

Geochemistry  
Research  
Lab Notebook  
Vol. GC-11

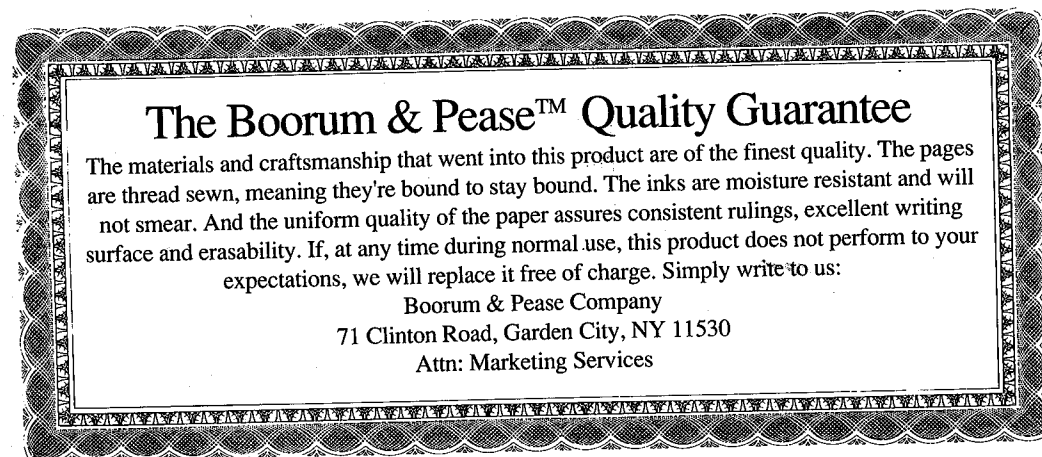
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Geochemistry Research  
Lab Notebook  
Vol. # GC-11

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This Book is a continuation of  
GC-07.

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Sr. Research Scientist



9 June 1993

URANIUM SORPTION EXPERIMENT B-IIIB:Kd vs pH: Equilibrium with atmospheric pCO<sub>2</sub>; Initial EU=5 ppbWRITTEN BY: R.T. PABALAN  
REVISION NO.: 0DATE 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<sub>3</sub> solid, aqueous solutions of NaHCO<sub>3</sub> 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)  
0.5-ml Eppendorf fixed-volume micropipet (for taking samples and for transferring 0.02 M HNO<sub>3</sub> solution into scintillation vial)  
various Eppendorf micropipets (fixed- or variable-volume; for adding HNO<sub>3</sub> or NaHCO<sub>3</sub> solutions to uranium solutions)  
scintillation vials  
weighing paper  
Na<sup>+</sup>-clinoptilolite (CDV\*100/200\*UC\*WA\*HL\*CPT\*Naf)  
reagent grade NaHCO<sub>3</sub>  
500 ppb U stock solution prepared from 50 ppm <sup>233</sup>U commercial spike



4 L	0.1 m NaNO <sub>3</sub> stock solution
1000 ml	stock solution of 1.0 m HNO <sub>3</sub>
1000 ml	stock solution of 0.1 m HNO <sub>3</sub>
1000 ml	stock solution of 0.02 m HNO <sub>3</sub>
1000 ml	stock solution of 0.001 m HNO <sub>3</sub>
500 ml	stock solution of 1.0 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.5 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.1 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.05 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.01 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.005 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.001 m NaHCO <sub>3</sub>
	ultrapure water

## PROCEDURE:

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

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

- Initial  $\Sigma U = 5$  ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO<sub>3</sub> or NaHCO<sub>3</sub>
- Initial volume = 50 ml
- Ionic strength = 0.1 m NaNO<sub>3</sub>
- Wt. zeolite to use =  $0.100 \pm 0.001$
- Initial [Na<sup>+</sup>] = 0.1 m NaNO<sub>3</sub> + [NaHCO<sub>3</sub>] added
- pCO<sub>2</sub> = 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<sub>3</sub> matrix; prepared previously from commercial 50 ppm <sup>233</sup>U spike) to a total of 2000 g by carefully taring 0.1 m NaNO<sub>3</sub> solution into the teflon bottle on a Mettler 4600 balance.

b) Into each of 29 60-ml FEP bottle labeled B-IIIB\*pHi [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\*pHi [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<sub>3</sub>. Reweigh each vial. Homogenize the mixture and save for later analysis of uranium concentration by liquid scintillation counting.

c) For each solution B-IIIB\*pHi and B-IIIB-C\*pHi:

Adjust the pH of each solution to the approximate value *i* by adding HNO<sub>3</sub> solution or NaHCO<sub>3</sub> 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<sub>2</sub>(g).

d) Measure and record the pH of each solution B-IIIB\*pHi and B-IIIB-C\*pHi. *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\*pHi and B-IIIB-C\*pHi, take 2 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIB\*IU-pHi\*a (or b)] scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO<sub>3</sub>. 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  $0.100 \pm 0.001$  gm of Na-clinoptilolite onto weighing paper, and carefully transfer into each of the B-IIIB\*pHi (not the B-IIIB-C\*pHi) 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\*pHi and B-IIIB-C\*pHi with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIB-pHi\*a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO<sub>3</sub>. 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\*pHi and B-IIIB-C\*pHi. 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  $^{233}\text{U}$  commercial spike
  - 4 L 0.1 M  $\text{NaNO}_3$  stock solution
  - 1000 ml stock solution of 1.0 M  $\text{HNO}_3$
  - 1000 ml stock solution of 0.1 M  $\text{HNO}_3$
  - 1000 ml stock solution of 0.02 M  $\text{HNO}_3$
  - 1000 ml stock solution of 0.001 M  $\text{HNO}_3$
  - 500 ml stock solution of 1.0 M  $\text{NaHCO}_3$  (42.005 g in 500 ml solution)
  - 500 ml stock solution of 0.5 M  $\text{NaHCO}_3$  (21.003 g in 500 ml solution)
  - 500 ml stock solution of 0.1 M  $\text{NaHCO}_3$  (4.201 g in 500 ml solution)
  - 500 ml stock solution of 0.05 M  $\text{NaHCO}_3$  (2.100 g in 500 ml solution)
  - 500 ml stock solution of 0.01 M  $\text{NaHCO}_3$  (0.4201 g in 500 ml solution)
  - 500 ml stock solution of 0.005 M  $\text{NaHCO}_3$  (0.2100 g in 500 ml solution)
  - 500 ml stock solution of 0.001 M  $\text{NaHCO}_3$  (0.0420 g in 500 ml solution)

The  $\text{NaHCO}_3$  solutions should be prepared with *degassed* deionized water and kept in tightly-capped glass reagent bottles.

**Table B-IIIB-1.** Amount of reagent grade  $\text{HNO}_3$  or  $\text{NaHCO}_3$  solutions to add to 50 ml 0.1 M  $\text{NaNO}_3$  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 $\text{HNO}_3$ needed, ml	Molarity of $\text{HNO}_3$ 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 $\text{NaHCO}_3$ needed, ml	Molarity of $\text{NaHCO}_3$ 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 <sub>3</sub> needed, ml	Molarity of NaHCO <sub>3</sub> 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 <sup>235</sup>U solution were prepared by diluting 20g of the 500ppb stock solution to 2000g using 0.1M NaNO<sub>3</sub> (#3, #4).

Actual weight <sup>235</sup>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 or down to the nearest 10 µl.

pH	Adjustment	Molarity of HNO <sub>3</sub>
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	0.050	0.001
5.00	0.170	0.001

pH	Adjustment (ml)	Molarity of NaHCO <sub>3</sub>
5.25	0.120	0.001
5.50	0.320	0.001
TD 5.75	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 kimwipe <sup>TD</sup> and placed on a gyratory shaker set to 120 rpm.

10 June 1993

TD 10 June 1993

Prepared 0.1L aliquots of 0.1M NaNO<sub>3</sub> samples

2 500 µl of the remaining initial solution <sup>TD</sup> were taken and prepared for liquid scintillation <sup>6/10/93</sup> analysis

	wt. vial (g)	wt. vial + sample (g)	wt. sample (g)
B III B * I V a	7.3319	7.8325	0.5006
I V b	7.3043	7.8059	0.5016



10 JUNE 1993 TD

Prepared 6 - 1L portions of 0.1M  $\text{NaNO}_3$  by dissolving 8.499g  $\text{NaNO}_3$  in 1000g  $\text{H}_2\text{O}$ .

Bottle #	Wt. $\text{NaNO}_3$ used (g)
1	8.4986
2	8.4993
3	8.4999
4	8.4991
5	8.5006
6	8.5007

lot #  $\text{NaNO}_3$  = 7808 KCC

14 JUNE 1993 TD

The counting of the 12<sup>th</sup> 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:25%	CPMB B:25%	CPMC C:25%	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	CPMB	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-III B also counted (9-12). The results of the concentration analysis follow.

SAMPLE NAME	CPMB	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)	AVG [U]
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-III B*IUa	51.594	0.5006	103.0643	1.191812E+13	1.97877E-11	4.6113	
B-III B*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\* $\text{pH}7.00$ .

Two were taken with an Eppendorf pipet and two with a Nucleopore filter. This is to test whether this is an acceptable filter. The filtering apparatus contains a long metal tube and a plastic housing for the filter, which to this plastic housing is 2 pieces and has an O-ring and a metal screen. The samples taken were prepared for L. S. analysis.

SAMPLE NAME	WT VIAL (g)	WT VIAL+SAMPLE (g)	WT SAMPLE (g)
W2-50* $\text{pH}7.00$ *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 mL 0.1 M  $\text{HNO}_3$ . This amount was calculated by DEQ3. 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	$\Delta T$ (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 to 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	144, 25	4.61/23.2
8	1330, 6/22	188.50 to 192.5	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	1300, 7/7	552	4.74/23.0

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

SAMPLE #	TIME/DATE	$\Delta T$ (hours)	pH/T(°C)
1	1500, 6/14	2	4.10/21.6
2	1700, 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	144, 25	4.24/23.2
8	1331, 6/22	TD 188.50 to 192.5	4.29/22.9
9	1301, 6/25	264	4.28/22.5
10	1501, 6/29	362	4.27/23.4
11	1301, 7/2	434	4.30/22.1
12	1300, 7/7	552	4.33/23.0

K3\*ARC, INITIAL pH 6.96, 1302 6/14

SAMPLE #	TIME, DATE	$\Delta T$ (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	4.25/22.9
7	1117, 6/20	142.25	4.05/23.2
8	1332, 6/22	186.25 to 192.5	4.09/22.9
9	1302, 6/25	264	4.03/22.5
10	1502, 6/29	362	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 scintillation analysis and the weights are given below.

Reverse Kinetics, Samples 1 and 2, 14 June 1993

SAMPLE NAME	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  
May 1993

The Spike 23A solution was taken from the large bottle and placed into two 2 L 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 <sup>are</sup> ~~is~~ given below.  
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:25%	CPMB B:25%	CPMC C:25%	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 pH 7.00 XN1
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	CPMB	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 <sup>680</sup>55 hours added to it.  
6/16/93

The 4<sup>th</sup> 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 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 6<sup>th</sup> sample of the reverse kinetics was taken. The solutions' pH was measured and recorded on <sup>6/16/93</sup>page 10 & 11. The sample weights are on the following page (page 16)



TD

TD

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)	SOLUTION	pH/T(°C)
B-IB <sup>B</sup> pH 2.00	1.89/23.8	B-IB <sup>B</sup> pH 6.00	5.42/24.0
2.25	2.11/23.8	6.25	5.81/24.1
2.50	2.38/23.8	6.50	5.98/24.1
2.75	2.66/23.8	6.75	6.33/24.1
3.00	2.86/23.8	7.00	6.62/24.2
3.25	3.13/23.8	7.25	6.84/24.2
3.50	3.39/23.9	7.50	7.13/24.2
3.75	3.64/23.9	7.75	7.30/24.3
4.00	3.88/23.9	8.00	7.67/24.3
4.25	4.18/23.9	8.25	7.98/24.3
4.50	4.34/23.9	8.50	8.28/24.3
4.75	4.61/23.9	8.75	8.63/24.3
5.00	4.80/23.9	9.00	8.87/24.3
5.25	4.99/23.9		
5.50	5.23/24.0		
5.75	5.42/24.0		

The pH of the control solutions were also measured.

SOLUTION	pH/T(°C)
B-IB-C* <sup>B</sup> pH 2.0	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			
B-IB*pH7.25*IU1			
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B-IB*pH45.00*IU2			
B-IB*pH45.25*IU1			
B-IB*pH45.25*IU2			
B-IB*pH45.50*IU1			
B-IB*pH45.50*IU2			

The liquid Scintillation Analysis of the 3rd and 4th K3xH 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:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
1	999.98	18.94 1.45	2.836 3.76	27.77 1.20	131.63
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	8342.400	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

Also included on the list was Analysis of the 2<sup>nd</sup> spike solutions. The bottle containing spike 23A was rinsed with 1.0 M HNO<sub>3</sub> followed by Ultra pure H<sub>2</sub>O. The samples labeled R1-R3 were ~~not~~ 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 0.100g ± 0.001g Na-clingitilolite added. The solutions were swirled and returned to the gyratory shakers.

SOLUTION	wt. Zeolite added(g)	SOLUTION	wt. Zeolite (g)
B-IB* pH7.00	0.0997	9.0 TD 6/21/93 TD 0.1007	
2.25	0.1003	8.00 6/21/93 TD 0.1002 0.1007	
2.50	0.1000	8.25 6/21/93 TD 0.1007 0.100	
2.75	0.0993	8.50	0.1007
3.00	0.1000	8.75	0.1007
3.25	0.1003	9.00	0.1005
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 26.50	0.1001		
6.75	0.0995		
7.00	0.1010		
7.25	0.1001		
7.50	0.0994		
6/21/93 TD 27.75	0.0999		

6/15/94 TD

FOR VERIFICATION

OF CALCULATIONS

SEE pages 143-4

of this volume.



22 June 1993 TD

The liquid scintillation analysis of the 5<sup>th</sup>, 6<sup>th</sup>, and 7<sup>th</sup> 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:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
1	999.98	18.73	1.46	2.882	3.73
2	13.74	2.16	115.0	320.626	3.03
3	4.04	2.06	220.5	1098.85	3.01
4	3.44	3.94	130.4	1289.56	3.01
5	3.57	4.24	119.9	1243.62	3.01
6	11.30	1.00	264.6	390.392	3.02
7	6.11	4.67	83.95	724.777	3.01
8	5.55	5.41	77.22	798.379	3.01
9	4.13	5.48	88.47	1074.60	3.01
10	10.37	3.64	81.01	426.433	3.02
11	6.29	3.21	116.7	704.431	3.01
12	6.87	2.96	120.5	644.134	3.01
13	5.88	5.08	79.42	753.240	3.01
(2 missing vials)					
16	11.03	3.94	73.19	400.110	3.02
17	9.57	1.96	150.7	461.695	3.02
18	8.26	3.30	99.23	535.253	3.02
19	11.00	3.27	86.91	401.391	3.02
20	10.91	0.00	0.00	404.726	3.02
21	9.28	3.25	95.02	475.997	3.02
22	8.97	2.12	144.6	492.882	3.02
23	8.28	1.68	187.6	533.954	3.02
24	8.18	0.00	0.00	540.639	3.02
25	11.00	1.82	151.3	401.209	3.02
26	8.97	0.00	0.00	492.993	3.02
27	8.05	2.51	129.8	549.664	3.01

Jim's Samples

K3-A\*AR5

K3-A\*AR7

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 143-4 OF THIS

BOOK.

22 June 1993 EXPERIMENT B-III B

The pH of all the solutions was measured.

SOLUTION	pH/T(°C)	SOLUTION	pH/T(°C)
B-III B * pH 2.00	1.84/22.9	B-III B-C * pH 5.5	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	6.55/23.3		
7.25	6.86/23.4		
7.50	7.10/23.4		
7.75	7.35/23.4		
8.00	7.64/23.4		
8.25	7.94/23.4		
8.50	8.27/23.4		
8.75	8.59/23.5		
9.00	8.89/23.5		
B-III B-C * pH 2.0	1.87/23.6		
4.0	3.86/23.6		
5.0	4.69/23.6		

EXPERIMENT B-III B (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-III B*PH2.00*IU1	7.7500	8.2482	0.4982
B-III B*PH2.00*IU2	7.8185	8.3173	0.4988
B-III B*PH2.25*IU1	7.7062	8.2071	0.5009
B-III B*PH2.25*IU2	7.7076	8.2070	0.4994
B-III B*PH2.50*IU1	7.7685	8.2689	0.5004
B-III B*PH2.50*IU2	7.7368	8.2376	0.5008
B-III B*PH2.75*IU1	7.7689	8.2723	0.5034
B-III B*PH2.75*IU2	7.8267	8.3284	0.5017
B-III B*PH3.00*IU1	7.8062	8.3108	0.5046
B-III B*PH3.00*IU2	7.7589	8.2587	0.4998
B-III B*PH3.25*IU1	7.7932	8.2938	0.5006
B-III B*PH3.25*IU2	7.7797	8.2812	0.5015
B-III B*PH3.50*IU1	7.7962	8.2990	0.5028
B-III B*PH3.50*IU2	7.7649	8.2659	0.5010
B-III B*PH3.75*IU1	7.7749	8.2774	0.5025
B-III B*PH3.75*IU2	7.7757	8.2775	0.5018
B-III B*PH4.00*IU1	7.7454	8.2477	0.5023
B-III B*PH4.00*IU2	7.7290	8.2303	0.5013
B-III B*PH4.25*IU1	7.7056	8.2058	0.5002
B-III B*PH4.25*IU2	7.8265	8.3260	0.4995
B-III B*PH4.50*IU1	7.7495	8.2508	0.5013
B-III B*PH4.50*IU2	7.7204	8.2212	0.5008
B-III B*PH4.75*IU1	7.7336	8.2355	0.5019
B-III B*PH4.75*IU2	7.6780	8.1789	0.5009
B-III B*PH5.00*IU1	7.7312	8.2313	0.5001
B-III B*PH5.00*IU2	7.7254	8.2259	0.5005
B-III B*PH5.25*IU1	7.7468	8.2472	0.5004
B-III B*PH5.25*IU2	7.7723	8.2736	0.5013
B-III B*PH5.50*IU1	7.7689	8.2698	0.5009
B-III B*PH5.50*IU2	7.7486	8.2479	0.4993
B-III B*PH5.75*IU1	7.7567	8.2574	0.5007
B-III B*PH5.75*IU2	7.7760	8.2745	0.4985
B-III B*PH6.00*IU1	7.8151	8.3167	0.5016
B-III B*PH6.00*IU2	7.6962	8.1960	0.4998
B-III B*PH6.25*IU1	7.7300	8.2297	0.4997
B-III B*PH6.25*IU2	7.8122	8.3124	0.5002
B-III B*PH6.50*IU1	7.8013	8.3060	0.5047
B-III B*PH6.50*IU2	7.8188	8.3202	0.5014
B-III B*PH6.75*IU1	7.7538	8.2562	0.5024
B-III B*PH6.75*IU2	7.7479	8.2474	0.4995
B-III B*PH7.00*IU1	7.7615	8.2605	0.4990

SAMPLE NAME	WT VIAL (g)	WT VIAL + SAMPLE (g)	WT SAMPLE (g)
B-III B*PH7.00*IU2	7.7243	8.2232	0.4989
B-III B*PH7.25*IU1	7.6678	8.1684	0.5006
B-III B*PH7.25*IU2	7.8110	8.3098	0.4988
B-III B*PH7.50*IU1	7.7908	8.2920	0.5012
B-III B*PH7.50*IU2	7.7119	8.2115	0.4996
B-III B*PH7.75*IU1	7.7370	8.2370	0.5000
B-III B*PH7.75*IU2	7.8016	8.3011	0.4995
B-III B*PH8.00*IU1	7.6872	8.1875	0.5003
B-III B*PH8.00*IU2	7.7809	8.2781	0.4972
B-III B*PH8.25*IU1	7.7402	8.2410	0.5008
B-III B*PH8.25*IU2	7.7260	8.2260	0.5000
B-III B*PH8.50*IU1	7.8039	8.3032	0.4993
B-III B*PH8.50*IU2	7.7875	8.2855	0.4980
B-III B*PH8.75*IU1	7.6776	8.1779	0.5003
B-III B*PH8.75*IU2	7.7516	8.2506	0.4990
B-III B*PH9.00*IU1	7.7290	8.2308	0.5018
B-III B*PH9.00*IU2	7.7789	8.2774	0.4985
B-III B-C*PH2.0*IU1	7.7171	8.2177	0.5006
B-III B-C*PH2.0*IU2	7.8252	8.3235	0.4983
B-III B-C*PH4.0*IU1	7.7220	8.2231	0.5011
B-III B-C*PH4.0*IU2	7.7692	8.2678	0.4986
B-III B-C*PH5.0*IU1	7.7350	8.2373	0.5023
B-III B-C*PH5.0*IU2	7.7882	8.2865	0.4983
B-III B-C*PH5.5*IU1	7.7646	8.2663	0.5017
B-III B-C*PH5.5*IU2	7.7893	8.2897	0.5004
B-III B-C*PH6.0*IU1	7.7274	8.2281	0.5007
B-III B-C*PH6.0*IU2	7.7590	8.2566	0.4976
B-III B-C*PH6.5*IU1	7.7564	8.2540	0.4976
B-III B-C*PH6.5*IU2	7.7852	8.2859	0.5007
B-III B-C*PH7.0*IU1	7.8204	8.3179	0.4975
B-III B-C*PH7.0*IU2	7.8024	8.3009	0.4985
B-III B-C*PH7.5*IU1	7.7744	8.2761	0.5017
B-III B-C*PH7.5*IU2	7.7737	8.2708	0.4971
B-III B-C*PH8.0*IU1	7.7064	8.2064	0.5000
B-III B-C*PH8.0*IU2	7.6847	8.1831	0.4984
B-III B-C*PH9.5*IU1	7.7549	8.2559	0.5010
B-III B-C*PH9.5*IU2	7.6923	8.1934	0.5011

0.000 g  $\pm$  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-III B*PH2.00	0.1004	4.75	0.0993	1.50	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 TO EXPERIMENT K3A

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
K3A*AR*8	7.7294	8.2287	0.4993
K3A*BR*8	7.7641	8.2625	0.4984
K3A*CR*8	7.6826	8.1816	0.4990

24 June 1993 TO EXPERIMENT B-IB

The liquid scintillation Analysis of the BIB <sup>15 June 1993</sup> 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:25%	CPMB B:25%	CPMC C:25%	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	7.12	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	9.1	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	5.2	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	252.1	540.555	3.02 547.55 3.08 703.77

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:25%	CPMB B:25%	CPMC C:25%	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:25%	CPMB B:25%	CPMC C:25%	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 K3A 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 143-144  
OF THIS NOTEBOOK.

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 9<sup>th</sup> 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-IV

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

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:25%	CPMB B:25%	CPMC C:25%	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	50.784 5.29	51.45 6.39 728.98	
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	

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-III-B-C*PH2.0*I	55.341	0.5006	110.5493	1.2784E+13	2.1225E-11	4.9462	
61	B-III-B-C*PH2.0*I	57.901	0.4983	116.1971	1.3437E+13	2.2309E-11	5.1989	5.0726
62	B-III-B-C*PH4.0*I	51.551	0.5001	103.0814	1.1920E+13	1.9791E-11	4.6121	
63	B-III-B-C*PH4.0*I	52.041	0.4986	104.3742	1.2070E+13	2.0039E-11	4.6699	4.6410
64	B-III-B-C*PH5.0*I	28.949	0.5023	57.6329	6.6645E+12	1.1065E-11	2.5786	
65	B-III-B-C*PH5.0*I	27.165	0.4983	54.5154	6.3040E+12	1.0467E-11	2.4391	2.5089
66	B-III-B-C*PH5.5*I	18.938	0.5017	37.7477	4.3651E+12	7.2473E-12	1.6889	
67	B-III-B-C*PH5.5*I	19.591	0.5004	39.1507	4.5273E+12	7.5167E-12	1.7517	1.7203
68	B-III-B-C*PH6.0*I	15.117	0.5007	30.1917	3.4913E+12	5.7966E-12	1.3508	
69	B-III-B-C*PH6.0*I	15.584	0.4976	31.3183	3.6216E+12	6.0129E-12	1.4012	1.3760
70	B-III-B-C*PH6.5*I	27.043	0.4976	54.3469	6.2845E+12	1.0434E-11	2.4316	
71	B-III-B-C*PH6.5*I	26.239	0.5007	52.4046	6.0600E+12	1.0061E-11	2.3447	2.3881
72	B-III-B-C*PH7.0*I	40.068	0.4975	80.5367	9.3133E+12	1.5463E-11	3.6035	
73	B-III-B-C*PH7.0*I	40.554	0.4985	81.3521	9.4074E+12	1.5619E-11	3.6399	3.6217
74	B-III-B-C*PH7.5*I	50.787	0.5017	101.2298	1.1706E+13	1.9435E-11	4.5292	
75	B-III-B-C*PH7.5*I	47.648	0.4971	95.8519	1.1084E+13	1.8403E-11	4.2886	4.4089
76	B-III-B-C*PH8.0*I	52.786	0.5000	105.5720	1.2208E+13	2.0269E-11	4.7235	
77	B-III-B-C*PH8.0*I	54.136	0.4984	108.6196	1.2561E+13	2.0854E-11	4.8599	4.7917
78	B-III-B-C*PH9.5*I	54.753	0.5010	109.2874	1.2638E+13	2.0982E-11	4.8897	
79	B-III-B-C*PH9.5*I	54.971	0.5011	109.7007	1.2686E+13	2.1062E-11	4.9082	4.8990

6/15/94 TD

CALCULATIONS

VERIFIED ON

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OF THIS VOL.

29 JUNE 1993 TD EXPERIMENT K3xA

The 10<sup>th</sup> 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	8.2960	0.5013
K3*A*BR*10	7.7748	8.2747	0.4999
K3*A*CR*10	7.7585	8.2805	0.5020

2 July 1993 TD EXPERIMENT K3xA, Reverse

The liquid scintillation analysis of the 9<sup>th</sup> and 10<sup>th</sup> set of K3xA samples has finished. The raw data, as well as results of the calculations appears on the following page.

S#	TIME	CPMA A:25%	CPMB B:25%	CPMC C:25%	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	0.5048	836.4943	9.6730258E+13	1.60601E-10	37.4285
74	K3*A*AR*9b	403.537	0.5033	801.7822	9.2716241E+13	1.59937E-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	2.08212E-10	48.0557
78	K3*A*CR*9b	549.280	0.5022	1093.7475	1.2647843E+14	2.09992E-10	48.9366

6/15/94 TD

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

The 11<sup>th</sup> set of samples from K3xA, reverse <sup>was</sup> 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	7.8087	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



10 6 July 1993 Ex. BFB

Since about two weeks has passed, the B-IB solutions had 2 SD<sub>0.1</sub> 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	8.28/21.8
3.00	2.97/21.0	5.75	5.49/21.4	8.75	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		

<u>SOLUTION</u>	<u>pH/T(°C)</u>
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

The <sup>7/7/93</sup> 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. 2 500  $\mu$ l 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-III B* pH2.00*A	7.7776	8.2802	0.5026
B-III B* pH2.00*B	7.7307	8.2285	0.4978
B-III B* pH2.25*A	7.7196	8.2219	0.5023
B-III B* pH2.25*B	7.7796	8.2819	0.5023
B-III B* pH2.50*A	7.7349	8.2369	0.5020
B-III B* pH2.50*B	7.7188	8.2204	0.5016
B-III B* pH2.75*A	7.7835	8.2854	0.5019
B-III B* pH2.75*B	7.8460	8.3469	0.5009
B-III B* pH3.00*A	7.7753	8.2785	0.5032
B-III B* pH3.00*B	7.7750	8.2765	0.5015
B-III B* pH3.25*A	7.7544	8.2566	0.5022
B-III B* pH3.25*B	7.8183	8.3190	0.5007
B-III B* pH3.50*A	7.7425	8.2441	0.5016
B-III B* pH3.50*B	7.7851	8.2870	0.5019
B-III B* pH3.75*A	7.7439	8.2462	0.5023
B-III B* pH3.75*B	7.7203	8.2215	0.5012
B-III B* pH4.00*A	7.7950	8.2958	0.5008
B-III B* pH4.00*B	7.8058	8.3084	0.5026
B-III B* pH4.25*A	7.7341	8.2342	0.5001
B-III B* pH4.25*B	7.7878	8.2876	0.4998
B-III B* pH4.50*A	7.7489	8.2496	0.5007
B-III B* pH4.50*B	7.7707	8.2713	0.5006
B-III B* pH4.75*A	7.7358	8.2400	0.5042
B-III B* pH4.75*B	7.7438	8.2451	0.5013
B-III B* pH5.00*A	7.7397	8.2410	0.5013
B-III B* pH5.00*B	7.7451	8.2496	0.5045
B-III B* pH5.25*A	7.7553	8.2576	0.5023
B-III B* pH5.25*B	7.7432	8.2445	0.5013
B-III B* pH5.50*A	7.7503	8.2523	0.5020
B-III B* pH5.50*B	7.7759	8.2779	0.5020
B-III B* pH5.75*A	7.7377	8.2480	0.5103
B-III B* pH5.75*B	7.7118	8.2184	0.5066
B-III B* pH6.00*A	7.7248	8.1836	0.4588
B-III B* pH6.00*B	7.7612	8.2624	0.5012
B-III B* pH6.25*A	7.7253	8.2278	0.5025
B-III B* pH6.25*B	7.8018	8.3054	0.5036
B-III B* pH6.50*A	7.8392	8.3430	0.5038
B-III B* pH6.50*B	7.7946	8.2965	0.5019
B-III B* pH6.75*A	7.8562	8.3522	0.4960

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

SOLUTION	pH/T(°C)	SOLUTION	pH/T(°C)
B-III-B x pH 2.00	1.92/23.2	B-III-B-C x pH 7.5	7.71/23.6
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	8.59/23.5		
9.00	8.86/23.5		
B-III-B-C x 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-IB samples and the K3xAR 12<sup>th</sup> sample set has completed. The raw data, as well as results of calculations follow. The 11<sup>th</sup> 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:25%	CPMB	B:25%	CPMC	C:25%	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 GD CALCULATIONS VERIFIED ON PAGE 143-4 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	9.326978E+13	1.5486E-10	36.0876
100	K3*A*BR*11	479.595	0.5057	948.3785	1.098683E+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	9.287172E+13	1.5388E-10	35.8562
105	K3*A*AR*12b	397.219	0.4987	798.5089	9.210845E+13	1.5292E-10	35.6375
104	K3*A*BR*12a	463.876	0.4999	927.9376	1.073048E+14	1.7818E-10	41.5179
106	K3*A*BR*12b	467.939	0.5008	934.3830	1.080499E+14	1.794E-10	41.8083
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	0.4988	1089.8913	1.271889E+14	2.1117E-10	49.2114

6/15/94 RD.

VERIFICATION OF CALCULATION IS ON Pg 143-4 OF THIS BOOK.

#### URANIUM SORPTION EXPERIMENT B-IIB:

Kd vs pH: Equilibrium with atmospheric pCO<sub>2</sub>; Initial EU=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<sub>3</sub> solid, aqueous solutions of NaHCO<sub>3</sub> 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<sub>3</sub> or NaHCO<sub>3</sub> 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<sub>3</sub> solution into scintillation vial)
- various Eppendorf micropipets (fixed- or variable-volume; for adding HNO<sub>3</sub> or NaHCO<sub>3</sub> solutions to uranium solutions)
- scintillation vials
- weighing paper
- Na<sup>+</sup>-clinoptilolite (CDV\*100/200\*UC\*WA\*HL\*CPT\*Naf)
- reagent grade NaHCO<sub>3</sub>

4 L	500 ppb U stock solution prepared from 50 ppm $^{233}\text{U}$ commercial spike
1000 ml	0.1 M $\text{NaNO}_3$ stock solution
1000 ml	stock solution of 1.0 M $\text{HNO}_3$
1000 ml	stock solution of 0.1 M $\text{HNO}_3$
1000 ml	stock solution of 0.02 M $\text{HNO}_3$
500 ml	stock solution of 1.0 M $\text{NaHCO}_3$
500 ml	stock solution of 0.5 M $\text{NaHCO}_3$
500 ml	stock solution of 0.1 M $\text{NaHCO}_3$
500 ml	stock solution of 0.05 M $\text{NaHCO}_3$
	ultrapure water

## PROCEDURE:

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

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

- Initial  $\Sigma\text{U}$  = 500 ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with  $\text{HNO}_3$  or  $\text{NaHCO}_3$
- Initial volume = 50 ml
- Ionic strength = 0.1 M  $\text{NaNO}_3$
- Wt. zeolite to use =  $0.100 \pm 0.001$
- Initial  $[\text{Na}^+] = 0.1 \text{ M } \text{NaNO}_3 + [\text{NaHCO}_3]$  added
- $\text{pCO}_2 = \text{atmospheric} = 10^{-3.48} \text{ bar}$

- a) Into each of 29 60-ml FEP bottle labeled B-IIB\* $\text{pHi}$  [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\* $\text{pHi}$  [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  $\text{HNO}_3$ . Reweigh each vial. Homogenize the mixture and save for later analysis of uranium concentration by liquid scintillation counting.

- b) For each solution B-IIB\* $\text{pHi}$  and B-IIB-C\* $\text{pHi}$ :

Adjust the pH of each solution to the approximate value  $i$  by adding  $\text{HNO}_3$  solution or  $\text{NaHCO}_3$  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  $\sim 120 \text{ rpm}$ . Leave the bottles on the shaker for about ten days to allow the solutions to reach equilibrium with atmospheric  $\text{CO}_2(\text{g})$ .

