)	WEIGHT (g)	NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
W3-50*PC*A	5.72	22.4	67.59	W3-50*PC*A5	7.8327	8.3386	0.5059
W3-50*PC*B	5.70	22.4	66.95	W3-50*PC*A6	7.7410	8.2466	0.5056
W3-50*PC*C	5.75	22.4	67.05	W3-50*PC*B5	7.8230	8.3313	0.5083
W3-50*PC*D	5.73	22.4	66.73	W3-50*PC*B6	7.7679	8.2736	0.5057
W3-50*FEP*A	6.05	22.4	73.06	W3-50*PC*C5	7.8140	8.3219	0.5079
W3-50*FEP*B	6.02	22.5	71.78	W3-50*PC*C6	7.8423	8.3469	0.5046
W3-50*FEP*C	6.01	22.5	74.75	W3-50*PC*D5	7.8052	8.3123	0.5071
W3-50*FEP*D	6.05	22.5	74.66	W3-50*PC*D6	7.7051	8.2104	0.5053
				W3-50*FEP*A5	7.7674	8.2764	0.5090
				W3-50*FEP*A6	7.7755	8.2809	0.5054
				W3-50*FEP*B5	7.8610	8.3701	0.5091
				W3-50*FEP*B6	7.7984	8.3054	0.5070
				W3-50*FEP*C5	7.7925	8.2991	0.5066
				W3-50*FEP*C6	7.7811	8.2862	0.5051
				W3-50*FEP*D5	7.7451	8.2485	0.5034
				W3-50*FEP*D6	7.7575	8.2587	0.5012

D 18 May 1994 W3-50

The liquid scintillation analysis of the W3-50 third sample set has finished. Raw data and results follow.

Protocol #: 5 Name:U-233 3% 2 sigma 12-May-94 03:01
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	19.06	1.45	3.173	3.55	28.48	1.19	141.62	B
2	12.65	1.18	216.4	348.368	3.03	350.41	3.13	710.39	
3	12.82	0.99	255.3	343.551	3.03	345.07	3.13	710.27	
4	12.47	0.00	0.00	353.443	3.03	353.07	3.13	716.60	
5	12.33	0.89	287.6	357.492	3.03	357.65	3.13	711.54	
6	13.00	1.63	155.6	338.981	3.03	339.29	3.14	707.41	
7	12.70	2.59	101.3	346.827	3.03	349.86	3.12	707.98	
8	12.49	1.03	246.6	352.952	3.03	354.46	3.13	714.06	
9	12.75	0.00	0.00	345.690	3.03	345.24	3.14	713.00	
10	15.14	0.89	261.0	290.684	3.03	292.39	3.15	710.08	
11	15.14	0.49	467.7	290.618	3.03	291.40	3.16	705.31	
12	24.99	0.03	6740.	174.698	3.05	174.64	3.27	714.63	
13	24.86	0.00	0.00	175.588	3.06	175.22	3.27	714.31	
14	17.51	1.78	123.3	250.853	3.04	252.96	3.17	707.52	
15	17.06	1.92	116.2	257.319	3.04	259.21	3.17	706.60	
16	13.56	0.41	591.8	324.851	3.03	326.16	3.14	711.76	
17	13.94	1.53	160.2	315.837	3.03	319.37	3.13	708.69	
18	338.34	0.30	183.7	9.968	4.11	10.07	7.49	679.82	
19	496.00	0.39	122.5	5.795	5.03	6.49	9.69	667.88	
20	777.03	0.17	246.9	2.547	8.06	3.00	17.52	680.13	
21	578.39	0.24	194.6	4.510	5.69	4.89	12.00	690.23	
22	360.42	0.56	97.27	9.157	4.22	10.14	7.26	683.42	
23	733.74	0.48	89.65	2.886	7.41	3.61	14.91	628.22	
24	158.49	0.32	238.5	24.867	3.41	25.79	4.72	719.77	
25	573.06	0.17	277.7	4.585	5.64	4.85	12.13	714.00	
26	545.38	0.00	0.00	4.981	5.41	5.19	11.56	726.76	
27	451.53	0.00	0.00	6.676	4.74	7.04	9.30	754.59	
28	495.26	0.11	435.6	5.800	5.03	6.10	10.29	716.12	
29	476.81	0.00	0.00	6.149	4.90	6.09	10.43	755.89	
30	91.78	0.00	0.00	45.247	3.22	45.91	3.99	728.80	
31	23.56	1.52	124.0	185.494	3.05	188.33	3.23	726.19	
32	12.30	0.94	273.3	358.209	3.03	360.70	3.12	731.59	
33	178.47	1.03	70.72	21.727	3.48	23.01	4.89	700.57	
34	49.07	1.09	119.9	87.391	3.11	88.60	3.51	724.36	
35	20.77	1.83	110.4	210.789	3.05	212.92	3.21	724.16	
(1 missing vial)									
37	8.43	6.92	50.91	523.992	3.02	534.15	3.06	727.00	
38	8.52	2.89	111.6	518.541	3.02	523.86	3.07	729.49	
39	8.11	2.64	124.4	545.039	3.02	550.06	3.07	732.51	
40	8.00	5.44	64.55	552.952	3.02	558.89	3.07	725.59	
41	8.22	6.00	58.39	537.460	3.02	545.48	3.06	725.32	
42	8.16	4.71	72.67	541.435	3.02	547.01	3.07	725.20	
(12 missing vials)									
55	8.86	0.80	374.4	498.520	3.02	502.22	3.08	731.91	
56	8.79	3.01	105.7	502.629	3.02	507.35	3.08	726.85	
57	9.37	2.60	117.3	471.747	3.02	476.53	3.08	729.77	
58	8.92	6.05	55.65	495.706	3.02	502.12	3.07	721.38	
59	9.25	2.67	115.3	477.476	3.02	481.25	3.09	722.35	
60	9.13	2.63	117.9	483.902	3.02	486.63	3.09	724.37	

6/15/94 TD
Calculations verified on page 143-144 in this vol.

W3-50.XLS

NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
W3-50*PC*A~~3~~5	2	348.37	688.614	7.9630E+13	1.3221E-10	30.8100
W3-50*PC*A~~4~~6	3	343.55	679.490	7.8575E+13	1.3046E-10	30.4018
W3-50*PC*B~~3~~5	4	353.44	695.337	8.0407E+13	1.3350E-10	31.1109
W3-50*PC*B~~4~~6	5	357.49	706.921	8.1747E+13	1.3572E-10	31.6291
W3-50*PC*C~~3~~5	6	338.98	667.415	7.7178E+13	1.2814E-10	29.8615
W3-50*PC*C~~4~~6	7	346.83	687.337	7.9482E+13	1.3196E-10	30.7529
W3-50*PC*D~~3~~5	8	352.95	696.017	8.0486E+13	1.3363E-10	31.1412
W3-50*PC*D~~4~~6	9	345.69	684.128	7.9111E+13	1.3135E-10	30.6093
W3-50*FEP*A~~3~~5	10	290.68	571.081	6.6038E+13	1.0964E-10	25.5513
W3-50*FEP*A~~4~~6	11	290.62	575.030	6.6495E+13	1.1040E-10	25.7280
W3-50*FEP*B~~3~~5	12	174.7	343.155	3.9682E+13	6.5883E-11	15.3535
W3-50*FEP*B~~4~~6	13	175.59	346.331	4.0049E+13	6.6493E-11	15.4956
W3-50*FEP*C~~3~~5	14	250.85	495.164	5.7260E+13	9.5068E-11	22.1547
W3-50*FEP*C~~4~~6	15	257.32	509.444	5.8911E+13	9.7810E-11	22.7936
W3-50*FEP*D~~3~~5	16	324.85	645.312	7.4622E+13	1.2390E-10	28.8726
W3-50*FEP*D~~4~~6	17	315.84	630.168	7.2871E+13	1.2099E-10	28.1950

All changes in sample names were made by Todd Dietrich on 18 May 1994.

7 JUNE 1994 TD EXPERIMENT D-I

Experiment D-I was begun today. It is a U sorption experiment on clinoptilolite similar to B-IB (GC-07-pg. 298-301) EXCEPT that 1.0 g Na-clinoptilolite will be used, rather than the 0.1g used in B-IB.

2 kg 0.1 m $NaNO_3$ was prepared in 2 1kg portions by dissolving 8.499g $NaNO_3$ in 1 kg DI H_2O.

Wt $NaNO_3$ used: 8.4997g, 8.4990g
Lot #: 930601,

2000g of 50ppb ^{238}U was prepared by diluting 200g 500ppb ^{233}U (spike 28A) to 2000g using 0.1m $NaNO_3$.

6/7/94 TD

ACTUAL WT. SPIKE ~~2A~~ 28A USED: 200.91g
FINAL WT. (AFTER DILUTION) : 2000.1

The solution was mixed and distributed in 50g portions into pre weighed, labeled TD 6/7/94 FEP 60mL-bottles. The pH adjustments were made using table B-IB-I on pg GC-07-pg 300-301. All weights and adjustments are given below.

D-I.XLS

SOLN. NAME	WT BOTTLE (g)	WT. SOLN (g)	ADJUST. VOL (mL)	ADJUST CONC. (M)	ACTUAL ADJ. (mL)	FINAL WT (g)
D-I*pH2.00	28.2276	49.78	0.602	1	0.600	78.61
D-I*pH2.25	26.4758	49.93	0.336	1	0.340	76.75
D-I*pH2.50	25.4054	49.87	0.187	1	0.190	75.47
D-I*pH2.75	26.5758	50.00	0.103	1	0.100	76.68
D-I*pH3.00	26.9605	49.97	0.563	0.1	0.560	77.49
D-I*pH3.25	21.7634	49.90	0.299	0.1	0.300	71.96
D-I*pH3.50	24.8218	50.29	0.151	0.1	0.150	75.26
D-I*pH3.75	27.6534	50.10	0.087	0.1	0.070	77.82
D-I*pH4.00	26.5193	50.23	0.102	0.02	0.100	76.85
D-I*pH4.25	25.2223	50.18	0.120	0.005	0.120	75.52
D-I*pH4.50	26.5827	50.18	0.417	0.005	0.410	77.17
D-I*pH4.75	26.8053	50.12	0.293	0.01	0.290	77.22
D-I*pH5.00	26.0257	50.19	0.342	0.01	0.340	76.56
D-I*pH5.25	25.0429	50.00	0.371	0.01	0.370	75.41
D-I*pH5.50	23.7136	49.98	0.391	0.01	0.390	74.08
D-I*pH5.75	25.3923	50.09	0.409	0.01	0.410	75.89
D-I*pH6.00	26.3262	50.19	0.429	0.01	0.430	76.95
D-I*pH6.25	25.5942	49.84	0.460	0.01	0.460	75.89
D-I*pH6.50	23.4555	49.96	0.102	0.05	0.100	73.52
D-I*pH6.75	25.8656	49.83	0.120	0.05	0.120	75.82
D-I*pH7.00	26.5961	50.10	0.151	0.05	0.150	76.85
D-I*pH7.25	26.4763	49.97	0.207	0.05	0.210	76.66
D-I*pH7.50	26.4760	50.16	0.306	0.05	0.310	76.95
D-I*pH7.75	27.9446	49.92	0.242	0.1	0.240	78.10
D-I*pH8.00	24.6219	49.92	0.403	0.1	0.400	74.94
D-I*pH8.25	25.7040	49.95	0.139	0.5	0.140	75.79
D-I*pH8.50	24.4867	49.95	0.248	0.5	0.250	74.69
D-I*pH8.75	27.7681	49.89	0.228	1	0.230	77.89
D-I*pH9.00	25.5577	49.82	0.436	1	0.440	75.82
D-I-C*pH2.0	28.5465	50.05	0.602	1	0.600	79.20
D-I-C*pH4.0	26.5471	49.98	0.102	0.02	0.100	76.63
D-I-C*pH5.0	22.6945	50.10	0.342	0.01	0.340	73.13
D-I-C*pH5.5	26.7128	50.10	0.391	0.01	0.390	77.20
D-I-C*pH6.0	25.9355	50.13	0.429	0.01	0.430	76.50
D-I-C*pH6.5	26.8624	50.20	0.102	0.05	0.100	77.16
D-I-C*pH7.0	26.2826	50.21	0.151	0.05	0.150	76.64
D-I-C*pH7.5	27.6835	50.01	0.306	0.05	0.310	78.00
D-I-C*pH8.0	26.7129	49.90	0.403	0.1	0.400	77.01
D-I-C*pH9.5	26.7113	50.01	2.000	1	2.000	78.72

This is the weight of the empty bottle with the lid on.

From GC-07-pge300-301 Expt. B-IB

BOLD values are for NaHCO3

Page 1
D-I Startup Weights and pH Adjustments

13 JUNE 1994 TD EXPERIMENT S-ID (This page should be in GC-06 TD 6/24/94)

Since the S-ID solutions have had suffcient time to equilibrate, the solutions were sampled, the pH measured and the tubes and solutions weighed. A 500 µL sample of each was taken. The pH was also measured. The weight of the solutions was measured BEFORE sampling or pH measurements.

S-ID.XLS

SOLN. NAME	WT TUBE (g)	pH	T (C)	WT CLAY ADDED (g)	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
S-ID*pH2.00	72.89	1.95	21.4	0.00105	7.7999	8.2989	0.4990
S-ID*pH2.25	72.03	2.18	21.4	0.00110	7.7610	8.2604	0.4994
S-ID*pH2.50	72.21	2.42	21.4	0.00108	8.2764	8.7783	0.5019
S-ID*pH2.75	69.77	2.69	21.4	0.00098	7.7881	8.2892	0.5011
S-ID*pH3.00	72.04	2.94	21.4	0.00103	7.7703	8.2710	0.5007
S-ID*pH3.25	72.11	3.25	21.5	0.00102	7.8204	8.3203	0.4999
S-ID*pH3.50	72.51	3.49	21.5	0.00109	7.7953	8.2940	0.4987
S-ID*pH3.75	70.72	3.77	21.5	0.00099	7.7883	8.2874	0.4991
S-ID*pH4.00	71.80	3.99	21.5	0.00104	7.8234	8.3201	0.4967
S-ID*pH4.25	72.38	4.28	21.5	0.00106	7.8081	8.3069	0.4988
S-ID*pH4.50	73.31	4.56	21.5	0.00112	7.7849	8.2839	0.4990
S-ID*pH4.75	71.66	4.86	21.5	0.00099	7.7534	8.2529	0.4995
S-ID*pH5.00	72.12	5.21	21.5	0.00107	7.8191	8.3211	0.5020
S-ID*pH5.25	72.35	5.44	21.5	0.00100	7.7921	8.2875	0.4954
S-ID*pH5.50	71.41	5.64	21.5	0.00111	7.7791	8.2807	0.5016
S-ID*pH5.75	72.28	5.75	21.5	0.00109	7.7913	8.2892	0.4979
S-ID*pH6.00	73.60	5.89	21.5	0.00109	7.8339	8.3310	0.4971
S-ID*pH6.25	73.60	6.14	21.6	0.00107	7.8060	8.3030	0.4970
S-ID*pH6.50	72.30	6.41	21.6	0.00102	7.7719	8.2598	0.4879
S-ID*pH6.75	72.16	6.67	21.6	0.00106	7.7658	8.2666	0.5008
S-ID*pH7.00	73.30	6.81	21.6	0.00103	7.7517	8.2538	0.5021
S-ID*pH7.25	71.84	7.09	21.7	0.00101	7.7951	8.2974	0.5023
S-ID*pH7.50	71.42	7.32	21.7	0.00110	7.8243	8.3230	0.4987
S-ID*pH7.75	71.34	7.60	21.7	0.00097	7.8154	8.3194	0.5040
S-ID*pH8.00	72.11	7.88	21.8	0.00107	7.8196	8.3154	0.4958
S-ID*pH8.25	70.46	8.15	21.8	0.00108	7.7415	8.2441	0.5026
S-ID*pH8.50	70.84	8.38	21.8	0.00107	7.7799	8.2842	0.5043
S-ID*pH8.75	71.72	8.66	21.8	0.00110	7.8213	8.3231	0.5018
S-ID*pH9.00	70.81	8.90	21.8	0.00109	7.8012	8.2999	0.4987
S-ID-C*pH2.0	72.57	1.93	21.8	n.a.	7.8007	8.3011	0.5004
S-ID-C*pH4.0	72.63	4.01	21.8	n.a.	7.7862	8.2823	0.4961
S-ID-C*pH5.0	73.01	5.25	21.9	n.a.	7.8117	8.3111	0.4994
S-ID-C*pH5.5	70.96	5.45	21.9	n.a.	7.7200	8.2191	0.4991
S-ID-C*pH6.0	72.47	5.87	21.9	n.a.	7.8408	8.3400	0.4992
S-ID-C*pH6.5	71.38	6.42	21.9	n.a.	7.8255	8.3248	0.4993
S-ID-C*pH7.0	71.75	6.83	21.9	n.a.	7.7368	8.2323	0.4955
S-ID-C*pH7.5	72.51	7.30	21.9	n.a.	7.7743	8.2732	0.4989
S-ID-C*pH8.0	72.63	7.89	21.9	n.a.	7.7158	8.2160	0.5002
S-ID-C*pH9.5	73.28	9.26	21.9	n.a.	7.7373	8.2419	0.5046
S-ID*IU	n.a.	n.a.	n.a.	n.a.	7.8332	8.3302	0.4970

Page 1
S-ID Data from the Initial Sampling and Clay Addition

0.001 ± 10% g Na-montmorillonite was added to each tube (not the ...-C solutions). The clay was weighed on the Sartorius balance in the Corrosion Lab.

14 JUNE 1994 TD VERIFICATION OF CALCULATIONS

This entry is to verify and explain the calculations used in the liquid scintillation analysis of aqueous ^{233}U solutions. The first step is to correct the cpm B column for the mass of the aliquot. This is done to get the activity ~~for~~ TD 6/14/94 per gram of sample using the following equation.

$$A = \frac{\text{cpm B}}{\text{wt. aliquot (g)}}$$

This result is given in the column entitled "MASS CONV." The next step is to convert the counts per gram to atoms per gram of solution.

$$N = \frac{A}{\lambda}$$

$$\lambda = \text{decay constant} = \frac{\ln 2}{\text{½ life}} = \frac{\ln 2}{\text{½ life (min)}} = 8.6477 \times 10^{-12} \ \frac{\text{decay}}{\text{min}}$$

result TD 6/14/94

This can be found in "ATOM CONV."
The number of moles is then calculated from the number of atoms by dividing by Avagadro's number.

$$\text{Moles} = \frac{N}{6.023 \times 10^{23}}$$

The result is given in "MOLE CONV." The number of moles is ~~converted~~ TD 6/14/94 converted to grams and then to ppb ^{233}U.

$$\text{GRAMS} = (\text{Moles})(233.039629 \ \tfrac{g}{mol})$$

$$\text{ppb } ^{233}U = \frac{\text{GRAMS}}{1 \times 10^{-9}}$$

The result can be found in the "ppb ^{233}U" column.
233.039629 is the atomic weight of ^{233}U.

An example can be found on the next page

EXAMPLE

CPM B = 500, wt of aliquot = 0.5000 g

$A = {}^{500}/_{0.5000} = 1000\ {}^{counts}/_{g}$

$N = \frac{A}{\lambda} = \frac{1000\ counts/g}{8.6427 \times 10^{-12}\ counts} = \frac{1.1564 \times 10^{14}}{\text{TD } 6/14/94} = \frac{1.1564 \times 10^{14}}{} \text{ atoms}$

$MOLES = \frac{N}{6.023 \times 10^{23}} = \frac{\text{TD } 6/14/94}{1.9199 \times 10^{-10}} \quad 1.9199 \times 10^{-10}$

$GRAMS = MOLES\ (233.039629) = 4.4742 \times 10^{-8}$

$ppb\ ^{233}U = \frac{GRAMS}{10^{-9}} = 44.74\ ppb\ ^{233}U$

23 JUNE 1994 TD EXPERIMENT D-I

The D-I solutions have had sufficient time to equilibrate. A 500 µl sample was taken from each and 1.00 g zeolite (Na-clinoptilolite) was added to each, except the control solutions (D-I-C*...). The solutions also had their pH measured. They were then returned to the gyratory shaker. Solution weights were ~~TD~~ 6/23/94 measured BEFORE sampling and pH measurements.

D-I.XLS

SOLN. NAME	WT BOTTLE (g)	pH	T (C)	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)	WT ZEOLITE ADDED (g)
D-I*pH2.00	78.48	1.97	22.6	7.7746	8.2731	0.4985	1.0006
D-I*pH2.25	76.52	2.21	22.6	7.6865	8.1813	0.4948	1.0004
D-I*pH2.50	75.24	2.45	22.6	7.6916	8.1881	0.4965	0.9997
D-I*pH2.75	76.50	2.70	22.6	7.6502	8.1443	0.4941	1.0014
D-I*pH3.00	77.24	2.95	22.6	7.7223	8.2241	0.5018	1.0005
D-I*pH3.25	71.79	3.18	22.6	7.7087	8.2035	0.4948	1.0010
D-I*pH3.50	75.06	3.44	22.6	7.6844	8.1831	0.4987	1.0008
D-I*pH3.75	77.61	3.67	22.6	7.6915	8.1898	0.4983	0.9997
D-I*pH4.00	76.65	3.94	22.6	7.6913	8.1877	0.4964	1.0007
D-I*pH4.25	75.30	4.24	22.6	7.6809	8.1754	0.4945	0.9998
D-I*pH4.50	76.95	4.51	22.6	7.6817	8.1819	0.5002	1.0001
D-I*pH4.75	77.04	4.80	22.7	7.6400	8.1354	0.4954	1.0001
D-I*pH5.00	76.28	5.10	22.7	7.6728	8.1665	0.4937	0.9991
D-I*pH5.25	75.19	5.44	22.7	7.7174	8.2127	0.4953	1.0000
D-I*pH5.50	73.89	5.51	22.7	7.6923	8.1864	0.4941	1.0001
D-I*pH5.75	75.69	5.78	22.7	7.7070	8.2061	0.4991	1.0007
D-I*pH6.00	76.79	6.06	22.7	7.7355	8.2306	0.4951	1.0001
D-I*pH6.25	75.72	6.20	22.7	7.6639	8.1607	0.4968	1.0000
D-I*pH6.50	73.26	6.36	22.8	7.6870	8.1846	0.4976	0.9997
D-I*pH6.75	75.61	6.58	22.8	7.7113	8.2081	0.4968	1.0003
D-I*pH7.00	76.66	6.82	22.8	7.7428	8.2417	0.4989	1.0009
D-I*pH7.25	76.48	7.08	22.8	7.6612	8.1455	0.4943	0.9994
D-I*pH7.50	76.71	7.30	22.9	7.7027	8.2006	0.4979	0.9993
D-I*pH7.75	77.90	7.50	22.9	7.6508	8.1444	0.4936	0.9998
D-I*pH8.00	74.68	7.79	22.9	7.6653	8.1578	0.4925	0.9998
D-I*pH8.25	75.61	8.09	22.9	7.6646	8.1605	0.4959	1.0004
D-I*pH8.50	74.52	8.35	23.0	7.7002	8.1940	0.4938	0.9999
D-I*pH8.75	77.66	8.60	23.0	7.7082	8.2012	0.4930	0.9997
D-I*pH9.00	75.60	8.91	23.0	7.7694	8.2670	0.4976	0.9999
D-I-C*pH2.0	79.10	1.92	23.0	7.6638	8.1610	0.4972	n.a.
D-I-C*pH4.0	76.40	3.95	23.0	7.6921	8.1835	0.4914	n.a.
D-I-C*pH5.0	72.95	5.10	23.0	7.7131	8.2097	0.4966	n.a.
D-I-C*pH5.5	77.02	5.51	23.0	7.7251	8.2207	0.4956	n.a.
D-I-C*pH6.0	76.30	6.02	23.0	7.7044	8.2072	0.5028	n.a.
D-I-C*pH6.5	76.98	6.39	23.1	7.6767	8.1709	0.4942	n.a.
D-I-C*pH7.0	76.47	6.77	23.1	7.7312	8.2263	0.4951	n.a.
D-I-C*pH7.5	77.78	7.30	23.1	7.6761	8.1723	0.4962	n.a.
D-I-C*pH8.0	76.84	7.81	23.1	7.6830	8.1769	0.4939	n.a.
D-I-C*pH9.5	78.63	9.25	23.1	7.6786	8.1735	0.4949	n.a.
D-I*IU	n.a.	n.a.	n.a.	7.7160	8.2096	0.4936	n.a.

Page 1
D-I = pH, soln wt, sample wt and zeolite wt.

29 JUNE 1994 TD EXPERIMENT ~~D-I~~ TD 29 Jun D-I

The liquid scintillation analysis of the D-I initial samples has finished. Raw data and the results of calculations follow.