- d) Measure and record the pH of each solution B-IIB\* $\text{pHi}$  and B-IIB-C\* $\text{pHi}$ . *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\* $\text{pHi}$  and B-IIB-C\* $\text{pHi}$ , take 2 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIB\*IU- $\text{phi}$ \*a (or b)] scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M  $\text{HNO}_3$ . 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  $0.100 \pm 0.001 \text{ gm}$  of Na-clinoptilolite onto weighing paper, and carefully transfer into each of the B-IIB\* $\text{pHi}$  (not the B-IIB-C\* $\text{pHi}$ ) 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\* $\text{pHi}$  and B-IIB-C\* $\text{pHi}$  with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIB- $\text{phi}$ \*a (or b)] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M  $\text{HNO}_3$ . 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\* $\text{pHi}$  and B-IIB-C\* $\text{pHi}$ . 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-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  $^{233}\text{U}$  commercial spike
  - 4 L 0.1 M  $\text{NaNO}_3$  stock solution
  - 1000 ml stock solution of 1.0 M  $\text{HNO}_3$
  - 1000 ml stock solution of 0.1 M  $\text{HNO}_3$
  - 1000 ml stock solution of 0.02 M  $\text{HNO}_3$
  - 500 ml stock solution of 1.0 M  $\text{NaHCO}_3$  (42.005 g in 500 ml solution)
  - 500 ml stock solution of 0.5 M  $\text{NaHCO}_3$  (21.003 in 500 ml solution)
  - 500 ml stock solution of 0.1 M  $\text{NaHCO}_3$  (4.201 g in 500 ml solution)
  - 500 ml stock solution of 0.05 M  $\text{NaHCO}_3$  (2.100 g in 500 ml solution)

The  $\text{NaHCO}_3$  solutions should be prepared with *degassed* deionized water and kept in tightly-capped glass reagent bottles.

Table B-IIB-1. Amount of reagent grade  $\text{HNO}_3$  or  $\text{NaHCO}_3$  solutions to add to 50 ml 0.1 M  $\text{NaNO}_3$  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 $\text{HNO}_3$ needed, ml	Molarity of $\text{HNO}_3$ 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 $\text{NaHCO}_3$ needed, ml	Molarity of $\text{NaHCO}_3$ 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 $\text{NaHCO}_3$ needed, ml	Molarity of $\text{NaHCO}_3$ 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 50g 500 ppb  $^{233}\text{U}$  into 60 mL teflon bottles labeled B-IIB\* $\text{pH}_i$  ( $i=2, 9, \Delta\text{pH } 0.25$ ) or B-IIB-C\* $\text{pH}_j$  ( $j=2, 4, 5.0, 5.5, 6, 6.5, 7, 7.5, 8, 9.5$ ). The solution was adjusted to the target pH using the data from table B-IIB-1 on page 44. The actual  $\text{pH}$  adjustments are given below.

TARGET pH	ADJUSTMENT MADE
2.00	0.570 mL 1.0M $\text{HNO}_3$
2.25	0.300 mL
2.50	0.150 mL
2.75	0.070 mL
3.00	0.210 mL, 0.1M $\text{HNO}_3$
3.25	0.120 mL, 0.05 M $\text{NaHCO}_3$
3.50	0.210 mL, 0.1M $\text{NaHCO}_3$
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 $\text{NaHCO}_3$
8.00	0.150 mL



TARGET pH	ADJUSTMENT
8.25	0.210 mL, 0.5 M $\text{NaHCO}_3$
8.50	0.320 mL
8.75	0.260 mL, 1.0 M $\text{NaHCO}_3$
9.00	0.470 mL
9.50	2.00 mL

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

2 500  $\mu\text{L}$  samples of the initial solution were taken. The sample weights are given below.

	wt. vial	wt. vial + sample	wt. sample (g)
B-IIB*IV <sub>a</sub>	7.8814	8.3847	0.5033
IOb	7.8149	8.3151	0.5002

All the solutions were covered with a kimwipe and placed on a gyratory shaker set to  $\sim 120$  rpm.

The <sup>7/13/93</sup> solution weights were noted, and the adjustment weights (1 mL  $\approx$  1 g) 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 to

2000 g 1.1 M  $\text{NaNO}_3$  was prepared by dissolving 93.49 g  $\text{NaNO}_3$  in 1000 g  $\text{H}_2\text{O}$  (2 solns prepared in this manner)

wt.  $\text{NaNO}_3$  used: (1) 93.50 g  
(2) 93.50 g

lot # 7808 KCL

16 July 1993 EXPERIMENT B-IB, REVERSE IB

## Reversibility experiments:

h) Prior to starting the reverse experiments, take 2 0.5-ml samples from each bottle B-IB\*phi listed in Table B-IB-2 and all B-IB-C\*phi solutions using Eppendorf pipets, transfer into pre-labeled [e.g., B-IBR-phi\*a, B-IBR-C\*phi\*a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO<sub>3</sub>. 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\*phi listed in Table B-IB-2 up or down by about 1 pH unit by adding HNO<sub>3</sub> or NaHCO<sub>3</sub> 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-IBR-phi\*a, B-IBR-C\*phi\*a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO<sub>3</sub>. 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<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to remaining 0.1 M NaNO<sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of HNO <sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of NaHCO <sub>3</sub> 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-IB 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 TO VERIFICATION OF CALCULATIONS ON THIS PAGE AND THE  
THE PRECEDING PAGE ARE ON p143-144 OF THIS  
BOOK.

10 20 July 1993 Experiment B-IB, REVERSE

The reverse experiments were begun, according to the procedure on page 4B. 2 500  $\mu$ L <sup>TD Thop's</sup> 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.

\*\*\*\*\*  
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.  
\*\*\*\*\*

## Reversibility experiments:

h) Prior to starting the reverse experiments, take 2 0.5-ml samples from each bottle B-IIIB\*phi listed in Table B-IIIB-2 and all B-IIIB-C\*phi solutions using Eppendorf pipets, transfer

into pre-labeled [e.g., B-IIIBR-phi\*a, B-IIIBR-C\*phi\*a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO<sub>3</sub>. 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\*phi listed in Table B-IIIB-2 up or down by about 1 pH unit by adding HNO<sub>3</sub> or NaHCO<sub>3</sub> 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-IIIBR-phi\*a, B-IIIBR-C\*phi\*a] and pre-weighed scintillation vials containing 5 ml of cocktail and 0.5 ml of 0.02 M HNO<sub>3</sub>. 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<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to remaining 0.1 M NaNO<sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of HNO <sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of NaHCO <sub>3</sub> 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-IB reverse experiments were begun, according to the procedure on page 53. 2 500  $\mu$ L samples of each solution <sup>were</sup> 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 Table B-IB-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-IBR*PH3.00*IUA	7.8969	8.3881	0.4912	3.07	1.0M HNO3
B-IBR*PH3.00*IUB	7.9044	8.4037	0.4993	23.5	0.55
B-IBR*PH4.00*IUA	7.9070	8.4061	0.4991	4.23	0.1M HNO3
B-IBR*PH4.00*IUB	7.8586	8.3574	0.4988	23.5	0.54
B-IBR*PH4.50*IUA	7.8816	8.3815	0.4999	4.67	
B-IBR*PH4.50*IUB	7.8424	8.3395	0.4971	23.5	0.17
B-IBR*PH5.00*IUA	7.8531	8.3557	0.5026	5.12	
B-IBR*PH5.00*IUB	7.7979	8.2962	0.4983	23.6	0.06
B-IBR*PH5.50*IUA	7.8513	8.3479	0.4966	5.36	0.02M HNO3
B-IBR*PH5.50*IUB	7.8293	8.3294	0.5001	23.6	0.09
B-IBR*PH6.00*IUA	7.8360	8.3361	0.5001	5.58	
B-IBR*PH6.00*IUB	7.8865	8.3852	0.4987	23.6	0.04
B-IBR*PH6.25*IUA	7.8033	8.3032	0.4999	5.77	
B-IBR*PH6.25*IUB	7.8375	8.3354	0.4979	23.7	0.04
B-IBR*PH6.50*IUA	7.8774	8.3772	0.4998	6.09	0.1M NaHCO3
B-IBR*PH6.50*IUB	7.8305	8.3286	0.4981	23.7	0.10
B-IBR*PH6.75*IUA	7.8596	8.3585	0.4989	6.37	
B-IBR*PH6.75*IUB	7.8219	8.3195	0.4976	23.7	0.18
B-IBR*PH7.00*IUA	7.8988	8.3967	0.4979	6.47	
B-IBR*PH7.00*IUB	7.8282	8.3260	0.4978	23.8	0.33
B-IBR*PH7.50*IUA	7.8856	8.3850	0.4994	7.24	1.0M NaHCO3
B-IBR*PH7.50*IUB	7.8723	8.3703	0.4980	23.8	0.11
B-IBR-C*PH2.0*IUA	7.8619	8.3605	0.4986	1.91	
B-IBR-C*PH2.0*IUB	7.8538	8.3526	0.4988	23.9	
B-IBR-C*PH4.0*IUA	7.8479	8.3446	0.4967	3.9	
B-IBR-C*PH4.0*IUB	7.8775	8.3742	0.4967	23.9	
B-IBR-C*PH5.0*IUA	7.8544	8.3527	0.4983	4.65	
B-IBR-C*PH5.0*IUB	7.8750	8.3723	0.4973	23.9	
B-IBR-C*PH5.5*IUA	7.8711	8.3691	0.4980	4.88	
B-IBR-C*PH5.5*IUB	7.8094	8.3077	0.4983	23.9	
B-IBR-C*PH6.0*IUA	7.8062	8.3055	0.4993	5.03	
B-IBR-C*PH6.0*IUB	7.8959	8.3926	0.4967	24.0	
B-IBR-C*PH6.5*IUA	7.9108	8.4114	0.5006	5.77	
B-IBR-C*PH6.5*IUB	7.8504	8.3507	0.5003	24.0	
B-IBR-C*PH7.0*IUA	7.8997	8.3977	0.4980	6.68	
B-IBR-C*PH7.0*IUB	7.8899	8.3912	0.5013	24.0	
B-IBR-C*PH7.5*IUA	7.8879	8.3871	0.4992	7.23	
B-IBR-C*PH7.5*IUB	7.8648	8.3621	0.4973	24.1	
B-IBR-C*PH8.0*IUA	7.9065	8.4062	0.4997	7.72	
B-IBR-C*PH8.0*IUB	7.9015	8.4016	0.5001	24.1	
B-IBR-C*PH9.5*IUA	7.8613	8.3592	0.4979	9.37	
B-IBR-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	688.36
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	0.85 516.8	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	122.898	3.08 122.66	3.38	698.16

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
182	31.54	0.00	0.00	137.811	3.07	137.47
183	16.76	2.75	83.20	262.034	3.04	265.57
184	16.86	1.67	133.0	260.461	3.04	263.30
185	7.81	1.76	184.8	565.893	3.02	567.55
186	7.52	0.70	464.0	587.969	3.02	591.85
187	7.88	3.10	107.9	561.092	3.02	566.32
188	8.21	0.00	0.00	538.535	3.02	537.31
189	8.93	1.19	251.9	494.639	3.02	495.08
190	9.22	1.87	161.4	478.983	3.02	481.44
191	10.56	2.17	130.5	417.996	3.02	420.10
192	10.82	1.48	185.9	407.600	3.02	407.76
193	10.04	0.00	0.00	439.907	3.02	441.72
194	9.72	0.90	317.3	454.286	3.02	455.34
195	10.33	2.25	127.5	427.179	3.02	429.60
196	10.43	2.82	102.8	423.053	3.02	425.88
197	9.17	0.00	0.00	482.048	3.02	482.48
198	8.96	1.57	192.7	492.861	3.02	495.56
199	8.35	2.95	110.1	529.454	3.02	534.41
200	8.40	1.63	192.8	525.927	3.02	529.16
201	8.10	1.89	169.9	546.015	3.02	548.20
202	8.17	0.37	840.8	541.310	3.02	541.30
203	7.79	1.18	273.8	567.354	3.02	570.36
204	7.86	1.12	284.7	562.401	3.02	564.27
(1 missing vial)						
206	0.83	22.11	63.55	5396.88	2.99	5427.32
207	0.83	8.86	130.5	5396.88	2.99	5417.68

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
163	B-IBR*PH3.00*U	542.278	0.4990	1086.7295	1.2567E+14	2.0864E-10	48.6226	
164	B-IBR*PH3.00*U	558.826	0.5000	1117.6520	1.2924E+14	2.1458E-10	50.0061	49.3143
165	B-IBR*PH4.00*U	487.397	0.5010	972.8483	1.1250E+14	1.8678E-10	43.5273	
166	B-IBR*PH4.00*U	480.775	0.4997	962.1273	1.1126E+14	1.8472E-10	43.0476	43.2874
167	B-IBR*PH4.50*U	380.644	0.5004	760.6795	8.7963E+13	1.4605E-10	34.0344	
168	B-IBR*PH4.50*U	394.374	0.4984	791.2801	9.1502E+13	1.5192E-10	35.4035	34.7190
169	B-IBR*PH5.00*U	268.928	0.5018	535.9267	6.1973E+13	1.0289E-10	23.9785	
170	B-IBR*PH5.00*U	270.417	0.5002	540.6178	6.2516E+13	1.0380E-10	24.1884	24.0834
171	B-IBR*PH5.50*U	217.963	0.5012	434.8823	5.0289E+13	8.3495E-11	19.4575	
172	B-IBR*PH5.50*U	225.362	0.4997	450.9946	5.2152E+13	8.6588E-11	20.1784	19.8180
173	B-IBR*PH6.00*U	201.669	0.5006	402.8546	4.6585E+13	7.7345E-11	18.0246	
174	B-IBR*PH6.00*U	204.445	0.5001	408.8082	4.7274E+13	7.8489E-11	18.2909	18.1577
175	B-IBR*PH6.25*U	131.413	0.5001	262.7734	3.0387E+13	5.0451E-11	11.7570	
176	B-IBR*PH6.25*U	131.996	0.5003	263.8337	3.0509E+13	5.0654E-11	11.8045	11.7808
177	B-IBR*PH6.50*U	130.282	0.5028	259.1130	2.9963E+13	4.9748E-11	11.5933	
178	B-IBR*PH6.50*U	129.221	0.5020	257.4124	2.9767E+13	4.9421E-11	11.5172	11.5552
179	B-IBR*PH6.75*U	122.097	0.5005	243.9500	2.8210E+13	4.6837E-11	10.9148	
180	B-IBR*PH6.75*U	122.899	0.4994	246.0933	2.8458E+13	4.7248E-11	11.0107	10.9628
181	B-IBR*PH7.00*U	136.602	0.4998	273.3133	3.1605E+13	5.2474E-11	12.2286	
182	B-IBR*PH7.00*U	137.811	0.5013	274.9072	3.1790E+13	5.2780E-11	12.2999	12.2643
183	B-IBR*PH7.50*U	262.034	0.4993	524.8027	6.0687E+13	1.0076E-10	23.4808	
184	B-IBR*PH7.50*U	260.461	0.4959	525.2289	6.0736E+13	1.0084E-10	23.4998	23.4903
185	B-IBR-C*PH2.0*U	565.893	0.5015	1128.4008	1.3049E+14	2.1665E-10	50.4870	
186	B-IBR-C*PH2.0*U	587.969	0.5042	1166.1424	1.3485E+14	2.2389E-10	52.1757	51.3313
187	B-IBR-C*PH4.0*U	561.092	0.5031	1115.2693	1.2897E+14	2.1412E-10	49.8995	
188	B-IBR-C*PH4.0*U	538.535	0.4998	1077.5010	1.2460E+14	2.0687E-10	48.2097	49.0546
189	B-IBR-C*PH5.0*U	494.639	0.5003	988.6848	1.1433E+14	1.8982E-10	44.2358	
190	B-IBR-C*PH5.0*U	478.983	0.5005	957.0090	1.1067E+14	1.8374E-10	42.8186	43.5272
191	B-IBR-C*PH5.5*U	417.996	0.5028	831.3365	9.6134E+13	1.5961E-10	37.1957	

6/15/94 TO

CALCULATIONS VERIFIED ON PAGE 143-144 OF THIS VOLUME.

6/15/94 TO CALCULATIONS VERIFIED ON P. 143-144 OF THIS VOLUME.

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
192	B-IBR-C*PH5.5*U	407.600	0.4987	817.3250	9.4514E+13	1.5692E-10	36.5688	36.8823
193	B-IBR-C*PH6.0*U	439.907	0.4995	880.6947	1.0184E+14	1.6909E-10	39.4041	
194	B-IBR-C*PH6.0*U	454.286	0.5165	879.5470	1.0171E+14	1.6887E-10	39.3528	39.3784
195	B-IBR-C*PH6.5*U	427.179	0.5018	851.2933	9.8442E+13	1.6344E-10	38.0886	
196	B-IBR-C*PH6.5*U	423.053	0.5000	846.1060	9.7842E+13	1.6245E-10	37.8566	37.9726
197	B-IBR-C*PH7.0*U	482.048	0.4995	965.0611	1.1160E+14	1.8529E-10	43.1789	
198	B-IBR-C*PH7.0*U	492.861	0.4981	989.4820	1.1442E+14	1.8997E-10	44.2715	43.7252
199	B-IBR-C*PH7.5*U	529.454	0.5002	1058.4846	1.2240E+14	2.0322E-10	47.3588	
200	B-IBR-C*PH7.5*U	525.927	0.4975	1057.1397	1.2225E+14	2.0296E-10	47.2986	47.3287
201	B-IBR-C*PH8.0*U	546.015	0.4981	1096.1955	1.2676E+14	2.1046E-10	49.0461	
202	B-IBR-C*PH8.0*U	541.310	0.4972	1088.7168	1.2590E+14	2.0903E-10	48.7115	48.8788
203	B-IBR-C*PH9.5*U	567.654	0.5056	1122.7334	1.2983E+14	2.1556E-10	50.2334	
204	B-IBR-C*PH9.5*U	562.401	0.5010	1122.5569	1.2981E+14	2.1552E-10	50.2255	50.2295
206	B-IIB*U1	5396.880	0.5033	10722.9883	1.2400E+15	2.0587E-09	479.7689	
207	B-IIB*U2	5396.880	0.5002	10789.4442	1.2477E+15	2.0715E-09	482.7423	481.2556

27 July 1993 EXPERIMENT B-III, Reverse m

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-IIIIR*PH3.00*U	59.439	0.4912	121.0077	1.3993E+13	2.3233E-11	5.4141	
3	B-IIIIR*PH3.00*U	56.727	0.4993	113.6131	1.3138E+13	2.1813E-11	5.0833	5.2487
4	B-IIIIR*PH4.00*U	44.578	0.4991	89.3168	1.0328E+13	1.7148E-11	3.9962	
5	B-IIIIR*PH4.00*U	46.653	0.4988	93.5305	1.0816E+13	1.7957E-11	4.1847	4.0905
6	B-IIIIR*PH4.50*U	30.526	0.4999	61.0642	7.0613E+12	1.1724E-11	2.7321	
7	B-IIIIR*PH4.50*U	30.840	0.4971	62.0398	7.1741E+12	1.1911E-11	2.7758	2.7540
8	B-IIIIR*PH5.00*U	13.449	0.5026	26.7589	3.0943E+12	5.1375E-12	1.1972	
9	B-IIIIR*PH5.00*U	13.009	0.4983	26.1068	3.0189E+12	5.0123E-12	1.1681	1.1827
10	B-IIIIR*PH5.50*U	9.949	0.4966	20.0342	2.3167E+12	3.8464E-12	0.8964	
11	B-IIIIR*PH5.50*U	9.946	0.5001	19.8880	2.2998E+12	3.8184E-12	0.8898	0.8931
12	B-IIIIR*PH6.00*U	7.510	0.5001	15.0170	1.7365E+12	2.8832E-12	0.6719	
13	B-IIIIR*PH6.00*U	7.800	0.4987	15.6407	1.8087E+12	3.0029E-12	0.6998	0.6858
14	B-IIIIR*PH6.25*U	6.677	0.4999	13.3567	1.5445E+12	2.5644E-12	0.5976	
15	B-IIIIR*PH6.25*U	6.852	0.4979	13.7618	1.5914E+12	2.6422E-12	0.6157	0.6067
16	B-IIIIR*PH6.50*U	6.124	0.4998	12.2529	1.4169E+12	2.3525E-12	0.5482	
17	B-IIIIR*PH6.50*U	6.345	0.4981	12.7384	1.4730E+12	2.4457E-12	0.5699	0.5591
18	B-IIIIR*PH6.75*U	5.832	0.4989	11.6897	1.3518E+12	2.2443E-12	0.5230	
19	B-IIIIR*PH6.75*U	5.820	0.4976	11.6961	1.3525E+12	2.2456E-12	0.5233	0.5232
20	B-IIIIR*PH7.00*U	9.118	0.4979	18.3129	2.1177E+12	3.5160E-12	0.8194	
21	B-IIIIR*PH7.00*U	8.669	0.4978	17.4146	2.0138E+12	3.3435E-12	0.7792	0.7993
22	B-IIIIR*PH7.50*U	19.324	0.4994	38.6944	4.4745E+12	7.4291E-12	1.7313	
23	B-IIIIR*PH7.50*U	19.104	0.4980	38.3614	4.4360E+12	7.3651E-12	1.7164	1.7238
24	B-IIIIR-C*PH2.0*U	59.093	0.4986	118.5178	1.3705E+13	2.2755E-11	5.3027	
25	B-IIIIR-C*PH2.0*U	56.756	0.4988	113.7851	1.3158E+13	2.1846E-11	5.0910	5.1969
26	B-IIIIR-C*PH4.0*U	53.613	0.4967	107.9384	1.2482E+13	2.0723E-11	4.8294	
27	B-IIIIR-C*PH4.0*U	53.872	0.4967	108.4598	1.2542E+13	2.0824E-11	4.8527	4.8411
28	B-IIIIR-C*PH5.0*U	36.849	0.4983	73.9494	8.5513E+12	1.4198E-11	3.3087	
29	B-IIIIR-C*PH5.0*U	37.345	0.4973	75.0955	8.6839E+12	1.4418E-11	3.3599	3.3343
30	B-IIIIR-C*PH5.5*U	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

Protocol #: 6 Name: U-233 5% 2 Sigma 24-Jul-93 09:41  
Region A: LL-UL= 0.0-100. Lor= 0 Bkg= 0.00 %2 Sigma=0.25  
Region B: LL-UL=100.-350. Lor= 0 Bkg= 0.00 %2 Sigma=5.00  
Region C: LL-UL= 0.0-2000 Lor= 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:25%	CPMB B:25%	CPMC C:25%	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 14.66 702.58		
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	0.25 699.9	59.093 5.24	59.70 6.19 694.95		
25	26.89	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 6.40 703.87		
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

ID 29 July 1993 EXPERIMENT B-II B

The pH has had sufficient time to equilibrate, so 2 500 µL 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*IU A	7.9268	8.4328	0.5060
B-IIB*PH2.00*IU B	7.8391	8.3439	0.5048
B-IIB*PH2.25*IU A	7.8482	8.3530	0.5048
B-IIB*PH2.25*IU B	7.8059	8.3076	0.5017
B-IIB*PH2.50*IU A	7.8349	8.3393	0.5044
B-IIB*PH2.50*IU B	7.8730	8.3751	0.5021
B-IIB*PH2.75*IU A	7.8251	8.3257	0.5006
B-IIB*PH2.75*IU B	7.8421	8.3425	0.5004
B-IIB*PH3.00*IU A	7.8482	8.3478	0.4996
B-IIB*PH3.00*IU B	7.8574	8.3553	0.4979
B-IIB*PH3.25*IU A	7.8673	8.3664	0.4991
B-IIB*PH3.25*IU B	7.8917	8.3908	0.4991
B-IIB*PH3.50*IU A	7.8107	8.3091	0.4984
B-IIB*PH3.50*IU B	7.8918	8.3903	0.4985
B-IIB*PH3.75*IU A	7.8412	8.3441	0.5029
B-IIB*PH3.75*IU B	7.8241	8.3234	0.4993
B-IIB*PH4.00*IU A	7.8628	8.3609	0.4981
B-IIB*PH4.00*IU B	7.8540	8.3537	0.4997
B-IIB*PH4.25*IU A	7.8341	8.3341	0.5000
B-IIB*PH4.25*IU B	7.8082	8.3063	0.4981
B-IIB*PH4.50*IU A	7.8854	8.3857	0.5003
B-IIB*PH4.50*IU B	7.8727	8.3711	0.4984
B-IIB*PH4.75*IU A	7.8656	8.3650	0.4994
B-IIB*PH4.75*IU B	7.8474	8.3454	0.4980
B-IIB*PH5.00*IU A	7.8882	8.3861	0.4979
B-IIB*PH5.00*IU B	7.8507	8.3486	0.4979
B-IIB*PH5.25*IU A	7.8634	8.3622	0.4988
B-IIB*PH5.25*IU B	7.9260	8.4241	0.4981
B-IIB*PH5.50*IU A	7.8757	8.3755	0.4998
B-IIB*PH5.50*IU B	7.8769	8.3758	0.4989
B-IIB*PH5.75*IU A	7.9044	8.4029	0.4985
B-IIB*PH5.75*IU B	7.8741	8.3709	0.4968
B-IIB*PH6.00*IU A	7.8352	8.3318	0.4966
B-IIB*PH6.00*IU B	7.9304	8.4300	0.4996
B-IIB*PH6.25*IU A	7.8731	8.3723	0.4992
B-IIB*PH6.25*IU B	7.8847	8.3839	0.4992
B-IIB*PH6.50*IU A	7.8152	8.3169	0.5017
B-IIB*PH6.50*IU B	7.8459	8.3437	0.4978
B-IIB*PH6.75*IU A	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. 0.000 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 has 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:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
1	999.98	18.54 1.47	2.94 3.89	27.51 1.21	135.18 B
2	7.24	11.44 35.88	5523.30 1.00	5549.70 1.00	708.78
3	7.30	15.03 28.80	5478.86 1.00	5508.73 1.00	704.79
4	7.21	13.36 31.55	5550.48 1.00	5577.48 1.00	704.81
5	7.26	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	5538.89 1.00	5566.82 1.00	705.06
8	7.28	15.07 28.81	5512.07 1.00	5539.29 1.00	705.15
9	7.22	16.84 28.58	5542.35 1.00	5572.77 1.00	703.00
10	7.25	14.98 28.78	5518.18 1.00	5548.83 1.00	704.03
11	7.22	17.75 25.30	5544.15 1.00	5578.78 1.00	703.33
12	7.27	13.65 30.89	5501.46 1.00	5530.87 1.00	704.87
13	7.23	11.20 36.29	5533.71 1.00	5558.38 1.00	704.88
14	7.28	13.33 31.45	5487.33 1.00	5521.80 1.00	703.53
15	7.33	12.71 32.57	5458.00 1.00	5480.40 1.00	708.05
16	7.25	13.33 31.53	5517.75 1.00	5548.70 1.00	708.10
17	7.36	11.22 35.93	5432.25 1.00	5457.54 1.00	703.68
18	7.42	8.89 44.21	5392.81 1.00	5410.83 1.00	708.14
19	7.34	17.84 25.00	5448.92 1.00	5476.44 1.00	707.88
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	708.42
22	7.56	14.40 29.05	5293.88 1.00	5318.18 1.00	708.46
23	7.57	17.79 24.87	5287.55 1.00	5316.08 1.00	705.88
24	7.73	14.19 29.08	5179.34 1.00	5204.44 1.00	708.88
25	7.73	18.00 26.47	5175.71 1.00	5203.87 1.00	707.81
26	7.51	18.48 24.07	5325.15 1.00	5358.11 1.00	709.30
27	7.55	11.88 34.38	5301.30 1.00	5323.08 1.00	709.88
28	7.75	15.40 27.24	5181.58 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	4825.29 1.00	4844.82 1.00	708.58
32	7.87	21.38 21.39	5218.05 1.00	5248.80 1.00	708.27
33	7.71	14.54 28.58	5189.80 1.00	5217.49 1.00	710.02
34	7.85	17.38 24.88	5099.10 1.00	5129.94 1.00	707.88
35	7.71	13.37 30.50	5187.85 1.00	5211.14 1.00	709.43
36	7.58	15.50 27.40	5279.78 1.00	5302.83 1.00	708.79
37	7.83	13.97 29.82	5245.81 1.00	5270.28 1.00	708.30
38	7.81	9.12 41.37	5122.41 1.00	5140.88 1.00	707.98
39	7.77	11.71 33.78	5150.34 1.00	5188.83 1.00	708.70
40	7.68	11.02 35.88	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 38.20	5194.48 1.00	5214.18 1.00	709.18
43	7.75	9.08 41.70	5184.54 1.00	5179.20 1.00	709.12
44	7.54	13.58 30.50	5303.88 1.00	5325.84 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	5408.38 1.00	5428.03 1.00	709.88
49	7.33	7.93 48.05	5458.13 1.00	5471.94 1.00	707.80

S#	TIME	CPMA A:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
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	705.83
52	7.30	21.19 22.06	5478.98 1.00	5508.52 1.00	705.17
53	7.33	15.02 28.54	5457.83 1.00	5481.90 1.00	704.57
54	7.33	9.02 43.09	5455.58 1.00	5488.94 1.00	708.05
55	7.32	12.81 32.78	5485.84 1.00	5484.37 1.00	708.05
56	7.25	15.95 27.41	5518.09 1.00	5540.83 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	708.49
59	7.32	13.84 30.45	5468.48 1.00	5493.53 1.00	707.80
60	7.36	12.85 32.21	5432.39 1.00	5480.67 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 39.82	5172.87 1.00	5196.29 1.00	708.41
65	7.70	14.08 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	708.04
67	7.58	9.83 39.48	5274.83 1.00	5295.05 1.00	708.38
68	7.82	10.82 38.48	5115.73 1.00	5135.86 1.00	708.31
69	7.83	11.09 35.18	5109.32 1.00	5129.19 1.00	707.30
70	7.97	13.58 29.82	5019.77 1.00	5044.28 1.00	704.97
71	7.93	18.02 28.12	5043.84 1.00	5070.09 1.00	708.51
72	8.21	13.01 30.21	4873.31 1.00	4898.48 1.00	707.84
73	8.20	8.78 41.89	4876.82 1.00	4899.44 1.00	710.01
74	7.61	10.11 38.48	5253.58 1.00	5271.31 1.00	707.02
75	7.84	12.09 33.19	5235.02 1.00	5253.90 1.00	705.32
76	7.31	13.75 30.84	5469.15 1.00	5489.45 1.00	707.75
77	7.35	11.80 34.50	5445.38 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 37.88	5318.34 1.00	5338.05 1.00	708.78

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	

S#	SAMPLE NAME	CPM B	WEIGHT	MASS CONV	ATOM CONV	MOLE CONV	U ppb	AVG U ppb
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 RD  
CALCULATIONS  
VERIFIED ON  
P. 113-114 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	485.0396
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

## 2 AUGUST 1993 EXPERIMENT C-I

### URANIUM SORPTION EXPERIMENT C-I

Kd vs pH: Ionic strength effect; atmospheric pCO<sub>2</sub>; Initial EU=50 ppb

WRITTEN BY: R.T. PABALAN

DATE WRITTEN: May 27, 1993

REVISION NO.: 1

DATE REVISED: July 12, 1993

OBJECTIVE:

- 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<sub>3</sub>, is designed to complement experiment C-I, which was conducted at I=0.1 m NaNO<sub>3</sub>. Procedure modified from that for B-IB.