Protocol #:18 Name:U-233 3% 2 sigma 28-Jun-94 14:09
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	19.91	1.42	3.242	3.51	29.41	1.17	138.42	B
2	8.21	0.67	474.4	538.171	3.02	538.31	3.09	731.45	
3	8.51	1.94	165.7	519.085	3.02	525.23	3.07	730.92	
4	8.50	0.56	560.3	519.817	3.02	521.88	3.09	735.13	
5	8.57	2.72	119.8	515.311	3.02	520.41	3.08	733.61	
6	8.69	0.91	340.1	508.265	3.02	510.41	3.09	735.35	
7	8.57	4.82	70.69	515.311	3.02	521.23	3.08	730.11	
8	8.19	3.04	110.5	539.859	3.02	544.09	3.08	731.83	
9	8.44	1.29	246.0	523.535	3.02	526.63	3.08	732.47	
10	9.25	5.06	65.20	477.190	3.02	482.16	3.09	726.62	
11	9.55	0.00	0.00	462.098	3.02	461.06	3.11	735.34	
12	10.81	0.00	0.00	408.044	3.02	408.15	3.12	737.66	
13	10.21	0.46	620.2	432.115	3.02	434.64	3.10	731.10	
14	21.77	1.26	158.0	200.892	3.05	202.61	3.23	728.47	
15	13.29	0.00	0.00	331.145	3.03	330.56	3.15	735.71	
16	14.06	3.98	65.84	312.903	3.03	319.38	3.12	725.45	
17	16.67	1.98	116.6	263.345	3.04	267.35	3.16	726.39	
18	34.49	2.03	79.66	125.607	3.08	129.77	3.32	724.65	
19	19.63	0.00	0.00	223.248	3.04	224.08	3.21	733.67	
20	13.58	1.74	146.5	324.225	3.03	327.81	3.13	723.12	
21	14.03	0.00	0.00	313.864	3.03	314.85	3.15	732.71	
22	11.96	1.91	142.3	368.748	3.02	371.34	3.12	727.68	
23	12.52	0.00	0.00	351.790	3.03	354.06	3.13	731.80	
24	9.46	5.46	60.28	466.948	3.02	473.02	3.08	724.88	
25	11.16	0.00	0.00	394.966	3.02	394.78	3.12	732.53	
26	8.86	1.64	190.6	498.451	3.02	501.74	3.09	725.16	
27	8.58	2.81	116.2	515.056	3.02	520.01	3.08	724.51	
28	8.52	0.00	0.00	518.706	3.02	518.36	3.09	734.77	
29	8.56	0.18	1719.	516.267	3.02	521.17	3.08	735.20	
30	8.48	0.00	0.00	520.815	3.02	521.18	3.09	734.57	
31	8.40	3.42	97.85	526.044	3.02	530.83	3.08	727.17	
32	9.18	3.40	94.18	480.854	3.02	486.38	3.08	728.18	
33	24.47	0.00	0.00	178.368	3.06	178.52	3.27	735.36	
34	27.38	0.00	0.00	159.139	3.06	159.41	3.30	737.83	
35	24.02	1.11	170.5	181.770	3.05	184.58	3.24	732.91	
36	16.70	1.76	130.3	262.926	3.04	265.14	3.17	710.84	
37	12.61	1.66	158.9	349.177	3.03	352.75	3.12	727.58	
38	9.39	0.00	0.00	470.240	3.02	471.44	3.10	728.55	
39	8.52	2.03	158.4	518.824	3.02	521.06	3.09	728.55	
40	8.47	2.16	149.8	521.433	3.02	525.84	3.08	729.31	
41	8.34	4.07	83.69	529.612	3.02	536.66	3.07	722.67	

SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED

D-I.XLS

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
D-I*pH2.00	2	538.17	1079.579	1.2484E+14	2.0727E-10	48.3026
D-I*pH2.25	3	519.08	1049.070	1.2131E+14	2.0141E-10	46.9376
D-I*pH2.50	4	519.82	1046.969	1.2107E+14	2.0101E-10	46.8436
D-I*pH2.75	5	515.31	1042.927	1.2060E+14	2.0024E-10	46.6627
D-I*pH3.00	6	508.27	1012.894	1.1713E+14	1.9447E-10	45.3190
D-I*pH3.25	7	515.31	1041.451	1.2043E+14	1.9995E-10	46.5967
D-I*pH3.50	8	539.86	1082.535	1.2518E+14	2.0784E-10	48.4349
D-I*pH3.75	9	523.54	1050.652	1.2149E+14	2.0172E-10	47.0084
D-I*pH4.00	10	477.19	961.301	1.1116E+14	1.8456E-10	43.0106
D-I*pH4.25	11	462.10	934.479	1.0806E+14	1.7941E-10	41.8106
D-I*pH4.50	12	408.04	815.754	9.4332E+13	1.5662E-10	36.4985
D-I*pH4.75	13	432.12	872.265	1.0087E+14	1.6747E-10	39.0270
D-I*pH5.00	14	200.89	406.907	4.7054E+13	7.8124E-11	18.2059
D-I*pH5.25	15	331.14	668.565	7.7311E+13	1.2836E-10	29.9130
D-I*pH5.50	16	312.90	633.273	7.3230E+13	1.2158E-10	28.3339
D-I*pH5.75	17	263.34	527.630	6.1014E+13	1.0130E-10	23.6073
D-I*pH6.00	18	125.61	253.706	2.9338E+13	4.8710E-11	11.3514
D-I*pH6.25	19	223.25	449.376	5.1965E+13	8.6277E-11	20.1060
D-I*pH6.50	20	324.22	651.568	7.5346E+13	1.2510E-10	29.1525
D-I*pH6.75	21	313.86	631.763	7.3056E+13	1.2129E-10	28.2664
D-I*pH7.00	22	368.75	739.126	8.5471E+13	1.4191E-10	33.0700
D-I*pH7.25	23	351.79	711.693	8.2299E+13	1.3664E-10	31.8426
D-I*pH7.50	24	466.95	937.839	1.0845E+14	1.8006E-10	41.9609
D-I*pH7.75	25	394.97	800.182	9.2531E+13	1.5363E-10	35.8018
D-I*pH8.00	26	498.45	1012.081	1.1703E+14	1.9431E-10	45.2826
D-I*pH8.25	27	515.06	1038.637	1.2011E+14	1.9941E-10	46.4708
D-I*pH8.50	28	518.71	1050.446	1.2147E+14	2.0168E-10	46.9991
D-I*pH8.75	29	516.27	1047.201	1.2110E+14	2.0106E-10	46.8540
D-I*pH9.00	30	520.81	1046.644	1.2103E+14	2.0095E-10	46.8290
D-I-C*pH2.0	31	526.04	1058.005	1.2235E+14	2.0313E-10	47.3374
D-I-C*pH4.0	32	480.85	978.531	1.1316E+14	1.8787E-10	43.7815
D-I-C*pH5.0	33	178.37	359.182	4.1535E+13	6.8961E-11	16.0706
D-I-C*pH5.5	34	159.14	321.106	3.7132E+13	6.1650E-11	14.3669
D-I-C*pH6.0	35	181.77	361.516	4.1805E+13	6.9409E-11	16.1750
D-I-C*pH6.5	36	262.93	532.032	6.1523E+13	1.0215E-10	23.8042
D-I-C*pH7.0	37	349.18	705.272	8.1556E+13	1.3541E-10	31.5553
D-I-C*pH7.5	38	470.24	947.682	1.0959E+14	1.8195E-10	42.4013
D-I-C*pH8.0	39	518.82	1050.456	1.2147E+14	2.0168E-10	46.9996
D-I-C*pH9.5	40	521.43	1053.607	1.2184E+14	2.0229E-10	47.1406
D-I*IU	41	529.61	1072.954	1.2407E+14	2.0600E-10	48.0062
VALIDATION		500.00	1000.000	1.1564E+14	1.9199E-10	44.7421

Calculations verified on pgs 143-144 of this notebook.

11 July 1994 TD EXPERIMENT D-I

Final samples of this experiment were taken today. pH of each solution was also measured. The weight of the bottle was measured BEFORE sampling and pH measurement. Samples were prepared for liquid Scintillation analysis.

D-I.XLS

SOLN. NAME	WT BOTTLE (g)	pH	T (C)	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
D-I*pH2.00	78.67	2.36	24.8	7.6231	8.1244	0.5013
D-I*pH2.25	76.74	2.30	24.8	7.7079	8.2125	0.5046
D-I*pH2.50	75.50	2.88	24.8	7.6975	8.2006	0.5031
D-I*pH2.75	76.75	3.26	24.9	7.6668	8.1700	0.5032
D-I*pH3.00	77.47	3.64	24.9	7.7187	8.2225	0.5038
D-I*pH3.25	72.07	4.06	24.9	7.7198	8.2215	0.5017
D-I*pH3.50	75.33	4.46	24.9	7.7072	8.2120	0.5048
D-I*pH3.75	77.73	4.78	24.9	7.6468	8.1449	0.4981
D-I*pH4.00	76.90	5.07	24.9	7.6365	8.1369	0.5004
D-I*pH4.25	TD 7/11/94 77.15	5.51	25.0	7.6500	8.1505	0.5005
D-I*pH4.50	75.51	5.40	25.0	7.7003	8.2004	0.5001
D-I*pH4.75	77.30	5.72	25.0	7.7528	8.2504	0.4976
D-I*pH5.00	76.53	5.80	25.0	7.6944	8.1947	0.5003
D-I*pH5.25	75.36	6.07	25.1	7.6887	8.1877	0.4990
D-I*pH5.50	74.17	6.13	25.1	7.7384	8.2369	0.4985
D-I*pH5.75	75.91	6.18	25.1	7.7899	8.2889	0.4990
D-I*pH6.00	77.00	6.23	25.2	7.7171	8.2170	0.4999
D-I*pH6.25	75.91	6.29	25.2	7.7157	8.2166	0.5009
D-I*pH6.50	73.49	6.37	25.2	7.7505	8.2559	0.5054
D-I*pH6.75	75.89	6.55	25.2	7.7528	8.2512	0.4984
D-I*pH7.00	76.87	6.77	25.2	7.7918	8.2924	0.5006
D-I*pH7.25	76.73	7.02	25.4	7.6920	8.1950	0.5030
D-I*pH7.50	76.87	7.27	25.4	7.7420	8.2423	0.5003
D-I*pH7.75	78.15	7.45	25.6	7.7572	8.2600	0.5028
D-I*pH8.00	74.93	7.70	25.6	7.7978	8.2979	0.5001
D-I*pH8.25	75.79	8.14	25.7	7.8069	8.3059	0.4990
D-I*pH8.50	74.71	8.34	25.7	7.7207	8.2202	0.4995
D-I*pH8.75	77.91	8.61	25.7	7.7652	8.2655	0.5003
D-I*pH9.00	75.80	8.91	25.7	7.6644	8.1655	0.5011
D-I-C*pH2.0	78.39	1.92	25.7	7.7800	8.2801	0.5001
D-I-C*pH4.0	75.68	4.03	25.8	7.7391	8.2397	0.5006
D-I-C*pH5.0	72.20	5.07	25.8	7.7193	8.2202	0.5009
D-I-C*pH5.5	76.26	5.48	25.8	7.7133	8.2129	0.4996
D-I-C*pH6.0	75.32	6.00	25.8	7.7354	8.2326	0.4972
D-I-C*pH6.5	76.27	6.41	25.8	7.7100	8.2114	0.5014
D-I-C*pH7.0	75.80	6.80	25.8	7.7665	8.2666	0.5001
D-I-C*pH7.5	77.01	7.33	25.8	7.7661	8.2667	0.5006
D-I-C*pH8.0	76.16	7.81	25.8	7.7304	8.2316	0.5012
D-I-C*pH9.5	77.60	9.27	25.8	7.7866	8.2861	0.4995

21 July 1994 TD EXPERIMENT D-I

The ~~TD 7/11/94~~ L.S. Analysis of the samples has finished. Raw data and results of calculations follow.

14 Jul 94 11:25 ALPHA/BETA - 1.02 Page #2
Protocol #:17 U-233 3% 2 sigma User : Todd Dietrich

55	8.65	2.18	143.8	511.155	3.02	513.15	3.08	697.29
56	8.54	2.34	135.6	517.312	3.02	521.52	3.08	700.67
57	8.82	2.80	112.8	500.788	3.02	505.33	3.08	695.52
58	9.30	1.03	286.9	474.777	3.02	476.09	3.09	702.31
59	11.16	3.79	75.78	395.386	3.02	400.72	3.09	694.63
60	15.55	1.09	209.7	282.608	3.03	284.51	3.15	697.39
61	22.82	1.23	154.8	191.561	3.05	192.73	3.23	696.95
62	40.21	0.00	0.00	107.365	3.09	107.02	3.44	700.05
63	84.16	0.00	0.00	49.624	3.20	48.74	3.97	721.40
64	132.06	0.00	0.00	30.471	3.33	30.32	4.51	711.58
65	159.59	0.00	0.00	24.673	3.42	23.89	4.96	727.33
66	156.44	0.00	0.00	25.227	3.41	24.97	4.84	712.14
67	180.97	0.00	0.00	21.388	3.49	21.33	5.13	715.01
68	188.47	0.00	0.00	20.405	3.51	19.83	5.34	725.07
69	211.52	0.00	0.00	17.830	3.59	16.86	5.80	749.98
70	212.30	0.00	0.00	17.753	3.59	17.88	5.51	712.60
71	202.82	0.00	0.00	18.736	3.56	18.17	5.55	727.42
72	207.42	0.00	0.00	18.245	3.58	18.18	5.49	711.93
73	178.89	0.00	0.00	21.662	3.48	21.52	5.12	710.28
74	195.90	0.00	0.00	19.505	3.54	18.10	5.65	755.35
75	160.96	0.00	0.00	24.436	3.42	24.53	4.84	707.33
76	110.17	0.00	0.00	37.158	3.27	37.12	4.23	708.15
77	78.77	0.00	0.00	53.237	3.19	53.23	3.86	709.25
78	63.57	0.45	250.9	66.727	3.15	67.98	3.64	697.46
79	25.21	1.53	118.9	173.179	3.06	175.16	3.25	695.52
80	12.27	3.11	86.64	359.249	3.03	362.61	3.11	697.67
81	9.49	3.26	94.26	465.945	3.02	470.12	3.08	698.11
82	8.48	3.79	86.84	520.995	3.02	525.05	3.08	699.75
83	8.58	3.99	82.35	514.885	3.02	521.06	3.07	694.63
84	8.44	2.83	114.1	523.360	3.02	527.91	3.07	701.74
85	9.24	8.41	41.08	478.097	3.02	487.27	3.07	689.27
86	19.15	1.29	161.2	228.987	3.04	231.28	3.18	698.83
87	23.35	0.00	0.00	187.184	3.05	187.51	3.24	702.94
88	19.79	2.75	76.72	221.378	3.04	225.18	3.18	689.94
89	16.00	1.96	117.3	274.757	3.03	277.35	3.15	694.42
90	12.00	4.03	69.10	367.153	3.03	372.89	3.10	693.10
91	9.43	1.81	164.6	468.718	3.02	472.75	3.08	696.59
92	8.60	5.79	58.77	514.262	3.02	521.41	3.07	690.11
93	8.46	1.95	162.0	522.115	3.02	526.12	3.08	697.79

D-I.XLS

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
D-I*pH2.00	55	511.155	1019.659	1.1791E+14	1.9577E-10	45.6217
D-I*pH2.25	56	517.312	1025.192	1.1855E+14	1.9683E-10	45.8692
D-I*pH2.50	57	500.788	995.404	1.1511E+14	1.9111E-10	44.5365
D-I*pH2.75	58	474.777	943.516	1.0911E+14	1.8115E-10	42.2149
D-I*pH3.00	59	395.386	784.807	9.0753E+13	1.5068E-10	35.1139
D-I*pH3.25	60	282.608	563.301	6.5139E+13	1.0815E-10	25.2033
D-I*pH3.50	61	191.561	379.479	4.3882E+13	7.2858E-11	16.9787
D-I*pH3.75	62	107.365	215.549	2.4926E+13	4.1384E-11	9.6441
D-I*pH4.00	63	49.624	99.169	1.1468E+13	1.9040E-11	4.4370
D-I*pH4.25	64	30.471	60.881	7.0402E+12	1.1689E-11	2.7239
D-I*pH4.50	65	24.673	49.336	5.7051E+12	9.4722E-12	2.2074
D-I*pH4.75	66	25.227	50.697	5.8625E+12	9.7336E-12	2.2683
D-I*pH5.00	67	21.388	42.750	4.9436E+12	8.2078E-12	1.9127
D-I*pH5.25	68	20.405	40.892	4.7286E+12	7.8510E-12	1.8296
D-I*pH5.50	69	17.830	35.767	4.1360E+12	6.8671E-12	1.6003
D-I*pH5.75	70	17.753	35.577	4.1141E+12	6.8306E-12	1.5918
D-I*pH6.00	71	18.736	37.479	4.3340E+12	7.1958E-12	1.6769
D-I*pH6.25	72	18.245	36.424	4.2120E+12	6.9933E-12	1.6297
D-I*pH6.50	73	21.662	42.861	4.9564E+12	8.2291E-12	1.9177
D-I*pH6.75	74	19.505	39.135	4.5255E+12	7.5137E-12	1.7510
D-I*pH7.00	75	24.436	48.813	5.6447E+12	9.3719E-12	2.1840
D-I*pH7.25	76	37.158	73.873	8.5425E+12	1.4183E-11	3.3052
D-I*pH7.50	77	53.237	106.410	1.2305E+13	2.0430E-11	4.7610
D-I*pH7.75	78	66.727	132.711	1.5346E+13	2.5480E-11	5.9378
D-I*pH8.00	79	173.179	346.289	4.0044E+13	6.6485E-11	15.4937
D-I*pH8.25	80	359.249	719.938	8.3252E+13	1.3822E-10	32.2115
D-I*pH8.50	81	465.945	932.823	1.0787E+14	1.7910E-10	41.7364
D-I*pH8.75	82	520.995	1041.365	1.2042E+14	1.9994E-10	46.5929
D-I*pH9.00	83	514.885	1027.509	1.1882E+14	1.9728E-10	45.9729
D-I-C*pH2.0	84	523.360	1046.511	1.2102E+14	2.0092E-10	46.8231
D-I-C*pH4.0	85	478.097	955.048	1.1044E+14	1.8336E-10	42.7308
D-I-C*pH5.0	86	228.987	457.151	5.2864E+13	8.7770E-11	20.4539
D-I-C*pH5.5	87	187.184	374.668	4.3326E+13	7.1934E-11	16.7634
D-I-C*pH6.0	88	221.378	445.249	5.1488E+13	8.5485E-11	19.9214
D-I-C*pH6.5	89	274.757	547.980	6.3367E+13	1.0521E-10	24.5178
D-I-C*pH7.0	90	367.153	734.159	8.4896E+13	1.4095E-10	32.8478
D-I-C*pH7.5	91	468.718	936.312	1.0827E+14	1.7977E-10	41.8926
D-I-C*pH8.0	92	514.262	1026.061	1.1865E+14	1.9700E-10	45.9081
D-I-C*pH9.5	93	522.115	1045.275	1.2087E+14	2.0069E-10	46.7678
VALIDATION		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

Calculations verified on pgs 143.144 of GC-11 (CNWRA controlled copy 081).

17 August 1994 TD

CONTAINER SORPTION EXPERIMENT **CS-I**

OBJECTIVE:

- To investigate the amount of competitive sorption present between the container walls and the zeolite mineral clinoptilolite.

EQUIPMENT:

Gyratory Shaker
Packard liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Analytical balance

SUPPLIES:

pH buffers for calibration of the meter (pH = 2,4,7,10)
40 60 mL FEP bottles (to contain experimental mixtures)
1 2000 mL FEP bottle (to prepare the 50 ppb solution)
various eppendorf pipets (for pH adjustment and samples)
scintillation vials
weighing paper
Na^+-clinoptilolite (CDV*100/200*UC*WA*HL*CPT*Naf)
1L 0.1 m $NaNO_3$
0.005 M $NaHCO_3$
0.01 M $NaHCO_3$
0.05 M $NaHCO_3$

PROCEDURE:

1. Prepare 1000 g of a 50 ppb ^{233}U solution by diluting 100 g of the 500 ppb spike to 1000 g using 0.1 m $NaNO_3$.

2. Tare 50 g of the 50 ppb ^{233}U solution into each of 20 precleaned, prelabeled and preweighed 60 mL FEP bottles.

3. Adjust the pH using the values in Table CS-I-1. Reweigh the bottle and solution. Loosely cap the bottles and place on a gyratory shaker to equilibrate with CO_2, about 14 days.

4. After pH equilibration, remove the bottles and reweigh to determine the amount lost to evaporation. Take a 500 μL sample of each mixture for liquid scintillation analysis. Make sure that the weight of the samples is known. Measure the pH of each solution. Reweigh each bottle. Add 0.1 ± 0.001 g

clinoptilolite to each bottle. Reweigh each bottle and return to the gyratory shaker. Allow the mixtures to equilibrate for 10–14 days.

5. Weigh each bottle. Take a 500 μL sample from each solution for liquid scintillation counting. Measure the pH of each solution.

6. Transfer all the solid to another preweighed bottle using an Eppendorf pipet. Make sure that all the solid is removed along with a minimum amount of liquid. Weigh the second bottle and then add 5 mL 0.1M HNO_3. Reweigh the first bottle and then add 0.5 mL 1M HNO_3. Return both sets of bottles to the gyratory shaker and allow them to equilibrate for 10–14 days.

7. After equilibration, weigh each bottle and take a 500 μL sample from each for liquid scintillation analysis. Dry the bottles containing the solid and weigh when dry.

Table CS-I-1

Mixture Label	Molality $NaHCO_3$ to Use	Vol (mL) $NaHCO_3$ to Use
CS-I*pH4.5	0.005	0.420
CS-I*pH4.7	0.01	0.280
CS-I*pH4.9	0.01	0.325
CS-I*pH5.1	0.01	0.350
CS-I*pH5.3	0.01	0.375
CS-I*pH5.5	0.01	0.390
CS-I*pH5.7	0.01	0.405
CS-I*pH5.9	0.01	0.420
CS-I*pH6.1	0.01	0.440
CS-I*pH6.2	0.01	0.450
CS-I*pH6.3	0.01	0.470
CS-I*pH6.4	0.01	0.490
CS-I*pH6.5	0.01	0.510
CS-I*pH6.6	0.05	0.110
CS-I*pH6.7	0.05	0.115
CS-I*pH6.8	0.05	0.125
CS-I*pH6.9	0.05	0.140
CS-I*pH7.1	0.05	0.170
CS-I*pH7.3	0.05	0.225
CS-I*pH7.5	0.05	0.310

Experiment CS-I was begun. 1000 g 0.1 m $NaNO_3$ was prepared by dissolving 8.50 g $NaNO_3$ in 1000 g H_2O.

1000 g of 50 ppb U solution was prepared by diluting 100 g of Spike 28A ([U] = 500 ppb) to 1000 g using 0.1 m $NaNO_3$.

NT SPIKE USED : 100.04 g

FINAL WT : 1002.0 g

The spike solution A (50 ppb) TD 8/17/94 was distributed into pre-weighed, pre-labeled TD 8/17/94 60 mL FEP bottles ~~and TD 8/17/94~~ in ~50 g aliquots. The weights of the empty bottles and solution can be found in the table below. The pH was adjusted according to Table CS-I-1. The solutions were then reweighed and placed on a gyratory shaker and allowed to equilibrate w/ CO_2. The bottles were loosely capped to allow equilibration.

NAME	WT BOTTLE EMPTY(g)	WT. SOL'N(g)	WT. AFTER ~~pH ADJUSTMENT~~ TD 8/17/94 (g)
CS-I*pH4.5	25.7233	50.00	76.2458
4.7	25.0304	49.57	75.0020
4.9	25.6782	49.70	75.8091
5.1	26.1387	49.52	76.1147
5.3	25.9476	49.78	76.2082
5.5	28.0939	49.98	78.5562
5.7	26.1851	50.08	76.7831
5.9	25.5708	49.81	75.9034
6.1	26.0034	49.74	76.3045
6.2	28.5042	50.10	79.1675
6.3	26.4942	49.52	76.6172
6.4	26.4079	49.62	76.6126
6.5	26.2945	49.72	76.6299
6.6	25.9916	49.84	75.9586
6.7	26.8980	49.87	76.9863
6.8	26.5279	50.09	76.8521
6.9	26.0389	49.54	75.8215
7.1	24.5133	49.75	74.5300
7.3	26.9620	49.77	77.0651
7.5	27.6698	49.85	77.9414

17 Aug 1994 TD EXPERIMENT CS-II

CONTAINER SORPTION EXPERIMENT **CS-II**

OBJECTIVE:

- To investigate the amount of competitive sorption present between the container walls and the zeolite mineral clinoptilolite.

EQUIPMENT:

Gyratory Shaker
Packard liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Analytical balance

SUPPLIES:

pH buffers for calibration of the meter (pH = 2,4,7,10)
40 60 mL FEP bottles (to contain experimental mixtures)
1 2000 mL FEP bottle (to prepare the 5 ppb solution)
various eppendorf pipets (for pH adjustment and samples)
scintillation vials
weighing paper
Na^+-clinoptilolite (CDV*100/200*UC*WA*HL*CPT*Naf)
1L 0.1 m $NaNO_3$
0.005 M $NaHCO_3$
0.01 M $NaHCO_3$
0.05 M $NaHCO_3$
0.005 M $NaHCO_3$
0.001 M $NaHCO_3$
0.001 M HNO_3
0.02 M HNO_3

PROCEDURE:

1. Prepare 1000 g of a 5 ppb ^{233}U solution by diluting 10 g of the 500 ppb spike to 1000 g using 0.1 m $NaNO_3$.

2. Tare 50 g of the 5 ppb ^{233}U solution into each of 20 precleaned, prelabeled and preweighed 60 mL FEP bottles.

3. Adjust the pH using the values in Table CS-II-1. Reweigh the bottle and solution. Loosely cap the bottles and place on a gyratory shaker to equilibrate with CO_2, about 14 days.

4. After pH equilibration, remove the bottles and reweigh to determine the amount lost to evaporation. Take a 500 µL sample of each mixture for liquid scintillation analysis. Make sure that the weight of the samples is known. Measure the pH of each solution. Reweigh each bottle. Add 0.1 ± 0.001 g clinoptilolite to each bottle. Reweigh each bottle and return to the gyratory shaker. Allow the mixtures to equilibrate for 10–14 days.

5. Weigh each bottle. Take a 500 µL sample from each solution for liquid scintillation counting. Measure the pH of each solution.

6. Transfer all the solid to another preweighed bottle using an Eppendorf pipet. Make sure that all the solid is removed along with a minimum amount of liquid. Weigh the second bottle and then add 5 mL 0.1M HNO_3. Reweigh the first bottle and then add 0.5 mL 1M HNO_3. Return both sets of bottles to the gyratory shaker and allow them to equilibrate for 10–14 days.

7. After equilibration, weigh each bottle and take a 500 µL sample from each for liquid scintillation analysis. Dry the bottles containing the solid and weigh when dry.

Table CS-II-1

Mixture Label	Molarity HNO_3 to Use	Vol (mL) to Use
CS-II*pH4.3	0.02	0.130
CS-II*pH4.5	0.02	0.075
CS-II*pH4.7	0.02	0.040
CS-II*pH4.9	0.001	0.330
CS-II*pH5.0	0.001	0.170
CS-II*pH5.1	0.001	0.035
	Molarity $NaHCO_3$ to Use	
CS-II*pH5.3	0.001	0.160
CS-II*pH5.5	0.001	0.320
CS-II*pH5.7	0.001	0.460
CS-II*pH5.9	0.005	0.120
CS-II*pH6.1	0.005	0.160
CS-II*pH6.3	0.005	0.220
CS-II*pH6.5	0.005	0.300
CS-II*pH6.6	0.005	0.360
CS-II*pH6.7	0.005	0.430
CS-II*pH6.9	0.01	0.320
CS-II*pH7.1	0.05	0.100
CS-II*pH7.3	0.05	0.150
CS-II*pH7.5	0.05	0.230
CS-II*pH7.7	0.05	0.370

1000 g 0.1m $NaNO_3$ was prepared by dissolving 8.50 g TD 8/17/94 $NaNO_3$ in 1000 g Di H_2O.

1000 g 5 ppb U solution was prepared by diluting 10 g Spike 28A TD 8/17/94 ([U] = 500 ppb) to 1000 g using 0.1 m $NaNO_3$.

WT. SPIKE USED: 10.96 g
FINAL WT: 1003.5

The 5 ppb solution was distributed into pre weighed, pre-labeled 60 mL FEP bottles in ~50 g aliquots. The pH of each solution was adjusted according to Table CS-II-1. After adjustment, the solutions were ~~returned~~ TD 8/17/94 placed on a gyratory shaker, loosely capped, and allowed to equilibrate w/ CO_2.

The bottle and solution weights can be found in the table below

NAME	WT. BOTTLE EMPTY(g)	WT SOLN (g)	WT. AFTER pH ADJUSTMENT(g)
CS-II* pH4.3	27.7876	49.74	77.7535
4.5	25.3563	49.84	75.3713
4.7	22.1532	50.13	72.4371
4.9	25.5587	50.04	76.0493
5.0	25.9067	49.90	76.0728
5.1	28.6185	49.76	78.5384 (5384 to 8/17/94)
5.3	24.5631	49.90	74.7257
5.5	28.6026	50.09	79.1268
5.7	28.6295	50.13	79.3634
5.9	24.5457	49.53	74.3078
6.1	25.9067	49.67	75.8485
6.3	26.0616	49.90	76.2880
6.5	22.9367	49.59	72.9496
6.6	27.0012	49.98	77.4609
6.7	26.8114	49.87	77.2402
6.9	25.1015	50.07	75.6154
7.1	25.9584	49.70	75.8844
7.3	22.4721	49.73	72.4430
7.5	25.9354	50.03	76.3353
7.7	28.0235	49.98	78.4923

31 August 1994 TD EXPERIMENT B-IC

Experiment B-IC was begun today. The procedure (to 9/2/94) is given on the following pages. This experiment is similar to B-IB with a few exceptions. All data will be entered on the data sheets at the end of the procedure. When entered, references will be made to the date (and page) when the measurement etc was made.

URANIUM SORPTION EXPERIMENT **B-IC**:
(Kd vs pH; Equilibrium with $pCO_2=10^{-3.50}$; ΣU=50 ppb; 0.1m $NaNO_3$)

WRITTEN BY: R.T. PABALAN
REVISION NO.: 0
DATE WRITTEN: August 22, 1994
DATE REVISED:

OBJECTIVE:

- To investigate the importance of uranium sorption on the zeolite mineral clinoptilolite as a function of solution pH, total uranium concentration and ionic strength. Experimental data will be correlated with uranium aqueous speciation.
- To investigate reversibility of uranium sorption reactions.
- To investigate the sorption of uranium on container walls.

Note: HNO_3 or $NaHCO_3$ solutions are used here to adjust the starting pH of the uranium solutions. The amounts of HNO_3 and $NaHCO_3$ needed to adjust the pH were calculated using EQ3 (neglecting the effects of H^+ ion-exchange at low pH). Weights of the bottles are measured at each step to account for evaporation losses.

EQUIPMENT:

Gyratory shaker or constant temperature shaker bath
Packard liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Automatic temperature compensator probe
Analytical balance

SUPPLIES:

	pH buffer (pH = 2,4,7,9,10)
2	60-ml polycarbonate bottle (to contain B-IC*IU)
29	60-ml polycarbonate bottles (to contain experimental mixtures)
21	15-ml polypropylene bottle (to contain B-ICD*pH*i*)
1	2000-ml polycarbonate bottle (for preparation of 50 ppb U solution)
1	5-ml Eppendorf pipet (for transferring 5 ml cocktail into scintillation vial)
1	0.5-ml Eppendorf fixed-volume micropipet (for taking samples and for transferring 0.02 M HNO_3 solution into scintillation vial)
various	Eppendorf micropipets (fixed- or variable-volume; for adding HNO_3 or $NaHCO_3$ solutions to uranium solutions)
	scintillation vials
	weighing paper
	Na-clinoptilolite (CDV*100/200*UC*WA*HL*CPT*Naf)
	reagent grade $NaHCO_3$
	500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
2 L	0.1 m $NaNO_3$ stock solution
1000 ml	stock solution of 1.0 m HNO_3
1000 ml	stock solution of 0.1 m HNO_3
1000 ml	stock solution of 0.02 m HNO_3
500 ml	stock solution of 1.0 m $NaHCO_3$

500 ml stock solution of 0.5 m $NaHCO_3$
500 ml stock solution of 0.1 m $NaHCO_3$
500 ml stock solution of 0.05 m $NaHCO_3$
500 ml stock solution of 0.01 m $NaHCO_3$
500 ml stock solution of 0.005 m $NaHCO_3$
ultrapure water

PROCEDURE:

Note: In transferring uranium solutions, avoid using glass or polypropylene labware.

Solution B-IC (1 bottle for each pH value)

- Initial $\sum U$ = 50 ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO_3 or $NaHCO_3$
- Initial volume = 50 ml
- Ionic strength = 0.1 m $NaNO_3$
- Wt. Na-clinoptilolite to use = 0.100±0.001
- Initial $[Na^+]$ = 0.1 m $NaNO_3$ + $[NaHCO_3]$ added
- $pCO_2 = 10^{-3.50}$ atm

a) Prepare 1600 g of 50 ppb U solution in a pre-cleaned 2-liter polycarbonate bottle by diluting 160 g of a 500 ppb stock solution (in 0.1 m $NaNO_3$ matrix; prepared previously from commercial 50 ppm ^{233}U spike) to a total of 1600 g by carefully taring 0.1 m $NaNO_3$ solution into the polycarbonate bottle on a Mettler 4600 balance.

b) Into each of 29 60-ml **preweighed** polycarbonate bottle labeled B-IC*pH*i* [where *i* is the approximate initial pH of the solution (see below)], tare 50 g of the 50 ppb uranium solution. Record the weight of each solution.

(Cap the bottles tightly at this time if pH adjustment is to be made at a later time, i.e., a few hours later).

Transfer the remaining solution into two 60-ml polycarbonate bottles labeled B-IC*IU*a (or *b). **Add 100 µL of 50% HNO_3 solution**, then mix thoroughly. Take two 0.5-ml samples from B-IC*IU with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IC-IU*a (or b)] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Swirl each vial to mix. Reweigh each vial and save for later analysis of uranium concentration by liquid scintillation counting.

c) For each solution B-IC*pH*i*

Adjust the pH of each solution to the approximate value *i* by adding HNO_3 or $NaHCO_3$ solution (with an Eppendorf micropipet). The approximate amount to be added is given in Table B-IC-1. Swirl the solutions by hand, then **reweigh** each bottle. *Do not measure the pH at this time.* Cap each bottle loosely, then place the bottles on a gyratory shaker set to ≈120 rpm. Leave the bottles on the shaker for about ten days to allow the solutions to reach equilibrium with atmospheric $CO_2(g)$.

d) After equilibrium with atmospheric $CO_2(g)$ has been reached, **reweigh** each bottle to determine any evaporative losses. From each solution B-IC*pH*i* , take a 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IC*IU-ph*ii*] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Swirl to mix. Reweigh each vial and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH of each solution B-IC*pH*i* . *Minimize the amount of time the glass electrode is in contact with the uranium solution. Make sure to rinse the electrode well before transferring into another solution.*

Reweigh each polycarbonate bottle to determine amount of solution lost during pH measurement and sampling.

e) Tare 0.100±0.001 gm of Na-clinoptilolite onto weighing paper, then carefully transfer into each of the B-IC*pH*i* bottles. **Reweigh** the bottles. Swirl each bottle by hand, replace the cover, then place on the shaker.

f) After equilibrium is reached (at least 10 days), **reweigh** each bottle to determine evaporative losses. Then take a 0.5-ml sample from each bottle B-IC*ph*i* with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IC-ph*i*] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Swirl to mix. Reweigh each vial and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of solutions B-IC*pH*i* . Make sure to rinse the pH electrode very well before transferring into another solution.

Reweigh each polycarbonate bottle to determine amount of solution lost during pH measurement and sampling.

Cap all bottles tightly if reverse or desorption experiments are not going to be done immediately.

g) Analyze the U concentration by liquid scintillation counting.

h) For mixtures listed in Table B-IC-2, conduct reversibility experiment:

Adjust the pH of the solutions B-IC*ph*i* listed in Table B-IC-2 up or down by about 1 pH unit by adding HNO_3 or $NaHCO_3$ solutions in the amounts given in the table. **Reweigh** each bottle. Swirl each bottle by hand, replace the cover, then place on the gyratory shaker.

After equilibrium is reached (at least 10 days), take a 0.5-ml sample from each solution using an Eppendorf pipet, transfer into pre-labeled (e.g., B-IC**R**-pH*i*) and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Swirl to mix and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of those solutions. Make sure to rinse the pH electrode very well before transferring into another solution.

Cap all bottles tightly to prevent evaporation.

i) For mixtures **not** listed in Table B-IC-2, conduct desorption experiment:

1) **Reweigh** each bottle to determine evaporative losses. Using an Eppendorf micropipet,

carefully retrieve as much of the solid phase as possible (taking care to minimize the amount of solution entrained with the solid). Transfer into pre-weighed and pre-labeled (i.e., B-ICD-pH*i*) 15-ml polypropylene bottles. **Reweigh** each polycarbonate and polypropylene bottle.

2) Add 3 ml of 0.1 m HNO_3 solution to each of the 15-ml polypropylene bottles; swirl to mix. **Reweigh** each polypropylene bottle.

3) To each of the remaining solutions in the polycarbonate bottles B-IC*pH*i*, add 0.5 ml of 50% HNO_3 solution; swirl to mix. **Reweigh** each polycarbonate bottle.

4) Allow at least ten days for all the solutions to equilibrate. Then take a **1.0**-ml sample from each solution using an Eppendorf pipet, transfer into pre-labeled (e.g., B-ICD-pH*i* or B-ICF-pH*i*) and pre-weighed scintillation vials (no acid needed). Reweigh each vial. Swirl to mix and save for later analysis of uranium concentration by liquid scintillation counting.

5) Cap all bottles tightly to prevent evaporation.

j) Analyze the U concentration by liquid scintillation counting.

PREPARATION:

1. Preclean:
   - 29 60-ml polycarbonate bottles (to contain experimental mixtures
   - 2 60-ml polycarbonate bottle (to contain B-IC*IU)
   - 21 15-ml polypropylene bottle (to contain B-ICD*pH*i*)
   - 1 2000-ml polycarbonate bottle (for preparation of 50 ppb U solution)

2. Prepare:
   - 500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
   - 2 L 0.1 m $NaNO_3$ stock solution
   - 1000 ml stock solution of 1.0 m HNO_3
   - 1000 ml stock solution of 0.1 m HNO_3
   - 1000 ml stock solution of 0.02 m HNO_3
   - 500 ml stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml solution)
   - 500 ml stock solution of 0.5 M $NaHCO_3$ (21.003 in 500 ml solution)
   - 500 ml stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml solution)
   - 500 ml stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml solution)
   - 500 ml stock solution of 0.01 M $NaHCO_3$ (0.4201 g in 500 ml solution)
   - 500 ml stock solution of 0.005 M $NaHCO_3$ (0.2100 g in 500 ml solution)

The $NaHCO_3$ solutions should be prepared with *degassed* deionized water and kept in tightly-capped glass reagent bottles.

Table B-IC-1. Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to 50 ml 0.1 m $NaNO_3$ solution containing 50 ppb U to result in pH values given in column-1. The amount of reagent to be added was estimated using EQ3 calculations (and rounded off to nearest 10 microliters).

Solution pH	Volume of HNO_3 needed, microliters	Molarity of HNO_3 to use
2.00	600	1
2.25	340	1
2.50	190	1
2.75	100	1
3.00	560	0.1
3.25	300	0.1
3.50	150	0.1
3.75	330	0.02
4.00	100	0.02
Solution pH	**Volume of $NaHCO_3$ needed, microliters**	**Molarity of $NaHCO_3$ solution to use**
4.25	120	.005
4.5	210	0.01
4.75	290	0.01
5	340	0.01
5.25	370	0.01
5.5	390	0.01
5.75	410	0.01
6	430	0.01
6.25	460	0.01
6.5	100	0.05
6.75	120	0.05
7	150	0.05
7.25	210	0.05
7.5	310	0.05
7.75	240	0.10
8.00	400	0.10
8.25	140	0.50
8.50	250	0.50
8.75	230	1.0
9.00	440	1.0

Table B-IC-2. For reverse experiment: Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to remaining 0.1 m $NaNO_3$ solution containing 50 ppb U to decrease or increase the pH by 1 unit. The amount of reagent to be added was estimated using EQ3 calculations.

Mixture Label	Estimated equil. pH (end of forward expt.)	Volume of HNO_3 needed (microL)	Molarity of HNO_3 solution to use
B-IC*pH4.50	4.69	170	0.1
B-IC*pH5.00	5.17	60	0.1
B-IC*pH5.50	5.42	90	TP 10/14/94 ~~0.2~~ 0.02
B-IC*pH6.00	5.61	50	TP 10/14/94 ~~0.2~~ 0.02
Mixture Label	Equilibrium pH (end of forward expt.)	Volume of $NaHCO_3$ needed (microL)	Molarity of $NaHCO_3$ solution to use
B-IC*pH6.50	6.07	100	0.1
B-IC*pH6.75	6.36	180	0.1
B-IC*pH7.00	6.60	330	0.1
B-IC*pH7.50	7.16	110	1.0

SOLN. NAME	Wt. Bottle	Tared Wt. of U	Vol. of Acid/Base to	Conc. of Acid	Reagent	Total Wt. after
	Empty (g)	Solution (g)	Adjust pH (microL)	or Base (M)		pH Adjust.
B-IC*pH2.00	20.2518	50.06	600	1	HNO3	71.0502
B-IC*pH2.25	20.2551	49.98	340	1	HNO3	70.6866
B-IC*pH2.50	20.3135	50.03	190	1	HNO3	70.7365
B-IC*pH2.75	20.3267	50.02	100	1	HNO3	70.5769
B-IC*pH3.00	20.4378	49.83	560	0.1	HNO3	70.9584
B-IC*pH3.25	20.2890	50.05	300	0.1	HNO3	70.9507
B-IC*pH3.50	20.2978	49.93	150	0.1	HNO3	70.4902
B-IC*pH3.75	20.2474	49.24	330	0.02	HNO3	70.4373
B-IC*pH4.00	20.2817	49.84	100	0.02	HNO3	70.3286
B-IC*pH4.25	20.3658	49.99	120	0.005	NaHCO3	70.5787
B-IC*pH4.50	20.2505	50.08	210	0.01	NaHCO3	70.8251
B-IC*pH4.75	20.2280	49.92	290	0.01	NaHCO3	70.8857
B-IC*pH5.00	20.2785	50.06	340	0.01	NaHCO3	70.7856
B-IC*pH5.25	20.4192	49.94	370	0.01	NaHCO3	70.8551
B-IC*pH5.50	20.3014	50.04	390	0.01	NaHCO3	70.8857
B-IC*pH5.75	20.3217	50.12	410	0.01	NaHCO3	70.9526
B-IC*pH6.00	20.3890	49.91	430	0.01	NaHCO3	70.8407
B-IC*pH6.25	20.2659	50.08	460	0.01	NaHCO3	70.9113
B-IC*pH6.50	20.2861	49.91	100	0.05	NaHCO3	70.3812
B-IC*pH6.75	20.4053	49.94	120	0.05	NaHCO3	70.5484
B-IC*pH7.00	20.2151	49.92	150	0.05	NaHCO3	70.3641
B-IC*pH7.25	20.3133	49.85	210	0.05	NaHCO3	70.4580
B-IC*pH7.50	20.3452	50.11	310	0.05	NaHCO3	70.8726
B-IC*pH7.75	20.1957	49.83	240	0.1	NaHCO3	70.3759
B-IC*pH8.00	20.3116	50.13	400	0.1	NaHCO3	70.4448
B-IC*pH8.25	20.2552	50.12	140	0.5	NaHCO3	70.6389
B-IC*pH8.50	20.3022	50.11	250	0.5	NaHCO3	70.7698
B-IC*pH8.75	20.3996	50.16	230	1	NaHCO3	70.8034
B-IC*pH9.00	20.2013	49.98	440	1	NaHCO3	70.7940
B-IC*IU*a	20.2589	56.44	100	50% (w/w)	HNO3	—
B-IC*IU*b	20.3600	81.41	100	50% (w/w)	HNO3	—

SOLN. NAME	Total Wt. After	T (C)	Total Wt. after	Total Wt. after
	CO2 equilib.		Sampl.&pH Meas.	Mineral Add'n
B-IC*pH2.00	70.4238	24.2	69.8292	69.9216
B-IC*pH2.25	70.2711	24.2	69.6847	69.7062
B-IC*pH2.50	70.3239	24.2	69.7200	69.8130
B-IC*pH2.75	70.2219	24.2	69.5729	69.6762
B-IC*pH3.00	70.5070	24.2	69.5936	69.7938
B-IC*pH3.25	70.2218	24.3	69.5561	69.6562
B-IC*pH3.50	70.1099	24.3	69.5290	69.6302
B-IC*pH3.75	70.1407	24.3	69.4919	69.5915
B-IC*pH4.00	70.0023	24.3	69.4149	69.5147
B-IC*pH4.25	70.2233	24.3	69.6405	69.7409
B-IC*pH4.50	70.3223	24.3	69.6904	69.7919
B-IC*pH4.75	70.1658	24.3	69.5456	69.6439
B-IC*pH5.00	70.4937	24.3	69.9058	70.0049
B-IC*pH5.25	70.5004	24.3	69.9013	69.9937
B-IC*pH5.50	70.5098	24.3	69.9814	70.0779
B-IC*pH5.75	70.5832	24.4	69.9625	70.0635
B-IC*pH6.00	70.5808	24.4	69.9891	70.0711
B-IC*pH6.25	70.6371	24.4	70.0591	70.1604
B-IC*pH6.50	70.0924	24.5	69.5217	69.6228
B-IC*pH6.75	70.2312	24.4	69.6688	69.7695
B-IC*pH7.00	70.0482	24.5	69.4948	69.5946
B-IC*pH7.25	70.1456	24.5	69.5482	69.6405
B-IC*pH7.50	70.5635	24.5	69.9687	70.0672
B-IC*pH7.75	70.0817	24.5	69.4575	69.5585
B-IC*pH8.00	70.6587	24.5	70.0576	70.1563
B-IC*pH8.25	70.2965	24.6	69.7259	69.8276
B-IC*pH8.50	70.4748	24.6	69.8901	69.9906
B-IC*pH8.75	70.5948	24.6	70.0077	70.1072
B-IC*pH9.00	70.4628	24.7	69.8766	69.9761
B-IC*IU*a	—	—	—	n/a
B-IC*IU*b	—	—	—	n/a

SOLN. NAME	WT VIAL (g)	Wt. Vial +	pH
	w/ 0.5ml HNO3	0.5 ml sample	
B-IC*pH2.00	1.1004	8.4950	1.95
B-IC*pH2.25	1.7142	8.2158	2.20
B-IC*pH2.50	1.6926	8.1878	2.48
B-IC*pH2.75	1.7871	8.2811	2.77
B-IC*pH3.00	1.7571	8.2533	3.03
B-IC*pH3.25	1.7509	8.2174	3.27
B-IC*pH3.50	1.8173	8.3107	3.50
B-IC*pH3.75	1.7522	8.2488	3.72
B-IC*pH4.00	1.6771	8.1717	3.98
B-IC*pH4.25	1.7248	8.2174	4.23
B-IC*pH4.50	1.7064	8.1993	4.51
B-IC*pH4.75	1.7591	8.2516	4.75
B-IC*pH5.00	1.6969	8.1827	4.95
B-IC*pH5.25	1.7132	8.2090	5.20
B-IC*pH5.50	1.7535	8.2496	5.46
B-IC*pH5.75	1.7389	8.2372	5.77
B-IC*pH6.00	1.7169	8.2147	5.89
B-IC*pH6.25	1.7373	8.2313	6.18
B-IC*pH6.50	1.7171	8.2100	6.31
B-IC*pH6.75	1.7433	8.2358	6.56
B-IC*pH7.00	1.7411	8.2876	6.80
B-IC*pH7.25	1.6848	8.1771	7.00
B-IC*pH7.50	1.7390	8.2362	9.16
B-IC*pH7.75	1.7192	8.2124	7.48
B-IC*pH8.00	1.8143	8.3081	7.96
B-IC*pH8.25	1.7778	8.2733	8.09
B-IC*pH8.50	1.7577	8.2534	8.31
B-IC*pH8.75	1.7626	8.2650	8.64
B-IC*pH9.00	1.7249	8.2330	8.97
B-IC*IU*a	—	—	—
B-IC*IU*b	—	—	—

SOLN. NAME	Total Wt. before twd sampling	WT VIAL (g) w/ 0.5ml HNO3	Wt. Vial + 0.5 ml sample	pH	T (C)	Total Wt. After Sampl.&pH Meas.
B-IC*pH2.00	69.3047	7.7566	8.2573	2.07	20.9	68.7384
B-IC*pH2.25	69.0740	7.7410	8.2408	2.30	20.9	68.5256
B-IC*pH2.50	69.2009	7.7642	8.2646	2.55	20.9	68.6258
B-IC*pH2.75	68.9741	7.7025	8.2008	2.81	21.0	68.4267
B-IC*pH3.00	69.1717	7.7489	8.2473	3.09	21.0	68.7212
B-IC*pH3.25	69.0687	7.7788	8.2368	3.36	21.0	68.5232
B-IC*pH3.50	68.8643	7.6827	8.1805	3.64	21.0	68.3179
B-IC*pH3.75	68.9241	7.7598	8.2555	3.91	21.0	68.3279
B-IC*pH4.00	68.8199	7.7156	8.2131	4.21	21.0	68.2650
B-IC*pH4.25	69.0554	7.6730	8.1720	4.47	21.1	68.4967
B-IC*pH4.50	69.1495	7.7882	8.2865	4.64	21.1	68.5935
B-IC*pH4.75	68.9219	7.6958	8.1914	4.97	21.1	68.3598
B-IC*pH5.00	69.2586	7.6956	8.1924	5.04	21.1	68.7116
B-IC*pH5.25	69.3534	7.7428	8.2348	5.21	21.1	68.7972
B-IC*pH5.50	69.4045	7.7360	8.2825	5.37	21.1	68.8636
B-IC*pH5.75	69.3124	7.7141	8.2083	5.44	21.2	68.8048
B-IC*pH6.00	69.4457	7.6642	8.1583	5.61	21.2	68.8855
B-IC*pH6.25	69.4864	7.7639	8.2609	5.77	21.2	68.9265
B-IC*pH6.50	68.9662	7.7023	8.2003	6.00	21.3	68.9051
B-IC*pH6.75	69.1583	7.7668	8.2578	6.35	21.3	68.6136
B-IC*pH7.00	68.9067	7.7729	8.2689	6.57	21.4	68.3554
B-IC*pH7.25	68.9889	7.7432	8.2405	6.84	21.5	68.4267
B-IC*pH7.50	69.0406	7.7483	8.2430	7.13	21.6	68.4284
B-IC*pH7.75	68.8672	7.7339	8.2295	7.38	21.6	68.3151
B-IC*pH8.00	69.5340	7.7323	8.2265	7.64	21.7	68.9563
B-IC*pH8.25	69.0354	7.6954	8.1907	7.90	21.7	68.4598
B-IC*pH8.50	69.3107	7.7205	8.2183	8.16	21.8	69.1100
B-IC*pH8.75	69.3938	7.7395	8.2539	8.46	21.8	68.8257 ~~68.8257~~
B-IC*pH9.00	69.3619	7.7459	8.2420	8.92	21.9	68.7850

SOLN. NAME	Total Wt. Before Solid Removed (g)	Total Wt. After Solid Removed	Wt. After 0.5 ml 50% HNO3 Added	Wt. 15-ml PP Btl. Empty (g)	Wt. PP btl. + Transf. Solid	Wt. PP btl w/ 3ml 0.1 HNO3
B-IC*pH2.00	68.7310	65.0451	65.6691	6.9328	10.5622	13.5521
B-IC*pH2.25	68.5237	65.4240	66.0468	6.9843	10.0723	13.0803
B-IC*pH2.50	68.6163	65.1140	65.7368	7.1223	10.6185	13.6167
B-IC*pH2.75	68.4244	65.2909	65.9155	7.1307	10.2354	13.2349
B-IC*pH3.00	68.7195	64.6469	65.2706	7.1123	11.1780	*
B-IC*pH3.25	68.5220	64.8784	65.4998	7.1076	10.7095	13.7264
B-IC*pH3.50	68.3165	64.7482	65.3162	7.0685	10.6299	13.6318
B-IC*pH3.75	68.3094	65.7296	66.3532	~~7.2647~~ 7.0653 TD 10/17/24	9.8357	12.8365
B-IC*pH4.00	68.2556	64.1755	64.7950	7.2193	11.2924	14.2993
B-IC*pH4.25	68.4870	65.4454	66.0684	7.0127	10.0465	13.0606
~~B-IC*pH4.50~~ TD 10/17/24						
B-IC*pH4.75	68.3569	65.2813	65.9045	7.1380	10.2025	13.2256
~~B-IC*pH5.00~~ TD 10/17/24						
B-IC*pH5.25	68.7959	65.6583	66.2788	7.0773	10.1838	13.1850
~~B-IC*pH5.50~~ TD 10/17/24						
B-IC*pH5.75	68.8036	65.7120	66.3395	7.1053	10.1542	13.1637
~~B-IC*pH6.00~~ TD 10/17/24						
B-IC*pH6.25	68.9248	64.7966	65.4145	7.0508 TD 10/17/24	11.1638	14.1661
~~B-IC*pH6.50~~ TD 10/17/24						
~~B-IC*pH6.75~~ TD 10/17/24						
~~B-IC*pH7.00~~ TD 10/17/24						
B-IC*pH7.25	68.9361	64.8742	65.4993	7.1164	10.6681	13.6707
~~B-IC*pH7.50~~ TD 10/17/24						
B-IC*pH7.75	68.3142	64.6095	65.2334	7.0803	10.7515	13.5786
B-IC*pH8.00	68.9554	65.4212	66.0416	7.1137	10.6012	13.6043
B-IC*pH8.25	68.4543	66.0183	66.6431	7.0859	~~10.~~ 9.5105 TD 10/17/24	12.5064
B-IC*pH8.50	68.7087	67.1994	67.8195	7.0712	8.5356	11.5372
B-IC*pH8.75	68.8226	65.2459	65.8720	7.0603	10.6058	13.6172
B-IC*pH9.00	69.7816	65.6571	66.2797	7.0174	10.0995	13.1068

* - spilled during Acid Addit.

Sample Name (Solid Desorp.)	Wt. Vial empty (no acid needed)	Wt. Vial + 1.0 ml sample	Sample Name (Container Desorp.)	Wt. Vial Empty (no acid needed)	Wt. Vial + 1.0 ml sample
B-ICD*pH2.00	7.3174	8.3064	B-ICD*pH2.00	7.3535	8.3501
B-ICD*pH2.25	7.3423	8.3412	B-ICD*pH2.25	7.3670	8.3549
B-ICD*pH2.50	7.3332	8.3331	B-ICD*pH2.50	7.3171	8.3119
B-ICD*pH2.75	7.3872	8.3840	B-ICD*pH2.75	7.3610	8.3611
B-ICD*pH3.00	7.3180	—	B-ICD*pH3.00	7.3477	8.3431
B-ICD*pH3.25	7.4092	8.3982	B-ICD*pH3.25	7.3488	8.3515
B-ICD*pH3.50	7.2059	8.2875	B-ICD*pH3.50	7.3738	8.3[illegible]
B-ICD*pH3.75	7.3751	8.3717	B-ICD*pH3.75	7.2873	8.2862
B-ICD*pH4.00	7.3140	8.3162	B-ICD*pH4.00	7.3670	8.3479
B-ICD*pH4.25	7.3600	8.3573	B-ICD*pH4.25	7.3904	8.3903
B-ICD*pH4.75	7.3521	8.3519	B-ICD*pH4.75	7.3069	8.3098
B-ICD*pH5.25	7.3187	8.3186	B-ICD*pH5.25	7.3329	8.3227
B-ICD*pH5.75	7.3113	8.3063	B-ICD*pH5.75	7.2973	8.2817
B-ICD*pH6.25	7.3345	8.3242	B-ICD*pH6.25	7.3262	8.3216
B-ICD*pH7.25	7.4025	8.4027	B-ICD*pH7.25	7.4366	8.4409
B-ICD*pH7.75	7.3556	8.3517	B-ICD*pH7.75	7.3006	8.3000
B-ICD*pH8.00	7.4038	8.3982	B-ICD*pH8.00	7.3543	8.3520
B-ICD*pH8.25	7.2896	8.2984	B-ICD*pH8.25	7.3249	8.3250
B-ICD*pH8.50	7.3460	8.3399	B-ICD*pH8.50	7.3962	8.3872
B-ICD*pH8.75	7.4058	8.4022	B-ICD*pH8.75	7.3450	8.3276
B-ICD*pH9.00	7.3704	8.3677	B-ICD*pH9.00	7.3182	8.3067

Initiate Reverse Experiment	SOLN. NAME	Vol. of Acid/Base to Adjust pH (microL)	Conc. of Acid or Base (M)	Reagent	Total Wt. after pH Adjust.
	B-IC*pH4.50	170	0.1	HNO3	68.9999
	B-IC*pH5.00	60	0.1	HNO3	68.8155
	B-IC*pH5.50	90	~~0.2~~ 0.07	HNO3	68.9516
	B-IC*pH6.00	50	~~0.2~~ 0.02	HNO3	68.9341
	B-IC*pH6.50	100	0.1	NaHCO3	68.5044
	B-IC*pH6.75	180	0.1	NaHCO3	68.7923
	B-IC*pH7.00	330	0.1	NaHCO3	68.6770
	B-IC*pH7.50	110	1	NaHCO3	~~68.~~ 69.0005

Sample Reverse Experiment	SOLN. NAME	WT VIAL (g) w/ 0.5ml HNO3	Wt. Vial + 0.5 ml sample	pH	T (C)
	B-IC*pH4.50	7.8651	8.3661	3.70	21.9
	B-IC*pH5.00	7.7672	8.2695	4.24	22.0
	B-IC*pH5.50	7.8584	8.3588	4.77	~~4.79~~ 22.0
	B-IC*pH6.00	7.8709	8.3695	5.16	21.9
	B-IC*pH6.50	7.8094	8.3064	6.90	21.9
	B-IC*pH6.75	7.8105	8.3179	7.30	21.8
	B-IC*pH7.00	~~7.87~~ 7.8677	8.3725	7.62	21.8
	B-IC*pH7.50	7.8604	8.3582	8.23	21.9

8/31/94 B-IC

Experiment B-IC was begun. 2 1000g portions of 0.1m $NaNO_3$ were prepared by dissolving 8.50g $NaNO_3$ in 1000g H_2O.