EQUIPMENT:

Gyratory shaker or constant temperature shaker bath  
Packard liquid scintillation counter  
ORION pH/mV/ASE/°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<sub>3</sub> solution into scintillation vial)
- various Eppendorf micropipets (fixed- or variable-volume; for adding HNO<sub>3</sub> or NaHCO<sub>3</sub> solutions to uranium solutions)
- scintillation vials
- weighing paper
- Na<sup>+</sup>-clinoptilolite (CDV\*100/200\*UC\*WA\*HL\*CPT\*NaF)
- reagent grade NaHCO<sub>3</sub>
- 500 ppb U stock solution prepared from 50 ppm <sup>233</sup>U commercial spike
- 2 L 1.10 m NaNO<sub>3</sub> stock solution
- 1000 ml stock solution of 1.0 m HNO<sub>3</sub>
- 1000 ml stock solution of 0.1 m HNO<sub>3</sub>
- 1000 ml stock solution of 0.02 m HNO<sub>3</sub>
- 500 ml stock solution of 1.0 m NaHCO<sub>3</sub>
- 500 ml stock solution of 0.5 m NaHCO<sub>3</sub>
- 500 ml stock solution of 0.1 m NaHCO<sub>3</sub>
- 500 ml stock solution of 0.05 m NaHCO<sub>3</sub>

500 ml stock solution of 0.01 m NaHCO<sub>3</sub>  
500 ml stock solution of 0.005 m NaHCO<sub>3</sub>  
ultrapure water

### PROCEDURE:

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

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

- Initial EU = 50 ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO<sub>3</sub> or NaHCO<sub>3</sub>
- Initial volume = 50 ml
- Ionic strength = 1.0 m NaNO<sub>3</sub>
- Wt. zeolite to use = 0.100±0.001
- Initial [Na<sup>+</sup>] = 1.0 m NaNO<sub>3</sub> + [NaHCO<sub>3</sub>] added
- pCO<sub>2</sub> = atmospheric = 10<sup>-3.48</sup> 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<sub>3</sub> matrix; prepared previously from commercial 50 ppm <sup>233</sup>U spike) to a total of 2000 g by carefully taring 1.10 m NaNO<sub>3</sub> solution into the teflon bottle on a Mettler 4600 balance.

b) Into each of 29 60-ml FEP bottle labeled C-I\*pHi [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\*pHi [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<sub>3</sub>. Reweigh each vial. Homogenize the mixture and save for later analysis of uranium concentration by liquid scintillation counting.

c) For each solution C-I\*pHi and C-I-C\*pHi:

Adjust the pH of each solution to the approximate value *i* by adding HNO<sub>3</sub> solution or NaHCO<sub>3</sub> 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<sub>2</sub>(g).

d) Measure and record the pH of each solution C-I\*pHi and C-I-C\*pHi. *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\*pHi and C-I-C\*pHi, 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<sub>3</sub>. 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\*pHi (not the C-I-C\*pHi) 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\*pHi 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<sub>3</sub>. 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\**pHi* and C-I-C\**pHi*. 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 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 <sup>233</sup>U commercial spike
  - 2 L 1.10 m NaNO<sub>3</sub> stock solution
  - 1000 ml stock solution of 1.0 m HNO<sub>3</sub>
  - 1000 ml stock solution of 0.1 m HNO<sub>3</sub>
  - 1000 ml stock solution of 0.02 m HNO<sub>3</sub>
  - 500 ml stock solution of 1.0 M NaHCO<sub>3</sub> (42.005 g in 500 ml solution)
  - 500 ml stock solution of 0.5 M NaHCO<sub>3</sub> (21.003 in 500 ml solution)
  - 500 ml stock solution of 0.1 M NaHCO<sub>3</sub> (4.201 g in 500 ml solution)
  - 500 ml stock solution of 0.05 M NaHCO<sub>3</sub> (2.100 g in 500 ml solution)
  - 500 ml stock solution of 0.01 M NaHCO<sub>3</sub> (0.4201 g in 500 ml solution)
  - 500 ml stock solution of 0.005 M NaHCO<sub>3</sub> (0.2100 g in 500 ml solution)

The NaHCO<sub>3</sub> 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<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to 50 ml 1.0 m NaNO<sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of HNO <sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of NaHCO <sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of NaHCO <sub>3</sub> 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 <sub>3</sub> solid]	[1.0]
[9.50]	[4.01] or [0.337 g NaHCO <sub>3</sub> solid]	[1.0]

Experiment C-I was begun by diluting 200.97 g 500 ppb <sup>233</sup>U to 2006.9 g using 1.1 M NaNO<sub>3</sub> (to give final concentration of 10 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<sub>3</sub> 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 HNO <sub>3</sub>	50.78
C-I*PH2.25	50.20	0.37	1.0 M HNO <sub>3</sub>	50.57
C-I*PH2.50	50.01	0.20	1.0 M HNO <sub>3</sub>	50.21
C-I*PH2.75	49.88	0.11	1.0 M HNO <sub>3</sub>	49.99
C-I*PH3.00	49.83	0.60	0.1 M HNO <sub>3</sub>	50.43
C-I*PH3.25	50.18	0.32	0.1 M HNO <sub>3</sub>	50.50
C-I*PH3.50	50.02	0.16	0.1 M HNO <sub>3</sub>	50.18
C-I*PH3.75	49.99	0.07	0.1 M HNO <sub>3</sub>	50.06
C-I*PH4.00	50.13	0.12	0.02 M HNO <sub>3</sub>	50.25
C-I*PH4.25	50.08	0.09	0.005 M NaHCO <sub>3</sub>	50.17
C-I*PH4.50	49.96	0.40	0.005 M NaHCO <sub>3</sub>	50.36
C-I*PH4.75	49.87	0.29	0.01 M NaHCO <sub>3</sub>	50.16
C-I*PH5.00	50.21	0.34	0.01 M NaHCO <sub>3</sub>	50.55
C-I*PH5.25	49.82	0.37	0.01 M NaHCO <sub>3</sub>	50.19
C-I*PH5.50	50.00	0.40	0.01 M NaHCO <sub>3</sub>	50.40
C-I*PH5.75	50.14	0.42	0.01 M NaHCO <sub>3</sub>	50.56
C-I*PH6.00	49.76	0.45	0.01 M NaHCO <sub>3</sub>	50.21
C-I*PH6.25	49.97	0.50	0.01 M NaHCO <sub>3</sub>	50.47
C-I*PH6.50	50.16	0.12	0.05 M NaHCO <sub>3</sub>	50.28
C-I*PH6.75	49.65	0.15	0.05 M NaHCO <sub>3</sub>	49.80
C-I*PH7.00	49.70	0.20	0.05 M NaHCO <sub>3</sub>	49.90
C-I*PH7.25	50.05	0.30	0.05 M NaHCO <sub>3</sub>	50.35
C-I*PH7.50	49.83	0.47	0.05 M NaHCO <sub>3</sub>	50.30
C-I*PH7.75	50.16	0.39	0.1 M NaHCO <sub>3</sub>	50.55
C-I*PH8.00	50.18	0.13	0.5 M NaHCO <sub>3</sub>	50.31
C-I*PH8.25	49.95	0.24	0.5 M NaHCO <sub>3</sub>	50.19
C-I*PH8.50	49.89	0.43	0.5 M NaHCO <sub>3</sub>	50.32
C-I*PH8.75	49.88	0.41	1.0 M NaHCO <sub>3</sub>	50.29
C-I*PH9.00	50.03	0.81	1.0 M NaHCO <sub>3</sub>	50.84
C-I-C*PH2.0	49.84	0.69	1.0 M HNO <sub>3</sub>	50.53
C-I-C*PH4.0	50.06	0.12	0.02 M HNO <sub>3</sub>	50.18
C-I-C*PH5.0	49.71	0.34	0.01 M NaHCO <sub>3</sub>	50.05
C-I-C*PH5.5	49.91	0.40	0.01 M NaHCO <sub>3</sub>	50.31
C-I-C*PH6.0	50.11	0.45	0.01 M NaHCO <sub>3</sub>	50.56
C-I-C*PH6.5	50.20	0.12	0.05 M NaHCO <sub>3</sub>	50.32
C-I-C*PH7.0	49.63	0.20	0.05 M NaHCO <sub>3</sub>	49.83
C-I-C*PH7.5	50.32	0.47	0.05 M NaHCO <sub>3</sub>	50.79
C-I-C*PH8.0	50.01	0.13	0.5 M NaHCO <sub>3</sub>	50.14
C-I-C*PH9.5	50.17	0.337 g NaHCO <sub>3</sub> 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



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Two 500  $\mu$ L samples of each of the B-IIB, 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-IIBR*PH3.00*A	7.8180	8.3194	0.5014	2.04
B-IIBR*PH3.00*B	7.8356	8.3359	0.5003	20.0
B-IIBR*PH4.00*A	7.8945	8.3934	0.4989	3.06
B-IIBR*PH4.00*B	7.9033	8.3968	0.4935	20.0
B-IIBR*PH4.50*A	7.8797	8.3828	0.5031	3.60
B-IIBR*PH4.50*B	7.8992	8.3976	0.4984	20.0
B-IIBR*PH5.00*A	7.9017	8.4024	0.5007	4.18
B-IIBR*PH5.00*B	7.8776	8.3757	0.4981	20.1
B-IIBR*PH5.50*A	7.8531	8.3541	0.5010	4.84
B-IIBR*PH5.50*B	7.9084	8.4055	0.4971	20.1
B-IIBR*PH6.00*A	7.8769	8.3787	0.5018	5.19
B-IIBR*PH6.00*B	7.8870	8.3870	0.5000	20.1
B-IIBR*PH6.25*A	7.9198	8.4242	0.5044	5.37
B-IIBR*PH6.25*B	7.8537	8.3519	0.4982	20.1
B-IIBR*PH6.50*A	7.8536	8.3548	0.5012	6.45
B-IIBR*PH6.50*B	7.8923	8.3911	0.4988	20.2
B-IIBR*PH6.75*A	7.8864	8.3893	0.5029	6.79
B-IIBR*PH6.75*B	7.8636	8.3632	0.4996	20.2
B-IIBR*PH7.00*A	7.8796	8.3792	0.4996	7.00
B-IIBR*PH7.00*B	7.8850	8.3835	0.4985	20.2
B-IIBR*PH7.50*A	7.8476	8.3511	0.5035	8.44
B-IIBR*PH7.50*B	7.8407	8.3408	0.5001	20.2
B-IIBR-C*PH2.0*A	7.9200	8.4188	0.4988	1.97
B-IIBR-C*PH2.0*B	7.8856	8.3821	0.4965	20.2
B-IIBR-C*PH4.0*A	7.8659	8.3687	0.5028	3.94
B-IIBR-C*PH4.0*B	7.9326	8.4311	0.4985	20.2
B-IIBR-C*PH5.0*A	7.8781	8.3812	0.5031	4.65
B-IIBR-C*PH5.0*B	7.8809	8.3790	0.4981	20.3
B-IIBR-C*PH5.5*A	7.8884	8.3938	0.5054	4.80
B-IIBR-C*PH5.5*B	7.8559	8.3560	0.5001	20.3
B-IIBR-C*PH6.0*A	7.8028	8.3034	0.5006	4.92
B-IIBR-C*PH6.0*B	7.8387	8.3385	0.4998	20.3
B-IIBR-C*PH6.5*A	7.8623	8.3634	0.5011	5.65
B-IIBR-C*PH6.5*B	7.8392	8.3377	0.4985	20.3
B-IIBR-C*PH7.0*A	7.9455	8.4473	0.5018	6.73
B-IIBR-C*PH7.0*B	7.8853	8.3845	0.4992	20.3
B-IIBR-C*PH7.5*A	7.8517	8.3465	0.4948	7.27
B-IIBR-C*PH7.5*B	7.8178	8.3174	0.4996	20.4
B-IIBR-C*PH8.0*A	7.8031	8.3037	0.5006	7.87
B-IIBR-C*PH8.0*B	7.9149	8.4139	0.4990	20.4
B-IIBR-C*PH9.5*A	7.8107	8.3094	0.4987	9.47
B-IIBR-C*PH9.5*B	7.8232	8.3200	0.4968	20.4

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The B-IIB solutions were sampled and the pH measured. 2 500  $\mu$ L samples were taken and prepared for d.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 acid or base given, rounded to the nearest 10  $\mu$ L. The actual adjustments are given below Table B-IIB-2.

Table B-IIB-2. For reverse experiments: Amount of reagent grade HNO<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to remaining 0.1 M NaNO<sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of HNO <sub>3</sub> 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 <sub>3</sub> needed, ml	Molarity of NaHCO <sub>3</sub> 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 <sub>3</sub>
B-IIB*PH4.00	0.54 mL 0.1 M HNO <sub>3</sub>
B-IIB*PH4.50	0.17 mL 0.1 M HNO <sub>3</sub>
B-IIB*PH5.00	0.06 mL 0.1 M HNO <sub>3</sub>
B-IIB*PH5.50	0.09 mL 0.02 M HNO <sub>3</sub>
B-IIB*PH6.00	0.04 mL 0.02 M HNO <sub>3</sub>
B-IIB*PH6.25	0.04 mL 0.02 M HNO <sub>3</sub>
B-IIB*PH6.50	0.10 mL 0.1 M NaHCO <sub>3</sub>
B-IIB*PH6.75	0.18 mL 0.1 M NaHCO <sub>3</sub>
B-IIB*PH7.00	0.33 mL 0.1 M NaHCO <sub>3</sub>
B-IIB*PH7.50	0.11 mL 1.0 M NaHCO <sub>3</sub>

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	0.4974
B-IIB*PH7.50*B	7.8567	8.3280	0.4683
B-IIB*PH7.75*A	7.8139	8.3182	0.4993
B-IIB*PH7.75*B	7.8782	8.3754	0.4972
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	7.8863	8.3598	0.5535
B-IIB-C*PH7.0*B	7.8031	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

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B-IIB\*PH 7.75 A  
Values are correct

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\*EV 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
2	7.62	2.22	151.2	580.743	3.01	583.67
3	7.51	0.00	0.00	588.893	3.02	587.04
4	7.59	1.25	263.3	582.523	3.02	583.59
5	7.70	2.26	148.0	574.678	3.01	578.75
6	7.97	0.00	0.00	554.732	3.02	554.31
7	8.00	2.46	133.8	553.391	3.01	556.25
8	8.98	0.00	0.00	492.450	3.02	491.39
9	8.95	0.00	0.00	493.776	3.02	493.91
10	11.36	1.38	195.5	388.389	3.02	390.26
11	11.25	1.40	193.4	392.394	3.02	394.35
12	14.32	0.65	363.7	307.561	3.03	307.53
13	14.64	0.56	415.9	300.636	3.03	301.09
14	17.91	0.00	0.00	245.201	3.04	242.48
15	17.98	0.00	0.00	244.179	3.04	243.09
16	40.57	0.00	0.00	106.555	3.09	108.19
17	37.50	0.00	0.00	115.523	3.08	115.62
18	30.30	0.00	0.00	143.683	3.08	144.14
19	30.78	0.00	0.00	141.428	3.06	141.23
20	22.70	0.98	198.4	192.831	3.05	193.89
21	22.71	0.00	0.00	192.789	3.05	191.63
22	7.91	0.00	0.00	559.342	3.01	560.62
23	7.84	1.24	261.0	564.235	3.02	567.28
24	7.32	0.00	0.00	604.803	3.01	604.50
25	7.26	0.00	0.00	609.413	3.01	609.31
26	7.53	2.87	119.3	587.321	3.02	591.12
27	7.63	1.01	322.5	579.454	3.02	581.04
28	8.24	1.95	164.2	536.336	3.02	539.24
29	8.57	1.38	225.1	515.686	3.02	517.17
30	9.82	0.00	0.00	449.562	3.02	450.33
31	9.82	1.83	159.9	450.071	3.02	453.08
32	8.45	0.00	0.00	523.170	3.02	523.25
33	8.48	2.07	153.4	521.544	3.02	524.72
34	9.97	0.00	0.00	442.753	3.02	443.74
35	9.96	4.15	73.85	443.301	3.02	448.43
36	9.27	1.13	262.4	476.628	3.02	477.84
37	9.10	1.29	233.4	485.917	3.02	488.39
38	8.17	1.40	227.3	541.447	3.02	544.22
39	8.30	2.40	134.3	532.558	3.02	535.98
40	7.60	4.77	74.41	582.411	3.01	589.49
41	8.01	5.30	65.98	552.946	3.01	560.64
42	7.83	1.01	318.8	564.577	3.02	567.02
43	7.67	0.00	0.00	576.938	3.01	579.69
(3 missing vials)						
47	8.18	4.08	83.03	541.026	3.01	544.13
48	8.10	1.82	176.9	546.028	3.02	549.28

SAMPLE NAME	CPM B	WEIGHT (g)	MASS	ATOM CONV	MOLE CONV	ppb U(233)	AVG [U]
C-1*Ua	541.026	0.5254	1029.7411	1.19076882E+14	1.977036E-10	46.0728	
C-1*Ua	546.028	0.5244	1041.2433	1.20406897E+14	1.999119E-10	46.5874	46.3301

6/15/94 ED

CALCULATIONS VERIFIED ON PAGE 143-4 OF THE 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	2.2138E-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	51.8331
6	B-IBR*ph4.50*A	554.732	0.4971	1115.9384	1.2904E+14	2.1425E-10	49.9293	
7	B-IBR*ph4.50*B	553.391	0.4979	1111.4501	1.2853E+14	2.1399E-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	1.8980E-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	487.9622	5.6427E+13	9.3686E-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	1.4058E+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	1.2950E+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	896.2580	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	1.8893E-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	1086.6093	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	2.1268E-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	51.8268	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 9.86 732.62	
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 14.65 749.38	
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 9.80 708.60	
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	38.656 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	

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-IIBR*PH3.00*A	58.037	0.5014	115.7499	1.3385E+13	2.2223E-11	5.1789	
3	B-IIBR*PH3.00*B	59.762	0.5003	119.4523	1.3813E+13	2.2934E-11	5.3445	5.2617
4	B-IIBR*PH4.00*A	61.191	0.4989	122.6518	1.4183E+13	2.3546E-11	5.4877	
5	B-IIBR*PH4.00*B	56.219	0.4935	113.9189	1.3173E+13	2.1872E-11	5.0970	5.2923
6	B-IIBR*PH4.50*A	54.441	0.5031	108.2111	1.2513E+13	2.0776E-11	4.8416	
7	B-IIBR*PH4.50*B	55.172	0.4984	110.6982	1.2801E+13	2.1253E-11	4.9529	4.8972
8	B-IIBR*PH5.00*A	46.115	0.5007	92.1011	1.0850E+13	1.7683E-11	4.1208	
9	B-IIBR*PH5.00*B	43.156	0.4981	86.6412	1.0019E+13	1.6635E-11	3.8765	3.9987
10	B-IIBR*PH5.50*A	25.678	0.5010	51.2535	5.9268E+12	9.8403E-12	2.2932	
11	B-IIBR*PH5.50*B	24.734	0.4971	49.7566	5.7537E+12	9.5529E-12	2.2262	2.2597
12	B-IIBR*PH6.00*A	14.195	0.5018	28.2882	3.2712E+12	5.4311E-12	1.2657	
13	B-IIBR*PH6.00*B	14.507	0.5000	29.0140	3.3551E+12	5.5705E-12	1.2981	1.2819
14	B-IIBR*PH6.25*A	12.479	0.5044	24.7403	2.8609E+12	4.7500E-12	1.1089	
15	B-IIBR*PH6.25*B	13.271	0.4982	26.6379	3.0803E+12	5.1143E-12	1.1918	1.1494
16	B-IIBR*PH6.50*A	5.773	0.5012	11.5184	1.3320E+12	2.2114E-12	0.5154	
17	B-IIBR*PH6.50*B	6.369	0.4988	12.7686	1.4765E+12	2.4515E-12	0.5713	0.5433
18	B-IIBR*PH6.75*A	7.278	0.5029	14.4721	1.6735E+12	2.7785E-12	0.6475	
19	B-IIBR*PH6.75*B	7.414	0.4996	14.8399	1.7100E+12	2.8492E-12	0.6640	0.6557
20	B-IIBR*PH7.00*A	12.790	0.4996	25.8005	2.9804E+12	4.9151E-12	1.1454	
21	B-IIBR*PH7.00*B	12.869	0.4985	25.8154	2.9852E+12	4.9564E-12	1.1550	1.1502
22	B-IIBR*PH7.50*A	55.843	0.5035	110.9096	1.2825E+13	2.1294E-11	4.9623	
23	B-IIBR*PH7.50*B	55.042	0.5001	110.0620	1.2727E+13	2.1131E-11	4.9244	4.9434
24	B-IIBR-C*PH2.0*A	59.983	0.4988	120.2546	1.3906E+13	2.3088E-11	5.3804	
25	B-IIBR-C*PH2.0*B	62.366	0.4985	125.6113	1.4525E+13	2.4117E-11	5.6201	5.5003
26	B-IIBR-C*PH4.0*A	58.162	0.5028	115.6762	1.3377E+13	2.2209E-11	5.1756	
27	B-IIBR-C*PH4.0*B	58.528	0.4985	117.4082	1.3577E+13	2.2542E-11	5.2531	5.2143
28	B-IIBR-C*PH5.0*A	42.896	0.5031	85.2634	9.8597E+12	1.6370E-11	3.8149	
29	B-IIBR-C*PH5.0*B	42.776	0.4981	85.8783	9.9308E+12	1.6488E-11	3.8424	3.8286
30	B-IIBR-C*PH5.5*A	32.902	0.5094	65.1009	7.5281E+12	1.2499E-11	2.9128	
31	B-IIBR-C*PH5.5*B	33.200	0.5001	66.3867	7.6768E+12	1.2746E-11	2.9703	2.9415
32	B-IIBR-C*PH6.0*A	29.185	0.5006	58.3000	6.7417E+12	1.1193E-11	2.6085	
33	B-IIBR-C*PH6.0*B	29.411	0.4996	58.8455	6.8048E+12	1.1298E-11	2.6329	2.6207
34	B-IIBR-C*PH6.5*A	28.362	0.5011	58.5995	6.5450E+12	1.0867E-11	2.5324	
35	B-IIBR-C*PH6.5*B	35.481	0.4985	71.1755	8.2306E+12	1.3665E-11	3.1845	2.8585
36	B-IIBR-C*PH7.0*A	27.351	0.5018	54.5058	6.3029E+12	1.0465E-11	2.4367	
37	B-IIBR-C*PH7.0*B	36.856	0.4992	73.4295	8.4912E+12	1.4098E-11	3.2854	2.8620
38	B-IIBR-C*PH7.5*A	53.668	0.4948	108.4640	1.2543E+13	2.0824E-11	4.8529	
39	B-IIBR-C*PH7.5*B	53.797	0.4996	107.6801	1.2452E+13	2.0674E-11	4.8178	4.8354
40	B-IIBR-C*PH8.0*A	56.686	0.5006	113.2361	1.3094E+13	2.1741E-11	5.0684	
41	B-IIBR-C*PH8.0*B	56.627	0.4990	113.4810	1.3123E+13	2.1788E-11	5.0774	5.0719
42	B-IIBR-C*PH8.5*A	56.028	0.4987	112.3481	1.2992E+13	2.1570E-11	5.0267	
43	B-IIBR-C*PH8.5*B	60.632	0.4986	122.0451	1.4113E+13	2.3432E-11	5.4806	5.2436

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

# 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 <sup>TD 26/8/93</sup> were <sup>8/24/93</sup> taken from each solution. 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 I 0.0079 TD of Na-Clinoptilolite was added to each solution, but not those labeled C-I-C\*. The solution C-I\*PH5.50 accidentally had 2 portions of zeolite added. The pH values and zeolite weights can be found on page 78 <sup>TD 80</sup>



## 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*PH7.00*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	0.5806
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 TO EXPERIMENT B-IIB

The results of the pH measurements of 19 August (p 71) were <sup>to 9/1/93</sup> accidentally left out of the notebook. 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-IV 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 =999.98 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	5237.28 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 24.88	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 TO calculations verified on pages 143-44 of this volume.

## LSA RESULTS FOR C-IX...YIV

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	2.02 182.9 567.619	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	3.06 684.80	
13	7.77	3.23 104.8 568.345	3.01 573.73	3.07 685.12	
14	7.61	1.73 181.4 582.036	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 98.92 571.584	3.01 575.16	3.07 683.77	
17	7.65	1.10 298.2 578.062	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	0.43 719.6 544.922	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	1.63 190.4 518.269	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	



S#	TIME	CPMA A:2S%	CPMB B:2S%	CPMC C:2S%	SIS FLAG
50	7.70	2.00 185.0	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	3.08 681.84
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*UUA	566.542	0.5262	1076.6667	1.2450E+14	2.0671E-10	48.1723	
3	C-I*PH2.00*UUB	582.787	0.5230	1114.3155	1.2886E+14	2.1394E-10	49.8568	49.0146
4	C-I*PH2.25*UUA	567.619	0.5250	1081.1790	1.2503E+14	2.0758E-10	48.3742	
5	C-I*PH2.25*UUB	573.799	0.5218	1099.6531	1.2716E+14	2.1113E-10	49.2008	48.7875
6	C-I*PH2.50*UUA	574.419	0.5207	1103.1669	1.2757E+14	2.1180E-10	49.3580	
7	C-I*PH2.50*UUB	561.102	0.5197	1079.6652	1.2485E+14	2.0729E-10	48.3065	48.8322
8	C-I*PH2.75*UUA	586.804	0.5259	1115.8091	1.2903E+14	2.1423E-10	49.9236	
9	C-I*PH2.75*UUB	580.218	0.5219	1111.7417	1.2856E+14	2.1345E-10	49.7417	49.8326
10	C-I*PH3.00*UUA	555.559	0.5231	1062.0512	1.2281E+14	2.0391E-10	47.5184	
11	C-I*PH3.00*UUB	557.419	0.5215	1068.8763	1.2360E+14	2.0522E-10	47.8238	47.6711
12	C-I*PH3.25*UUA	573.083	0.5229	1095.9705	1.2674E+14	2.1042E-10	49.0360	
13	C-I*PH3.25*UUB	569.345	0.5209	1093.0025	1.2639E+14	2.0985E-10	48.9032	48.9696
14	C-I*PH3.50*UUA	582.036	0.5244	1109.9085	1.2835E+14	2.1310E-10	49.6596	
15	C-I*PH3.50*UUB	567.529	0.5216	1088.0541	1.2582E+14	2.0890E-10	48.6818	49.1707
16	C-I*PH3.75*UUA	571.564	0.5250	1088.6933	1.2589E+14	2.0902E-10	48.7104	
17	C-I*PH3.75*UUB	578.062	0.5222	1106.9743	1.2801E+14	2.1253E-10	49.5283	49.1194
18	C-I*PH4.00*UUA	563.640	0.5249	1073.8045	1.2417E+14	2.0616E-10	48.0443	
19	C-I*PH4.00*UUB	576.443	0.5210	1106.4165	1.2794E+14	2.1242E-10	49.5034	48.7738
20	C-I*PH4.25*UUA	563.980	0.5231	1078.1495	1.2467E+14	2.0700E-10	48.2387	
21	C-I*PH4.25*UUB	570.341	0.5200	1096.8096	1.2683E+14	2.1058E-10	49.0736	48.6561
22	C-I*PH4.50*UUA	564.704	0.5245	1076.6520	1.2450E+14	2.0671E-10	48.1717	
23	C-I*PH4.50*UUB	564.108	0.5225	1079.6325	1.2485E+14	2.0728E-10	48.3050	48.2383
24	C-I*PH4.75*UUA	544.922	0.5238	1040.3246	1.2030E+14	1.9974E-10	46.5463	
25	C-I*PH4.75*UUB	566.888	0.5216	1086.8252	1.2568E+14	2.0866E-10	48.6268	47.5866
26	C-I*PH5.00*UUA	528.834	0.5260	1005.3878	1.1626E+14	1.9303E-10	44.9832	
27	C-I*PH5.00*UUB	521.190	0.5216	999.2140	1.1555E+14	1.9184E-10	44.7069	44.8450
28	C-I*PH5.25*UUA	572.436	0.5266	1087.0414	1.2570E+14	2.0870E-10	48.6365	
29	C-I*PH5.25*UUB	560.434	0.5226	1072.3957	1.2401E+14	2.0589E-10	47.9812	48.3089
30	C-I*PH5.50*UUA	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*UUB	516.269	0.5216	989.7795	1.1446E+14	1.9003E-10	44.2848	44.6038
32	C-I*PH5.75*UUA	519.460	0.5245	990.3908	1.1453E+14	1.9015E-10	44.3122	
33	C-I*PH5.75*UUB	529.073	0.5216	1014.3271	1.1729E+14	1.9474E-10	45.3831	44.8476
34	C-I*PH6.00*UUA	503.743	0.5261	957.5043	1.1072E+14	1.8383E-10	42.8407	
35	C-I*PH6.00*UUB	505.940	0.5211	970.9077	1.1227E+14	1.8641E-10	43.4404	43.1406
36	C-I*PH6.25*UUA	450.791	0.5256	857.6693	9.9179E+13	1.6467E-10	38.3739	
37	C-I*PH6.25*UUB	467.704	0.5222	895.6415	1.0357E+14	1.7196E-10	40.0729	39.2234
38	C-I*PH6.50*UUA	501.438	0.5231	958.5892	1.1085E+14	1.8404E-10	42.8893	
39	C-I*PH6.50*UUB	502.704	0.5204	965.9954	1.1171E+14	1.8546E-10	43.2207	43.0550
40	C-I*PH6.75*UUA	551.947	0.5226	1056.1558	1.2213E+14	2.0278E-10	47.2546	
41	C-I*PH6.75*UUB	546.275	0.5232	1044.1036	1.2074E+14	2.0046E-10	46.7154	46.9850
42	C-I*PH7.00*UUA	529.711	0.5246	1009.7427	1.1676E+14	1.9386E-10	45.1780	
43	C-I*PH7.00*UUB	544.371	0.5210	1044.8580	1.2082E+14	2.0061E-10	46.7491	45.9636
44	C-I*PH7.25*UUA	567.529	0.5306	1069.5986	1.2369E+14	2.0536E-10	47.8561	
45	C-I*PH7.25*UUB	561.819	0.5276	1064.8578	1.2314E+14	2.0445E-10	47.6440	47.7500
46	C-I*PH7.50*UUA	566.070	0.5233	1081.7313	1.2509E+14	2.0769E-10	48.3989	
47	C-I*PH7.50*UUB	568.959	0.5201	1093.9415	1.2650E+14	2.1003E-10	48.9452	48.6721
48	C-I*PH7.75*UUA	591.141	0.5270	1121.7097	1.2971E+14	2.1536E-10	50.1876	
49	C-I*PH7.75*UUB	565.814	0.5228	1082.2762	1.2515E+14	2.0779E-10	48.4233	49.3055
50	C-I*PH8.00*UUA	574.419	0.5258	1092.4667	1.2633E+14	2.0975E-10	48.8792	
51	C-I*PH8.00*UUB	574.159	0.5227	1098.4484	1.2702E+14	2.1089E-10	49.1469	49.0131
52	C-I*PH8.25*UUA	585.508	0.5238	1117.8083	1.2926E+14	2.1461E-10	50.0131	
53	C-I*PH8.25*UUB	561.229	0.5211	1077.0083	1.2454E+14	2.0678E-10	48.1876	49.1003
54	C-I*PH8.50*UUA	562.073	0.5196	1081.7417	1.2509E+14	2.0769E-10	48.3994	
55	C-I*PH8.50*UUB	577.068	0.5176	1114.8918	1.2892E+14	2.1405E-10	49.8826	49.1410
56	C-I*PH8.75*UUA	556.513	0.5196	1071.0412	1.2385E+14	2.0563E-10	47.9206	
57	C-I*PH8.75*UUB	562.200	0.5181	1085.1187	1.2548E+14	2.0834E-10	48.5505	48.2356
58	C-I*PH9.00*UUA	575.039	0.5202	1105.4191	1.2783E+14	2.1223E-10	49.4588	
59	C-I*PH9.00*UUB	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*UUA	566.542	0.5267	1075.6446	1.2439E+14	2.0652E-10	48.1266	
61	C-I-C*PH2.0*UUB	575.169	0.5222	1101.4343	1.2737E+14	2.1147E-10	49.2805	48.7035
62	C-I-C*PH4.0*UUA	570.435	0.5245	1087.5786	1.2577E+14	2.0881E-10	48.6605	
63	C-I-C*PH4.0*UUB	545.228	0.5215	1045.4995	1.2090E+14	2.0073E-10	46.7778	47.7192
64	C-I-C*PH5.0*UUA	542.783	0.5243	1035.2527	1.1971E+14	1.9876E-10	46.3194	
65	C-I-C*PH5.0*UUB	522.430	0.5212	1002.3599	1.1591E+14	1.9245E-10	44.8477	45.5835
66	C-I-C*PH5.5*UUA	545.781	0.5237	1042.1635	1.2051E+14	2.0009E-10	46.6286	
67	C-I-C*PH5.5*UUB	529.471	0.5192	1019.7824	1.1793E+14	1.9579E-10	45.6272	46.1279
68	C-I-C*PH6.0*UUA	478.077	0.5227	914.6298	1.0577E+14	1.7560E-10	40.9225	
69	C-I-C*PH6.0*UUB	491.454	0.5212	942.9279	1.0904E+14	1.8104E-10	42.1886	41.5555
70	C-I-C*PH6.5*UUA	500.300	0.5228	956.9625	1.1066E+14	1.8373E-10	42.8165	
71	C-I-C*PH6.5*UUB	499.844	0.5209	959.5777	1.1096E+14	1.8423E-10	42.9335	42.8750
72	C-I-C*PH7.0*UUA	555.109	0.5253	1056.7466	1.2220E+14	2.0289E-10	47.2811	
73	C-I-C*PH7.0*UUB	550.939	0.5219	1055.6409	1.2207E+14	2.0268E-10	47.2316	47.2563
74	C-I-C*PH7.5*UUA	587.973	0.5249	1120.1619	1.2953E+14	2.1506E-10	50.1184	
75	C-I-C*PH7.5*UUB	581.247	0.5218	1113.9268	1.2881E+14	2.1387E-10	49.8394	49.9789
76	C-I-C*PH8.0*UUA	573.410	0.5257	1090.7552	1.2613E+14	2.0942E-10	48.8027	
77	C-I-C*PH8.0*UUB	575.922	0.5207	1106.0534	1.2790E+14	2.1236E-10	49.4871	49.1449
78	C-I-C*PH9.5*UUA	563.768	0.5268	1070.1746	1.2375E+14	2.0547E-10	47.8819	
79	C-I-C*PH9.5*UUB	584.466	0.5238	1115.8190	1.2903E+14	2.1423E-10	49.9241	48.9030

6/15/94 TO  
 Calculations on this page and preceding pages are verified  
 on pages 193-4 of this notebook.

9 Sept 1993 EXPERIMENT B-IIB, REVERSE TD

The pH of the reverse solution have had time to equilibrate. 2 500  $\mu$ L 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)	SOLUTION NAME	WEIGHT (g)
B-IIBR*PH2.00	65.27	B-IIBR-C*PH7.5	67.84
2.25	66.62	8.0	66.49
2.50	68.50	9.5	67.33
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-IIBR-C*PH2.0	67.67		
4.0	66.97		
9/9/93 10.50 5.0	68.13		
5.5	66.15		
6.0	65.46		
6.5	67.66		
7.0	69.51		

16 Sept 1993 TD Experiment C-1

The solutions have had sufficient time to equilibrate, so 2 500  $\mu$ L samples of each solution were taken, weighed and <sup>TD 9/16/93</sup> 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*PH7.00*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-IBR and C-I samples has finished. The raw data as well as <sup>TD 9/27/93</sup> print results of calculations follow. The B-IBR\*PHi\*IUa(b) (i=4-7) and B-IBR\*PHi\*IUa(b) were recounted to check the previous results.



## Experiment B-IBB

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:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
1	999.98	19.04	1.45	2.91	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	6.77	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:25%	CPMB B:25%	CPMC C:25%	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	21.24	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-IBR-ph3.00*A	6037.82	0.5086	11871.4510	1.3728E+15	2.2792E-09	531.1598	
3	B-IBR-ph3.00*B	6037.82	0.5056	11941.8908	1.3809E+15	2.2928E-09	534.3052	532.7294
4	B-IBR-ph4.00*A	5972.76	0.5084	11794.5498	1.3639E+15	2.2645E-09	527.7128	
5	B-IBR-ph4.00*B	5970.97	0.5051	11821.3821	1.3670E+15	2.2686E-09	528.8125	528.3127
6	B-IBR-ph4.50*A	5882.34	0.5112	11487.8013	1.3281E+15	2.2017E-09	513.0934	
7	B-IBR-ph4.50*B	5840.16	0.5088	11523.5991	1.3326E+15	2.2125E-09	515.5899	514.3417
8	B-IBR-ph5.00*A	5715.81	0.5070	11273.7870	1.3037E+15	2.1845E-09	504.4128	
9	B-IBR-ph5.00*B	5609.01	0.5059	11087.1911	1.2821E+15	2.1287E-09	498.0841	500.2385
10	B-IBR-ph5.50*A	4844.02	0.5037	9021.2825	1.0432E+15	1.7320E-09	403.8311	
11	B-IBR-ph5.50*B	4877.53	0.5049	8066.2111	1.0484E+15	1.7407E-09	405.8413	404.8362
12	B-IBR-ph6.00*A	3258.70	0.5034	8443.8089	7.4515E+14	1.2372E-09	288.3094	
13	B-IBR-ph6.00*B	3316.83	0.5042	8578.4014	7.8071E+14	1.2630E-09	294.3315	291.3204
14	B-IBR-ph6.25*A	2952.71	0.5054	5842.3229	6.7559E+14	1.1217E-09	281.3978	
15	B-IBR-ph6.25*B	2852.78	0.5048	5851.7241	6.7888E+14	1.1235E-09	281.8184	281.6081
16	B-IBR-ph6.50*A	3775.66	0.5082	7458.8305	8.6252E+14	1.4320E-09	333.7237	
17	B-IBR-ph6.50*B	3755.31	0.5040	7451.0119	8.6182E+14	1.4305E-09	333.3739	333.5488
18	B-IBR-ph6.75*A	4893.81	0.5085	9212.5910	1.0853E+15	1.7888E-09	412.1902	
19	B-IBR-ph6.75*B	4833.36	0.5087	9144.1879	1.0574E+15	1.7550E-09	409.1301	410.8801
20	B-IBR-ph7.00*A	5836.25	0.5080	11138.8340	1.2881E+15	2.1388E-09	498.3748	
21	B-IBR-ph7.00*B	5552.93	0.5040	11017.7183	1.2741E+15	2.1153E-09	492.9558	495.6853
22	B-IBR-ph7.50*A	5893.12	0.5046	11678.7951	1.3505E+15	2.2423E-09	522.5337	
23	B-IBR-ph7.50*B	5910.83	0.5027	11758.1659	1.3597E+15	2.2575E-09	526.0850	524.3094
24	B-IBR-C-ph2.0*A	6032.99	0.5046	11955.9849	1.3826E+15	2.2955E-09	534.9358	
25	B-IBR-C-ph2.0*B	6075.75	0.5035	12087.0308	1.3954E+15	2.3188E-09	539.9042	537.4200
26	B-IBR-C-ph4.0*A	6095.42	0.5080	12046.2846	1.3930E+15	2.3128E-09	538.9780	
27	B-IBR-C-ph4.0*B	6038.27	0.5032	11999.7417	1.3878E+15	2.3039E-09	538.8938	537.9348
28	B-IBR-C-ph5.0*A	5715.52	0.5044	11331.3243	1.3103E+15	2.1755E-09	508.9872	
29	B-IBR-C-ph5.0*B	5783.51	0.5023	11514.0553	1.3315E+15	2.2108E-09	515.1829	511.0751
30	B-IBR-C-ph5.5*A	5845.61	0.5039	11203.8301	1.2958E+15	2.1511E-09	501.2828	
31	B-IBR-C-ph5.5*B	5851.19	0.5038	11221.5846	1.2978E+15	2.1545E-09	502.0772	501.8800
32	B-IBR-C-ph6.0*A	5617.74	0.5050	11124.2376	1.2864E+15	2.1358E-09	497.7217	
33	B-IBR-C-ph6.0*B	5585.92	0.5037	11088.7757	1.2824E+15	2.1292E-09	498.1788	496.9507
34	B-IBR-C-ph6.5*A	5837.80	0.5057	11148.5070	1.2892E+15	2.1404E-09	498.8075	
35	B-IBR-C-ph6.5*B	5554.87	0.5032	11039.0898	1.2765E+15	2.1194E-09	493.9120	498.3598
36	B-IBR-C-ph7.0*A	5331.63	0.5031	10597.5552	1.2255E+15	2.0347E-09	474.1568	
37	B-IBR-C-ph7.0*B	5348.83	0.5017	10681.4112	1.2329E+15	2.0489E-09	477.0139	475.5853
38	B-IBR-C-ph7.5*A	5884.31	0.5009	11348.1933	1.3123E+15	2.1788E-09	507.7419	
39	B-IBR-C-ph7.5*B	5888.38	0.5001	11390.4819	1.3172E+15	2.1869E-09	509.8340	508.6880
40	B-IBR-C-ph8.0*A	6183.65	0.5024	12308.2205	1.4233E+15	2.3831E-09	550.8856	
41	B-IBR-C-ph8.0*B	6106.25	0.5013	12180.8298	1.4088E+15	2.3388E-09	544.9958	547.8457
42	B-IBR-C-ph9.5*A	5928.94	0.5025	11798.8856	1.3644E+15	2.2853E-09	527.9088	
43	B-IBR-C-ph9.5*B	5974.26	0.5021	11898.5461	1.3759E+15	2.2844E-09	532.3659	530.1364

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



6/15/94 MD  
CALCULATIONSVERIFIED 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*UA	5393.18	0.4981	10827.5045	1.2521E+15	2.0788E-09	484.4452	
56	B-IIB*PH4.00*UB	5424.19	0.4997	10854.8929	1.2552E+15	2.0841E-09	485.8708	485.0579
57	B-IIB*PH4.25*UA	5388.87	0.5000	10777.7400	1.2463E+15	2.0693E-09	482.2187	
58	B-IIB*PH4.25*UB	5333.36	0.4981	10707.4082	1.2382E+15	2.0558E-09	479.0719	480.6453
59	B-IIB*PH4.50*UA	5281.50	0.5003	10556.6660	1.2207E+15	2.0268E-09	472.3273	
60	B-IIB*PH4.50*UB	5267.32	0.4984	10568.4591	1.2221E+15	2.0291E-09	472.8550	472.5912
61	B-IIB*PH4.75*UA	5192.55	0.4984	10397.5771	1.2024E+15	1.9963E-09	465.2094	
62	B-IIB*PH4.75*UB	5162.77	0.4980	10367.0080	1.1988E+15	1.9904E-09	463.8416	464.5255
63	B-IIB*PH5.00*UA	5258.85	0.4979	10562.0607	1.2214E+15	2.0278E-09	472.5687	
64	B-IIB*PH5.00*UB	5289.55	0.4979	10623.7196	1.2285E+15	2.0397E-09	475.3275	473.9481
65	B-IIB*PH5.25*UA	5185.42	0.4988	10395.7899	1.2021E+15	1.9959E-09	465.1294	
66	B-IIB*PH5.25*UB	5174.06	0.4981	10387.5929	1.2012E+15	1.9944E-09	464.7627	464.9460
67	B-IIB*PH5.50*UA	4817.45	0.4988	9638.7555	1.1146E+15	1.8508E-09	431.2581	
68	B-IIB*PH5.50*UB	4798.73	0.4989	9614.6121	1.1118E+15	1.8459E-09	430.1779	430.7180
69	B-IIB*PH5.75*UA	5191.64	0.4985	10414.5236	1.2043E+15	1.9995E-09	465.9678	
70	B-IIB*PH5.75*UB	5178.08	0.4988	10422.8663	1.2053E+15	2.0011E-09	466.3409	466.1542
71	B-IIB*PH6.00*UA	5129.01	0.4986	10328.2521	1.1943E+15	1.9830E-09	462.1076	
72	B-IIB*PH6.00*UB	5227.81	0.4996	10463.9912	1.2100E+15	2.0090E-09	468.1809	465.1442
73	B-IIB*PH6.25*UA	5223.33	0.4992	10463.4014	1.2100E+15	2.0089E-09	468.1545	
74	B-IIB*PH6.25*UB	5233.43	0.4992	10483.8338	1.2123E+15	2.0128E-09	469.0597	468.6071
75	B-IIB*PH6.50*UA	5114.10	0.5017	10193.5420	1.1788E+15	1.9571E-09	456.0804	
76	B-IIB*PH6.50*UB	5067.43	0.4978	10179.6505	1.1772E+15	1.9544E-09	455.4589	455.7696
77	B-IIB*PH6.75*UA	5189.44	0.4991	10397.5957	1.2024E+15	1.9963E-09	465.2102	
78	B-IIB*PH6.75*UB	5147.41	0.4981	10334.0895	1.1950E+15	1.9841E-09	462.3683	463.7895
79	B-IIB*PH7.00*UA	5202.03	0.4997	10410.3062	1.2038E+15	1.9987E-09	465.7789	
80	B-IIB*PH7.00*UB	5173.68	0.4989	10370.1744	1.1992E+15	1.9910E-09	463.9833	464.8811
81	B-IIB-C*PH4.0*UA	5408.71	0.5002	10813.0948	1.2504E+15	2.0760E-09	483.8005	
82	B-IIB-C*PH4.0*UB	5391.97	0.4972	10844.6702	1.2541E+15	2.0821E-09	485.2132	484.5069
83	B-IIB-C*PH5.0*UA	5149.86	0.4965	10372.3263	1.1994E+15	1.9914E-09	464.0796	
84	B-IIB-C*PH5.0*UB	5178.46	0.4988	10381.8364	1.2005E+15	1.9932E-09	464.5051	464.2923
85	B-IIB-C*PH5.5*UA	5282.96	0.5025	10513.3532	1.2157E+15	2.0185E-09	470.3894	
86	B-IIB-C*PH5.5*UB	5318.37	0.5009	10613.8355	1.2273E+15	2.0377E-09	474.8763	472.6329
87	B-IIB-C*PH6.0*UA	5090.73	0.5005	10171.2887	1.1762E+15	1.9528E-09	455.0848	
88	B-IIB-C*PH6.0*UB	5028.66	0.4977	10103.7975	1.1684E+15	1.9399E-09	452.0651	453.5749
89	B-IIB-C*PH6.5*UA	5036.76	0.4988	10097.7546	1.1677E+15	1.9387E-09	451.7947	
90	B-IIB-C*PH6.5*UB	5045.39	0.4977	10137.4121	1.1723E+15	1.9463E-09	453.5690	452.6819
91	B-IIB-C*PH7.0*UA	4877.58	0.4981	9792.3710	1.1324E+15	1.8801E-09	438.1312	
92	B-IIB-C*PH7.0*UB	4907.40	0.4975	9864.1206	1.1407E+15	1.8938E-09	441.3414	439.7363

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	594.74 3.07	657.87

EXPERIMENT  
C-I

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 TO 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 TO  
calculations  
verified on  
pgs 143-144 of  
this book

10/29/93 TO 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<sub>2</sub>O.

2 1L Portions of 0.1 M NaNO<sub>3</sub> were prepared by dissolving 8.499 g NaNO<sub>3</sub> in DI H<sub>2</sub>O in a volumetric flask and diluting to the mark.

Wt. NaNO<sub>3</sub> used: 8.4998g

8.5002g lot # 7808 KCL

2 Nov 1993 TO 11/2/94 TO 11/2/94 BE  
0.1 g of the Wedron Silica was weighed out and placed into each 30 mL PP bottle labeled SiO<sub>2</sub>\*PZC\*PH i (i=1-11, DPH=1.0). The silica had been ultrasonically cleaned several times and dried.

SOLUTION NAME	WT. SILICA (SiO <sub>2</sub> ) ADDED(g)
SiO <sub>2</sub> * 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<sub>3</sub> was measured with a graduated cylinder and placed into a 100 mL plastic beaker.
- (2) The pH of the solution<sup>TO VIALS</sup> was adjusted either up or down using acid or base to the desired pH value (measured using pH electrode [calibrated]).
- (3) 2-25 mL <sup>TO VIALS</sup> aliquots of the final solution were taken, one as a control solution (SiO<sub>2</sub> \* PZC \* pH i \* C) the other as an experimental solution (SiO<sub>2</sub> \* PZC \* pH i) containing silica. w/ a Kimwipe - TD
- (4) The solutions were then covered and placed on a gyratory shaker @ 120 rpm.

SOLUTION	Adjustment	pH/T(°C)
SiO <sub>2</sub> * PZC * pH 1.00	1d. conc HNO <sub>3</sub> , 145d. 1.0M HNO <sub>3</sub>	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	8.94/19.5

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

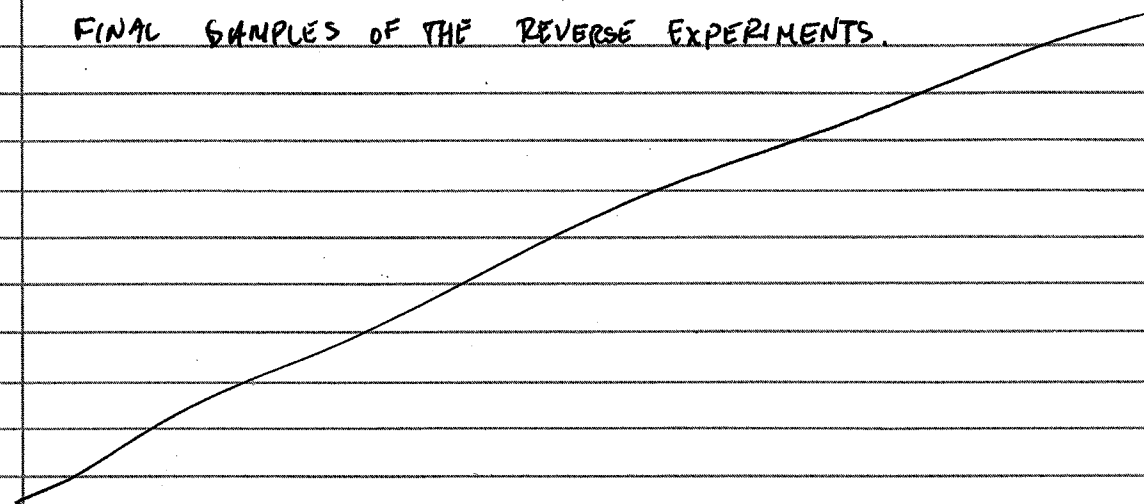
0.01N NaOH - 931156-12

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 TO EXPERIMENT B-III

ALL THE SAMPLES FOR THIS EXPERIMENT WERE RECOUNTED BY LSM 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	0.04 327.8	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	0.10 143.8	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:25%	CPMB B:25%	CPMC C:25%	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	0.07 122.6	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	0.08 108.1	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	0.16 107.6	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	0.13 132.8	55.496 5.27	55.40 6.33 727.64	
137	27.08	0.76 229.4	56.186 5.26	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	0.07 229.3	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:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
162	34.294	0.57 273.3	43.762 5.34	44.35 6.61 713.24	
163	32.704	1.75 92.95	46.031 5.32	48.64 6.34 702.01	
164	26.92408	0.91 192.1	56.537 5.26	58.25 6.18 711.38	
165	47.25445	0.18 732.2	30.964 5.49	31.62 7.22 731.84	
166	47.8045	0.00 0.00	30.574 5.49	29.96 7.48 720.64	
167	99.9650	0.00 0.00	13.108 6.20	12.54 10.72 760.67	
168	33.28550	0.00 0.00	45.178 5.33	44.43 6.70 736.73	
169	56.85555	1.21 102.8	25.246 5.60	26.34 7.59 690.76	
170	118.9455	0.00 0.00	10.554 6.52	10.61 11.49 744.11	
171	161.1460	0.16 479.5	7.031 7.36	7.42 13.94 711.44	
172	158.0600	0.61 129.1	7.224 7.29	8.36 12.60 655.75	
173	161.60635	0.00 0.00	7.002 7.37	7.35 14.04 735.85	
174	167.97635	0.00 0.00	6.627 7.51	7.05 14.35 738.40	
175	176.22650	0.00 0.00	6.198 7.70	5.91 16.59 800.04	
176	181.77650	0.05 158.1	5.904 7.85	6.19 15.69 705.12	
177	185.73000	0.62 119.8	5.721 7.95	6.79 14.29 641.81	
178	188.52000	0.06 114.7	5.594 8.02	6.25 15.33 706.66	
179	142.85000	0.06 130.6	8.302 6.97	8.67 12.71 721.23	
180	140.16700	0.00 0.00	8.524 6.91	8.80 12.65 741.17	
181	73.80700	0.00 0.00	18.795 5.82	18.85 8.74 731.84	
182	75.44700	0.23 468.4	18.310 5.85	19.14 8.55 720.02	
183	25.95200	0.76 233.7	58.758 5.25	60.07 6.16 710.42	
184	25.18700	1.67 109.9	60.684 5.24	62.40 6.10 706.95	
185	28.21400	0.54 311.8	53.819 5.28	54.72 6.30 716.64	
186	40.92500	0.00 0.00	36.226 5.41	35.50 7.11 747.84	
187	42.85500	0.00 0.00	34.441 5.44	34.15 7.15 744.61	
188	53.70500	0.27 457.3	26.897 5.56	27.64 7.52 719.85	
189	53.36500	0.00 0.00	27.086 5.56	27.07 7.66 732.75	
190	56.34600	0.25 484.9	25.518 5.60	26.68 7.55 707.40	
191	59.15600	0.00 0.00	24.185 5.63	24.42 7.89 726.72	
192	56.14600	0.00 0.00	25.602 5.59	25.72 7.78 731.30	
193	55.46600	1.04 120.3	26.005 5.58	27.72 7.38 702.49	
194	40.11700	0.41 351.6	36.992 5.41	37.60 6.88 719.68	
195	41.12700	0.54 260.5	36.012 5.42	37.09 6.87 713.26	
196	28.62700	0.48 352.4	53.041 5.28	53.05 6.38 718.78	
197	29.66700	1.56 108.9	51.080 5.29	53.19 6.26 703.84	
198	28.33600	0.36 473.0	53.579 5.28	53.98 6.34 716.35	
199	27.33500	0.98 177.2	55.645 5.27	56.56 6.26 718.85	
200	27.12000	1.02 170.7	56.098 5.26	58.21 6.16 720.24	
201	28.19000	0.00 0.00	53.930 5.27	54.28 6.33 721.00	
(1 missing vial)					
203	24.94700	0.87 209.0	61.255 5.24	62.50 6.12 704.26	
204	25.50300	0.51 345.4	59.925 5.24	60.68 6.18 714.28	
205	25.87400	0.00 0.00	58.988 5.25	59.65 6.20 721.89	
206	25.42400	0.26 679.5	60.044 5.25	60.96 6.17 717.13	
207	27.34400	0.24 703.6	55.624 5.27	57.30 6.20 720.22	
208	28.07400	0.57 299.0	54.102 5.27	55.13 6.28 719.19	
209	32.91500	0.89 178.7	45.901 5.32	46.94 6.48 715.99	
210	98.45500	0.84 114.5	13.353 6.18	14.09 9.77 694.97	
211	116.77300	0.70 128.0	10.804 6.48	11.54 10.75 683.94	
212	55.94500	0.51 240.1	25.703 5.59	26.66 7.58 701.13	
213	90.94600	0.78 128.2	14.805 6.04	15.78 9.20 684.93	
214	95.60600	0.00 0.00	13.859 6.13	14.06 9.92 726.86	
215	105.83600	0.00 0.00	12.220 6.30	12.02 10.83 748.38	
216	105.18600	0.00 0.00	12.313 6.29	12.41 10.57 734.36	
217	177.12600	0.00 0.00	6.135 7.73	6.53 15.08 740.23	

S#	TIME	CPMA A:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
218	173.14600	0.10 758.4	6.354 7.63	6.77 14.73 705.63	
219	156.96600	0.00 0.00	7.301 7.26	7.48 13.99 740.07	
220	154.79400	0.00 0.00	7.444 7.21	7.52 13.99 744.34	
221	101.42700	0.00 0.00	12.887 6.23	13.48 10.01 723.48	
222	99.54700	0.71 135.1	13.175 6.20	14.13 9.70 690.15	
223	26.22700	0.37 476.0	58.162 5.25	58.90 6.21 714.74	
224	27.61700	0.00 0.00	55.051 5.27	55.56 6.30 729.71	
225	25.03200	0.60 301.3	61.025 5.24	62.10 6.14 723.58	
226	24.95200	0.00 0.00	61.270 5.24	60.86 6.23 726.81	
227	26.78400	0.30 568.9	56.885 5.26	57.73 6.23 719.80	
228	26.49400	0.00 0.00	57.577 5.25	58.59 6.20 724.62	
229	36.36500	0.68 222.9	41.106 5.36	42.59 6.61 708.43	
230	35.29500	0.98 156.9	42.440 5.35	43.53 6.60 702.72	
231	44.93500	0.51 265.9	32.735 5.46	33.99 7.01 713.07	
232	47.02500	0.00 0.00	31.129 5.49	30.72 7.40 740.34	
233	49.98600	0.00 0.00	29.114 5.52	29.31 7.44 730.55	
234	49.52600	0.00 0.00	29.412 5.51	29.51 7.43 731.80	
235	54.60600	0.09 141.1	26.405 5.58	26.36 7.73 717.40	
236	57.07600	0.00 0.00	25.137 5.61	25.41 7.79 734.53	
237	38.78700	0.42 347.0	38.360 5.39	38.86 6.84 712.92	
238	40.65700	0.87 166.0	36.462 5.41	37.96 6.79 711.74	
239	28.80700	0.18 908.5	52.657 5.28	53.62 6.32 718.25	
240	28.29700	0.00 0.00	53.658 5.28	53.46 6.39 720.56	
241	26.25800	0.38 455.7	58.054 5.26	60.02 6.13 720.78	
242	25.91800	1.52 118.7	58.892 5.25	61.33 6.09 709.48	
243	24.70800	0.13 142.0	61.879 5.24	62.49 6.15 723.75	
244	26.17900	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-III-B*PH2.00*IU1	57.479	0.4982	115.3733	1.3342E+13	2.2151E-11	5.1620	
3	B-III-B*PH2.00*IU2	57.539	0.4988	115.3549	1.3339E+13	2.2147E-11	5.1612	5.1616
4	B-III-B*PH2.25*IU1	56.098	0.5009	111.9944	1.2951E+13	2.1502E-11	5.0109	
5	B-III-B*PH2.25*IU2	56.251	0.4994	112.6372	1.3025E+13	2.1626E-11	5.0396	5.0252
6	B-III-B*PH2.50*IU1	56.803	0.5004	113.5152	1.3127E+13	2.1794E-11	5.0789	
7	B-III-B*PH2.50*IU2	56.186	0.5008	112.1925	1.2974E+13	2.1540E-11	5.0197	5.0493
8	B-III-B*PH2.75*IU1	55.030	0.5034	109.3166	1.2641E+13	2.0988E-11	4.8911	
9	B-III-B*PH2.75*IU2	55.432	0.5017	110.4883	1.2777E+13	2.1213E-11	4.9435	4.9173
10	B-III-B*PH3.00*IU1	57.907	0.5046	114.7582	1.3270E+13	2.2033E-11	5.1345	
11	B-III-B*PH3.00*IU2	56.317	0.4998	112.6791	1.3030E+13	2.1634E-11	5.0415	5.0880
12	B-III-B*PH3.25*IU1	54.552	0.5006	108.9732	1.2601E+13	2.0922E-11	4.8757	
13	B-III-B*PH3.25*IU2	55.432	0.5015	110.5324	1.2782E+13	2.1222E-11	4.9455	4.9106
14	B-III-B*PH3.50*IU1	55.725	0.5028	110.8294	1.2816E+13	2.1279E-11	4.9587	
15	B-III-B*PH3.50*IU2	56.937	0.5010	113.6467	1.3142E+13	2.1819E-11	5.0848	5.0218
16	B-III-B*PH3.75*IU1	55.404	0.5025	110.2567	1.2750E+13	2.1169E-11	4.9331	
17	B-III-B*PH3.75*IU2	54.780	0.5018	109.1670	1.2624E+13	2.0959E-11	4.8844	4.9087
18	B-III-B*PH4.00*IU1	53.415	0.5023	106.3408	1.2297E+13	2.0417E-11	4.7579	
19	B-III-B*PH4.00*IU2	54.526	0.5013	108.7692	1.2578E+13	2.0883E-11	4.8666	4.8122
20	B-III-B*PH4.25*IU1	51.153	0.5002	102.2651	1.1826E+13	1.9634E-11	4.5756	
21	B-III-B*PH4.25*IU2	49.762	0.4995	99.6236	1.1520E+13	1.9127E-11	4.4574	4.5165
22	B-III-B*PH4.50*IU1	46.714	0.5013	93.1857	1.0776E+13	1.7891E-11	4.1693	
23	B-III-B*PH4.50*IU2	46.091	0.5008	92.0347	1.0643E+13	1.7670E-11	4.1178	4.1436
24	B-III-B*PH4.75*IU1	34.639	0.5019	69.0157	7.9808E+12	1.3251E-11	3.0879	
25	B-III-B*PH4.75*IU2	38.531	0.5009	76.9235	8.8953E+12	1.4769E-11	3.4417	3.2648
26	B-III-B*PH5.00*IU1	27.671	0.5001	55.3309	6.3983E+12	1.0623E-11	2.4756	
27	B-III-B*PH5.00*IU2	28.280	0.5005	56.5035	6.5339E+12	1.0848E-11	2.5281	2.5019
28	B-III-B*PH5.25*IU1	18.991	0.5004	37.9516	4.3886E+12	7.2865E-12	1.6980	
29	B-III-B*PH5.25*IU2	20.627	0.5013	41.1470	4.7581E+12	7.9000E-12	1.8410	1.7695
30	B-III-B*PH5.50*IU1	21.140	0.5009	42.2040	4.8804E+12	8.1029E-12	1.8883	
31	B-III-B*PH5.50*IU2	21.725	0.4993	43.5109	5.0315E+12	8.3538E-12	1.9468	1.9175
32	B-III-B*PH5.75*IU1	21.569	0.5007	43.0597	4.9793E+12	8.2672E-12	1.9266	

6/15/94 to 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-III-B*PH5.75*IU2	20.558	0.4985	41.2397	4.7689E+12	7.9178E-12	1.8452	1.8859
34	B-III-B*PH6.00*IU1	14.688	0.5016	29.2823	3.3861E+12	5.6220E-12	1.3102	
35	B-III-B*PH6.00*IU2	15.370	0.4998	30.7523	3.5561E+12	5.9042E-12	1.3759	1.3430
36	B-III-B*PH6.25*IU1	14.008	0.4997	28.0328	3.2417E+12	5.3821E-12	1.2542	
37	B-III-B*PH6.25*IU2	14.782	0.5002	29.5522	3.4173E+12	5.6738E-12	1.3222	1.2882
38	B-III-B*PH6.50*IU1	31.681	0.5047	62.7719	7.2588E+12	1.2052E-11	3.8085	
39	B-III-B*PH6.50*IU2	32.671	0.5014	65.1596	7.5349E+12	1.2510E-11	2.9154	2.8620
40	B-III-B*PH6.75*IU1	21.551	0.5024	42.8961	4.9604E+12	8.2358E-12	1.9193	
41	B-III-B*PH6.75*IU2	22.074	0.4995	44.1922	5.1103E+12	8.4846E-12	1.9773	1.9483
42	B-III-B*PH7.00*IU1	37.505	0.4930	75.1603	8.6914E+12	1.4430E-11	3.3628	
43	B-III-B*PH7.00*IU2	37.591	0.4930	75.3478	8.7130E+12	1.4466E-11	3.3712	3.3670
44	B-III-B*PH7.25*IU1	41.325	0.5006	82.5509	9.5460E+12	1.5849E-11	3.6935	
45	B-III-B*PH7.25*IU2	40.170	0.4988	80.5333	9.3127E+12	1.5462E-11	3.6032	3.6484
46	B-III-B*PH7.50*IU1	46.622	0.5012	93.0208	1.0757E+13	1.7859E-11	4.1619	
47	B-III-B*PH7.50*IU2	49.117	0.4996	98.3127	1.1369E+13	1.8875E-11	4.3987	4.2803
48	B-III-B*PH7.75*IU1	50.397	0.5000	100.7940	1.1656E+13	1.9352E-11	4.5097	
49	B-III-B*PH7.75*IU2	50.046	0.4995	100.1922	1.1586E+13	1.9236E-11	4.4828	4.4963
50	B-III-B*PH8.00*IU1	54.449	0.5003	108.8327	1.2585E+13	2.0895E-11	4.8694	
51	B-III-B*PH8.00*IU2	54.639	0.4972	109.8934	1.2708E+13	2.1099E-11	4.9169	4.8931
52	B-III-B*PH8.25*IU1	55.076	0.5008	109.9760	1.2717E+13	2.1115E-11	4.9206	
53	B-III-B*PH8.25*IU2	55.028	0.5000	110.0560	1.2727E+13	2.1130E-11	4.9241	4.9223
54	B-III-B*PH8.50*IU1	55.505	0.4993	111.1656	1.2855E+13	2.1343E-11	4.9738	
55	B-III-B*PH8.50*IU2	54.609	0.4980	109.6566	1.2680E+13	2.1053E-11	4.9063	4.9400
56	B-III-B*PH8.75*IU1	52.870	0.5003	105.6766	1.2220E+13	2.0289E-11	4.7282	
57	B-III-B*PH8.75*IU2	56.361	0.4990	112.9479	1.3061E+13	2.1685E-11	5.0535	4.8909
58	B-III-B*PH9.00*IU1	54.816	0.5018	109.2387	1.2632E+13	2.0973E-11	4.8876	
59	B-III-B*PH9.00*IU2	53.819	0.4985	107.9619	1.2484E+13	2.0728E-11	4.8304	4.8590
60	B-III-B*PH2.0*IU1	57.722	0.5006	115.3056	1.3334E+13	2.2138E-11	5.1590	
61	B-III-B*PH2.0*IU2	53.554	0.4983	107.4734	1.2428E+13	2.0634E-11	4.8086	4.9838
62	B-III-B*PH4.0*IU1	49.870	0.5001	99.7201	1.1531E+13	1.9146E-11	4.4617	
63	B-III-B*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-III-B*PH5.0*IU1	27.070	0.5023	53.8921	6.2320E+12	1.0347E-11	2.4112	
65	B-III-B*PH5.0*IU2	28.905	0.4983	58.0072	6.7078E+12	1.1137E-11	2.5954	2.5033
66	B-III-B*PH5.5*IU1	19.101	0.5017	38.0726	4.4026E+12	7.3097E-12	1.7034	
67	B-III-B*PH5.5*IU2	18.000	0.5004	35.9712	4.1596E+12	6.9062E-12	1.6094	1.6564
68	B-III-B*PH6.0*IU1	15.861	0.5007	31.6777	3.6631E+12	6.0819E-12	1.4173	
69	B-III-B*PH6.0*IU2	16.023	0.4976	32.2006	3.7236E+12	6.1823E-12	1.4407	1.4290
70	B-III-B*PH6.5*IU1	24.788	0.4976	49.8151	5.7605E+12	9.5642E-12	2.2288	
71	B-III-B*PH6.5*IU2	26.836	0.5007	53.5970	6.1978E+12	1.0290E-11	2.3980	2.3134
72	B-III-B*PH7.0*IU1	40.020	0.4975	80.4422	9.3022E+12	1.5444E-11	3.5992	
73	B-III-B*PH7.0*IU2	39.817	0.4985	79.8736	9.2364E+12	1.5335E-11	3.5737	3.5864
74	B-III-B*PH7.5*IU1	50.739	0.5017	101.1341	1.1695E+13	1.9417E-11	4.5250	
75	B-III-B*PH7.5*IU2	48.041	0.4971	96.6425	1.1176E+13	1.8555E-11	4.3240	4.4245
76	B-III-B*PH8.0*IU1	54.816	0.5000	109.6320	1.2678E+13	2.1049E-11	4.9052	
77	B-III-B*PH8.0*IU2	52.236	0.4984	104.8074	1.2120E+13	2.0122E-11	4.6893	4.7972
78	B-III-B*PH9.5*IU1	54.341	0.5010	108.4651	1.2543E+13	2.0825E-11	4.8530	
79	B-III-B*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-III-B*PH2.00*A	58.428	0.5026	116.2515	1.3443E+13	2.2320E-11	5.2013	
82	B-III-B*PH2.00*B	60.232	0.4978	120.9964	1.3992E+13	2.3231E-11	5.4136	5.3075
83	B-III-B*PH2.25*A	57.086	0.5023	113.6492	1.3142E+13	2.1820E-11	5.0849	
84	B-III-B*PH2.25*B	58.640	0.5023	116.7430	1.3500E+13	2.2414E-11	5.2233	5.1541
85	B-III-B*PH2.50*A	59.945	0.5020	119.4124	1.3809E+13	2.2926E-11	5.3428	
86	B-III-B*PH2.50*B	59.180	0.5016	117.9825	1.3643E+13	2.2652E-11	5.2788	5.3108
87	B-III-B*PH2.75*A	55.383	0.5019	110.3467	1.2760E+13	2.1186E-11	4.9371	
88	B-III-B*PH2.75*B	56.229	0.5009	112.2559	1.2981E+13	2.1552E-11	5.0226	4.9799
89	B-III-B*PH3.00*A	54.562	0.5032	108.4300	1.2539E+13	2.0818E-11	4.8514	
90	B-III-B*PH3.00*B	58.147	0.5015	115.9462	1.3408E+13	2.2261E-11	5.1877	5.0195
91	B-III-B*PH3.25*A	53.045	0.5022	105.6252	1.2214E+13	2.0279E-11	4.7289	
92	B-III-B*PH3.25*B	55.009	0.5007	109.8642	1.2704E+13	2.1093E-11	4.9156	4.8207
93	B-III-B*PH3.50*A	53.115	0.5016	105.8911	1.2245E+13	2.0330E-11	4.7378	
94	B-III-B*PH3.50*B	52.484	0.5019	104.5706	1.2092E+13	2.0077E-11	4.6787	4.7083
95	B-III-B*PH3.75*A	50.757	0.5023	101.0492	1.1685E+13	1.9401E-11	4.5212	
96	B-III-B*PH3.75*B	49.698	0.5012	99.1580	1.1466E+13	1.9038E-11	4.4365	4.4788
97	B-III-B*PH4.00*A	45.971	0.5008	91.7951	1.0615E+13	1.7624E-11	4.1071	
98	B-III-B*PH4.00*B	47.416	0.5026	94.3414	1.0909E+13	1.8113E-11	4.2210	4.1641
99	B-III-B*PH4.25*A	38.723	0.5001	77.4305	8.9539E+12	1.4866E-11	3.4644	
100	B-III-B*PH4.25*B	38.584	0.4998	77.1989	8.9271E+12	1.4822E-11	3.4540	3.4592
101	B-III-B*PH4.50*A	33.968	0.5007	67.8410	7.8450E+12	1.3025E-11	3.0353	
102	B-III-B*PH4.50*B	29.418	0.5006	58.7655	6.7955E+12	1.1283E-11	2.6293	2.8323
103	B-III-B*PH4.75*A	17.883	0.5042	35.4681	4.1014E+12	6.8096E-12	1.5869	
104	B-III-B*PH4.75*B	17.659	0.5013	35.2264	4.0735E+12	6.7632E-12	1.5761	1.5815
105	B-III-B*PH5.00*A	11.743	0.5013	23.4251	2.7088E+12	4.4975E-12	1.0481	
106	B-III-B*PH5.00*B	12.722	0.5045	25.2170	2.9160E+12	4.8415E-12	1.1283	1.0882
107	B-III-B*PH5.25*A	9.732	0.5023	19.3749	2.2405E+12	3.7199E-12	0.8669	
108	B-III-B*PH5.25*B	9.326	0.5013	18.6036	2.1513E+12	3.5718E-12	0.8324	0.8496
109	B-III-B*PH5.50*A	9.773	0.5020	19.4681	2.2512E+12	3.7378E-12	0.8710	
110	B-III-B*PH5.50*B	9.557	0.5020	19.0378	2.2015E+12	3.6551E-12	0.8518	0.8614
111	B-III-B*PH5.75*A	9.770	0.5103	19.1456	2.2140E+12	3.6718E-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 no 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-IIIb-C*PH3.00*IUA	58.830	0.4912	119.7679	1.3850E+13	2.2995E-11	5.3587	
161	B-IIIb-C*PH3.00*IUB	57.616	0.4993	115.3936	1.3344E+13	2.2155E-11	5.1629	5.2608
162	B-IIIb-C*PH4.00*IUA	46.762	0.4991	93.6926	1.0834E+13	1.7988E-11	4.1920	
163	B-IIIb-C*PH4.00*IUB	46.031	0.4988	92.2835	1.0671E+13	1.7718E-11	4.1290	4.1605
165	B-IIIb-C*PH4.50*IUA	30.964	0.4999	61.9404	7.1626E+12	1.1892E-11	2.7713	
166	B-IIIb-C*PH4.50*IUB	30.574	0.4971	61.5047	7.1123E+12	1.1809E-11	2.7519	2.7616
167	B-IIIb-C*PH5.00*IUA	13.108	0.5026	26.0804	3.0159E+12	5.0073E-12	1.1669	
210	B-IIIb-C*PH5.00*IUB	13.353	0.4983	26.7971	3.0988E+12	5.1449E-12	1.1990	1.1829
211	B-IIIb-C*PH5.50*IUA	10.804	0.4966	21.7559	2.5158E+12	4.1770E-12	0.9734	
170	B-IIIb-C*PH5.50*IUB	10.554	0.5001	21.1038	2.4404E+12	4.0518E-12	0.9442	0.9588
171	B-IIIb-C*PH6.00*IUA	7.031	0.5001	14.0592	1.6258E+12	2.6993E-12	0.6290	
172	B-IIIb-C*PH6.00*IUB	7.224	0.4987	14.4857	1.6751E+12	2.7812E-12	0.6481	0.6386
173	B-IIIb-C*PH6.25*IUA	7.002	0.4999	14.0068	1.6197E+12	2.6892E-12	0.6267	
174	B-IIIb-C*PH6.25*IUB	6.627	0.4979	13.3099	1.5391E+12	2.5554E-12	0.5955	0.6111
175	B-IIIb-C*PH6.50*IUA	6.198	0.4998	12.4010	1.4340E+12	2.3809E-12	0.5548	
176	B-IIIb-C*PH6.50*IUB	5.904	0.4981	11.8530	1.3707E+12	2.2757E-12	0.5303	0.5426
177	B-IIIb-C*PH6.75*IUA	5.721	0.4989	11.4672	1.3260E+12	2.2016E-12	0.5131	
178	B-IIIb-C*PH6.75*IUB	5.594	0.4976	11.2420	1.3000E+12	2.1584E-12	0.5030	0.5080
179	B-IIIb-C*PH7.00*IUA	8.302	0.4979	16.6740	1.9281E+12	3.2013E-12	0.7460	
180	B-IIIb-C*PH7.00*IUB	8.524	0.4978	17.1233	1.9801E+12	3.2876E-12	0.7661	0.7561
181	B-IIIb-C*PH7.50*IUA	18.795	0.4994	37.6352	4.3520E+12	7.2257E-12	1.6839	
182	B-IIIb-C*PH7.50*IUB	18.310	0.4980	36.7671	4.2517E+12	7.0590E-12	1.6450	1.6645
183	B-IIIb-C*PH8.00*IUA	58.758	0.4986	117.8460	1.3627E+13	2.2626E-11	5.2727	
184	B-IIIb-C*PH8.00*IUB	60.684	0.4988	121.6600	1.4068E+13	2.3358E-11	5.4433	5.3580
185	B-IIIb-C*PH8.50*IUA	53.819	0.4967	108.3531	1.2530E+13	2.0803E-11	4.8479	
186	B-IIIb-C*PH8.50*IUB	56.537	0.4967	113.8252	1.3162E+13	2.1854E-11	5.0928	4.9704
187	B-IIIb-C*PH9.00*IUA	36.226	0.4983	72.6992	8.4068E+12	1.3958E-11	3.2527	
188	B-IIIb-C*PH9.00*IUB	34.441	0.4973	69.2560	8.0086E+12	1.3297E-11	3.0987	3.1757
189	B-IIIb-C*PH9.50*IUA	26.897	0.4980	54.0100	6.2456E+12	1.0370E-11	2.4165	
190	B-IIIb-C*PH9.50*IUB	27.086	0.4983	54.3568	6.2857E+12	1.0436E-11	2.4320	2.4243
190	B-IIIb-C*PH6.00*IUA	25.518	0.4993	51.1076	5.9100E+12	9.8123E-12	2.2867	