A 50 ppb solution was prepared by diluting 160g (160.14 actually used) to 1600g (1599.8 g) using 0.1m $NaNO_3$.

~50g Aliquots were distributed into 31 PC bottles. The bottle weight and solution wt. can be found on page 162. The pH of the solutions was adjusted w/ HNO_3 or $NaHCO_3$ according to Table B-IC-I on page 161. The solutions were then loosely capped and placed on a gyratory shaker.

2 samples of the 2 ~1L solutions were taken for LSA. The sample weights are on the next page.

NAME	WT. VIAL (g)	(WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-IC*IUa1	7.6991	8.2040	0.5049
B-IC*IUa2	7.1876	8.2901	0.5025
B-IC*IUb1	7.8111	8.3136	0.5025
B-IC*IUb2	7.7446	8.2459	0.5013

9 Sept 1994
RD

URANIUM SORPTION EXPERIMENT **B-IIIC**:

(Kd vs pH; Equilibrium with $pCO_2=10^{-3.50}$; $\sum U$=5 ppb; 0.1m $NaNO_3$)

WRITTEN BY: R.T. PABALAN
REVISION NO.: 0

DATE WRITTEN: August 25, 1994
DATE REVISED:

OBJECTIVE:

- To investigate the importance of uranium sorption on the zeolite mineral clinoptilolite as a function of solution pH, total uranium concentration and ionic strength. Experimental data will be correlated with uranium aqueous speciation.
- To investigate reversibility of uranium sorption reactions.
- To investigate the sorption of uranium on container walls.

Note: HNO_3 or $NaHCO_3$ solutions are used here to adjust the starting pH of the uranium solutions. The amounts of HNO_3 and $NaHCO_3$ needed to adjust the pH were calculated using EQ3 (neglecting the effects of H^+ ion-exchange at low pH). Weights of the bottles are measured at each step to account for evaporation losses.

EQUIPMENT:

Gyratory shaker or constant temperature shaker bath
Packard liquid scintillation counter
ORION pH/mV/ISE/°C meter
Combination pH electrode
Automatic temperature compensator probe
Analytical balance

SUPPLIES:

	pH buffer (pH = 2,4,7,9,10)
2	60-ml polycarbonate bottle (to contain B-IIIC*IU)
29	60-ml polycarbonate bottles (to contain experimental mixtures)
21	15-ml polypropylene bottle (to contain B-IIICD*pH*i*)
1	2000-ml polycarbonate bottle (for preparation of 5 ppb U solution)
1	5-ml Eppendorf pipet (for transferring 5 ml cocktail into scintillation vial)
1	0.5-ml Eppendorf fixed-volume micropipet (for taking samples and for transferring 0.02 M HNO_3 solution into scintillation vial)
various	Eppendorf micropipets (fixed- or variable-volume; for adding HNO_3 or $NaHCO_3$ solutions to uranium solutions)
	scintillation vials
	weighing paper
	Na-clinoptilolite (CDV*100/200*UC*WA*HL*CPT*Naf)
	reagent grade $NaHCO_3$
	500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
2 L	0.1 m $NaNO_3$ stock solution
1000 ml	stock solution of 1.0 m HNO_3
1000 ml	stock solution of 0.1 m HNO_3
1000 ml	stock solution of 0.02 m HNO_3
500 ml	stock solution of 1.0 m $NaHCO_3$

500 ml	stock solution of 0.5 m $NaHCO_3$
500 ml	stock solution of 0.1 m $NaHCO_3$
500 ml	stock solution of 0.05 m $NaHCO_3$
500 ml	stock solution of 0.01 m $NaHCO_3$
500 ml	stock solution of 0.005 m $NaHCO_3$
	ultrapure water

PROCEDURE:

Note: In transferring uranium solutions, avoid using glass or polypropylene labware.

Solution B-IIIC (1 bottle for each pH value)

- Initial $\sum U$ = 5 ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO_3 or $NaHCO_3$
- Initial volume = 50 ml
- Ionic strength = 0.1 m $NaNO_3$
- Wt. Na-clinoptilolite to use = 0.100±0.001
- Initial $[Na^+]$ = 0.1 m $NaNO_3$ + $[NaHCO_3]$ added
- $pCO_2 = 10^{-3.50}$ atm

a) Prepare 1600 g of 5 ppb U solution in a pre-cleaned 2-liter polycarbonate bottle by diluting 16 g of a 500 ppb stock solution (in 0.1 m $NaNO_3$ matrix; prepared previously from commercial 50 ppm ^{233}U spike) to a total of 1600 g by carefully taring 0.1 m $NaNO_3$ solution into the polycarbonate bottle on a Mettler 4600 balance.

b) Into each of 29 60-ml **preweighed** polycarbonate bottle labeled B-IIIC*pH*i* [where *i* is the approximate initial pH of the solution (see below)], tare 50 g of the 5 ppb uranium solution. Record the weight of each solution.

(Cap the bottles tightly at this time if pH adjustment is to be made at a later time, i.e., a few hours later).

Transfer the remaining solution into two 60-ml polycarbonate bottles labeled B-IIIC*IU*a (or *b). **Add 100 µL of 50% HNO_3 solution**, then mix thoroughly. Take two 0.5-ml samples from B-IIIC*IU with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIC-IU*a (or b)] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Swirl each vial to mix. Reweigh each vial and save for later analysis of uranium concentration by liquid scintillation counting.

c) For each solution B-IIIC*pH*i*

Adjust the pH of each solution to the approximate value *i* by adding HNO_3 or $NaHCO_3$ solution (with an Eppendorf micropipet). The approximate amount to be added is given in Table B-IIIC-1. Swirl the solutions by hand, then **reweigh** each bottle. *Do not measure the pH at this time.* Cap each bottle loosely, then place the bottles on a gyratory shaker set to ≈120 rpm. Leave the bottles on the shaker for about ten days to allow the solutions to reach equilibrium with atmospheric CO_2(g).

d) After equilibrium with atmospheric $CO_2(g)$ has been reached, **reweigh** each bottle to determine any evaporative losses. From each solution B-IIIC*pH*i* , take a 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIC*IU-ph*ii*] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Swirl to mix. Reweigh each vial and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH of each solution B-IIIC*pH*i* . *Minimize the amount of time the glass electrode is in contact with the uranium solution. Make sure to rinse the electrode well before transferring into another solution.*

Reweigh each polycarbonate bottle to determine amount of solution lost during pH measurement and sampling.

e) Tare 0.100±0.001 gm of Na-clinoptilolite onto weighing paper, then carefully transfer into each of the B-IIIC*pH*i* bottles. **Reweigh** the bottles. Swirl each bottle by hand, replace the cover, then place on the shaker.

f) After equilibrium is reached (at least 10 days), **reweigh** each bottle to determine evaporative losses. Then take a 0.5-ml sample from each bottle B-IIIC*ph*i* with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIC-ph*i*] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Swirl to mix. Reweigh each vial and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of solutions B-IIIC*pH*i* . Make sure to rinse the pH electrode very well before transferring into another solution.

Reweigh each polycarbonate bottle to determine amount of solution lost during pH measurement and sampling.

Cap all bottles tightly if reverse or desorption experiments are not going to be done immediately.

g) Analyze the U concentration by liquid scintillation counting.

h) For mixtures listed in Table B-IIIC-2, conduct reversibility experiment:

Adjust the pH of the solutions B-IIIC*ph*i* listed in Table B-IIIC-2 up or down by about 1 pH unit by adding HNO_3 or $NaHCO_3$ solutions in the amounts given in the table. **Reweigh** each bottle. Swirl each bottle by hand, replace the cover, then place on the gyratory shaker.

After equilibrium is reached (at least 10 days), take a 0.5-ml sample from each solution using an Eppendorf pipet, transfer into pre-labeled (e.g., B-IIIC**R**-pH*i*) and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Reweigh each vial. Swirl to mix and save for later analysis of uranium concentration by liquid scintillation counting.

Measure and record the pH and temperature of those solutions. Make sure to rinse the pH electrode very well before transferring into another solution.

Cap all bottles tightly to prevent evaporation.

i) For mixtures **not** listed in Table B-IIIC-2, conduct desorption experiment:

1) **Reweigh** each bottle to determine evaporative losses. Using an Eppendorf micropipet, carefully retrieve as much of the solid phase as possible (taking care to minimize the amount of solution entrained with the solid). Transfer into pre-weighed and pre-labeled (i.e., B-IIICD-pH*i*) 15-ml polypropylene bottles. **Reweigh** each polycarbonate and polypropylene bottle.

2) Add 3 ml of 0.1 m HNO_3 solution to each of the 15-ml polypropylene bottles; swirl to mix. **Reweigh** each polypropylene bottle.

3) To each of the remaining solutions in the polycarbonate bottles B-IIIC*pH*i*, add 0.5 ml of 50% HNO_3 solution; swirl to mix. **Reweigh** each polycarbonate bottle.

4) Allow at least ten days for all the solutions to equilibrate. Then take a **1.0**-ml sample from each solution using an Eppendorf pipet, transfer into pre-labeled (e.g., B-IIICD-pH*i* or B-IIICF-pH*i*) and pre-weighed scintillation vials (no acid needed). Reweigh each vial. Swirl to mix and save for later analysis of uranium concentration by liquid scintillation counting.

5) Cap all bottles tightly to prevent evaporation.

j) Analyze the U concentration by liquid scintillation counting.

PREPARATION:

1. Preclean:
   - 29 60-ml polycarbonate bottles (to contain experimental mixtures
   - 2 60-ml polycarbonate bottle (to contain B-IIIC*IU)
   - 21 15-ml polypropylene bottle (to contain B-IIICD*pH*i*)
   - 1 2000-ml polycarbonate bottle (for preparation of 5 ppb U solution)

2. Prepare:
   - 2 L 500 ppb U stock solution prepared from 50 ppm ^{233}U commercial spike
   - 1000 ml 0.1 m $NaNO_3$ stock solution
   - 1000 ml stock solution of 1.0 m HNO_3
   - 1000 ml stock solution of 0.1 m HNO_3
   - 500 ml stock solution of 0.02 m HNO_3
   - 500 ml stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml solution)
   - 500 ml stock solution of 0.5 M $NaHCO_3$ (21.003 in 500 ml solution)
   - 500 ml stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml solution)
   - 500 ml stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml solution)
   - 500 ml stock solution of 0.01 M $NaHCO_3$ (0.4201 g in 500 ml solution)
   - 500 ml stock solution of 0.005 M $NaHCO_3$ (0.2100 g in 500 ml solution)

The $NaHCO_3$ solutions should be prepared with *degassed* deionized water and kept in tightly-capped glass reagent bottles.

Table B-IIIC-1. Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to 50 ml 0.1 m $NaNO_3$ solution containing 5 ppb U to result in pH values given in column-1. The amount of reagent to be added was estimated using EQ3 calculations (and rounded off to nearest 10 microliters).

Solution pH	Volume of HNO_3 needed, microliters	Molarity of HNO_3 to use
2.00	610	1.0
2.25	340	1.0
2.50	190	1.0
2.75	110	1.0
3.00	60	1.0
3.25	340	0.10
3.50	190	0.10
3.75	100	0.10
4.00	280	0.02
4.25	150	0.02
4.50	75	0.02
4.75	650	0.001
5.00	170	0.001
Solution pH	**Volume of $NaHCO_3$ needed, microliters**	**Molarity of $NaHCO_3$ solution to use**
5.25	120	0.001
5.5	320	0.001
5.75	500	0.001
6	140	0.005
6.25	200	0.005
6.5	300	0.005
6.75	480	0.005
7	400	0.01
7.25	140	0.05
7.5	230	0.05
7.75	410	0.05
8.00	370	0.1
8.25	130	0.5
8.50	240	0.5
8.75	450	0.5
9.00	430	1

Table B-IIIC-2. For reverse experiment: Amount of reagent grade HNO_3 or $NaHCO_3$ solutions to add to remaining 0.1 m $NaNO_3$ solution containing 5 ppb U to decrease or increase the pH by 1 unit. The amount of reagent to be added was estimated using EQ3 calculations.

Mixture Label	Equilibrium pH (end of forward expt.)	Volume of HNO_3 needed (microL)	Molarity of HNO_3 solution to use
B-IIIC*pH4.50		170	0.1
B-IIIC*pH5.00		60	0.1
B-IIIC*pH5.50		90	0.02
B-IIIC*pH6.00		40	0.02
Mixture Label	**Equilibrium pH (end of forward expt.)**	**Volume of $NaHCO_3$ needed (microL)**	**Molarity of $NaHCO_3$ solution to use**
B-IIIC*pH6.50		100	0.1
B-IIIC*pH6.75		180	0.1
B-IIIC*pH7.00		330	0.1
B-IIIC*pH7.50		110	1.0

SOLN. NAME	Wt. Bottle Empty (g)	Tared Wt. of U Solution (g)	Vol. of Acid/Base to Adjust pH (microL)	Conc. of Acid or Base (M)	Reagent	Total Wt. after pH Adjust.
B-IIIC*pH2.00	20.3363	49.84	610	1	HNO3	70.8049
B-IIIC*pH2.25	20.2977	50.06	340	1	HNO3	70.7001
B-IIIC*pH2.50	20.3326	49.87	190	1	HNO3	70.3973
B-IIIC*pH2.75	20.2264	49.86	110	1	HNO3	70.2045
B-IIIC*pH3.00	20.3516	50.22	60	1	HNO3	70.6589
B-IIIC*pH3.25	20.2932	50.00	340	0.1	HNO3	70.6286
B-IIIC*pH3.50	20.2575	49.91	190	0.1	HNO3	70.2579
B-IIIC*pH3.75	20.3086	50.19	100	0.1	HNO3	70.6144
B-IIIC*pH4.00	20.3423	49.76	280	0.02	HNO3	70.3937
B-IIIC*pH4.25	20.4273	49.81	150	0.02	HNO3	70.3948
B-IIIC*pH4.50	20.2629	50.11	75	0.02	HNO3	70.4463
B-IIIC*pH4.75	20.2618	49.96	650	0.001	HNO3	70.8858
B-IIIC*pH5.00	20.2505	50.03	170	0.001	HNO3	70.4500
B-IIIC*pH5.25	20.2506	49.82	120	0.001	NaHCO3	70.4017
B-IIIC*pH5.50	20.2017	50.15	320	0.001	NaHCO3	70.6753
B-IIIC*pH5.75	20.3150	50.04	500	0.001	NaHCO3	70.8652
B-IIIC*pH6.00	20.3452	49.83	140	0.005	NaHCO3	70.3038
B-IIIC*pH6.25	20.2049	50.11	200	0.005	NaHCO3	70.5719
B-IIIC*pH6.50	20.2783	49.78	300	0.005	NaHCO3	70.3439
B-IIIC*pH6.75	20.2454	50.21	480	0.005	NaHCO3	70.9317
B-IIIC*pH7.00	20.2337	49.94	400	0.01	NaHCO3	70.5744
B-IIIC*pH7.25	20.2720	50.24	140	0.05	NaHCO3	70.6507
B-IIIC*pH7.50	20.2385	49.90	230	0.05	NaHCO3	70.4496
B-IIIC*pH7.75	20.2454	49.86	410	0.05	NaHCO3	70.5618
B-IIIC*pH8.00	20.2392	49.96	370	0.1	NaHCO3	70.5709
B-IIIC*pH8.25	20.2138	49.90	130	0.5	NaHCO3	70.2961
B-IIIC*pH8.50	20.3608	50.29	240	0.5	NaHCO3	70.9065
B-IIIC*pH8.75	20.3308	49.75	450	0.5	NaHCO3	70.5357
B-IIIC*pH9.00	20.2182	50.34	430	1	NaHCO3	71.0682
B-IIIC*IU*a	20.2578	50.17	—	—	—	—
B-IIIC*IU*b	20.2693	50.54	—	—	—	—

SOLN. NAME	Total Wt. before fwd sampling	WT VIAL (g) w/ 0.5ml HNO3	Wt. Vial + 0.5 ml sample	pH	T (C)	Total Wt. After Sampl.&pH Meas.
B-IIIC*pH2.00	69.2451	7.1341	8.2400	2.05	24.0	68.1076
B-IIIC*pH2.25	69.2893	7.1344 to 7.1005	8.1979	2.29	24.0	68.7501
B-IIIC*pH2.50	69.0073	7.1771	8.2720	2.53	24.0	68.9773
B-IIIC*pH2.75	68.7944	7.1715	8.2452	2.76	24.0	68.2557
B-IIIC*pH3.00	69.2245	7.8903	8.3359	3.02	24.0	68.6859
B-IIIC*pH3.25	69.1288	7.7061	8.2030	3.30	24.0	68.4530
B-IIIC*pH3.50	68.7174	7.7902	8.2842	3.59	24.0	68.1765
B-IIIC*pH3.75	68.9564	7.7113	8.2087	3.79	24.0	68.4112
B-IIIC*pH4.00	69.0074	7.6941	8.1887	4.20	24.0	68.4580
B-IIIC*pH4.25	69.0260	7.7713	8.2722	4.54	24.0	68.4781
B-IIIC*pH4.50	69.1963	7.8008	8.2987	4.76	24.0	68.6345
B-IIIC*pH4.75	69.6528	to 8.2 8.1931	7.6447 lost	4.89	24.1	69.1016
B-IIIC*pH5.00	69.0440	7.6367	8.1251	5.18	24.1	68.4899
B-IIIC*pH5.25	69.1675	7.7120	8.2036	5.05	24.1	68.6259
B-IIIC*pH5.50	69.3156	7.7126	8.2035	5.34	24.1	68.7711
B-IIIC*pH5.75	69.4867	7.7244	8.2156	5.58	24.1	68.9462
B-IIIC*pH6.00	68.8821	7.6883	8.1787	5.27	24.1	68.3412
B-IIIC*pH6.25	69.2642	7.7709	8.2619	6.31	24.1	68.7296
B-IIIC*pH6.50	68.9004	7.7074	8.1964	6.10	24.2	68.3516
B-IIIC*pH6.75	69.4940	7.6854	8.1779	6.33	24.2	68.9010
B-IIIC*pH7.00	69.2998	7.6998	8.1849	6.63	24.2	68.7638
B-IIIC*pH7.25	69.3679	7.7515	8.2760	7.15	24.3	68.8329
B-IIIC*pH7.50	69.1566	7.7359	8.2265	7.24	24.3	68.6111
B-IIIC*pH7.75	68.9239	7.7819	8.2699	7.31	24.3	68.4004
B-IIIC*pH8.00	69.1067	7.7710	8.2579	7.66	24.4	68.5771
B-IIIC*pH8.25	68.5580	7.7016	8.1896	8.02	24.4	68.0163
B-IIIC*pH8.50	69.5493	7.7826	8.2784	8.40	24.4	69.0055
B-IIIC*pH8.75	69.1677	7.7426	8.2292	8.57	24.4	68.6297
B-IIIC*pH9.00	69.7443	7.7625	8.3530	8.90	24.4	69.1532

SOLN. NAME	Total Wt. after CO2 equilib.	WT VIAL (g) w/ 0.5ml HNO3	Wt. Vial + 0.5 ml sample	pH	T (C)	Total Wt. After Sampl.&pH Meas.	Total Wt. after Mineral Add'n
B-IIIC*pH2.00	70.3174	7.6957	8.1869	1.96	25.0	69.7007	69.8024
B-IIIC*pH2.25	70.2308	7.7614	8.2631	2.20	25.0	69.5908	69.6908
B-IIIC*pH2.50	69.9400	7.7299	8.2310	2.48	25.0	69.2602	69.3604
B-IIIC*pH2.75	69.7453	7.7434	8.2436	2.69	25.0	69.0889	69.1879
B-IIIC*pH3.00	70.1839	7.7006	8.2064	2.93	25.0	69.5650	69.6634
B-IIIC*pH3.25	70.1127	7.7728	8.2719	3.18	25.0	69.4836	69.5832
B-IIIC*pH3.50	69.6899	7.7857	8.2876	3.41	25.0	69.0404	69.1397
B-IIIC*pH3.75	69.9868	7.7183	8.2180	3.63	25.0	69.3271	69.4280
B-IIIC*pH4.00	69.9201	7.6577	8.1595	3.77	25.0	69.2599 *	69.4384
B-IIIC*pH4.25	69.9151	7.8020	8.3006	3.87	25.1	69.2677 *	69.4677
B-IIIC*pH4.50	70.0160	7.7468	8.2440	3.97	25.1	69.3883 *	69.5767
B-IIIC*pH4.75	70.4559	7.7343	8.2341	4.10	25.1	69.8589 *	70.0299
B-IIIC*pH5.00	70.0138	7.6999	8.1998	4.15	25.1	69.4092 *	69.5863
B-IIIC*pH5.25	69.9766	7.7356	8.2378	4.16	25.1	69.3775 *	69.5498
B-IIIC*pH5.50	70.1863	7.7456	8.2448	4.22	25.1	69.5622 *	69.7322
B-IIIC*pH5.75	70.3468	7.7959	8.2926	4.19	25.1	69.6966 *	69.8762
B-IIIC*pH6.00	69.8094	7.7756	8.2746	4.24	25.1	69.1315 *	69.3073
B-IIIC*pH6.25	70.1008	7.7546	8.2529	3.98	23.9	69.4582 *	69.7622
B-IIIC*pH6.50	69.8604	7.7364	8.2355	4.31	23.9	69.1908 *	69.3647
B-IIIC*pH6.75	70.4434	7.7089	8.2058	4.01	23.9	69.8447 *	70.0153
B-IIIC*pH7.00	70.1355	7.7331	8.2308	5.50	23.9	69.5532 *	69.7223
B-IIIC*pH7.25	70.2419	7.7350	8.2324	6.62	23.9	69.6274 *	69.8196
B-IIIC*pH7.50	69.9874	7.7560	8.2531	7.20	23.9	69.3484 *	69.5645
B-IIIC*pH7.75	69.9870	7.6497	8.1462	7.53	23.8	69.3280	69.4274
B-IIIC*pH8.00	70.0591	7.7805	8.2791	7.76	23.8	69.4522	69.5524
B-IIIC*pH8.25	69.7569	7.7286	8.2275	8.05	23.9	69.1459	69.2431
B-IIIC*pH8.50	70.4565	7.6693	8.1642	8.36	23.7	69.8285	69.9281
B-IIIC*pH8.75	70.0778	7.6740	8.1683	8.62	23.7	69.4767	69.5759
B-IIIC*pH9.00	70.6565	7.7370	8.2305	8.91	23.7	70.0401	70.1404
B-IIIC*IU*a	—	—	—	—	—	—	n/a
B-IIIC*IU*b	—	—	—	—	—	—	n/a

*. weight before pH adjustment
final wt. before clinop. addition is
given on p. 182. TD.

Sample Name	Wt. Vial empty	Wt. Vial +	Sample Name	Wt. Vial Empty	Wt. Vial +
(Solid Desorp.)	(no acid needed)	1.0 ml sample	(Container Desorp.)	(no acid needed)	1.0 ml sample
B-IIICD*pH2.00	7.3361	8.3417	B-IIICD*pH2.00	7.3567	8.3977
B-IIICD*pH2.25	7.3245	8.3273	B-IIICD*pH2.25	7.2718	8.2654
B-IIICD*pH2.50	7.3609	8.3504	B-IIICD*pH2.50	7.3477	8.3406
B-IIICD*pH2.75	7.2811	8.2732	B-IIICD*pH2.75	7.3543	8.3431
B-IIICD*pH3.00	7.3562	8.3786	B-IIICD*pH3.00	7.3435	8.3312
B-IIICD*pH3.25	7.3748	8.3668	B-IIICD*pH3.25	7.2999	8.2879
B-IIICD*pH3.50	7.3253	8.3211	B-IIICD*pH3.50	7.3169	8.3063
B-IIICD*pH3.75	7.3413	8.3422	B-IIICD*pH3.75	7.3375	8.3343
B-IIICD*pH4.00	7.3558	8.3565	B-IIICD*pH4.00	7.2999	8.2949
B-IIICD*pH4.25	7.3119	8.3075	B-IIICD*pH4.25	7.29 29	8.2865
B-IIICD*pH4.75	7.4116	8.4185	B-IIICD*pH4.75	7.3180	8.3099
B-IIICD*pH5.25	7.2441	8.2866	B-IIICD*pH5.25	7.3257	8.3195
B-IIICD*pH5.75	7.3651	8.3564	B-IIICD*pH5.75	7.2751	8.2559
B-IIICD*pH6.25	7.3366	8.3240	B-IIICD*pH6.25	7.4347	8.4243
B-IIICD*pH7.25	7.3981	8.3839	B-IIICD*pH7.25	7.3664	8.3141
B-IIICD*pH7.75	7.3682	8.3696	B-IIICD*pH7.75	7.2496	8.3496
B-IIICD*pH8.00	7.3554	8.3395	B-IIICD*pH8.00	7.2843	8.2692
B-IIICD*pH8.25	7.3427	8.3399	B-IIICD*pH8.25	7.3773	8.3780
B-IIICD*pH8.50	7.2965	8.2897	B-IIICD*pH8.50	7.2981	8.2886
B-IIICD*pH8.75	7.3004	8.2955	B-IIICD*pH8.75	7.3431	8.3303
B-IIICD*pH9.00	7.3016	8.3001	B-IIICD*pH9.00	7.3290	8.2984

SOLN. NAME	Total Wt. Before Solid Removed (g)	Total Wt. After Solid Removed	Wt. After 0.5 ml 50% HNO3 Added	Wt. 15-ml PP Btl. Empty (g)	Wt. PP btl. + Transf. Solid	Wt. PP btl w/ 3ml 0.1 HNO3
B-IIIC*pH2.00	68.6819	64.6092	65.2324	7.1461	To volume 10.11.2052	14.2520
B-IIIC*pH2.25	68.7073	65.1918	65.7722	7.1351	10.6740	13.6897
B-IIIC*pH2.50	68.4529	64.9225	65.5380	6.9921	10.5123	13.5236
B-IIIC*pH2.75	68.2318	65.2027	65.8194	7.1196	10.1374	13.1553
B-IIIC*pH3.00	68.6591	65.5975	66.2128	7.1029	To 10.2 Tank 0.14 10.1513	13.1668
B-IIIC*pH3.25	68.4090	65.3479	65.9639	7.1014	10.1499	13.1604
B-IIIC*pH3.50	68.1480	64.5794	65.1954	7.0995	10.6516	13.6701
B-IIIC*pH3.75	68.3835	64.3329	64.9488	6.9377	10.9769	13.9967
B-IIIC*pH4.00	68.4228	65.3748	65.9915	6.9358	9.9711	13,0082
B-IIIC*pH4.25	68.4404	65.3943	66.0121	7.2203	10.2490	13.2774
B-IIIC*pH4.50	—	—	—	—	—	—
B-IIIC*pH4.75	69.0722	66.0098	66.6270	7.0708	10.1704	13.1506
B-IIIC*pH5.00	—	—	—	—	—	—
B-IIIC*pH5.25	68.6004	65.0468	65.6638	6.9905	10.5338	13.5583
B-IIIC*pH5.50	—	—	—	—	—	—
B-IIIC*pH5.75	68.9216	65.3612	65.9804	7.1122	10.6575	13.6704
B-IIIC*pH6.00	—	—	—	—	—	—
B-IIIC*pH6.25	68.7038	65.3817	66.0034	7.0339	10.3416	13.3737
B-IIIC*pH6.50	—	—	—	—	—	—
B-IIIC*pH6.75	—	—	—	—	—	—
B-IIIC*pH7.00	—	—	—	—	—	—
B-IIIC*pH7.25	68.7963	64.7258	65.3481	7.1405	11.1816	14.2353
B-IIIC*pH7.50	—	—	—	—	—	—
B-IIIC*pH7.75	68.3671	64.8062	65.4276	7.1748	10.7177	13.7162
B-IIIC*pH8.00	68.5435	65.9931	66.6101	6.9337	9.4737	12.5121
B-IIIC*pH8.25	67.9811	64.4203	65.0392	7.1110	10.6566	13.6946
B-IIIC*pH8.50	68.9808	64.9299	65.5491	7.1948	11.2322	14.2572
B-IIIC*pH8.75	68.6043	66.0615	66.6802	7.2511	9.7342	12.8539
B-IIIC*pH9.00	69.1299	65.0766	65.6945	7.1269	11.1603	14.2285

10/27 D — indicates solution used in Reverse exp., no desorption done

Initiate Reverse Experiment	SOLN. NAME	Vol. of Acid/Base to Adjust pH (microL)	Conc. of Acid or Base (M)	Reagent	Total Wt. after pH Adjust.	T (C)	Sample Reverse Experiment	SOLN. NAME	WT VIAL (g) w/ 0.5ml HNO3	Wt. Vial + 0.5 ml sample	pH
	B-IIIC*pH4.50	170	0.1	HNO3	68.7599	20.5		B-IIIC*pH4.50	7.8731	8.3771	3.71
	B-IIIC*pH5.00	60	0.1	HNO3	68.5162	20.4		B-IIIC*pH5.00	7.7839	8.2624	4.26
	B-IIIC*pH5.50	90	0.02	HNO3	68.8471	20.5		B-IIIC*pH5.50	7.8508	8.3417	4.94
	B-IIIC*pH6.00	40	0.02	HNO3	68.3643	20.5		B-IIIC*pH6.00	7.8261	8.3248	5.17
	B-IIIC*pH6.50	100	0.1	NaHCO3	68.4280	20.5		B-IIIC*pH6.50	7.8695	8.3727	7.05
	B-IIIC*pH6.75	180	0.1	NaHCO3	69.0663	20.4		B-IIIC*pH6.75	7.8446	8.3460	7.32
	B-IIIC*pH7.00	330	0.1	NaHCO3	69.0820	20.4		B-IIIC*pH7.00	7.8706	8.3713	7.58
	B-IIIC*pH7.50	110	1	NaHCO3	68.7041	20.6		B-IIIC*pH7.50	7.8253	8.3295	8.37

12 Sept 1994 EXPERIMENT B-IIIC.

EXPERIMENT B-IIIC was begun by dissolving today. 2 1kg portions of 0.1 m $NaNO_3$ was prepared by dissolving 8.50 g $NaNO_3$ in 1000 g H_2O.