8/15/94 TO 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-IIIb-C*PH6.00*IUB	24.185	0.4967	48.6914	5.6306E+12	9.3484E-12	2.1786	2.2326
192	B-IIIb-C*PH6.50*IUA	25.602	0.5006	51.1426	5.9140E+12	9.8191E-12	2.2882	
193	B-IIIb-C*PH6.50*IUB	26.005	0.5003	51.9788	6.0107E+12	9.9796E-12	2.3256	2.3069
194	B-IIIb-C*PH7.00*IUA	36.992	0.4980	74.2811	8.5897E+12	1.4261E-11	3.3235	
195	B-IIIb-C*PH7.00*IUB	36.102	0.5013	72.0168	8.3279E+12	1.3827E-11	3.2222	3.2728
196	B-IIIb-C*PH7.50*IUA	53.041	0.4992	106.2520	1.2287E+13	2.0400E-11	4.7539	
197	B-IIIb-C*PH7.50*IUB	51.080	0.4973	102.7147	1.1878E+13	1.9721E-11	4.5957	4.6748
198	B-IIIb-C*PH8.00*IUA	53.579	0.4997	107.2223	1.2399E+13	2.0586E-11	4.7974	
199	B-IIIb-C*PH8.00*IUB	55.645	0.5001	111.2677	1.2867E+13	2.1363E-11	4.9784	4.8879
200	B-IIIb-C*PH9.50*IUA	56.098	0.4979	112.6692	1.3029E+13	2.1632E-11	5.0411	
201	B-IIIb-C*PH9.50*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-IIIIR*PH3.00*A	61.255	0.5014	122.1679	1.4127E+13	2.3455E-11	5.4660	
204	B-IIIIR*PH3.00*B	59.925	0.5003	119.7781	1.3851E+13	2.2997E-11	5.3591	5.4126
205	B-IIIIR*PH4.00*A	58.988	0.4989	118.2361	1.3673E+13	2.2701E-11	5.2901	
206	B-IIIIR*PH4.00*B	60.044	0.4935	121.6697	1.4070E+13	2.3360E-11	5.4438	5.3669
207	B-IIIIR*PH4.50*A	55.624	0.5031	110.5625	1.2785E+13	2.1227E-11	4.9468	
208	B-IIIIR*PH4.50*B	54.102	0.4984	108.5514	1.2553E+13	2.0841E-11	4.8568	4.9018
209	B-IIIIR*PH5.00*A	45.901	0.5007	91.6737	1.0601E+13	1.7601E-11	4.1017	
168	B-IIIIR*PH5.00*B	45.178	0.4981	90.7007	1.0488E+13	1.7414E-11	4.0581	4.0799
169	B-IIIIR*PH5.50*A	25.246	0.5010	50.3912	5.8271E+12	9.6748E-12	2.2546	
212	B-IIIIR*PH5.50*B	25.703	0.4971	51.7059	5.9791E+12	9.9272E-12	2.3134	2.2840
213	B-IIIIR*PH6.00*A	14.805	0.5018	29.5038	3.4117E+12	5.6645E-12	1.3201	
214	B-IIIIR*PH6.00*B	13.859	0.5000	27.7180	3.2052E+12	5.3217E-12	1.2402	1.2801
215	B-IIIIR*PH6.25*A	12.220	0.5044	24.2268	2.8015E+12	4.6514E-12	1.0840	
216	B-IIIIR*PH6.25*B	12.313	0.4982	24.7150	2.8580E+12	4.7451E-12	1.1058	1.0949
217	B-IIIIR*PH6.50*A	6.135	0.5012	12.2406	1.4155E+12	2.3501E-12	0.5477	
218	B-IIIIR*PH6.50*B	6.354	0.4988	12.7386	1.4731E+12	2.4457E-12	0.5700	0.5588
219	B-IIIIR*PH6.75*A	7.301	0.5029	14.5178	1.6788E+12	2.7873E-12	0.6496	
220	B-IIIIR*PH6.75*B	7.444	0.4996	14.8999	1.7230E+12	2.8607E-12	0.6667	0.6581
221	B-IIIIR*PH7.00*A	12.887	0.4996	25.7946	2.9828E+12	4.9524E-12	1.1541	
222	B-IIIIR*PH7.00*B	13.175	0.4985	26.4293	3.0562E+12	5.0743E-12	1.1825	1.1683
223	B-IIIIR*PH7.50*A	58.162	0.5035	115.5154	1.3358E+13	2.2178E-11	5.1684	
224	B-IIIIR*PH7.50*B	55.051	0.5001	110.0800	1.2729E+13	2.1135E-11	4.9252	5.0468
225	B-IIIIR-C*PH2.0*A	61.025	0.4988	122.3436	1.4148E+13	2.3489E-11	5.4739	
226	B-IIIIR-C*PH2.0*B	61.270	0.4965	123.4038	1.4270E+13	2.3693E-11	5.5213	5.4976
227	B-IIIIR-C*PH4.0*A	56.885	0.5028	113.1364	1.3083E+13	2.1721E-11	5.0620	
228	B-IIIIR-C*PH4.0*B	57.577	0.4985	115.5005	1.3356E+13	2.2175E-11	5.1677	5.1148
229	B-IIIIR-C*PH5.0*A	41.106	0.5031	81.7054	9.4482E+12	1.5687E-11	3.6557	
230	B-IIIIR-C*PH5.0*B	42.440	0.4981	85.2038	9.8528E+12	1.6359E-11	3.8122	3.7339
231	B-IIIIR-C*PH5.5*A	32.735	0.5054	64.7705	7.4899E+12	1.2436E-11	2.8980	
232	B-IIIIR-C*PH5.5*B	31.129	0.5001	62.2456	7.1979E+12	1.1951E-11	2.7850	2.8415
233	B-IIIIR-C*PH6.0*A	29.114	0.5006	58.1582	6.7253E+12	1.1166E-11	2.6021	

6/15/94 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-IIIIR-C*PH6.0*B	29.412	0.4998	58.8475	6.8050E+12	1.1298E-11	2.6330	2.6175
235	B-IIIIR-C*PH6.5*A	26.405	0.5011	52.6941	6.0934E+12	1.0117E-11	2.3576	
236	B-IIIIR-C*PH6.5*B	25.137	0.4985	50.4253	5.8311E+12	9.6813E-12	2.2561	2.3069
237	B-IIIIR-C*PH7.0*A	38.360	0.5018	76.4448	8.8399E+12	1.4677E-11	3.4203	
238	B-IIIIR-C*PH7.0*B	36.462	0.4992	73.0409	8.4463E+12	1.4023E-11	3.2680	3.3442
239	B-IIIIR-C*PH7.5*A	52.657	0.4948	106.4208	1.2306E+13	2.0432E-11	4.7615	
240	B-IIIIR-C*PH7.5*B	53.658	0.4996	107.4019	1.2420E+13	2.0620E-11	4.8054	4.7834
241	B-IIIIR-C*PH8.0*A	58.054	0.5006	115.9688	1.3410E+13	2.2265E-11	5.1887	
242	B-IIIIR-C*PH8.0*B	58.892	0.4990	118.0200	1.3648E+13	2.2659E-11	5.2805	5.2346
243	B-IIIIR-C*PH9.5*A	61.879	0.4987	124.0806	1.4348E+13	2.3823E-11	5.5516	
244	B-IIIIR-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<sub>2</sub> + 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<sub>2</sub> + 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

4.19/20.2

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-IIIB solutions were filtered to remove the zeolite. The zeolite from the solutions where the pH was either .00 or .50 (range from <sup>11/10/93</sup> 2-9) were rinsed with the experimental solutions and saved separately. The others were filtered collectively and rinsed several times with 0.1M HNO<sub>3</sub> followed by several with DI H<sub>2</sub>O. 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:25%	CPMB B:25%	CPMC C:25%	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 <sup>11/23/93</sup> saved collectively. The zeolite was washed with 0.1M HNO<sub>3</sub> and DI H<sub>2</sub>O several times. After drying it was added to the zeolite from B-IIIB. A sample of the total solution mixture was taken for LSA to determine the <sup>233</sup>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 0.1M HNO<sub>3</sub> and DI H<sub>2</sub>O. These solutions were added to those filtered from C-I. The final weight of the combinations of the solutions is 4039.49 g <sup>11/30/93</sup> ~~g~~ <sup>making</sup> <sup>TD</sup> 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 <sup>233</sup>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:25%	CPMB B:25%	CPMC C:25%	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	393.61 5.17 686.86
5	10.19	2.31	128.0	154.333 5.09	156.81 5.47 693.46

S1: BACKGROUND

2 } CHECKS OF RINSED LS VIALS; OK TO THROW OUT

3 }

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

5: ACTIVITY FROM TOTAL <sup>233</sup>U IN CONTAINER (27A + 23A from B-IIIB).

These results lead to the following activities.

FOR 27A:

CPM B = 392.872

WT. SAMPLE = 0.5179 g

 $\text{CPM/g} = 758.5866$  $\frac{\text{ACT}}{g} = 0.3417 \text{ nCi/g}$ 

TOTAL ACTIVITY FROM 27A = 702.4409 nCi

FOR THE TOTAL VOLUME

CPMB = 154.333

WT SAMPLE = 0.5106

 $\text{CPM/g} = 302.2581$  $\frac{\text{ACT}}{g} = 0.1362 \text{ nCi}$ 9859 TO 12/2/93  
TOTAL ACTIVITY = 549.7746 nCi

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 <sup>233</sup>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 &amp; 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:25%	CPMB B:25%	CPMC C:25%	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

 $\text{CPM/g} = 532.8607$  $\frac{\text{ACT}}{g} = 0.2400 \text{ nCi}$ 

Total activity = 969.59 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

SAMPLE B

CPMB = 284.197

WT Sample = 0.5175 g

 $\text{CPM/g} = 549.1729$  $\frac{\text{ACT}}{g} = 0.2474 \text{ nCi}$ 

Total Activity = 999.27 nCi

3 Jan 94 TD

The solutions from Exp. B-I and B-II were filtered and the solution placed into  $^{233}\text{U}$  waste 3. The zeolite was filtered and washed with 1.0N  $\text{HNO}_3$  several times, followed by several washings with DI  $\text{H}_2\text{O}$ . A portable radiation detector  $^{137}\text{Ba}$  was used to determine if all the activity was removed. It was not so the zeolite will be exchanged with a 1.0M  $\text{HNO}_3$ /1.0M NaOH 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  $^{233}\text{U}$  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  $^{137}\text{Ba}$  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:25%	CPMB B:25%	CPMC C:25%	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  $^{233}\text{U}$  waste, 3

A

CPMB = 3732.08

WT = 0.4955g

CPM/g = 7531.95

ACT/g = 3.39 nCi/g

TOTAL ACT = 13,945.88

B

CPMB = 3554.98

WT = 0.4960g

CPM/g = 6764.01

ACT/g = 3.05

TOTAL ACT = 12,233.99

AVG. ACT/g = 3.22 nCi/g

AVG TOTAL ACT = 13,235.71 nCi

DISPOSEL OF 25g DISPOSES OF 80.50 nCi OF ACTIVITY.

For  $^{233}\text{U}$  WASTE 4

A

CPMB = 443.033

WT = 0.4937

CPM/g = 897.373

ACT/g = 0.404 nCi/g

TOTAL ACT = 1544.059 nCi

AVG ACT/g = 0.417 nCi/g

AVG TOTAL ACTIVITY = 1590.959 nCi

200

B

CPMB = 473.391

WT = 0.4969

CPM/g = 952.689

ACT/g = 0.429

TOTAL ACT = 1,639.238 nCi

1/12/94 TD

The pH of some of the B-IB solutions <sup>were 1/12/94</sup> were <sup>TD</sup> 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 0.1M HNO<sub>3</sub> added. After equilibration, samples will be taken for Liquid Scintillation Analysis.

SOLUTION	pH/T(°C)
B-IB x 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	4.26/21.2 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

<sup>TD 1/19/94</sup> A ~~1~~ sample of each of the marked solutions (pH) 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. <sup>TD 1/24/94</sup> 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:25%	CPMB B:25%	CPMC C:25%	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 <sup>was 1/24/94</sup> ~~has~~ begun. The solutions noted on the following page are being filtered <sup>separately</sup> and the ~~solution~~ <sup>IB bottles</sup> bottles washed with the solution in them. All traces of liquid are removed, and 50 g 0.1M HNO<sub>3</sub> added. The solutions will be resampled after ~10 days to check the container sorption. The zeolite from these <sup>was</sup> ~~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
6.50	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	<del>28.00</del>	49.81	77.81

\* WITH LID ON

TD

1/31/94 TD

The following solutions are being analyzed for <sup>233</sup>U concentration so they can be disposed of. All of them, except Waste 5 are solutions from the  $\alpha$ -aluminas experiments (related experiments) done by Jim Piikryl. WASTE 5 contains solutions from B-IB, W1, and W2 and K3A.

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~~ <sup>net</sup> counts per gram by 2220 counts/net.

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:25%	CPMB B:25%	CPMC C:25%	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 (mCi) PER GRAM	TOTAL ACTIVITY (mCi)
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 <sup>UP</sup> the counting. <sub>delay</sub>

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 container 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:25%	CPMB B:25%	CPMC C:25%	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: Please check the values in the table above.

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
2	53.82	2.35	55.43	79.371	3.12
3	103.18	1.28	73.32	39.958	3.25
4	74.81	0.88	122.2	56.204	3.18
5	70.73	1.33	84.10	59.630	3.17
6	81.62	0.76	135.5	51.260	3.19
7	67.73	1.11	102.4	62.413	3.16
8	52.69	2.98	44.66	81.142	3.12
9	42.45	1.87	77.13	101.535	3.10
10	81.36	1.67	62.99	51.434	3.19

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

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 p.121 and it is evident that there is not much difference.

11 FEB 1994 TD

The acid solutions used by Jim Prikrnyl to clean the  $\alpha$ -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-8006*AS	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	15.87
2	60.00	0.60	265.5	14.433	7.97
3	51.04	0.11	1440.	28.631	5.67
4	60.00	1.58	101.9	5.250	16.07
5	31.82	1.51	129.4	47.598	5.38

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-8006*AS	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

6/15/94 TD

Calculations

verified on

pages 143-144

this book

TD

2/22/94 TD

URANIUM SORPTION CONTROL TEST <sup>W3</sup>

Uranium loss to container walls: Polycarbonate vs Teflon

ALL CHANGES MADE

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

## OBJECTIVE:

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

## 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)  
8.5 60-ml polycarbonate (PC) bottle  
8.5 60-ml teflon (FEP) bottles  
2 500-ml FEP bottles  
reagent grade NaHCO<sub>3</sub>  
500 ppb U stock solution prepared from 50 ppm <sup>233</sup>U commercial spike  
1 L 0.10 m NaNO<sub>3</sub> stock solution

## PROCEDURE:

1. Solution <sup>W3</sup> W1-50

- Initial EU ≈ 50 ppb
- Initial pH ≈ 7.0; adjustment made with NaHCO<sub>3</sub>
- Initial volume ≈ 50 ml
- Ionic strength = 0.1 m NaNO<sub>3</sub>
- Initial [Na<sup>+</sup>] = 0.1 m NaNO<sub>3</sub> + [NaHCO<sub>3</sub>] added
- pCO<sub>2</sub> = atmospheric = 10<sup>-3.48</sup> bar

a) <sup>500</sup> In a pre-cleaned 500-ml teflon (FEP) bottle, prepare 400 g of 50 ppb U solution by diluting 40 g of a 500 ppb stock solution (in 0.1 m NaNO<sub>3</sub> matrix; prepared previously from commercial 50 ppm <sup>233</sup>U spike) to a total of 400 g by carefully taring 0.10 m NaNO<sub>3</sub> solution

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.

into the bottle on a Mettler 4600 balance.

Within the same day, analyze 5 samples (sample names <sup>W3</sup> W1-50-IU<sub>i</sub>, 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<sub>3</sub> + 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<sub>3</sub> 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) <sup>W3</sup> Into each of 4 60-ml <sup>PC</sup> bottles labeled W1-50-PP and 4 60-ml FEP bottles labeled W1-50-FEP<sub>i</sub> [where *i* is the mixture number 1, 2, or 3], 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<sub>3</sub> + 0.5 g sample). Analyze 5 samples (sample names <sup>W3</sup> W1-50-IU<sub>i</sub>, where *i* is 6, 7, 8, 9, or 10).

c) <sup>PC</sup> After periods of one, two and three weeks, analyze three samples from each PP 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 and FEP bottles.

2. Solution <sup>W3-5</sup> W1-5

- Initial EU ≈ 5 ppb
- Initial pH ≈ 7.0; adjustment made with NaHCO<sub>3</sub>
- Initial volume ≈ 50 ml
- Ionic strength = 0.1 m NaNO<sub>3</sub>
- Initial [Na<sup>+</sup>] = 0.1 m NaNO<sub>3</sub> + [NaHCO<sub>3</sub>] added
- pCO<sub>2</sub> = atmospheric = 10<sup>-3.48</sup> bar

a) <sup>500</sup> In a pre-cleaned 500-ml teflon (FEP) bottle, prepare 400 g of 5 ppb U solution by diluting 40 g of a 500 ppb stock solution (in 0.1 m NaNO<sub>3</sub> matrix; prepared previously from commercial 50 ppm <sup>233</sup>U spike) to a total of 400 g by carefully taring 0.10 m NaNO<sub>3</sub> solution into the bottle on a Mettler 4600 balance.

Within the same day, analyze 5 samples (sample names <sup>W3</sup> W1-5-IU<sub>i</sub>, 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<sub>3</sub> + 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<sub>3</sub> 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) <sup>W3</sup> Into each of 4 60-ml <sup>PC</sup> bottles labeled W1-5-PP and 4 60-ml FEP bottles labeled W1-5-FEP<sub>i</sub> [where *i* is the mixture number 1, 2, or 3], 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<sub>3</sub> + 0.5 g sample). Analyze 5 samples (sample names <sup>W3</sup> W1-5-IU<sub>i</sub>, where *i* is 6, 7, 8, 9, or 10).

c) <sup>PC</sup> After periods of one, two and three weeks, analyze three samples from each PP 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 and FEP bottles.



1000g 0.1m  $\text{NaNO}_3$  were prepared by dissolving 9.499 g  $\text{NaNO}_3$  in 1000g deionized  $\text{H}_2\text{O}$ .

Actual wt  $\text{NaNO}_3$  used - 8.4984g

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

Wt  $^{233}\text{U}$  (50ppb) used: 50.05g  
Final Wt: 500.09g

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

Wt.  $^{233}\text{U}$  (50ppb) used, <sup>TD 2/22/94</sup> 50.519g  
Final Wt: 500.01g

The solutions were mixed, and 5 samples from the 50ppb and 5 samples from the 5ppb 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	8.3286	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  $\text{NaHCO}_3$ . The target pH is ~6.5. It will be measured periodically until it equilibrates w/  $\text{CO}_2$  in the atmosphere.

wt  $\text{NaHCO}_3$  used for W3-50: 0.0029  
wt  $\text{NaHCO}_3$  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/(r%)  
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 was 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. Ler= 0 Bkg= 0.00 %2 Sigma=0.25  
Region B: LL-UL=100.-350. Ler= 0 Bkg= 0.00 %2 Sigma=3.00  
Region C: LL-UL= 0.0-2000 Ler= 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	
2	8.37	5.75 60.24	528.120 3.02	536.31 3.06	705.88	B
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	0.48 225.3	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	1.58 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

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

6/15/94 re  
calculations  
Verified on  
page 143-144  
of book.

March  
4 FEB 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  
8TD 1.0M NaHCO<sub>3</sub> with dropwise addition. The final  
pH was 6.68. 5.92

1 March 1994 TD W3

The pH of the solutions was remeasured.

pH/T(°C)  
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.

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 Polycarbonate (PC) and 4 Teflon  
(FEP) bottle, 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\*EU6-10  
samples has finished. The raw data & results of  
calculations follow.

W3-5 Initial [u] (prior to taking 50 g Aliquots)

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 =999.99 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	19.57 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 3.96 701.89	
4	88.20	0.00 0.00	47.532 3.19	46.99 4.00 708.27	
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

W3-SI.XLS

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

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

14 March 1994 TD

The W3-5 \* PC (or FEP) solution have been sitting a week, so the pH, weight, and  $^{235}\text{U}$  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.

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.

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	18.618 3.62	17.15 5.57	690.47
4	228.18	0.13 478.8	18.404 3.63	18.88 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	702.48
9	276.51	0.22 273.4	12.987 3.91	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

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 an pH in an 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 polycarbonate (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 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 experiment

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

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:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
1	999.98	18.95	1.45	2.945	3.69
2	232.91	0.18	346.6	16.135	3.61
3	227.59	0.76	85.22	16.586	3.59
4	226.31	0.40	161.1	16.696	3.59
5	230.03	0.00	0.00	16.379	3.60
6	251.40	0.08	798.2	14.736	3.67
7	253.19	0.25	241.9	14.611	3.68
8	270.53	0.34	178.8	13.482	3.74
9	274.88	0.06	1055.	13.222	3.76
10	448.33	0.18	282.2	6.974	4.54
11	436.56	0.34	146.4	7.237	4.48
12	285.52	0.00	0.00	12.620	3.80
13	291.99	0.34	173.3	12.275	3.82
14	456.12	0.00	0.00	6.798	4.59
15	457.66	0.23	210.9	6.765	4.60
16	450.81	0.00	0.00	6.915	4.56
17	455.14	0.00	0.00	6.819	4.58

(1 missing vial)

## 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	106.8	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)

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

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

6 April 1994 EXPT. W3-50

The <sup>first</sup> final sample of w3-50 was taken. The weight & pH were also measured. The samples were prepared for liquid scintillation analysis of each solution (D)

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 measurement 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 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  
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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

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:25%	CPMB B:25%	CPMC C:25%	SIS	FLAG
1	999.98	19.04	1.45	2.838	3.75	27.83
2	225.98	0.17	376.6	16.827	3.56	17.65
3	234.90	0.10	623.6	16.085	3.59	16.66
4	232.18	0.31	204.5	16.302	3.58	17.03
5	234.55	0.12	540.4	16.109	3.59	16.65
6	221.18	0.27	240.1	17.254	3.55	18.03
7	218.83	0.00	0.00	17.470	3.54	17.65
8	273.93	0.00	0.00	13.385	3.72	13.71
9	284.79	0.35	168.0	12.766	3.76	13.82
10	377.13	0.04	1322.	8.946	4.13	9.67
11	358.79	0.02	2345.	9.548	4.05	10.41
12	264.34	0.00	0.00	13.974	3.69	14.06
13	254.85	0.00	0.00	14.600	3.66	14.66
14	400.02	0.05	972.0	8.274	4.23	8.84
15	405.77	0.00	0.00	8.114	4.26	8.34
16	390.11	0.00	0.00	8.556	4.18	8.97
17	393.64	0.00	0.00	8.467	4.20	8.32
(1 missing vial)						
19	14.67	0.87	270.8	300.161	3.03	301.21
20	14.81	0.00	0.00	297.229	3.03	296.81
21	14.47	0.86	273.1	304.349	3.03	306.38
22	14.09	0.00	0.00	312.563	3.03	312.55
23	15.57	0.55	410.5	282.711	3.03	284.24
24	15.68	0.73	309.1	280.772	3.03	281.48
25	14.47	0.00	0.00	304.349	3.03	303.89
26	14.14	1.40	172.9	311.448	3.03	313.68
27	16.61	0.11	2029.	264.712	3.03	264.04
28	16.03	0.24	928.9	274.392	3.03	275.29
29	33.14	0.00	74975	131.260	3.07	131.94
30	34.85	0.00	0.00	124.709	3.07	124.19
31	21.79	1.11	175.3	201.109	3.04	202.50
32	21.27	1.22	161.0	206.095	3.04	207.90
33	15.59	0.00	0.00	282.409	3.03	281.53
34	15.59	0.00	0.00	293.824	3.03	293.82

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

## 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:25%	CPMB	B:25%	CPMC	C:25%	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	1007.1	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

12 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  $\mu$ L 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

12 19 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:25%	CPMB B:25%	CPMC C:25%	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	6740.1	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*A25	2	348.37	688.614	7.9630E+13	1.3221E-10	30.8100
W3-50*PC*A46	3	343.55	679.490	7.8575E+13	1.3046E-10	30.4018
W3-50*PC*B25	4	353.44	695.337	8.0407E+13	1.3350E-10	31.1109
W3-50*PC*B46	5	357.49	706.921	8.1747E+13	1.3572E-10	31.6291
W3-50*PC*C25	6	338.98	667.415	7.7178E+13	1.2814E-10	29.8615
W3-50*PC*C46	7	346.83	687.337	7.9482E+13	1.3196E-10	30.7529
W3-50*PC*D25	8	352.95	696.017	8.0486E+13	1.3363E-10	31.1412
W3-50*PC*D46	9	345.69	684.128	7.9111E+13	1.3135E-10	30.6093
W3-50*FEP*A25	10	290.68	571.081	6.6038E+13	1.0964E-10	25.5513
W3-50*FEP*A46	11	290.62	575.030	6.6495E+13	1.1040E-10	25.7280
W3-50*FEP*B25	12	174.7	343.155	3.9682E+13	6.5883E-11	15.3535
W3-50*FEP*B46	13	175.59	346.331	4.0049E+13	6.6493E-11	15.4956
W3-50*FEP*C25	14	250.85	495.164	5.7260E+13	9.5068E-11	22.1547
W3-50*FEP*C46	15	257.32	509.444	5.8911E+13	9.7810E-11	22.7936
W3-50*FEP*D25	16	324.85	645.312	7.4622E+13	1.2390E-10	28.8726
W3-50*FEP*D46	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  $\text{NaNO}_3$  was prepared in 2 Lkg portions  
by dissolving 8.499g  $\text{NaNO}_3$  in 1 kg DI  $\text{H}_2\text{O}$ .

wt  $\text{NaNO}_3$  used: 8.4997g, 8.4990g  
wt #: 930601,

2000g of 50ppb  $^{233}\text{U}$  was prepared by diluting  
200g 500ppb  $^{233}\text{U}$  (spike 28A) to 2000g using  
0.1 M  $\text{NaNO}_3$ .

6/17/94  
TD  
ACTUAL WT. SPIKE 28A USED: 200.91g  
FINAL WT. (AFTER DILUTION) : 2000.1

The solution was mixed and distributed in 50g portions into  
pre weighed, labeled ~~TD-MAT~~ FEP 60ml- bottles. The pH adjustments  
were made using table B-IB-I on pg 6C-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	28.4758	49.93	0.338	1	0.340	78.75
D-I*PH2.50	25.4054	49.87	0.187	1	0.190	75.47
D-I*PH2.75	28.5758	50.00	0.103	1	0.100	78.68
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	77.96
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	23.4556	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	76.86
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	74.84
D-I*PH8.25	25.7040	49.95	0.139	0.5	0.140	76.79
D-I*PH8.50	24.4867	49.95	0.248	0.5	0.250	74.89
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*PH2.0	28.5466	50.05	0.602	1	0.600	79.20
D-I*PH4.0	26.5471	49.98	0.102	0.02	0.100	76.63
D-I*PH5.0	22.6945	50.10	0.342	0.01	0.340	73.13
D-I*PH5.5	26.7128	50.10	0.391	0.01	0.390	77.20
D-I*PH6.0	25.9355	50.13	0.429	0.01	0.430	76.50
D-I*PH6.5	26.8624	50.20	0.102	0.05	0.100	77.16
D-I*PH7.0	26.2826	50.21	0.151	0.05	0.150	76.84
D-I*PH7.5	27.6835	50.01	0.306	0.05	0.310	78.00
D-I*PH8.0	26.7129	49.90	0.403	0.1	0.400	77.01
D-I*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-pgs300-301  
Expt. B-IB

BOLD  
values are for  $\text{NaHCO}_3$



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

Since the S-ID solutions have had sufficient time to equilibrate, the solutions were sampled, the pH measured and the tubes and solutions weighed. A 500  $\mu$ L 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  $\pm$  10% g Na<sup>+</sup> 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 TO VERIFICATION OF CALCULATIONS

This entry is to verify and explain the calculations used in the liquid scintillation analysis of aqueous  $^{233}\text{U}$  solutions. The first step is to correct the cpm B column for the mass of the aliquot. This is done to get the activity  $\text{cpm/g}$  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.

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

$$\lambda = \text{decay constant} = \frac{\ln 2}{t_{1/2} (\text{min})} = \frac{\ln 2}{6.14194 \times 10^4} = 8.6477 \times 10^{-12} \frac{\text{decay}}{\text{min}}$$

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 to grams and then to ppb  $^{233}\text{U}$ .

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

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

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

An example can be found on the next page

## EXAMPLE

CPM B = 500, wt of aliquot = 0.5000 g

$$A = \frac{500}{0.5000} = 1000 \text{ counts/g}$$

$$N = \frac{A}{\lambda} = \frac{1000 \text{ counts/g}}{8.6477 \times 10^{-12} \text{ counts}} = 1.1564 \times 10^{14} \text{ atoms}$$

TD 6/14/94

$$\text{MOLES} = \frac{N}{6.023 \times 10^{23}} = \frac{1.1564 \times 10^{14}}{6.023 \times 10^{23}} = 1.9199 \times 10^{-10}$$

TD 6/14/94

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

$$\text{ppb } ^{235}\text{U} = \frac{\text{GRAMS}}{10^{-9}} = 44.74 \text{ ppb } ^{235}\text{U}$$

23 JUNE 1994 TO EXPERIMENT O-I

The D-I solutions have had sufficient time to equilibrate. A 500  $\mu\text{L}$  sample was taken from each and 1.00g 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 <sup>TD 6/14/94</sup> 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	7.6512	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*PH2.00	79.10	1.92	23.0	7.6638	8.1610	0.4972	n.a.
D-I-C*PH4.00	76.40	3.95	23.0	7.6921	8.1835	0.4914	n.a.
D-I-C*PH5.00	72.95	5.10	23.0	7.7131	8.2097	0.4966	n.a.
D-I-C*PH5.50	77.02	5.51	23.0	7.7251	8.2207	0.4956	n.a.
D-I-C*PH6.00	76.30	6.02	23.0	7.7044	8.2072	0.5028	n.a.
D-I-C*PH6.50	76.98	6.39	23.1	7.6767	8.1709	0.4942	n.a.
D-I-C*PH7.00	76.47	6.77	23.1	7.7312	8.2263	0.4951	n.a.
D-I-C*PH7.50	77.78	7.30	23.1	7.6761	8.1723	0.4962	n.a.
D-I-C*PH8.00	76.84	7.81	23.1	7.6830	8.1769	0.4939	n.a.
D-I-C*PH9.00	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 TO 29 JUN  
TO EXPERIMENT S-ID D-I

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

Protocol #:19 Name:U-233 3% 2 sigma 28-Jun-84 14:09  
Region A: LL-UL= 0.0-100. Ler= 0 Bkg= 0.00 %2 Sigma=0.25  
Region B: LL-UL=100.-350. Ler= 0 Bkg= 0.00 %2 Sigma=3.00  
Region C: LL-UL= 0.0-2000 Ler= 0 Bkg= 0.00 %2 Sigma=0.10  
Time =899.99 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 3.12 737.68		
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 65.84 312.803	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 79.66 125.807	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 60.26 466.948	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	1.64 190.8 498.451	3.02 501.74 3.09 725.18		
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	18.70	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	1.2080E+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

Page 1  
D-I (U),i

Calculations verified on pgs 143-144 of this notebook.

11 July 1994 TO 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	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	8.3069	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 TO EXPERIMENT D-I

The <sup>to 4/11/94</sup> ~~to 4/11/94~~ L.S. Analysis of the samples has finished. Raw data and results of calculations follow.

14 Jul 94 11:25  
Protocol #:17ALPHA/BETA - 1.02  
U-233 3% 2 sigmaPage #2  
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



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	6.8308E-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<sup>+</sup>-clinoptilolite (CDV\*100/200\*UC\*WA\*HL\*CPT\*Naf)  
1L 0.1 m NaNO<sub>3</sub>  
0.005 M NaHCO<sub>3</sub>  
0.01 M NaHCO<sub>3</sub>  
0.05 M NaHCO<sub>3</sub>

PROCEDURE:

- Prepare 1000 g of a 50 ppb <sup>233</sup>U solution by diluting 100 g of the 500 ppb spike to 1000 g using 0.1 m NaNO<sub>3</sub>.
- Tare 50 g of the 50 ppb <sup>233</sup>U solution into each of 20 precleaned, prelabeled and preweighed 60 mL FEP bottles.
- 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<sub>2</sub>, about 14 days.
- 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  $\mu\text{L}$  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  $\text{HNO}_3$ . Reweigh the first bottle and then add 0.5 mL 1M  $\text{HNO}_3$ . 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  $\mu\text{L}$  sample from each for liquid scintillation analysis. Dry the bottles containing the solid and weigh when dry.

Table CS-I-1

Mixture Label	Molality $\text{NaHCO}_3$ to Use	Vol (mL) $\text{NaHCO}_3$ 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  $\text{NaNO}_3$  was prepared by dissolving 8.50 g  $\text{NaNO}_3$  in 1000 g  $\text{H}_2\text{O}$ .

1000 g of 50ppb U solution was prepared by diluting 100 g of Spike 28A ( $[\text{U}] = 500\text{ppb}$ ) to 1000 g using 0.1 m  $\text{NaNO}_3$ .

NT SPIKE USED : 100.04 g

FINAL WT : 1002.0 g

(50ppb) to 8/17/94

The spike solution was distributed into pre-weighed, pre-labeled 60 mL FEP bottles and then 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/  $\text{CO}_2$ . The bottles were loosely capped to allow equilibration.

NAME	WT BOTTLE EMPTY(g)	WT. SOL'N(g)	pH ADJUSTMENT WT. AFTER ADJUST (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	49.02	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	27.6648	49.85	77.9414

17 Aug 1994 to 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/ $^{\circ}\text{C}$  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  
 $\text{Na}^+$ -clinoptilolite (CDV\*100/200\*UC\*WA\*HL\*CPT\*Naf)  
1L 0.1 M  $\text{NaNO}_3$   
0.005 M  $\text{NaHCO}_3$   
0.01 M  $\text{NaHCO}_3$   
0.05 M  $\text{NaHCO}_3$   
0.005 M  $\text{NaHCO}_3$   
0.001 M  $\text{NaHCO}_3$   
0.001 M  $\text{HNO}_3$   
0.02 M  $\text{HNO}_3$

## PROCEDURE:

- Prepare 1000 g of a 5 ppb  $^{233}\text{U}$  solution by diluting 10 g of the 500 ppb spike to 1000 g using 0.1 M  $\text{NaNO}_3$ .
- Tare 50 g of the 5 ppb  $^{233}\text{U}$  solution into each of 20 precleaned, prelabeled and preweighed 60 mL FEP bottles.
- 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  $\text{CO}_2$ , about 14 days.
- After pH equilibration, remove the bottles and reweigh to determine the amount lost to evaporation. Take a 500  $\mu\text{L}$  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  $0.1 \pm 0.001$  g clinoptilolite to each bottle. Reweigh each bottle and return to the gyratory shaker. Allow the mixtures to equilibrate for 10–14 days.
- Weigh each bottle. Take a 500  $\mu\text{L}$  sample from each solution for liquid scintillation counting. Measure the pH of each solution.
- 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  $\text{HNO}_3$ . Reweigh the first bottle and then add 0.5 mL 1M  $\text{HNO}_3$ . Return both sets of bottles to the gyratory shaker and allow them to equilibrate for 10–14 days.
- After equilibration, weigh each bottle and take a 500  $\mu\text{L}$  sample from each for liquid scintillation analysis. Dry the bottles containing the solid and weigh when dry.

Table CS-II-1

Mixture Label	Molarity $\text{HNO}_3$ 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 $\text{NaHCO}_3$ 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  $\text{NaNO}_3$  was prepared by dissolving 8.50g  $\text{NaNO}_3$  in 1000g  $\text{D}_2\text{H}_2\text{O}$ .

1000g 5 ppb U solution was prepared by diluting 10g Spike  $^{233}\text{U}$  (CJ=500 ppb) to 1000g using 0.1M  $\text{NaNO}_3$ .

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 ~50g aliquots. The pH of each solution was adjusted according to Table CS-II-1. After adjustment, the solutions were returned placed on a gyratory shaker, loosely capped, and allowed to equilibrate w/  $\text{CO}_2$ .

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)
GS-II* pH 4.3	27.7876	49.74	77.7535
4.5	25.3563	49.84	75.3713
4.7	22.532	50.13	72.4371
4.9	25.5597	50.04	76.0493
5.0	25.9067	49.90	76.0728
5.1	28.6185	49.76	78.5384 to 8/17/94
5.3	24.5631	49.90	74.7257
5.5	28.6026	50.04	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	72.4496
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	28.7235	49.98	78.4923

31 August 1994 TO EXPERIMENT B-IC

Experiment B-IC was begun today. The procedure 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  $pCO_2=10^{-3.50}$ ;  $\Sigma U=50$  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/ $^{\circ}C$  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)
- 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 <sub>3</sub>
500 ml	stock solution of 0.1 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.05 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.01 m NaHCO <sub>3</sub>
500 ml	stock solution of 0.005 m NaHCO <sub>3</sub>
	ultrapure water

## PROCEDURE:

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

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

- Initial  $\Sigma U = 50$  ppb
- Initial pH = 2.0 to 9.0, every 0.25 pH unit; adjustments made with HNO<sub>3</sub> or NaHCO<sub>3</sub>
- Initial volume = 50 ml
- Ionic strength = 0.1 m NaNO<sub>3</sub>
- Wt. Na-clinoptilolite to use = 0.100 $\pm$ 0.001
- Initial [Na<sup>+</sup>] = 0.1 m NaNO<sub>3</sub> + [NaHCO<sub>3</sub>] added
- pCO<sub>2</sub> = 10<sup>-3.50</sup> 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<sub>3</sub> matrix; prepared previously from commercial 50 ppm <sup>233</sup>U spike) to a total of 1600 g by carefully taring 0.1 m NaNO<sub>3</sub> solution into the polycarbonate bottle on a Mettler 4600 balance.

b) Into each of 29 60-ml **preweighed** polycarbonate bottle labeled B-IC\**pHi* [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  $\mu$ L of 50% HNO<sub>3</sub> 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<sub>3</sub>. 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\**pHi*

Adjust the pH of each solution to the approximate value *i* by adding HNO<sub>3</sub> or NaHCO<sub>3</sub> 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  $\approx$ 120 rpm. Leave the bottles on the shaker for about ten days to allow the solutions to reach equilibrium with atmospheric CO<sub>2</sub>(g).

d) After equilibrium with atmospheric CO<sub>2</sub>(g) has been reached, **reweigh** each bottle to determine any evaporative losses. From each solution B-IC\**pHi*, take a 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IC\*IU-*pHi*] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO<sub>3</sub>. 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\**pHi*. *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 $\pm$ 0.001 gm of Na-clinoptilolite onto weighing paper, then carefully transfer into each of the B-IC\**pHi* 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\**pHi* with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IC-*pHi*] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO<sub>3</sub>. 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\**pHi*. 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\**pHi* listed in Table B-IC-2 up or down by about 1 pH unit by adding HNO<sub>3</sub> or NaHCO<sub>3</sub> 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-ICR-*pHi*) and pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO<sub>3</sub>. 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-pHi) 15-ml polypropylene bottles. **Reweigh** each polycarbonate and polypropylene bottle.

2) Add 3 ml of 0.1 M HNO<sub>3</sub> 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\*pHi, add 0.5 ml of 50% HNO<sub>3</sub> 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-pHi or B-ICF-pHi) 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\*pHi)
- 1 2000-ml polycarbonate bottle (for preparation of 50 ppb U solution)

##### 2. Prepare:

- 2 L 500 ppb U stock solution prepared from 50 ppm <sup>233</sup>U commercial spike
- 0.1 M NaNO<sub>3</sub> stock solution
- 1000 ml stock solution of 1.0 M HNO<sub>3</sub>
- 1000 ml stock solution of 0.1 M HNO<sub>3</sub>
- 1000 ml stock solution of 0.02 M HNO<sub>3</sub>
- 500 ml stock solution of 1.0 M NaHCO<sub>3</sub> (42.005 g in 500 ml solution)
- 500 ml stock solution of 0.5 M NaHCO<sub>3</sub> (21.003 g in 500 ml solution)
- 500 ml stock solution of 0.1 M NaHCO<sub>3</sub> (4.201 g in 500 ml solution)
- 500 ml stock solution of 0.05 M NaHCO<sub>3</sub> (2.100 g in 500 ml solution)
- 500 ml stock solution of 0.01 M NaHCO<sub>3</sub> (0.4201 g in 500 ml solution)
- 500 ml stock solution of 0.005 M NaHCO<sub>3</sub> (0.2100 g in 500 ml solution)

The NaHCO<sub>3</sub> 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<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to 50 ml 0.1 M NaNO<sub>3</sub> 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 <sub>3</sub> needed, microliters	Molarity of HNO <sub>3</sub> 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 <sub>3</sub> needed, microliters	Molarity of NaHCO <sub>3</sub> 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<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to remaining 0.1 M NaNO<sub>3</sub> 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 <sub>3</sub> needed (microL)	Molarity of HNO <sub>3</sub> 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	<sup>TP 10/14/94</sup> 0.2 0.02
B-IC*pH6.00	5.61	50	<sup>TP 10/14/94</sup> 0.2 0.02
Mixture Label	Equilibrium pH (end of forward expt.)	Volume of NaHCO <sub>3</sub> needed (microL)	Molarity of NaHCO <sub>3</sub> 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	Total Wt. after CO2 equilb.	WT VIAL (g)	WT. VIAL w/ 0.5 ml sample	pH	T (C)	Total Wt. After Sampl.&pH Meas.	Total Wt. after Mineral Add'n
B-IC*U <sup>a</sup> b	---	---	---	---	---	---	n/a
B-IC*U <sup>a</sup>	---	---	---	---	---	---	n/a
B-IC*PH9.00	70.4628	7.7626	8.5226	6.94	24.6	70.0000	70.0012
B-IC*PH8.75	70.5501	7.7521	8.5121	6.94	24.6	69.9900	69.9900
B-IC*PH8.50	70.4401	7.7421	8.5021	6.94	24.6	69.9800	69.9800
B-IC*PH8.25	70.5401	7.7421	8.5121	6.94	24.6	69.9700	69.9700
B-IC*PH8.00	70.4401	7.7421	8.5021	6.94	24.6	69.9600	69.9600
B-IC*PH7.75	70.5401	7.7421	8.5121	6.94	24.6	69.9500	69.9500
B-IC*PH7.50	70.4401	7.7421	8.5021	6.94	24.6	69.9400	69.9400
B-IC*PH7.25	70.5401	7.7421	8.5121	6.94	24.6	69.9300	69.9300
B-IC*PH7.00	70.4401	7.7421	8.5021	6.94	24.6	69.9200	69.9200
B-IC*PH6.75	70.5401	7.7421	8.5121	6.94	24.6	69.9100	69.9100
B-IC*PH6.50	70.4401	7.7421	8.5021	6.94	24.6	69.9000	69.9000
B-IC*PH6.25	70.5401	7.7421	8.5121	6.94	24.6	69.8900	69.8900
B-IC*PH6.00	70.4401	7.7421	8.5021	6.94	24.6	69.8800	69.8800
B-IC*PH5.75	70.5401	7.7421	8.5121	6.94	24.6	69.8700	69.8700
B-IC*PH5.50	70.4401	7.7421	8.5021	6.94	24.6	69.8600	69.8600
B-IC*PH5.25	70.5401	7.7421	8.5121	6.94	24.6	69.8500	69.8500
B-IC*PH5.00	70.4401	7.7421	8.5021	6.94	24.6	69.8400	69.8400
B-IC*PH4.75	70.5401	7.7421	8.5121	6.94	24.6	69.8300	69.8300
B-IC*PH4.50	70.4401	7.7421	8.5021	6.94	24.6	69.8200	69.8200
B-IC*PH4.25	70.5401	7.7421	8.5121	6.94	24.6	69.8100	69.8100
B-IC*PH4.00	70.4401	7.7421	8.5021	6.94	24.6	69.8000	69.8000
B-IC*PH3.75	70.5401	7.7421	8.5121	6.94	24.6	69.7900	69.7900
B-IC*PH3.50	70.4401	7.7421	8.5021	6.94	24.6	69.7800	69.7800
B-IC*PH3.25	70.5401	7.7421	8.5121	6.94	24.6	69.7700	69.7700
B-IC*PH3.00	70.4401	7.7421	8.5021	6.94	24.6	69.7600	69.7600
B-IC*PH2.75	70.5401	7.7421	8.5121	6.94	24.6	69.7500	69.7500
B-IC*PH2.50	70.4401	7.7421	8.5021	6.94	24.6	69.7400	69.7400
B-IC*PH2.25	70.5401	7.7421	8.5121	6.94	24.6	69.7300	69.7300
B-IC*PH2.00	70.4401	7.7421	8.5021	6.94	24.6	69.7200	69.7200
B-IC*PH1.75	70.5401	7.7421	8.5121	6.94	24.6	69.7100	69.7100
B-IC*PH1.50	70.4401	7.7421	8.5021	6.94	24.6	69.7000	69.7000
B-IC*PH1.25	70.5401	7.7421	8.5121	6.94	24.6	69.6900	69.6900
B-IC*PH1.00	70.4401	7.7421	8.5021	6.94	24.6	69.6800	69.6800
B-IC*PH0.75	70.5401	7.7421	8.5121	6.94	24.6	69.6700	69.6700
B-IC*PH0.50	70.4401	7.7421	8.5021	6.94	24.6	69.6600	69.6600
B-IC*PH0.25	70.5401	7.7421	8.5121	6.94	24.6	69.6500	69.6500
B-IC*U <sup>b</sup>	---	---	---	---	---	---	---

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-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	50.13	190	1	HNO3	70.7365
B-IC*PH2.75	20.3267	50.02	100	1	HNO3	70.5799
B-IC*PH3.00	20.4378	49.83	560	0.1	HNO3	70.9584
B-IC*PH3.25	20.2860	50.05	300	0.1	HNO3	70.6507
B-IC*PH3.50	20.2978	49.93	150	0.1	HNO3	70.4902
B-IC*PH3.75	20.2474	49.74	330	0.02	HNO3	70.4373
B-IC*PH4.00	20.2817	49.84	100	0.02	HNO3	70.3289
B-IC*PH4.25	20.3058	49.91	120	0.005	HNO3	70.5787
B-IC*PH4.50	20.2505	50.08	210	0.01	NaHCO3	70.6487
B-IC*PH4.75	20.2280	49.92	290	0.01	NaHCO3	70.5621
B-IC*PH5.00	20.2185	50.06	340	0.01	NaHCO3	70.7956
B-IC*PH5.25	20.4192	49.94	370	0.01	NaHCO3	70.8251
B-IC*PH5.50	20.3014	50.09	390	0.01	NaHCO3	70.6857
B-IC*PH5.75	20.3217	50.12	410	0.01	NaHCO3	70.9529
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	20.4031	49.94	120	0.05	NaHCO3	70.5484
B-IC*PH7.00	20.2151	49.92	150	0.05	NaHCO3	70.3864
B-IC*PH7.25	20.3133	50.11	210	0.05	NaHCO3	70.4580
B-IC*PH7.50	20.3452	49.83	310	0.05	NaHCO3	70.8729
B-IC*PH8.00	20.3116	50.13	240	0.1	NaHCO3	70.3756
B-IC*PH8.25	20.2552	50.12	400	0.1	NaHCO3	70.4946
B-IC*PH8.50	20.3022	50.11	140	0.5	NaHCO3	70.6366
B-IC*PH8.75	20.3796	50.06	250	0.5	NaHCO3	70.7968
B-IC*PH9.00	20.2073	49.98	230	1	NaHCO3	70.9034
B-IC*U <sup>a</sup>	20.2594	50.44	440	1	NaHCO3	70.7692
B-IC*U <sup>b</sup>	20.3600	51.41	100	50% (v/v)	HNO3	---

\* - spilled during Acid

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	6.9329	10.5622	13.5521
B-IC*PH2.25	68.5237	65.4240	66.0468	6.9843	10.0723	3.0807
B-IC*PH2.50	68.6063	65.1140	65.1398	7.1223	10.6185	7.9161
B-IC*PH2.75	68.4244	65.2909	65.9155	7.1307	10.2354	6.4322
B-IC*PH3.00	68.1795	64.6469	65.2709	7.1123	11.1780	*
B-IC*PH3.25	68.5220	64.8749	65.4968	7.1016	10.7095	4.9261
B-IC*PH3.50	68.3089	65.1296	65.3162	7.0685	10.6294	13.1
B-IC*PH3.75	68.3089	65.1296	66.3532	7.2193	11.2924	12.8331
B-IC*PH4.00	68.2556	65.1140	66.4798	7.2193	11.2924	12.8331
B-IC*PH4.25	68.4844	65.4469	66.0069	7.0127	10.4067	6.0901
B-IC*PH4.50	68.3569	65.2909	65.9155	7.1307	10.2354	9.5993
B-IC*PH4.75	68.7959	65.2913	65.9155	7.1380	10.2025	9.5993
B-IC*PH5.00	68.7959	65.6583	66.2788	7.0773	10.1938	5.5813
B-IC*PH5.25	68.8036	65.7120	66.3395	7.11053	10.1542	13.6371
B-IC*PH5.50	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH5.75	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH6.00	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH6.25	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH6.50	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH6.75	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH7.00	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH7.25	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH7.50	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH7.75	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH8.00	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH8.25	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH8.50	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH8.75	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661
B-IC*PH9.00	68.9248	64.7960	65.4945	7.0508	11.1638	14.1661

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 Sample & pH Meas.
B-IC*PH2.00	69.3047	7.1566	8.2573	2.07	20.9	68.7384
B-IC*PH2.25	69.0740	7.1410	8.2408	2.30	20.9	68.5256
B-IC*PH2.50	69.2009	7.1642	8.2646	2.55	20.9	68.6258
B-IC*PH2.75	69.1911	7.1025	8.2008	2.81	21.0	68.4267
B-IC*PH3.00	69.2717	7.1489	8.2473	3.09	21.0	68.7212
B-IC*PH3.25	69.0007	7.1798	8.2768	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	7.1598	8.2555	3.91	21.0	68.3279
B-IC*PH4.00	68.8199	7.1156	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	7.1882	8.2865	4.69	21.1	68.5935
B-IC*PH4.75	69.9219	7.6959	8.1914	4.97	21.1	68.3599
B-IC*PH5.00	69.2586	7.6956	8.1924	5.08	21.1	68.7116
B-IC*PH5.25	69.3534	7.1428	8.2398	5.21	21.1	68.7972
B-IC*PH5.50	69.4045	7.1360	8.2325	5.37	21.1	68.8636
B-IC*PH5.75	69.3724	7.1141	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	69.4869	7.1639	8.2604	5.77	21.2	68.9265
B-IC*PH6.50	68.9662	7.1023	8.2003	6.00	21.3	68.4051
B-IC*PH6.75	69.1583	7.1608	8.2578	6.35	21.3	68.6136
B-IC*PH7.00	68.9067	7.1729	8.2689	6.57	21.4	68.3554
B-IC*PH7.25	68.9889	7.1432	8.2405	6.84	21.5	68.4367
B-IC*PH7.50	69.4406	7.1483	8.2430	7.13	21.6	68.4884
B-IC*PH8.00	68.8672	7.1339	8.2295	7.64	21.7	68.9563
B-IC*PH8.25	69.5340	7.1323	8.2265	7.90	21.7	68.4598
B-IC*PH8.50	69.0354	7.6954	8.1904	8.16	21.8	69.7100
B-IC*PH8.75	69.3107	7.1265	8.2183	8.46	21.8	68.8257
B-IC*PH9.00	69.3319	7.1459	8.2420	8.42	21.8	68.7830



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	1.3174	8.3054	B-ICD*PH2.00	7.3535	8.3501
B-ICD*PH2.25	1.3423	8.3412	B-ICD*PH2.25	7.3670	8.3549
B-ICD*PH2.50	1.3332	8.3331	B-ICD*PH2.50	7.3171	8.3119
B-ICD*PH2.75	1.3872	8.3840	B-ICD*PH2.75	7.3610	8.3611
B-ICD*PH3.00	1.3180	—	B-ICD*PH3.00	7.3477	8.3431
B-ICD*PH3.25	1.4092	8.3982	B-ICD*PH3.25	7.3488	8.3515
B-ICD*PH3.50	1.2059	8.2675	B-ICD*PH3.50	7.3738	8.3686
B-ICD*PH3.75	1.3140	8.3717	B-ICD*PH3.75	7.2873	8.2862
B-ICD*PH4.00	1.3140	8.3162	B-ICD*PH4.00	7.3670	8.3499
B-ICD*PH4.25	1.3600	8.3573	B-ICD*PH4.25	7.3069	8.3903
B-ICD*PH4.75	1.3521	8.3519	B-ICD*PH4.75	7.3069	8.3099
B-ICD*PH5.25	1.3187	8.3166	B-ICD*PH5.25	7.3329	8.3227
B-ICD*PH5.75	1.3113	8.3063	B-ICD*PH5.75	7.2473	8.2817
B-ICD*PH6.25	1.3345	8.3242	B-ICD*PH6.25	7.3262	8.3216
B-ICD*PH7.25	1.4025	8.4027	B-ICD*PH7.25	7.4366	8.4409
B-ICD*PH7.75	1.3556	8.3517	B-ICD*PH7.75	7.3006	8.3000
B-ICD*PH8.00	1.4038	8.3482	B-ICD*PH8.00	7.3543	8.3520
B-ICD*PH8.25	1.2896	8.2984	B-ICD*PH8.25	7.3249	8.3250
B-ICD*PH8.50	1.3460	8.3399	B-ICD*PH8.50	7.3402	8.3872
B-ICD*PH8.75	1.4058	8.4022	B-ICD*PH8.75	7.3450	8.3276
B-ICD*PH9.00	1.3704	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	HNO3	68.9516
	B-IC*PH6.00	50	0.2	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	3.10	21.9
	B-IC*PH5.00	7.7672	8.2695	4.24	22.0
	B-IC*PH5.50	7.8584	8.3588	4.71	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	7.8677	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<sub>3</sub> were prepared by dissolving 8.50g NaNO<sub>3</sub> in 1000g H<sub>2</sub>O.

A 50 ppb solution was prepared by diluting 160g (160.14 actually used) to 1600g (1599.8g) using 0.1M NaNO<sub>3</sub>.

~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<sub>3</sub> or NaHCO<sub>3</sub> 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 ...II 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-IIC*IUa1	7.6991	8.2040	0.5049
B-IIC*IUa2	7.1876	8.2901	0.5025
B-IIC*IUb1	7.8111	8.3136	0.5025
B-IIC*IUb2	7.7446	8.2459	0.5013

# URANIUM SORPTION EXPERIMENT B-IIIC:

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

1 Sept 1994

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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/ $^{\circ}C$  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\*pHi)
- 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  $\Sigma U = 5$  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 =  $0.100 \pm 0.001$
- 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\*pHi [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  $\mu L$  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\*pHi

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  $\approx 120$  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  $\text{CO}_2(\text{g})$  has been reached, **reweigh** each bottle to determine any evaporative losses. From each solution B-IIIC\* $\text{pHi}$ , take a 0.5-ml sample with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIC\*IU- $\text{phi}$ ] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M  $\text{HNO}_3$ . 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\* $\text{pHi}$ . *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  $0.100 \pm 0.001$  gm of Na-clinoptilolite onto weighing paper, then carefully transfer into each of the B-IIIC\* $\text{pHi}$  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\* $\text{phi}$  with an Eppendorf pipet, transfer into pre-labeled [e.g., B-IIIC- $\text{phi}$ ] and pre-weighed scintillation vials containing 0.5 ml of 0.02 M  $\text{HNO}_3$ . 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\* $\text{pHi}$ . 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\* $\text{phi}$  listed in Table B-IIIC-2 up or down by about 1 pH unit by adding  $\text{HNO}_3$  or  $\text{NaHCO}_3$  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-IIICR- $\text{pHi}$ ) and pre-weighed scintillation vials containing 0.5 ml of 0.02 M  $\text{HNO}_3$ . 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- $\text{pHi}$ ) 15-ml polypropylene bottles. **Reweigh** each polycarbonate and polypropylene bottle.

2) Add 3 ml of 0.1 M  $\text{HNO}_3$  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\* $\text{pHi}$ , add 0.5 ml of 50%  $\text{HNO}_3$  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- $\text{pHi}$  or B-IIICF- $\text{pHi}$ ) 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\* $\text{pHi}$ )
  - 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  $^{233}\text{U}$  commercial spike
  - 0.1 M  $\text{NaNO}_3$  stock solution
  - 1000 ml stock solution of 1.0 M  $\text{HNO}_3$
  - 1000 ml stock solution of 0.1 M  $\text{HNO}_3$
  - 1000 ml stock solution of 0.02 M  $\text{HNO}_3$
  - 500 ml stock solution of 1.0 M  $\text{NaHCO}_3$  (42.005 g in 500 ml solution)
  - 500 ml stock solution of 0.5 M  $\text{NaHCO}_3$  (21.003 g in 500 ml solution)
  - 500 ml stock solution of 0.1 M  $\text{NaHCO}_3$  (4.201 g in 500 ml solution)
  - 500 ml stock solution of 0.05 M  $\text{NaHCO}_3$  (2.100 g in 500 ml solution)
  - 500 ml stock solution of 0.01 M  $\text{NaHCO}_3$  (0.4201 g in 500 ml solution)
  - 500 ml stock solution of 0.005 M  $\text{NaHCO}_3$  (0.2100 g in 500 ml solution)

The  $\text{NaHCO}_3$  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<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to 50 ml 0.1 m NaNO<sub>3</sub> 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 <sub>3</sub> needed, microliters	Molarity of HNO <sub>3</sub> 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 <sub>3</sub> needed, microliters	Molarity of NaHCO <sub>3</sub> 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<sub>3</sub> or NaHCO<sub>3</sub> solutions to add to remaining 0.1 m NaNO<sub>3</sub> 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 <sub>3</sub> needed (microl)	Molarity of HNO <sub>3</sub> 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 <sub>3</sub> needed (microl)	Molarity of NaHCO <sub>3</sub> 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	50.26	60	1	HNO3	70.6589
B-IIIC*PH3.25	20.2932	50.07	340	0.1	HNO3	70.6286
B-IIIC*PH3.50	20.2575	49.81	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	70.5948
B-IIIC*PH4.50	20.2629	50.11	75	0.02	HNO3	70.4483
B-IIIC*PH4.75	20.2618	49.90	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	49.18	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	70.5741
B-IIIC*PH7.25	20.2720	50.24	140	0.05	NaHCO3	70.6507
B-IIIC*PH7.50	20.2395	49.98	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	70.2461
B-IIIC*PH8.50	20.3608	50.29	240	0.5	NaHCO3	70.9065
B-IIIC*PH8.75	20.5308	49.75	450	0.5	NaHCO3	70.5357
B-IIIC*PH9.00	20.2782	50.34	430	1	NaHCO3	71.0682
B-IIIC*IU'a	20.2578	50.11	—	—	—	—
B-IIIC*IU'b	20.2673	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	8.2200	2.05	24.0	68.7076
B-IIIc*PH2.25	69.2393	7.1341	8.1979	2.29	24.0	68.7501
B-IIIc*PH2.50	69.0073	7.1724	8.2720	2.53	24.0	68.9773
B-IIIc*PH2.75	68.7944	7.1475	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	69.1286	7.7061	8.2030	3.30	24.0	68.4530
B-IIIc*PH3.50	68.7174	7.7902	8.2842	3.54	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	8.1897	4.20	24.0	68.9580
B-IIIc*PH4.25	69.0260	7.7773	8.2722	4.54	24.0	68.4781
B-IIIc*PH4.50	69.1963	7.9008	8.2987	4.76	24.0	68.6345
B-IIIc*PH4.75	69.0528	7.7445	8.251	4.89	24.1	69.1016
B-IIIc*PH5.00	69.0440	7.6367	8.2036	5.05	24.1	68.4899
B-IIIc*PH5.25	69.1675	7.7120	8.2035	5.34	24.1	68.6259
B-IIIc*PH5.50	69.3156	7.7244	8.2156	5.58	24.1	68.9462
B-IIIc*PH5.75	69.4967	7.6883	8.1787	5.74	24.1	68.3412
B-IIIc*PH6.00	68.8821	7.7709	8.2619	6.31	24.1	68.7296
B-IIIc*PH6.25	69.2642	7.7074	8.1964	6.10	24.2	68.3576
B-IIIc*PH6.50	68.9004	7.6854	8.1779	6.33	24.2	68.9010
B-IIIc*PH6.75	69.4940	7.6948	8.1849	6.63	24.2	68.7638
B-IIIc*PH7.00	69.2998	7.7546	8.2460	6.94	24.3	68.8329
B-IIIc*PH7.25	69.3679	7.7359	8.2265	7.26	24.3	68.6111
B-IIIc*PH7.50	69.1566	7.7819	8.2699	7.31	24.3	68.4004
B-IIIc*PH7.75	68.9339	7.7710	8.2579	7.66	24.4	68.5771
B-IIIc*PH8.00	69.1067	7.7016	8.1896	8.02	24.4	68.0163
B-IIIc*PH8.25	68.5580	7.7846	8.2784	8.40	24.4	69.0055
B-IIIc*PH8.50	69.5493	7.7426	8.2292	8.57	24.4	68.6297
B-IIIc*PH8.75	69.1677	7.7625	8.2530	8.91	24.4	69.1532
B-IIIc*PH9.00	69.7443					

\*. weight before pH adjustment  
Final wt. before cinop. addition is  
given on p. 194. TD.