1600 g of a 5 ppb solution was prepared by diluting 16 g of 500 ppb U (spike 28A) to 1600 g using 0.1 m $NaNO_3$

ACTUAL WT OF SPIKE : 16.56 g
FINAL WT. : 1611.7 g

50 g aliquots of the 5ppb solution were distributed to 28 60 ml PC containers that were preweighed. The bottle weights and solution weights can be found on page 173. The remaining solution was placed into 2 60 ml PC bottles and acidified with 100 µL of 0.1 m HNO_3. 2 1 ml samples were taken from each for liquid scintillation analysis. The weights are below. The pH of each solution was adjusted using HNO_3 or $NaHCO_3$ according to the table on page 172 (Table B-IIIC-1). The bottles were reweighed and placed on a gyratory shaker set to 120 rpm.

NAME	WT. VIAL (g)	WT VIAL + SAMPLE (g)	WT. SAMPLE (g)
B-IIIC*Inal	7.2532	8.2693	1.0161
a2	7.2446	8.1731	0.9285
b1	7.3357	8.3265	1.0108
b2	7.2665	8.2717	1.0052

9/15/94 TD EXPERIMENT B-IIIC

The pH of the solutions has had sufficient time to equilibrate, so the experiment will proceed. The bottles will be weighed. the solutions sampled and the solution pH measured. then clinoptilolite was added (0.1 ± 0.001 g) and the bottles reweighed, loosely capped, and returned to the gyratory shaker. The samples were prepared for LSA. These steps are described on page 159 Steps (d) & (e). All data was entered on the table on page 163.

9/20/94 TD EXPERIMENT TD Pudan #: B-IC

The liquid scintillation analysis of the samples has finished. Raw data and Results of calculations follow

17 Sep 94 09:52 ALPHA/BETA - 1.02 Page #2
Protocol #:17 U-233 3% 2 sigma User : Todd Dietrich

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
12 MISSING TUBE(S)									
55	8.19	0.98	313.0	539.902	3.02	540.20	3.08	697.92	
56	8.15	2.31	138.4	542.567	3.02	547.03	3.07	698.24	
57	8.12	2.51	128.2	545.076	3.01	548.91	3.07	696.86	
58	8.10	3.79	87.42	545.565	3.02	550.21	3.07	697.89	
1 MISSING TUBE(S)									
60	8.33	1.74	178.9	530.656	3.02	534.87	3.07	707.08	
61	8.18	2.23	142.6	540.199	3.02	543.95	3.07	698.85	
62	8.52	1.53	200.4	518.754	3.02	522.58	3.07	700.63	
63	8.15	1.32	235.2	542.444	3.02	544.33	3.08	701.25	
64	8.24	4.87	69.07	536.607	3.02	545.13	3.06	699.50	
65	8.33	2.34	135.0	530.656	3.02	534.51	3.07	704.17	
66	8.42	2.95	108.1	525.308	3.02	531.83	3.06	702.24	
67	8.37	2.24	140.3	528.225	3.02	534.10	3.07	702.42	
68	8.56	2.84	111.2	516.315	3.02	520.94	3.07	698.01	
69	9.01	1.89	158.9	490.930	3.02	495.47	3.07	700.60	
70	8.88	0.00	0.00	497.936	3.02	499.73	3.08	705.43	
71	9.48	0.00	0.00	465.805	3.02	466.82	3.09	704.20	
72	9.92	3.47	85.82	444.907	3.02	450.16	3.08	697.32	
73	10.12	2.74	105.7	436.053	3.02	440.54	3.09	701.01	
74	10.54	1.52	181.1	418.650	3.02	421.05	3.10	700.93	
75	10.29	1.23	225.8	429.187	3.02	432.42	3.09	698.00	
76	12.63	1.09	228.5	348.942	3.03	351.11	3.12	698.50	
77	11.05	0.88	301.6	399.276	3.02	400.47	3.11	700.61	
78	13.04	1.17	210.0	337.721	3.03	340.15	3.12	702.24	
79	10.11	1.18	236.7	436.587	3.02	438.92	3.09	701.59	
80	9.48	3.84	79.83	466.016	3.02	471.15	3.08	697.99	
81	8.97	0.76	387.1	492.575	3.02	495.79	3.08	704.14	
82	8.72	2.79	111.8	506.556	3.02	510.78	3.08	702.92	
83	8.65	2.50	124.5	511.605	3.02	515.82	3.07	701.22	
84	8.43	0.55	542.2	524.681	3.02	528.68	3.07	705.96	
85	8.43	4.11	79.58	524.206	3.02	531.05	3.06	699.78	
86	8.31	0.22	1335	531.941	3.02	533.09	3.08	704.77	
87	8.28	3.07	105.1	533.638	3.02	537.30	3.07	700.26	
88	8.40	2.65	119.8	526.804	3.02	531.62	3.07	701.10	

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IC*pH2.00	60	530.656	1095.039	1.2663E+14	2.1024E-10	48.9943
B-IC*pH2.25	61	540.199	1087.795	1.2579E+14	2.0885E-10	48.6702
B-IC*pH2.50	62	518.754	1047.565	1.2114E+14	2.0113E-10	46.8702
B-IC*pH2.75	63	542.444	1098.065	1.2698E+14	2.1082E-10	49.1297
B-IC*pH3.00	64	536.607	1081.433	1.2505E+14	2.0763E-10	48.3856
B-IC*pH3.25	65	530.656	1070.518	1.2379E+14	2.0553E-10	47.8972
B-IC*pH3.50	66	525.308	1064.670	1.2312E+14	2.0441E-10	47.6365
B-IC*pH3.75	67	528.225	1063.683	1.2300E+14	2.0422E-10	47.5914
B-IC*pH4.00	68	516.315	1043.904	1.2071E+14	2.0042E-10	46.7065
B-IC*pH4.25	69	490.930	996.610	1.1525E+14	1.9134E-10	44.5904
B-IC*pH4.50	70	497.936	1014.333	1.1730E+14	1.9475E-10	45.3834
B-IC*pH4.75	71	465.805	943.880	1.0915E+14	1.8122E-10	42.2312
B-IC*pH5.00	72	444.907	897.352	1.0377E+14	1.7229E-10	40.1494
B-IC*pH5.25	73	436.053	879.494	1.0170E+14	1.6886E-10	39.3504
B-IC*pH5.50	74	418.650	843.882	9.7585E+13	1.6202E-10	37.7571
B-IC*pH5.75	75	429.187	861.302	9.9599E+13	1.6536E-10	38.5365
B-IC*pH6.00	76	348.942	700.968	8.1058E+13	1.3458E-10	31.3628
B-IC*pH6.25	77	399.276	808.251	9.3464E+13	1.5518E-10	36.1628
B-IC*pH6.50	78	337.721	685.171	7.9232E+13	1.3155E-10	30.6560
B-IC*pH6.75	79	436.587	886.471	1.0251E+14	1.7020E-10	39.6626
B-IC*pH7.00	80	466.016	938.602	1.0854E+14	1.8021E-10	41.9950
B-IC*pH7.25	81	492.575	1000.559	1.1570E+14	1.9210E-10	44.7671
B-IC*pH7.50	82	506.556	1018.817	1.1781E+14	1.9561E-10	45.5840
B-IC*pH7.75	83	511.605	1037.318	1.1995E+14	1.9916E-10	46.4118
B-IC*pH8.00	84	524.681	1062.537	1.2287E+14	2.0400E-10	47.5402
B-IC*pH8.25	85	524.206	1057.933	1.2234E+14	2.0312E-10	47.3342
B-IC*pH8.50	86	531.941	1073.111	1.2409E+14	2.0603E-10	48.0132
B-IC*pH8.75	87	533.638	1062.178	1.2283E+14	2.0393E-10	47.5240
B-IC*pH9.00	88	526.804	1067.269	1.2342E+14	2.0491E-10	47.7519
B-IC*IU*a1	55	539.902	1069.325	1.2365E+14	2.0530E-10	47.8438
B-IC*IU*a2	56	542.567	1079.735	1.2486E+14	2.0730E-10	48.3096
B-IC*IU*b1	57	545.076	1084.728	1.2544E+14	2.0826E-10	48.5330
B-IC*IU*b2	58	545.565	1088.300	1.2585E+14	2.0895E-10	48.6928
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

Calculations verified on pg 143-144 of this notebook.

22 Sept 1994 TD EXPERIMENT D-I desorption

The desorption experiment was begun today. Solution pH and [U] will be measured. The zeolite will be removed and both the remaining solution and zeolite will be acidified. All data will be given in tables on following pages

NAME	WT TUBE (g)	pH	T (C)	WT VIAL (g)	WT VIAL + SAMPLE (g)
D-I*pH2.00	78.0898	2.51	20.7	7.7585	8.2576
D-I*pH3.75	76.9618	5.03	20.2	7.6686	8.1414
D-I*pH4.00	76.3882	5.26	20.2	7.7225	8.2219
D-I*pH4.25	74.9499	5.70	20.3	7.7404	8.2399
D-I*pH4.50	76.6318	5.82	20.3	7.7152	8.2139
D-I*pH4.75	76.8540	5.97	20.3	7.6996	8.1967
D-I*pH5.00	76.0989	6.08	20.3	7.6864	8.1849
D-I*pH5.25	74.8552	6.14	20.3	7.7194	8.2167
D-I*pH5.50	73.6119	6.16	20.4	7.7103	8.2074
D-I*pH5.75	75.4427	6.18	20.5	7.7208	8.2196
D-I*pH6.00	76.4807	6.23	20.5	7.7120	8.2125
D-I*pH6.25	75.2301	6.28	20.5	7.7463	8.2444
D-I*pH6.50	72.0724	6.33	20.6	7.6999	8.1982
D-I*pH6.75	75.4858	6.43	20.6	7.7680	8.2660
D-I*pH7.00	76.4158	6.62	20.6	7.7687	8.2667
D-I*pH7.25	76.0824	6.87	20.6	7.7855	8.2804
D-I*pH7.50	75.8995	7.15	20.7	7.6773	8.1762
D-I*pH7.75	77.7330	7.31	20.7	7.7418	8.2398
D-I*pH8.00	74.4710	7.70	20.7	7.7589	8.2557
D-I*pH9.00	75.2921	8.85	20.7	7.7722	8.2710

9/26/94 TD

NAME	WT BEFORE ZEOLITE	WT AFTER ZEOLITE	WT BOTTLE 2+	WT BOTTLE 2	WT BOTTLE 2+	WT AFTER ACID
	REMOVED (g)	REMOVED (g)	ZEOLITE (g)	EMPTY (g)	ACID (g)	ADDED (g)
D-I*pH2.00	17.5369	71.8487	12.6840	7.0386	15.6997	72.4690
D-I*pH3.75	16.4166	71.6172	11.7605	7.0952	14.3557	72.2365
D-I*pH4.00	15.8476	69.1618	12.2933	7.1068	15.2970	69.7856
D-I*pH4.25	14.4133	70.0609	11.3549	7.0726	14.3576	70.6835
D-I*pH4.50	16.0807	68.7954	12.3224	7.1202	15.3245	69.4179
D-I*pH4.75	16.2857	70.7852	12.4576	7.1228	15.4704	71.4064
D-I*pH5.00	15.5323	70.9001	12.2238	7.0490	15.2278	71.5212
D-I*pH5.25	14.3221	69.1579	12.0063	7.1138	15.0172	69.7773
D-I*pH5.50	13.0646	67.7836	11.7428	7.1071	14.7460	69.4044
D-I*pH6.00	14.8999	70.2427	12.5859	6.8878	15.5906	70.9646
D-I*pH6.25	16.9352	70.2326	12.4612	6.9032	15.4706	70.9578
D-I*pH6.50	14.6749	69.1160	12.0272	6.9624	15.0324	69.7350
D-I*pH6.75	11.5308	66.4952	10.6119	7.0292	13.6167	67.1175
D-I*pH7.00	14.4542	71.2734	11.1641	6.9739	14.1686	71.4942
D-I*pH7.25	15.8665	71.6699	14.1250	7.0291	17.1334	72.2886
D-I*pH7.50	15.5325	68.4101	12.2363	7.0285	15.2373	69.0304
D-I*pH7.75	16.3586	70.1324	13.0189	7.0556	16.0421	70.7445
D-I*pH8.00	17.1847	71.1024	13.8027	7.0617	15.8031	71.7224
D-I*pH9.00	18.9343	68.1724	12.8027	7.1913	15.8031	68.7884
	14.7419	68.5478	13.3677	7.2145	16.3696	69.1084

9/28/94 TD B-IIIC

The equilibration with CO_2 is complete. The solutions will/were be sampled, the pH was measured, and 0.1 ± 0.001 g Na-clinoptilolite were added to each bottle. All data can be found on pages 174.

10/4/94 TD D-I Desorption

The LSA of the initial desorption samples has finished. The raw data and results of calculations follow. Verification of calculations can be found on pages 143-144 of this notebook.

30 Sep 94 04:39 ALPHA/BETA - 1.02 Page #1
Protocol #:17 U-233 3% 2 sigma User : Todd Dietrich

Time: 999.99
Data Mode: CPM Nuclide: MANUAL
Background Subtract: 1st Vial

	LL	UL	LCR	2S%	BKG
Region A:	0.0 -	100	0	0.3	18.42
Region B:	100 -	350	0	3.0	3.24
Region C:	0.0 -	2000	0	0.1	27.48

Quench Indicator: SIS
alpha cpm U-233 1st vial bkgnd
Coincidence Time(ns): 18
Delay Before Burst(ns): Normal

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.99	18.42	1.47	3.242	3.51	27.48	1.21	144.52	B
2	8.61	5.04	65.66	513.250	3.02	517.93	3.07	705.76	
3	63.17	0.00	0.00	67.108	3.15	66.11	3.72	729.96	
4	123.81	0.00	0.00	32.660	3.32	32.89	4.36	715.55	
5	201.54	0.26	251.6	18.808	3.57	19.45	5.25	705.36	
6	208.25	0.00	0.00	18.103	3.59	18.12	5.48	716.11	
7	233.39	0.00	0.00	15.799	3.69	15.29	6.00	735.57	
8	255.88	0.23	259.2	14.125	3.78	14.69	5.97	702.96	
9	270.12	0.11	560.6	13.210	3.83	13.47	6.28	706.05	
10	267.80	0.12	478.4	13.352	3.82	13.84	6.16	704.70	
11	263.43	0.00	0.00	13.628	3.81	13.74	6.24	720.45	
12	252.08	0.19	328.2	14.387	3.76	14.96	5.92	705.97	
13	261.71	0.00	0.00	13.739	3.80	13.65	6.30	725.85	
14	241.55	0.00	0.00	15.160	3.72	14.78	6.09	735.03	
15	231.74	0.13	481.0	15.943	3.68	16.19	5.74	710.61	
16	213.64	0.52	125.3	17.559	3.61	18.44	5.34	694.92	
17	136.73	0.85	94.13	29.260	3.36	30.58	4.40	693.06	
18	91.97	0.47	201.1	45.078	3.23	45.74	3.97	702.56	
19	76.93	0.26	388.5	54.564	3.18	55.35	3.80	704.94	
20	30.57	0.98	164.6	142.195	3.07	142.75	3.31	702.97	
21	8.58	1.40	218.4	514.823	3.02	520.31	3.07	707.36	

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
D-I*pH2.00	2	513.250	1028.351	1.1892E+14	1.9744E-10	46.0106
D-I*pH3.75	3	67.108	141.937	1.6413E+13	2.7251E-11	6.3506
D-I*pH4.00	4	32.660	65.398	7.5625E+12	1.2556E-11	2.9261
D-I*pH4.25	5	18.808	37.654	4.3542E+12	7.2293E-12	1.6847
D-I*pH4.50	6	18.103	36.300	4.1977E+12	6.9694E-12	1.6242
D-I*pH4.75	7	15.799	31.782	3.6752E+12	6.1020E-12	1.4220
D-I*pH5.00	8	14.125	28.335	3.2766E+12	5.4401E-12	1.2678
D-I*pH5.25	9	13.210	26.563	3.0717E+12	5.1000E-12	1.1885
D-I*pH5.50	10	13.352	26.860	3.1060E+12	5.1569E-12	1.2018
D-I*pH5.75	11	13.628	27.322	3.1594E+12	5.2456E-12	1.2224
D-I*pH6.00	12	14.387	28.745	3.3240E+12	5.5189E-12	1.2861
D-I*pH6.25	13	13.739	27.583	3.1896E+12	5.2957E-12	1.2341
D-I*pH6.50	14	15.160	30.423	3.5181E+12	5.8411E-12	1.3612
D-I*pH6.75	15	15.943	32.014	3.7020E+12	6.1465E-12	1.4324
D-I*pH7.00	16	17.559	35.259	4.0773E+12	6.7695E-12	1.5776
D-I*pH7.25	17	29.260	59.123	6.8369E+12	1.1351E-11	2.6453
D-I*pH7.50	18	45.078	90.355	1.0448E+13	1.7348E-11	4.0427
D-I*pH7.75	19	54.564	109.566	1.2670E+13	2.1036E-11	4.9022
D-I*pH8.00	20	142.195	286.222	3.3098E+13	5.4953E-11	12.8062
D-I*pH9.00	21	514.823	1032.123	1.1935E+14	1.9816E-10	46.1793
VALIDATION		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

10/5/94 TD B-IIIC

Since some of pH values failed to reach the desired pH values (See pg 174 i:4-7.50) the clinoptilolite was not added on 9/28/94. The pH values of those solutions were adjusted ~~according to~~ using TD 10/5/94 EQ3 calculated values. A table with the adjustments is ~~on the following pages~~ below TD 10/5/94. These solutions where weighed both before and after adjustment. The weight in the table on page 174 is the weight before adjustment. The weight after adjustment is on page 186. 0.1 ± 0.001 g N_a-clinoptilolite was then added to all the bottles and they were reweighed. Those weights can be found on pg. 174.

pH	NaHCO3 to add Moles/kg	Add to 50 ml moles NaHCO3	molality NaHCO3	For 50 solution, Vol.(microL) needed	Rounded off vol. (microL)
4.00	8.415E-05	4.207E-06	0.05	84	80
4.25	9.483E-05	4.742E-06	0.05	95	100
4.50	9.114E-05	4.557E-06	0.05	91	90
4.75	7.456E-05	3.728E-06	0.05	75	75
5.00	7.382E-05	3.691E-06	0.05	74	75
5.25	7.768E-05	3.884E-06	0.05	78	75
5.50	7.083E-05	3.542E-06	0.05	71	70
5.75	7.937E-05	3.968E-06	0.05	79	80
6.00	7.481E-05	3.741E-06	0.05	75	75
6.25	1.980E-04	9.898E-06	0.05	198	200
6.50	7.999E-05	3.999E-06	0.05	80	80
6.75	6.733E-05	3.367E-06	0.05	67	70
7.00	6.959E-05	3.479E-06	0.05	70	70
7.25	9.306E-05	4.653E-06	0.05	93	90
7.50	1.305E-04	6.524E-06	0.05	130	130

NAME	WT(g)
B-IIIC *pH 4.00	69.3380
4.25	69.3661
4.50	69.4765
4.75	69.9297
5.00	69.4851
5.25	69.4483
5.50	69.6318
5.75	69.7782
6.00	69.2069
6.25	69.6628
~~6.50~~ 7.0 6.50	69.2696
6.75	69.9149
7.00	69.6224
7.25	69.7192
7.50	69.4632

10/13/94 TD EXPERIMENT B-IC

The final samples were taken today. The pH and solution weights were also measured. All data can be found on pg 164. The reversibility and desorption experiments will be begun tomorrow.

10/14/94 TD EXPERIMENT B-IC

The reverse experiment was begun. The solutions in Table B-IC-2 had their pH adjusted using the values in the same table (See pg. 161). The weights before and after adjustment can be found on page 167.

10/17/94 TD EXPERIMENT B-IC

The desorption experiment was begun. The zeolite was removed from the solutions (all except the reverse) using an Eppendorf pipet. the solution that remained was acidified with 50% (v/v) HNO_3 and the zeolite acidified with 3 mL 0.1 M HNO_3. The weights can be found on page 165.

20 Oct 1994 TD

The liquid scintillation analysis of the B-IIIC (initial) and the B-IC (Final) samples has finished. Raw data and results of calculations follow. Calculations were verified on page 143-144 of this note book.

EXPERIMENT B-IIIC

08 Oct 94 07:36 ALPHA/BETA - 1.02 Page #1
Protocol #:18 U-233 5% 2 sigma User : Todd Dietrich

Time: 999.99
Data Mode: CPM Nuclide: MANUAL
Background Subtract: 1st Vial

	LL	UL	LCR	2S%	BKG
Region A:	0.0 -	100	0	0.3	18.44
Region B:	100 -	350	0	5.0	3.11
Region C:	0.0 -	2000	0	0.1	27.22

Quench Indicator: SIS
alpha cpm U-233 1st vial bkgnd
Coincidence Time(ns): 18
Delay Before Burst(ns): Normal

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.99	18.44	1.47	3.106	3.59	27.22	1.21	139.43	B
2	15.67	0.70	317.0	99.128	5.15	100.48	5.69	692.30	
3	17.62	0.23	903.8	87.700	5.18	88.34	5.81	705.81	
4	16.51	0.21	1005	93.866	5.17	94.47	5.76	703.92	
5	16.26	0.00	0.00	95.356	5.16	95.23	5.77	702.33	
1 MISSING TUBE(S)									
7	29.10	0.25	645.2	51.877	5.30	52.82	6.31	705.62	
8	29.96	0.00	0.00	50.299	5.31	49.35	6.51	723.54	
9	30.43	0.00	0.00	49.474	5.32	49.81	6.42	720.11	
10	31.03	0.00	0.00	48.457	5.33	48.29	6.50	716.50	
11	31.08	0.00	0.00	48.374	5.33	47.43	6.57	726.41	
12	31.61	0.00	0.00	47.511	5.33	47.54	6.51	728.69	
13	31.69	0.00	0.00	47.383	5.33	47.76	6.48	717.37	
14	31.02	0.67	236.2	48.474	5.33	49.25	6.41	702.07	
15	31.61	1.87	87.05	47.511	5.33	50.10	6.28	680.36	
16	34.06	0.00	0.00	43.870	5.36	44.16	6.60	714.11	
17	31.74	0.15	1062	47.304	5.33	47.33	6.51	707.28	
18	33.98	0.39	385.7	43.980	5.36	45.09	6.51	707.83	
19	31.55	0.00	0.00	47.639	5.33	47.65	6.50	730.89	
20	35.53	0.61	243.3	41.926	5.38	41.80	6.72	701.64	
21	35.69	0.00	0.00	41.752	5.38	41.49	6.74	719.30	
22	35.77	0.85	176.2	41.652	5.38	43.77	6.48	698.20	
23	34.73	1.37	112.2	42.964	5.37	44.19	6.53	692.44	
24	31.80	0.00	0.00	47.208	5.33	47.47	6.49	725.32	
25	36.78	0.07	1971	40.450	5.39	41.06	6.69	711.25	
26	52.84	0.00	0.00	27.174	5.59	26.91	7.62	723.90	
27	47.76	0.00	0.00	30.395	5.52	30.53	7.28	721.26	
28	45.56	0.00	0.00	32.100	5.49	31.92	7.21	732.32	
29	35.07	0.18	834.1	42.517	5.37	42.79	6.65	708.63	
30	32.21	0.00	0.00	46.568	5.34	46.92	6.50	721.01	
31	31.95	0.99	159.2	46.972	5.34	48.12	6.42	691.51	
32	30.60	5.28	33.73	49.214	5.32	55.20	5.98	644.87	
33	32.30	22.80	9.98	46.430	5.34	69.07	5.02	481.67	
34	33.48	0.49	309.1	44.684	5.35	46.41	6.43	701.32	
35	32.10	1.93	83.68	46.801	5.33	49.30	6.30	684.66	