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	7.6857	8.1869	1.96	25.0	69.7007	69.8024
B-IIIC*PH2.25	70.2308	7.7614	8.1631	2.20	25.0	69.5908	69.6908
B-IIIC*PH2.50	69.9400	7.7294	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	69.6654
B-IIIC*PH3.25	70.1127	7.7128	8.2719	3.18	25.0	69.4836	69.5832
B-IIIC*PH3.50	69.6099	7.7057	8.2876	3.41	25.0	69.0404	69.1397
B-IIIC*PH3.75	69.9868	7.7153	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	7.6020	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	7.6949	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	7.71959	8.2926	4.19	25.1	69.6966	69.8762
B-IIIC*PH6.00	69.8094	7.7756	8.2746	4.24	25.1	69.7345	69.3073
B-IIIC*PH6.25	70.1008	7.71546	8.2529	3.81	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	8.2531	6.62	23.9	69.6274	69.8196
B-IIIC*PH7.50	69.9874	7.7560	8.2531	6.62	23.9	69.3484	69.5645
B-IIIC*PH7.75	69.9070	7.6497	8.1462	1.53	23.8	69.3280	69.4274
B-IIIC*PH8.00	70.0591	7.7805	8.2791	1.76	23.8	69.4452	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	70.6778	7.6740	8.1683	8.61	23.7	69.4767	69.5759
B-IIIC*PH9.00	70.6565	7.7370	8.2305	8.91	23.7	70.0401	70.4404
B-IIIC*PH9.25	—	—	—	—	—	—	—
B-IIIC*PH9.50	—	—	—	—	—	—	—
B-IIIC*PH9.75	—	—	—	—	—	—	—
B-IIIC*PH10.00	—	—	—	—	—	—	—

Sample Name (Solid Desorp.)	Wt. Vial empty (no acid needed)	Wt. Vial + 1.0 ml sample	Sample Name (Container Desorp.)	Wt. Vial + (no acid needed)	Wt. Vial Empty	Wt. Vial + 1.0 ml sample
B-IIICD*PH2.00	7.325	8.341	B-IIICD*PH2.00	7.356	8.377	8.377
B-IIICD*PH2.25	7.322	8.321	B-IIICD*PH2.25	7.271	8.265	8.265
B-IIICD*PH2.50	7.360	8.350	B-IIICD*PH2.50	7.34	8.340	8.340
B-IIICD*PH2.75	7.262	8.273	B-IIICD*PH2.75	7.354	8.331	8.331
B-IIICD*PH3.00	7.356	8.378	B-IIICD*PH3.00	7.335	8.332	8.332
B-IIICD*PH3.25	7.327	8.348	B-IIICD*PH3.25	7.299	8.287	8.287
B-IIICD*PH3.50	7.323	8.343	B-IIICD*PH3.50	7.316	8.306	8.306
B-IIICD*PH3.75	7.347	8.357	B-IIICD*PH3.75	7.335	8.333	8.333
B-IIICD*PH4.00	7.355	8.365	B-IIICD*PH4.00	7.299	8.284	8.284
B-IIICD*PH4.25	7.311	8.322	B-IIICD*PH4.25	7.292	8.285	8.285
B-IIICD*PH4.50	7.327	8.343	B-IIICD*PH4.50	7.325	8.309	8.309
B-IIICD*PH4.75	7.327	8.343	B-IIICD*PH4.75	7.325	8.309	8.309
B-IIICD*PH5.00	7.327	8.343	B-IIICD*PH5.00	7.325	8.309	8.309
B-IIICD*PH5.25	7.327	8.343	B-IIICD*PH5.25	7.325	8.309	8.309
B-IIICD*PH5.50	7.327	8.343	B-IIICD*PH5.50	7.325	8.309	8.309
B-IIICD*PH5.75	7.327	8.343	B-IIICD*PH5.75	7.325	8.309	8.309
B-IIICD*PH6.00	7.327	8.343	B-IIICD*PH6.00	7.325	8.309	8.309
B-IIICD*PH6.25	7.327	8.343	B-IIICD*PH6.25	7.325	8.309	8.309
B-IIICD*PH6.50	7.327	8.343	B-IIICD*PH6.50	7.325	8.309	8.309
B-IIICD*PH6.75	7.327	8.343	B-IIICD*PH6.75	7.325	8.309	8.309
B-IIICD*PH7.00	7.327	8.343	B-IIICD*PH7.00	7.325	8.309	8.309
B-IIICD*PH7.25	7.327	8.343	B-IIICD*PH7.25	7.325	8.309	8.309
B-IIICD*PH7.50	7.327	8.343	B-IIICD*PH7.50	7.325	8.309	8.309
B-IIICD*PH7.75	7.327	8.343	B-IIICD*PH7.75	7.325	8.309	8.309
B-IIICD*PH8.00	7.327	8.343	B-IIICD*PH8.00	7.325	8.309	8.309
B-IIICD*PH8.25	7.327	8.343	B-IIICD*PH8.25	7.325	8.309	8.309
B-IIICD*PH8.50	7.327	8.343	B-IIICD*PH8.50	7.325	8.309	8.309
B-IIICD*PH8.75	7.327	8.343	B-IIICD*PH8.75	7.325	8.309	8.309
B-IIICD*PH9.00	7.327	8.343	B-IIICD*PH9.00	7.325	8.309	8.309

whTD - indicates solution used in reverse etc., no description done

SOLN. NAME	Total Wt. Before Solid Removed (g)	Total Wt. After Solid Removed	Wt. After 0.5 ml 50% HNO <sub>3</sub> Added	Wt. 15-ml PE Btl. Empty (g)	Wt. PP btl. + Transf. Solid	Wt. PP btl w/ 3ml 0.1 HNO <sub>3</sub>
B-IIIC*PH2.00	68.0819	64.6042	65.7722	7.1461	10.6740	14.2520
B-IIIC*PH2.25	68.7073	65.1518	65.7722	7.1351	10.6740	13.6877
B-IIIC*PH2.50	68.4529	64.9225	65.5380	6.9921	10.5123	13.5236
B-IIIC*PH2.75	68.2319	65.2027	65.4194	7.1196	10.3714	13.1553
B-IIIC*PH3.00	68.6591	65.5915	66.2128	7.1029	10.1499	13.1668
B-IIIC*PH3.25	68.4090	65.3479	65.1454	7.1014	10.6518	13.6701
B-IIIC*PH3.50	68.1490	64.5794	65.1454	7.0945	10.9169	13.9967
B-IIIC*PH3.75	68.3835	64.3329	64.9488	6.9377	9.9711	13.0082
B-IIIC*PH4.00	68.4228	65.3749	65.9915	6.9358	10.2490	13.2774
B-IIIC*PH4.25	68.4404	65.3943	66.0121	7.2203	10.1204	13.1506
B-IIIC*PH4.50	69.0722	66.0098	65.6658	6.9905	10.5338	13.5593
B-IIIC*PH4.75	68.6004	65.0468	65.4804	7.1122	10.6575	13.6904
B-IIIC*PH5.00	68.9216	65.3612	65.4804	7.1122	10.6575	13.6904
B-IIIC*PH5.25	68.7038	65.3617	66.0034	7.0339	10.3416	13.3737
B-IIIC*PH5.50	68.7038	65.3617	66.0034	7.0339	10.3416	13.3737
B-IIIC*PH6.00	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH7.00	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH7.25	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH7.50	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH7.75	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH8.00	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH8.25	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH8.50	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH8.75	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953
B-IIIC*PH9.00	68.7963	64.7288	65.3481	7.1405	11.0516	14.2953

Initial Reverse Experiment	SOLN. NAME	Vol. of Acid/Base to Adjust pH (microl.)	Conc. of Acid or Base (M)	Reagent pH Adjust.	Total Wt. after
Experiment	B-IIIC*PH4.50	170	0.1	HNO <sub>3</sub>	68.7599
	B-IIIC*PH5.00	60	0.1	HNO <sub>3</sub>	68.5162
	B-IIIC*PH5.50	90	0.02	HNO <sub>3</sub>	68.8471
	B-IIIC*PH6.00	40	0.02	HNO <sub>3</sub>	68.3643
	B-IIIC*PH6.50	100	0.1	NaHCO <sub>3</sub>	68.4280
	B-IIIC*PH6.75	180	0.1	NaHCO <sub>3</sub>	69.0663
	B-IIIC*PH7.00	330	0.1	NaHCO <sub>3</sub>	69.0820
	B-IIIC*PH7.50	110	1	NaHCO <sub>3</sub>	68.7091
Sample Reverse Experiment	SOLN. NAME	WT VIAL (g)	WT. Vial + 0.5 ml sample	pH	T (C)
	B-IIIC*PH4.50	7.8731	8.3771	5.71	20.5
	B-IIIC*PH5.00	7.7039	8.2024	4.26	20.4
	B-IIIC*PH5.50	7.8308	8.3417	4.94	20.4
	B-IIIC*PH6.00	7.8261	8.3248	5.17	20.5
	B-IIIC*PH6.50	7.8695	8.3727	7.05	20.5
	B-IIIC*PH6.75	7.8446	8.3460	7.32	20.5
	B-IIIC*PH7.00	7.8106	8.3713	7.58	20.4
	B-IIIC*PH7.50	7.8253	8.3295	8.31	20.6

129 Sept 1994

### EXPERIMENT B-IIIC

EXPERIMENT B-IIIC was begun by dissolving today.  
2 1kg portions of 0.1 M NaNO<sub>3</sub> was prepared by  
dissolving 8.50g NaNO<sub>3</sub> in 1000g H<sub>2</sub>O.

1600 g of a 5 ppb solution was prepared  
by dissolving diluting 16g of 500 ppb U (spike 26A)  
to 1600 g using 0.1 M NaNO<sub>3</sub>

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

50 g aliquots of the 5 ppb solution were distributed to  
20 60ml PC containers that were preweighed.  
The bottle weights and solution weights can be  
found on page 173. The remaining solution was  
placed into 2 60ml PC bottles and acidified with  
100 µl of 0.1 M HNO<sub>3</sub>. 2 1ml samples were taken from  
each for liquid scintillation analysis. The weights  
are below. The pH of each solution was adjusted  
using HNO<sub>3</sub> or NaHCO<sub>3</sub> 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*Vial 1	7.2532	8.2693	1.0161
a2	7.2446	8.1731	0.9285
b1	7.3197	8.3265	1.0108
b2	7.2665	8.2717	1.0052

9/15/94 TO EXPERIMENT B-IC

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 ± 0.001g)  
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 TO EXPERIMENT <sup>TD 9/20/94</sup> S-B-IL

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:25%	CPMB B:25%	CPMC C:25%	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	47.6355
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	1067.933	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 TO 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	20.2	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	6.14	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 REMOVED (g)	WT AFTER ZEOLITE REMOVED (g)	WT AFTER ACID ADDED (g)	WT BOTTLE 2 EMPTY (g)	WT BOTTLE 2+ ZEOLITE (g)	WT BOTTLE 2+ ACID (g)
D-I*pH2.00	77.5369	71.0487	72.4630	7.0396	12.6840	15.6597
D-I*pH3.75	76.4166	71.6172	72.2365	7.0952	12.6840	15.6597
D-I*pH4.00	75.9476	69.1618	69.7856	7.1068	12.2933	15.2970
D-I*pH4.25	74.4133	70.0609	70.6835	7.0726	11.3549	14.3576
D-I*pH4.50	76.0807	68.7954	69.4174	7.1202	14.3612	17.3645
D-I*pH4.75	76.2857	70.7852	71.4064	7.1228	12.3224	15.3295
D-I*pH5.00	75.5323	70.9001	71.5212	7.0990	11.6576	14.4312
D-I*pH5.25	74.3221	69.1579	69.7775	7.1138	12.2238	15.2298
D-I*pH5.50	73.0646	67.7836	68.4044	6.8878	12.0063	15.0142
D-I*pH5.75	74.8999	70.2427	70.8646	7.1671	11.7428	14.7460
D-I*pH6.00	75.9352	70.2326	70.8538	6.9032	12.5859	15.5906
D-I*pH6.25	74.6749	69.1160	69.7350	6.9624	12.4612	15.4708
D-I*pH6.50	71.5308	66.4952	67.1175	7.0292	12.0272	15.0324
D-I*pH6.75	74.9542	71.2734	71.8942	6.9739	10.6119	13.6167
D-I*pH7.00	75.8665	71.6699	72.2886	7.0291	11.1641	14.1666
D-I*pH7.25	75.5325	68.4101	69.0314	7.0285	14.1250	17.1334
D-I*pH7.50	75.3586	70.1320	70.7445	7.0556	12.2363	15.2373
D-I*pH7.75	77.1847	71.1024	71.7224	7.0917	13.0189	16.0421
D-I*pH8.00	73.9343	68.1724	68.7889	7.1913	12.8027	15.8031
D-I*pH9.00	74.7418	68.5478	69.1684	7.2145	13.3677	16.3696

9/28/94 RD B-III C

The equilibration with  $\text{CO}_2$  is complete. The solutions will <sup>be</sup> sampled, the pH was measured, and  $0.1 \pm 0.001$  g Na-clinoptilolite were added to each bottle. All data can be found on pages 174.

10/4/94 RD 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  
Protocol #:17ALPHA/BETA - 1.02  
U-233 3% 2 sigma

Page #1

User : Todd Dietrich

Time: 999.99

Data Mode: CPM

Background Subtract: 1st Vial

Nuclide: MANUAL

	LL	UL	LCR	25%	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:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
1	999.99	18.42	1.47	3.242	3.51
2	8.61	5.04	65.66	513.250	3.02
3	63.17	0.00	0.00	67.108	3.15
4	123.81	0.00	0.00	32.660	3.32
5	201.54	0.26	251.6	18.808	3.57
6	208.25	0.00	0.00	18.103	3.59
7	233.39	0.00	0.00	15.799	3.69
8	255.88	0.23	259.2	14.125	3.78
9	270.12	0.11	560.6	13.210	3.83
10	267.80	0.12	478.4	13.352	3.82
11	263.43	0.00	0.00	13.628	3.81
12	252.08	0.19	328.2	14.387	3.76
13	261.71	0.00	0.00	13.739	3.80
14	241.55	0.00	0.00	15.160	3.72
15	231.74	0.13	481.0	15.943	3.68
16	213.64	0.52	125.3	17.559	3.61
17	136.73	0.85	94.13	29.260	3.36
18	91.97	0.47	201.1	45.078	3.23
19	76.93	0.26	388.5	54.564	3.18
20	30.57	0.98	164.6	142.195	3.07
21	8.58	1.40	218.4	514.823	3.02

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 RD B-III C

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 <sup>using</sup> ~~according to~~ EQ3 calculated values. A table with the adjustments is <sup>below</sup> ~~on the following pages~~. These solutions were 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.  $0.1 \pm 0.001$  g Na-clinoptilolite was then added to all the bottles and they were reweighed. Those weights can be found on pg. 174.

pH	NaHCO3 to add	Add to 50 ml	molality NaHCO3	For 50 solution,	
	Moles/kg	moles NaHCO3		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	120

NAME	WT(g)
B-III C & 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	69.2696
6.75	69.9149
7.00	69.6224
7.25	69.7192
7.50	69.4632

10/13/94 TO 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 TO 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 TO 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)  $\text{HNO}_3$  and the zeolite acidified with 3ml 0.1M  $\text{HNO}_3$ . The weights can be found on page 165.

20 Oct 1994 TO

The liquid scintillation analysis of the B-III C (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 notebook.

### EXPERIMENT B-III C

08 Oct 94 07:36 ALPHA/BETA - 1.02  
 Protocol #:18 U-233 5% 2 sigma Page #1  
 User : Todd Dietrich  
 Time: 999.99  
 Data Mode: CPM Nuclide: MANUAL  
 Background Subtract: 1st Vial  
 Region A: LL UL LCR 2S% BKG  
 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-IL

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	5.2566E+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	194.881	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  
Protocol #:17ALPHA/BETA - 1.02  
U-233 3% 2 sigmaPage #1  
User : Todd Dietrich

Time: 999.99

Data Mode: CPM

Nuclide: MANUAL

Background Subtract: 1st Vial

	LL	UL	LCR	25%	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 bkgn

Coincidence Time(ns): 18

Delay Before Burst(ns): Normal

S#	TIME	CPMA A:25%	CPMB B:25%	CPMC C:25%	SIS FLAG
1	999.99	17.79	1.50	3.139	3.57
2	8.24	0.66	456.3	536.667	3.02
3	7.96	1.68	186.4	555.906	3.02
4	8.15	3.32	97.39	542.137	3.02
5	8.36	3.86	83.61	528.679	3.02
6	8.43	0.12	2360	524.382	3.02
7	8.42	1.10	274.5	524.652	3.02
8	8.52	3.34	94.67	519.631	3.01
9	9.15	0.03	10769	482.981	3.02
10	9.49	2.55	115.3	465.460	3.02
11	10.20	1.82	153.1	432.841	3.02
12	11.66	1.51	171.5	378.250	3.02
13	14.65	2.14	109.5	300.206	3.03
14	15.65	2.47	92.85	281.078	3.03
15	19.41	0.60	325.1	225.918	3.04
16	24.57	0.00	0.00	177.773	3.05
17	26.90	1.06	160.0	162.065	3.06
18	36.06	0.35	414.4	120.183	3.08
19	35.96	1.37	108.2	120.443	3.08
20	44.36	0.38	342.9	97.041	3.10
21	38.82	1.74	83.05	111.338	3.09
22	31.25	1.41	112.6	139.165	3.07
23	21.59	0.92	203.5	202.743	3.05
24	17.90	1.32	158.1	245.185	3.04
25	12.55	0.38	638.5	351.204	3.03
26	10.01	2.09	135.3	440.817	3.02
27	8.44	1.29	234.4	523.638	3.02
28	8.17	2.53	125.1	541.292	3.02
29	8.26	1.95	159.5	534.875	3.02
30	8.24	2.48	127.0	536.424	3.02

10/27/94 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

The reverse experiment was begun today. The solutions indicated in Table B-IIIc-2 had their pH's adjusted by the values listed in the same table. The weight after pH adjustment can be found in the table on page 178.



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 RB D-J

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	NAME	WT TUBE (g)	WT VIAL (g)	WT VIAL + SAMPLE (g)
are the samples	D-I*pH2.00*Z	15.5767	7.6484	8.1449
of the zeolite/acid	D-I*pH3.75*Z	14.2625	7.7830	8.2788
mixture	D-I*pH4.00*Z	15.1591	7.7696	8.2632
Labled ...*Z for	D-I*pH4.25*Z	14.3011	7.7563	8.2501
zeolite	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	14.9917	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	NAME	WT TUBE (g)	WT VIAL (g)	WT VIAL + SAMPLE (g)
are the samples	D-I*pH2.00*RS	72.4231	7.7230	8.2269
taken from	D-I*pH3.75*RS	72.2142	7.7317	8.2340
the remaining	D-I*pH4.00*RS	69.7829	7.7310	8.2315
solution.	D-I*pH4.25*RS	70.6697	7.6952	8.1939
Labled ...*RS	D-I*pH4.50*RS	69.3989	7.7347	8.2363
for remaining	D-I*pH4.75*RS	71.2995	7.7178	8.2155
solution	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	7.7281	8.2366
	D-I*pH7.25*RS	69.0227	7.7296	8.2337
	D-I*pH7.50*RS	70.5783	7.7039	8.2144
	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 TB 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 pages. All other data will be on pages 166-167.

SOLN NAME	WT. BOTTLE + SOLN (g)
B-IC *pH4.50	68.2803
B-IC *pH5.00	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-III C pH2.00	13.4904	65.4216
2.25	12.9447	65.7965
2.50	13.5210	65.4975
2.75	13.7301	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	65.2764
7.75	13.4355	65.0015
8.00	13.5821	65.7491
8.25	12.4730	66.4020
8.50	11.5319	67.5774
8.75	13.5373	65.6280
9.00	12.9896	66.0430

29 Nov 1994 TD

The liquid scintillation Analysis of the B-III C, B<sup>0</sup>-II C (Reverse and desorption), and D<sup>-</sup>I (desorp) has finished. Raw data & results of calculations follows. Verification of calculations can be found on page 143-144 of this book.

B-III C

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-III C pH2.00	2	48.507	97.816	1.1311E+13	1.8780E-11	4.3765
B-III C pH2.25	3	50.964	102.461	1.1848E+13	1.9672E-11	4.5843
B-III C pH2.50	4	47.996	96.069	1.1109E+13	1.8445E-11	4.2983
B-III C pH2.75	5	45.322	91.063	1.0530E+13	1.7483E-11	4.0743
B-III C pH3.00	6	48.791	98.448	1.1384E+13	1.8901E-11	4.4048
B-III C pH3.25	7	46.785	94.154	1.0888E+13	1.8077E-11	4.2126
B-III C pH3.50	8	46.894	94.927	1.0977E+13	1.8225E-11	4.2472
B-III C pH3.75	9	42.884	86.216	9.9699E+12	1.6653E-11	3.8575
B-III C pH4.00	10	37.237	75.287	8.7060E+12	1.4455E-11	3.3685
B-III C pH4.25	11	28.718	58.028	6.7102E+12	1.1141E-11	2.5963
B-III C pH4.50	12	27.417	55.065	6.3676E+12	1.0572E-11	2.4637
B-III C pH4.75	13	22.675	45.743	5.2897E+12	8.7824E-12	2.0467
B-III C pH5.00	14	13.956	28.575	3.3043E+12	5.4862E-12	1.2785
B-III C pH5.25	15	17.004	34.589	3.9998E+12	6.6409E-12	1.5476
B-III C pH5.50	16	9.690	19.739	2.2826E+12	3.7898E-12	0.8832
B-III C pH5.75	17	6.966	14.182	1.6399E+12	2.7228E-12	0.6345
B-III C pH6.00	18	6.674	13.609	1.5737E+12	2.6129E-12	0.6089
B-III C pH6.25	19	6.388	13.013	1.5048E+12	2.4984E-12	0.5822
B-III C pH6.50	20	4.580	9.366	1.0831E+12	1.7982E-12	0.4191
B-III C pH6.75	21	5.304	10.770	1.2454E+12	2.0677E-12	0.4819
B-III C pH7.00	22	9.678	19.747	2.2835E+12	3.7913E-12	0.8835
B-III C pH7.25	23	15.117	30.763	3.5574E+12	5.9063E-12	1.3764
B-III C pH7.50	24	23.886	48.687	5.6301E+12	9.3476E-12	2.1784
B-III C pH7.75	25	25.143	51.523	5.9579E+12	9.8920E-12	2.3052
B-III C pH8.00	26	38.407	78.881	9.1216E+12	1.5145E-11	3.5293
B-III C pH8.25	27	43.230	88.586	1.0244E+13	1.7008E-11	3.9635
B-III C pH8.50	28	45.735	93.375	1.0798E+13	1.7927E-11	4.1778
B-III C pH8.75	29	48.472	99.614	1.1519E+13	1.9125E-11	4.4569
B-III C 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

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22 Nov 94 05:07  
Protocol #:17ALPHA/BETA - 1.02  
U-233 3% 2 sigmaPage #1  
User : Todd DietrichTime: 999.99  
Data Mode: CPM  
Background Subtract: 1st Vial  
Nuclide: MANUAL

	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	2403.585 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  
Protocol #:17ALPHA/BETA - 1.02  
U-233 3% 2 sigmaPage #2  
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	5.6659
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	2403.665	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	4.7562E+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	1.4668E-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	1084.225	1076.806	1.2450E+14	2.0670E-10	48.1696
Validation		500.000	1000.000	1.1564E+14	1.9199E-10	44.7421

2 Dec 1994 TO EXPERIMENT B-IIIc

The reverse and desorption experiments were sampled today. All data (wt%, 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.

NAME WT BOTTLE(g)

B-IIIc\*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

WT BOTTLE, zeolite (g)

WT BOTTLE, CONTAINER (g)

B-IIIc\*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 12.4960 66.2782

8.25 13.6872 64.7099

8.50 14.2177 65.2118

8.75 12.8209 66.3507

9.00 14.2144 65.3305

solid  
desorption

reverse

container  
desorption

07 Dec 1994 B-III C

The liquid scintillation analysis of the  
B-III C <sup>90</sup>Y samples has finished. The results  
of analysis and results of calculations follow.  
Calculations are verified on page 143-144 of this notebook.

07 Dec 94 07:43 ALPHA/BETA - 1.02  
Protocol #:18 U-233 5% 2 sigma Page #1  
User : Todd DietrichTime: 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 6.02 728.91	
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	

07 Dec 94 23:19 ALPHA/BETA - 1.02  
Protocol #:18 U-233 5% 2 sigma Page #2  
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	28.60	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-III C*PH2.00	11	58.077	57.696	6.6719E+12	1.1077E-11	2.5814
B-III C*PH2.25	12	56.835	56.676	6.5539E+12	1.0881E-11	2.5358
B-III C*PH2.50	13	57.267	57.875	6.6925E+12	1.1112E-11	2.5894
B-III C*PH2.75	14	54.331	54.764	6.3327E+12	1.0514E-11	2.4502
B-III C*PH3.00	15	61.354	60.010	6.9394E+12	1.1621E-11	2.6850
B-III C*PH3.25	16	67.846	68.256	7.8929E+12	1.3105E-11	3.0539
B-III C*PH3.50	17	83.526	83.878	9.6995E+12	1.6104E-11	3.7529
B-III C*PH3.75	18	96.362	96.275	1.1133E+13	1.8484E-11	4.3076
B-III C*PH4.00	19	141.82	141.717	1.6388E+13	2.7209E-11	6.3407
B-III C*PH4.25	20	149.03	149.693	1.7310E+13	2.8740E-11	6.6976
B-III C*PH4.75	21	248.69	246.981	2.8560E+13	4.7419E-11	11.0504
B-III C*PH5.25	22	267.98	270.009	3.1223E+13	5.1840E-11	12.0808
B-III C*PH5.75	23	337.65	340.612	3.9388E+13	6.5395E-11	15.2397
B-III C*PH6.25	24	501.83	503.137	5.8182E+13	9.6599E-11	22.5114
B-III C*PH7.25	25	395.56	401.255	4.6400E+13	7.7038E-11	17.9530
B-III C*PH7.75	26	338.59	338.318	3.9122E+13	6.4955E-11	15.1371
B-III C*PH8.00	27	166.22	165.537	1.9142E+13	3.1782E-11	7.4065
B-III C*PH8.25	28	90.201	90.910	1.0513E+13	1.7454E-11	4.0675
B-III C*PH8.50	29	60.416	60.830	7.0342E+12	1.1679E-11	2.7216
B-III C*PH8.75	30	45.027	45.249	5.2325E+12	8.6875E-12	2.0245
B-III C*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-III C*PH4.50	2	46.782	92.821	1.0734E+13	1.7821E-11	4.1530
B-III C*PH5.00	3	37.583	75.392	8.7182E+12	1.4475E-11	3.3732
B-III C*PH5.50	4	29.365	58.391	6.7522E+12	1.1211E-11	2.6126
B-III C*PH6.00	5	19.816	39.735	4.5949E+12	7.6289E-12	1.7778
B-III C*PH6.50	6	16.456	32.703	3.7817E+12	6.2787E-12	1.4632
B-III C*PH6.75	7	26.958	53.765	6.2173E+12	1.0323E-11	2.4056
B-III C*PH7.00	8	40.785	81.456	9.4194E+12	1.5639E-11	3.6445
B-III C*PH7.50	9	43.137	85.555	9.8934E+12	1.6426E-11	3.8279

Solid desorption

Reverse

Container  
desorption

SOLN. NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
B-III C*PH2.00	34	94.960	95.822	1.1081E+13	1.8397E-11	4.2873
B-III C*PH2.25	32	99.692	100.334	1.1602E+13	1.9264E-11	4.4892
B-III C*PH2.50	35	93.597	94.266	1.0901E+13	1.8099E-11	4.2177
B-III C*PH2.75	36	96.115	97.204	1.1240E+13	1.8662E-11	4.3491
B-III C*PH3.00	37	93.885	95.054	1.0992E+13	1.8250E-11	4.2529
B-III C*PH3.25	38	91.866	92.982	1.0752E+13	1.7852E-11	4.1602
B-III C*PH3.50	39	90.256	91.408	1.0570E+13	1.7550E-11	4.0898
B-III C*PH3.75	40	91.249	91.542	1.0586E+13	1.7575E-11	4.0958
B-III C*PH4.00	41	87.914	88.356	1.0217E+13	1.6964E-11	3.9532
B-III C*PH4.25	42	79.924	80.277	9.2831E+12	1.5413E-11	3.5918
B-III C*PH4.75	43	68.850	69.412	8.0267E+12	1.3327E-11	3.1056
B-III C*PH5.25	44	65.438	66.846	7.6143E+12	1.2642E-11	2.9461
B-III C*PH5.75	45	56.948	58.063	6.7142E+12	1.1148E-11	2.5979
B-III C*PH6.25	46	31.618	31.950	3.6947E+12	6.1342E-12	1.4295
B-III C*PH7.25	47	42.145	42.357	4.8980E+12	8.1322E-12	1.8951
B-III C*PH7.75	48	57.062	57.245	6.6197E+12	1.0991E-11	2.5613
B-III C*PH8.00	49	81.283	82.546	9.5454E+12	1.5848E-11	3.6933
B-III C*PH8.25	50	91.144	91.080	1.0532E+13	1.7487E-11	4.0751
B-III C*PH8.50	51	90.201	91.066	1.0531E+13	1.7484E-11	4.0745
B-III C*PH8.75	52	96.736	97.990	1.1331E+13	1.8813E-11	4.3843
B-III C*PH9.00	53	94.184	97.157	1.1235E+13	1.8654E-11	4.3470

092975 - RJP

Preparation of  $\gamma$ - $\text{Al}_2\text{O}_3$ ,  $\gamma$ - $\text{O}_2$  (am),  
and Kaurandite samples  
for EXAFS analysis

Objective: U-loaded minerals  
will be prepared and sent to  
LNL for EXAFS study  
of the structure of  $\gamma$ - $\text{Al}_2\text{O}_3$  U.

Supplies:

①  $\gamma$ -alumina - purchased  
from Alfa Aesar, Lot #  
C16819;  
99.97% purity; surface area  
approx. 100 m<sup>2</sup>/g

② amorphous  $\gamma$ - $\text{O}_2$  -  
from Alfa Aesar, Lot #  
J25005; 99.8%  
purity; surface area approx.  
400 m<sup>2</sup>/g

③ Kaurandite - locality  
Pronah, Maharashtra State,  
India

Stock solution used:

1000 ppm  $\text{U}^{238}$  prepared on  
12/08/94 by RTP from reagent  
grade  $\text{U}_3\text{O}_8$  (Lot # 66420)  
(Mallinckrodt Lot # 66406CXP)  
and deionized  $\text{H}_2\text{O}$ .

1110 hrs - RJP

Prepare 5 ppm  $\text{U}^{238}$  solutions  
by diluting 5 gms of the  
1000 ppm stock to 1000 gms  
with deionized  $\text{H}_2\text{O}$ .

Prepare solutions in polycarb  
bottles labeled:

EXAFS  $\gamma$ - $\text{Al}_2\text{O}_3$  \* 1

EXAFS  $\gamma$ - $\text{O}_2$  \* 2

EXAFS  $\text{UO}_2$  \* 1

EXAFS  $\text{SiO}_2$  \* 2

1130 hrs - Measure pH of each soln.  
Deionized calibrated using buffers  
prepared on 06/29/95 by M. Mendenhall.  
pH 2, 4, 7 buffers read  
2.04, 4.03 & 7.03 respectively.

pH values of U solutions are:

EXPTS  $\text{Al}_2\text{O}_3$ -1 pH 4.97

EXPTS  $\text{Al}_2\text{O}_3$ -2 5.01

EXPTS  $\text{SiO}_2$ -1 5.02

EXPTS  $\text{SiO}_2$ -2 5.01

EQ3 predicted pH of a  
5 ppm  $\text{UO}_2(\text{NO}_3)_2$  solution  
is 4.85.

1400 hrs - measured pH of the  
100 ppm U stock soln  
= 3.49

EQ3 predicted pH = 3.43

1415 hrs - Approx. 30 ml aliquots  
were taken from each  
100 ml U soln &  
transferred to 60 ml FEP  
bottles labeled

EXPTS  $\text{Al}_2\text{O}_3$  #1 & SAN

etc.

Some of each U analyses  
using polarography.

1500 hrs - Weigh out 1.0 g of  
 $\text{SiO}_2$  (amorph) or  $\gamma\text{-Al}_2\text{O}_3$   
onto weighing paper, then  
transfer into U solutions.

1615 hrs - Remeasure the pH of U soln:

	pH
EXPTS $\text{Al}_2\text{O}_3$ #1	5.05
" " #2	5.17
EXPTS $\text{SiO}_2$ #1	4.54
" " #2	4.55

pH of silica/U mixture  
went down!