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IIIC*pH2.00	7	51.877	103.506	1.1969E+13	1.9872E-11	4.6311
B-IIIC*pH2.25	8	50.299	100.257	1.1594E+13	1.9249E-11	4.4857
B-IIIC*pH2.50	9	49.474	98.731	1.1417E+13	1.8956E-11	4.4174
B-IIIC*pH2.75	10	48.457	96.875	1.1202E+13	1.8599E-11	4.3344
B-IIIC*pH3.00	11	48.374	95.639	1.1059E+13	1.8362E-11	4.2791
B-IIIC*pH3.25	12	47.511	95.193	1.1008E+13	1.8277E-11	4.2591
B-IIIC*pH3.50	13	47.383	94.407	1.0917E+13	1.8126E-11	4.2240
B-IIIC*pH3.75	14	48.474	97.006	1.1218E+13	1.8625E-11	4.3403
B-IIIC*pH4.00	15	47.511	94.681	1.0949E+13	1.8178E-11	4.2362
B-IIIC*pH4.25	16	43.870	87.986	1.0175E+13	1.6893E-11	3.9367
B-IIIC*pH4.50	17	47.304	95.141	1.1002E+13	1.8266E-11	4.2568
B-IIIC*pH4.75	18	43.980	87.995	1.0176E+13	1.6895E-11	3.9371
B-IIIC*pH5.00	19	47.639	95.297	1.1020E+13	1.8296E-11	4.2638
B-IIIC*pH5.25	20	41.926	83.485	9.6540E+12	1.6029E-11	3.7353
B-IIIC*pH5.50	21	41.752	83.638	9.6717E+12	1.6058E-11	3.7421
B-IIIC*pH5.75	22	41.652	83.857	9.6971E+12	1.6100E-11	3.7520
B-IIIC*pH6.00	23	42.964	86.100	9.9564E+12	1.6531E-11	3.8523
B-IIIC*pH6.25	24	47.208	94.738	1.0955E+13	1.8189E-11	4.2388
B-IIIC*pH6.50	25	40.450	81.046	9.3720E+12	1.5560E-11	3.6262
B-IIIC*pH6.75	26	27.174	54.687	6.3239E+12	1.0500E-11	2.4468
B-IIIC*pH7.00	27	30.395	61.071	7.0621E+12	1.1725E-11	2.7324
B-IIIC*pH7.25	28	32.100	64.536	7.4627E+12	1.2390E-11	2.8875
B-IIIC*pH7.50	29	42.517	85.530	9.8905E+12	1.6421E-11	3.8268
B-IIIC*pH7.75	30	46.568	93.610	1.0825E+13	1.7972E-11	4.1883
B-IIIC*pH8.00	31	46.972	94.208	1.0894E+13	1.8087E-11	4.2151
B-IIIC*pH8.25	32	49.214	98.645	1.1407E+13	1.8939E-11	4.4136
B-IIIC*pH8.50	33	46.430	93.817	1.0849E+13	1.8012E-11	4.1976
B-IIIC*pH8.75	34	44.684	90.399	1.0453E+13	1.7356E-11	4.0446
B-IIIC*pH9.00	35	46.801	94.835	1.0966E+13	1.8208E-11	4.2431
B-IIIC*IU*a1	2	99.128	97.557	1.1281E+13	1.8730E-11	4.3649
B-IIIC*IU*a2	3	87.700	94.453	1.0922E+13	1.8134E-11	4.2260
B-IIIC*IU*b1	4	93.866	92.863	1.0738E+13	1.7829E-11	4.1549
B-IIIC*IU*b2	5	95.356	94.863	1.0970E+13	1.8213E-11	4.2444
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

EXPERIMENT B-IC

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IC*pH2.00	2	536.667	1071.833	1.2394E+14	2.0579E-10	47.9561
B-IC*pH2.25	3	555.906	1112.257	1.2862E+14	2.1355E-10	49.7647
B-IC*pH2.50	4	542.137	1083.407	1.2528E+14	2.0801E-10	48.4739
B-IC*pH2.75	5	528.679	1060.965	1.2269E+14	2.0370E-10	47.4698
B-IC*pH3.00	6	524.382	1051.920	1.2164E+14	2.0196E-10	47.0651
B-IC*pH3.25	7	524.652	1053.518	1.2183E+14	2.0227E-10	47.1366
B-IC*pH3.50	8	519.631	1043.855	1.2071E+14	2.0041E-10	46.7043
B-IC*pH3.75	9	482.981	974.341	1.1267E+14	1.8707E-10	43.5941
B-IC*pH4.00	10	465.460	935.598	1.0819E+14	1.7963E-10	41.8606
B-IC*pH4.25	11	432.841	867.417	1.0031E+14	1.6654E-10	38.8100
B-IC*pH4.50	12	378.250	759.081	8.7778E+13	1.4574E-10	33.9629
B-IC*pH4.75	13	300.206	605.743	7.0047E+13	1.1630E-10	27.1022
B-IC*pH5.00	14	281.078	565.777	6.5425E+13	1.0863E-10	25.3140
B-IC*pH5.25	15	225.918	454.563	5.2565E+13	8.7273E-11	20.3381
B-IC*pH5.50	16	177.773	358.052	4.1404E+13	6.8744E-11	16.0200
B-IC*pH5.75	17	162.065	327.934	3.7922E+13	6.2961E-11	14.6725
B-IC*pH6.00	18	120.183	243.236	2.8127E+13	4.6700E-11	10.8829
B-IC*pH6.25	19	120.443	242.569	2.8050E+13	4.6572E-11	10.8531
B-IC*pH6.50	20	97.041	194.861	2.2533E+13	3.7412E-11	8.7185
B-IC*pH6.75	21	111.338	224.020	2.5905E+13	4.3010E-11	10.0231
B-IC*pH7.00	22	139.165	280.575	3.2445E+13	5.3868E-11	12.5535
B-IC*pH7.25	23	202.743	407.688	4.7144E+13	7.8273E-11	18.2408
B-IC*pH7.50	24	245.185	495.624	5.7313E+13	9.5157E-11	22.1752
B-IC*pH7.75	25	351.204	708.644	8.1946E+13	1.3606E-10	31.7062
B-IC*pH8.00	26	440.817	891.981	1.0315E+14	1.7125E-10	39.9091
B-IC*pH8.25	27	523.638	1057.855	1.2233E+14	2.0310E-10	47.3306
B-IC*pH8.50	28	541.292	1087.368	1.2574E+14	2.0877E-10	48.6511
B-IC*pH8.75	29	534.875	1081.867	1.2510E+14	2.0771E-10	48.4050
B-IC*pH9.00	30	536.424	1081.282	1.2504E+14	2.0760E-10	48.3788
VALIDATION		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

16 Oct 94 10:16 ALPHA/BETA - 1.02 Page #1
Protocol #:17 U-233 3% 2 sigma User : Todd Dietrich

Time: 999.99
Data Mode: CPM Nuclide: MANUAL
Background Subtract: 1st Vial

	LL	UL	LCR	2S%	BKG
Region A:	0.0 -	100	0	0.3	17.79
Region B:	100 -	350	0	3.0	3.14
Region C:	0.0 -	2000	0	0.1	26.60

Quench Indicator: SIS
alpha cpm U-233 1st vial bkgnd
Coincidence Time(ns): 18
Delay Before Burst(ns): Normal

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.99	17.79	1.50	3.139	3.57	26.60	1.23	145.58	B
2	8.24	0.66	456.3	536.667	3.02	538.70	3.08	706.70	
3	7.96	1.68	186.4	555.906	3.02	557.07	3.07	709.26	
4	8.15	3.32	97.39	542.137	3.02	548.01	3.07	704.99	
5	8.36	3.86	83.61	528.679	3.02	531.78	3.07	706.36	
6	8.43	0.12	2360	524.382	3.02	525.48	3.08	713.30	
7	8.42	1.10	274.5	524.652	3.02	526.26	3.08	711.75	
8	8.52	3.34	94.67	519.631	3.01	523.76	3.07	707.38	
9	9.15	0.03	10769	482.981	3.02	482.04	3.09	714.52	
10	9.49	2.55	115.3	465.460	3.02	468.66	3.08	707.51	
11	10.20	1.82	153.1	432.841	3.02	433.89	3.10	708.28	
12	11.66	1.51	171.5	378.250	3.02	380.61	3.11	710.82	
13	14.65	2.14	109.5	300.206	3.03	302.89	3.13	707.10	
14	15.65	2.47	92.85	281.078	3.03	283.63	3.14	706.49	
15	19.41	0.60	325.1	225.918	3.04	226.83	3.19	709.64	
16	24.57	0.00	0.00	177.773	3.05	178.29	3.24	713.87	
17	26.90	1.06	160.0	162.065	3.06	163.74	3.26	707.90	
18	36.06	0.35	414.4	120.183	3.08	120.69	3.36	711.38	
19	35.96	1.37	108.2	120.443	3.08	122.18	3.34	703.82	
20	44.36	0.38	342.9	97.041	3.10	98.04	3.44	707.45	
21	38.82	1.74	83.05	111.338	3.09	114.13	3.35	701.24	
22	31.25	1.41	112.6	139.165	3.07	140.12	3.30	703.09	
23	21.59	0.92	203.5	202.743	3.05	204.02	3.21	706.56	
24	17.90	1.32	158.1	245.185	3.04	247.37	3.17	705.98	
25	12.55	0.38	638.5	351.204	3.03	353.56	3.11	712.51	
26	10.01	2.09	135.3	440.817	3.02	443.83	3.09	708.51	
27	8.44	1.29	234.4	523.638	3.02	526.49	3.08	711.54	
28	8.17	2.53	125.1	541.292	3.02	544.27	3.07	710.16	
29	8.26	1.95	159.5	534.875	3.02	536.60	3.08	712.11	
30	8.24	2.48	127.0	536.424	3.02	538.70	3.08	710.09	

10/24/94 TO EXPERIMENT B-IIIC

Final forward samples were taken today. The weight and pH of solutions was also measured. Data can be found in the table on pg 175.

10/25/94 EXPERIMENT B-IIIC

~~TO 10/25/94~~ The reverse experiment was begun today. The solutions labeled indicated in Table B-IIIC-2 had their pH adjusted by the values listed in the same table. The weight after pH adjustment can be found in the table on page 176.

Pages 1 through 189 of this Scientific Notebook were reviewed for compliance with QAP-001 in response to Corrective Action Request 94-02. Corrections and clarifications were made as appropriate. In some cases, the date of a change will reflect the date of this review rather than the date of the original Scientific Notebook entry.

Randy Folck
SwRI - QA
11/02/94

11/9/94 TD D-I

The desorption mixtures were sampled today. The samples were prepared for I.S.A. The sample weights and mixture weights are given below.

The following are the samples of the zeolite/acid mixture Labled ...*Z for zeolite	NAME	WT TUBE (g)	WT VIAL (g)	WT VIAL + SAMPLE (g)
	D-I*pH2.00*Z	15.5767	7.6484	8.1449
	D-I*pH3.75*Z	14.2625	7.7830	8.2788
	D-I*pH4.00*Z	15.1591	7.7696	8.2632
	D-I*pH4.25*Z	14.3011	7.7563	8.2501
	D-I*pH4.50*Z	17.2407	7.7597	8.2580
	D-I*pH4.75*Z	15.1779	7.7126	8.2063
	D-I*pH5.00*Z	14.2733	7.6794	8.1727
	D-I*pH5.25*Z	15.1283	7.7736	8.2689
	D-I*pH5.50*Z	14.9509	7.7297	8.2228
	D-I*pH5.75*Z	14.6852	7.7454	8.2423
	D-I*pH6.00*Z	15.5767	7.7047	8.1993
	D-I*pH6.25*Z	15.3782	7.7392	8.2314
	D-I*pH6.50*Z	15.0224	7.8109	8.3073
	D-I*pH6.75*Z	13.5974	7.7546	8.2466
	D-I*pH7.00*Z	14.1630	7.6749	8.1671
	D-I*pH7.25*Z	17.1297	7.7657	8.2653
	D-I*pH7.50*Z	15.2056	7.7003	8.1947
	D-I*pH7.75*Z	TD 11/9/94 ~~17.1299~~ 16.0274	7.7130	8.2066
	D-I*pH8.00*Z	15.7719	7.7298	8.2255
	D-I*pH9.00*Z	16.2775	7.7404	8.2370

The following are the samples taken from the remaining solution. Labled ...*RS for remaining solution	NAME	WT TUBE (g)	WT VIAL (g)	WT VIAL + SAMPLE (g)
	D-I*pH2.00*RS	72.4231	7.7230	8.2269
	D-I*pH3.75*RS	72.2142	7.7317	8.2340
	D-I*pH4.00*RS	69.7829	7.7310	8.2315
	D-I*pH4.25*RS	70.6697	7.6952	8.1939
	D-I*pH4.50*RS	69.3989	7.7347	8.2363
	D-I*pH4.75*RS	71.2995	7.7178	8.2155
	D-I*pH5.00*RS	71.4856	7.7501	8.2499
	D-I*pH5.25*RS	69.7161	7.7181	8.2164
	D-I*pH5.50*RS	68.3547	7.7742	8.2717
	D-I*pH5.75*RS	70.7249	7.7414	8.2394
	D-I*pH6.00*RS	70.8309	7.7227	8.2264
	D-I*pH6.25*RS	69.7101	7.7344	8.2369
	D-I*pH6.50*RS	67.1016	7.7499	8.2529
	D-I*pH6.75*RS	71.8909	7.7309	8.2288
	D-I*pH7.00*RS	72.2807	7.7291	8.2366
	D-I*pH7.25*RS	69.0227	7.7296	8.2337
	D-I*pH7.50*RS	70.5783	7.7039	TD 11/9/94 ~~8.1998~~ 8.2004
	D-I*pH7.75*RS	71.6994	7.7318	8.2315
	D-I*pH8.00*RS	68.7701	7.7086	8.2104
	D-I*pH9.00*RS	69.0769	7.6777	8.1721

11/15/94 TD EXPERIMENT B-IC

The reverse and desorption experiments were sampled. Since the Tables on page 166-167 have no space for solution Weights, They will be recorded on the following ~~10~~ 11 pages. All other data will be on pages 166-167.

SOLN NAME	WT. BOTTLE + SOLN (g)
B-IC * pH 4.50	68.2803
B-IC * pH 5.00	68.1259
5.50	68.2029
6.00	68.3273
6.50	67.7832
6.75	68.1207
7.00	68.0169
7.50	68.2996

NAME	WT. BOTTLE(g), Solid Sorp	WT. BOTTLE(g) Container Sorp
B-IC @ pH2.00	13.4904	65.4216
2.25	12.9447	65.7965
2.50	13.5210	65.4975
2.75	13.2301	65.6470
3.00	—	65.0200
3.25	13.7202	65.2561
3.50	13.6149	65.1057
3.75	12.6493	66.1037
4.00	14.2263	64.5453
4.25	13.0451	65.8325
4.75	13.2043	65.6642
5.25	13.1499	66.0497
5.75	13.1593	66.1099
6.25	14.1614	65.1847
7.25	13.4794	65.2768
7.75	13.4355	65.0015
8.00	13.5821	65.7991
8.25	12.4730	66.4020
8.50	11.5319	67.5778
8.75	13.5373	65.6280
9.00	12.9896	66.0430

29 Nov 1994 TD

The liquid scintillation Analysis of the B-IIIC, B-IC (reverse and desorption), and D-I (desorp) has finished. Raw data & results of calculations follows. Verification of calculations can be found on page 143-144 of this book.

B-IIIC

20 Nov 94 00:02 ALPHA/BETA - 1.02 Page #1
Protocol #:18 U-233 5% 2 sigma User : Todd Dietrich

Time: 999.99
Data Mode: CPM Nuclide: MANUAL
Background Subtract: 1st Vial

	LL	UL	LCR	2S%	BKG
Region A:	0.0 -	100	0	0.3	18.21
Region B:	100 -	350	0	5.0	3.11
Region C:	0.0 -	2000	0	0.1	26.80

Quench Indicator: SIS
alpha cpm U-233 1st vial bkgnd
Coincidence Time(ns): 18
Delay Before Burst(ns): Normal

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.99	18.21	1.48	3.106	3.59	26.80	1.22	142.42	B
2	31.00	0.00	0.00	48.507	5.33	48.62	6.45	721.51	
3	29.61	1.82	91.49	50.964	5.31	54.15	6.14	700.31	
4	31.31	0.00	0.00	47.996	5.33	47.71	6.50	735.80	
5	33.08	0.00	0.00	45.322	5.34	44.69	6.62	733.84	
6	30.83	0.15	1020	48.791	5.32	48.80	6.45	723.13	
7	32.07	0.13	1184	46.785	5.34	47.50	6.45	718.98	
8	32.04	1.49	106.9	46.894	5.33	49.01	6.31	702.51	
9	34.79	0.00	0.00	42.884	5.37	43.22	6.61	723.44	
10	39.66	1.54	93.43	37.237	5.43	39.06	6.65	693.52	
11	50.37	0.00	0.00	28.718	5.55	28.94	7.36	728.82	
12	52.42	0.00	0.00	27.417	5.58	27.34	7.53	731.42	
13	62.06	0.20	571.4	22.675	5.71	23.32	7.83	716.34	
14	94.01	0.00	0.00	13.956	6.16	14.14	9.62	744.11	
15	79.71	0.00	0.00	17.004	5.94	17.48	8.73	735.27	
16	125.12	0.68	120.8	9.690	6.70	11.07	10.37	673.80	
17	158.86	0.00	0.00	6.966	7.40	7.19	13.64	734.38	
18	163.60	0.09	806.4	6.674	7.51	7.11	13.61	718.03	
19	168.64	2.37	31.66	6.388	7.63	9.18	10.67	530.12	
20	208.29	0.08	845.3	4.580	8.73	4.86	17.39	700.45	
21	190.72	0.00	0.00	5.304	8.19	5.72	15.53	740.15	
22	125.16	0.55	149.9	9.678	6.70	11.11	10.34	685.20	
23	87.80	0.10	973.8	15.117	6.07	15.66	9.13	723.74	
24	59.35	0.00	0.00	23.886	5.67	24.01	7.83	741.93	
25	56.64	0.10	1130	25.143	5.64	25.35	7.68	725.16	
26	38.59	0.00	0.00	38.407	5.41	39.30	6.71	740.49	
27	34.53	1.89	81.84	43.230	5.37	45.31	6.42	698.60	
28	32.80	0.00	0.00	45.735	5.34	45.94	6.52	733.40	
29	31.06	0.18	874.7	48.472	5.32	49.37	6.38	725.70	
30	32.11	1.82	88.05	46.723	5.34	49.18	6.29	705.27	

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IIIC*pH2.00	2	48.507	97.816	1.1311E+13	1.8780E-11	4.3765
B-IIIC*pH2.25	3	50.964	102.461	1.1848E+13	1.9672E-11	4.5843
B-IIIC*pH2.50	4	47.996	96.069	1.1109E+13	1.8445E-11	4.2983
B-IIIC*pH2.75	5	45.322	91.063	1.0530E+13	1.7483E-11	4.0743
B-IIIC*pH3.00	6	48.791	98.448	1.1384E+13	1.8901E-11	4.4048
B-IIIC*pH3.25	7	46.785	94.154	1.0888E+13	1.8077E-11	4.2126
B-IIIC*pH3.50	8	46.894	94.927	1.0977E+13	1.8225E-11	4.2472
B-IIIC*pH3.75	9	42.884	86.216	9.9699E+12	1.6553E-11	3.8575
B-IIIC*pH4.00	10	37.237	75.287	8.7060E+12	1.4455E-11	3.3685
B-IIIC*pH4.25	11	28.718	58.028	6.7102E+12	1.1141E-11	2.5963
B-IIIC*pH4.50	12	27.417	55.065	6.3676E+12	1.0572E-11	2.4637
B-IIIC*pH4.75	13	22.675	45.743	5.2897E+12	8.7824E-12	2.0467
B-IIIC*pH5.00	14	13.956	28.575	3.3043E+12	5.4862E-12	1.2785
B-IIIC*pH5.25	15	17.004	34.589	3.9998E+12	6.6409E-12	1.5476
B-IIIC*pH5.50	16	9.690	19.739	2.2826E+12	3.7898E-12	0.8832
B-IIIC*pH5.75	17	6.966	14.182	1.6399E+12	2.7228E-12	0.6345
B-IIIC*pH6.00	18	6.674	13.609	1.5737E+12	2.6129E-12	0.6089
B-IIIC*pH6.25	19	6.388	13.013	1.5048E+12	2.4984E-12	0.5822
B-IIIC*pH6.50	20	4.580	9.366	1.0831E+12	1.7982E-12	0.4191
B-IIIC*pH6.75	21	5.304	10.770	1.2454E+12	2.0677E-12	0.4819
B-IIIC*pH7.00	22	9.678	19.747	2.2835E+12	3.7913E-12	0.8835
B-IIIC*pH7.25	23	15.117	30.763	3.5574E+12	5.9063E-12	1.3764
B-IIIC*pH7.50	24	23.886	48.687	5.6301E+12	9.3476E-12	2.1784
B-IIIC*pH7.75	25	25.143	51.523	5.9579E+12	9.8920E-12	2.3052
B-IIIC*pH8.00	26	38.407	78.881	9.1216E+12	1.5145E-11	3.5293
B-IIIC*pH8.25	27	43.230	88.586	1.0244E+13	1.7008E-11	3.9635
B-IIIC*pH8.50	28	45.735	93.375	1.0798E+13	1.7927E-11	4.1778
B-IIIC*pH8.75	29	48.472	99.614	1.1519E+13	1.9125E-11	4.4569
B-IIIC*pH9.00	30	46.723	95.256	1.1015E+13	1.8289E-11	4.2619
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

Pages 194 and 195 Are Intentionally
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22 Nov 94 05:07 ALPHA/BETA - 1.02 Page #1
Protocol #:17 U-233 3% 2 sigma User : Todd Dietrich

Time: 999.99
Data Mode: CPM Nuclide: MANUAL
Background Subtract: 1st Vial

	LL	UL	LCR	2S%	BKG
Region A:	0.0 -	100	0	0.3	18.11
Region B:	100 -	350	0	3.0	2.92
Region C:	0.0 -	2000	0	0.1	26.71

Quench Indicator: SIS
alpha cpm U-233 1st vial bkgnd
Coincidence Time(ns): 18
Delay Before Burst(ns): Normal

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.99	18.11	1.49	2.921	3.70	26.71	1.22	136.18	B
2	8.60	7.24	47.58	513.939	3.02	520.85	3.06	704.54	
3	37.34	0.00	0.00	116.227	3.08	117.19	3.36	714.17	
4	36.90	0.81	180.8	117.513	3.08	118.82	3.35	708.35	
5	42.24	0.31	437.1	102.311	3.09	103.38	3.41	709.78	
6	45.70	0.84	156.7	94.344	3.09	95.24	3.45	707.28	
7	70.88	0.77	139.1	59.776	3.15	61.20	3.68	704.78	
8	42.00	0.18	767.3	102.888	3.09	104.20	3.40	713.63	
9	63.62	0.85	132.9	66.931	3.14	69.02	3.59	708.62	
10	68.57	0.66	164.0	61.889	3.15	63.04	3.67	710.70	
11	52.62	0.32	374.8	81.553	3.11	82.24	3.52	713.00	
12	33.47	0.00	0.00	129.855	3.07	129.70	3.34	718.91	
13	42.94	0.50	270.3	100.572	3.09	101.82	3.41	712.24	
14	60.86	1.66	70.70	70.115	3.13	72.44	3.55	700.82	
15	57.64	0.40	290.3	74.265	3.12	75.13	3.56	708.57	
16	60.52	0.71	161.6	70.509	3.13	72.15	3.57	708.29	
17	39.77	0.00	0.00	108.821	3.08	107.69	3.43	718.65	
18	58.26	0.53	219.2	73.375	3.12	74.67	3.56	705.91	
19	39.12	0.32	436.8	110.678	3.08	111.84	3.38	713.23	
20	27.23	1.06	160.4	160.281	3.06	162.13	3.25	712.90	
21	8.72	0.93	320.3	506.712	3.02	508.50	3.08	711.41	
1 MISSING TUBE(S)									
23	11.39	1.56	169.8	387.421	3.02	389.01	3.11	728.35	
24	1.60	12.51	69.95	2780.204	3.00	2794.54	3.01	727.57	
25	1.81	12.83	64.49	2460.615	3.00	2473.85	3.00	731.31	
26	1.56	12.66	70.20	2863.104	2.99	2873.93	3.00	736.14	
27	2.17	7.24	94.54	2055.143	3.00	2063.16	3.01	726.90	
28	1.62	22.63	44.34	2750.165	3.00	2773.91	3.00	730.38	
29	1.53	6.07	131.0	2915.380	3.00	2921.66	3.01	732.00	
30	1.66	11.41	73.97	2684.428	3.00	2692.57	3.01	732.02	
31	1.63	8.27	97.34	2732.048	3.00	2738.94	3.01	734.79	
32	1.57	13.10	68.10	2835.295	3.00	2849.73	3.00	735.33	
33	1.98	15.22	53.93	2241.523	3.00	2257.64	3.01	727.90	
34	1.85	15.94	53.85	2403.865	3.00	2422.48	3.00	730.65	
35	1.64	8.72	92.83	2710.493	3.00	2718.42	3.01	732.35	
36	1.40	15.46	63.37	3182.079	3.00	3203.29	3.00	734.51	
37	1.44	14.53	65.56	3088.745	3.00	3103.15	3.00	734.00	
38	2.22	23.33	37.05	2003.385	3.00	2025.55	3.00	722.86	
39	1.61	11.70	73.57	2760.433	3.00	2775.78	3.01	730.45	
40	2.01	8.76	83.57	2280.661	2.96	2291.70	2.96	727.81	
41	2.10	9.99	73.31	2114.222	3.00	2124.72	3.01	728.20	

22 Nov 94 21:21 ALPHA/BETA - 1.02 Page #2
Protocol #:17 U-233 3% 2 sigma User : Todd Dietrich

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
42	13.79	2.05	118.7	319.341	3.03	321.08	3.13	720.27	
12 MISSING TUBE(S)									
55	8.58	2.75	113.7	515.494	3.02	518.05	3.08	720.26	
56	9.49	3.18	94.71	465.572	3.02	468.97	3.08	718.77	
57	11.68	2.27	117.2	377.901	3.02	381.43	3.10	719.89	
58	18.49	1.20	172.1	237.479	3.04	238.41	3.18	721.70	
59	18.52	0.00	0.00	237.090	3.04	237.87	3.18	722.24	
60	12.68	1.76	142.8	347.552	3.03	349.63	3.12	720.45	
61	9.92	4.57	66.42	445.164	3.02	451.22	3.08	714.31	
62	8.46	2.22	140.1	522.847	3.02	526.37	3.07	718.30	
1 MISSING TUBE(S)									
64	7.23	4.85	73.70	612.017	3.01	620.04	3.05	739.62	
65	7.72	3.65	92.25	574.022	3.01	579.90	3.06	738.12	
66	7.12	5.49	66.56	621.939	3.01	628.77	3.05	732.69	
67	7.42	6.15	58.98	596.001	3.01	604.83	3.05	737.10	
68	5.95	6.60	61.92	744.978	3.01	752.96	3.04	738.17	
69	5.04	3.91	107.0	879.222	3.01	884.40	3.04	740.00	
70	4.20	13.08	41.72	1056.841	3.01	1075.20	3.01	714.93	
71	3.60	5.50	93.24	1233.468	3.00	1238.02	3.03	735.62	
72	2.67	5.49	108.5	1664.495	3.00	1672.17	3.02	741.15	
73	1.46	20.25	50.65	3049.134	3.00	3070.55	3.00	737.76	
74	1.09	6.66	143.2	4103.501	2.99	4109.07	3.00	744.66	
75	0.91	25.85	53.79	4938.837	2.98	4972.19	2.98	740.44	
76	1.01	10.60	100.6	4414.901	3.00	4426.76	3.00	748.45	
77	0.90	7.45	143.2	4971.523	2.99	4983.29	2.99	749.98	
78	1.40	10.46	86.41	3180.650	3.00	3194.72	3.00	750.50	
79	2.50	12.29	56.79	1774.679	3.01	1792.49	3.01	743.47	
80	4.72	0.00	0.00	940.299	3.01	941.30	3.04	741.75	
81	8.83	2.39	128.1	500.816	3.02	503.98	3.08	742.04	
82	7.37	1.56	209.6	601.421	3.01	603.82	3.06	744.68	
83	7.79	4.10	82.67	567.554	3.02	573.55	3.06	740.99	
2 MISSING TUBE(S)									
86	4.22	4.16	110.5	1051.818	3.01	1056.71	3.03	704.75	
87	4.19	7.90	63.14	1058.893	3.01	1066.85	3.03	701.23	
88	4.21	2.55	173.8	1053.374	3.01	1059.04	3.03	703.10	
89	4.13	8.52	59.67	1074.077	3.01	1083.46	3.03	702.37	
90	4.22	4.88	95.90	1051.107	3.01	1056.47	3.03	702.70	
91	4.20	6.65	73.12	1057.555	3.01	1064.25	3.03	701.82	
92	4.27	5.07	91.99	1038.765	3.01	1046.60	3.03	705.00	
93	4.42	6.32	74.48	1005.224	3.00	1012.21	3.03	701.55	
94	4.67	0.00	0.00	949.542	3.01	949.10	3.05	709.78	
95	4.80	5.64	79.03	923.954	3.01	929.75	3.04	701.72	
96	5.78	2.31	163.5	766.110	3.01	768.62	3.05	703.05	
97	7.33	3.72	93.11	603.355	3.01	607.67	3.06	701.86	
98	9.24	4.40	71.20	478.248	3.02	485.41	3.07	700.52	
99	9.64	6.89	46.91	458.386	3.02	466.24	3.07	698.02	
100	10.08	3.42	85.88	437.952	3.02	442.94	3.08	700.67	
101	6.37	5.12	74.73	695.195	3.01	702.18	3.05	699.87	
102	4.85	5.19	84.64	913.986	3.01	920.72	3.04	704.97	
103	4.24	8.30	60.20	1045.900	3.01	1056.08	3.03	702.00	
104	4.18	4.14	111.7	1060.955	3.01	1066.12	3.03	705.32	
105	4.15	4.06	114.1	1069.850	3.01	1075.22	3.03	705.43	
106	4.17	7.07	69.62	1064.225	3.01	1071.85	3.03	704.64	