092995 - RPP

0830 hrs - Measure pH of U/soln  
mixture

	pH	
buffer 2	2.04	NO meas. b. done.
buffer 4	4.05	
buffer 7	7.03	

EXPTS  $\text{Al}_2\text{O}_3$  #1 5.02

EXPTS  $\text{Al}_2\text{O}_3$  #2 5.07

EXPTS  $\text{SiO}_2$  #1 4.54

EXPTS  $\text{SiO}_2$  #2 4.52



1200 hrs - ~~WJ~~

Prepare 10 ppm U solutions by  
diluting 10 g of 1000 ppm stock  
to 1000 g with distilled water in  
PC bottles labeled  
EXATS-5:02x3 and  
EXATS-5:03x3.

Measure pH of U solution:

Measure pH	pH
buffer 2	2.02
buffer 4	4.04
buffer 7	7.05
EXATS-5:02x3	4.82
EXATS-5:03x3	4.82

1400 hrs - ~~WJ~~

Take 20 ml aliquots from  
EXATS-5:02x3 and EXATS-5:03x3  
transfer into 60 ml PET bottles  
labeled ... & ...

1515 hrs - ~~WJ~~

Add 1 g  $\text{Na}_2\text{CO}_3$  or  
1 g concn.  $\text{NaOH}$  to  
U solutions.

1540 - ~~WJ~~

Prepare 0.05 M U solution in water

Dissolved 25.105 g  $\text{SO}_2(\text{aq}) \cdot 6\text{H}_2\text{O}$   
in 1000 g H<sub>2</sub>O. Label EXATS-6:01x1

Measure pH

Measure pH	pH
buffer 2	2.02
buffer 4	4.04
buffer 7	7.04
0.05M U	2.85
EXATS-6:02x3	5.62
EXATS-5:02x3	4.38

EXATS-6:01x1  
pH 2.85  
pH 5.62  
pH 4.38

1600 hrs - Take 20 ml of the 0.05 M U  
solution transfer to 60 ml PET  
bottle labeled EXATS-6:01x1

Measure pH of U solution +  
gaseous mixture:

EXATS-6:01x1	6.57
EXATS-6:02x2	6.42
EXATS-5:02x1	6.70
EXATS-5:02x2	6.36
EXATS-6:03x3	6.68
EXATS-5:02x3	6.58

10025 - MJP  
 0900 hrs - Measure pH of U solution  
 & solvent mixtures;

Calibrate using pH 2, 4, 7, 9 buffers  
 prepared by M. K. M. in lab  
 on 6/28/25

Measured pH	Adj. pH to
buffer 7 7.10	check → 7.00
EXPS * H <sub>2</sub> O <sub>2</sub> #1 6.07	6.80
EXPS * H <sub>2</sub> O <sub>2</sub> #2 5.96	6.77
EXPS * H <sub>2</sub> O <sub>2</sub> #3 6.00	6.68
EXPS * H <sub>2</sub> O <sub>2</sub> #1 6.25	6.63
EXPS * H <sub>2</sub> O <sub>2</sub> #2 6.10	6.51
EXPS * H <sub>2</sub> O <sub>2</sub> #3 6.21	7.28

Adjust pH higher with  
 0.5 M NaOH or 0.1 M HCl

1045 hrs - MJP  
 Measure pH of 0.05 M U soln  
 (EXPS \* H<sub>2</sub>O<sub>2</sub>) = 7.76

1050 hrs - Separated two single crystals  
 of heulandite from specimen  
 of intergrowth heulandite  
 (Gyokko; Polaris, India).

① ~ 6.1 x 1.3 x 0.6 cm / 1.29 gm  
 ② ~ 0.7 x 0.6 x 0.6 cm / 0.11 gm

1100 hrs - MJP  
 The big crystal of heulandite  
 (1.29 gm) was added to the  
 0.05 M U solution (EXPS \* H<sub>2</sub>O<sub>2</sub>)

100325 - MJP

1022 hrs - Measure pH of U +  
 solvent mixture  
 (No recalibration  
 done)

buffer	2	pH measured
"	4	2.00
"	7	4.00
"	7	7.00
EXPS * H <sub>2</sub> O <sub>2</sub> #1		6.49
" #2		6.44
" #3		6.40
EXPS * H <sub>2</sub> O <sub>2</sub> #1		6.48
" #2		6.33
" #3		6.59
EXPS * H <sub>2</sub> O <sub>2</sub> #1		7.76

1608 hrs - Measure pH

buffer	2	pH measured
"	4	1.99
"	7	4.61
"	7	7.01
EXPS * H <sub>2</sub> O <sub>2</sub> #1		6.51
" #2		6.43
" #3		6.42
EXPS * H <sub>2</sub> O <sub>2</sub> #1		6.41
" #2		6.39
" #3		6.69

1090 hrs — Added 0.824 g  $\text{NaNO}_3$   
to  $\text{EXPS} \times \text{Al}_2\text{O}_3 \times 1$  &  
 $\text{EXPS} \times \text{SiO}_2 \times 1$ .

10/4/45 MJP The  $\text{NaNO}_3$   
was added to try to flocculate  
the colloids, particularly the  
 $\gamma$ - $\text{Al}_2\text{O}_3$  1 to make  
ultrafiltration easier  
(due to smaller volume).  
 $\text{NaNO}_3$  lot # 930601  
Fisher reagent

10/4/45 MJP

0845 hrs — No flocculation  
observed on  $\gamma$ - $\text{Al}_2\text{O}_3$ .  
Added additional 7.421 g  
 $\text{NaNO}_3$  to  $\text{EXPS} \times \text{Al}_2\text{O}_3 \times 1$   
&  $\text{EXPS} \times \text{SiO}_2 \times 1$  (total  
 $\text{NaNO}_3$  concentration = 0.14)

11/5 hrs — MJP

Measured pH:

buffer 2	2.00
" 4	4.01
" 7	6.99
$\text{EXPS} \times \text{Al}_2\text{O}_3 \times 1$	6.91
" $\times 2$	6.39
" $\times 3$	6.38
$\text{EXPS} \times \text{SiO}_2 \times 1$	6.09
" 2	6.27
" 3	6.53

1390 hrs — Take 30 ml aliquots from the  
 $\text{EXPS} \times \text{Al}_2\text{O}_3 \times 1, 2, 3$  &  $\text{EXPS} \times \text{SiO}_2 \times 1, 2, 3$   
mixtures. Transfer into 60 ml FEP  
bottles, labeled  $\text{EXPS} \times \dots$  &  $\text{SiO}_2 \times 2$ .

1345 hrs — Add 7.29 g  $\text{NaNO}_3$  to the  
remaining 940 ml suspensions of  
 $\text{EXPS} \times \text{Al}_2\text{O}_3 \times 3$  &  $\text{EXPS} \times \text{SiO}_2 \times 3$ ,  
to flocculate most of the colloidal  
particle.

1400 hrs — PM mixture  $\text{EXPS} \times \text{Al}_2\text{O}_3 \times 2$  &  
 $\text{EXPS} \times \text{SiO}_2 \times 2$ , which have 0.1M  
 $\text{NaNO}_3$  mixture & which have  
most of the  $\text{Al}_2\text{O}_3$  &  $\text{SiO}_2$  flocculated  
at the bottom of the container, remove  
the volume of colloidal suspension  
by decanting most of the clear  
or semiclear solution down the sink.  
Initiate ultrafiltration of the  
 $\text{EXPS} \times \text{SiO}_2 \times 1$  colloidal suspension  
using the spectrum stirred cell.  
Inject ~11 ml of mixture into the  
cell. Start stirring & pressurize  
to 40 psi with  $\text{N}_2$  gas.

10/10/45 — MJP

1946 hrs — Measure pH

buffer 2	2.00	pH measured (No results done)
" 4	4.01	
" 7	7.01	
$\text{EXPS} \times \text{Al}_2\text{O}_3 \times 2$	6.40	pH went down
" $\times 3$	6.50	
$\text{EXPS} \times \text{SiO}_2 \times 2$	6.30	
" $\times 3$	5.56	

add 20  $\mu$ l of 0.5 M NaOH  
to ~~EXPS#5, 0.2 #3~~.  
pH measure = 6.47

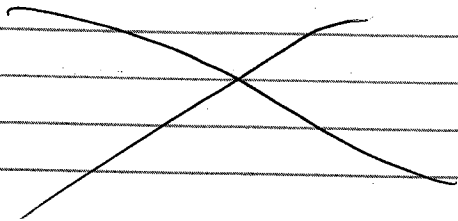
1000 hrs - Prepare 100  $\mu$ l of (1 M triethanolamine + 1 M fumaric acid) > 44.  
Use 14.9 g triethanolamine  
fisher lot # 91094 J  
15.0 g fumaric acid request  
fisher lot # 920136  
dilute to 100  $\mu$ l w/ de I  
used in 100  $\mu$ l sol. stage  
transfer to pH bottle.

1015 hrs - Prepare 0.5, 1, 2, 3, 4, 5 ppm  
U standard solutions in  
0.05 M TT matrix. Use ~~expt.~~  
micropipets + 1000 ppm ~~stock~~  
stock solution 2 1 M TT  
stock solution

1030 hrs - Re-measure pH  

buffer 2	2.00
4	4.02
7	7.03
<del>EXPS#5, 0.2 #3</del>	6.27

 add  
10  $\mu$ l of  
0.5 M NaOH  
pH measure = 6.53



1400 hrs - Reduce volume of ~~EXPS#5, 0.2 #3~~  
2 ~~EXPS#5, 0.2 #3~~ to 20  $\mu$ l by pipetting  
out + discarding the relatively clear  
solution above the flocculated particles.  
start ultrafiltration of the  
~~EXPS#5, 0.2 #3~~ with the stirred  
cell (1000 MWCO filter).

Transfer filtered ~~EXPS#5, 0.2 #3~~ 1  
to plastic vial, labeled ~~EXPS#5, 0.2 #3~~.

106/25 pH  
1030 hrs - calibrate pH electrode  
w/ buffers 2, 4, 7, 10  
4/10/99 Measure pH of U solns.  
meas. pH

buffer 2	2.00
" 4	4.01
" 7	7.00
<del>EXPS#5, 0.2 #2</del>	6.40
<del>EXPS#5, 0.2 #2</del>	6.27
<del>EXPS#5, 0.2 #3</del>	6.03
<del>EXPS#5, 0.2 #1</del>	2.73

 add 20  $\mu$ l  
of 0.5 M  
NaOH  
measured pH  
= 6.62

1000 hrs - Ultrafiltration of ~~EXPS#5, 0.2 #3~~ 1  
was completed. Filtrate transferred  
to plastic vial, labeled ~~EXPS#5, 0.2 #3~~ 1.

1030 hrs Re-measure pH of  
~~EXPS#5, 0.2 #3~~ = 6.46



1040 hrs - measure volume of  $\text{OAPS} \cdot \text{SiO}_2 \cdot 2$  by decanting & discarding clear solution. Volume ~ 30 ml. Initiate ultrafiltration.

1040 hrs - Finishing ultrafiltration of  $\text{SiO}_2$  sample. Transfer to plastic vial labeled  $\text{OAPS} \cdot \text{SiO}_2 \cdot 3$ .

10/9/85 MJD

0915 hrs - Calculate  $\text{wt} \%$  of  $\text{SiO}_2$  in buffer 2.  $\frac{4.7}{25.0} = 9.8\%$

	wt % $\text{SiO}_2$
$\text{OAPS} \cdot \text{SiO}_2 \cdot 2$	6.39
$\text{OAPS} \cdot \text{SiO}_2 \cdot 3$	6.24
$\text{OAPS} \cdot \text{SiO}_2 \cdot 1$	2.75
buffer 2	6.99

1130 hrs - removed the heulandite crystal from the  $\text{OAPS}$  solution. Rinsed briefly with deion. Air dry in Kimwipe. Transfer to plastic vial labeled  $\text{OAPS} \cdot \text{SiO}_2 \cdot 1$ .

1150 hrs - packaged  $\text{OAPS} \cdot \text{SiO}_2 \cdot 1$ ,  $\text{OAPS} \cdot \text{SiO}_2 \cdot 2$ ,  $\text{OAPS} \cdot \text{SiO}_2 \cdot 3$ ,  $\text{OAPS} \cdot \text{SiO}_2 \cdot 4$ ,  $\text{OAPS} \cdot \text{SiO}_2 \cdot 5$  &  $\text{OAPS} \cdot \text{SiO}_2 \cdot 6$  to EHDSON of UNC.

1400 hrs - Initiate ultrafiltration of mixture  $\text{OAPS} \cdot \text{SiO}_2 \cdot 2$ .

10/10/85 MJD

1530 hrs - complete ultrafiltration of mixture  $\text{OAPS} \cdot \text{SiO}_2 \cdot 2$ . The latter part of the filtration step was done with W stirring; the stirrer got stuck.

Transfer filtrate to plastic vial labeled  $\text{OAPS} \cdot \text{SiO}_2 \cdot 2$ .

11/10/85 MJD

1100 hrs - Samples prepared for surface area analysis using the Coulter SA 3100 with  $\text{N}_2$  gas.

Sample ID	Sample Desc.
110285-1	NIST 8007 standard 0.069 $\text{m}^2/\text{g}$ reported surface area
110285-2	After used in U & N sorption expts; used in sand; W970460/1000000000 to HCL
110285-3	After used in NP sorption expts; ground from 1/22; W970460/1000000000 to HCL & 25000

continued on p. 17

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	Al <sub>2</sub> O <sub>3</sub>	33.2350	42.8236				see page	
110295-2	Al <sub>2</sub> O <sub>3</sub>	33.4841	42.2049				268	
110295-3	Al <sub>2</sub> O <sub>3</sub>	33.6828	42.7789					
110295-4	Al <sub>2</sub> O <sub>3</sub>	29.7794	30.7589					
110295-5	Al <sub>2</sub> O <sub>3</sub>	29.2099	29.4088					
110295-6	Al <sub>2</sub> O <sub>3</sub> (am)	29.2099	29.2815					
110295-7								
110295-8								
110295-9								
110295-10								

Sample ID

110295-4

Sample Description

Al<sub>2</sub>Smiles 8571  
 NIST standard;  
 this standard  
 provided w/ the  
 equipment;  
 158 m<sup>2</sup>/g reported  
 surface area

110295-5

γ-Al<sub>2</sub>O<sub>3</sub> used SN  
 GFS study;  
 purchased from  
 Alfa Aesar.

110295-6

γ-Al<sub>2</sub>O<sub>3</sub> (am) used  
 SN GFS study;  
 purchased from  
 Alfa Aesar.

Results on wet  
 weight.

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 <sup>2</sup> /g)	One-Pl. BET (m <sup>2</sup> /g)
110295-1	11/8/95	NIST 8007	33.2350	42.8238	9.5888	42.8138	9.5788	0.077	0.073
110295-1	11/8/95	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*RF*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*RF*HL*325*UC	33.6828	37.7889	4.1161	37.7882	0.5870	0.568	
110295-3	11/9/95	W510*60/100*UC*RC*RF*HL*325*UC	same sample				0.5860	0.567	
110295-3	11/13/95	W510*60/100*UC*RC*RF*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-Al <sub>2</sub> O <sub>3</sub>	29.2099	29.4088	0.1989	sample entrained during vacuum			
110295-6	11/9/95	SiO <sub>2</sub> (am)	29.2094	29.2815	0.0721	29.2693	0.0599	error: problem w/ tube???	

11/13/95 RJA

samples prepared for surface  
area analysis as on 11/10/95.  
sample ID ~~110295-1~~ 110295-1

110295-1 to 110295-6 have  
the sample sample descriptions  
as 110295-1 to 110295-6.  
Additional samples of T-H<sub>2</sub>O<sub>2</sub>  
& SiO<sub>2</sub>(am) were prepared and  
given sample IDs 110295-7  
and 110295-8, respectively.  
Results on next page.  
(page 222)

1/11/96 RWD  
 1000ms - prepared  $5 \times 10^{-3}$  M  $UO_2(NO_3)_2$  solution.  
 used 2.907 g  $UO_2(NO_3)_2 \cdot 6H_2O$  reagent  
 (Mallenbach lot # 8640 KLS) and 1000 g deion H<sub>2</sub>O in  
 polypropylene bottle.

Transfer 20 g of  $5 \times 10^{-3}$  M U into  
 polycarb bottle, dilute to  
 1000 g with deion H<sub>2</sub>O.  
 Label EXPTS & MONT #1  
 ( $2U_i = 1 \times 10^{-4}$  M)

Transfer 20 g of  $5 \times 10^{-3}$  M U into  
 polycarb bottle, add 5.844 g  
 NaCl, dilute to 1000 g  
 total wt (U soln + H<sub>2</sub>O)  
 using deion H<sub>2</sub>O.  
 Label EXPTS & MONT #2.  
 ( $2U_i = 1 \times 10^{-4}$  M)

Transfer 20 g of  $5 \times 10^{-3}$  M U into  
 polycarb bottle, add 0.5844 g  
 NaCl, dilute to 1000 g (U + H<sub>2</sub>O)  
 using deion H<sub>2</sub>O.  
 Label EXPTS & MONT #3  
 ( $2U_i = 1 \times 10^{-4}$  M)

Transfer 10 g of  $5 \times 10^{-3}$  M U into  
 polycarb bottle, add deion H<sub>2</sub>O  
 to make 1000 g total.  
 RWD 11/11/96  
 Add 5.844 g NaCl, then  
 H<sub>2</sub>O to make 1000 g  
 total (U + H<sub>2</sub>O)  
 Label EXPTS & MONT #4.  
 ( $1.5 \times 10^{-4}$  M)

prepare 0.01 M  $SO_2(NO_3)_2$  solutions:  
 1) dissolve 5.0213 g  $SO_2(NO_3)_2 \cdot 6H_2O$   
 in 1000 g H<sub>2</sub>O; 11/11/96  
 Label EXPTS & MONT #4  
 2) same as in 1, label  
 EXPTS & MONT #4

1/12/96 RWD

120 ml 0.01 M U solutions)  
 0900 hrs - Take 30 ml aliquots from  
 each of the solutions prepared  
 yesterday and transfer into 30 ml  
 PP bottles labeled, e.g.,  
 EXPTS & MONT #1 & 5000...  
 some SA later analysis  
 of U conc. by polarography.

0930 hrs - Measure the pH of EXPTS  
 solutions. Calibrate electrode  
 with buffers 2, 4, 7 prepared  
 in 6/28/95.  
 slope = 98%

Solution		pH meas	Compare BQ3 calc.
buffer	2	2.00	
	4	4.00	
	7	7.00	
EXPTS & MONT #1		4.51	4.44
	#2	4.61	4.61
	#3	4.56	4.50
	#4	4.62	4.79
EXPTS & MONT #4		3.16	3.19
EXPTS & MONT #4		2.00	2.10



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 <sup>2</sup> /g)	One-Pt. BET (m <sup>2</sup> /g)
111395-1	11/15/95	NIST 8007	33.2236	42.8222	9.5986	42.8063	9.5847	0.067	0.081
111395-2	11/15/95	W510*60/100*UC*RC*RF*HL	33.8809	42.3658	8.8849	42.3648	8.8839	0.03	0.027
111395-3	11/16/95	W510*60/100*UC*RC*RF*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	0.5942	163.983	160.763
111395-5	not done	gamma-Al <sub>2</sub> O <sub>3</sub>	28.3317	28.4313	0.0996	28.3205	-0.0112	negative weight	not done
111395-6	11/15/95	SiO <sub>2</sub> (am)	65.6818	65.7283	0.0465	65.7242	0.0424	370.144	364.814
111395-7	11/16/95	gamma-Al <sub>2</sub> O <sub>3</sub>	65.8338	65.8574	0.0536	65.8845	0.0507	86.886	85.163
111395-8	11/16/95	SiO <sub>2</sub> (am)	65.74	65.7782	0.0382	65.7746	0.0346	370.142	364.39

The measured pH SA ~~extremely~~ appear too high compared to the result 7 is close to value SN ~~extremely~~ 2, w/c is at twice the volume but same m/c conc. Possible error in dilution (may have used 20 g instead of 10 g of ~~extremely~~ stock solution).

11/15/95 - prepared new ~~extremely~~ solution. Dilute 10 g of ~~extremely~~ to 100 g (with 5.844 g NaCl added). Label PC bottle ~~extremely~~ 4 B.

Measured pH of ~~extremely~~ is 4.87, close to ~~extremely~~ value of 4.79.

Remeasure ~~extremely~~, pH = 4.62 same as before.

Thus, error is indicated SN preparation of ~~extremely~~ 4.

1300 hrs - Add 0.97 g amorphous silica (see page 202) to ~~extremely~~ 4 solution.

Add 0.97 g  $\gamma$ -alumina (see page 202) to ~~extremely~~ 4 solution.

Measure pH of DAB\*Mat\*1 = 4.51  
Adjusted to 4.00 by add'n  
of aliquots 0.1M & 0.02M  
HNO<sub>3</sub> solutions using  
Eppendorf 250 µL pipette

Measure pH of DAB\*Mat\*2 = 4.58 A?  
Adjusted to 4.03 by addition  
of 1,000 µL of 0.1M HNO<sub>3</sub>.

Measure pH of DAB\*Mat\*3 = 4.97  
Adjusted to 4.02 by addition of  
1000 µL of 0.1M HNO<sub>3</sub> +  
250 µL of 0.02M HNO<sub>3</sub>.

Measure pH of DAB\*Mat\*4 =  
N/A 1/12/96

1400 hrs - Add 0.97 g of monochloride  
(5.42 µL of 2.2% F1\*Ser) to the  
following: DAB\*Mat\*1  
DAB\*Mat\*2  
DAB\*Mat\*3  
DAB\*Mat\*4B

Put all solutions in gyrotary  
shaker loosely capped,  
start shaker.

1630 hrs - Measure pH of solutions!

soln	pH	pH adj
buffer 2	1.96	—
4	3.98	—
7	7.01	—
DAB*Mat*1	5.67	add 2.5 µL 0.1M HNO <sub>3</sub> 3.99
*2	4.26	add 0.5 µL 0.1M HNO <sub>3</sub> 4.03
*3	4.50	add 0.1 µL 0.1M HNO <sub>3</sub> 4.02
*4B	5.01	add 0.5 µL 0.05M NaOH 6.97
DAB*Ser*4	3.06 A?	—
DAB*Al*4	3.22 A	—

01/15/96, N/A

0830 hrs - Measure pH of U & Lys.  
No recalc. done.

soln	pH	pH adj
buffer 2	2.01	—
4	4.01	—
7	7.00	—
DAB*Mat*1	4.47	—
*2	4.19	add 1.0 µL 0.1M HNO <sub>3</sub> 4.00
*3	4.19	add 0.5 µL 0.1M HNO <sub>3</sub> 3.98
*4B	4.30	add 0.1 µL 0.1M HNO <sub>3</sub> 4.02
DAB*Ser*4	6.02	add 0.5 µL 0.05M NaOH 6.41
DAB*Al*4	3.13	—
	3.40	—

0930 hrs - Prepare 0.01M V soln  
by dissolving 0.0213g  $\text{VCl}_3$  (96%)  
in 1000 ml of H<sub>2</sub>O. Polycond  
bottle labeled  
EXPS & Mont #5

Measured pH = 3.25  
(compare to 3 calc pH = 3.18)

Take 20 ml of EXPS & Mont #5  
and transfer into 100 ml bottle  
labeled EXPS & Mont #5 & SPLN  
SN later U analysis.

Add 0.97 g of  $\text{SnCl}_4 \cdot 5\text{H}_2\text{O}$  to the 100 ml  
bottle. Place on magnetic stirrer.

1000 hrs - Pumped solution  
EXPS & Mont #4 into sink  
while water is running.  
Polycond bottle cleaned  
SN Venge.

01/14/96 JRP

0930 hrs. - measuring pH of solns  
No rec'd.

ml	pH		
1	4.99		
2	4.10		
3	3.01		
4	4.11	add 200 ml	4.09
5	4.07	add 200 ml	
6	4.13	add 200 ml	4.02
7	6.23	add 200 ml	
8	7.24	add 200 ml	

0930 hrs  
EXPS & Mont #4 3.21  
EXPS & Mont #5 3.42

0930 hrs - Transfer contents of  
EXPS & Mont #4 into a  
polycond bottle. (mlc is  
made transparent), SN  
earlier decontamination of V soln.

1030 hrs - Prepare 100 ml of 1M TT  
(tartaric acid - triethanolamine)  
(Fisher lot # 920126 - Fda lot 91824)  
14.9 g trieth  
15.0 g tart. acid 100 ml w/  
as of H<sub>2</sub>O

Prepare 100 ml of 1.05M TT  
19.66 g triethanolamine  
19.76 g tartaric acid  
Dilute to 100 ml.

1400 hrs - Decant supernatant from  
EXPS & Mont #7 slowly into 6  
25 ml centrifuge bottles;  
centrifuge at 13K for 60  
minutes. Decant clear soln  
into 1L PP bottle. Repeat  
until volume of sup is 900 ml.  
is reduced to ~100 ml.

07/17/76 ~~228~~

0730 hrs - initiate ultraviolet  
 of ~~EXPS~~  $\text{Al}_2\text{O}_3$  & 2 using  
 the spectrophotometer.

0930 hrs - measure pH of solutions.  
 No recalc.

Solus	pH
buffer 2	2.00
4	4.01
7	7.02
EXPS & unit #1	4.11
#2	4.06
#3	4.11
#4B	6.41
#7	3.24
EXPS & $\text{SO}_2$ #4	3.14
EXPS & $\text{Al}_2\text{O}_3$ #4	7.48

1045 hrs - Take 30 ml samples from  
 the EXPS solutions.

EXPS & unit #1 & #2 - cloudy soln.

#2 &  $\text{SO}_2$  - clear soln

#7 &  $\text{SO}_2$  - a little cloudy, less dense  
 than unit #1

#4B &  $\text{SO}_2$  - clear soln

#7 &  $\text{SO}_2$  - clear yellowish soln

EXPS &  $\text{SO}_2$  #4 &  $\text{SO}_2$  - mostly clear  
 yellow soln

EXPS &  $\text{Al}_2\text{O}_3$  #4 &  $\text{SO}_2$  - cloudy yellow  
 liquid.

1100 hrs - start filtration of most insoluble  
 solutions using Whatman  
 0.45  $\mu\text{m}$  47 mm filters  
 & small vacuum pump.

EXPS & unit #2 - Whatman nylon  
 filter; decant most  
 of the solution before  
 filtering ~ 150 ml soln.  
 transfer filtrate (w/ filter)  
 into a plastic (PP?)  
 vial labeled EXPS & unit #2.

EXPS & unit #4B - as above; vial  
 labeled EXPS & unit #4B

EXPS & unit #5 - as above; vial  
 labeled EXPS & unit #5

EXPS & unit #3 - Gelman 0.45  $\mu\text{m}$   
 Metrical membrane  
 ~ 150 ml to be filtered  
 slow & leave N<sub>2</sub> riser  
 but cover glass container  
 with parafilm.

~~EXPS~~  $\text{SO}_2$  filter

1200 hrs - turn off  $\text{SO}_2$  &  
 N<sub>2</sub> gas pressure on spectrophotometer  
 w/ EXPS &  $\text{Al}_2\text{O}_3$  #2. To  
 continue filtration tomorrow.



01/18/96 MWH  
0815 hrs - Injection of ~~XXXXX~~ down to ~30 ml. Most clay settled. Pipet out the clear ~~XXXXX~~. Continue filtration.

0930 hrs - Resume filtration of ~~XXXXX~~ #2.

1200 hrs - completed filtration of ~~XXXXX~~ #2. Transfer filter with most of plastic vial labeled ~~XXXXX~~ #2.

1200 hrs - initiate filtration of ~~XXXXX~~ #1. Use nylon Whamco 100 µm filter. Pipet cloudy ~~XXXXX~~ into glass flask w/ 11/18/96 reservoir. Initially ~200 ml.

1450 hrs - ~~XXXXX~~ #1 solution down to ~175 ml.

1700 hrs - down to ~150 ml. Make up to 200 ml. Leave overnight.

01/19/96 MWH  
1100 hrs - ~160 ml left in ~~XXXXX~~ #1. Pipet out most of the clear solution.

1045 hrs - Pipet out & decant most of the cloudy ~~XXXXX~~ remaining in the plastic bottle of ~~XXXXX~~ #1. Then shake the remaining ~~XXXXX~~ & transfer into filtration flask. ~150 ml.

1000 hrs - ~115 ml remaining in ~~XXXXX~~ #1.

1200 hrs - Ultrafiltration of ~~XXXXX~~ #2 completed. Transfer filter + filtrate to plastic vial labeled ~~XXXXX~~ #2.

1420 hrs - Decant most of the clear yellow solution from ~~XXXXX~~ #1, leaving ~100 ml. Measure pH of decanted solution (pH was transferred into plastic beaker). Decantation actually by using 100 ml pipette. No recalculation.

buffer 2	pH
4	2.02
7	4.02
<del>XXXXX</del> #1	7.03
clear solution	3.15

1615 hrs - ~ 105 ml left in  
EXHPS & MONT #1 being filtered  
transfer most of the soln  
into a 125 ml PDP bottle  
evacuate further to reduce  
to moist paste.

1645 hrs - Filtration of EXHPS & MONT #1  
is complete. Transfer to plastic  
vial labeled EXHPS & MONT #1.

01/22/96

0830 hrs - Resume ultrafiltration  
of EXHPS & MONT #4.

1030 hrs - Completed ultrafiltration  
of EXHPS & MONT #4. Transfer into  
plastic vial labeled  
EXHPS & MONT #4.

1/24/96 -

0900 hrs - Evacuate ultrafiltration  
of EXHPS & MONT #4. Pipette ~ 40 ml  
into each of 6 PDP centrifuge  
tubes. Centrifuge at ~ 1200 rpm  
for ~ 30 mins. Result clear  
solutions. But in some cloudy  
mls. Repeat process.

1/24/96 - MTP

0830 - hrs Ultrafiltration of  
EXHPS & MONT #4 using the Spectrum  
shirred cell was initiated.

1100 hrs - completed ultrafiltration  
transfer into plastic vial  
labeled EXHPS & MONT #4.

Samples for EXHPS analysis sent  
to Ekudson of UNL by  
Fedex next day service. Ekudson  
will prepare the specimens for  
EXHPS work. Samples sent:  
EXHPS & MONT #1, 2, 3, 4 & 5;  
EXHPS & MONT #2 and 4;  
EXHPS & MONT #2 and 4.

3/28/96 Preparation of U solutions  
for ICP analysis (Div. 01)

The following solutions were acidified  
by adding 100  $\mu$ L of 6M HCl  
prepared by J. Wilkyl on 7/96.  
New labels were attached to  
each bottle for identification  
1/11/045 during analysis.

Labels:  
RTP-1: EXHPS & Al<sub>2</sub>O<sub>3</sub> #1 SOLN  
RTP-2: " #2 SOLN  
RTP-3: " #3 SOLN  
RTP-4: " #4 SOLN  
RTP-5: EXHPS & SiO<sub>2</sub> #1 SOLN  
RTP-6: " #2 SOLN

MTH-7 EXPTS # 2, 3 & 4 SOLN  
 " -8 " # 4 & SOLN  
 " -9 EXPTS # MONT # 1 & SOLN  
 " -10 " # 2 & SOLN  
 " -11 " # 3 & SOLN  
 " -12 " # 4 & SOLN  
 " -13 " # 5 & SOLN

08/30/96 MTH

1100 hrs - Transfer 20 mL of each of the solutions

EXPTS # 1 & 2 AL<sub>2</sub>O<sub>3</sub> & SOLN 2  
 EXPTS # 3 & 4 AL<sub>2</sub>O<sub>3</sub> & SOLN 2  
 EXPTS # 5 & 6 AL<sub>2</sub>O<sub>3</sub> & SOLN 2  
 EXPTS # 7 & 8 AL<sub>2</sub>O<sub>3</sub> & SOLN 2

From the 60 mL FEP bottles  
 into 20 mL PP bottles using  
 an Eppendorf 10 mL pipet

All the above solutions  
 had AL<sub>2</sub>O<sub>3</sub> colloid settled  
 on the bottom. The 20 mL  
 samples were transferred to  
 minimize entrainment of  
 AL<sub>2</sub>O<sub>3</sub> colloid in samples  
 for DEP analysis.

Label the PP bottles  
 as EXPTS # 1, 2, 3, 4, 5, 6, 7, 8  
 acidify with 100 µL  
 of 16 M HCl.

1130 hrs - The following solutions  
 were acidified by adding 100 µL  
 of 16 M HCl:

EXPTS # 1 & 2 SiO<sub>2</sub> & SOLN 2  
 EXPTS # 3 & 4 SiO<sub>2</sub> & SOLN 2  
 EXPTS # 5 & 6 SiO<sub>2</sub> & SOLN 2  
 EXPTS # 7 & 8 SiO<sub>2</sub> & SOLN 2

MTH 8/30/96  
 Transfer 20 mL of EXPTS # 1 & 2  
 EXPTS # 1 & 2 MONT & SOLN 2, which  
 has montmorillonite colloids  
 settled at the bottom of  
 the bottle, into a 30 mL  
 PP bottle labeled  
 EXPTS # 10 MONT & SOLN 2 B.

Acidify the following solutions  
 with 100 µL of 16 M HCl:

EXPTS # 1 & 2 MONT & SOLN 2 B  
 EXPTS # 3 & 4 MONT & SOLN 2  
 EXPTS # 5 & 6 MONT & SOLN 2  
 EXPTS # 7 & 8 MONT & SOLN 2

EXPTS # 1 & 2 MONT & SOLN 3  
 EXPTS # 3 & 4 MONT & SOLN 3  
 EXPTS # 5 & 6 AL<sub>2</sub>O<sub>3</sub> & 3 & SOLN 3  
 EXPTS # 7 & 8 AL<sub>2</sub>O<sub>3</sub> & 4 & SOLN 3