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
D-I*pH2.00*RS	2	513.939	1019.923	1.1794E+14	1.9582E-10	45.6335
D-I*pH3.75*RS	3	116.227	231.390	2.6757E+13	4.4425E-11	10.3529
D-I*pH4.00*RS	4	117.513	234.791	2.7151E+13	4.5078E-11	10.5051
D-I*pH4.25*RS	5	102.311	205.155	2.3724E+13	3.9389E-11	9.1791
D-I*pH4.50*RS	6	94.344	188.086	2.1750E+13	3.6111E-11	8.4154
D-I*pH4.75*RS	7	59.776	120.104	1.3889E+13	2.3059E-11	5.3737
D-I*pH5.00*RS	8	102.888	205.858	2.3805E+13	3.9523E-11	9.2105
D-I*pH5.25*RS	9	66.931	134.319	1.5532E+13	2.5788E-11	6.0097
D-I*pH5.50*RS	10	61.889	124.400	1.4385E+13	2.3884E-11	5.5659
D-I*pH5.75*RS	11	81.553	163.761	1.8937E+13	3.1441E-11	7.3270
D-I*pH6.00*RS	12	129.855	257.802	2.9812E+13	4.9496E-11	11.5346
D-I*pH6.25*RS	13	100.572	200.143	2.3144E+13	3.8426E-11	8.9548
D-I*pH6.50*RS	14	70.115	139.394	1.6119E+13	2.6763E-11	6.2368
D-I*pH6.75*RS	15	74.265	149.156	1.7248E+13	2.8637E-11	6.6736
D-I*pH7.00*RS	16	70.509	138.661	1.6034E+13	2.6622E-11	6.2040
D-I*pH7.25*RS	17	108.821	215.872	2.4963E+13	4.1446E-11	9.6586
D-I*pH7.50*RS	18	73.375	147.784	1.7089E+13	2.8374E-11	6.6122
D-I*pH7.75*RS	19	110.678	221.489	2.5612E+13	4.2524E-11	9.9099
D-I*pH8.00*RS	20	160.281	319.412	3.6936E+13	6.1325E-11	14.2912
D-I*pH9.00*RS	21	506.712	1024.903	1.1852E+14	1.9677E-10	45.8563
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
D-I*pH2.00*Z	23	387.421	780.304	9.0233E+13	1.4981E-10	34.9124
D-I*pH3.75*Z	24	2780.204	5607.511	6.4844E+14	1.0766E-09	250.8918
D-I*pH4.00*Z	25	2460.615	4985.038	5.7646E+14	9.5709E-10	223.0411
D-I*pH4.25*Z	26	2863.104	5798.104	6.7048E+14	1.1132E-09	259.4193
D-I*pH4.50*Z	27	2055.143	4124.309	4.7693E+14	7.9184E-10	184.5302
D-I*pH4.75*Z	28	2750.165	5570.519	6.4416E+14	1.0695E-09	249.2367
D-I*pH5.00*Z	29	2915.380	5909.953	6.8341E+14	1.1347E-09	264.4237
D-I*pH5.25*Z	30	2684.428	5419.802	6.2673E+14	1.0406E-09	242.4933
D-I*pH5.50*Z	31	2732.048	5540.556	6.4070E+14	1.0638E-09	247.8961
D-I*pH5.75*Z	32	2835.295	5705.967	6.5982E+14	1.0955E-09	255.2969
D-I*pH6.00*Z	33	2241.523	4531.992	5.2407E+14	8.7011E-10	202.7708
D-I*pH6.25*Z	34	2403.565	4883.310	5.6469E+14	9.3756E-10	218.4895
D-I*pH6.50*Z	35	2710.493	5460.300	6.3142E+14	1.0483E-09	244.3053
D-I*pH6.75*Z	36	3182.079	6467.640	7.4790E+14	1.2417E-09	289.3758
D-I*pH7.00*Z	37	3088.745	6275.386	7.2567E+14	1.2048E-09	280.7739
D-I*pH7.25*Z	38	2003.385	4009.978	4.6370E+14	7.6989E-10	179.4148
D-I*pH7.50*Z	39	2760.433	5583.400	6.4565E+14	1.0720E-09	249.8130
D-I*pH7.75*Z	40	2280.661	4620.464	5.3430E+14	8.8710E-10	206.7292
D-I*pH8.00*Z	41	2114.222	4265.124	4.9321E+14	8.1888E-10	190.8306
D-I*pH9.00*Z	42	319.341	643.055	7.4361E+13	1.2346E-10	28.7716
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IC*pH2.00	64	612.017	619.450	7.1632E+13	1.1893E-10	27.7155
B-IC*pH2.25	65	574.022	574.654	6.6452E+13	1.1033E-10	25.7112
B-IC*pH2.50	66	621.939	622.001	7.1927E+13	1.1942E-10	27.8296
B-IC*pH2.75	67	596.001	597.914	6.9141E+13	1.1480E-10	26.7519
B-IC*pH3.00	-	-	-	-	-	-
B-IC*pH3.25	68	744.978	753.264	8.7106E+13	1.4462E-10	33.7026
B-IC*pH3.50	69	879.222	877.817	1.0151E+14	1.6854E-10	39.2754
B-IC*pH3.75	70	1056.841	1060.447	1.2263E+14	2.0360E-10	47.4466
B-IC*pH4.00	71	1233.468	1230.760	1.4232E+14	2.3630E-10	55.0668
B-IC*pH4.25	72	1664.495	1669.001	1.9300E+14	3.2044E-10	74.6746
B-IC*pH4.75	73	3049.134	3049.744	3.5267E+14	5.8553E-10	136.4519
B-IC*pH5.25	74	4103.501	4112.136	4.7552E+14	7.8950E-10	183.9856
B-IC*pH5.75	75	4938.837	4963.655	5.7399E+14	9.5299E-10	222.0843
B-IC*pH6.25	76	4414.901	4460.848	5.1584E+14	8.5645E-10	199.5877
B-IC*pH7.25	77	4971.523	4970.529	5.7478E+14	9.5431E-10	222.3919
B-IC*pH7.75	78	3180.650	3193.103	3.6924E+14	6.1306E-10	142.8661
B-IC*pH8.00	79	1774.679	1784.673	2.0638E+14	3.4265E-10	79.8500
B-IC*pH8.25	80	940.299	932.097	1.0779E+14	1.7896E-10	41.7040
B-IC*pH8.50	81	500.816	503.890	5.8269E+13	9.6744E-11	22.5451
B-IC*pH8.75	82	601.421	603.594	6.9798E+13	1.1589E-10	27.0061
B-IC*pH9.00	83	567.554	569.091	6.5808E+13	1.0926E-10	25.4623
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421
REVERSE	**S#**	**CPM B**	**MASS CONV**	**ATOM CONV**	**MOLE CONV**	**ppb U(233)**
B-IC*pH4.50	55	515.494	1028.930	1.1898E+14	1.9755E-10	46.0365
B-IC*pH5.00	56	465.572	926.880	1.0718E+14	1.7796E-10	41.4706
B-IC*pH5.50	57	377.901	755.198	8.7329E+13	1.4499E-10	33.7891
B-IC*pH6.00	58	237.479	476.292	5.5077E+13	9.1445E-11	21.3103
B-IC*pH6.50	59	237.090	477.042	5.5164E+13	9.1589E-11	21.3439
B-IC*pH6.75	60	347.552	684.966	7.9208E+13	1.3151E-10	30.6468
B-IC*pH7.00	61	445.164	881.862	1.0198E+14	1.6931E-10	39.4564
B-IC*pH7.50	62	522.847	1050.315	1.2146E+14	2.0165E-10	46.9933

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IC*pH2.00	86	1051.818	1055.406	1.2204E+14	2.0263E-10	47.2211
B-IC*pH2.25	87	1058.893	1071.863	1.2395E+14	2.0579E-10	47.9574
B-IC*pH2.50	88	1053.374	1058.880	1.2245E+14	2.0330E-10	47.3765
B-IC*pH2.75	89	1074.077	1073.970	1.2419E+14	2.0620E-10	48.0516
B-IC*pH3.00	90	1051.107	1055.964	1.2211E+14	2.0274E-10	47.2461
B-IC*pH3.25	91	1057.555	1054.707	1.2196E+14	2.0250E-10	47.1898
B-IC*pH3.50	92	1038.765	1047.248	1.2110E+14	2.0106E-10	46.8561
B-IC*pH3.75	93	1055.224	1056.386	1.2216E+14	2.0282E-10	47.2649
B-IC*pH4.00	94	949.542	966.062	1.1171E+14	1.8548E-10	43.2236
B-IC*pH4.25	95	923.954	924.046	1.0685E+14	1.7741E-10	41.3438
B-IC*pH4.75	96	766.110	763.895	8.8335E+13	1.4666E-10	34.1782
B-IC*pH5.25	97	603.355	609.573	7.0490E+13	1.1703E-10	27.2736
B-IC*pH5.75	98	478.248	485.827	5.6180E+13	9.3276E-11	21.7369
B-IC*pH6.25	99	458.386	460.504	5.3252E+13	8.8414E-11	20.6039
B-IC*pH7.25	100	437.952	436.077	5.0427E+13	8.3724E-11	19.5110
B-IC*pH7.75	101	695.195	695.612	8.0439E+13	1.3355E-10	31.1232
B-IC*pH8.00	102	913.986	920.707	1.0647E+14	1.7677E-10	41.1944
B-IC*pH8.25	103	1045.900	1045.795	1.2093E+14	2.0079E-10	46.7911
B-IC*pH8.50	104	1060.955	1070.590	1.2380E+14	2.0555E-10	47.9005
B-IC*pH8.75	105	1069.850	1088.795	1.2591E+14	2.0904E-10	48.7150
B-IC*pH9.00	106	1064.225	1076.606	1.2450E+14	2.0670E-10	48.1696
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

12 Dec 1994 TO EXPERIMENT B-III C

The reverse and desorption experiments were sampled today. All data (wts, pH, etc) was entered in the Tables on pg 177-178. The tables do not include a space for the solution wt. before sampling so that will be entered here.

50:1 desorption

NAME	WT BOTTLE(g)
B-III C* pH4.50 R	67.7911
5.00	67.3892
5.50	67.8985
6.00	67.3419
6.50	67.2610
6.75	68.0258
7.00	68.0549
7.50	67.6986

reverse

	WT BOTTLE, ZEOLITE (g)	WT BOTTLE, CONTAINER (g)
B-III C* pH2.00	14.2348	64.9022
2.25	13.6586	65.4524
2.50	13.5191	65.2196
2.75	13.1484	65.5131
3.00	13.1599	65.9109
3.25	13.0899	65.6572
3.50	13.6217	64.8725
3.75	13.9881	64.6215
4.00	12.9876	65.6748
4.25	13.2526	65.6841
4.75	13.1335	66.3026
5.25	13.5481	65.3419
5.75	13.6235	65.6406
6.25	13.3524	65.6802
7.25	14.2312	65.0295
7.75	13.6859	65.1117
8.00	~~12.44~~ TO 12/12/94 12.4960	66.2782
8.25	13.6872	64.7099
8.50	14.2477	65.2118
8.75	12.8209	66.3307
9.00	14.2144	65.3305

container desorption

9 Dec 1994 B-IIIC

The liquid scintillation analysis of the B-IIIC soil 9/10/94 samples has finished. The results of analysis and results of calculations follow. Calculations are verified on page 143-144 of this note book.

07 Dec 94 07:43 ALPHA/BETA - 1.02 Page #1
Protocol #:18 U-233 5% 2 sigma User : Todd Dietrich

Time: 999.99
Data Mode: CPM Nuclide: MANUAL
Background Subtract: 1st Vial

	LL	UL	LCR	2S%	BKG
Region A:	0.0 -	100	0	0.3	17.95
Region B:	100 -	350	0	5.0	3.20
Region C:	0.0 -	2000	0	0.1	26.91

Quench Indicator: SIS
alpha cpm U-233 1st vial bkgnd
Coincidence Time(ns): 18
Delay Before Burst(ns): Normal

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.99	17.95	1.49	3.202	3.53	26.91	1.22	144.63	B
2	32.01	0.67	232.2	46.782	5.35	47.82	6.43	709.85	
3	39.23	0.00	0.00	37.583	5.43	36.54	7.02	736.12	
4	49.16	0.00	0.00	29.365	5.56	29.83	7.29	726.18	
5	69.51	0.00	0.00	19.816	5.84	19.30	8.62	735.99	
6	81.39	0.45	218.1	16.456	6.01	17.09	8.81	710.62	
7	53.05	0.31	383.8	26.958	5.61	27.78	7.40	720.27	
8	36.42	0.53	275.2	40.785	5.40	42.01	6.59	719.04	
9	34.55	1.12	134.6	43.137	5.38	44.04	6.55	703.40	
1 MISSING TUBE(S)									
11	26.11	1.81	97.25	58.077	5.28	61.41	6.01	722.57	
12	26.65	1.56	111.0	56.835	5.29	58.61	6.14	730.98	
13	26.46	0.00	0.00	57.267	5.28	57.52	6.24	755.39	
14	27.81	0.24	675.6	54.331	5.30	55.58	6.23	745.99	
15	24.80	0.96	184.2	61.354	5.26	61.64	6.15	737.99	
16	22.52	0.30	610.3	67.846	5.24	68.21	6.05	745.01	
17	18.46	0.30	661.2	83.526	5.19	83.87	5.85	746.71	
18	16.07	0.59	365.9	96.362	5.17	97.05	5.73	737.37	
19	11.04	1.70	157.4	141.816	5.11	145.47	5.44	742.10	
20	10.51	1.27	214.4	149.034	5.11	151.21	5.45	742.49	
21	6.36	1.07	323.4	248.685	5.06	251.24	5.27	747.59	
22	5.90	3.40	112.1	267.984	5.06	271.40	5.24	743.35	
23	4.70	0.98	408.9	337.649	5.04	338.63	5.21	745.32	
24	3.18	5.63	96.81	501.829	5.02	507.06	5.11	741.43	
25	4.03	3.39	136.1	395.557	5.03	399.40	5.15	738.69	
26	4.69	2.30	180.8	338.589	5.04	341.54	5.19	738.51	
27	9.45	0.35	788.4	166.216	5.10	166.64	5.44	751.84	
28	17.13	0.38	551.6	90.201	5.18	91.19	5.77	747.92	
29	25.15	1.65	108.2	60.416	5.27	63.04	6.02	726.91	
30	33.32	0.00	0.00	45.027	5.35	44.70	6.60	757.49	
31	27.48	0.00	0.00	55.022	5.29	54.06	6.38	754.20	
32	15.55	0.00	0.00	99.692	5.16	100.88	5.69	706.06	
1 MISSING TUBE(S)									
34	16.32	0.00	0.00	94.960	5.17	95.34	5.75	710.39	
35	16.56	0.95	227.0	93.597	5.17	94.95	5.72	703.44	
36	16.11	0.17	1235	96.115	5.17	97.05	5.73	705.37	
37	16.48	1.65	133.4	93.885	5.17	96.27	5.69	696.59	
38	16.83	1.95	112.2	91.866	5.18	93.36	5.74	692.76	
39	17.12	0.00	0.00	90.256	5.18	90.44	5.80	703.67	
40	16.94	1.76	123.2	91.249	5.18	92.58	5.75	691.01	
41	17.56	0.56	372.6	87.914	5.18	87.84	5.83	699.54	

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Protocol #:18 U-233 5% 2 sigma User : Todd Dietrich

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
42	19.26	0.00	0.00	79.924	5.20	79.84	5.91	705.74	
43	22.22	1.76	108.1	68.850	5.23	71.38	5.91	688.04	
44	23.31	0.00	0.00	65.438	5.25	64.82	6.14	702.04	
45	26.60	2.31	76.42	56.948	5.28	59.52	6.08	681.23	
46	45.95	0.15	831.1	31.618	5.52	32.46	7.08	706.38	
47	35.35	0.01	13132	42.145	5.38	42.29	6.66	704.24	
48	26.55	0.00	0.00	57.062	5.28	57.24	6.25	713.43	
49	18.95	0.31	646.7	81.283	5.20	82.70	5.83	696.66	
50	16.98	2.66	83.44	91.144	5.17	93.53	5.71	684.63	
51	17.13	0.00	0.00	90.201	5.18	89.50	5.84	706.51	
52	16.01	1.29	171.8	96.736	5.17	97.20	5.74	696.57	
53	16.45	0.16	1296	94.184	5.17	93.16	5.81	704.86	

SYSTEM NORMALIZED

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IIIC*pH2.00	11	58.077	57.696	6.6719E+12	1.1077E-11	2.5814
B-IIIC*pH2.25	12	56.835	56.676	6.5539E+12	1.0881E-11	2.5358
B-IIIC*pH2.50	13	57.267	57.875	6.6925E+12	1.1112E-11	2.5894
B-IIIC*pH2.75	14	54.331	54.764	6.3327E+12	1.0514E-11	2.4502
B-IIIC*pH3.00	15	61.354	60.010	6.9394E+12	1.1521E-11	2.6850
B-IIIC*pH3.25	16	67.846	68.256	7.8929E+12	1.3105E-11	3.0539
B-IIIC*pH3.50	17	83.526	83.878	9.6995E+12	1.6104E-11	3.7529
B-IIIC*pH3.75	18	96.362	96.275	1.1133E+13	1.8484E-11	4.3076
B-IIIC*pH4.00	19	141.82	141.717	1.6388E+13	2.7209E-11	6.3407
B-IIIC*pH4.25	20	149.03	149.693	1.7310E+13	2.8740E-11	6.6976
B-IIIC*pH4.75	21	248.69	246.981	2.8560E+13	4.7419E-11	11.0504
B-IIIC*pH5.25	22	267.98	270.009	3.1223E+13	5.1840E-11	12.0808
B-IIIC*pH5.75	23	337.65	340.612	3.9388E+13	6.5395E-11	15.2397
B-IIIC*pH6.25	24	501.83	503.137	5.8182E+13	9.6599E-11	22.5114
B-IIIC*pH7.25	25	395.56	401.255	4.6400E+13	7.7038E-11	17.9530
B-IIIC*pH7.75	26	338.59	338.318	3.9122E+13	6.4955E-11	15.1371
B-IIIC*pH8.00	27	166.22	165.537	1.9142E+13	3.1782E-11	7.4065
B-IIIC*pH8.25	28	90.201	90.910	1.0513E+13	1.7454E-11	4.0675
B-IIIC*pH8.50	29	60.416	60.830	7.0342E+12	1.1679E-11	2.7216
B-IIIC*pH8.75	30	45.027	45.249	5.2325E+12	8.6875E-12	2.0245
B-IIIC*pH9.00	31	55.022	55.105	6.3722E+12	1.0580E-11	2.4655
Validation		500	1000.000	1.1564E+14	1.9199E-10	44.7421
B-IIICR*pH4.50	2	46.782	92.821	1.0734E+13	1.7821E-11	4.1530
B-IIICR*pH5.00	3	37.583	75.392	8.7182E+12	1.4475E-11	3.3732
B-IIICR*pH5.50	4	29.365	58.391	6.7522E+12	1.1211E-11	2.6126
B-IIICR*pH6.00	5	19.816	39.735	4.5949E+12	7.6289E-12	1.7778
B-IIICR*pH6.50	6	16.456	32.703	3.7817E+12	6.2787E-12	1.4632
B-IIICR*pH6.75	7	26.958	53.765	6.2173E+12	1.0323E-11	2.4056
B-IIICR*pH7.00	8	40.785	81.456	9.4194E+12	1.5639E-11	3.6445
B-IIICR*pH7.50	9	43.137	85.555	9.8934E+12	1.6426E-11	3.8279

Solid desorption

Reverse

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-IIIC*pH2.00	34	94.960	95.822	1.1081E+13	1.8397E-11	4.2873
B-IIIC*pH2.25	32	99.692	100.334	1.1602E+13	1.9264E-11	4.4892
B-IIIC*pH2.50	35	93.597	94.266	1.0901E+13	1.8099E-11	4.2177
B-IIIC*pH2.75	36	96.115	97.204	1.1240E+13	1.8662E-11	4.3491
B-IIIC*pH3.00	37	93.885	95.054	1.0992E+13	1.8250E-11	4.2529
B-IIIC*pH3.25	38	91.866	92.982	1.0752E+13	1.7852E-11	4.1602
B-IIIC*pH3.50	39	90.256	91.408	1.0570E+13	1.7550E-11	4.0898
B-IIIC*pH3.75	40	91.249	91.542	1.0586E+13	1.7575E-11	4.0958
B-IIIC*pH4.00	41	87.914	88.356	1.0217E+13	1.6964E-11	3.9532
B-IIIC*pH4.25	42	79.924	80.277	9.2831E+12	1.5413E-11	3.5918
B-IIIC*pH4.75	43	68.850	69.412	8.0267E+12	1.3327E-11	3.1056
B-IIIC*pH5.25	44	65.438	65.846	7.6143E+12	1.2642E-11	2.9461
B-IIIC*pH5.75	45	56.948	58.063	6.7142E+12	1.1148E-11	2.5979
B-IIIC*pH6.25	46	31.618	31.950	3.6947E+12	6.1342E-12	1.4295
B-IIIC*pH7.25	47	42.145	42.357	4.8980E+12	8.1322E-12	1.8951
B-IIIC*pH7.75	48	57.062	57.245	6.6197E+12	1.0991E-11	2.5613
B-IIIC*pH8.00	49	81.283	82.546	9.5454E+12	1.5848E-11	3.6933
B-IIIC*pH8.25	50	91.144	91.080	1.0532E+13	1.7487E-11	4.0751
B-IIIC*pH8.50	51	90.201	91.066	1.0531E+13	1.7484E-11	4.0745
B-IIIC*pH8.75	52	96.736	97.990	1.1331E+13	1.8813E-11	4.3843
B-IIIC*pH9.00	53	94.184	97.157	1.1235E+13	1.8654E-11	4.3470

Container desorption

092995 — RTP

Preparation of γ-Al_2O_3, SiO_2 (am), and Heulandite samples for EXAFS analysis

Objective: U-loaded minerals will be prepared and sent to LLNL for EXAFS study of the structure of solved U.

Sorbents:

(1) γ-alumina — purchased from Alfa Aesar, Lot # C16F19; 99.97%; surface area approx. 100 m^2/g

(2) amorphous SiO_2 — from Alfa Aesar, Lot # J25D05; 99.8%; surface area approx. 400 m^2/g

(3) Heulandite — locality Poonah, Maharashtra State, India

Stock solution used:

1000 ppm ^{238}U prepared on 12/08/94 by RTP from reagent grade $^{238}UO_2(NO_3)_2 \cdot 6H_2O$ (Mallinkrodt Lot # 8640 KCAP) and deI H_2O.

1110 hrs — RTP

Prepare 5 ppm ^{238}U solutions by diluting 5 gms of the 1000 ppm stock to 1000 gms with deI H_2O.

Pour solutions in polycarb bottles labeled:

EXAFS * Al_2O_3 * 1

EXAFS * Al_2O_3 * 2

EXAFS * SiO_2 * 1

EXAFS * SiO_2 * 2

1330 hrs — Measure pH of each soln. Electrode calibrated using buffers prepared on 062795 by M Armendariz. pH 2, 4, & 7 buffers read 2.02, 4.03 & 7.03, respectively.

pH values for U solutions are:

	pH
EXAFS+Al_2O_3-1	4.97
EXAFS+Al_2O_3-2	5.01
EXAFS+SiO_2-1	5.02
EXAFS+SiO_2-2	5.01

EQ3 predicted pH for a 5 ppm $UO_2(NO_3)_2$ solution is 4.95.

1000 hrs – measured the pH of the 1000 ppm U stock soln = 3.49

EQ3 predicted pH = 3.43

1015 hrs – Approx. 30 ml aliquots were taken from each 500 ml U soln & transferred to 60 ml FEP bottles labeled EXAFS+Al_2O_3#1+SOLN etc

Some of each U analysis using polarography.

1500 hrs – Weigh out 1.0 g of SiO_2 (amorph) & γ-Al_2O_3 onto weighing paper, then transfer into U solutions.

1615 hrs – Remeasure the pH of U soln:

	pH
EXAFS+Al_2O_3#1	5.05
...#2	5.17
EXAFS+SiO_2#1	4.54
...#2	4.55

pH of silica/U mixture went down

092995 – NM

0830 hrs – Measure pH of U/solvent mixtures

	pH	
buffer 2	2.04	No need to do
buffer 4	4.05	
buffer 7	7.03	
EXAFS+Al_2O_3#1	5.02	
EXAFS+Al_2O_3#2	5.07	
EXAFS+SiO_2#1	4.54	
EXAFS+SiO_2#2	4.52	

1300 hrs – [illegible]

Prepare 10 ppm ^{238}U solutions by diluting 10 g of 1000 ppm stock to 1000 g with deI H_2O in PC bottles labeled EXAFS*SiO_2*3 and EXAFS*Al_2O_3*3.

Measure pH of U solution:

	mg/kg	pH
buffer 2		2.02
buffer 4		4.04
buffer 7		7.05
EXAFS*Al_2O_3*3		4.82
EXAFS*SiO_2*3		4.82

EQ3 calc. pH of 10 ppm is 4.66

1500 hrs – [illegible]

Take 230 ml aliquots from EXAFS*SiO_2*3 and EXAFS*Al_2O_3*3 transfer into 60 ml FEP bottles labeled ...*soln.

1515 hrs – [illegible]

Add 1 g γ-Al_2O_3 or 1 g amorph. SiO_2 to U solutions.

1540 – [illegible]

Prepare 0.05 m ^{238}U solution, Liter

Dissolved 25.105 g $UO_2(NO_3)\cdot 6H_2O$ in 1000 g H_2O. Label EXAFS*HEUL*1

Measure pH

	pH
buffer 2	2.02
buffer 4	4.04
buffer 7	7.04
0.05M U	2.85 (EXAFS*HEUL*1)
EXAFS*Al_2O_3*3	5.02
EXAFS*SiO_2*3	4.38

EQ3 calc. pH of 0.05M U is 2.66.

1600 hrs – Take 20 ml of the 0.05 m U solution; transfer to 60 ml FEP bottle labeled EXAFS*HEUL*1*soln

Measure pH of U solution + sorbent mixtures:

EXAFS*Al_2O_3*1	6.57
EXAFS*Al_2O_3*2	6.42
EXAFS*SiO_2*1	6.70
EXAFS*SiO_2*2	6.36
EXAFS*Al_2O_3*3	6.68
EXAFS*SiO_2*3	6.58

10/25/95 — MJP

0900 hrs — Measure pH of Ca(OH)2 + soil mixtures

Calibrate using pH 2, 4, 7, 9 buffers prepared by M Amundson on 6/28/95

	Measured pH	Adj pH to check → 7.00
Buffer 7	7.00	
Soil + $Mn(NO_3)_2$ #1	6.84	6.80
Soil + $Mn(NO_3)_2$ #2	6.96	6.92
Soil + $Mn(NO_3)_2$ #3	6.80	6.76
Soil + $ZnCl_2$ #1	6.75	6.71
Soil + $ZnCl_2$ #2	6.70	6.67
Soil + $ZnCl_2$ #3	6.21	7.28

Adjust pH triplicates with 0.5 M NaOH

0.01 M HNO3

1045 hrs — MJP

Measure pH of 0.05 M Ca soln (Soil + Deion H2O) → 2.76

1050 hrs — Equilibrated two single crystals of Kenlandite soln specimen in polypropylene tube (Source: Poland, India).

1) ~ 0.6 x 1.3 x 0.6 cm / 1.29 gm

2) ~ 0.7 x 0.6 x 0.6 cm / 0.92 gm

1100 hrs — MJP

The big crystal of kenlandite (1.29 g) was added to the 0.05 M Ca solution (Soil + Deion H2O)

10/26/95 — MJP

1022 hrs — Measure pH of Ca(OH)2 + soil mixtures (NO recalibration done)

		pH measured
Buffer	2	2.00
"	4	4.00
"	7	7.00
Soil + $Mn(NO_3)_2$	#1	6.49
"	#2	6.44
"	#3	6.40
Soil + $ZnCl_2$	#1	6.48
"	#2	6.33
"	#3	6.59
Soil + $Ca(OH)_2$	#1	2.76

1608 hrs — Measure pH

		pH measured
Buffer	2	1.99
"	4	4.01
"	7	7.01
Soil + $Mn(NO_3)_2$	#1	6.51
"	#2	6.43
"	#3	6.47
Soil + $ZnCl_2$	#1	6.51
"	#2	6.33
"	#3	6.59

1630 hrs — Added 0.824 g $NaNO_3$ to EXAFS*Al_2O_3*1 & EXAFS*SiO_2*1.
10/4/95 RJP The $NaNO_3$ was added to try to flocculate the colloids, particular the γ-Al_2O_3, to make ultrafiltration easier (due to smaller volume).
$NaNO_3$ Lot# 930601
Fisher reagent

10/4/95 RJP
0845 hrs — No flocculation observed for γ-Al_2O_3. Added additional 7.421 g $NaNO_3$ to EXAFS*Al_2O_3*1 & EXAFS*SiO_2*1 (total $NaNO_3$ concentration = 0.1 M)

1115 hrs — RJP
Measured pH:

buffer 2	2.00
" 4	4.00
" 7	6.99
EXAFS*Al_2O_3*1	6.81
" *2	6.39
" *3	6.34
EXAFS*SiO_2*1	6.09
" 2	6.27
" 3	6.53

1330 hrs — Take 30 ml aliquots from the EXAFS*Al_2O_3*1, 2, 3 & EXAFS*SiO_2*1, 2, 3 mixtures. Transfer into 60 ml FEP bottles, labeled EXAFS*...*SOLN2.

1345 hrs — Add 7.99 g $NaNO_3$ to the remaining 940 ml solutions of EXAFS*Al_2O_3*3 & EXAFS*SiO_2*3, to flocculate most of the colloidal particle.

1400 hrs — For mixtures EXAFS*Al_2O_3*3 & EXAFS*SiO_2*3, which have 0.1 M $NaNO_3$ matrix & which have most of the Al_2O_3 & SiO_2 flocculated at the bottom of the container, reduce the volume of colloidal suspension by decanting most of the clear or semiclear solution down the sink. Initiate ultrafiltration of the EXAFS*SiO_2*1 colloidal suspension using the spectrum stirred cell. Inject ~11 ml of mixture into the cell. Start stirring & pressurize to 40 psi with N_2 gas.

10/05/95 — RJP
0930 hrs — Measure pH

	pH measured
buffer 2	2.00
4	4.01
7	7.01
EXAFS*Al_2O_3*2	6.40
" *3	6.50
EXAFS*SiO_2*2	6.30
*3	5.56 → pH went down

(No recalib. done)

Add 30 µL of 0.5 M NaOH
to EXAFS*SiO2*3.
pH measured = 6.47

1000 hrs – Prepare 100 mL of (1 M triethanolamine + 1 M tartaric acid) > 4 M.
Use 14.9 g triethanolamine
Fisher lot # 911834 &
15.0 g tartaric acid reagent
Fisher lot # 920136,
dilute to 100 mL w/ DI
HCl in 100 mL vol. flask.
Transfer to PP bottle.

1015 hrs – Prepare 0.5, 1, 2, 3, 4, 5 ppm
U standard solutions in
0.05 M TT matrix. Use Eppert.
micropipets + 1000 ppm 238U
stock solution & 1 M TT
stock solution

1400 hrs – Remeasure pH

buffer 2	2.00
4	4.02
7	7.03
EXAFS*SiO2*3	6.23 ← add 10 µL of 0.5 M NaOH

pH meas = 6.53

1410 hrs – Reduce volume of EXAFS*Al2O3*3
& EXAFS*SiO2*3 to ~20 mL by pipetting
out + discarding the relatively clear
solution above the flocculated particles.
Start ultrafiltration of the
EXAFS*SiO2*3 with the stirred
cell (10000 MWCO filter).

Transfer filtered EXAFS*SiO2*1
to plastic vial, labeled EXAFS*SiO2*1

1006/95 RJP
0930 hrs – Calibrate pH electrode
w/ buffers 2, 4, 7, prepared
4/10/99 o/o by M Almendarez on 6/27/95.
Measure pH of U solns.

	meas. pH
buffer 2	2.00
" 4	4.01
" 7	7.00
EXAFS*Al2O3*2	6.40
EXAFS*SiO2*2	6.25
EXAFS*SiO2*3	6.03 ← add 20 µL of 0.5 M NaOH
EXAFS*HEUL*1	2.73

Measured pH
= 6.62

1000 hrs – Ultrafiltration of EXAFS*Al2O3*1
was completed. Filtrate transferred
to plastic vial labeled EXAFS*Al2O3*1

1030 hrs – Remeasure pH of
EXAFS*SiO2*3 = 6.46

1040 hrs – Reduce volume of UAFS*SiO2*3 by decanting & discarding clear solution. Volume ~ 30 ml. Initiate ultrafiltration.

1200 hrs – Finish ultrafiltration of SiO2 sample. Transfer to plastic vial labeled UAFS*SiO2*3.

10/9/95 RJP

0915 hrs – Calibrate pH electrode with buffers 2, 4, 7. Slope = 98.8%

	pH meas.
UAFS*Al2O3*2	6.39
UAFS*SiO2*2	6.24
UAFS*HEUL*1	2.75
buffer 7	6.99

1130 hrs – Removed the heulandite crystal from the U solution. Rinsed briefly with dei H2O. Air dry on kimwipe. Transfer to plastic vial labeled UAFS*HEUL*1.

1150 hrs – Packaged UAFS*SiO2*1, UAFS*SiO2*3, UAFS*Al2O3*2, UAFS*Al2O3*3, & UAFS*HEUL*1 for fedex to EHUDSON of UNC.

1400 hrs – Initiate ultrafiltration of mixture UAFS*SiO2*2.

10/10/95 RJP

1530 hrs – Complete ultrafiltration of mixture UAFS*SiO2*2. The latter part of the filtration step was done with no stirring; the stirrer got stuck.

Transfer filtrate to plastic vial labeled UAFS*SiO2*2.

11/02/95 RJP

1000 hrs – Samples prepared for surface area analysis using the Coulter SA3100 with N2 gas.

Sample ID	Sample Desc.
110295-1	NIST 8007 standard 0.069 m²/g reported surface area
110295-2	Qtz used in U & Np sorption expts; wedron sand; W970*60/100*UC*RC*RFe*HL
110295-3	Qtz used in Np sorption expts; ground from #2; W970*60/100*UC*RC*RFe*HL*325*UC

continued on p. 217

Analysis I.D.	Sample Name	Wt. Tube/Filler Empty	Wt. w/ Sample	Calc. Wt. Sample	Wt. after Degas.	Calc. Wt. Sample Dry	Multi-pt. BET (m^2/g)	One-Pt. BET (m^2/g)
110295-1	NIST 9705	33.2350	42.8236			see page 218		
110295-2	[illegible]	33.4841	42.2048					
110295-3	[illegible]	33.6828	37.7989					
110295-4	Alumina 8571	29.3941	30.0589					
110295-5	γ-Al_2O_3	29.2099	29.4088					
110295-6	SiO_2 (am)	29.2099	29.2815					
110295-7								
110295-8								
110295-9								
110295-10								

Sample ID	Sample Description
110295-4	Alumina 8571 NIST standard; this standard provided w/ the instrument; 158 m^2/g reported surface area
110295-5	γ-Al_2O_3 used for LAFS study; purchased from Alfa Aesar.
110295-6	SiO_2 (am) used for LAFS study; purchased from Alfa Aesar.

Results on next page.

110295 Set

Analysis I.D.	Analysis Date	Sample Name	Wt. Tube/Filler Empty	Wt. w/ Sample	Calc. Wt. Sample	Wt. after Degas.	Calc. Wt. Sample Dry	Multi-pt. BET (m^2/g)	One-Pt. BET (m^2/g)
110295-1	11/8/95	NIST 8007	33.2350	42.8238	9.5888	42.8138	9.5788	0.077	0.073
110295-1	11/9/95	NIST 8007	same sample					0.079	0.074
110295-1	11/13/95	NIST 8007	same sample					0.079	0.071
110295-2	11/9/95	W510*60/100*UC*RC*RFe*HL	33.4841	42.2048	8.7207	42.199	8.7149	0.024	0.023
110295-3	11/9/95	W510*60/100*UC*RC*RFe*HL*325*UC	33.6828	37.7989	4.1161	37.7882	0.5870	0.568	
110295-3	11/9/95	W510*60/100*UC*RC*RFe*HL*325*UC	same sample				0.5860	0.567	
110295-3	11/13/95	W510*60/100*UC*RC*RFe*HL*325*UC	same sample				0.5870	0.549	
110295-4	not done	Alumina 8571	29.3941	30.0589	0.6648	sample tube broke			
110295-5	not done	gamma-Al2O3	29.2099	29.4088	0.1989	sample entrained during vacuum			
110295-6	11/9/95	SiO2(am)	29.2094	29.2815	0.0721	29.2693	0.0599	error; problem w/ tube???	

11/13/95 RJM

Samples prepared for surface area analysis as on 11/02/95. Sample ID RJM 11/16/95

110395-1 to 110395-6 have the sample sample descriptions as 110295-1 to 110295-6. Additional samples of γ-Al_2O_3 & SiO_2(am) were prepared and given sample IDs 110395-7 and 110395-8, respectively. Results on next page. (page 222)

1/11/96 RDP

1500 hrs - Prepared 5×10^{-3} m $UO_2(NO_3)_2$ solution. Used 2.5107 g $UO_2(NO_3)_2 \cdot 6H_2O$ reagent (Mallinkrodt Lot # 8640 KCXP) and 1000 g deI H_2O in polypropylene bottle.

Transfer 20 g of 5×10^{-3} m U into polycarb bottle, dilute to 1000 g with deI H_2O. Label EXAFS * Mont * 1 ($\Sigma U_i = 1\times10^{-4}$ m)

Transfer 20 g of 5×10^{-3} m U into polycarb bottle, add 5.844 g NaCl, dilute to 1000 g total wt (U soln + H_2O) using deI H_2O. Label EXAFS * Mont * 2. ($\Sigma U_i = 1\times10^{-4}$ m)

Transfer 20 g of 5×10^{-3} m U into polycarb bottle, add 0.5844 g NaCl, dilute to 1000 g (U + H_2O) using deI H_2O. Label EXAFS * Mont * 3 ($\Sigma U_i = 1\times10^{-4}$ m)

Transfer 10 g of 5×10^{-3} m U into polyc bottle ~~add deI H_2O to make 1000 g total.~~ RDP 1/11/96

Add 5.844 g NaCl, then H_2O to make 1000 g total (U + H_2O). Label EXAFS * Mont * 4. ($\Sigma U_i = 5\times10^{-5}$ m)

Prepare 0.01 m $UO_2(NO_3)_2$ solutions:

(1) Dissolve 5.0213 g $UO_2(NO_3)_2 \cdot 6H_2O$ in 1000 g H_2O; PP btl. Label EXAFS * Al_2O_3 * 4

(2) Same as in (1); label EXAFS * SiO_2 * 4

RDP 1/12/96

1/12/96 RDP

0900 hrs - Take 30 ml (20 ml from the 0.01 m U solns) aliquots from each of the solutions prepared yesterday and transfer into 30 ml PP bottles labeled, e.g., EXAFS * Mont * 1 * Soln. Save for later analysis of U conc. by polarography.

0930 hrs - Measure the pH of EXAFS solutions. Calibrate electrode with buffers 2, 4, 7 prepared on 6/28/95. Slope = 98%

Solution	pH meas	Compare EQ3 calc. pH
buffer 2	2.00	
4	4.00	
7	7.00	
EXAFS * Mont * 1	4.51	4.44
* 2	4.61	4.61
* 3	4.56	4.50
* 4	4.62	4.79
EXAFS * SiO_2 * 4	3.16	3.18
EXAFS * Al_2O_3 * 4	[illegible]	3.18

111395 Set

Analysis I.D.	Analysis Date	Sample Name	Wt. Tube/Filler Empty	Wt. w/ Sample	Calc. Wt. Sample	Wt. after Degas.	Calc. Wt. Sample Dry	Multi-pt. BET (m^2/g)	One-Pt. BET (m^2/g)
111395-1	11/15/95	NIST 8007	33.2236	42.8222	9.5986	42.8083	9.5847	0.087	0.081
111395-2	11/15/95	W510*60/100*UC*RC*RFe*HL	33.6809	42.3658	8.6849	42.3648	8.6839	0.03	0.027
111395-3	11/16/95	W510*60/100*UC*RC*RFe*HL*325*UC	33.4744	37.5168	4.0424	37.5149	4.0405	0.561	0.544
111395-4	11/15/95	Alumina 8571	66.4217	67.065	0.6433	67.0059	0.5842	163.983	160.783
111395-5	not done	gamma-Al2O3	29.3317	29.4313	0.0996	29.3205	-0.0112	negative weight	not done
111395-6	11/15/95	SiO2(am)	65.6818	65.7283	0.0465	65.7242	0.0424	370.144	364.614
111395-7	11/16/95	gamma-Al2O3	65.8338	65.8874	0.0536	65.8845	0.0507	86.886	85.163
111395-8	11/16/95	SiO2(am)	65.74	65.7782	0.0382	65.7746	0.0346	370.142	364.39

The measured SA for BET frequently appears too high compared to Ell 3 result & is close to value for BET&mont #2, w/c is at twice the N2 cart but same N2 conc. Possible error in dilution (may have used 20 g instead of 10 g of 5x10⁻³ m² stock solution).

11/15/95 – Prepared new 5x10⁻³ m² solution. Diluted 10 g of 5x10⁻³ m² to 100 g (with E-grade N2 added). Label PC bottle BET&mont #4 B.

Measured SA of #4 is 4.87, close to Ell 3 value of 4.79.

Remeasure #4, SA = 4.62 same as before

Thus, error is indicated for preparation of BET&mont #4.

1300 hrs –
Add 0.97 g amorphous silica (see page 202) to BET&mont #4 solution.

Add 0.97 g γ-alumina (see page 182) to BET&mont #4 solution.

Measure pH of CHES+Mont#1 = 4.51
Adjusted to 4.00 by addn
of aliquots 0.1m & 0.02m
HNO_3 solutions using
Eppendorfs 250µL pipettes

Measure pH of CHES+Mont#2 = 4.58 @ 1
Adjusted to 4.03 by addition
of 1,000µL of 0.1m HNO_3.

Measure pH of CHES+Mont#3 = 4.57
Adjusted to 4.02 by addition of
1000µL of 0.1m HNO_3 +
250µL of 0.02m HNO_3.

~~Measure pH of CHES+Mont#4 =~~
NVH 1/15/96

1100 hrs - Add 0.97g of montmorillonite (SAz-1 Lot#1N22 EF1#5x1) to the following: CHES+Mont#1
CHES+Mont#2
CHES+Mont#3
CHES+Mont#4B

Put all solutions on gyrotory shaker, loosely capped, shaker shaker.

1630 hrs - Measure pH of solutions:

soln	pH		pH adj
buffer 2	1.96		—
4	2.98		—
7	7.01		—
CHES+Mont#1	5.67 @	add 2.5 mL 0.1m HNO_3	3.99
#2	4.26	add 0.5 mL 0.1m HNO_3	4.03
#3	4.50	add 0.4 mL 0.1m HNO_3	4.02
#4B	5.01	add 0.5 mL 0.1m HNO_3 + 0.05m NaOH	6.37
CHES+SiO_2#4	2.06 @		—
CHES+Al_2O_3#4	2.22 @		—

01/16/96, NVH
0830 hrs - Measure pH of 0 solns. No readjs. done.

soln	pH		pH adj
buffer 2	2.01		—
4	4.01		—
7	7.00		—
CHES+Mont#1	4.43		
#2	add 0.4 mL 0.1m HNO_3	stay overnight	4.00
#3	4.19	add 30 mL 0.1m HNO_3	stay overnight 3.98
#4B	4.30	add 0.4 mL 0.1m HNO_3	stay overnight 4.02
CHES+SiO_2#4	6.02	add 0.6 mL 0.05m NaOH	stay overnight 6.41
CHES+Al_2O_3#4	3.13		
	3.40		

0930 hrs – Prepare 0.01 M U soln by dissolving 0.0213 g $UO_2(NO_3)_2 \cdot 6H_2O$ in 1000 g deion H2O. Pour into bottle labeled EXAFS & MONT #5

Measured pH = 3.25
(compare EA3 calc pH = 3.18)

Take 20 mL of EXAFS & MONT #5 and transfer into 20 mL std labeled EXAFS & MONT #5 + SLN for later U analysis.

Add 0.97 g of $SrCl_2 \cdot 6H_2O$ + EDTA + Sr nitrate trihydrate to the U soln. Place on gyratory shaker.

1000 hrs – Pumped solution EXAFS & MONT #4 into sink while water is running. Polycarb bottle cleaned for reuse.

01/16/96 TUES

0830 hrs. – Remeasure pH of stocks

soln	bottle #	pH		pH adj
U	2	4.99		
	4	4.00		pH adj
	2	3.01		
EXAFS & MONT #5	1	4.00	add more 0.1M HNO3	4.03
	2	4.03		—
	3	4.13	add more 0.1M HNO3	4.02
	4B	6.23	add 20 mL 0.05 M HNO3	
	5	3.24		

soln	pH
EXAFS & SiO_2 #4	3.21
EXAFS & Al_2O_3 #4	3.42

0940 hrs – Transfer contents of EXAFS & SiO_2 #4 into a polycarbonate bottle (note is under transparent) & SW easier decantation of U soln.

1030 hrs – Prepare 100 mL of 1 M TT (Tartaric acid - triethanolamine) (Fisher lot #920126 – Fisher lot 916824)
14.9 g triet 7 dilute to
15.0 g tart. acid 7 100 mL w/ DI H2O

Prepare 100 mL of 1.05 M TT
19.66 g triethanolamine
15.756 g Tartaric acid
Dilute to 100 mL.

1400 hrs – Decant supernatant from EXAFS & Al_2O_3 #2 slowly into 6 35 mL centrifuge bottles; centrifuge at 13K for 60 minutes. Decant clear soln into 1 L PP bottle. Repeat until volume of original soln is reduced to ~ 100 mL.

01/17/96 [illegible]

0930 hrs — initiate ultrafiltration of EXAFS*Al2O3*2 using the spectra cell.

0930 hrs — Measure pH of solutions. No recalib.

Solns	pH
buffer 2	2.00
4	4.01
7	7.02
EXAFS*Mont*1	4.11
*2	4.06
*3	4.11
*4B	6.41
*5	3.24
EXAFS*SiO2*4	3.14
EXAFS*Al2O3*4	3.48

1015 hrs — Take 30 ml samples from the EXAFS solutions.

EXAFS*Mont*1*SOLN2 — cloudy soln.
*2*SOLN2 — clear soln
*3*SOLN2 — a little cloudy, less cloudy than Mont*1
*4B*SOLN2 — clear soln
*5*SOLN2 — clear yellow soln
EXAFS*SiO2*4*SOLN2 — mostly clear, yellow soln
EXAFS*Al2O3*4*SOLN2 — cloudy yellow soln.

1600 hrs — Start filtration of montmorill solutions using whatman 0.45 μm 47 mm filters & small vacuum pump.

EXAFS*Mont*2 — whatman nylon filter; decant most of the solution before filtering ~150 ml soln. Transfer filtrate (w/ filter) into a plastic (PP?) vial labeled EXAFS*Mont*2.

EXAFS*Mont*4B — as above; vial labeled EXAFS*Mont*4B

EXAFS*Mont*5 — as above; vial labeled EXAFS*Mont*5

EXAFS*Mont*3 — Gelman 0.45 μm Metricel membrane; ~150 ml to be filtered; slow ? Leave overnight but cover glass container with parafilm.

~~[illegible]~~ [illegible]

1700 hrs — turn off stirrer & N2 gas pressure on spectra cell w/ EXAFS*Al2O3*2. To continue filtration tomorrow.

01/18/96 [illegible]

0815 hrs — Solution EXAFS+Mont#3 down to ~30 ml. Most clay settled. Pipet out the clear soln. Continue filtration.

0830 hrs — Resume filtration of EXAFS+Al2O3+2.

1230 hrs — completed filtration of EXAFS+Mont#3. Transfer filter with mont. to plastic vial labeled EXAFS+Mont#3.

1300 hrs — Initiate filtration of EXAFS+Mont#1 ~~[illegible]~~ [illegible] 1/18/96 solution. Use nylon Whatman 0.45 μm filter. Pipet cloudy soln. into glass ~~[illegible]~~ [illegible] 1/18/96 reservoir. Initially ~225 ml.

1450 hrs — EXAFS+Mont#1 solution down to ~175 ml.

1700 hrs down to ~150 ml. Make up to 250 ml. Leave overnight.

01/19/96 [illegible]

1030 hrs — ~160 ml left in EXAFS+Mont#1. Pipet out most of the clear solution.

1045 hrs — Pipet out & discard most of the cloudy soln remaining in the pt bottle of EXAFS+Mont#1. Then shake the remaining mixture & transfer into filtration flask. ~130 ml.

1300 hrs — ~115 ml remaining on EXAFS+Mont#1.

1300 hrs — Ultrafiltration of EXAFS+Al2O3+2 completed. Transfer filter + filtrate to plastic vial labeled EXAFS+Al2O3+2.

1320 hrs — Decant most of the clear yellow solution from EXAFS+SiO2+4, leaving 5 cm. Measure pH of decanted solution (w/c was transferred into plastic beaker). [Decantation actually by using 100 ml pipette]. No recalibration.

		pH
bubbles	2	2.02
	4	4.02
	7	7.03
EXAFS+SiO2+4 clear solution		3.15

1615 hrs – ~ 105 ml left in EXAFS & Mont #1 being filtered. Transfer most of the soln into a 125 ml FEP bottle evacuate further to reduce to moist paste.

1645 hrs – Filtration of EXAFS & Mont #1 is complete. Transfer to plastic vial labeled EXAFS & Mont #1.

01/23/96
0830 hrs – Resume ultrafiltration of EXAFS & SiO_2 #4.

1030 hrs – Completed ultrafiltration of EXAFS & SiO_2 #4. Transfer into plastic vial labeled EXAFS & SiO_2 #4.

1/24/96 –
0900 hrs – Initiate ultracentrifugation of EXAFS & Al_2O_3 #4. Pipette ~40 ml into each of 6 FEP centrifuge tubes. Centrifuge at ~12.7 k g for ≥ 30 mins. Decant clear solutions. Put in more cloudy soln. Repeat process.

1/25/96 – [illegible]
0830 hrs Ultrafiltration of EXAFS & Al_2O_3 #4 using the Spectrum stirred cell was initiated.

1100 hrs – completed ultrafiltration. Transfer into plastic vial labeled EXAFS & Al_2O_3 #4.

Samples for EXAFS analysis sent to E Hudson of LLNL by Fedex next day service. Hudson will prepare the specimens for EXAFS work. Samples sent: EXAFS & Mont #1, 2, 3, 4B & 5; EXAFS & SiO_2 #2 and 4; EXAFS & Al_2O_3 #2 and 4.

8/28/96 Preparation of U solutions for ICP analysis (Div. 01)

The following solutions were acidified by adding 100 µL of 6M HCl prepared by J Prikryl on 7/96. New labels were attached to each bottle for identification purposes during analysis.

Label:
RTP-1: EXAFS & Al_2O_3 #1 & SOLN
RTP-2: " #2 & SOLN
RTP-3: " #3 & SOLN
RTP-4: " #4 & SOLN
RTP-5: EXAFS & SiO_2 #1 & SOLN
RTP-6: " #2 & SOLN

MTR-7 EXAFS * SiO_2 * 3 * SOLN
" -8 " * 4 * SOLN
-9 EXAFS * MONT * 1 * SOLN
-10 " * 2 * SOLN
" -11 " * 3 * SOLN
-12 " * 4B * SOLN
" -13 " * 5 * SOLN

08/30/96 MTR

1100 hrs — Transfer ~20 mL of each of the solutions
EXAFS * 1 * Al_2O_3 * SOLN2
EXAFS * 2 * Al_2O_3 * SOLN2
EXAFS * 3 * Al_2O_3 * SOLN2
EXAFS * 4 * Al_2O_3 * SOLN2

Cloudy solution when sampled

from the 60 mL FEP bottles into 30 mL PP bottles using an Eppendorf 10 ml pipet.

All the above solutions had Al_2O_3 colloid settled on the bottom. The 20 mL samples were transferred to minimize entrainment of Al_2O_3 colloid in samples for DEP analysis.

Label the PP bottles as EXAFS * ... * SOLN2B, acidify with 100 µL of 6 M HCl.

1130 hrs — The following solutions were acidified by adding 100 µL of 6 M HCl:

EXAFS * 1 * SiO_2 * SOLN2
EXAFS * 2 * SiO_2 * SOLN2
EXAFS * 3 * SiO_2 * SOLN2
EXAFS * 4 * SiO_2 * SOLN2

MTR 8/30/96

Transfer ~20 ml of ~~EXAFS * 1 * MONT *~~ EXAFS * 1 * MONT * SOLN2, which has montmorillonite colloids settled at the bottom of the bottle, into a 30 ml PP bottle labeled EXAFS * 1 * MONT * SOLN2B.

Acidify the following solutions with 100 µL of 6 M HCl:
EXAFS * 1 * MONT * SOLN2B
EXAFS * 2 * MONT * SOLN2
EXAFS * 3 * MONT * SOLN2
EXAFS * 4B * MONT * SOLN2
EXAFS * 5 * MONT * SOLN2

EXAFS * 1 * MONT * SOLN3
EXAFS * 3 * MONT * SOLN3
EXAFS * Al_2O_3 * 3 * SOLN3
EXAFS * Al_2O_3 * 4 * SOLN3

1330 hrs — Transfer ~20 mL of 5×10^{-3} M $UO_2(NO_3)_2$ solution prepared on 01/11/96 (Notebook page # GC-11-220) into 30 mL PP bottle labeled RTP-14.

Transfer ~20 mL of 1000 ppm $UO_2(NO_3)_2$ solution prepared on 120894 into 30 mL PP bottle labeled RTP-15.

Attach new labels to the U solutions prior to submission to HIV 01 SW DCP analysis

RTP-16: EXAFS * 1 * Al_2O_3 * SOLN2 B
-17 " * 2 * " "
-18 " * 3 * " "
-19 " * 4 * " "
-20 EXAFS * 1 * SiO_2 * SOLN2
-21 " * 2 * "
-22 " * 3 * "
-23 " * 4 * "
-24 EXAFS * 1 * MMS * SOLN2 B
-25 " * 2 * " * SOLN2
-26 " * 3 * " * "
-27 " * 4 B * " * "
-28 " * 5 * " * "
-29 EXAFS * MONT * 1 * SOLN3
-30 EXAFS * MONT * 3 * SOLN3
-31 EXAFS * Al_2O_3 * 3 * SOLN3
-32 EXAFS * Al_2O_3 * 4 * SOLN3

12/10/96

This project ended due to lack of funding.

[signature]